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1 INQUEST HELD ON BODIES OF JULIA RISING,
2 LOUIS GARCIA, WILLIAM Y. WEINLAND, MARVIN
3 CASPRESS, FRANCES RUTH McINTOSH HOPP, RICHARD
4 EARL PIKE, DONALD FERRELL HOPP, NELLIE HANSON,
5 KENNETH H. COE, JOHN PARKER, RICHARD ALLEN PIKE,
6 CARL JAMES MATHEWS, JR., EVA HOLT, MAZIE CURTIS,
7 SOLOMON J. BIRD, ROLAND ERROTCHINA, THELMA
8 MATHEWS (HOLLANDER), LEONA JOHNSON, VIDA MATHEWS,
9 EDWARD P. PRICE, GRIFFITH O. HUGHES, ROSARIA RUIZ,
10 FRANCES GARCIA, ROSARIA ERROTCHINA, GEORGE A. MANN,
11 WILLIAM W. NEILSON, JR., LYMAN W. CURTIS, ORAMAE
12 BEVERLY BERRY, ALBERTA ISAAC, WILLIAM W. NEILSON,
13 SR., TOOTSIE GARCIA, MARGARET C. ELY, EUGENE M.
14 FRAZER, DELORIS RISING, ADELINE RISING, JUNE
15 BEVERLY HUGHES, ELENOR RISING, REBA M. KENNEDY,
16 DOROTHY FAY MATHIS, MAX BOWSKY, CHARLES EUGENE
17 KENNEDY, LOIS BESSIE BURNS, ETHEL ELIZABETH
18 COCHEMS, ELLA DELLA VINSON, HARRY GARCIA, WILLIAM
19 THOMAS STROUD, CARITA HOLSCLAU, PAULINE KENNEDY,
20 Unidentified Jap, CARLOS ALVARADO, BELEN ALVARADO,
21 JOACHIM KLIEMAN, HOMER C. COE, ELLEN CROSMO,
22 CARMEN ALVAREZ, BILLIE McINTIRE, HENRY JOSEPH
23 VOELKER, BERTHA JANE NEILSON, Unidentified boy,
24 white 4, FRANK A. NEILSON, A. THOMAS KENNEDY,
25 DOROTHY CAROLINE MATHIS, LOUIE MARTIN BURNS,
26 INA REBECCA WEINLAND, HOWARD THOMSON, CHARLEY
27 MATHEWS, CECELIA M. SMALL, JANE DOE, about 75.
28 MILLIE MATHEWS, AT THE CORONER'S OFFICE, HALL
29 OF JUSTICE, LOS ANGELES, CALIFORNIA, MARCH 21ST,
30 1928, AT 10:00 A. M.

RAY E. RISING, being

first duly sworn, testified as follows:

BY THE CORONER.

Q Please state your name.

A Ray E. Rising.

Q Where do you reside?

A Number 1, Power House, of the Bureau of Power and
Light, of the City of Los Angeles.

Q What is your occupation?

A General utility man.

Q Mr. Rising, were you in the disaster at the St. Francis

1
2 Dam?

3 A Yes sir.

4 Q Your family was in the disaster also?

5 A Yes.

6 Q And you lost your wife, did you?

7 A Yes sir.

8 Q Did you see her body afterwards?

9 A Yes, I did.

10 Q Where did you see her?

11 A At the morgue at Newhall.

12 Q You identified it as the body of your wife?

13 A Yes sir.

14 Q What was her full and correct name?

15 A Julia Rising.

16 Q Where was she born?

17 A In Minnesota.

18 Q What was her age?

19 A Twenty-nine.

20 Q What was the date of her death?

21 A March 13th.

22 Q Where was she residing at the time of her death?

23 A At Power Plant Number Two.

24 Q Situated in the San Francisquito Canyon?

25 A Yes sir.

26 Q Near the St. Francis Dam?

27 A Yes sir.

28 Q How near to the dam did she live?

29 A About a mile and a half down the canyon, below the dam,
30 in a southerly direction.

31 Q As far as you know, what was the cause of her death?

32 A As far as I know, it was from drowning.

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Q As the result of the collapse of the St. Francis Dam?

A Yes sir.

Q I think that is sufficient at this time, Mr. Rising.

THE CORONER: This testimony, gentlemen, is to establish the record of the death of Julia Rising. The information adduced at the hearing will cover all those persons whose deaths occurred as the result of the breaking of the St. Francis Dam. However, we are reading into the record in this case only those whose bodies were recovered in the County of Los Angeles, as all the others were recovered in the County of Ventura, and, for the purpose of the death record, I will read at this time a list of all those whose bodies have been found dead in this County:

- Louis Garcia
- William Y. Weinland
- Marvin Caspress
- Frances Ruth McIntosh Hopp
- Richard Earl Pike
- Donald Ferrell Hopp
- Julia Rising
- Nellie Hansen
- Kenneth H. Coe
- John Parker
- Richard Allen Pike
- Carl James Mathews, Jr.
- Eva Holt
- Mazie Curtis
- Solomon J. Bird
- Roland Errotchina

1	Thelma Mathews (Hollander)
2	Leona Johnson
3	Vida Mathews
4	Millie Mathews
5	Edward P. Price
6	Griffith O. Hughes
7	Rosario Ruiz
8	Frances Garcia
9	Rosaria Errotchina
10	George A. Mann
11	William W. Neilson, Jr.
12	Lyman W. Curtis
13	Oramae Beverly Berry
14	Alberta Isaac
15	William W. Neilson, Sr.
16	Tootsie Garcia
17	Margaret C. Ely
18	Eugene M. Frazer
19	Deloris Rising
20	Adeline Rising
21	June Beverly Hughes
22	Eleanor Rising
23	Reba M. Kennedy
24	Dorothy Fay Mathis
25	Max Bowsky
26	Charles Eugene Kennedy
27	Lois Bessie Burns
28	Ethel Elizabeth Cochens
29	Ella Della Vinson
30	Harry Garcia
31	William Thomas Stroud
32	Carita Holsclaw
	Pauline Kennedy

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- Unidentified Jap
- Carlos Alvarado
- Belen Alvarado
- Joachim Klisman
- Homer C. Coo
- Ellen Cresno
- Carmen Alvarez
- Billie McIntire
- Henry Joseph Voelker
- Bertha Jane Neilson
- Unidentified boy, White - 4
- Frank A. Neilson
- A. Thomas Kennedy
- Dorothy Caroline Mathis
- Louis Martin Burns
- Ina Rebecca Weinland
- Howard Thomson
- Charley Mathews
- Cecelia M. Small
- Jane Doe - about 75

THE CORONER: That, gentlemen, covers all the persons whose bodies were recovered from this flood in the County of Los Angeles. Dr. Webb, will you take the stand, please.

DR. FRANK R. WEBB, being first duly sworn, testified as follows:

BY THE CORONER.

- Q Please state your name.
- A Frank R. Webb.
- Q What is your position?

1 A Assistant Autopsy Surgeon of Los Angeles County.

2 Q Did you make an autopsy on the body of Julia Rising?

3 A I did.

4 Q Will you state your findings, please.

5 A ~~It was~~ The autopsy was made at the mortuary of W.G.
6 Noble in San Fernando on the 15th day of March, 1928. The body
7 was a female of the white race, aged twenty-nine years and five
8 months, height five foot five inches, estimated weight about a
9 hundred and seventy-five pounds, dark brown hair and light com-
10 plexion. Further examination showed numerous superficial scratches
11 and bruises scattered over the body, the face and the limbs.
12 There was a deep gash three inches long from the center front of
13 the left leg. There was a laceration diagonally of the right
14 forehead. The lungs were red and inflamed and contained water.
15 The trachea contained mud and silt. The other organs were normal
16 except for marked congestion. The stomach contained a considerable
17 amount of silt. From these findings the deduction was made that
18 death was due to drowning.

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21
22 WILLIAM MULHOLLAND, being

23 first duly sworn, testified as follows:

24 BY THE CORONER.

25 Q Please state your name.

26 A William Mulholland.

27 Q Where do you reside?

28 A 426 South St. Andrews Place, Los Angeles, California.

29 Q You are the Chief engineer of the Bureau of Water and
30 Power of the City of Los Angeles?

31 A Of Water, but not of power.

32 Q What is the official title, how is it designated?

A I am manager and chief engineer of the Department of

1 Water.

2 Q You have been the Chief Engineer of that department for
3 some time, have you not?

4 A Since 1886.

5 Q Were you Chief Engineer of the Water Department at the
6 time that the St. Francis Dam was built?

7 A I was.

8 Q And at the time that the site was selected for the St.
9 Francis Dam?

10 A Yes sir.

11 Q How was the site of the St. Francis Dam selected?

12 A We observed that there was a large water space at the
13 camp; we had a camp in there when we were building the aqueduct,
14 contained there, I think, for six years. I was very familiar
15 with the topography there and I have had a habitation there that
16 long; I virtually made my habitation there because I lived more or
17 less on the aqueduct while it was under construction. I am speak-
18 ing now of the Los Angeles Aqueduct. I was Chief Engineer on
19 that and designer and constructor of it.

20 Q How was the property there where the dam was erected
21 acquired by the City of Los Angeles?

22 A By purchase.

23 Q Who were the engineers who actually located the site
24 for the dam?

25 A The regular organization in the department, surveying
26 organization. We have a large and active organization in the de-
27 partment and they are constantly busy all the time.

28 Q Do you recall the names of the engineers who actually
29 made the tests there for the location of the dam?

30 A Stanley Dunham was the constructing engineer in charge
31 of the construction and also the preparation of this site.

32 Q Did anyone assist him?

1 A He had a corps of men with him.
2 Q Can you recall their names?
3 A No. We have twenty-five or more men constantly employed.
4 Q When was the site selected?
5 A Definitely selected about six years ago.
6 Q When was the erection of the dam begun?
7 A About four years ago.
8 Q How long was it in the course of construction?
9 A Two years and a half---- no, in course of construction----
10 it was built in sixteen months, from the time of beginning until
11 it was completed.
12 Q Sixteen months from the time you began to pour concrete
13 until it was finished?
14 A Yes.
15 Q Are you positive about the length of time, Mr. Mulholland?
16 A No, but I can definitely set the time later by one of the
17 other witnesses.
18 Q It might have been a little more than sixteen months?
19 A Yes, a month or two.
20 Q How long did it take to build the dam?
21 A About sixteen or seventeen months.
22 Q When was it completed?
23 A In May, three years ago, that is, this coming May.
24 Q It would have been in operation three years this coming
25 May?
26 A Yes.
27 Q Was it immediately filled?
28 A No, gradually. The first part of the year it was perhaps
29 half filled. We have a definite record day by day of all the
30 lowering and falling, of all our reservoirs. We can produce the
31 stage of water in all our reservoirs.
32 Q As far as you can recall, was it ever filled to capacity

1 prior to the last two months?

2 A Not absolutely full. It stood for three or four months
3 last year, at eighteen inches from overflow.

4 Q Do you recall the dimensions of the dam?

5 A About a hundred and eighty feet high.

6 Q How thick at the base?

7 A A hundred and seventy feet.

8 Q What is the length of it overall?

9 A That is a hard thing to deal with, to generalize by a
10 certain answer. Part of the dam covers the ravine that drains
11 the country. That goes much deeper than near the top of the dam
12 at the western extension. The western extension is up on a sort of
13 a natural dyke, but the main bulk of the dam is about six hundred
14 feet long and it goes down in a "V" form into the canyon. At the
15 bottom it is about two hundred and fifty feet long, I would say.
16 I can furnish the drawings, giving the dimensions of all these
17 things, your Honor.

18 Q All right, sir, I think we will want those drawings.
19 Are they here now?

20 MR. DENNISON: I had the drawings and they are in the hands
21 of Mr. Mayberry.

22 Q BY HERMAN MOHR: It will not be necessary to produce
23 them now, however. We merely wanted to get a picture of the con-
24 struction of the dam.

25 Q BY THE CORONER: Did you personally oversee the con-
26 struction of the dam?

27 A I was very close to it. Occasionally I might have miss-
28 ed three or four days in succession, but I was there almost every
29 day.

30 Q It was built of concrete?

31 A Yes sir.

32 Q Was it reinforced?

1 A No sir. No dams of that kind are reinforced.
2 Q Why is that?
3 A That is the general practice. The concrete figures out
4 a greater factor of safety against strains when they are filled
5 with water.
6 Q Do you know what factor of safety was figured on this
7 dam?
8 A About three or four.
9 Q Your office records will show just what the factor of
10 safety was?
11 A Yes sir. The induration and strain charts are avail-
12 able.
13 Q Do you know where the materials were secured for the
14 building of the dam?
15 A Right there.
16 Q All except the cement?
17 A Yes.
18 Q The sand and gravel was taken right out of the bed of
19 the river?
20 A Right there. We tested the material and tests have
21 proven there now, that the concrete was all there.
22 Q What tests were made for the foundation of the dam?
23 A Ordinary stripping. We stripped down and it seemed to
24 be sound. We made some borings.
25 Q Did you make the borings with a diamond drill?
26 A A Core drill.
27 Q Did you preserve the cores?
28 A Yes sir. The concrete was taken away from us at this
29 break.
30 Q Was the dam based on bed rock?
31 A Yes sir.
32 Q How much of it was on bed rock?

1 A All of it. What is generally called bed rock. There
2 are many qualities of rock. It rests on two layers of rock on the
3 east end and up to quite a distance of the west end it was in
4 schist mica. Schist is the name that is attached to the rock.
5 The west end was on a solid indurated conglomerate.

6 Q What was the bottom on?

7 A On the schist.

8 Q Did you find any granite there anywhere for the building
9 of the dam?

10 A There is no granite in the country until you get away
11 up the canyon past Power Plant Number Two and then it is not a
12 true granite, and then it is gneissoid granite.

13 Q This was known as a gravity dam?

14 A Yes, plus the arch, a pure gravity dam is concrete one
15 that depends for its stability on the mass of the concrete or of
16 the material, maybe masonry that is in it without the advantage
17 of an arch. It is quite common, however, to arch a dam and this
18 was one of the arched kind. We call that really supplying a
19 factor of safety.

20 Q The arch then is the part that remains standing?

21 A It is a piece of it. The whole thing ^{across} ~~crosses~~ the main
22 canyon was an arch up to the dyke part, which is four hundred or
23 five hundred feet long and that rests on the dyke, and that remains
24 there still.

25 Q About how large a section is that which still remains?

26 A It is about ten feet thick and of various depths, due to
27 the observations of the arch. It stands on an arch. The undulations
28 make it as deep as twenty-five feet in places, but it is all buried
29 in the ground about a third. It is buried at an average of about
30 a third, I would say, of the thickness of the excavation is buried
31 in the material, in the formation.

32 Q When the dam was built did you go down deeper below the

1 surface of the bed of the stream to get your foundation for the
2 central part of the dam, deeper than you did for the sides?

3 A Yes sir, we went down about--- disregarding the real
4 loose material, the grist material, which averaged about ten feet
5 deep, we went about ten or twelve feet on an average beyond that.

6 Q Did you get solid rock down there?

7 A Yes sir, the rock of the country. Unfortunately, the
8 accident has given a difference appearance to things now. It has
9 cut away the flanges and sides of the trench we dug and the arch is
10 torn out of there and it looks as if the dam had rested on the
11 flat ground, but the drawings will show. We have the topography
12 of the original surface as it was when we first started before we
13 put anything there. We put the instruments there and made a com-
14 plete survey of the whole thing. We, very fortunately, have got
15 that. I don't see why I should use the word 'fortunately', but it
16 is a fact that it would convince, maybe, people that we did not
17 build the thing as stated by certain publications, that we laid
18 the thing flat on the ground. We went down deep in the trench
19 there and when the dam broke---

20 Q Did you consider the dam absolutely safely anchored to
21 the sides of the canyon as well as firmly based on a solid founda-
22 tion?

23 A I surely did. I have built nineteen dams in my day and
24 they are all in use, and I have always had in mind the hazard
25 attending the construction of a dam. I certainly took all the
26 care that prudence suggested.

27 Q Were you at the dam within a week or ten days prior to
28 the 12th of March?

29 A I was there within eleven hours from the time it went up.

30 Q That would be Monday afternoon?

31 A Yes, just about afternoon --- no, it was about 12:30 when
32 I left there. I remember I got into town here and had lunch about

1 two o'clock.

2 Q What was your observation of the condition of the dam
3 at that time?

4 A There was a leak that brought us there. Mr. Van Norman
5 and myself were brought there and it was a leak that had not mani-
6 fested itself before, a new one. It was running down the slope of
7 a hill and running across an old side hill out where there was a
8 road.

9 Q On which side?

10 A On the west side. An old construction road running up
11 there and washing the dirt which was thrown from that road, and
12 made dirty water. The keeper telephoned us that the water was
13 dirty and we went up there and the water was not dirty and had not
14 been dirty, but it was cutting. It was throwing it to the side
15 of the road, but it was a new leak, because, like all dams, there
16 are little seeps here and there and I will say as to that feature
17 of it that of all the dams I have built and of all the dams I have
18 ever seen, it was the driest dam of its size I ever saw in my life.
19 I have traveled many miles to look at new dams here and there and
20 everywhere. Dams are one of the features of engineering, espec-
21 ially in the hydraulic office, that we go to look at. It was full
22 or nearly full then, within a foot and a half of last year--- not
23 all last year,--- but six or seven months. And this year it has
24 gradually filled up to the overflow point and it was the driest
25 dam I ever saw. It was the driest for a massive dam, I ever saw.
26 We were there--- Mr. Van Norman and I went up ----- it was about
27 due time for me to go up because I have been in the habit of go-
28 ing up there, and to all the dams we have got, at least once in
29 ten days or two weeks. It is part of my patrol, but Mr. Van
30 Norman and I went up there that morning because Tony Harnischfeger---
31 that is the man who was drowned there, and he was the keeper---

32 Q What did Tony tell you?

1 A He said the water was muddy and it was a new leak.

2 Q What difference did it make if the water was muddy?

3 A That is an indication--- it is taken as a very bad char-
4 acteristic of a leak through the earth anywhere. It means that
5 the earth is cutting, but there was no earth coming from under the
6 dam. The earth, as I say, came from that side hill out.

7 Q That leak seemed to come through the soft dirt of a road
8
9 that you had built to get up to the west side of the dam?

10 A It was visibly doing so.

11 Q Was not all the west side saturated?

12 A It was.

13 Q Did you start to build a new road a week or ten days be-
14 fore this occurred?

15 A Yes, the road we had there was a bad road because it had
16 a very sharp creek in it. We were all of six months in changing
17 the line of the road.

18 Q You were not changing the line of the road because the
19 ground was too wet there?

20 A No, I have been up and down it and the ground was damp
21 there, but that was all. No sir, that had nothing to do with the
22 changing of the road. The changing of the road was due to the
23 greater convenience in getting up to the dam.

24 Q When you saw the dam last Monday did it occur to you
25 that it was in danger?

26 A No sir, it never occurred to me that it was in danger.
27 I just wanted to see the new leak, naturally.

28 Q Can you account for this dam going out?

29 A I surely would like to. I would like to be able to say
30 in what manner it went out, why it fell.

31 Q BY MR. SCOTT: Mr. Mulholland, the leak that you speak
32 of is on the west side away from the main dam structure?

A Yes.

1 Q It is right where the road was built and where there is
2 part of the road washed out because of that leak, is that what you
3 are referring to?

4 A The last leak made a gash across the road, yes. The
5 leak that was always there and which we ----- Tony Harnischfeger's
6 house was on a superinduced leak, a determined leak. That is
7 one of the leaks that usually occur in dams by leading the pressure
8 water, which we always expect, under the dam, and relieve the dam
9 of that much weight. These are a common thing and that water is
10 let out to relieve that pressure that, in this case, was less than
11 it is usually in dams. I have one dam where that water amounts to
12 four or five inches. I have seen dams where it amounted to thirty
13 or forty inches. It is the upthrusting water from the deeply cut
14 formation where the dam is set, and is only let ^{through} up/ to the pipes
15 and led through the dam away to one side. We used that water be-
16 cause it was sweet and clear, and piped it down to the house.
17 That water amounted to perhaps one or two miners inches, and it
18 was right close to this place.

19 Q That was not in the canyon itself, that was up to the
20 west end of the main structure?

21 A It was the west end of the main structure and a little
22 away from the dam, but it was not a great ways from the dam. It
23 was fifty feet. The piping was let down to the bank there and we
24 used the water at the house. We did that from the very first.

25 Q What do you estimate, Mr. Mulholland that the amount of
26 water was which was seeping or leaking from the dam?

27 A Up to the time that this greater leak developed we have
28 the whole record on all of them. It is a daily record because
29 it is observed all the time and reported on occasions. We have a
30 "V" weir to measure the leakage from both sides, and all sides,
31 and a little "V" weir, and that amounted at the very most to five
32 miners inches and the average was about four inches, depending

1 upon the height of the water in the dam.

2 Q But it was not an unusual amount of leakage for a dam
3 of that size?

4 A Yes, it was unusual. It was unusual for its smallness.

5 Q What was the object of the construction of the St.
6 Francis Dam?

7 A The conservation of water. Sometimes our water is de-
8 rived as the Lord makes it. Sometimes it is in buckets full in
9 the mountains and as fast as we can we use it and there are periods
10 when there is a dearth of water and then we have to use the reser-
11 voirs. The usual use of a reservoir is to conserve the water.
12 Some cities do not have to have them because they are fronting on
13 great rivers or lakes or great sources of inexhaustible supplies.
14 The City of Los Angeles is one of the unfortunate cities in regard
15 to a water supply. We live under a hazard here. The people of
16 the City of Los Angeles take this as a matter of course, that
17 there is going to be water in the faucet the next morning. There
18 have been various times in my experience here--- I have been in
19 charge of these works for nearly fifty years--- where we were
20 pretty close to the bottom. That is the purpose of reservoirs,
21 and we could not exist without reservoirs at all.

22 Q In the construction of this dam state what precautions
23 and prudence was exercised, as an engineer who has constructed dams,
24 in the construction of this dam?

25 A The conventional observations used in building dams. I
26 have had rather more experience than most engineers in building
27 dams. I have built nineteen of them and took the usual precautions,
28 judging the formation the best I could, the hazards which the dam
29 must be exposed to and all the things that relate to the continuous
30 safety of the dam. We overlooked something here. This inquiry
31 is a very painful thing for me to have to attend but it is the
32 occasion of it that is painful. The only ones I envy are--the
about this thing are the ones who are dead.

1
2 Q BY MR. DENNISON: As I understand, this dam was in a
3 "V" shape, is that correct?

4 A The canyon was a typical "V" canyon. Almost all canyons
5 have that shape.

6 Q So at the extreme level you went down to solid rock, is
7 that correct?

8 A Yes sir.

9 Q And found that about twenty feet below the stream level
10 surface?

11 A Just about--- well, rather nearer the little stream was
12 running there in that canyon, usually very little in the summer
13 time, but occasional floods come down and it did about touch bed
14 rock at the lowest point of the rock. The sides run up ten or
15 twelve feet.

16 Q Of course, you made your borings into the bed rock to de-
17 termine what that was?

18 A Yes sir.

19 Q Was that a shale?

20 A No sir, schist. I want to say that I have read in the
21 papers statements that shale showed in the concrete. That could
22 not be because there is no shale in the country.

23 Q No shale up in that country?

24 A No sir. The real shale is in formations five or six
25 miles from there.

26 Q By a schist, what do you mean by that?

27 A A hard igneous mica schist.

28 Q That comes in layers?

29 A Yes, the word schist means solid. It is the German for
30 solid.

31 Q How wide was that piece that stood up?

32 A The piece that remains there is about seventy-five feet.

1 Q In width?

2 A Yes.

3 Q And then the rest of the dam went up the hill. Would
4 you call them wings or what?

5 A No, part of the arch. It is all in one arch.

6 Q So the hill itself on either side was a kind of natural
7 dyke, is that right?

8 A The hill itself. We built to the hill. The hill on
9 the east side runs up to a great height.

10 Q Does it run up at an angle, the incline of it where
11 you placed this cement on top of it?

12 A Yes sir. That is all buried now. When the dam went
13 out it permitted a slide from that mountain and there is only one
14 spot there--- at least there was on the day before yesterday, when
15 I went up there---, that was visible. The east abutment of the
16 dam was against a very solid mass of hard schist.

17 Q How about the west?

18 A The west goes up a different formation.

19 Q Goes up on a formation of what you would call a conglom-
20 erate?

21 A Yes sir.

22 Q What is that?

23 A A conglomeration formed by water, by the solidification
24 of drifted matter by water. It is called conglomerate. It is an
25 admixture generally of rock, gravel and other materials, maybe
26 sand and it is a peculiar type. It is an altered conglomerate,
27 that is, it was originally conglomerate and then it was altered
28 by heat and induration, heat and pressure, it is a very different
29 form. The tunnels are there yet. I tunnelled into that to find
30 out if it was secure to build part of the dam. It was quite solid
31 and very impervious.

32 Q In going up to the top of this hill with your dam, what

1 did you do? Did you tunnel it out or dig it out?

2 A Oh, yes, we had to shovel there.

3 Q How deep did you go there?

4 A An average of about ten, twelve, up to twenty-five or
5 thirty feet on the top of that so-called conglomerate arch.

6 Q Went into the conglomerate arch twenty-five feet?

7 A Well, not into the conglomerate. We dug that deep, it
8 was the loose soil and went into the solid conglomerate about ten
9 or twelve feet and the whole cut up there in places is as much as
10 twenty-five feet.

11 Q On either side?

12 A Not on either side. On the nearest side. Over on the
13 east side we did not have to. We were in the bed rock at once.

14 Q You leaned it against the hill?

15 A The conglomerate is not on the west side.

16 Q How about the west side?

17 A On the east side----

18 Q Did you excavate the whole thing?

19 A Yes.

20 Q How deep?

21 A It is hard to say how deep it was. The photographs and
22 the topography we have will show that to the engineers, your
23 engineers or other engineers.

24 Q Then, this dam proper that was resting on the solid
25 foundation was erected to withstand a certain pressure, was it not?

26 A Yes sir.

27 Q Do you remember how much?

28 A Not in units, but it was about three times the resultant
29 that would come from the height of water to fill in.

30 Q The map or diagram that you have there shows twenty-four
31 thousand feet horizontal pressure on this piece that stood up, is
32 that correct?

1 A I don't want to answer that because I would be guessing
2 at it.

3 Q What pressure would there be?

4 A The diagrams would show.

5 Q Approximately what pressure would there be on the west
6 side?

7 A The thrust of the skew back, that is the arch thrusting
8 in there?

9 Q Yes.

10 A I would not try to guess that. I know the formulas---
11 not without working it out and you have diagrams that show what
12 that figure should be.

13 Q It was equally as great as that upon the center portion,
14 was it not?

15 A Yes sir, the center portion was like the keystone in an
16 arch. It had the resultant the same as any slice out through the
17 arch.

18 Q And that would be true of the pressure of the other side
19 that went out too?

20 A Yes sir.

21 Q Where was this leak? Was it in the masonry?

22 A No sir.

23 Q Was it beneath the masonry?

24 A That is, you are speaking of the last leak there. That
25 came out of the joint between the masonry and the ground. Mr. Van
26 Norman was right over the top. I could not,--- I was not able to
27 climb in where he was, or at least I was disinclined, but he was
28 right there on it. Maybe he was ten feet from it, and he said
29 the leak came from the contact between the conglomerate and the
30 ground or thereabouts.

31 Q Between the conglomerate and the masonry?

32 A The masonry, yes.

1 Q If there was a leak in there with that great pressure
2 back of it it would cause an upward pressure upon the dam itself,
3 would it not?

4 A Yes sir. The dam was provided with means for getting
5 rid of using that pressure.

6 Q In this leak from the dam, this one between the conglom-
7 erate and the masonry upon it, where did the water then go to?

8 A It would run off down into the canyon?

9 Q Did you see that water yourself?

10 A Oh, yes.

11 Q Will you describe to the jury what was its appearance?

12 A The water came out of the leak and it was as clear as
13 glass.

14 Q Was it carrying any silt in it?

15 A No sir.

16 Q Was it carrying anything from the hill?

17 A Yes, from the hill just below where we stood.

18 Q How about what from the place where it broke through
19 under the masonry?

20 A It was clear water.

21 Q Below this dam isn't there some tunnels that connect
22 with the aqueduct proper?

23 A No, no.

24 Q How did you draw the water from the aqueduct?

25 A We ran it down in a concrete adit, a conduit that ran
26 down a mile and a half to Power House Number Two.

27 Q How does it go to that place?

28 A Right down the main canyon in a concreted channel.

29 Q Are there any tunnels leading from this channel?

30 A None whatsoever, that is, through the old stream bed.

31 Q How do you take care of the flood waters?

32 A The flood waters run down there.

1 Q In the same way?
2 A Yes.
3 Q Are the flood waters opened from this dam in the spring?
4 A Yes, they go over the spillway when the dam is full or
5 through the gates.
6 Q I understand the depth on this map is a hundred and
7 seventy feet?
8 A A hundred and seventy feet.
9 Q That is through the spillway?
10 A But there are gates from the center of the dam.
11 Q So that you can give the lower owners their flood waters
12 if they are entitled to them?
13 A Yes sir.
14 Q You have had occasion to let that water out?
15 A We let it out ^{to them} / in the summer.
16 Q And in the spring?
17 A In the two years----
18 Q What was the occasion of your inspecting the dam Monday?
19 A I went up there because it was about time for the
20 occasional visit and it was prompted a little by Tony's phone that
21 the water was coming out there.
22 Q You have been an engineer, have you not, for thirty or
23 fifty years?
24 A Fifty years.
25 Q And have erected a great many dams?
26 A Yes sir.
27 Q Let me ask you, as an engineer, this fact, if the water
28 was leaking between the masonry and this conglomerate, going under
29 it, would there not be a natural erosion, that it would be an
30 absolute certainty that that dam would go out?
31 A No sir.
32 Q How long would it take before it would go out?

1 A It might not cut at all. Just an ordinary crack in the
2 materials will cause it to respond to erosion, but after it was in
3 that condition why there is nothing we could do to help it, be-
4 cause if you opened all the gates which were there and forty more,
5 you could not have lowered that water more than ~~an~~ inch or two a
6 day in the reservoir.

7 Q You say that if that water was pouring through there or
8 cutting through there, that there would not be a natural erosion
9 in the conglomerate?

10 A The We at that time thought there was not because the
11 water is very clear.

12 Q Of course, I don't know anything about dams and you know
13 something about them.

14 A I am here to give you all I know, and I swear to God that
15 my oath is as binding on me as----

16 Q Have you any explanation as to the cause of the failure
17 of this dam?

18 A I have no explanation that could be called an explanation,
19 but I have a suspicion, and I don't want to divulge it. It is a
20 very serious thing to make a charge---- to me it is a sacred thing
21 to make a charge, even of the remotest implication.

22 Q Colonel Mulholland, this is a very important matter to
23 everybody?

24 A Yes sir. It is most important to me. Several human
25 beings are dead.

26 Q Of course, if it is only a suspicion it does not amount
27 to anything, but can you---- that is all you have to offer, that
28 you have a bare suspicion?

29 A Yes sir, I don't want to offer it even.

30 Q I want to ask you this question as an engineer, from an
31 engineering standpoint, was it not an utter impossibility to build
32 that dam with any factor of safety in the manner in which it was

1 constructed?

2 A An impossibility?

3 Q To build it with any factor of safety?

4 A If I thought that was the case I would not have built it.

5 Q A, great many men make mistakes and everybody is liable
6 to make a mistake. Isn't it a fact, established by the best minds
7 of engineering, that in that location and in the form of a dam as
8 it is built there, it would be an utter impossibility to build it
9 with any factor of safety?

10 A I would not have built it if I thought that.

11 Q What do you say now?

12 A I would not have built it if I had the slightest or re-
13 motest----

14 Q What would you say if you had to do it over again, build
15 that dam in the same manner in which it was constructed?

16 A I will answer that frankly and say, I would not.

17 Q I understand you are the engineer of just the water?

18 A The Water Department, the pipes and reservoirs and all
19 the things we build in a water works.

20 Q Is there a Power Department too?

21 A Yes sir.

22 Q Who was the engineer of the Power Department?

23 A Mr. Scattergood.

24 Q At that time?

25 A Yes sir, for long years; everysince 1906 or 1907.

26 Q Were you and Mr. Scattergood in the selection of this
27 dam site?

28 A He had nothing to do with the selection.

29 Q Was there any agreement upon it, was there at that time?

30 A No sir. That is, he was not there in the capacity of
31 an engineer.

32 Q Was this dam a unit of the power department?

1 A No, I would not say it was, though the water coming from
2 it was used through Power Plant Number Two and through Power Plant
3 Number Three. It was used before it got in there and sent down to
4 the San Fernando Power Plant.

5 Q Would you call it an auxillary rather than a unit of a
6 Power Department?

7 A It was possible to get some use out of it in the genera-
8 tion of power, but, as a matter of fact, it was not used for power
9 because they did not get the advantage of the water, which was stor-
10 ed there dropping through Power Plant Number Two.

11 Q Then, what was the necessity of its erection?

12 A As I say, conservation of the water.

13 Q That is all?

14 A That is all.

15 Q You said that you would not build this dam again in the
16 manner in which it was constructed. Will you tell us why not?

17 A In the manner in which it was constructed?

18 Q Yes.

19 A I build all dams in that manner.

20 Q I understood you to say that if you had to do it over
21 again you would not build this dam in the same way it was erected?

22 A Not in the same place.

23 Q Why not?

24 A Well, it fell this time and there is a hoodoo on it,
25 that would be enough for me.

26 Q A hoodoo?

27 A Yes, it is vulnerable against human aggression, and I
28 would not build it there.

29 Q You don't mean that because it went out on the morning of
30 the 13th?

31 A Perhaps that, but I did not think of that before, but
32 that is an additional hazard. I had not thought of that.

1 Q BY MR. SCOTT: Really the St. Francis Dam was not a
2 Power project and had nothing to do with the Power Department, and
3 it is a storage reservoir for the water?

4 A It has nothing---- it was rather a disadvantage to the
5 power than otherwise.

6 Q State again how the water came from Power Plant Number
7 Two?

8 A After number one used the water it was turned down the
9 regular aqueduct or diverted into this reservoir. It could be
10 turned either way and was usually ~~usually~~ so split.

11 Q You have photographs, have you not, that were taken from
12 the very first day that you went to lay the foundation for the
13 erection of the St. Francis Dam?

14 A Yes sir.

15 Q And from that time every week photographs were taken?

16 A About once a week.

17 Q And they have been preserved and are in the department
18 of Water and Power?

19 A Yes sir. It is customary in all cases of that kind.

20 Q BY THE CORONER: Will you produce those photographs?

21 MR. SCOTT: It tells the story in photographs?

22 A Yes. (A diagram of the dam is drawn on the blackboard)

23 Q BY A JUROR: Have you blueprints of that dam, sections
24 of it?

25 A Yes sir, blue prints without end and computations and
26 it is all preserved.

27 Q BY MR. SCOTT: Let us assume that this is the bottom of
28 the canyon and this is the top of the dam and this is the east side
29 and this is the west side, those are wings of the dam built into
30 the mountains?

31 A Yes sir.

32 Q There is another part of the dam extending over that con-

1 glomerate here?

2 A Yes sir.

3 Q That is about ten or fifteen feet to twenty-five feet
4 from the ground and along there above the ground---

5 A Yes.

6 Q Assuming that this is the road which was built?

7 A Yes.

8 Q That road extends around this mountain side here that
9 goes down into this canyon here, does it not?

10 A Yes.

11 Q The leak that you were speaking of is the leak which was
12 developed in this part of the dam, is it not?

13 A No, it was a separate thing. It was one of the minor
14 shrinkage cracks. We plug them up with anything that we can get
15 into them. That is just a small crack. You cannot have a wall
16 of concrete six hundred or seven hundred feet high without cracks
17 developing.

18 Q Speaking of the leak which was developed---

19 A It is about there (indicating). You see by the photo-
20 graphs that the end of the dam abruptly terminated here. It went
21 down here and over the edge of the road. The road that we were
22 substituting for that is a road running up here and down here and
23 it made an easier grade to get up on the dam. It was not because
24 this was wet.

25 Q BY MR. DENNISON: Let the record show that the leak
26 pointed out by Colonel Mulholland was a leak in the portion beneath
27 the portion of the masonry that fell, is that correct?

28 A Yes.

29 Q BY A JUROR: What is your estimate of the amount of
30 water which was flowing in this new leak when you were up there?

31 A About a second foot.

32 Q Was there any evidence of an increasing flow at that time?

1 A Not increasing at that time, but manifestly since it
2 broke out, since the day before, and it started at nothing. It
3 was a foot a second then and was increasing.

4 Q Is there any record of Tony's observations of the rela-
5 increase
6 tive/in the flow?

7 A They are not written yet. He had reported verbally and
8 over the phone to us. That is what brought us out.

9 Q To whom did he make that report over the phone?

10 A To the office engineer, a man who substitutes for the
11 engineer, a man named McIntyre, who keeps all the water records,
12 flows and all of that. McIntyre very likely got it down.

13 Q Was this dam under-drained practically for its entire
14 distance?

15 A No, it was only where the rock was fissured, that is,
16 those igneous rocks are always more or less jointed a little bit,
17 and we find it usually and always expedient to drain them out so
18 there will not be any up-pressure, taking that much pressure of
19 the dam away. So we lead them out. These drains are provided
20 in every dam I have ever built.

21 Q At what intervals were these bleeders put in?

22 A About every fifteen or twenty or twenty-five feet.

23 Q Practically almost to the top of the dam, as you went
24 along?

25 A No, the west end was a homogeneous ground. There was
26 no drain necessary in those. It was much tighter. It was about
27 as hard as the other but tighter and more compact. The rocks----
28 the fractured rocks, all the hard rocks in this country are more
29 or less fractured and you can go into the mountains here and look
30 at the granites on every hillside and you will see them fissured
31 and fractured more or less, but they will carry water without
32 doubt, but the prudent thing is to drain them out.

Q But the points of under drainage was put in where the

1 rock was seen to be fractured?

2 A Yes.

3 Q How much feet of water was there at the leak?

4 A I would like to tell you these things ---- I would say
5 the water was sixty or seventy feet deep there.
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1 Q BY DISTRICT ATTORNEY (E. J. Dennison): Colonel
2 Mulholland, during the time of the erection of this dam, did you
3 exercise supervision and control over it, and were you there fre-
4 quently?

5 A They paid attention to what I said. I was frequently
6 on the job, and gave directions.

7 Q At the time of the erecting of this dam, there were
8 samples made for the purpose particularly of testing the strength
9 of the materials?

10 A Oh, yes.

11 Q What became of these?

12 A We had them all stored there in a building one eighth
13 of a mile below the dam, and the borings and cores and all the
14 rest went with it.

15 Q This is concrete conglomerate?

16 A Yes.

17 Q Do you know what the crushing strength of that was?

18 A It was always sound and good, and very high, and this
19 is not lost to investigation, the rock is all there yet.

20 Q The concrete itself, did you make a separate block of
21 it?

22 A I made some beams and blocks, as usual.

23 Q Were they tested?

24 A Yes sir.

25 Q Can you remember approximately how much pressure---

26 A No, but I can certainly get it. I can certainly
27 state as high as the usual concrete, higher.

28 Q Was Portland cement used?

29 A Yes sir.

30 Q In what proportion?

31 A The average run at the end of the job, taking a
32 volume of concrete, it ran pretty close to a barrel to the yard.
I think it was ninety-three, the ultimate result was ninety-three

1 one hundredths of a cubic yard to the barrel.

2 Q Would that be five to one, six to one, three to one?

3 A It would be one in about five and seven eighths.

4 Q That is the standard recognized by contractors?

5 A Usually the stuff is not made as rich as that.

6 Q What kind of sand was used or gravel-- was gravel
7 used?

8 A Yes sir, the gravel of the wash there, gravel of the
9 country. We had used it in the lining of the tunnel and building
10 of the power plant - had about ten or twelve years' experience in
11 its use, built large and important structures with it - Power Plant
12 No. 2 is built of it, and partly No. 1, and the tunnel and aqueduct,
13 the tunnel was lined with it. The material was tested several
14 years before it was used in there.

15 Q Would a square foot of that stand a pressure of one
16 hundred tons?

17 A I think it would beat that.

18 Q What would you think it would crush at?

19 A It would run up. The best way to do is get a chunk
20 out and let's try it. I am satisfied that will run as high as
21 any concrete in any building in this town. There is no concrete
22 used in a structure in this city that will surpass it in strength.

23 Q Will you tell me why, in this western country, as an
24 engineer, why a structure of that size is not reinforced?

25 A Figures up enormously stronger than the duty required
26 of it is the reason.

27 Q If it were reinforced it would be stronger?

28 A Yes, but there would be a good deal of waste reinforce-
29 ing the thing. All the figures and all the tenets of good
30 practice figure out stronger than the needs be.

31 Q Is there a dam in California reinforced?

32 A Never heard of one.

Q Is the Roosevelt Dam reinforced?

1 A No sir.

2 Q If it were reinforced, it would be stronger?

3 A Oh, if you made it of cast steel, it would be much
4 stronger. No use making it that way.

5 Q I noticed that the two wings broke off when I was up
6 there-- you saw it?

7 A Yes sir.

8 Q Broke off just like an egg shell-- that was on account
9 of the load that was on it?

10 A Yes, the resultant place of the strain.

11 Q Cracked it right off?

12 A Where the strain was.

13 Q BY THE CORONER: Where do you believe the dam broke
14 first?

15 A I am inclined to think it broke on the west side.

16 Q How do you account for the wing on the east side being
17 broken out from the center, almost identically like it did on the
18 west side?

19 A The reason is that the west side let go a tremendous
20 water and over against the east side, and there being there below
21 the dam was rocks in the formation-- great caves came down from
22 above-- that made the least little bit of an easement there, and
23 if you take and ease up on an arch, the arching effect is gone.

24 Q BY A JUROR: That central section still stands, not
25 moved on its foundation?

26 A I had a gang out there yesterday, and I am informed it
27 was moved three tenths of an inch down stream, and seven tenths
28 laterally, to one side. He had to take his observations from the
29 shore. I wouldn't say the thing is accurate.

30 Q Is there any record of the dam having settled since
31 its completion?

32 A We had observations on it, as we have on all the new
dams, and there was no displacement, no distortion. That isn't

1 Always the case with dams, sometimes we find dams yield quite
2 perceptibly.

3 Q Is there any place where the contact of the concrete
4 with the rock^{is}/exposed at present on that middle section?

5 A No, the section rests flat on the bottom where it was
6 built. They tell me going down stream, some of the engineers been
7 out there, a great many been there, they have been in the office
8 looking for data they want to have supplied, tell me there is one
9 piece down stream, I haven't seen it, that tore off the bottom.

10 Q Was there any grouting anytime beneath the dam?

11 A No.

12 Q Was there any perceptible flattening of the arch from
13 the usual flattening of an arch?

14 A None. I tried to detect that because I have had ex-
15 perience with arches. The dam was unusually tight after the
16 first year's experience, and the second, and this year up to within
17 a week or two ago.

18 Q BY MR. SCOTT: Has there been any time since the con-
19 struction of the St. Francis Dam, any apprehension or any un-
20 easiness on the part of engineers of the Department of Water and
21 Power, that it was about to break?

22 A No.

23 Q You didn't have any on the Monday that you were out
24 there?

25 A No, I didn't.

26 Q BY THE CORONER: Did any employees indicate to you
27 they were afraid the dam was unsafe?

28 A Absolutely none, no sir.

29 Q Did you know any employees were contemplating moving
30 their families out of the camp?

31 A I knew them both. When I left there Harnischfeger and
32 Ely, and both in the closest kind of contact with Van and I when
we were up there laying out some work.

1 Q Did you give any instructions there for any other work
2 that day?

3 A Reviewing the road that was being built, I think I
4 made some suggestions, some changes in method.

5 Q If you had realized the dam was likely to break, what
6 measures would you have taken for the safety of the lives of
7 persons in the canyon?

8 A I would have sent a Paul Revere alarm up and down the
9 Valley.

10 Q It didn't look to you that there was any occasion for
11 alarming the people in the valley of the canyon?

12 A No sir.

13 Q What effect does silt or other than sharp sand used in
14 the construction of concrete have on the structure, Mr. Mulholland?

15 A Silt-- you mean included--

16 Q Yes, included in the mixture?

17 A It may have a very beneficial effect. The tests of
18 the famous-- what they call the Yellowstone Test of the United
19 States Government, revealed the fact that some addition of silt,
20 and even clay, added to the strength of cement, but we had nothing
21 of that kind to bother our heads, because there was no silt,
22 nothing but pure gravel used.

23 Q And sand?

24 A Yes.

25 Q Sand washed?

26 A Yes, taken out of the wash there. That is all dis-
27 closed in the quality of the goods, and the quality is revealed
28 right there in the concrete. The concrete couldn't be any better,
29 or much better than that that is there now. Nobody has ever
30 questioned the quality of that concrete. Every engineer that
31 comes in gives a sigh of relief that it wasn't the concrete.

32 Q If you find it was claimed by anyone that there was
dirt in the sand, that there was some quantity of clay and dirt

1 there, that the sand wasn't washed, what effect would that have?

2 A I would deny it. In the first place, we would have to
3 import clay to get it into the concrete.

4 Q How about decomposed granite?

5 A No granite in the mountain until you get up above Power
6 Plant No. 1, a half mile above there a granite mountain comes in
7 there, and you will find occasionally pieces of boulders in the
8 concrete or in the wash.

9 Q If there was presence of dirt in the concrete, would you
10 say it would have no right being there?

11 A I would say if it showed its effect in depreciating the
12 value of the concrete, I would say it had no business there.

13 Q Do you know whether soil mixed with concrete would
14 weaken the structure?

15 A I don't know that, but I avoid putting it in, that is
16 all. There has been many tests made, reveals the fact that con-
17 crete is absolutely improved by the addition of finer materials
18 than is actually used. I don't follow that practice though.

19 Q Are your engineers in charge of construction directed to
20 avoid dirt?

21 A Yes sir.

22 Q If there was any dirt in there, it was without your
23 knowledge?

24 A Yes sir.

25 Q BY A JUROR: After you found this new leak, what
26 happened, what did you do?

27 A I had no plan in mind yet.

28 Q I presume you planned to lower the flow carefully?

29 A Yes, draw the water out slowly. There is no means of
30 lowering it more than a foot a day.

31 Q BY THE CORONER: Did you state awhile ago, even if you
32 had wanted to relieve the pressure on that dam, you couldn't re-
lieve the pressure by opening all the gates?

1 A No sir.

2 Q There would be no way to relieve the pressure within a
3 few hours?

4 A No, it would come down too slow. All four gates
5 opened there would draw about a thousand, a little over one
6 thousand feet.

7 Q The only thing you could do was warn the people and let
8 the dam go?

9 A That is all, just the same as any big dam anywhere.
10 There is no possible chance of warning them, but that thing would
11 lower at the rate of a foot and a half a day-- not that much--
12 about a foot a day.

13 Q BY MR. SCOTT: I have these original photographs-- Mr.
14 Mulholland might explain to the jury-- these photographs were
15 taken April, 1925. Mr. Mulholland, point out the leak as you saw
16 it the Monday you were there at St. Francis Dam.

17 A The leak occurred just about here (indicating on
18 photograph)-- that little dark place you see is a leak, one of
19 these pinhole leaks, had been running for a long time.

20 Q BY A JUROR: At that time, the depth of the water was
21 about sixty feet?

22 A Sixty or seventy feet, I judge.

23 Q Where is the spillway located?

24 A They are there (indicating).

25 Q Were these taken recently?

26 A This was taken about June, 1926.

27 Q BY DISTRICT ATTORNEY: 1926 or 1927?

28 A Yes.

29 Q BY A JUROR: Did the conglomerate formation extend
30 clear to the top of the dam?

31 A Unless you go way out here (indicating), run up the
32 hump there. There is a conglomerate near the edge of the canyon,
and that is the main formation of the canyon.

1 Q Then there was no ordinary top soil condition under the
2 base of the dam at any point?

3 A Oh, no.

4 Q BY MR. MOHR: They were speaking of conglomerate-- this
5 will show better.

6 A The conglomerate runs down to a point about twenty,
7 yes thirty feet beyond where the thing terminates.

8 Q BY A JUROR: Can you locate the contact between the two
9 formations?

10 A Yes sir, very clearly marked. It isn't shown there,
11 but if you go out on the ground you can see it clearly.

12 Q Where was this leak with reference to the contact?

13 A It was above the contact.

14 Q Would it be possible to go out on the ground and dis-
15 cuss some of these things?

16 THE CORONER: That can be arranged, possibly.

17 Q BY DISTRICT ATTORNEY: When was this picture taken?

18 MR. MOHR: I had it taken the morning after the flood.
19 This is an airplane picture, Mr. Dennison. You will notice the
20 names printed on there.

21 THE CORONER: Taken by Spence Airplane Photos. If you
22 have no further questions, we will excuse Mr. Mulholland now.

23
24
25 NAT FISHER, being first duly sworn,
26 testified as follows:

27 BY THE CORONER:

28 Q Please state your name.

29 A Nat Fisher.

30 Q Where do you reside?

31 A 1150 West Garvey Avenue, Monterey Park, California.

32 Q What is your occupation?

A Moving pictures.

1 Q Did you take moving pictures of the site of the St.
2 Francis Dam since it happened?

3 A I did.

4 Q Have you those pictures here today?

5 A I have.

6 Q Just when did you make the pictures?

7 A The next morning after the tragedy.

8 Q All of them the next morning, and some subsequently?

9 A All of last week I have been up there, practically
10 every day, and I was there again Sunday, and I was there again
11 yesterday, and yesterday I took another shot of the dam. The
12 first day I was up there, I took the upper part of the dam, upper
13 section where the basin was, where the water was, and yesterday
14 I also made the trip again. The Forestry Department detailed a
15 man to take me around, and I went up again over another route, and
16 took this part of the valley where the water came out, and I got a
17 very lovely picture.

18 Q On whose behalf were you taking these pictures?

19 A My own.

20 Q You are not employed by any interests?

21 A Absolutely none.

22 Q I wish you would show these pictures at this time, if
23 you will do so.

24 A I will do so.

25 (The room was darkened and the moving pictures shown).
26
27

28 STANLEY DUNHAM, being first duly sworn,
29 testified as follows:

30 BY THE CORONER:

31 Q Please state your full name.

32 A Stanley Dunham.

Q Where do you reside?

1 A Lower Reservoir, San Fernando.

2 Q What is your occupation?

3 A General Superintendent-- Superintendent of the Water
4 Department, City of Los Angeles.

5 Q You are familiar with the construction of the St.
6 Francis Dam?

7 A Yes sir.

8 Q Were you engineer in charge of the dam?

9 A I was superintendent of construction.

10 Q Did you also have to do with the selection of a site
11 for the dam?

12 A No sir.

13 Q Who selected the sight?

14 A Engineers from the office.

15 Q You did the preliminary work of the excavation?

16 A Yes sir.

17 Q At the direction of the Chief Engineer?

18 A Yes, Chief Engineer.

19 Q Personally, the Chief Engineer?

20 A Him and his representatives.

21 Q Do you recall just when the dam was started?

22 A I was there in May, the first of May, 1924, was when I
23 first went up there.

24 Q What was the first thing you did there?

25 A Complete roads around the hills.

26 Q When did the actual work of excavating for the dam
27 begin?

28 A About June, 1924.

29 Q What tests were made, if you know, for testing for the
30 foundation of the dam?

31 A None made at all.

32 Q Give in detail to the jury how this dam was built.

A First started with the construction-- we dug a trench

1 about eight feet wide to the upper tow of the dam. I went down
2 into bed rock, before we concreted, to shut off the underground
3 water. After that put a tunnel in the full width of the dam-- ex-
4 cavated all we could-- after that we cleaned that off, took all the
5 loose stuff possible to pick with the use of gads. We started in
6 with the construction of the dam, drilled at least twenty feet ^{apart} in
7 the axis of the dam, ten, twelve or fifteen feet deep, afterwards
8 they were all connected by pipes to drain off any water. After
9 that we started pouring the dam. Everything was cleaned, washed
10 everything possible to tear loose by gads or picks, and from then
11 on we just built the concrete, put the concrete in, keeping it
12 practically level to the formation on both sides, and you may see
13 some smooth places in the dam where there is chunks broken off. At
14 the end of a day's work, bulkhead made from the base of the dam,
15 bulkheaded it at ten to twelve feet, from then tapered off to make
16 a smooth joint on the base, bulkhead taken out and next day put it
17 up against it, new concrete, carried that out---

18 Q How many days a week did you work?

19 A Six days a week.

20 Q You had a general plan for the construction work?

21 A Yes sir.

22 Q What plan did you follow?

23 A The plan handed me.

24 Q Show to the jury the plan you worked upon.

25 A (Witness handed a number of blueprints) This type of
26 the dam showing the outline on the outside.

27 Q BY DISTRICT ATTORNEY: What is the number of that?

28 A Here it is, No. 10489, small sheet is 9392, the small
29 sheet is the reservoir.

30 Q The next one?

31 A That is copy of the amount of water during construction
32 in 1926. I was still building it, and they filled it with water,
and 1927, last year, it was that full, and this (indicating) is

1 this year, it went out. It shows daily report of the reservoir.

2 Q Give me the number what it is.

3 A That is the same we were talking about, this was 10489.

4 Q What is that (indicating blueprint)?

5 A It is a cut of the dam, section of the dam.

6 Q The next number?

7 A 10490.

8 Q What is that?

9 A It just gives a cut of the dam and the plan of the dam
10 up in the corner-- it is 10515-- shows the gates, detail of the gate
11 is all. This (indicating) is 10614-A, details of the map-- this
12 is detail of the spillway, and this is the deck of the spillway.
13 This is the breast construction here (indicating), No. 10414-B, de-
14 tailed stuff. This is 10508, cross section of the axis of the dam
15 on the bed rock in the bottom of the canyon.

16 Q BY THE CORONER: What are the dimensions of that bed
17 rock in the bottom of the canyon, the width across the stream facing
18 down stream?

19 A I can tell you, I got it right here, from 9.20 to 80
20 feet wide. That was underneath the stream bed.

21 Q Was ^{that} the part on which the center also was constructed?

22 A The part standing now. This (indicating) is a contour
23 map of the dam, No. 5149. This is No. 1145, detour of the bed rock.

24 Q BY DISTRICT ATTORNEY: Would that be the cross section
25 before it was poured?

26 A Yes sir, the concrete was poured against this (in-
27 dicating). That profile you see in that first picture is right
28 through here (indicating). This is what is called the axis of the
29 dam, center of the crest.

30 Q BY A JUROR: Are these bed rock contours carried out?

31 A No, just as far as they show they are, because the dirt
32 remains there.

1 Q Any drillings made outside of the projection of the dam?

2 A The drillings were all made in the dam site itself.

3 Q There were no drillings outside?

4 A Outside of the dam.

5 Q Then you don't know the position of the bed rock any
6 material distance from the dam?

7 A No.

8 Q Which way was that strata confined, down stream or up-
9 stream?

10 A It was cross stream, tipping from the hill in on this
11 side (indicating), tipped towards the west.

12 Q As you kept coming in here (indicating), picking off that
13 top soil, moved it off to one side?

14 A The first thing we done, before I excavated anything, we
15 had a high pressure of about a hundred and sixty or a hundred and
16 seventy-five water pressure, and washed this whole hillside off, all
17 that was loose, the whole mountain side where the dam was going to be
18 placed. Then we shovelled that all out, and as we progressed up the
19 sides of the hills, we dug in all we possibly could get off.

20 Q You stated you dug a trench eight feet wide?

21 A That was in the bottom here (indicating).

22 Q The tunnel didn't run up the sides?

23 A No, no, we just started at the stream bed. There is
24 original ground surface. We excavated with this trench down to
25 bedrock.

26 Q BY MR. MOHR: What did you do on those wings?

27 A The original surface of the mountain was here (indicating).
28 We started right at the top and dug down on this arc, the upper tow,
29 clear into bedrock.

30 Q Before any concrete was placed, it was all cleared out?

31 A This (indicating) was eight feet wide, and dug clear to
32 bedrock, and that eight foot trench was poured with concrete-- that

1 shut off the underground water, let me get in behind it with
2 shevels and dig out that-- very cheap, just a cheap method of
3 getting the back part out.

4 Q Did any order go through to you to put that in?

5 A No, that is the way I done it to shut the water off,
6 to avoid having trouble with water.

7 Q BY THE CORONER: How much of the dam was to the east of
8 the bedrock there where your profile map shows-- how wide was the
9 dam-- in other words, from the central part of the dam to the east
10 wall of the canyon-- how much of the dam extended to the east and
11 west part of the dam which was resting on this bedrock-- how far
12 east from the part standing now to where it sheered off on the west
13 side?

14 A It doesn't show on this.

15 Q Have you been there since the accident?

16 A Just one time.

17 Q Did you take any measurements?

18 A No. There is a gap in there of about one hundred and
19 fifty feet, I would say.

20 Q None of that part rested on bedrock?

21 A Oh, yes, every part of the dam rested on bedrock.

22 Q What was the formation on the west side, what kind of
23 bedrock?

24 A I am not geologist enough to state, I might call it
25 conglomerate.

26 Q On the east side what is the formation?

27 A Shale formation.

28 Q Different formation?

29 A Some of it and some shale. I call it shale.

30 Q Is that part of the west part that now remains standing
31 embedded as deep in the bottom as the central part?

32 A No, because bedrock, both east and west sides, have

1 quite a ways up the canyon in height above the stream bed was very
2 steep and no dirt. Broken rock was exposed before I started clean-
3 ing, but I took all that rock off I possibly could.

4 Q And set your concrete on the native rock?

5 A On the native rock there.

6 Q BY MR. MOHR: In speaking of shale, commonly known as
7 schist?

8 A Commonly known as shale. I am not geologist enough to
9 tell you.

10 Q BY MR. SCOTT: As Superintendent of Construction of the
11 Department of Water and Power, at the time this dam was built, you
12 had full charge of that construction work, the actual digging in the
13 ground until you reached bedrock?

14 A Yes sir.

15 Q I believe you said there were some borings made there?

16 A I made it as far up, all across the bottom and as far
17 up as I could get the machine.

18 Q How far up on the west side did you make the borings--
19 about as high as the original stream-- you made borings on the east
20 and west side?

21 A On the east side was just up from the bottom, loose bed-
22 rock-- was just a little ways, because it started right straight up,
23 couldn't walk up it.

24 Q How deep did you dig in on both sides, on the east side
25 and west side to anchor the dam in?

26 A Until you couldn't dig any more, until solid rock, then
27 I dug a little drift in on the east side to see if all that shale,
28 what I call shale, was the same, and I dug in about thirty feet,
29 between thirty and forty feet, used a little powder, and it was the
30 same thing, and we filled it up as full as we could by hand, and put
31 a greuting machine in.

32 Q You ran a little tunnel on the east side?

1 A Yes sir.

2 Q About thirty feet?

3 A It was a little over thirty.

4 Q What was the object of running the tunnel?

5 A To see that the rock was the same there, inside, as it
6 was on the outside.

7 Q What was the character of the rock in the base of the
8 tunnel?

9 A It was the same as the outside.

10 Q Then you covered it up or filled it up?

11 A Filled it up with concrete when I built the dam.

12 Q What part of the dam did that go into-- before you con-
13 structed the dam was it above the dam or below the dam?

14 A It was just a little down stream from the axis of the
15 dam.

16 Q Was it completely cemented up?

17 A Yes sir, by pressure.

18 Q One of these blueprints shows the depth only to bedrock
19 all the way up on the east side, and all the way up on the west side?

20 A That shows contours of the bedrock.

21 Q That would be the depth from the surface down to where
22 you---

23 A No, shows the elevation of the bedrock in respect to the
24 hill.

25 Q Did you do any blasting?

26 A No sir, only in this little drift, blasted out a little
27 to get in.

28 Q Was the entire dam set on bedrock all the way up on the
29 east side and on the west side?

30 A Absolutely.

31 Q BY DISTRICT ATTORNEY: What kind of bedrock was it on
32 the east side?

1 A I am calling it shale, what I call shale-- I am not
2 geologist enough to know.

3 Q As I understand you, in answer to the questions, you
4 put it in your explanation, drilling down to the stream level, as
5 shown on your map?

6 A We made borings after the dirt was taken out in the
7 stream bed.

8 Q First you went up and washed down the sides of the hill?

9 A Yes sir.

10 Q Down to the natural hill on either side?

11 A As much as would come off by water.

12 Q Then you took and washed that stuff out of the way?

13 A Carted it out of the way.

14 Q Then you used a diamond drill?

15 A Shot drill.

16 Q You went down vertically at the stream level until about
17 twenty feet to what you call bedrock?

18 A You misunderstand me. We washed the hillsides down,
19 then I put this eight foot upper tow in to shut the water off. Then
20 we excavated all the sand, gravel and rock, until we got down to
21 bedrock. After the shovel wouldn't touch any more, cleaned that
22 all off then by picks and gads, took all the remaining part off, and
23 from there the whole borings was in rock.

24 Q When did you make the borings?

25 A Before we put the concrete on the bedrock.

26 Q How long a distance did you bore?

27 A Twelve to fifteen feet.

28 Q Laterally?

29 A Straight down.

30 Q But laterally, what distance did you use?

31 A Didn't bore any laterally, only this tunnel I put in.

32 Q Your profile shows a certain length-- it was about eighty

1 feet, or the width of that standing structure now?

2 A Yes.

3 Q How many holes did you bore?

4 A Twenty feet apart, and there was two lines of them, so
5 they averaged ten feet.

6 Q You got down to bedrock, went into bedrock?

7 A Yes.

8 Q How far did you go into it?

9 A All we could take off. It was a foot someplace, it was
10 irregular, all the soft pieces we took out.

11 Q After you took the cores out, what was that shale or
12 schist?

13 A I tell you I can't qualify to say.

14 Q Would you submit it to a geologist?

15 A All the borings were brought up, kept and recorded there.

16 Q You made a log of it?

17 A Oh, yes.

18 Q Where is it?

19 A Either in our office-- don't know just where it is-- I
20 haven't turned it in.

21 Q You didn't do any boring on the side of the hill?

22 A No.

23 Q Laterally or horizontally?

24 A No.

25 Q Or anyway?

26 A Not outside of that tunnel.

27 Q Did you make any determinations whether that bedrock ran
28 horizontally across that valley?

29 A We didn't make any test outside of the floor of the dam.

30 Q So, as I understand this thing, you put this structure,
31 this dam upon bedrock, that is the portion that remains, and the
32 rest of it you just put on the side of the hill?

1 A Oh, no.

2 Q How did you get it to the hill, onto the hill, what did
3 you do?

4 A We placed it right against the bedrock.

5 Q Poured it up against the hill?

6 A Certainly.

7 Q What did you do to make it water tight?

8 A Made concrete.

9 Q Nothing else?

10 A Why, no.

11 Q What do you estimate the safe load you could put on
12 these wings?

13 A We didn't do any estimating, it was done in our office,
14 in the engineer's office.

15 Q What did you estimate the safe load you could put on
16 the structure?

17 A I don't do that, the engineers in the office do that.

18 Q What was the safe load to place upon that dam?

19 A It is beyond me to say, I don't know.

20 Q Is there anybody over there that knows?

21 A Probably figure it out.

22 Q What was the load on the dam at the time it fell?

23 A Full of water is the only load against the dam.

24 Q Don't you know what the load would be against it?

25 A I never figured it out myself.

26 Q Whose duty was it to know that?

27 A Our engineer.

28 Q Who was that?

29 A Directly under Mr. Mulholland and his assistants.

30 Q Was there anybody else over there would know that?

31 A Probably is, I couldn't call their names.

32 Q Whose duty was it there to know it?

1 A They turn those plans over to me and I went and followed
2 it. I never questioned the plans at all.

3 Q As you erected this structure, did you test the strength
4 of it?

5 A Yes sir.

6 Q How?

7 A By crushing strength.

8 Q How did you do that?

9 A Brought down samples to Los Angeles, and they sent it
10 over to have a crushing strength put on it.

11 Q What did they report the crushing strength of these
12 materials were?

13 A Didn't report to me.

14 Q Didn't make any report?

15 A Said it was good enough, tried to crush a cubic foot
16 and couldn't. I understand they put two hundred tons to the square
17 foot.

18 Q Did you exercise supervision over this mixture of cement
19 and sand?

20 A Yes sir.

21 Q What was the ratio?

22 A A barrel and thirteen one hundredths to the yard.

23 Q What would that be, four, five or six?

24 A Figures a little under six.

25 Q Is that the recognized standard of richness for that
26 kind of thing?

27 A Yes.

28 Q Where did you get the sand from?

29 A Stream bed below the dam.

30 Q Its percentage of silt was how much?

31 A Never was tested, it was small, we never tested it.

32 Q If you had forty percent of silt in that, would it make

1 a strong wall?

2 A No sir. I believe the government allows ten percent.

3 Q You can use that safely?

4 A I think the government allows that much.

5 Q Would you say that was a good sand?

6 A I wouldn't want to ~~any~~ use too much of it.

7 Q What kind of cement did you use?

8 A Monolith.

9 Q Is that a Portland cement?

10 A Yes sir.

11 Q Is that the kind of cement used in all structures of
12 that kind?

13 A Two cars of Riverside Portland cement.

14 Q Is there any difference in Monolith cement and Portland
15 cement?

16 A Only price is all.

17 Q It is Portland cement?

18 A Portland cement.

19 Q That is supposed to be the best cement you can get?

20 A It was price, because it would be cheaper to deliver
21 there. The price at the mill was the same.

22 Q Do you know anything about any soil being brought from
23 an adjacent field there and mixed in this thing, in the concrete?

24 A Absolutely not.

25 Q Was there any such thing took place?

26 A No.

27 Q You were there from the time this structure was started
28 until it was completed?

29 A I put the first shovelful in, and the last.

30 Q When was it tested, the dam itself, when completed?

31 A Started filling it before I was completed with the dam.

32 Q Steps down in there, all poured at the same time, dam,

1 steps and everything?

2 A Poured in with these forms, that is just the height of
3 the form, pour five foot lifts at a time.

4 Q Start at the bottom, pour five feet, go up the same way,
5 the whole dam?

6 A Yes sir. At the east end and west end wing it was so
7 far out, the last of the wings, we poured it in, poured against the
8 bedrock-- we couldn't reach it, put on a little later, but practical-
9 ly the dam was brought up level from the bedrock clear to the top.

10 Q Did you have to put any braces, anything in it?

11 A No sir.

12 Q Anything to keep it from slipping?

13 A No sir.

14 Q Didn't have to have any reinforcements of any kind?

15 A No.

16 Q Did you have to have any reinforcements between these
17 various places of pouring?

18 A Poured just like figs are packed.

19 Q Like a brick wall is put up?

20 A Not necessarily-- piles in a pile-- let ~~in~~ the concrete
21 fall in one pile, it will come up a little to a level, and we will
22 move it, and pour another pile in between. That is the way it was
23 poured all over the dam.

24 Q You truthfully believe this dam was properly con-
25 structed?

26 A In my estimation it was.

27 Q Out of proper materials?

28 A Yes sir.

29 Q Proper workmanship?

30 A Yes sir.

31 Q Have you any opinion why it failed?

32 A No sir, I can't conceive of it.

1 Q It was designed, as I understand, to carry a safe load?

2 A Yes sir.

3 Q You put in the proper materials?

4 A Yes sir.

5 Q Built according to plans and specifications-- it fell
6 down, it went out?

7 A It went out, evidently that, wouldn't say it fell down.

8 Q Do you think it went out because it had too heavy a
9 load on it?

10 A No sir, it was within a foot of the same height last
11 year, and stayed that way for quite a length of time.

12 Q Have you any opinion why that thing should have gone
13 out?

14 A I haven't, and I am not competent enough to express an
15 opinion.

16 Q BY THE CORONER: When were you up there last?

17 A I inquired of Mr. Phillips, and it was about a month
18 ago, didn't stop.

19 Q Didn't see any seepages there?

20 A I asked Mr. Phillips about it then, and he said there
21 was about four inches of seepage in the whole dam.

22 Q Who is he?

23 A He is my superior, engineer, so I drove up, didn't even
24 stop, and I noticed that the leakage, couldn't see any only the wet
25 spots-- leakage in the dam, there wasn't any, probably sweats.

26 Q How many mixers did you use?

27 A Two.

28 Q Who were the mixers?

29 A I couldn't call them by name. I have one working for
30 me now.

31 Q What is his name?

32 A Al Plummer.

1 Q Don't know the names of the others?

2 A No.

3 Q How long did it take you to build this dam?

4 A The first concrete I poured was around the tenth of
5 October, 1924. I finished in May, practically, 1926, or June. We
6 have the daily progress recorded.

7 Q You have specifications for mixing concrete?

8 A Yes.

9 Q You followed the specifications furnished?

10 A Absolutely.

11 Q If it was shown there was clay, lumps of clay, large
12 lumps several inches in diameter in that concrete now, how would you
13 account for that?

14 A Might slip by the man watching it.

15 Q And dirt in large quantities, if found in the concrete,
16 how would it get there?

17 A It would have to just slip by, but I haven't seen any
18 of it myself.

19 Q Did you personally superintend the pouring of all that
20 concrete?

21 A I had my foreman, Mr. Lindsay, William Lindsay was
22 there.

23 Q Is he here?

24 A He is not here now. He is running my job in Owens
25 Valley.

26 Q BY MR. MOHR: Just to clear up an impression, Gentlemen
27 of the Jury-- Mr. Dunham, I think you were confused and didn't
28 quite understand the question of Mr. Dennison brought out, and we
29 would like to have you explain to the Jury just exactly how you
30 constructed the west portion of the dam into the mountain up to
31 these wings, and what you did so far as the construction---

32 A You know this (indicating blueprint) is just xxx the
rough contours of the dirt, but we was in there from the bottom of

1 the stream bed right here (indicating) to about this high (in-
2 dicating). I washed all of it, washed the loose dirt, anything
3 that was loose, and from here on to here (indicating) is a trench
4 dug by shovel.

5 Q How wide?

6 A It varies, there, it is only two feet deep, and that is
7 the height of the dam. It ran from about fifteen feet here to
8 nothing.

9 Q How high would this be (indicating) above the more
10 level-- runs into this knoll, this is the top of the knoll (in-
11 dicating)?

12 A This knoll is a couple of feet high.

13 Q BY A JUROR: What was done in here (indicating on blue-
14 print) in the way of excavating for the tow?

15 A After the hydraulic--^{as}/we built the dam up we kept com-
16 ing back in-- we come into the hill as we built the dam.

17 Q How far back into that did you go?

18 A After the hydraulic, went two, three or four feet, as
19 much as we could pick off by picks and gads.

20 Q Did you do any shooting there?

21 A No sir.

22 Q Was that enough to eliminate-- any seam there?

23 A We would notice a little white seam once in awhile.

24 Q As a rule, it was solid formation?

25 A It was conglomerate.

26 Q Where was the actual break?

27 A The actual break was about here (indicating on blue-
28 print) to that point there (indicating). That is how much is gone.

29 Q Did you use any of the conglomerate at all?

30 A No sir.

31 Q How did you break it?

32 A Just loosened it enough to pick it, so we could pick it

1 out, and then I filled the tunnel by running a pipe---

2 Q Any excavating-- this west wing-- did you notice on top
3 of the conglomerate a streak of black, about six or eight inches of
4 black?

5 A Red adobe, red clay.

6 Q On top of that?

7 A That was the ground surface. We would hit some black
8 stuff, black clay in that red clay.

9 Q How about the juncture between the conglomerate and the
10 schist or shale?

11 A That was a black substance, don't know.

12 Q There was a black layer in there six or eight inches
13 thick?

14 A Yes, and there was a yellow color in there too, seemed
15 to be fairly hard.

16 Q How was this black layer, pretty hard?

17 A It was at the time I built the dam. We dug in there,
18 if it was a soft piece, dug in just as far as we could get into
19 that stuff. It was against the rock on both sides. We would make
20 a little richer mix around four to one, and sloppy.

21 Q Who decided when you were deep enough into this rock--
22 that was left to you purely?

23 A I excavated as far as I could, and at the approval of
24 Mr. Mulholland.

25 Q No one else?

26 A Engineers he had with him.

27 Q Did you have inspectors on the ground, representing the
28 office?

29 A No sir, we done our own work.

30 Q Are you able to indicate the approximate location of
31 the fracture at the west side of the piece standing up?

32 A Above this contour line here (indicating).

1 Q What was the shape of the bottom of that central
2 portion, flat bottom or picked down stream or upstream?

3 A Practically flat. Contours in the picture will show.

4 Q Have you seen it since the accident?

5 A I was there one day last Wednesday with the geologist.

6 Q Did you see exposure of the bedrock under that portion
7 in the vertical section?

8 A Here is a piece (indicating). There is some of the
9 bedrock washed away from here and some bedrock adhering to the dam.

10 Q BY MR. MOHR: I called your attention to the fact that
11 about three quarters of a mile from the dam site there are several
12 portions of that dam washed down there. Did you make examination
13 of that?

14 A I didn't. I was with the geologist and stayed with
15 him.

16 Q You didn't see this piece of concrete down there?

17 A Just from a distance.

18 Q Did you see any bedrock embedded into the piece?

19 A No sir, I wasn't down there, could see that just from a
20 distance.

21 Q BY THE CORONER: Mr. Dunham, from whom did you take in-
22 structions, from Mr. Mulholland or from Mr. Van Norman?

23 A Mr. Van Norman wasn't on the job, he was City Engineer
24 at that time.

25 Q He wasn't at the beginning of the construction work?

26 A No sir, he might have, I couldn't say that, but he
27 wasn't in as Mr. Mulholland's assistant at that time.

28 Q Was Mr. Phillips?

29 A Mr. Phillips was there, yes sir. If Mr. Mulholland
30 couldn't come out, he sent his orders out through Mr. Phillips.

31 Q BY A JUROR: As you laid your course, you kept that
32 more or less on a level?

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A Yes sir.

Q When you got to the west portion, you had to fill that up separate from the balance of the section?

A It was probably ten feet lower. The further out from the contour you went, you had to have a certain slope on your chutes, and you couldn't reach the same level way out to the extreme edges, so they would probably be five or ten feet lower. There is photographs will show you.

Q How many days ^{interval} pouring that in?

A Probably two or three weeks.

1 Q BY MR. SCOTT: Was there any clay in the formation there?

2 A That I built on?

3 Q Yes.

4 A No sir, the clay was on top.

5 Q There was no clay in the concrete that you laid?

6 A Not that I ever saw. There may have been a few clots
7 that slipped by us once in a while, but there were men at the pit
8 watching and men on the grizzley watching and the men filling the
9 measuring hepper were watching it. It had to go through three or
10 four places.

11 Q Is there any clay in the country around there?

12 A Just a little on the hills, very hard, very little.

13 Q BY THE CORONER: Did you ever forbid your workmen there
14 or your mixers from using any dirt or anything that was not proper
15 for a concrete mixture?

16 A Oh, yes, I had a foreman that stayed right at the mixer
17 all the time watching the material as it came out.

18 Q What was his name?

19 A Jackson.

20 Q It was Jackson's duty to see that the mixture was right?

21 A It was his duty to see that I got clean gravel.

22 Q BY A JUROR: Was your sand and rock kept in bins?

23 A It was not separated. In one bin. The measuring hoppers
24 were over the mixer.

25 Q You used pit run stuff, you did not have a screen?

26 A Yes sir, only at the bin there were six inch T-rails,
27 railroad iron, across there, six inches apart, so that nothing
28 bigger than six inches went in before it was crushed, because the
29 mixer would not handle anything more than six inch stuff.
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32

1 JAMES EMERSON PHILLIPS, be-
2 ing first duly sworn, testified as follows:

3 BY THE CORONER.

4 Q Please state your name.

5 A James Emerson Phillips.

6 Q Where do you reside?

7 A 1322 Homby Avenue, Los Angeles, California.

8 Q What is your occupation or business or profession?

9 A I am employed as an engineer by the Los Angeles City
10 Water Department.

11 Q Were you so employed at the time that the St. Francis
12 Dam was first placed under construction?

13 A Yes sir.

14 Q Did you have something to do with the engineering of
15 that project?

16 A Part of the engineering. At that particular time I was
17 in charge of the Field Surveys, seeing that the dam was located as
18 laid out on the drawings. My main duties at that time, however,
19 were more particularly connected with making studies and collect-
20 ing data as to stream run-off and such things for the negotiating
21 with the ranchers below, in regard to the wise division of the
22 water.

23 Q Were you familiar with the geology of the location there
24 at the dam?

25 A I am familiar with it as it existed--- I am not a geolo-
26 gist, an expert.

27 Q Did you assist in making any ground tests there or tests
28 of the rock or the formation which was encountered there?

29 A Not previous to the selection of the site for the dam
30 but during the construction I was there frequently, but usually
31 where anything in connection with determination of the depth of
32 the foundation came up, it was usually in company with Mr. Malholl-
and or some of the other engineers.

1 Q There was a geological study of the ground made?

2 A We usually looked to Mr. Mulholland for such information
3 seeing that he has had more experience along that line that I have
4 had, and we accepted his judgment in such matters.

5 Q It is your opinion that a geological survey of the place
6 was made by Mr. Mulholland?

7 A Yes.

8 Q And there were no other geologists employed?

9 A There may have been others.

10 Q Were you present during the actual construction work?

11 A I made frequent trips there, yes.

12 Q You did not have actual supervision over the construction?

13 A No.

14 Q Do you know what the specifications were for the concrete
15 which was to be poured there?

16 A There were no written specifications. In our Department
17 we usually do not get out written specifications for our own work
18 because our own organization does the work and men are employed who
19 it is felt are competent to do the work in a workmanlike and satis-
20 factory manner and select such materials as are adequate for the
21 purpose for which they are used, and, of course, the general super-
22 vision is made over such things by the engineers.

23 Q Were Mr. Dunham's instructions in regard to building
24 the dam, except the plans, verbal?

25 A Yes sir.

26 Q There were no written instructions as to how the concrete
27 should be mixed?

28 A No sir.

29 Q Do you know of your own knowledge whether or not the con-
30 crete that went in there was according to the instructions given to
31 Mr. Dunham?

32 A They were, as far as I know.

1 Q Do you know of any faulty or weak concrete going in
2 there?

3 A No sir, not while I was there.

4 Q Do you know of any material that was improper in a case
5 of that kind, being used?

6 A No sir.

7 Q Do you know whether a test was made to determine the
8 strength of the concrete?

9 A I don't know, I did not make it myself.

10 Q Was it ever communicated to you that the dam was unsafe
11 prior to the time that it went out?

12 A No sir.

13 Q Were you up there prior to the time it went out?

14 A Yes.

15 Q Did you see any leaks there?

16 A Yes.

17 Q Where were they?

18 A There was slight leakage at the east end of the dam and
19 has been for some time when the water was well up in the reservoir.

20 Q When you say the east end do you mean the hill at the
21 side of the canyon or through the concrete or under it?

22 A As far as I could tell it was coming through either the
23 formation of the concrete or near the end of the dam.

24 Q It might have been around the end of the concrete or-its
25 where it abutted up against the hill?

26 A Yes.

27 Q Where else did you see leaks?

28 A There was seepage at the west abutment at a point from,
29 I should say, thirty feet above what would be the original stream
30 bed of the creek, and then away on top of the hill at this so-called
31 dyke, the projecting wing at the west end.

32 Q Will you refer to this photograph?

1 A We consider that to be the so-called dyke. It is just a
2 low concrete dam, an extension of the dam.

3 Q I will show you this picture of the dam. About where
4 would you indicate that leak on the west side?

5 A The one I refer to cannot be seen on this photograph. We
6 have the one leak from the easterly side of the canyon.

7 Q Does this show it?

8 A No, I cannot show it from this picture. A picture taken
9 from the east side---- as long as you have this one here, I will
10 speak of another one, which was through a crack in this dyke.

11 Q How far west of the abutment?

12 A It was about at this point here (indicating), probably a
13 hundred and fifty feet west of the abutment. That leak appeared
14 after the water reached near the high water mark.

15 Q BY MR. SCOTT: What was the depth of the water at that
16 point?

17 A This so-called dyke goes down into the original formation
18 there, into the hard material of which this hill is composed, eight
19 or ten feet. We excavated into that hard material and the bottom
20 of the concrete in the dam here will vary from six to eight or ten
21 feet below this ground surface here (indicating). This ground
22 here was filled in. After the concrete structure was built we
23 put the dirt against the face of the dyke.

24 Q What was the depth of the water at the time that you saw
25 that leak?

26 A The reservoir was full.

27 Q How much water was behind the wall at that point? How
28 many feet from the surface of the water to the point of issue of
29 the leak?

30 A I could not tell. As soon as this water came through
31 that crack it began soaking up the loose soil on the top of that
32 formation there and we thought it a good plan---- Mr. Mulholland or

1 Mr. Van Norman, I forget which---- if we put a tile drain in there
2 to lead that leak water away from the dam, so as not to soften
3 that up, and in excavating for the trench we dug down along the
4 face of the dyke in front of the crack and we noticed this water
5 bubbling up like a spring, as though it was coming through the
6 crack in the concrete and meeting this hard material of which the
7 hill was formed and being unable to go through it the only place
8 it could come was to rise up until it reached the surface or some
9 of the weathered material on the top and seeped through. These
10 men working there made that muddy water.

11 Q That was not recently?

12 A Yes, that was the week before last.

13 Q BY A JUROR: Was that the big break?

14 A No, just a minor break. It was not exactly a leak. It
15 was just a sweating through the formation. It was down below.
16 this point here, more nearly towards the bottom of the dam.

17 Q BY THE CORONER: Was there a crack in the concrete there
18 that was admitting the water?

19 A There was a vertical crack here, yes, and another one
20 here and some of the water was coming through that crack in the
21 dam.

22 Q Towards the west side of the canyon, towards the abutment,
23 was there not a long crack which was caulked up with oakum?

24 A We grouted that.

25 Q Was there any oakum stuck in cracks there that you know
26 of?

27 A They may have put some oakum on the lower side to hold
28 this grout. ~~We filled up~~^{drilled} into the top and face of the dam and in
29 order to get a hold there we poured this grout down there to keep
30 it from running out. We put a little oakum or something in the
31 lower face of the dam. That is just a construction detail of do-
32 ing these things.

1 Q I understand that the ground just west of the abutment
2 there was becoming pretty moist and the road you had originally
3 used to get up around the west side of the dam, was pretty soft,
4 and you were building another road?

5 A That came from this leak of which I spoke to you a while
6 ago. Softening up of loose dirt on top.

7 Q How long had that leak been running, do you know?

8 A I could not say definitely. The first indication I knew
9 of it was over a month ago.

10 Q Were you with Mr. Mulholland on the 12th of March when
11 he was up there?

12 A No, I was not with him that day.

13 Q Were you up there a few days prior to that?

14 A Yes.

15 Q Did you talk to the keeper up there at that time?

16 A No, I did not see the keeper.

17 Q Did you talk to anybody up there around the camp or at
18 the dam about the condition of the dam?

19 A Not personally that day, but I talk to him over the
20 telephone about every day. That is the usual practice.

21 Q Did you talk to the keeper on Monday, the 12th of March?

22 A No sir.

23 Q Did anybody report to you or did it come to your know-
24 ledge in any way that there was any serious condition up there at
25 the dam?

26 A No sir, none whatsoever.

27 Q It never was communicated to you?

28 A No.

29 Q You know Tony Harnischfeger?

30 A Yes sir.

31 Q He is on duty twenty-four hours a day up there?

32 A Twenty-four hours a day.

1 Q Where was he stationed, on the dam?

2 A No sir. The keeper's house was about a quarter of a mile
3 below the dam. There was really no place up on top there to build
4 a keeper's house.

5 Q Was he required to be on the dam at night?

6 A Not at all hours, no.

7 Q So there was nobody especially detailed to watch the dam
8 at the time that it began to break, there was no one there to see
9 it and give any warning?

10 A Not to my knowledge, no one on the top.

11 Q The keeper himself, like the other members of the camp,
12 were probably asleep in their own homes down the canyon?

13 A Very likely because there was no indication of alarm
14 and no reason^{why}/he should be up there at night.

15 Q As far as you know your office never received any warn-
16 ing that the dam was in danger and likely to go out?

17 A Not until the Sunday preceding. I was out of town. I
18 left Sunday night and did not return until after the dam went out.

19 Q Are you able to account for this calamity, as an engineer?

20 A No sir.

21 Q Have you any information that you could give this jury
22 that would probably be a clue as to why the dam failed?

23 A No, I could not. I have not had an opportunity to make
24 an inspection of the site since it went out and I don't know that
25 I would be competent to say what caused it.

26 Q How much experience have you had in this business?

27 A I have been--- I have attended an engineering school in
28 Indiana and had about two years experience on railway construction
29 and I was County Engineer in Indiana for two years, and on road
30 construction and bridge construction and in 1912 I entered the em-
31 ploy of the Los Angeles Water Department as a draftsman and have
32 been continuously employed with this department since that time.

1 Q How many dams have you assisted in building?

2 A All that I can say in regard to that is this, that I
3 have been out on the work a portion of the time and visited the
4 dams--- not in an advisory capacity or a supervisory capacity on
5 any of them until recently. It has only been recently when I
6 have been given any actual authority over the construction of the
7 dams. That has been since the construction of the St. Francis
8 Dam. I have been looking after the Tenemaha Dam during the past
9 year, in the Owans Valley.

10 Q BY MR. SCOTT: Who laid the plans for the St. Frances
11 Dam?

12 A Do you mean the designing of the dam?

13 Q Yes, who designed it?

14 A I believe that the computations were made under the
15 direction of Mr. Ed Bailey in the office of the Water Department.

16 Q No specifications were made as to the depth that should
17 be excavated for it?

18 A We could not make any specifications because we did not
19 know how deep we would go.

20 Q Was that survey of the depth that the excavations should
21 be made to reach bed rock made under your directions, the survey?

22 A So far as the survey was concerned we only determined
23 the location on the ground, the setting of the stakes to fit in
24 with the dam as planned and laid out on the maps.

25 Q Was that under your supervision?

26 A Yes sir.

27 Q Were you there when the excavation first began?

28 A I made frequent trips there, yes. I was not on the job.

29 Q Explain to the jury how you proceeded to lay the struc-
30 ture upon which this dam rested?

31 A In the first place the topography was taken of the reser-
32 voir and the dam site, which consisted of five foot contours. From

1 that map, photographic map, and from an examination of the site,
2 I suppose Mr. Mulholland or someone determined where that location
3 should be--- where the dam should be built on this map, and we laid
4 it out where it was laid out on the map, and then when construction
5 was ready to begin the surveyors staked it out on the ground in
6 accordance with this plan and then the surveyors were there all the
7 time, made that their headquarters, assisting in locating the form
8 work in the proper places, so as to follow out with exactness the
9 plans as shown.

10 Q What inspection was made from time to time and day to
11 day and week to week of the progress of the work?

12 A Mr. Dunham had charge of the construction work and fre-
13 quently Mr. Mulholland made frequent trips up there and quite often
14 I went with him and at times I went up alone just to see how the
15 work was going, to see what the formation and the footings looked
16 like, and various phases of the work.

17 Q What depth did you go right in the bottom of the canyon
18 to lay the foundation?

19 A A maximum depth of thirty feet below the original stream
20 bed.

21 Q Did you reach bed rock at that point?

22 A Yes, reached a point in the formation where the rock
23 seemed to be solid and impact, not broken up.

24 Q Did you personally inspect it at the time?

25 A Yes, I was down there in this trench and saw the rock.

26 Q Before the cement was poured?

27 A Yes sir.

28 Q Now then, take the east side, how was the excavation
29 made in the east side, to what depth, before the cement was poured?

30 A The soft material or any earth material or anything like
31 that, loose stones that could be sloughed off with a jet; we had
32 high pressure there from the aqueduct with fire hose and nozzles.

1 We hydrauliced all that loose material off that we could. That
2 was the practice on both sides of the dam, that is, both abutments.
3 Then, after that, with picks and gads and implements of such nature,
4 it was further taken off and excavated over the full width of the
5 concrete dam at the base. At the bottom, of course, it was quite
6 wide. The dam was, I believe, a hundred and sixty-seven feet
7 through at the bottom. That whole face against the hill was clean-
8 ed off, cleaned off of all loose material and picked off, all the
9 loose stones and then, along the axis of the dam a trench was ex-
10 cavated in still further into that hard rock on the east side.

11 Q To what depth did it go?

12 A That depth varied depending upon the nature of the rock.
13 If it seemed to be a little seamy we would go in a little further
14 and clean that off.

15 Q Whose judgment was it left to as to what depth to go in
16 on the east side?

17 A It was usually Mr. Mulholland's or Mr. Dunham would be
18 there together, and we would say in our judgment that was certainly
19 far enough to go. As I say, we did that same practice on the west
20 end, the west abutment. All such material the full thickness of
21 the dam of whatever height was cleaned off, hydrauliced off, sliced
22 off, and then we went in with hooks and gads and shovels and got
23 off what we could with them, and then along this axis of the dam
24 a trench from eight to---- about sixteen feet wide and it varied
25 in depth, depending on the formation at that point. We went far
26 enough into the hill on both sides until we were satisfied that we
27 would not get any better rock by going in further, and this key
28 into the rock was carried out the full length of the profile of the
29 dam.

30 Q Both on the east and west sides of the dam?

31 A Yes sir. Of course, the deepest place we went in was
32 in the bottom of the canyon where we went to a depth of thirty feet.

1 Q You have had some experience in anchoring dams of that
2 character into rock or soil such as it was in the San Francisco
3 Canyon?

4 A On small structures. I have never had any experience
5 of that kind on large structures.

6 Q Was it done in a good, workmanlike manner, and carried
7 in to the proper depth?

8 A I would so consider. The material that we encountered
9 in there where we stopped our excavation was---- anyone can see
10 that if you went a mile further back you would get the same thing.

11 Q What about this tunnel which was run on the east side
12 there that Mr. Stanley spoke of, was that made as a test tunnel
13 to determine the character of the material?

14 A Yes sir.

15 Q How far was that carried?

16 A About thirty to forty feet.

17 Q It was run into the mountain on the east side, thirty
18 feet?

19 A Yes sir.

20 Q And it was done to determine what?

21 A To determine the character of the rock on that side.

22 Q What did it disclose?

23 A That it was the same formation at the end of the tunnel
24 that it was out where we stopped excavating to place the concrete.

25 Q And then later it was filled up with cement?

26 A Yes.

27 Q And became part of the dam?

28 A Yes, an integral part of the dam.

29 Q Did you run any tunnel on the west side to determine
30 the character of the material on the west side?

31 A No sir.

32 Q Were these engineers that had charge of the construction
of the St. Francis Dam, competent engineers?

1 A Well,-----

2 Q Had they had any experience in constructing dams?

3 A It was all under the direction of Mr. Mulholland and he
4 has had quite a bit of experience in the construction of dams.

5 Q Has Stanley Dunham ever had any experience as a con-
6 struction engineer or as a foreman in pouring cement?

7 A Yes sir.

8 Q About what was the depth of the west/^{wing}end of the dam
9 anchored in to the mountain side?

10 A That varied from this key, as we call it. This trench
11 which was excavated to a width of about sixteen feet. That follow-
12 ed up the side of the hill clear to the farther end of this so-
13 called dyke, about a sixteen foot excavation, and that varied from
14 two feet in depth to ten feet in depth, depending upon the founda-
15 tion as we found it.

16 Q BY A JUROR: I did not get that understanding from Mr.
17 Dunham as to that key. Was that key on the axis of the dam?

18 A About on the axis of the dam.

19 Q And it was intended to key in both of the east and west
20 ends with the center section?

21 A Yes sir. It was merely a safeguard. Instead of key-
22 ing the whole width of the dam into the rock, we went in to what
23 we considered solid rock and then this narrow width we keyed into
24 the hill.

25 Q Were the abutments normal to the axis of the dam or did
26 they stand at an angle where they might easily slip off?

27 A The west side of the foundation wherever the slope of
28 the material tilted, that is, where the contour of the hill would
29 slope quite abruptly, it was the practice to cut that off level in
30 places, both in the direction of the axis of the dam and at right
31 angles to it, and depending upon the slope of the hill, but we
32 aim as nearly as possible to keep the footing horizontal, except

1 in cases, of course,---- for instance--- if this is the hill here
2 (indicating) and this is the level, the concrete was allowed to
3 sit up against a slope in this direction where it would kick back
4 along the axis of the dam, but latterly it was leveled also, so
5 as to get a flat horizontal footing for the concrete.

6 Q To take the thrust?

7 A Yes.

8 Q BY MR. SCOTT: Did you remain more or less in close
9 touch on your visits to the dam, continuously and from the time
10 construction was first started until construction was completed?

11 A Yes. I made frequent trips up there, usually about
12 once a week. At least once a week during the entire construction.

13 Q Could you say whether the dam was constructed in a good
14 and workmanlike manner, as far as you know?

15 A Yes sir.

16 Q As to the quality of the concrete or cement, tell the
17 jury about that?

18 A The concrete was made from gravels obtained in the wash
19 below the dam site. It was available there. It was the only
20 material which was available in that immediate vicinity. It was
21 gravel of the same kind and character that had been used years
22 before in building the aqueduct and power houses up there and used
23 in structures where great strength is required, that is, in
24 structural steel work and reinforced concrete work where strength
25 is required more than in a big block of massive concrete, such as
26 a dam of this kind, and we considered that that was test enough
27 for the material. It had gone through fifteen years of active
28 service and use and had performed all the functions required of
29 it and we thought that was sufficient evidence that it was good
30 material of which to make concrete.

31 Q Did you notice any clay or soil in this concrete?

32 A There is no clay in that country.

1 Q BY THE CORONER: Was any brought in from outside any-
2 where to be used there?

3 A No. That would be very unlikely. Of course, we would
4 not haul any material from the outside when we had good material
5 there. That part of it was watched very closely.

6 Q BY MR. MOHR: Have you been up there since the catastro-
7 phe?

8 A No, I have not.

9 Q In your examination of the dam did you see any play in
10 the concrete?

11 A No sir.

12 Q Did you ever see any in any part of it?

13 A No sir, never did.

14 Q I am speaking of the westerly dyke now. Have you seen
15 that recently?

16 A I saw it about the 7th of March. I think it was the
17 7th of March.

18 Q That is this portion of the dam, speaking of the large
19 picture? Were there any cracks in that?

20 A There is one slight crack. It is just a temperature
21 crack the same as you find in all large blocks of concrete.
22 These cracks occur in large masses of concrete.

23 Q Did you see anything sticking in that crack?

24 A No, I did not. This dyke away over here (indicating),
25 I was not out on that dyke on the last trip. The dyke I have re-
26 ferred to is just a long, low wing of the main dam.

27 Q That is the furthest westerly dyke?

28 A Yes.

29 Q That is also referred to as a dyke?

30 A Yes, we call it a dyke. It is just a small concrete
31 dam. There was a depression there and we filled it with concrete.

32 Q But you don't recall that there was anything sticking

1 in that crack there?

2 A No, I don't.

3 Q You spoke of there not being any specifications for the
4 concrete, on file in the office. Do you have various kinds of
5 concrete mixtures which are used by the department?

6 A Yes, our superintendents, depending on the nature of the
7 work, they mix in accordance with the nature of the work.

8 Q In the particular kind of work that is done you have a
9 standard for the concrete mixture, do you not?

10 A Well, yes, it maybe a one, two and four mixture, or a
11 one to six proportion, or one to eight. It depends entirely on
12 the nature of the construction. Reinforced concrete where great
13 strength is required takes a richer mixture.

14 Q Those various mixtures that are required for these
15 various kinds of work are standard in the office, are they not?

16 A No, I would not say that they are standard. We deter-
17 mine that for the particular case in hand.

18 Q Now, in this particular work, in the particular mix
19 which was used here, the mixture was that which was determined
20 as the best kind of a mixture for this kind of construction?

21 A Yes, it was a mix which was considered would give ample
22 strength for a structure of that kind.

23 Q Do you know whether or not that particular mixture was
24 the same as that used in the construction of similar dams?

25 A Well, yes, I think so. We varied the mixes somewhat
26 where we had contact with the rock, the foundation. That was
27 usually made somewhat richer and on the extreme face of the dam---
28 it was customary when we were pouring that part of the concrete
29 to make that concrete a little bit richer to provide somewhat
30 against any seepage or percolation of the water through the con-
31 crete.

32 Q The formation on the top is adequately inspected, is it

1 not?

2 A Yes sir.

3 Q And then, in addition to that inspection, the other in-
4 spection is made by the other officials in the department?

5 A Yes sir. Unless we contract work. Then, of course, we
6 put on regular inspectors to do the work.

7 Q BY MR. SCOTT: Were you there on the Sunday before?

8 A On Wednesday, the 7th of March.

9 Q About how much water was coming from the dam?

10 A The total flow of everything coming through these cracks
11 which I have spoken of, and any seepage which might have been com-
12 ing through the formation, amounted to about a second foot. I
13 think the maximum was fifty-two miners inches. We had a weir.
14 One cubic foot a second or fifty miners inches. We placed a
15 weir in the concrete conduit, which led below the dam far enough
16 so that it caught all waters which came around or through the dam,
17 or could get through at all, and measured that water by this weir,
18 and the maximum flow amounted to about fifty-two miners inches.

19 Q Had it increased recently?

20 A It had increased some, yes. We expect these things to
21 occur when we raise the level of the water in the reservoir.

22 Q Did you observe the color of the water as it came from
23 the reservoir?

24 A Yes sir, it was perfectly clear. There was no indica-
25 tion of any erosion whatever.

26 Q Did you know of anything, at the time that you were
27 there, to arouse your apprehension as an engineer, arouse your
28 suspicion that there was something wrong with the St. Francis Dam?

29 A No.

30 Q Did you have any discussion there that there was any-
31 thing wrong with it, in the Department of Water and Power?

32 A No. It is our practice to visit all of our dams fre-

1 quently, and we make these inspections as to leakage or any other
2 disturbance around the dams, and we usually, of course, talk about
3 it when we make these trips, as to conditions that we find them.
4 There was nothing, though, on this trip, which I made, to indicate
5 that there was anything to cause alarm.

6 Q BY MR. DENNISON: I may be mistaken but did you answer
7 the juror's question, as to the depth of the water opposite the
8 crack, near what you call the dyke?

9 A There seems to be some doubt as to what I called the
10 dyke. What I referred to was the low west wing of the main dam,
11 not this separate dam over at the other side.

12 Q You said that it was somewhere up in this vicinity (in-
13 dicating)?

14 A Yes.

15 Q What was the depth of the water opposite that?

16 A The elevation of the water when I was there was three
17 feet below the top of the dam, three feet and two-tenths.

18 Q How many feet of water was opposite that?

19 A About thirteen feet.

20 Q Is that all?

21 A Yes sir.

22 Q This picture was taken ~~for~~ some time ago. Will you
23 point out on this picture---- I will ask you what is that shade
24 of water, or what is it?

25 A That is a stain due to water being turned through this
26 pipe which is one of our outlet pipes. It is very indistinctly
27 shown there.

28 Q BY THE CORONER: What is the size of that pipe?

29 A Thirty inches in diameter.

30 Q BY MR. DENNISON: Where was this water that you saw
31 last Sunday?

32 A It was on Saturday.

1 Q When you saw it?

2 A As I say, this water which was coming through this crack
3 in the conduit up here, and we failed to find a photograph here on
4 which I could show where this seepage was.

5 Q Just show me on this photograph where it was?

6 A It is down below this point here (indicating).

7 Q How far down?

8 A About twenty feet below that point there (indicating).

9 Q Could you indicate it with a pencil on there?

10 A No, I cannot because the point where it was leaking is
11 not visible.

12 Q Could you indicate to me where the water flowed to?

13 A Into the canyon below.

14 Q Can you point it out on the blueprint?

15 A (Witness examines several blueprints) About the first
16 seepage that shows up at all---- it was just a moist sweat---- is
17 right in through here (indicating). Then, more recently, another
18 one somewhat higher up was down in here, which we figured was
19 coming from this leak away up here (indicating).

20 Q What I want to know is where the water that you found
21 over here was going to?

22 A Down into the trough of the canyon.

23 Q The river bed?

24 A Yes sir.

25 Q BY A JUROR: Where was the weir?

26 A This is a concrete conduit, open ditch, to carry the
27 water which we turned out of the reservoir into our Power House
28 Number Two, and we placed that weir into this conduit here. Wher-
29 ever that came from, whether it slopped over the top of the dam
30 during high winds, it was all collected in this basin and flowed
31 out through this conduit.

32 Q Then, that measurement of fifty-two inches, represented

1 the increase in the leakage at the dam?

2 A No, we measured this leakage. We had weirs up in
3 here (indicating) to catch this leakage and another one on this
4 side to measure this one and those weirs have been in ever since
5 the dam was placed in operation. We do that in all of our dams
6 in order to watch those leaks. Of course, as the water rises
7 in the reservoir it is quite customary for those leaks to in-
8 crease, and as the water filled the reservoir this winter, those
9 leaks showed a slight increase from about ---- up until the
10 water in the reservoir reached a point where it could come through
11 this crack away back here (indicating)---- about four miners
12 inches was the maximum whichever came by the dam, and then,
13 after the water in the reservoir got high enough to reach this
14 leak in the dam away over here (indicating) and it began coming
15 down, of course, that leakage then showed an increase, and it
16 came up, as I say, to about fifty-two miners inches.

17 Q How much water issuing from that crack on the dyke
18 that you refer to was carried off by the tile drain?

19 A We did not measure that.

20 Q Approximately?

21 A I should say about thirty inches, thirty miners inches.

22 Q Did you see the new leak which was approximately forty
23 feet from the west abutment when you were up there on Saturday?

24 A Yes---- not on Saturday, on Wednesday, the last time
25 I was up there.

26 Q The leak that Tony reported?

27 A Yes, when there was a slight sloughing off of the road
28 there?

29 Q Yes.

30 A Yes.

31 Q How much water was that making, approximately?

32 A Five or six inches. It was not in a running stream

1 where you could judge very well. It may have been three or four
2 inches or ten or twelve inches.

3 Q It was not enough to take off some of the loose embank-
4 ment?

5 A Just the water seeping through there and loosening out
6 this material on top. It was very steep where we excavated for
7 that road and the same thing might have occurred if we had a
8 continuous rain for three or four days.

9 Q Did I understand that you took this water down into
10 another canyon?

11 A We laid a tile drain there to lead it away from the
12 dam and into a canyon over in here (indicating).

13 Q When did you do that?

14 A That was done the week before last, about three weeks
15 ago.

16 Q In the meantime you had been following more or less a
17 run along this fill here (indicating), this earth that you put
18 in?

19 A Yes sir.

20 Q Is that fifty-two the accumulation of all the seepages?

21 A Yes, and including that that came down here (indicating)
22 and was drained into this pond here (indicating) and went out over
23 the weir into the conduit below.

24 Q BY THE CORONER: How often did you measure that water?

25 A About once a week regularly. We have a man that makes
26 his rounds.

27 Q The last few times it was more than before?

28 A Well, it had been gradually increasing, which was to be
29 expected due to the rising of the water in the reservoir.

30 Q Who measured it?

31 A Our man. Tony measured it occasionally--- our man who
32 has charge of the measuring of the water through the weirs and so

1
2 on would go up there about once a month to measure it.

3 Q Where is the record of those measurements kept?

4 A In my office.

5 Q Have you any record of the last day's measurements, on
6 the 12th day of March?

7 A I could not say as to that.

8 Q You don't know that the volume of water was a great
9 deal higher?

10 A No.

11 Q Were there any expansion joints in the dam proper?

12 A Yes, those vertical cracks are expansion cracks.

13 Q Do you recall where these cracks were?

14 A Approximately.

15 Q Did they discharge any water, any leakage?

16 A There was some seepage through there. I believe I
17 stated earlier in my testimony that we grouted these cracks and
18 practically stopped those leaks. This leak on the one dyke, we
19 grouted that.

20 Q Was there a temperature crack in the vicinity of this
21 leak that started recently?

22 A Do you mean the one in the lower part of the dam or
23 the one farther down?

24 Q The one which was reported and was the occasion of Mr.
25 Mulholland's trip to the dam?

26 A I cannot spot these exactly. There was one of those
27 expansion cracks approximately at this point here (indicating),
28 which would be approximately fifty-eight or sixty feet to the
29 west of the gates. Then, there was another one approximately the
30 same distance from the other side and one about the quarter point
31 here (indicating), and one about the quarter point here (indicat-
32 ing), which would be about opposite where the slide occurred.

Q BY A JUROR: Do those cracks show all the way through

1 the face of the dam?

2 A Yes.

3 Q They were expansion cracks, put there intentionally?

4 A No, they were not. We expected them to come.

5 Q Was there a crack through the face of the existing
6 portion which is standing now?

7 A I could not say, I have not seen it.

8 Q Prior to the break?

9 A I could not say. I have only seen the photograph of
10 what is left standing.

11 Q When you were up there on your last visit there was
12 nothing there in evidence at that time?

13 A No, these cracks here (indicating)---- there was
14 practically no leakage at all through them, because we had
15 grouted them and cut off that leakage there through those ex-
16 pansion cracks.

17 Q You say there was a crack about in here (indicating)?

18 A Yes sir.

19 Q How far from the top of the dam was that?

20 A It starts at the top and goes down through the dam.
21 It is a transverse vertical crack through the dam.

22 Q Then, if this part of the dam were to wash out under-
23 neath here (indicating) there would be no adhesion of concrete
24 to prevent that following right down in, would there?

25 A No sir.

26 Q Was this grout in prior to the time that the water
27 came up?

28 A No, afterwards. There is a buttress built on this
29 reverse curve which does not show on this plan. It was put in
30 afterwards and on my last trip up there I inspected that espec-
31 ially to see if there had been any settlement in the buttress
32 which was projecting out on the lower side of the dam. You

1 gentlemen have probably seen photographs of that buttress and
2 know what it is--- because I expected if there had been any soft-
3 ening up of the ground at that point that buttress would show
4 signs of settlement and pull away from the main part of the dam.

5 Q There were no cracks?

6 A ^{At} The east corner there was just a faint hair crack.

7 Q On which corner, the front or the back?

8 A At the point of contact of the buttress and the face
9 of the dam. On the other side there was a crack about a six-
10 teenth of an inch, which was no more than it was a year ago, be-
11 cause when we put it up I thought, well, now, it is likely that
12 that may settle a little ~~it~~ away. You know, when you build
13 one building up against another, if it takes much of a settle-
14 ment, it will show a crack there. I expected that here, and it
15 showed absolutely no sign of any crack at all.

16 Q How far east of that buttress was the first crack in
17 the dam that you know of?

18 A I could not say exactly but probably seventy-five to
19 one hundred feet.

20 Q You think about on this radius line here (indicating)?

21 A Yes, more in here (indicating). There was several of
22 these vertical cracks.

23 Q How much did they open up?

24 A The widest one, I should say, would be about one-eighth
25 of an inch, possibly three-sixteenths, that would be at the top.

26 Q Obviously there could not have been any cracks in
27 there if the arches of the dam had been working?

28 A Well, the dam was not designed as an arch.

29 Q If the dam was working as an arch there obviously
30 could have been no cracks in the structure?

31 A Hardly. There would have been pressure and it would
32 have shoved together. No, it was designed as a gravity struc-

1 ture and just arched somewhat for appearance and any possible
2 safety that it might add to it.

3 Q Was there any precaution taken to protect the dam from
4 erosion at these gates?

5 A No sir.

6 Q BY A JUROR: The dam was designed as a gravity sec-
7 tion?

8 A Yes.

9 Q Was the factor of safety on that design based gently
10 upon the gravity factor without any consideration of the com-
11 pressible factor you get through the arch shape of the dam it-
12 self?

13 A I did not design the dam, but I believe that it was
14 designed for a loading of ten tons per square foot. I think it
15 was computed on that basis.

16 Q BY MR. DENNISON: That was not the question. What
17 the factor of safety, do you know?

18 A I don't know, because I did not make the computations.

19 Q When was the last time you were up to the dam before
20 its failure?

21 A I think it was the 7th. It may have been the 8th, it
22 was on Wednesday.

23 Q How long did you remain there?

24 A About an hour.

25 Q Who was with you?

26 A Mr. Mulholland and Mr. Fisher.

27 Q When had you been there before that?

28 A I passed by there---

29 Q When had you been there before that?

30 A To examine the dam closely?

31 Q Yes.

32 A About three weeks. I stopped there on one of my

1 trips to the Owens Valley.

2 Q How long did you remain on that occasion?

3 A Just a short time.

4 Q Would that be five minutes or an hour?

5 A About twenty minutes.

6 Q How many times have you been there this spring, since
7 the first of January?

8 A I could not say off hand.

9 Q More than two or three?

10 A Probably three or four times.

11 Q How is the water conveyed from this spillway to the
12 aqueduct?

13 A When we took water out of the reservoir, do you mean
14 to convey it into the aqueduct?

15 Q Yes.

16 A We opened one of those gates, which I spoke of.

17 Q Is that shown on that diagram there?

18 A Not on this one but it is shown on one of them.

19 Q As a matter of fact, there are three or four?

20 A There are five gates in the dam.

21 Q And there are three or four openings in the earth or
22 tunnels in the earth that go over to this aqueduct?

23 A No sir.

24 Q How many?

25 A The way the water is turned through these gates which
26 I speak of, which I have are 3 x 3 feet square, sluice gates,
27 they are connected to a thirty inch pipe through the dam. Those
28 gates are opened and the water runs through the thirty inch pipe
29 and over the face of the dam to the foot of the dam and into a
30 conduit we have down the canyon.

31 Q After it gets into this conduit where does it go then?

32 A About a mile and a quarter down the canyon and is then

1 turned into power house No. 2.

2 Q How does it get there?

3 A Through a tunnel.

4 Q How many tunnels are there?

5 A Just one.

6 Q When was it closed up before this failure?

7 A I only know from hearsay.

8 Q Well, from hearsay, when was it closed up?

9 A I think it was about Friday or Saturday previous.

10 Q What was the purpose of closing it up?

11 A In case of a storm. A storm which we might get at
12 this time of the year and with a full reservoir, with flood
13 waters flowing over the dam through these spillways and down the
14 canyon, it might be of sufficient size and intensity to carry
15 debris and dirty water into the aqueduct which we wished to pre-
16 vent.

17 Q Isn't it a fact that the reason that tunnel was closed
18 was that in the event that the dam failed that the debris would
19 not be carried into the aqueduct?

20 A No sir, I never heard so.

21 Q Who told you that it had been closed?

22 A I heard Mr. Mulholland say that he would have it clos-
23 ed.

24 Q When did you hear him say that?

25 A The latter part of the week, ending March 10th. It
26 was after we went up there and was talking about the reservoir
27 being full, and the possibility that we might get a freshet this
28 spring, which we may get in this month or April or May, and, if
29 so, any storm water collected in the reservoir must of necessity
30 flow from the spillway, because the spillway was full up to the
31 top of the superstructure.

32 Q I did not understand who you heard him saying that to?

1 A I don't know. Possibly to Mr. Van Norman.

2 Q Do you remember whether that was about Saturday?

3 A That was the latter part of the week. It was a day or
4 two after we made this trip up there.

5 Q BY THE CORONER: Do you remember that you plugged up
6 the tunnel last year before the spring storms?

7 A We usually do. We did not last year because the re-
8 servoir was not as full as it was this year and we had plenty
9 of capacity behind the dam to collect storm water and give us
10 time to close those openings by putting in the stop logs if the
11 storm came.

12 Q What are the stop logs?

13 A Big logs we drop down into the opening over the tunnels.

14 Q That was the first time you had used them?

15 A No sir. The power house has used them ever since
16 the dam was built.

17 Q BY MR. DENNISON: Has not the storm season ceased?

18 A No sir, not until the middle of May.

19 Q BY MR. SCOTT: Did somebody have the tunnel stopped
20 up?

21 A I think Mr. Van Norman ordered Bill Revel of the power
22 house to put those stop logs in.

23 Q If you put the stop logs in what effect would that
24 have on the dam a mile and a half up the canyon?

25 A Nothing. It is merely a means of taking the water
26 from the reservoir back into the aqueduct again.

27 Q BY A JUROR: Would that have anything to do with the
28 breaking of the dam?

29 A No.

30 Q BY MR. SCOTT: Where does that tunnel lead to?

31 A Into Power House No. 2, below the turbines and into
32 the aqueduct. That order was given merely because in case of

1 a storm the water coming down the canyon, dirty water, would
2 flow into the aqueduct.

3 Q BY THE CORONER: Do you know that these plugs have
4 been used before?

5 A Yes sir.

6 Q For that same purpose?

7 A Yes sir.

8 Q How many times before?

9 A I could not say, but each year at certain times, since
10 the construction of Power House No. 2. That is when that tunnel
11 was built there.

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1 H. A. VAN NORMAN, being first duly
2 sworn, testified as follows:

3 BY THE CORONER:

4 Q Please state your full name.

5 A H. A. Van Norman.

6 Q Where do you reside?

7 A 2621 North Commonwealth Avenue, Los Angeles, California.

8 Q What is your business, occupation or profession?

9 A At present, employed as assistant to Mr. Mulholland,
10 who is Chief Engineer of the Water Department of the City of Los
11 Angeles.

12 Q Mr. Van Norman, are you familiar with the construction
13 of the St. Francis Dam?

14 A To some extent, yes.

15 Q Did you have any part in the location of the dam?

16 A I went with Mr. Mulholland to the dam site once or
17 twice before it was decided to locate it there, during the time
18 surveys were being made, capacity surveys of the reservoir and de-
19 tail surveys of the topography at the dam site. That was, I think,
20 about the extent of my connection with it. In company with Mr.
21 Mulholland, we went there numbers of times, I think two or three.

22 Q Did you study the formation there with him?

23 A I observed it, and it was discussed, yes.

24 Q Who especially had the authority, or did exercise the
25 authority of selecting that particular site for the dam?

26 A Mr. Mulholland, of course, is the Chief Engineer of the
27 Department. In many matters of that character affecting engineer-
28 ing problems, he conferred with his assistants and others, whenever
29 he thought necessary.

30 Q Do you know of any independent geologists or engineers
31 who were called in consultation with regard to the selection of that
32 site?

1 A No, I don't. Mr. Mulholland occupies a rather unique
2 position in the engineering world. He is called upon by geologists
3 and engineers in all the major projects of the United States, and my
4 opinion has always been, and is now, that his judgment is as sound
5 as could be gotten on any engineering problem.

6 Q The selection of the site and all the preliminary surveys
7 were made by your own department?

8 A As far as I know, yes sir. There may have been someone
9 else Mr. Mulholland discussed it with, I don't know.

10 Q From your observation, did it appear that the site was
11 proper for the dam?

12 A The rock in sight, as far as was visible at the time I
13 saw it, was sound in character, and in my opinion, the location--
14 from what I saw-- the location of the dam was justifiable.

15 Q Would you consider it bedrock?

16 A I did.

17 Q Is it your opinion that the whole dam was resting on
18 bedrock?

19 A I am speaking now before the dam was constructed. Re-
20 connaissance observations of it were made preliminary to location of
21 the dam.

22 Q Do you now feel that the site which was selected for the
23 dam, where the dam was later built, was bedrock?

24 A That is a matter of judgment. The dam is gone out.
25 The cause of that failure is not known. Until a thorough investiga-
26 tion is made by competent engineering authorities, I don't believe
27 that there is any man in position to state what caused that failure,
28 therefore, I am reserving any expression of opinion on it until un-
29 prejudiced and unbiased engineering boards have had an opportunity of
30 determining the facts.

31 Q Are you a geologist?

32 A I am not.

1 Q Do you know what the formation was there-- different
2 kinds of formation?

3 A Only from what I have been told. I am not sufficient-
4 ly informed in science or geology to classify rocks by an in-
5 spection, and only from what I have been told have I any opinion
6 as to the specific character of that rock.

7 Q Did you have to do with the construction of the dam
8 itself?

9 A My recollection is that there was no construction work,
10 preparatory work, I think, in the assembling of equipment. The
11 discussion of method of building the dam, I engaged in that-- I
12 don't recall the date that the actual construction commenced-- that
13 is a matter of record that can be checked up. However, on the
14 first of May, 1923, I was given a leave of absence from the De-
15 partment of Water and Power, and went into the employ of the Board
16 of Public Works, of the City, in charge of the construction of the
17 north outfall sewer. I remained in that position until October,
18 1924, when I was made City Engineer, and remained as City Engineer
19 until I think it was August, 1925, when I was relieved from that
20 position and went back to the Department of Water and Power, as
21 Mr. Mulholland's assistant. When I returned to the Department of
22 Water and Power, the dam was, my recollection is, approximately
23 thirty feet from completion, that is in elevation. It was
24 practically to the elevation, I think about the elevation of the
25 bottom of the dyke standing there yet, and the work was going on
26 of excavating into the hillsides, on each side, and pouring of the
27 concrete in the manner the rest of the dam had been built.

28 Q At the sides-- take for instance east side-- how was
29 the dam joined to the side of the canyon?

30 A All loose material was being removed from both sides,
31 the east side as well as the west side, and considerable depth of
32 the rock in places, rock that hadn't been destroyed by water or

1 any other agency, was being removed and concrete poured after this
2 material had been removed.

3 Q What depth did the dam extend into the rock or the
4 canyon?

5 A I don't recall that, I couldn't say positively just
6 what the depth was. I went there in company with Mr. Mulholland
7 once or twice, as was Mr. Mulholland's custom in all his work-- he
8 is constantly on the job-- and the examination was made, inspection
9 was made, was satisfactory. Now, just the exact depth of the cuts,
10 etc., I am not able to state.

11 Q Do you believe it was built in a secure manner?

12 A I think it was.

13 Q You had some experience in other dams?

14 A No, not in concrete dams. I have had experience in
15 earth filled dams, those dams that have been built by the Water De-
16 partment in various places. I have been present a great many
17 times during the construction of these dams. There was only one
18 dam I actually had executive charge over, under Mr. Mulholland's
19 direction. That was the Fairmount Dam, that was the north portal
20 of the Elizabeth Tunnel, and during the construction of the Haywood
21 Dam, completed about the year 1910, '11 or '12. I was engineer in
22 the Owens Valley quite a period, at the time it was being con-
23 structed, and, of course, being interested in work of that character,
24 I was there frequently to see the way it was built.

25 Q Neither of those dams are concrete?

26 A No, earth filled dams.

27 Q Were you present at the St. Francis Dam within a few
28 days before the twelfth of this month?

29 A I was there on the twelfth of this month, yes sir.

30 Q With Mr. Mulholland?

31 A Yes sir.

32 Q What did you observe then as to the condition of the

1 dam, the looks, , anything of that sort?

2 A Everything was, as far as I could see, as secure as it
3 ever had been. There was some seepage coming from both ends of
4 the dam, some coming from under the very base of the dam. The
5 water in every case was crystal clear, no indication of any erosion,
6 and there was nothing that would alarm, or, at least, didn't alarm
7 me to any extent at all. I left there with perfect confidence
8 that the dam was perfectly all right.

9 Q What time did you leave?

10 A I think it was about twelve o'clock. My recollection
11 is we got back to town-- the cafeteria in our building was closed,
12 and we got lunch in a little restaurant on Second Street. One
13 thirty the restaurant closes, and it would take approximately an
14 hour and a half to drive-- approximately twelve o'clock when we
15 left there.

16 Q Mr. Mulholland came back with you?

17 A Yes, we had lunch together.

18 Q Who did you talk to up there-- did you talk to Tony
19 Harnischfeger?

20 A Yes, Tony was there and went around with us, and we
21 left him there, went around. Our custom in going to all these
22 places is to make a general survey and inspection of conditions.
23 We are constantly doing that, and we went there and went around in
24 our usual way, Tony with us. Tony is a man that I have a great
25 deal of confidence in. He worked for me nearly fifteen years,
26 many years was watchman at the Jawbone. The reason I am relating
27 this is I wanted to bring before you and the Jury the intimate
28 relationship that existed between Harnischfeger and myself. He
29 was a man that I had the utmost confidence in, and he did in me,
30 and if there had been anything at all there that he was appre-
31 hensive about, I am sure he would have told me, and he didn't tell
32 me anything of the kind, and, in addition to that, when we left

1 there-- don't know what he did the rest of the day, but he went to
2 bed immediately below it, apparently in security, at least, he felt
3 he was or he wouldn't have gone to bed.

4 Q Why did you go up on the twelfth of this month?

5 A Mr. Mulholland-- I was in my room next to his-- said
6 he was going out to San Francisquito Dam-- "It is full and the wind
7 has been blowing some, water coming over the spillway. I am going
8 to look at it." I said "I will go along with you."

9 Q It wasn't because it was indicated to you there was
10 danger of the dam breaking?

11 A No, I don't believe there was ever any indication, to
12 my knowledge, any indication came to me from any of the men up
13 there that there was danger of the dam breaking. I understand
14 such statements have been made-- I have been reading the newspapers--
15 I don't know of any such indication coming to our office, and that
16 is as far as I know. The reason Mr. Mulholland and I went to the
17 dam-- it is our custom to go to these places at intervals, as a
18 matter of taking care of our work.

19 Q I presume you have stayed up in the canyon over night?

20 A Yes, I have been there many nights, lived there quite
21 awhile during the construction of the aqueduct.

22 Q Did you have a guest house?

23 A There was a guest house, Power Plant No. 2. I have
24 stayed there. It has been several years since I stayed in the
25 canyon over night. Late years, my work hasn't required anything
26 of that nature.

27 Q From what you saw of the condition of the dam on the
28 day of the twelfth of March, this year, would you be perfectly
29 willing to stay in the canyon that night?

30 A Absolutely, I wouldn't have had any apprehension at
31 all. If I had any idea, the remotest idea that there was danger
32

1 of that dam going out, I would have been the first one, at least,
2 I would have spoken to Mr. Mulholland, and we, of course, if there
3 was any justification for it, we would have alarmed the country and
4 gotten the people out of there. Of course, both of us realized
5 with the quantity of water there was in that reservoir, that if a
6 major break occurred in the dam, very likely there would be a very
7 disastrous flood, and neither one of us would take a chance on
8 earth to jeopardize the lives of the people lost in that catastro-
9 phe.

10 Q If you realized the dam was going out, was there any-
11 thing you could have done that would have saved the property, as
12 well as the lives?

13 A No, that was impossible, that was beyond our control.
14 The only thing that could have been done would have been to give
15 the alarm to the people and gotten them out of the path of the
16 flood, but as far as saving property was concerned, by reducing
17 the water level in the reservoir, that was impossible to accomplish.
18 From the time we were up there until the day the dam fell, the
19 great quantity of water there, and the capacity of the channel, and
20 the facilities for releasing it were so limited, it couldn't be re-
21 duced but a very little in that period.

22 Q As to the construction of the dam, as you came back to
23 that work-- I think you said the dam was within thirty feet of the
24 top when you came back-- did you observe the concrete work that was
25 put in, mixing of the concrete?

26 A Yes.

27 Q And the ingredients?

28 A Yes.

29 Q Was that work done properly?

30 A Very well. The concrete stands there and speaks for
31 itself. I don't think there is any question about the proper
32 character of that concrete. Any man can go and look at it, and

1
2 if he knows what kind of concrete is required for a job of that
3 kind, I think he will readily say that the concrete was absolutely
4 all right.

5 Q Did you see any clay go into the concrete mixture?

6 A No.

7 Q Dirt of any kind?

8 A No, not any more than is ordinarily used; ordinary run
9 of gravel.

10 Q Silt?

11 A Always a little silt in it, but clean enough for the
12 purpose. There was nothing wrong about that.

13 Q You didn't see any red clay go in?

14 A No.

15 Q Did you see any big slabs of rock?

16 A I don't think-- of course, that is a matter of pro-
17 portion-- just what do you mean?

18 Q I understand you had a screen there through which the
19 rock was run, reduced to dimensions of six inches. Could larger
20 pieces than that pass through that screen?

21 A What is commonly called a grizzly was placed ahead of
22 the mixers to prevent rock of larger than the spacing between the
23 grizzlies from going into the mixers, because the chutes and
24 mixers themselves couldn't handle large rocks. They get jammed in
25 the chutes or mixers. The purpose of the grizzly was to keep
26 down the size of rock.

27 Q That is the standard practice?

28 A Yes. Of course, you will find large boulders, and,
29 of course, it is necessary to remove them.

30 Q Do you know of anything about the construction of that
31 dam which would be a clue to its failure?

32 A No, I don't.

Q BY MR. SCOTT: This was a gravity height dam, cement

1 dam?

2 A Yes, concrete dam.

3 Q Was it taken after, patterned after the Roosevelt Dam?

4 A I won't say that. There are a dozen similar in
5 character, many such dams, might say it was patterned after dozens
6 of other dams of the same type.

7 It was a type of dam that was considered safe, and is
8 built in many places. Just whether it was patterned after the
9 Roosevelt or not, I have never seen the Roosevelt Dam and don't
10 know what the construction was there, whether Monolith Dam---

11 Q Then it was the type of dam that has the approval of
12 the best engineers of the country?

13 A Yes, I think that is true.

14 Q Was that the type of dam constructed in California,
15 Southern California?

16 A A number of these are in California, not many concrete
17 dams in Southern California, one at Hollywood Canyon or Weed
18 Canyon, and one under construction in the Paeoima, but it is a
19 different type of dam, and that is the only ones I know of. There
20 is a small one down on Malibou Creek, and the Barrett Dam, at San
21 Diego. This dam is nearer a duplication of the Barrett Dam near
22 San Diego than any other dam I have ever seen. This dam and the
23 Hollywood Dam and Barrett Dam are very similar in appearance and
24 construction.

25 Q How about Arroyo Seco Dam?

26 A Oh, yes, the Arroyo Seco, near Pasadena.

27 Q In speaking of this site-- isn't it true that this
28 site was also approved by the City Engineer?

29 A I don't know of that of my own personal knowledge.

30 Q From time to time you visited the dam, although after
31 May 25, 1924, you were not connected with the Department of Water
32 and Power?

1
2 A I don't know whether I was up there or not during that
3 period. I was building the sewer, and, of course, had a good
4 many things to do, but Mr. Mulholland and I have been associated
5 for a good many years, and I never lost an opportunity to go with
6 him to look at some piece of work of necessity, because I always
7 learned something from him every time I went with him.

8 Q From your observation, would you say the dam was con-
9 structed with reasonable skill?

10 A Yes.

11 Q The engineers, did they use all the engineering science
12 and foresight that engineers usually do in the construction of
13 dams?

14 A Yes, I believe they did.

15 Q Were the same materials used in that construction,
16 cement, as was used in the aqueduct construction, sand?

17 A Yes. The tunnels from Power Plant No. 1 to the end
18 of the first tunnel below Power Plant No. 2, were lined with aggre-
19 gates gotten out of the creek bed. I don't recall where the
20 aggregates came from, from the construction of the lower tunnel
21 down to Dry Canyon. I know, because I built these other tunnels.
22 We got it out of the San Francisquito Creek channel. They were
23 washed down by the floods in the creek, from the igneous rocks
24 high up in the canyon. Lots of it was granite.

25 Q As a matter of fact, Mr. Van Norman, dams of this
26 character are not always built on granite rock, are they, the site
27 selected to have the hardest of rock?

28 A Dams are built as a matter of necessity, of course,
29 that is the impelling motive of building any dam. The considera-
30 tion, of course, then is as to the capacity of the reservoir, and
31 economic aspects of the problem, and proper location of the dam, as
32 far as safety is concerned. You will find many dams in granite,
you will find hundreds of them not in granite, many types of rock

1
2 that are perfectly safe for dam construction besides granite.

3 Q BY DISTRICT ATTORNEY: Mr. Van Norman, you are Mr.
4 Mulholland's chief assistant?

5 A At the present time, yes sir.

6 Q And have been for some length of time?

7 A Yes sir.

8 Q Are you familiar with the general data in relation to
9 when that dam started, those things?

10 A Not any more than I have just stated. AS I stated in
11 response to Mr. Nance's questions, it is a matter of record in the
12 office of the department.

13 Q Is it correct the construction was started August 6,
14 1925?

15 A No, I don't believe that is correct.

16 Q And that it was completed in May, 1926?

17 A No, I don't think that is correct. I think the con-
18 struction was started earlier than August, 1925, I am quite cogni-
19 zant of that, because I returned in August, 1925, and the dam was
20 within thirty feet of completion.

21 Q Do you know the approximate number of cubic yards of
22 concrete that were put in?

23 A I have seen those figures.

24 Q Let me refresh your recollection. Do you think one
25 hundred and sixty seven thousand cubic yards would be correct?

26 A I think that is correct.

27 Q That the height of the dam probably from the bedrock
28 was two hundred and eight feet?

29 A That would be from the very bottom of the trench. I
30 think that is about right.

31 Q And the maximum width one hundred and sixty-nine feet?

32 A Yes, I think so.

Q And the length was six hundred sixty-eight feet, the

1
2 dam proper-- I don't mean that spoonhandle?

3 A That would be a matter of starting where the dam
4 stopped and extension started-- over all it would be longer than
5 that. That would be approximately the main body of the dam.

6 Q And this additional dyke was six hundred thirteen feet
7 in length-- would that be about correct?

8 A I think that is approximately right.

9 Q And that it was a gravity type dam, arched for addition-
10 al safety-- was that the purpose of the arch?

11 A It was a gravity arched dam. Whether the arch was
12 given any value in the computations of the safety of it or not, I
13 am not sure. I rather say that it would have been safe if the
14 same amount of concrete had been used and been a straight section,
15 as far as engineering calculations were concerned.

16 Q And its capacity was thirty-eight thousand acre feet,
17 which would be approximately twelve billion gallons of water?

18 A Yes. I always think of it in terms of acre feet.

19 Q The first water was turned in March 1, 1926?

20 A Just one moment, would you mind referring to the date
21 that dam was completed?

22 Q I guess that is wrong.

23 A Then you turned the water in before it was completed--
24 must be something wrong with those figures.

25 Q Would they turn the water in before it was completed?

26 A It could be turned in when the dam got up a certain
27 height.

28 Q And the crest, elevation of this dam was three hundred
29 eighty-five feet above sea level?

30 A It was over a quarter of a mile above sea level. I
31 think I have that figure on a card here (referring to card). The
32 crest of it was, the spillway, according to this card, was 1844.75
above sea level, and the crest of it was three, four or five feet

1
2 above that, making the crest approximately, elevation one thousand
3 eight hundred forty-eight feet above sea level.

4 Q What was the pitch, or was the pitch on the west side
5 of the canyon about forty-five degrees?

6 A No, I would say it was flatter than forty-five. It
7 wasn't a straight profile from the bottom of the canyon up to the
8 top, would be one degree of pitch in one place and change as you go
9 down. The topography I have would show plainly what that was. It
10 was a fairly steep hillside, required effort to climb it.

11 Q Would you say the pitch on the east side of the canyon
12 was approximately seventy-five degrees?

13 A It was very much steeper on the east side than it was
14 on the west side. That is pretty steep, seventy-five degrees. I
15 would say it was probably less than that.

16 Q How much?

17 A I would say sixty or sixty-five, something like that.

18 Q Have you been up there since the failure?

19 A Yes.

20 Q Was there any defined showing of where the excavation
21 was for these walls that went up these two hills?

22 A You mean after the failure-- no, I think that is all
23 obliterated. That is merely a matter of check up of that from
24 the elevations that are in place up there. The survey will dis-
25 close the amount of bedrock that has been eroded. My opinion
26 would be that probably carried away some of the bedrock. Even
27 below the base of the dam, on the west side and on the east side,
28 there is a great slide there. I didn't go into the east side
29 closely, only had a few minutes there, spent most of my time climb-
30 ing on the west side, but from the appearance of it, it was covered
31 with the slide material, and there was very little I could tell
32 about it.

Q Colonel Mulholland yesterday gave some testimony in

1
2 relation to a visit made to the dam I think on the twelfth-- you
3 and Mr. Mulholland?

4 A Yes, that is the day we were there.

5 Q On that occasion, I think he gave the jury some in-
6 formation in relation to a leak that was discovered there. He
7 said, I think, that you made an examination of the water, that he
8 was about ten feet from it, from where that water was pouring from?

9 A It wasn't a leak that had been newly discovered, the
10 way your question would imply, it was a leak that had existed ever
11 since water was first put in the reservoir-- that was coming along
12 from various places, and I observed it.

13 Q You were not here, but I have a photograph-- we have a
14 profile, Engineer Phillips pointed out. Anyway, approximately,
15 it was a flow of water that was coming somewhere below this dam?

16 A The flow down there, I think-- let me show you what I
17 observed (indicating on photograph). Right in the center of the
18 dam, underneath, there was a pipe that was connected to other
19 pipes, that were in drill holes under the base of the dam.

20 Q What kind of pipe?

21 A Drainage pipes. There were minute seams in the rock
22 and seepage of water that got into them that could be carried
23 away. That was under the center of the dam-- then, on the east
24 side, looking at it this way (indicating), right hand side, east
25 side, there was a little stream of water coming down from I would
26 say approximately two thirds of the way up the hillside, running
27 down in the ground, between the contact of the dam and rock,
28 trickling down the hillside. That water was perfectly clear
29 until it got clear to the bottom of the canyon, because on this
30 side (indicating), at that particular place small stones had
31 gathered and what loose material there was on top of the bedrock.
32 There was no loose material to contribute any coloring to this
little stream of water running down, so that stream of water was

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2 perfectly clear all the way to the bottom. Then on the other end
3 there was likewise a stream coming along near the dam, and it was
4 also clear all the way to the bottom, coming out clear and clear
5 clear to the bottom. Then a little further to the left, there was
6 a small stream of water coming out of the rocks, and where it came
7 out I went to see, look at it, got within two feet of it, and it
8 was perfectly clear. In passing down, however, from the point
9 where it emerged from the rocks, below that was some material that
10 had been dumped when the road had been excavated, and that water
11 passing over that point where it emerged from the rock down to
12 this pool was colored to some extent by that loose material on top
13 of the rock below where it emerged from the rock.

14 Q Then all the leakage, seepage and flowage that was
15 there was gathered in kind of a little stream which was measured by
16 what you call a water weir?

17 A When the dam was built, about the time it was complete,
18 concrete lined conduit was built in the dam channel, in the dam,
19 down to Power Plant No. 2, so any excess water could be drawn from
20 that reservoir and let down, and relet into the aqueduct from the
21 St. Francis Canyon. At the head of that concrete lined conduit
22 was a weir that was put in there for the purpose primarily of
23 measuring the quantity of water released from the gates in the
24 power plant, and the Santa Clara Valley had a right to the water
25 that fell in the water shed, subject to final settlement of it,
26 and we religiously let out each summer as much water as we had ac-
27 cumulated, until such a time as the matter was properly settled.
28 That weir and other weirs down in the canyon, at other places, were
29 used for keeping a record of the amount of water.

30 Q Is a weir a dam or measuring apparatus?

31 A Measuring apparatus.

32 Q I think the testimony yesterday was something about a
second foot of water. Is there such a thing?

1
2 A Yes, that is one cubic foot of water in one second.
3 Q How much would that be in twenty-four hours?
4 A Would be two acre feet.
5 Q Water that flows, whether it flows from beneath the
6 dam, side of the dam, carries particles in it-- flowing water
7 carries material and sediment in it?
8 A If it isn't settled, it does.
9 Q You couldn't see it with your eye?
10 A Why, yes. After a rainstorm in this city, if there
11 is silt gets in the reservoir, housewives see it in a hurry.
12 Q So that if you went out and saw the water coming from
13 beneath that dam, you could tell whether or not it was washing
14 away?
15 A Without question.
16 Q Did you see it there that time at the dam?
17 A Absolutely.
18 Q Will you describe to the jury that water you saw flow-
19 ing beneath it?
20 A It was water coming out, Gentlemen of the Jury, clear
21 water. I don't know how to describe it any more fully than that.
22 Q Just white water?
23 A Yes.
24 Q You didn't know where that little stream started?
25 A No man could tell that. It came out of the reservoir,
26 that was obvious.
27 Q As an engineer, so you feel the design of that dam was
28 the proper design?
29 A I do.
30 Q Do you feel from your experience as an engineer that
31 your observation of it, it was properly put in?
32 A As far as I observed, I would say it was.
Q Do you feel that opening that "V" up there, that six

1
2 hundred eighty-six feet, was too wide or wide enough, or not wide
3 enough? I guess that is too complicated. There is in the center
4 of that that is left standing, this Monolith tower?

5 A Yes, portion of the dam.

6 Q That is about eighty feet wide?

7 A Yes, about eighty.

8 Q Height one hundred and eighty feet?

9 A Approximately.

10 Q That is on an arch, part of the arch?

11 A Yes, part of the dam.

12 Q The rest of the dam was arched, continued on for a
13 number of feet?

14 A Yes, on both sides.

15 Q Do you think that one single Monolith was sufficient
16 to close that opening, in strength?

17 A Yes, it did close it, and it is there yet.

18 Q Do you think it was strong enough to support the arch
19 from one bank to the other?

20 A You are getting a little technical, don't quite follow
21 you.

22 Q (Mr. Dennison at Blackbeard) That (indicating) would
23 be the way the thing looked-- this would be the hill, this is the
24 hill on this side. Your dam started down here (indicating)?

25 A Yes.

26 Q That is standing, isn't it?

27 A The section you have marked there represents about what
28 there is left of the dam.

29 Q This being the portion standing, this is the portion
30 washed away on this side of the hill, and this is the portion on
31 this side of the hill (indicating). This arch placed in there
32 wasn't placed for safety?

A There is some difference of opinion among engineers.

1 Q Here is what I want to get at---

2 A I can name one eminent engineer says an arch is as
3 strong as it would be if you had the same amount of concrete in a
4 straight section.

5 Q Isn't the use of an arch dam of this type-- isn't it
6 used as a matter of economy in cement?

7 A No sir, I believe if you will get some competent
8 engineer to take computations that were made in connection with the
9 design and study of the things in connection with this dam, it is
10 my opinion you will find if there was no arch in that dam, straight
11 sections without any arch in it at all, it would have the same
12 factor of safety.

13 Q Was this arch as it was supported there with this
14 thing in the center of it, wasn't it too long, wasn't there too
15 much arch there for this abutment in the center?

16 A No.

17 Q What is a multiple dressed arch or dam?

18 A A dam made of a series of more than one arch.

19 Q You found bedrock twenty feet below the dam?

20 A It was twenty or thirty feet, don't know just what.

21 Q You went down on which you erected this portion of the
22 dam (indicating)?

23 A Yes.

24 Q If you had gone over here (indicating) on either side,
25 followed the bedrock, you could have put in two of these structures,
26 or three?

27 A Oh, yes, you could go on.

28 Q In other words, you could have gone over to either side
29 of this hill (indicating), made this dam absolutely safe, isn't
30 that correct?

31 A I maintain it was safe.

32 Q It had thirty-six thousand, had a certain pressure of
water on it. What was the amount of water?

1 A Approximately full.

2 Q A hundred and seventy-five feet?

3 A Yes sir.

4 Q And you have your maps here that were calculated to
5 support-- how many cubic feet was it calculated to support?

6 A All you would put behind it.

7 Q What was the safe load to put on it?

8 A Up to the full height that it was designed to. It
9 would make no difference if that water was ten feet long in the
10 reservoir, or ten miles long, as far as static pressure.

11 Q That is the height of the water, one hundred seventy-
12 five feet?

13 A Yes sir.

14 Q That would support so many cubic feet of water,
15 wouldn't it?

16 A Yes, it would support a static height, or certain
17 height.

18 Q How many cubic feet of water would it be safe to put
19 against that dam?

20 A It would be safe to put all in there that the
21 reservoir would hold.

22 Q How many feet would that be?

23 A No limit to it.

24 Q How do you figure the factor of safety?

25 A You don't seem to understand the theory of hydraulics
26 that applies to a situation of this kind. It is a matter of
27 measuring the height of a column of water in the length of the
28 stream.

29 Q But if you have a hundred and seventy-five feet of
30 water, as you go down the pressure increases-- you have a weight
31 of water at the bottom, a hundred and seventy-five feet?

32 A Yes, the higher the water is in the reservoir, the

1
2 more pressure there is in the dam.

3 Q If it is a column a hundred and seventy-five feet
4 high in a pipe, or what it is in, you have a way of figuring it
5 out-- you know what that is?

6 A Yes.

7 Q You know what the base of this thing has to be to
8 support a pressure of water?

9 A Yes sir, now we are getting together.

10 Q Then you know how much water you can safely put on the
11 wings?

12 A Yes sir.

13 Q You know how big the wings have to be to support it?

14 A Yes.

15 Q When you say you have a factor of safety, you mean
16 this, that the safe load of water, that the wall itself has to be
17 so that it will not only support so many cubic feet of water to
18 the square foot of surface, but it would have to be a certain
19 number of times that?

20 A Yes.

21 Q So that errors of workmanship or those other things
22 can be taken care of?

23 A Yes.

24 Q What factor of safety would you put if it was there
25 today, for these wings to support?

26 A I don't know.

27 Q This wing (indicating) was computed to support---

28 A I can't say.

29 Q You didn't have to compute, you took into consideration
30 that the side hills were kind of a natural dam themselves, didn't
31 you?

32 A They were buttresses of the dam that the structure
rested against.

1
2
3 Q In the construction of these dams, it has been the ex-
4 perience of a lot of engineers in this country to make a dam that
5 is water tight, isn't it?

6 A The dam itself absolutely water tight, yes.

7 Q Did you ever see one absolutely water tight?

8 A You see in any great monolith of this size certain
9 temperature changes-- there always is more or less water coming
10 through these great dams-- I think they all show that.

11 Q Isn't that the object of going down to bedrock, so
12 that your dam will be water tight?

13 A No, going to bedrock has nothing to do with the water
14 tightness of the dam itself. If you are talking about concrete,
15 going to bedrock and getting securely anchored into bedrock, is to
16 keep the water from getting under or around the dam.

17 Q It was necessary-- the same rule applied to these side
18 hills-- it was necessary that that side hill, the wing itself
19 should be water tight?

20 A It was necessary to go in sufficient depth to give the
21 dam proper support and prevent excessive flowage around the dam
22 through any minor fissures that might be in the rock.

23 Q What kind of rock?

24 A It was a very hard grade of slate. I am told by
25 geologists that the German term for it is Graywack Slate. That
26 slate was very hard, highly silicious, hard in character, it would
27 drill hard.

28 Q As a matter of fact, the water percolated through it,
29 cutting a hole underneath that wing?

30 A I don't think that is the proper expression. The
31 water came through, and in my opinion came through the fissures in
32 the rock, didn't come through the rock itself.

Q There wasn't any granite in there, was there?

A No.

1
2 Q This soil up there was kind of a gneiss, schist--
3 any shale there?

4 A I never saw any shale.

5 Q You saw schist?

6 A This hard material I have described.

7 Q When you talk about schist or gneiss, we mean just
8 rotten rock, isn't that a fact?

9 A I think maybe the layman would.

10 Q When the water gets into it, softens it and turns it
11 into kind of mud which we call silt?

12 A There is no rock there that turned into mud.

13 Q What does water do to that kind of stuff up there?

14 A Hasn't done anything up until the dam went out.

15 Q If that stuff became like a sponge, as far as under-
16 neath that water, the water got through it, would that be the
17 cause of the failure of the dam?

18 A I would say it didn't become that.

19 Q If the geologists should show us that was a spongy,
20 soft, not argillaceous, and that the water went through it, tore
21 through it, that would be the failure of the dam, wouldn't it?

22 A I don't know hardly how to answer that question.

23 Q Assuming that that was true?

24 A I don't quite follow you, I am rather confused over the
25 way you put that question-- I don't know just how to answer it.

26 Q You have had experience, haven't you, in the building
27 of earth dams?

28 A Yes.

29 Q And you make those water tight by what is known as
30 double wall?

31 A Yes, some cases earth dams are made tight by a double
32 core of clay, or some impervious material, such as this argillaceous
material you mention. In other cases, concrete walls have been

1
2 built in them.

3 Q That is the whole tendency of dam construction, is to
4 make them water tight?

5 A An earth filled dam is quite a different matter than a
6 concrete dam. An earth filled dam could be-- the dam itself
7 destroyed by water accumulating in the dam, and then a great slide
8 occurring and being carried away. That isn't the case with the
9 concrete dam. Each particular problem in dam construction is one
10 of its own, has to be studied, and all the conditions at that
11 particular place taken into consideration.

12 Q Do you agree with this proposition, that the general
13 idea is to have the dam water tight?

14 A Yes, that is the purpose of building a dam, to retain
15 water behind it.

16 Q You can safely anchor dams in granite, as a foundation,
17 and granite as an anchor to hold wings as this, because there is
18 fissures through granite that the water can get through?

19 A Some granite has fissures, yes.

20 Q When you come to anchor a dam behind rotten rock on a
21 hillside, you know as an engineer that eventually the water is go-
22 ing to percolate in that thing, soften it, and it is only a matter
23 of time and your dam is going out?

24 A If it is rotten at times.

25 Q Rotten rock, isn't it schist, that kind the geologists
26 call schist, gneiss, isn't it nothing but rotten rock which
27 eventually becomes silt?

28 A That may be your understanding of it, that is the
29 layman's. Understand, as I said, there is plenty of experts can
30 tell you all about it. I am not a geologist. In my opinion
31 everything I saw there was justified, the construction of the dam
32 at that point.

Q What I was trying to get out was the point, a dam must

1 be water tight, from an engineering standpoint?

2 A That isn't necessary for a dam to be water tight. Very
3 few dams you will find that are water tight.

4 Q I think you said the only thing that could have been
5 done in this thing-- I think you answered the Coroner-- if you and
6 Mr. Mulholland went up and found this dam was liable to go out or
7 break, was to notify the lower valley?

8 A Yes.

9 Q Had you ever met a situation of that nature, flood in
10 the valley beneath that dam?

11 A I have been familiar with the San Francisquito Canyon,
12 and familiar with the Santa Clara Valley, as far as Piru, for quite
13 a number of years.

14 Q In your wildest dreams, Mr. Van Norman, when you looked
15 at that dam on Monday, you never contemplated if it did go out it
16 would create such devastation as it created?

17 A I don't believe any man, unless someone that had seen
18 a flood of that character in the same country, I don't believe they
19 would be able to apprehend it.

20 Q You had never seen that thing at flood time?

21 A Yes, I have seen the flood caused by rain.

22 Q There was some testimony given yesterday by Mr. Phillips
23 in relation to the ceiling of a tunnel built some mile and a half
24 below this dam, the closing up of a tunnel?

25 A Yes, this, as I explained a few moments ago-- the
26 purpose of this dam was to store such surplus water as was avail-
27 able during the winter months from the aqueduct for reserve for
28 succeeding use, in succeeding summer months, carry over a storage
29 from that time underneath power plant No. 2, where the discharge
30 from the upper turbine ran into the tunnel, passed down the
31 canyon into the waterway. Under these turbines was a box conduit
32 or tunnel with an intake, and right below the intake to that from

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2 the canyon bottom were some radial canals, the purpose was to pro-
3 vide a way of letting the water down the canyon, taking it into the
4 aqueduct, or in the event of rains, the water coming down in the
5 channel could be passed on through these radial canals-- what we
6 call stop logs, and when we were up there Monday, the reservoir was
7 practically full, it was cloudy, and I saw Mr. Ruble, Chief Power
8 House Operator. When we passed, Mr. Mulholland and I agreed that
9 should be closed, because if we got a big rain up here, there might
10 be considerable flow down to the creek. I said "I will attend to
11 that." I saw Bill Ruble, asked him to close it.

12 Q What would have been the effect on the aqueduct and
13 this power house if that hadn't been closed up?

14 A No other effect than what occurred. The water went
15 in this place. I suppose what happened, the great rush of water
16 ripped this out right at the structure, at the head of this con-
17 duit, went under the power house-- the water went in there, down
18 into the aqueduct-- the water was so high in the canyon over this
19 opening that more water went in than the aqueduct was designed to
20 carry. When it got to the tunnel portals, it wasn't supported by
21 rock on the outside, blew up, broke the concrete out.

22 Q What became of those logs placed in there, did it wash
23 them out?

24 A They are down the creek somewhere. The whole thing
25 is gone.

26 Q BY MR. MOHR: How far down from the dam site was No. 2
27 power plant?

28 A I would say about a mile and a half.

29 Q I show you this picture, and ask you if you can show
30 on that picture about where that intake was to the tunnel?

31 A I don't think No. 2 is on this picture. Oh, yes,
32 it is right in there (indicating on photograph).

Q Where is that intake to the tunnel approximately on
that?

1
2 A It was upstream from the power house, from the north-
3 west corner of the power house, I would say about one hundred
4 twenty-five feet.

5 Q BY MR. HOLLINGSWORTH (District Attorney Ventura County):
6 I was interested in what you said in regard to the watershed of the
7 Santa Clara River. Going back to the San Francisquito Canyon,
8 what is the name of the creek that fed the dam?

9 A The creek that was in the canyon. Above the dam was
10 San Francisquito Creek. The water we had in the reservoir came
11 from the aqueduct through Power Plant No. 1, ran through the creek
12 channel into the reservoir.

13 Q Do you know if there was any drilling done to determine
14 the subsurface topography?

15 A I understand there were some borings made with a
16 calyx drill.

17 Q Do you know how far below the dam?

18 A No, I don't.

19 Q Do you know how deep that went?

20 A No, I don't.

21 Q Do you know who did it?

22 A It was done I suppose under the direction of the
23 Superintendent in charge of the dam.

24 Q Have you any idea when that was done?

25 A No, I can't say, very likely immediately after the
26 bedrock was cleaned off-- the excavation made to bedrock, and
27 probably that was the time it was done.

28 Q Do you know whether any drilling was done above the
29 dam?

30 A No, I don't.

31 Q Do you know who could give that information?

32 A I think Mr. Dunham probably could, probably Mr. Phillips.

 Q As a matter of fact, in that particular formation, it

1
2 would have been a part of prudence to drill both below and above
3 the dam?

4 A That is a matter of judgment. Some formations where
5 it is very tight, no seams apparent, sometimes not much drilling
6 done, in other places a great deal is done, a matter of judgment
7 of the man directly in charge.

8 Q As a matter of fact, the old saying is that California
9 rivers are fifty feet deep underground. It applied to that
10 particular topography out there?

11 A I don't know how true that saying is.

12 Q Take the watershed to the Santa Clara, isn't the sub-
13 surface much greater than the surface---

14 A No, I don't think it is.

15 Q Don't you know that artesian wells are sunk?

16 A I know wells are sunk.

17 Q Don't you know it is a geological fact that the lower
18 saturated gravels is greater in volume than the upper you see
19 flowing on the surface?

20 A I think the actual condition is you have in fact a
21 large underground reservoir with very little water movement.

22 Q That is the opinion of geologists, as I understand.
23 Now, taking the place where the dam was constructed, assuming that
24 it was properly foundationed at the time, from an engineering
25 standpoint, and from the examination made there at the time, on the
26 ground, the mere fact that this water you observed on the twelfth
27 of March, it was flowing at the time at the position you indicated,
28 and had the appearance of being clear water, without any evidence
29 of carrying silt, or any erosion of any kind there, so really in
30 a foundation of that kind, it meant nothing---

31 A That is true.

32 Q It might easily have been the fact that the pressure
of the water above the dam upon the foundation, might have seeped

1
2
3 down into these permeable stratas that might have existed below,
4 and by a slow process undermined a weak structure and absolutely
5 give no evidence whatever?

6 A I don't think that would be possible.

7 Q What I am getting at is this-- you have a broken
8 country out there, from a geological standpoint, fault country,
9 that is well known?

10 A Yes.

11 Q You have a particular site you are putting a dam on.
12 Right there at that spot it looks good, but you don't know what is
13 best, whether one hundred feet above or below or fifty feet further
14 down?

15 A No, just a matter of judgment.

16 Q And it might have been easily the fact that the pressure
17 exerted by ^{the} water, it had been impounded, had slightly seeped under
18 what appeared to be good rock, upon which to rest the dam, and
19 that coming down past the point of the dam, it would have saturated
20 the lower gravels of the creek bed, without giving any possible---

21 A No, the gravels were all taken out of the creek bed,
22 the bedrock was exposed and the dam built on the bedrock. The
23 bedrock was standing there. You can look at the profile and you
24 will see the bedrock was extended across the bottom of the canyon,
25 and the gravels on top of that bedrock were all removed, and some
26 out made in the bedrock.

27 Q That merely refers to the place where the dam was lo-
28 cated?

29 A I don't think that was possible, because of the fact
30 that that big block remains in the center, right in place, wouldn't
31 bear out that theory.

32 Q You have a spotted formation there?

A I wouldn't say it was spotted, would say it was a
pretty continuous character of rock up a certain elevation on the

1
2 west side, and the character of the rock changed.

3 Q As a matter of fact, the standing of the portion of the
4 dam that remains doesn't indicate anything at all as to whether or
5 not the rest of the dam had been properly foundationed, does it--
6 just some evidence of it, but it doesn't really prove the case in
7 any way, does it?

8 A I don't believe-- would say that is a question that
9 shouldn't be answered as a horseback opinion, it should be studied
10 a good deal. I want to give the jury all the direct, frank
11 answers I can.

12 Q Assuming that proposition I stated to you were true,
13 that the water was seeping down there in the vicinity of the west
14 wing of the dam, through that formation you just described, and
15 which to say the least is rather uncertain, assuming it had seeped
16 down, and had flowed under the dam or seeped or percolated, I don't
17 mean flowed, if this seeped down under there in that manner, you
18 wouldn't have had any indication of it unless you had gone below
19 the dam and checked the levels in the creek?

20 A If there was any quantity of water flowing under the
21 dam through any kind of fissures or crack any other place, we would
22 have seen it. The road went right alongside the concrete line,
23 ditch that carried all the water that was below the dam.

24 Q But Mr. Van Norman, the condition of the gravels of
25 the creek bottom, not only in San Francisquito Creek, but Santa
26 Clara River proper, would have given evidence necessarily?

27 A I believe it would.

28 Q Do you know whether it did?

29 A I know it didn't.

30 Q Were tests made, was there anybody testing the flow of
31 the creek or the river below the dam?

32 A It was measured, you could see the water in there.

Q That was an examination right at the dam?

1
2 A No, down the canyon as far as Power Plant No. 2, be-
3 yond this water that ran out from the dam where it was released
4 from the gates, ran down, concrete line, ditch, for a mile and a
5 half down the canyon, and the road was alongside of it.

6 Q If there had been deeper underlying fissures, the
7 water might have gone down through these and not noticed?

8 A I think that is absolutely impossible.

9 Q In such a country as Santa Clara River?

10 A Yes, I think if there was any water of any quantity
11 coming out of that dam, it would be on the surface.

12 Q Do you know if the flow had increased some two weeks
13 before the breaking of the dam?

14 A No, I don't.

15 Q No check was being made on that?

16 A Of course, and if there was any increase in the Santa
17 Clara River, there would be no connection between that and ours.

18 Q Do you know if there was any in the St. Francis, or
19 any under surface flow?

20 A No, only that was accountable for.

21 Q I understand water doesn't exert an equal pressure in
22 all directions standing still?

23 A Yes, it does.

24 Q Laterally as well as vertical pressure?

25 A Yes, any given depth in water, the pressure would be
26 the same.

27 Q Assuming that the formation beneath the bedrock there
28 had become softened and weakened by slow gradual percolation or
29 saturation of the water from the dam, and that the formation was
30 such as to permit it to suddenly give way, that would have in-
31 creased the pressure against the walls tremendously?

32 A Yes, after the water started moving in the reservoir,
it, of course, would require a great deal more, greater obstruction

1
2 to stop.

3 Q If a condition of that kind actually occurred, there
4 was no chance at all for that dam to stand the pressure?

5 A No, I suppose not, if there was a great fissure opened
6 some place or other and a large body of water started through.

7 Q As a matter of fact, you couldn't give any information
8 as to whether drilling was made above and below the dam to de-
9 termine what the subsurface topography was before the dam was
10 started?

11 A Some drilling was done at the dam site, that is all I
12 know about it. Don't think the drilling below and above the dam
13 was ever engaged in.

14 Q Don't you think in that particular kind of formation?

15 A No.
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1 Q BY A JUROR: Mr. Van Norman, if the flow in the Santa
2 Clara River had suddenly increased, would it have been an in-
3 dication to you that water had been leaking out from the dam,
4 would that increase have come from the dam?

5 A I don't think it would be possible. Do you mean away
6 down in the Santa Clara River?

7 Q Yes.

8 A Not unless it was surface flow coming all the way down
9 from the dam.

10 Q If it had arisen in the Santa Clara River between Piru
11 and the dam?

12 A I think I could explain what the gentlemen have in
13 mind. There has been a series of very dry years almost since
14 1926 and the extraction of the water from the gravels in the
15 Santa Clara Valley, is, of course, continual from pumping and
16 the ground water table has been constantly lowered in the valley
17 for several years, and up near the San Francisquite Canyon Dam
18 it was lowered the same as in the Santa Clara River down below.
19 The impounding of the water in the dam, the local watershed
20 water which was released from the dam and which was considered
21 as belonging to the lower people, did raise the ground water
22 table in the dam below. A careful record was kept of that and
23 that actually occurred. The ground waters raised there. It
24 was a very slow movement and that is all of record, the water
25 which was let out into the canyon. If that is what you mean.

26 Q Take, for instance, the property below Dry Canyon Dam,
27 would it have been possible to have gotten a well down in Dry
28 Canyon before that dam was put in, in Dry Canyon, on the Newhall
29 property?

30 A I don't know. That Dry Canyon Dam was built in about
31 1910 or 1911 and it was a good many years ago, and just what the
32 water conditions were in the gravels below there, before and

1 after, I don't know.

2 Q Is it generally understood that in the places of these
3 flood control dams, that by storing the water at the head of a
4 dry stream, that it will seep through and fill the reservoirs
5 up below?

6 A No, that is not the theory. The theory is that the
7 flood control dams will hold the water back from running off
8 rapidly and escaping into the ocean, and will be released from
9 this water, which is retarded by the dam, and held in the reser-
10 voir and will be released at a slow rate of speed and spread
11 over the gravels and allowed to sink in the gravels below the
12 dam. That is the idea.

13 Q Will you explain to us, please, the detail, including
14 the dimensions of the excavation which was made in the founda-
15 tion, providing for keying the dam into the foundation from wall
16 to wall and from abutment to abutment?

17 A The only way I can do that is to refer to these draw-
18 ings here. As I have testified before, I was not there when
19 these excavations were made and the only knowledge I have of it
20 are the records which were kept of it by the engineers who were
21 on the job.

22 Q As a matter of fact, you don't know just what the di-
23 mensions were in that key?

24 A No, not without referring to these drawings.

25 Q Did you see any of that work?

26 A No, I did not.

27 Q Who had charge of that work?

28 A Mr. Dunham was the superintendent in charge during the
29 construction period.

30 Q Mr. Van Norman, on these profiles here, it does not
31 show anything of the section at the bottom of the dam itself, or
32 any keys or if there was any bed rock in back of that?

1 A This drawing that you have before you is simply a
2 cross section through the dam of the concrete.

3 Q It does not carry it on down?

4 A There is no ground level marked on that. If you will
5 refer to that little sketch there, that shows the depth below
6 the original ground surface. This is the original ground sur-
7 face, this line here (indicating).

8 Q We get this but we do not know whether that is an ex-
9 cavation into the bed rock or whether it is stripping or what it
10 is.

11 A I will tell you about that. In order to be able to
12 go into the bed rock and get the excavation down into the bed
13 rock, it was necessary to de-water the canyon, so the first
14 thing that was done, there was a trench cut somewhere near the
15 up-toe of the dam, right across the excavation into the gravels,
16 and carried right down into the bed rock and the water was pumped
17 out of that and all the water controlled during the excavation,
18 and when that excavation was completed, concrete was placed in
19 it so as to cut off the flow of the water under it or through it
20 and then the excavation below that, all the lower portions of the
21 dam, was made down into the bed rock and all the loose material
22 was carried out of there, so it could be filled up with concrete.

23 Q Is it possible to get a section of this dam here show-
24 ing actually how this dam sets in this excavation?

25 A Yes, I think that can be made. The trench is excavat-
26 ed all the way across there. I might give you a picture of
27 what is always done in all dams of this character. The first
28 thing which was done ^{that} we cutoff trench was built across there so
29 the water could be controlled and then all this material was ex-
30 cavated, everything loose and fragmentary was excavated and
31 cleared off to the bed rock, and the bed rock was taken out to
32 some depth or another, I cannot say just exactly what it was.

1 It is always taken off until it is felt that the bed rock is all
2 right. Then all of this is poured on the bed rock which has been
3 stripped.

4 Q You cannot give us testimony covering precisely this
5 point of the keying?

6 A Yes. What you are trying to find out is how deep this
7 excavation went into the bed rock?

8 Q Yes.

9 A I think that can be worked up. It does not appear to
10 be here and Mr. Hurlbert, the office engineer, who has charge of
11 all the details of the design, can furnish that information.

12 Q We understood from Mr. Dunham that there was a trench
13 from fifteen to twenty feet wide to form a key for the dam?

14 A I don't know about that. I know that there was a
15 trench made from about here (indicating) on across this way
16 (indicating).

17 Q That is what they call the dyke?

18 A Yes, I saw that. That trench was excavated the full
19 width.

20 Q There were some discrepancies in the testimony yester-
21 day relative to this keying on this east side. Mr. Dunham,
22 my impression was, thought it was so steep that he did not under-
23 take to do any particular keying. Mr. Phillips stated that it
24 was keyed?

25 A The keying consists of----

26 MR. SCOTT: Your Honor, it is quite apparent that Mr. Van
27 Noman was not there and I have present the surveyer here, who
28 can give us all that data, if you care to have him do so.

29 THE CORONER: Who is that surveyer?

30 MR. SCOTT: Mr. Hamberg.

31 Q BY A JUROR: Referring to this question that I asked
32 you a while ago, as to the water--- if there had been any

1 perceptible seepage there in the reservoir itself--- were you
2 keeping records of the amount of water going into that reservoir?

3 A Yes.

4 Q If there had been any perceptible seepage through
5 underneath, would it have been possible to determine that?

6 A Yes sir, the records---- we have---- every morning at
7 about eight o'clock a report is telephoned in from every reser-
8 voir on our system and it is telephoned in from certain gauging
9 stations along the line of the aqueduct, and other waterways,
10 where men are stationed to watch and take care of things, and
11 that daily record is recorded,---- the height of every reservoir,
12 and the quantity of water flowing through all the aqueducts, and
13 everything else, and my recollection is that a week or ten days
14 before this failure or break, the reservoir was practically full
15 at elevation 1834---- I will have to refresh my memory. I have a
16 card in my pocket of these elevations--- 183475 the elevation of
17 the water in the reservoir was on the seventh of March, and on
18 the twelfth of March when it failed and broke it was 183475.
19 There had been no change in water level in the reservoir in that
20 period of time. On the first of March it was 183385, a raise
21 of nine-tenths of a foot from the first of March until the seventh
22 of March, and it remained stationary from the seventh to the
23 twelfth. Now, if there had been any substantial quantity of
24 water going out, of course, it would have shown. There was
25 some difference in the elevations in the reservoir. That in-
26 formation is all available to anybody in our office.

27 Q During that period when the height in the reservoir
28 remained stationary, was there any water let into the reservoir,
29 through the aqueduct?

30 A No, I don't think there was. I am sure there was not,
31 because Mr. Mulholland went up there about the 6th or 7th. I
32 was not with him at that time because I had to go up into the

1 Owens Valley and he ordered the water shut off flowing into the
2 reservoir because it was full right up to the spillway. 183475
3 is about the elevation of the spillway in the reservoir so the
4 reservoir was full and the water was all shut off and passed into
5 the lower reservoirs in the San Fernando Valley.

6 Q If there had been any perceptible seepage under the
7 dam and no water being let into the reservoir during this time,
8 would you say that the elevation of the water would have decreased
9 ed?

10 A Yes, it would have lowered in the reservoir.

11 Q And it did not lower?

12 A No, I have just read you these figures. I was curious
13 to know just what the elevation of the water was in the reser-
14 voir when the thing occurred, and how that compared in elevation
15 with the height of water which was in the reservoir the year be-
16 fore. The dam was filled practically to the same elevation last
17 year and this year, you might say, because it was filled and stood
18 there and when the water was needed in the summer time it was
19 drawn down and then filled up again. I have made a record of
20 these figures for the purpose. In 1927 it was 3125, and in 1928--
21 3475, a difference of three and one-half feet only in elevation.

22 Q In the construction of dams of this character, the
23 concrete gravity type dams or gravity and arch dams, is it cus-
24 tomary to construct a cutoff wall on the heel of the dam or the
25 up-stream face of the dam to prevent seepage of water through
26 the dam?

27 A That would depend upon the particular site. Different
28 things are done at different times. I don't know whether that
29 is the time that is usually done or not, but it would depend upon
30 the requirements of the site and the judgment of the engineer
31 there, just what would be done in that case. I would say that
32 the clearing of the site and getting down to bed rock and having

1 a good contact with the bed rock, was all that would be necessary,
2 whether it would be required to do that--- if the character of
3 the rock said that you should put down a cut-off, possibly that
4 would be all right.

5 Q You don't think that the general practice among the
6 best engineers in building dams is--always to always build a cut-
7 off wall?

8 A Well, sometimes. The whole base of the dam itself is
9 a cut-off wall. Now, in an earth-filled dam that is one of the
10 things usually done. You excavate a trench along the axis of
11 the dam and fill that up with impervious material and sometimes
12 leave the material that is in place there on each side of the
13 cut-off wall.

14 Q Whether or not a cut-off wall is built is it the
15 general practice to place a system of underdrains under the dam
16 in its whole contact with the surface of the rock between the
17 surface of the rock and the dam itself, to underdrain the dam to
18 prevent principally uplift due to the head of water against the
19 dam?

20 A Yes, that was done, as I explained a while ago---
21 pipes were connected and the drain carried out to the lower part
22 of the dam.

23 Q You don't know if these underdrains were constructed
24 along the whole surface of the contact between the masonry and
25 the rock?

26 A I don't think they were. I don't know just how far
27 they went, but my understanding is that they were near the base
28 of the dam and not all the way up.

29 Q If the ground level of the water did rise in the Santa
30 Clara Valley, could that not have been due to rains?

31 A Yes, surely.

32 Q BY MR. DENNISON: On Monday when you went up there it

1 was about twelve o'clock?

2 A It was twelve o'clock, about, when we left. I think we
3 probably got there by a quarter to eleven or something like that.

4 Q How much water was flowing over the dam at that time,
5 any?

6 A Over the dam? No, I don't remember any.

7 Q When you left was there any flowing over?

8 A No sir.

9 Q Was any gate open?

10 A No sir.

11 Q Did you give any orders to open any gates?

12 A No sir. I will tell you where there was water in the
13 canyon. It is very likely what you have in mind. Below Power
14 Plant No. 2 water was being run into the canyon from the aqueduct.

15 Q Why?

16 A Because the reservoirs below were full and the St.
17 Francis was full and we run the surface water through Power Plant
18 No. 2, and we turned it into San Francisquito Creek at that point.

19 Q About twelve o'clock the water rose in the canyon down
20 there?

21 A No, it was earlier than that. Some of that water was
22 turned--- there had been water flowing continuously out of the
23 aqueduct.

24 Q Into the canyon?

25 A Yes, and that has always been the case. In agreements
26 with the Santa Clara Valley people, when Power Plant No. 2 was
27 built and the tunnel being driven in the gravel of the creek,
28 some water leaked in and we returned a like amount of water to
29 the canyon.

30 Q Was there any great increase of water in this canyon
31 on the 12th?

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A Yes, there was.

Q How much?

A Probably fifteen hundred inches, something like that.

Q That started about what time Monday?

A About 7:30 in the morning, or maybe eight or nine o'clock. That is a thing we have been doing for years,

Q Did it start as late as twelve o'clock?

A No, it did not. It started in the morning.

Q BY MR. SCOTT: This water below Power House No. 2, which was going out about twelve o'clock noon of March 12th, was compensation water that is usually given to these ranchers down below?

A Yes, and some in excess of that.

Q What was the excess?

A The excess was the old water that was coming from the Owens River Valley that the aqueduct was passing through Power Plant One and on through tunnels and through Power Plant 2, and into the aqueduct to go on to the Dry Canyon Reservoir, and the San Fernando reservoir and the rest of the reservoirs. The reservoirs at this end were at such a stage that we were wasting a portion of the water after the St. Francis Reservoir was full, and some of that was being let into the canyon and that would make a noticeable increase in the surface of the stream down the canyon for two or three miles.

Q Would it go as far as the Newhall place or Harry Carey's Ranch?

A Well, that is a thing we have done often.

Q BY THE CORONER: Did you measure the water there as it went down the canyon regularly?

A Yes sir.

Q Did you measure it very frequently a few days before the collapse of the dam than formerly?

1 A No sir, the hydraulic men in the office keep a record
2 of those things and make certain rounds.
3

4
5
6 HAROLD B. HEMBORG, being
7 first duly sworn, testified as follows:

8 BY THE CORONER.

9 Q Please state your name.

10 A Harold B. Hemberg.

11 Q Where do you reside?

12 A 1337 Carmen Drive, Glendale, California.

13 Q What is your occupation, trade or profession?

14 A I am a surveyor with the Water Department of the City
15 of Los Angeles.

16 Q How long have you been a surveyor for the Water De-
17 partment?

18 A Five years.

19 Q Did you survey the site for the St. Francis Dam?

20 A Yes sir.

21 Q Have you the engineering data on these surveys?

22 A Yes sir, the maps.

23 Q Were you assisted by anyone in that survey?

24 A I had charge of the survey party out there. I was
25 Chief of the party.

26 Q By that survey did you locate the site of the St.
27 Francis Dam?

28 A We laid the dam out and it was projected on the orig-
29 inal topography.

30 Q Can you explain the drawings and maps and charts?

31 A Yes, the part that I did. I made some of those maps.

32 Q Have you the maps here?

1 MR. SCOTT: He might state when it was first started and
2 the dimensions.

3 THE CORONER: When did you make your first survey there?

4 A I came to the dam on July 2nd, 1924. That is when I
5 set the first stakes of the dam. When they first started was
6 the concrete pouring in the water cut-off wall on August 17th,
7 1924.

8 Q What were the dimensions of the dam as you laid it
9 out there?

10 A We brought the top dam up to an elevation of 1858 from
11 the bed rock. That would be as far as I could determine here,
12 about two hundred feet above the bed rock to the top of the dam,
13 and the total length of the dam is about twelve hundred feet,
14 and of the crest is six hundred and eighty feet, that is, of the
15 main arc.

16 Q Between the walls of the canyon?

17 A Yes sir. That dyke running off of the side is six
18 hundred feet long.

19 Q What was the thickness of the dam at the base?

20 A About a hundred and sixty feet.

21 Q BY THE CORONER: I think probably it would be best for
22 the jury to question the witness themselves, if they wish to.

23 Q BY A JUROR: I would like to have brought out clearly
24 this point: The keying of the masonry to the foundation, the
25 dimensions, the nature of the work after they filled in the
26 courses, of the filling of the key, as to whether or not you
27 took off any water you might have found in the base of that key,
28 or that trench? I would like to get all available information
29 on that one point?

30 A I can begin by telling you first about that cut-off
31 wall. That was the work which was done first. The cut-off wall
32 was put down to bed rock.

1 Q Could you sketch it in plan on the blackboard?

2 A I could explain by the photographs and the contours
3 how far the keys went into the wall.

4 Q We want a section through the dam?

5 A When I came out they had just got through hydraulicizing
6 the dam site and when I came they were just going into the hard
7 rock which they had uncovered, and they went into that just as
8 these contours show. I worked this in sections as the dam was
9 constructed. Possibly I would only take five foot levels.
10 That was as high as the dam was brought up each day. The way
11 they did that they hydraulicized off the loose material and earth
12 until they uncovered the solid stuff that the hydraulicizing would
13 uncover and then went into that hard stuff about ten feet.

14 ~~BY A JUROR~~ MR. MOHR: Referring to St. Francis
15 Dam looking west, May 29th, 1925, a photograph on Page 91.

16 A There is where the hydraulicizing operations were
17 carried out, taking off the talus and then went in with picks
18 and gads and stripped off all they possibly could strip off in-
19 to that solid bed rock.

20 Q BY A JUROR: How far?

21 A Not less than seven feet and in the side wing walls
22 not more than fifteen or twenty feet. In the bottom it was
23 about thirty to forty feet.

24 MR. MOHR: Referring to photograph labeled "St. Francis
25 Dam, July 21st, 1925," looking down stream from road. Eleva-
26 tion top of concrete down stream, 1735, on Page 91 of the book.

27 A These are five foot forms. Here is the original
28 talus or top soil.

29 Q BY THE JUROR: Is that the full width of the base
30 at that point?

31 A Yes, we measured that out on the ground before they
32 went into the hard stuff.

1 Q In other words, that is approximately a hundred and
2 forty feet across there?

3 A Not at that elevation.

4 Q Did you follow your horizontal section all the way up?

5 A Just exactly, do you mean?

6 Q You had your section at a hundred and sixty feet or
7 two hundred feet, a maximum height, and you kept on up--- it was
8 stepped in the same horizontal----

9 A Yes. We followed into the rock all the way up. It is
10 keyed in as far as we could get into the rock into the solid
11 material all the way down on the wing wall after we had removed
12 the talus and soft material by hydraulicing.

13 Q Can you tell me anything about the angle of this face
14 to the axis of the dam?

15 A Yes sir, that was kept plain, normal to the axis of the
16 arch where it hit the ground.

17 Q What happened to be the angle of that bed rock, was
18 it bedded or standing on edge, or what was the nature of that
19 bed rock?

20 A I could not say as to that.

21 Q Have you any other photographs showing any other part
22 of the construction?

23 A They went into there with a steam shovel.

24 MR. MOHR: Referring to St. Francis Dam, showing progress
25 during construction, ^{July} ~~to line~~/17, 1925, no fill picture on page
26 101.

27 A They brought the steam shovel up there and went into
28 the hill. That is the standard way of putting the forms in on
29 the different sections of the dam.

30 Q BY MR. MOHR: Referring to pictures on Page 105, three
31 pictures.

32 A My contours cover all the hard material in the dyke.

1 Here is the elevation 1815; on the contour there is 84. That
2 makes eleven feet down in the hard material. This is the height
3 of the hard material after they had taken off all the soft
4 material. There is 1658 elevation and there is the contour
5 showing that elevation. That is the original. Now, we turn to
6 the bed rock. Here is that same radial line. There is 30.
7 That is 25 feet at the stream bed at that one point.

8 BY A JUROR:

9 Q Was there any kind of key provided on the major axis
10 of the dam or was it all just one flat bottom?

11 A Well, it was trenched in.

12 Q I would suggest that you go to the blackboard and
13 draw us a section on that line at the base of the dam.

14 MR. MOHR: He wants to find out if there was any prepara-
15 tion made here for any cutoff or key wall.

16 A There was a key wall provided at the bottom to shut
17 off the water.

18 Q That is behind the dam itself?

19 A That is part of it. I brought the cutoff wall far
20 enough out so that when they----

21 Q BY A JUROR: Draw us a diagram on the blackboard show-
22 ing the surface of the earth and how far it went down into the
23 earth?

24 A Supposing this is the original surface of the ground.
25 We came along that axis and put the cutoff wall down to bed
26 rock.

27 Q About how deep?

28 A As shown there, this thirty feet.

29 Q How high?

30 A I could not say exactly.

31 Q Was it for the full width of the dam, the footing?

32 A I will explain that. You see, there was water com-
ing down this creek. When they put the dam in and went to put

1 the shovel in and work behind the dam and excavate down to bed
2 rock they had to have the water away and we prevented that water
3 from going underneath the bed rock and they carried it through
4 a flume over to where the men were working and then they put the
5 shovel in and dug behind here. I will say that is the original
6 ground. Supposing that the design of the dam calls for the dam
7 to be a hundred and sixty feet thick according to the gravity
8 section like this (indicating) and the sets coming down like
9 that (indicating), and you understand the lower the dam went
10 the thicker it got because that is the principal of the gravity
11 dam. At this elevation of the bed rock we dug far enough away
12 from the center axis so the design would follow far enough away
13 from the bed rock.

14 Q On that section you have started there draw the final
15 appearance of the dam showing the exact bottom of the concrete,
16 you know, the idea?

17 A If this is the outline of the bed rock it was dug
18 out until they got to the hard material and picked and washed
19 and this whole section was filled in.

20 Q Where was the face of the water?

21 A In this direction (indicating).

22 Q How far was the heel of the dam from the top soil?

23 A The heel of the dam was--- They filled in all with
24 concrete and then we carried the design out and set the forms
25 here for this step line and it was dug far enough to take care
26 of that. I set the stakes over as far as it was supposed to go
27 at that elevation.

28 Q You did not go down into the bed rock at that point
29 there at the bottom?

30 A That is all bed rock. They cleaned off the bed rock
31 and my contours of the bed rock will show you the character of
32 the bed rock where they laid the concrete.

1 Q Did you have to shoot that or to drill it or how did
2 you excavate it?

3 A They brought the steam shovel down and then had men
4 with picks, gads and drills, and took out all the loose material,
5 and trenched and dug in the bottom. Before they got the con-
6 crete we set the boring pipes. I have the location in my
7 field book where they were set.

8 Q This gives a general idea as to where those pipes were
9 placed?

10 A One there (indicating) and one there (indicating).

11 Q They were just staggered?

12 A Yes, two rows running across the bottom of the canyon
13 this way (indicating). They are all connected and brought out
14 below the bottom of the dam.

15 Q The toe of this dam was thirty feet into bed rock, is
16 that correct?

17 A Yes sir.

18 Q Did you have a header for those bleeders?

19 A Yes sir.

20 Q What size pipe were they?

21 A I don't know now.

22 Q Those pipes were to take the upward pressure?

23 A Yes.

24 Q Where did they come out?

25 A They were connected together and brought out beyond
26 the dam.

27 Q To the horizontal header there and brought out?

28 A Yes.

29 Q Which side was it taken out on?

30 A Here (indicating) on the south side.

31 Q Was it in the center?

32 A Along the 10 plus 00 radial line.

1 Q We don't quite understand you, whether or not you
2 carried this dam down into bed rock or whether you stepped on
3 the surface of the bed rock?

4 A It was all rock when we got down to the stream.

5 Q I understand there was twenty or thirty feet of gravel
6 in the stream bed?

7 A I cannot sketch it because I don't think it is right.

8 Q Former testimony showed there was about twenty feet
9 of gravel in the stream bed. Where is the original stream bed
10 there (indicating)?

11 A Right there (indicating). This curtain wall is just
12 a little above the surface and they caught the water against the
13 curtain wall.

14 Q Was that stream the bed rock surface?

15 A Rock and gravel.

16 Q How deep was that rock and gravel before you struck
17 the bed rock?

18 A I could not say exactly. What

19 Q What is that lower line (indicating)?

20 A They wanted to get the general outline. That is bed
21 rock. Yes, they went down to bed rock.

22 Q Did they ever go into it?

23 A On all streams there is a surface of sand and gravel
24 and those things.

25 Q We are trying to determine just where you struck that
26 rock. How deep did you go when you first struck bed rock and
27 how far into bed rock did you go?

28 A ^{When} We came to the bed rock underneath this sand and
29 gravel?

30 Q Yes sir.

31 A I would say about nine or ten feet.

32 Q That leaves about twenty-one feet into the bed rock?

1 A Just about like that, yes.

2 Q How did you excavate that twenty-one feet, with a steam
3 shovel?

4 A No, they did not touch it with a steam shovel. They
5 got down to a lot of the hard material with the steam shovel
6 after they put the curtain wall in.

7 Q BY MR. DENNISON: That is not the question. How did
8 you take out that twenty-one feet of bed rock?

9 A I am explaining. By shovel and by men with picks and
10 drilling and gads.

11 Q BY A JUROR: You did not shoot any of it?

12 A No, I don't think there was any shooting done. I could
13 not say for sure.

14 Q The testimony yesterday showed that the cutoff did not
15 extend down into the bed rock or extend to the surface of the
16 bed rock. Mr. Dunham, I think, testified to that effect. Was
17 that correct or was it not?

18 A I am stating my own observation. I don't know what he
19 calls bed rock. That is where we came to the hard rock and they
20 took the loose materials from the top of the stream bed. I
21 would call that bed rock.

22 Q How far down into the rock did you go with that cutoff
23 wall, was it thirty feet?

24 A It would be about thirty feet, the total depth.

25 Q And twenty or twenty-one feet of that was bed rock?

26 A Was into the hard material, into bed rock.

27 Q Where you stopped there after digging down twenty-one
28 feet, was the rock any different in formation than it was up at
29 the top of that twenty-one feet?

30 A It was about the same to me. I could not say that
31 because----

32 Q It all looked alike?

1 A Yes, it looked alike. I was not a geologist.

2 Q Then, you would say that the dam was built into and

3 tunneled into the bed rock twenty to twenty-one feet in the base

4 of the dam, and from ten to twelve feet on the wings?

5 A Yes sir.

6 Q That would be your judgment?

7 A Yes sir.

8 Q Did you give lines and grades on this dam, from the

9 start to the finish?

10 A Yes sir, I put the first stake in and the last one.

11 Q Did you witness any preliminary borings or tunneling

12 into the site of the dam to determine the nature of the rock be-

13 fore the dam was placed there?

14 A I witnessed the tunneling into the east side.

15 Q That was the only tunnel which was sunk, to your

16 knowledge?

17 A That, and the borings in the bottom, that I spoke of

18 before.

19 Q How many holes were put down into the bottom?

20 A Ten holes.

21 Q There was no provision for drainage where the dam

22 started up the walls of the canyon, only in the base of the

23 canyon?

24 A There was nothing to drain in the walls of the canyon.

25 That was all dry. The water was in the bottom of the canyon.

26 Q I understand, the surface water, but there was no

27 system provided for under-drainage under the wings?

28 A I don't know what you mean at all.

29 Q In designing dams it is often the custom to provide

30 drains in the base of the dam to drain away any water, which

31 seeps in there to prevent up-lift from the head of the water

32 back of the dam?

1 A And you are asking if these samekind of pipes that we
2 had below were put up in the wing walls?
3 Q Yes.
4 A No, I don't think so.
5 Q Did you design the dam?
6 A No sir.
7 Q BY MR. SCOTT: Explain to the jury what the force of
8 that hydraulic pressure in that hose/^{used}in washing off this material
9 from the place where you put in the walls on each side, was?
10 A The water was taken from the aqueduct up on the hill
11 and I don't know exactly the pressure of the head of water.
12 Q BY A JUROR: It has been stated to be from a hundred
13 and fifty to a hundred and seventy-five pounds.
14 Q BY MR. SCOTT: Was it very forcible or not?
15 A Oh, yes.
16 Q How far was the aqueduct above it, three hundred feet?
17 A I could make an estimate like that--- I would say
18 about three hundred feet.
19 Q What size was the line?
20 A I could not say.
21 Q What was the nozzle attached to, a fire hose?
22 A The regular hydraulicing nozzle that they use.
23 Q A hydraulic giant?
24 A I guess that is what you call it.
25 Q BY MR. DENNISON: Will you tell me what was the pitch
26 of the west hill, the hill on the west side of the canyon?
27 A Do you mean the ratio of slope of the hill?
28 Q Yes. What angle was it at?
29 A The contours will show that.
30 Q Have you any data from which you could tell me?
31 A (The witness refers to a blueprint) It went up about
32 one foot vertically to every four feet horizontally.

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Q What angle would that be, approximately, forty-five?

A Oh, no.

Q More than forty-five?

A Much less than forty-five, about twenty degrees.

Q How about the pitch of the east hill, on the east side of the canyon?

A I could not say unless I get it off of the contours. It was steeper on the east than on the west.

Q When you went up these respective hills you excavated up the hill, did you? How deep after you washed it down?

A After washing it down they went in ten or twelve feet.

Q How often did you make calculations from keyways to key it into the hill?

A Just put in these trenches in the side of the hill. The keying in of the dam is keying it in the bed rock.

Q Does that show on the maps that you made?

A It shows the contours at intervals of every two feet.

Q Does it show in the map which you prepared for the erection of these----

A It shows the bed rock where they poured the concrete.

Q Does it show those keyways?

A No sir.

Q Mr. Hemberg said that he could show us a picture showing the trench into the west wall.

A (Witness illustrates by means of photographs).

R. R. PROCTOR, being first duly sworn, testified as follows:
BY THE CORONER.

Q Please state your full name.

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A R. R. Proctor.

Q Where do you reside?

A 1338 Menocade Street, Glendale, California.

Q What is your trade, occupation or profession?

A Assistant Civil Engineer in the Department of Water & Power of the City of Los Angeles.

Q What part did you have in the survey and location of the St. Francis Dam?

A The survey of that, as well as other structures, came under my jurisdiction. It was done by men working under my direction.

Q Were you personally on the ground part of the time?

A I came possibly once every week or every two weeks.

Q Who was doing the actual work?

A Do you mean in charge of construction?

Q Who did it immediately under your direction?

A Mr. Henberg, who preceded me on the stand.

THE CORONER: Gentlemen of the jury, if you wish to ask this witness about the location of the survey there, I think you should do it.

Q BY A JUROR: How far would you say that the dam was carried into bed rock?

A As Mr. Henberg has described.

Q I would like your answer.

A Around ten feet or possibly a little more on the sides and more on the bottom. I don't recall that I saw the bottom taken out. I don't believe that I came there at that time, and I don't recall that I was there.

Q Would you say that the cutoff wall was carried into bed rock or just to the surface of bed rock?

A I believe it went down the same as the rest of the structure, if I am not mistaken, or very closely to the same.

1 Q BY MR. DENNISON: Did I understand that you were up
2 there when this structure was erected?

3 A I came over every week or two weeks.

4 Q Did you remain any length of time when you were there?

5 A Long enough to see about the survey work and possibly
6 explain other information in connection with the project which
7 was required.

8 Q Now, do you remember how the thing was constructed?

9 A Yes.

10 Q First they went up there and they washed down the side
11 of the hill and then dug a hole down into the stream, didn't
12 they?

13 A Yes.

14 Q And built a wall down of cement?

15 A Yes, a cutoff wall of concrete.

16 Q They went down through that loose stuff until they
17 thought they struck something which was solid?

18 A Until they did strike something which was solid, as
19 witnessed by the fact that it is still there.

20 Q And then put some cement in there?

21 A Not cement, concrete. Cement comes in bags. Concrete
22 is a mixture of sand and rock.

23 Q Then, after they got this wall down there, they clean-
24 ed out back of it, didn't they?

25 A Yes sir.

26 Q And then they had two hills on either side, to clean
27 out?

28 A Yes.

29 Q To dig a ditch down the hill on either side?

30 A To dig a ditch?

31 Q Yes.

32 A The foundation for the dam was cut out on both sides.

1 Q After they got that ditch dug down on either side of
2 the hills they proceeded to pour the cement?

3 A No sir, the concrete was poured in in approximately
4 ^{feet} five layers and preceding each layer the rock on either side was
5 carefully cleaned and all loose crumbling material was taken out
6 and hosed down.

7 Q Will you draw an outline on the board of how they did
8 that, starting at the bottom of the wing?

9 A That has been pretty well covered.

10 Q It has not been for me. We will say that the hill on
11 one side was washed down and this hill on the other side you
12 have your wall in and your foundation, and that is the stream
13 level, somewhere along here (indicating), and this is the strata
14 of rock which you call solid, upon which you had this structure
15 built when you commenced to pour five feet--- you come up here
16 five feet to pour--- how far out did you go here into the hill?

17 A Do you mean how far it went this way?

18 Q Yes, that is it exactly.

19 A That is what we described as being ten or possibly
20 fifteen feet below the original hard surface. That would not
21 come away from the hydraulicing.

22 Q You excavated out here (indicating)?

23 A Yes, and each time the concrete would be poured to
24 some point like this (indicating).

25 Q What did you get the stuff out with?

26 A Wheelbarrows, picks and shovels.

27 Q That was the first pouring. Then you did the same on
28 the other side?

29 A You are talking about the first pouring and drew this
30 line and said it was the original stream bed.

31 Q You have it all poured and filled up down to there
32 (indicating), and got right up there where the hill commences?

1 A You are speaking now of the method of cleaning off
2 of the foundation?

3 Q What did you do to these hills, is what I want to know?

4 A As I saw it at the time, the operations proceeded in
5 this manner---

6 Q Start right at the bottom and show me what you did?

7 A That is what I am going to do. Just as shown in the
8 pictures.

9 Q Put the hill in there (indicating).

10 A You have the hill in just as it was. That represents
11 the surface of the concrete left irregular to give bond to the
12 next days work, known as a construction joint. Now, as they
13 proceeded up the hill, why this portion in here (indicating),
14 would be cleaned off something in that manner (indicating), and
15 concrete poured in and left rough. In the cleaning of this it
16 was taken off by hand methods and no dynamite used, not to dis-
17 turb the rock next to the dam. Had we used dynamite you
18 possibly might have caused cracks in here (indicating).

19 Q That is the way they ~~did~~^{until} ~~and still~~ they reached the
20 top of the hill?

21 A Yes sir.

22 Q That is all. Where were the keyways placed?

23 A Up here (indicating).

24 Q Show me where the keyways were placed?

25 A To erect a cross section, I will ~~not~~^{not} attempt to draw the
26 steps, but will draw an average line down that represents them.
27 The entire foundation was left very rough and irregular and that
28 was thought to be better than leaving the foundation in this
29 shape, with grooves cut in at intervals. This allows a natural
30 key due to the irregularities in the bottom.

31 Q Do I understand that is the foundation?

32 A The bottom of the concrete throughout the structure.

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Q In the rock?

A Yes.

Q Based in the rock?

A Yes.

Q Now, from this, was there any wall or pipe or concrete or anything else that went down into the solid rock below that base there?

A The wall was put in at the bottom for some distance up the side.

Q No, similar to that (indicating)?

A Similar to that, but possibly ten or fifteen feet from the edge.

Q Where was it, show me?

A One wall was put in in this manner (indicating). How far it extended up the hill, I don't know. I was there one day and saw them digging it out, saw them taking the material out, excavating for it.

Q How did they make that excavation?

A With sledge hammers and gads and picks, and by wheelbarrows.

Q They did not have to drill into it?

A I don't know whether they drilled or not.

Q It was not so hard that it required drilling into it?

A Most all types of rock---

Q I am talking about that rock there?

A I did not see them do it.

Q You did not see them doing any blasting?

A No blasting. Blasting is not permitted under those circumstances.

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EDWARD V. HENDRICKS, be-

ing first duly sworn, testified as follows:

BY THE CORONER.

Q Please state your full name.

A Edward V. Hendricks.

Q Where do you reside?

A Argonaut Hotel, Los Angeles, California.

Q What is your occupation?

A Chief rigger, boss rigger, for the City Water Department of Los Angeles.

Q Are you employed by the water department of Los Angeles at the present time?

A Yes sir.

Q Were you employed by the Los Angeles City Water Department during the construction of the St. Francis Dam?

A Yes sir.

Q And you were the boss rigger there, were you?

A At the time.

Q From the beginning of the dam until its completion?

A Practically.

Q Do you know anything about the technical construction of the dam?

A I never paid much attention to it, as my line of work consisted of the installation and maintaining of the concrete equipment throughout the job.

Q What does the concrete equipment include?

A The mixers and mixing plant from the time ^{the} concrete entered the mixers until it was distributed on the dam.

Q Certain hoists?

A Hoists and towers, as well as different parts of machinery around the job.

Q You had nothing to do with the actual mixing of the

1 concrete yourself?

2 A No sir, not outside of the installation of it.

3 Q Do you know anything about how the concrete was mixed
4 or the proportions of cement and gravel and sand?

5 A I cannot say that I do.

6 Q You saw the concrete as it went into the structure?

7 A Yes sir.

8 Q Did you see anything about the nature that did not
9 look regular or proper?

10 A I never paid no particular attention to it. It takes
11 a test to decide such things as that, and I never made such a
12 test.

13 Q How much experience have you had in concrete work?

14 A Considerable, amounting to about eleven or twelve con-
15 crete structures, dams of different types.

16 Q Did you see any differences in the construction of the
17 St. Francis Dam or anything that you considered was not standard
18 in structures of that sort?

19 A It was constructed, as near as I can say, the same as
20 the average structures are around over the country.

21 Q Did you ever hear any complaint of the wrong sort of
22 sand being used or too much silt in the sand or too much dirt,
23 or any quantity of dirt being mixed in the concrete?

24 A No sir.

25 Q In your opinion, was the concrete work done properly
26 there?

27 A Yes sir. I think that concrete will answer for itself.

28 Q Do you know of any weakness in the dam?

29 A I cannot say, for the simple reason I have not seen the
30 dam for the last seven months. I have been down in the city on
31 city jobs.

32 Q Have you ever had any suspicion that the dam was weak

1 in any respect after the dam was completed?

2 A No sir. After the dam was finished I was transferred
3 to town and very seldom got out there.

4 Q Where were you on the 12th day of this month?

5 A At Second and Ross Street Yard in Los Angeles.

6 Q And you had no knowledge and heard no rumors that the
7 dam might be in a dangerous condition?

8 A No sir.

9 Q You are not in touch with the people up at the dam?

10 A Not very much.

11 Q You have friends up there in the City Camp in the Canyon?

12 A Yes sir, all of them.

13 Q And none of them ever communicated to you that they
14 believed the dam was unsafe?

15 A No sir.

16 Q BY MR. SCOTT: Did you ever see any lumps of clay in
17 any of that concrete that you mixed up, lumps of clay with the
18 concrete?

19 A No, I never seen no clay in that country, what you
20 would call clay. I particularly looked for clay there at one
21 time myself, for some use that I needed there, around machinery,
22 and there is no good clay in that country.

23 Q Can you state the proportion of cement to the gravel?

24 A No sir, I don't know what the mix was exactly.

25 Q Have you seen the walls that have been broken there,
26 since the disaster occurred?

27 A Once only.

28 Q How does it look to you, as to cement, how is the con-
29 crete ?

30 A It looks good, in my opinion.

31 Q How many years experience have you had with concrete?

32 A About twelve to fifteen years.

1 Q Have you been nothing else?
2 A Oh, yes, other work included.
3 Q BY MR. DENNISON: Did I understand you to say that you
4 had charge of the concrete up there?
5 A No sir.
6 Q What did you have charge of?
7 A Installation and maintaining of the concrete equipment,
8 shooting, hoisting and distributing of the concrete.
9 Q You had the blocks that were made as the dam was being
10 erected, for the purpose of testing them for their strength?
11 A No sir.
12 Q Who did have these?
13 A I cannot say.
14 Q Did you see any?
15 A On the job?
16 Q Yes.
17 A We tested the concrete on the job ourselves.
18 Q How?
19 A By cutting blocks in two and seeing how the concrete
20 and the different materials of rock acted inside of the concrete.
21 In other words, we took concrete blocks and sawed them in two,
22 and seen the condition of everything inside of these blocks.
23 Q Were these blocks made for that purpose?
24 A Yes sir, test blocks.
25 Q How large were they?
26 A 36" x 36".
27 Q And you sawed them in two?
28 A And broke them.
29 Q You did not put them under pressure?
30 A We had no way on the job to put them under pressure.
31 No pressure test was made of them.
32 Q Were any of the blocks taken away for pressure tests?

1 A I could not say as to that.

2 Q You did not have anything to do with it, if they were?

3 A No.

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DAVID S. MENZIES, being

8 first duly sworn, testified as follows:

9 BY THE CORONER.

10 Q Please state your name.

11 A David S. Menzies.

12 Q Where do you reside?

13 A 1538 West 45th Street, Los Angeles, California.

14 Q What is your trade or occupation?

15 A I am a general foreman for the City. I am working
16 for the Bureau of Power and Light at present.

17 Q Were you working for the Los Angeles City Water Depart-
18 ment at the time that the St. Francis Dam was constructed?

19 A I was.

20 Q In what capacity were you employed?

21 A General foreman.

22 Q As general foreman, were you foreman over the laborers
23 who were mixing and spreading the concrete that went into the dam?

24 A Mixing, not spreading.

25 Q Who were the men that were working under you mixing
26 the concrete?

27 A Well, that would be pretty hard to remember all their
28 names. They changed once in a while.

29 Q How long did it take from beginning to end to pour the
30 concrete?

31 A A little over a year on the steel tower. We poured
32 a little before that, one mixer on the wooden tower.

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Q What kind of concrete went into the dam?

A The gravel was taken up from the creek bottom with a steam shovel and the cement was monolith.

Q Your gravel and sand was all mixed as it came out from the stream bottom and then mixed with the cement and water?

A Yes sir.

Q In a mechanical mixer?

A We had our hopper measure twenty-seven cubic feet and we put in one barrel of cement, that is four sacks. That was one mixture. We had two mixtures.

Q Will you explain the reason for the two mixtures?

A One mixture was for the center part of the dam and for the forms, and on each end there was a richer mix.

Q What proportions of cement and gravel were in each of those?

A The same amount of cement but we cut down the gravel about one-fifth.

Q Did any dirt go into it?

A No sir.

Q Did you personally inspect all the material that went in so that you are sure that no dirt went in it, no red clay, no large amount of silt?

A Some silt, yes sir.

Q How much silt, probably?

A It would vary, but you could easily tell by the looks of the gravel.

Q No soil or clay?

A A little soil and a little clay.

Q How ^{large} ~~much~~ gravel did you use?

A As large as would go through the hoppers.

Q How large was some of it. What were the largest ones like?

1 A Nothing could go through thicker than five and one-half
2 inches thick.

3 Q And about how long?

4 A Some were longer than that, ~~probably~~^{about} a foot long or a
5 foot wide, but nothing thicker.

6 Q You took the rock as it came from the river bed?

7 A Yes sir.

8 Q And the larger rocks could not go through that grizzly?

9 A Yes sir. That was piled to one side and broken up with
10 hammers, and what we called the soft rock was thrown to one side
11 and carted away with trucks. Once every day we would clean up
12 the refuse.

13 Q Did you see anything irregular about the mixing of the
14 materials there for the concrete?

15 A Nothing.

16 Q How much experience have you had in concrete work?

17 A Off and on for about twelve years. I am not an expert
18 at it, and do not pretend to be. I worked under the direction
19 of Mr. Dunham.

20 Q Did you have any instruction from Mr. Dunham relative
21 to keeping out clay and foreign matters, that don't belong in
22 good concrete?

23 A Certainly.

24 Q Did he insist on that?

25 A Yes sir.

26 Q All material was inspected carefully, was it, before it
27 went into the dam?

28 A Yes sir. When the trucks were hauling, if a load did
29 not look good on the outside it was taken to one side and dumped,
30 and later on we had a system of inspecting it, so we would not
31 have to take it to the shovel and then haul it back again.

32 Q You are not an engineer?

1 A No sir.

2 Q What was the bottom of the dam poured on?

3 A On rock.

4 Q Into the country rock or on solid rock?

5 A On solid rock.

6 Q As it went up the sides was it anchored firmly in your
7 opinion to the sides of the canyon?

8 A Yes sir.

9 Q On solid rock?

10 A Solid rock, as solid as anything in the side of the moun-
11 tain.

12 Q How deep into the sides of the mountain did the con-
13 crete walls go to meet the rock?

14 A That is pretty hard to judge. It was taken out a
15 little at the time, but the original contour of the hill, after
16 the dam was finished, stuck out in the face of the dam on the
17 ends, from ten to thirty feet. There was that much overlap.

18 Q The dam went into the hill ten to thirty feet, vary-
19 ing at places?

20 A Yes, according to the formation and the soil at the
21 dam. Some places were dug more out than at others.

22 Q Did you see any weak spot in the wall where the sides
23 of the dam met the canyon?

24 A No sir.

25 Q Did you work on both the east and west sides of the
26 dam?

27 A Yes sir.

28 Q Are you thoroughly familiar with all the formations
29 there?

30 A Yes sir.

31 Q And you don't know of any weak spot?

32 A I don't know of any weak spot.

1
2 Q In your opinion, as a mechanic, though not professing
3 to be an engineer, did it look like good, commonsense work and
4 that every precaution was being taken to make the dam safe at the
5 ends, as well as at the bottom?

6 A It looked like a thorough job.

7 Q I presume you don't understand geological formations?

8 A No sir.

9 Q And don't know what the formation was. Were you up
10 there just prior to the time that the dam collapsed?

11 A No sir.

12 Q How long has it been since you were up there?

13 A Not since it was finished.

14 Q Did you ever hear any rumors that the dam was unsafe?

15 A Yes sir.

16 Q You have?

17 A No, not unsafe.

18 Q Who did you hear that from?

19 A Just rumors around, you know. You would talk with
20 somebody and somebody would come around and say that the dam leaks.

21 Q Did you have any friends up there in the camp?

22 A I certainly did.

23 Q Do you know of any of them leaving because the dam was
24 not safe?

25 A No.

26 Q And you never received any warning from anybody then,
27 that they were apprehensive about the condition of the dam?

28 A No sir.

29 Q And you were in communication with your friends, there?
30 Were you?

31 A No, not frequently, no.

32 Q BY MR. SCOTT: How far was this gravel hauled to the
place where it was used at the St. Francis Dam?

1 A About--- it would average a little over a quarter of
2 a mile.

3 Q Was this ^{the} same kind of gravel that was used in the
4 aqueduct?

5 A Yes sir.

6 Q Did you work on the Los Angeles Aqueduct?

7 A Yes sir.

8 Q Did you have something to do with the cement work on
9 that canal?

10 A Not much with the cement, but I handled a lot of the
11 gravel.

12 Q Did you use this same character of gravel in construct-
13 ing the Los Angeles Aqueduct, as was used in the construction of
14 the St. Francis reservoir?

15 A Yes sir, it was the same gravel, from the same place,
16 practically, near the same place.

17 Q And it had very little silt in it?

18 A Some of it has silt in it, but that was all ^{kicked} ~~sticking~~
19 out. We did not take that, and we did not use it.

20 Q That did not go into the mixture?

21 A That did not go into the mixture. There was silt in
22 there--- probably three-quarters of the gravel is good and about
23 the other one-quarter is rotten and we did not use it.

24 Q BY MR. DENNISON: Was there a measuring of the cement
25 and the gravel?

26 A Yes sir.

27 Q How was it measured?

28 A In the bin. We had a mark, a natural mark, a lay in
29 the seam, and we measured that mark to make an exact estimate
30 of what that would hold, and it was filled up to that point.

31 Q What did that hold, a cubic yard?

32 A A ~~any~~ cubic yard of loose material, yes.

1 Q How much cement would you put in to the cubic yard?

2 A Four sacks.

3 Q Would that be four hundred pounds?

4 A Less than four hundred, according to how much the
5 cement weighs.

6 Q You had two different grades, didn't you? When you
7 were pouring the wings, you did not use as rich a mixture as when
8 you were pouring the foundation?

9 A We used the richer mixture next the forms and also at
10 each end, wherever it was necessary to have a little stronger
11 cement.

12 Q Were the four sacks of cement the richer one?

13 A The four sacks went in all the time. We cut down on
14 the gravel. We had twenty-seven cubic feet of gravel for four
15 sacks in one mix, and probably about twenty-three or twenty-four
16 cubic feet---

17 Q You also made blocks, to test?

18 A They made blocks, yes sir.

19 Q Did you see any of the testings of these made?

20 A Yes sir. I did not see the testing, only the saw and
21 hammer.

22 Q That is, they were not put under any pressure of any
23 kind?

24 A No, I think they were shipped into town, though.

25 Q BY A JUROR: Did they have any trouble from water down
26 in the bottom in laying their first course?

27 A Not a great deal. After the bulkhead was put across
28 the canyon there was not as much as would run from a two inch pipe.

29 Q It did not do any washing of the aggregate? There was
30 not any water in the bottom?

31 A It was all banded off. We always managed to pipe it
32 around or over so that the concrete did not go into the water.

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RICHARD BENNETT, being

first duly sworn, testified as follows:

BY THE CORONER.

Q Please state your name.

A Richard Bennett.

Q Where do you reside?

A 1319 Mountain View Street, San Fernando, California.

Q What is your trade or profession?

A I am a carpenter by trade.

Q Are you employed by the Los Angeles City Water Department?

A Not at present.

Q Were you employed by the Los Angeles City Water Department during the construction of the St. Francis Dam?

A Yes sir.

Q In what capacity?

A The first part as a carpenter and the last part running a concrete mixer.

Q How many mixers did you use?

A Two, at that time.

Q Where were they stationed?

A Side by side in one building.

Q All the concrete that was run through during the time you were employed there running a concrete mixer, was under your observation?

A In my one machine.

Q You could not see what went into the other machine?

A No sir, not very well.

Q Did you personally, or as foreman, attend to the mixtures which were used there?

A It was all mixed by sight, you understand, the water was poured onto it. I would say the variation in the different

1 gravels as it came through required more or less water, but to
2 get about the mixture that they wanted we had to guess at it by
3 sight.

4 Q You are an expert at mixing concrete, are you?

5 A No sir.

6 Q Did you learn the job up there?

7 A Yes sir.

8 Q You had never mixed any concrete before that?

9 A Not with a mixer, no sir.

10 Q Who directed you the way to mix it?

11 A Mr. Lindsey and all of them said what they wanted done
12 and showed me how they wanted it.

13 Q Mr. William Lindsey?

14 A He was one of them, yes sir.

15 Q Who else?

16 A Mr. Menzie.

17 Q Did you have anything to say whatever about what went
18 into the concrete?

19 A I did not.

20 Q Did you ever see anything go into the concrete that
21 should not have gone into it?

22 A In my own way ^{thinking,} ~~of casting,~~ I don't know whether it was
23 right or not.

24 Q What did you see?

25 A There was silt and some dirt and some clay--- not much
26 clay, but dirt and clay. It was called concrete after it was
27 mixed.

28 Q Did you have instructions from your superiors to see
29 that nothing of that sort went into the concrete?

30 A No sir. It could not have been helped for it had come
31 to me as it came down the hoppers into the machine. I could not
32 have stopped it at that place.

1 Q Was there anything about the building of the dam that
2 was weak or that might have contributed to the weakness of the
3 dam?

4 A I was not out on the dam to see what was done. My
5 place was at the machine.

6 Q Were you at the dam a short time prior to the time that
7 it collapsed?

8 A About nine days before it happened.

9 Q What was the condition there then, as you saw it?

10 A Well, there was a stream of water coming down over the
11 hills that I did not know anything about. I did not examine it.

12 Q On which side?

13 A On the west side of the dam.

14 Q How much of a stream of water?

15 A About three or four feet wide washing down the side hill.

16 Q How close to the dam?

17 A Where it struck into the hill. I should judge it was,
18 maybe, two hundred feet below the base of the dam.

19 Q Did you go up to the dam to see where it came from?

20 A No, not on top of it.

21 Q Was that southerly from the road which ran up along the
22 west side of the dam?

23 A It would be on the right hand of the road. It would be
24 east of west road.

25 Q Was that water muddy or clear?

26 A Down there it was muddy, caused by washing down the
27 hill, I expect, when it came down.

28 Q You don't know whether that came out from under the dam
29 or through the dam or where it came from?

30 A No sir, I was not up to it.

31 Q Did you talk to anybody up there at the camp or around
32 the dam?

1 A I did not see a soul at the camp, either going up or
2 coming back.

3 Q Were you alone on that trip?

4 A No sir, my wife and my wife's sister was with me.

5 Q You did not talk to any of the persons that live up
6 there in the canyon?

7 A No sir.

8 Q Did you, at any time prior to March 13th last, hear any
9 suspicion that the dam was not safe?

10 A There has always been something said about that, as a
11 common gossip, but nothing that I know personally.

12 Q Do you know of any reason that can be ascribed for that
13 rumor?

14 A No sir.

15 Q Do you know of anybody moving out of the canyon because
16 they felt that the dam was unsafe?

17 A No sir.

18 Q Are you able to account for ~~it~~^{giving} ~~skidding~~ away as it did?

19 A No, I am no expert on that. Of course, everybody has
20 their own opinion.

21 Q You do not presume to know what caused the failure of
22 the dam?

23 A No, I don't, because I was not there.

24 Q BY MR. SCOTT: When did you go to work for the Depart-
25 ment of Water and Power of the City of Los Angeles?

26 A In the fall when they began the construction work.

27 Q In what capacity?

28 A As a carpenter.

29 Q How long did you work as a carpenter?

30 A Until they began pouring the cement for the foundation
31 of the dam.

32 Q Then you quit the carpenter job and took the cement job?

1 A I ran the hoist engine, the first thing, putting in the
2 time, part of the time on the wooden hoist.

3 Q You had never had anything to do with cement until they
4 put you on that job up there?

5 A No sir. The only thing I built is foundations for
6 houses I built for myself.

7 Q Did it take you long to learn how to do that mixing
8 there?

9 A A man with any intellect ought to know what the mixture
10 ought to be.

11 Q You stood by and saw these different things going into
12 that concrete?

13 A I could see what went into my machine.
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2 Q Did you report the fact that any of that stuff was ge-
3 ing into your machine, did any go in the machine?

4 A Our foreman was on the job.

5 Q Did you report it to the foreman that stuff was going
6 in your machine that shouldn't go in?

7 A Yes.

8 Q Did he rectify it?

9 A He rectified it as soon as he could.

10 Q How long a space, period of time did you see earth go
11 into the machine?

12 A I would have to explain how that come in, the way the
13 shovel took it out of the creek bed, so possibly when they get too
14 close to the bank, as soon as they found it out, they get away from
15 it.

16 Q You don't mean to tell the jury they were using dirt in
17 this concrete?

18 A Not as a general thing.

19 Q Immediately when you heard there was dirt being used in
20 it, you reported it to your superior?

21 A They rectified it as soon as possible.

22 Q And the matter was rectified?

23 A Yes sir.

24 Q BY A JUROR: Did you have any trouble with any of the
25 bosses out there?

26 A No sir.

27 Q Were you discharged from your position or quit?

28 A I quit.

29 Q BY DISTRICT ATTORNEY: How long were you mixing cement?

30 A Twenty-one months.

31 Q Mixing cement?

32 A On the job out there.

Q How long were you mixing cement?

1
2 A From the time they started the surface of the founda-
3 tion---

4 Q I want to get the time?

5 A I think we began pouring somewhere in March, and I
6 poured until next January, when I quit.

7 Q Quite a long while. Was there any of this gravel or
8 sand taken from any other places in the river bed?

9 A Not that I know of.

10 Q You viewed it as it went over?

11 A I could see all of it as it went by.

12 Q Any silt?

13 A What we would call it ourselves, I am not an expert.

14 Q You can observe things without being an expert?

15 A Yes.

16 Q Are you able to enlighten the jury as to approximately
17 how much silt was in it, large or small quantity?

18 A It was a conglomeration of all kinds of soil.

19 Q Do you know anything about this dam you haven't told
20 this jury?

21 A I have answered every question they asked me to the
22 best of my ability.

23 Q Is there anything that hasn't been answered that you
24 should tell them?

25 A Not in an expert way.

26 Q If you know anything about this that hasn't been
27 answered, tell this jury now, we want the facts.

28 A In the first place, they told you they washed that hill
29 down on the right hand side until they came to hard rock.

30 Q Which is the right hand side?

31 A East side, that was washed off with hydraulic, the
32 width of the dam, the cement was poured in there, then as they
poured up to it, that stuff was cleaned off, any sediment, and

1 forms set up against the side, and cement poured against it. The
2 same on the west side.

3 Q BY A JUROR: How big a cut was there in the side of that
4 hill, how deep?

5 A Just itself, the contour of the rock.

6 Q Did they go into bedrock?

7 A Not that I seen.

8 Q Took off the surface?

9 A Washed it off and swept it off and poured concrete.

10 Q Nothing picked in?

11 A No, only just what a man would get off the surface.

12 Q BY THE CORONER: Didn't trench into the side of the
13 mountain there?

14 A I didn't see any of it.

15 Q Would you have seen it if they had done it?

16 A I think I would.

17 Q BY DISTRICT ATTORNEY: Were you up there when they went
18 down to bedrock?

19 A Yes sir.

20 Q Do you know whether they went into the bedrock?

21 A I can tell you what I seen. The trench was dug through
22 there, and frames, 6 x 6 timbers made and staves down the side of
23 it, deep as they could, water pumped out and filled with cement.

24 Q BY A JUROR: Would you know that rock if you saw it?

25 A I don't know if I would or not.

26 Q BY DISTRICT ATTORNEY: Was any tunnelling done up there
27 of any kind?

28 A Where they drifted in, one little drift at the edge of
29 the dam, on the right hand side, east side.

30 Q How far was that driven in?

31 A I wasn't back in. Some said about forty feet.
32

1 Q You saw it?
2 A I seen the hole.
3 Q What is the size of the hole?
4 A Big enough for a man to work running a wheelbarrow.
5 Q Did you hear any conversation about it, any of the men
6 in charge of the construction of this dam talking about it?
7 A No sir.
8 Q Did you see Mr. Mulholland up there?
9 A I have seen him there lots of times.
10 Q Did you see him there at the time of this tunnel?
11 A I can't say I did at that time.
12 Q Did you see Mr. Van Norman?
13 A I didn't know Mr. Van Norman at that time, never seen
14 him until today.
15 Q Was there anything said by the foreman about it?
16 A Not until I heard it was filled up.
17 Q Did you talk to someone in charge of the institution
18 about filling it up?
19 A No sir.
20 Q Some of the workmen merely criticising?
21 A That was it.
22 Q BY THE CORONER: What effect would that have on the dam,
23 if any?
24 A They claimed they couldn't drift in any further on ac-
25 count of silt and mud, they couldn't go back any further into that
26 hole.
27 Q BY A JUROR: That is only hearsay, you don't know any-
28 thing about it?
29 A No sir, I don't.
30 Q BY DISTRICT ATTORNEY: You have told us all you know
31 about this?
32 A That is all.

1 Q BY A JUROR: Have you ever seen any of these photographs?

2 A Never seen any of the photographs (witness taking
3 photographs).

4 Q Was that soft material, that bank in the picture?

5 A The west bank.

6 Q The east side?

7 A That was a hard formation.

8 Q The bank I am referring to, is that dark line (in-
9 dicating) you see in the picture, I was asking if that is soft
10 material or hard rock?

11 A I wasn't up on the side of the hill to go up to that,
12 my position was right over here (indicating).

13 Q On the side of this dam, down at the ~~bottom~~ bottom?

14 A Right here (indicating) where I could see until they
15 got way up on the side. My machine set right in here (indicating).

16 Q Your mixer was at the foot of the dam?

17 A No, the mixer was above the ground about fifteen feet.

18 Q How often did you go up there?

19 A Every day or two I had time to go over, just to see
20 what they were doing. You know "Curiosity killed a cat."

21 Q It wasn't your job?

22 A No sir, it wasn't my job.

23 Q BY MR. SCOTT: How far did you say your mixer was from
24 the place you saw them putting this cement against the west hill
25 and the east hill?

26 A Our mixer stood about the center, between the two hills.

27 Q About how far?

28 A It all depends upon what part of the hill you ask me.

29 Q If it was down at the bottom, it was only a little, if
30 at the top, several hundred feet. Did you examine to see if it
31 was laying up against the side of the hill?

32 A I have been by many times.

1 Q Who did you first tell that to?
2 A Here.
3 Q Didn't tell it until after the St. Francis Dam went out?
4 A Didn't know what was the cause of the St. Francis Dam
5 going out.
6 Q This tunnel you speak of, you saw that mud in it?
7 A That is what the men said.
8 Q Did you see any mud in that tunnel?
9 A I was never in the tunnel.
10 Q This tunnel was run in solid rock?
11 A Run into the side, right hand side of the hill, yes sir,
12 going up this way (indicating).
13 Q You never saw any mud come out?
14 A I seen some going into it.
15 Q What did they put in it?
16 A Material was brought out and then filled up with
17 cement.
18 Q Was anything wrong about that?
19 A I don't know anything about that.
20 Q You have been circulating that around as a rumor?
21 A No sir, nothing said about it.
22 THE CORONER: Mr. Scott, we don't want to go into any
23 cross examination. (Addressing witness) That is all, you may
24 be excused.
25
26
27 ROBERT E. ATMORE, being first duly
28 sworn, testified as follows:
29 BY THE CORONER:
30 Q Please state your name.
31 A Robert E. Atmore.
32 Q Where do you reside?

1 A Lake Hughes, Los Angeles County.
2 Q What is your occupation?
3 A Rancher.
4 Q Did you work in the St. Francis Dam?
5 A Never.
6 Q Did you live above the dam?
7 A Yes sir.
8 Q Near Power House No. 1?
9 A Lake Hughes.
10 Q How far is that?
11 A About fifteen miles.
12 Q What do you know about the condition of the St. Francis
13 Dam anytime prior to March 13, this year?
14 A I was past there on the morning of the tenth.
15 Q What did you see as you passed the dam?
16 A It was like the dam was leaking very bad on the west
17 side.
18 Q Just where on the west side?
19 A On the west side of the canyon, the ridge the wing was
20 built on, lots of water coming out of the ground.
21 Q Was it coming out of the ground west of the same
22 portion of the dam, west of the abutment there?
23 A I couldn't say exactly where it was coming out, but the
24 whole hillside seemed to be wet, you could see the water running
25 down.
26 Q How much water did you see coming out?
27 A Seen a stream, from a distance looked about the size of
28 a man's leg.
29 Q Was it clear or muddy?
30 A In the bottom of the canyon, that waterway they had to
31 carry off water, concrete dam, looked rather muddy.
32

1 Q Here is a photograph of the dam, you recognize it?
2 About where did you see that water coming out? Here is the main
3 portion of the dam (indicating).

4 A You can't see the dam where I could see it. There was
5 a road went up on this side (indicating). The road seemed to be
6 sloughed off.

7 Q The west side?

8 A Yes, west side. This is the east side here (indicating),
9 and I was here in a car about here (indicating), looking across
10 here (indicating). You could see where this water had sloughed
11 this road way off.

12 Q You were on the road on the east side of the lake?

13 A Yes sir.

14 Q As you go by the pen stock house?

15 A I was going up the canyon.

16 Q You were facing the dam?

17 A Yes sir.

18 Q Were you on the road when you saw it?

19 A Yes sir, in the car.

20 Q You were quite a distance from where you saw the water?

21 A About a quarter of a mile.

22 Q Across the canyon?

23 A Yes sir.

24 Q You didn't give it a close inspection?

25 A No, I didn't go over there.

26 Q At that time, you would estimate the stream was as big
27 as a man's leg?

28 A I could see quite a rivulet there, from my knowledge
29 of seeing streams of water.

30 Q You saw that with your naked eye, without glasses?

31 A Yes.

32 Q At that time, did it occur to you there was anything

1 dangerous about that condition?

2 A Yes, I thought it was dangerous, I talked to my friend
3 about it.

4 Q Who was that friend?

5 A A young man, Harry Burns, lost his life.

6 Q Where did he live?

7 A Lived just below Power House No. 2, about three or four
8 hundred yards.

9 Q Did he work for the City up there?

10 A Yes sir.

11 Q What did Burns say to you about it?

12 A Said he thought I was getting nervous.

13 Q Did he feel nervous about it?

14 A No, didn't seem to.

15 Q Did he say anything about that leak having been known
16 sometime before that?

17 A I don't think he did.

18 Q Did he say that was the first time he knew there was any
19 water running out of there?

20 A No sir.

21 Q He said he thought you were nervous?

22 A Yes.

23 Q More anxious about it than ~~you were~~ he was?

24 A Seemed so.

25 Q He didn't say he was going to report it to anybody?

26 A No sir.

27 Q Do you know whether he did report it to anybody?

28 A No, I don't.

29 Q Did you report it to anybody?

30 A No sir, I didn't.

31 Q That was the last time you saw the dam before it went
32 out?

1 A That was the last time. Tuesday noon I heard it had
2 gone out.

3 Q That was the only leak you know about?

4 A That was all I knew about, I heard it was leaking at the
5 same time on the east side, but I didn't see that.

6 Q Did you have any discussion with Mr. Burns about that?

7 A Talked a little with him and his father, his father was
8 with us.

9 Q Was his father also in the disaster?

10 A No sir, he was there at the lake. I had passed this
11 place twice before, I think first on the sixth, and then on the
12 eighth, and I noticed on the tenth there was a great deal more
13 water coming out on the tenth than there was previous. Always
14 before there was a certain amount of moisture on the hill.

15 Q Did you never go right over---

16 A I was never on the hill in my life, since the dam was
17 there.

18 Q All the observations you made were from a distance a-
19 cross the canyon from a road on the east side of the lake?

20 A Yes.

21 Q When you spoke to Harry Burns about it, he didn't seem
22 to feel any nervousness about it?

23 A No, kind of laughed the matter off.

24 Q He and his father were the only persons you talked to
25 about it?

26 A That is all, in their presence.

27 Q You didn't feel the dam was going out?

28 A I didn't know, it came to my mind it looked dangerous,
29 and I wouldn't like to be living in the bottom of the canyon where
30 he was, and told him so, that he ought to look the matter over and
31 get out, that it looked like it was going to be dangerous. I told
32

1 him if it broke, you would never have a chance to get out, it was
2 too close.

3 Q That is as far as your warning went, you didn't warn
4 anybody else?

5 A No, I talked about it to one of the neighbors after I
6 got home.

7 Q Are you an expert on this sort of thing?

8 A No sir.

9 Q Never had any experience with dams?

10 A No sir, just common sense told me it looked dangerous.

11 Q BY MR. SCOTT: This leak you saw was the leak you saw
12 there on March 8?

13 A Not so much ~~as~~ though.

14 Q But at the same place?

15 A About the same place.

16 Q About how far was it from the top of the dam down to
17 this place?

18 A It was right at the foot of the dam.

19 Q About how far from where the dam goes into the hill,
20 point of contact?

21 A I will show you the photograph. You can see the
22 bottom of the canyon here (indicating) where they had the cement
23 trough, down on that low point, towards where that road makes a
24 turn like this (indicating) up perhaps about one hundred fifty
25 yards out of the bottom of the canyon, maybe two hundred yards.

26 Q How far from the ground?

27 A On the right, I should judge about in here (indicating)
28 and the ground was wet here too (indicating).

29 Q Higher up?

30 A Yes.

31 Q You mean it was wet down where the road was, water
32

1 running across the road?

2 A Not the first time.

3 Q But on the tenth?

4 A Yes, on the tenth, the road, you could see where it slid
5 into the road.

6 Q Do you know whether that stream of water came from one
7 source?

8 A I have no way of telling whether it came from one source
9 or general seepage all over the hillside.

10 Q BY DISTRICT ATTORNEY: Have you told us all you know
11 about it?

12 A Yes sir.

13 Q Anything that hasn't been asked you, any information you
14 have of your own knowledge you could give to the jury?

15 A Nothing but hearsay.

16 Q BY A JUROR: You say you heard the dam go out?

17 A No, I didn't hear it go out, but I heard Tuesday morning
18 the report go out over the country.

19 Q Did anyone up there hear anything this night the dam
20 fell?

21 A No sir.

22 Q BY THE CORONER: Do you know of anybody in your
23 neighborhood who heard any noise about this night, the night of
24 March ~~12~~ 12 - 13?

25 A I don't.

26 Q BY MR. MOHR: Do you use the upper or lower road in go-
27 ing to your place?

28 A We use the road on the east side of the lake, east of
29 the reservoir.

30 Q What is the condition of that road now?

31 A From the pictures I seen here, it is pretty badly shot.
32

1 Q Have you been up there since the dam went out?

2 A No.

3 Q BY THE CORONER: How did you come down from there?

4 A Came down through Bouquet Canyon.

5 Q BY MR. MOHR: That would be on the west side of the
6 canyon, Bouquet Canyon?

7 A East of the canyon.

8 THE CORONER: That is all, you may be excused.

9
10
11
12 OSCAR O. DORSETT, being first duly
13 sworn, testified as follows:

14 BY THE CORONER:

15 Q Please state your name.

16 A Osear O. Dorsett.

17 Q Where do you reside?

18 A Fairmount, Los Angeles County.

19 Q What is your business or occupation?

20 A Rancher.

21 Q Did you work in the St. Francis Dam during its con-
22 struction?

23 A I did.

24 Q What did you do?

25 A Laborer.

26 Q Do you know anything about its construction, which was
27 not in your opinion regular?

28 A I am not an expert, and wouldn't want to express my
29 opinion about that.

30 Q We want the benefit of any information you have. Do
31 you particularly know about how the ends of the dam were anchored
32

1 into the sides of the canyon there?

2 A Only so far as it was finished, when I left there-- I
3 left there the first of September.

4 Q How high was the dam then?

5 A They were pouring the concrete into the trench at the
6 toe of the dam. I helped to excavate that trench, and also up on
7 each end, each side of that trench.

8 Q Did you help excavate for the base of the dam?

9 A No, I didn't, only just that trench.

10 Q Were you there when the base was poured?

11 A Not when the dam was poured, I was there two different
12 times while they were pouring.

13 Q Was the water drawn off-- was it comparatively dry when
14 they poured the concrete in the bottom, bottom of the dam?

15 A I wasn't there only just when they poured in this
16 trench, the front of the dam.

17 Q Were you there at the time the dam gave way?

18 A No sir.

19 Q Were you there just prior to that time?

20 A No sir.

21 Q Do you know anything about the condition of the dam just
22 prior to March 12, this year?

23 A I don't.

24 Q Did you do any digging into the sides of the canyon for
25 the wings or ends of the dam?

26 A Well, at each end of this trench, yes.

27 Q How deep did you dig into the rock or sides of the
28 canyon there where the ends of the dam met the canyon?

29 A Just dug down to the firm rock, where anyone that has
30 noticed, what I would call surface rock, anywhere where anyone
31 has seen where the water run over the surface of the ground, would

32

1 know that water washes trenches in the rock, irregular trenches.
2 We were told to clean that out in these trenches when we came to
3 that, and we did.

4 Q How many feet did you go into solid rock?

5 A Didn't go into at all, we were told not to pick into
6 that rock, leave it as it was.

7 Q Just picked off the brush soil, loose rock on the
8 surface, got down to the solid rock and stopped there?

9 A The gravel and sand in these little trenches, we cleaned
10 that out.

11 Q About how deep on an average did you go in, in taking
12 that off?

13 A Didn't go in at all. None I would say was ever a foot
14 in the little trenches, taking it off, disturbed rock, after we got
15 down to it, taking this sand and gravel from the top down that
16 trench, we dug there about twenty-five feet, the best I remember,
17 and on each side of it sloped up with the hill each way, and as we
18 went down, we would just take out the sand and gravel collected in
19 these crevices all the way along, and we were told not to pick
20 this firm rock off at all, but leave it, which we did.

21 Q Who gave you instructions?

22 A Mr. Menzies and Mr. Lindsay were bosses.

23 Q BY DISTRICT ATTORNEY: Was that true of both sides of
24 the hill?

25 A Yes.

26 Q The west as well as the east?

27 A Yes.

28 Q You say the trench was about twenty-five feet wide?

29 A No, deep, about six or eight feet wide. I am not
30 sure about that, something near that.

31 Q You mean you went into the hill twenty-five feet?
32

1 A No sir, down from the stream surface, surface of the
2 ground where we started, from the bottom of the stream level to the
3 bottom of the trench when we started pouring the concrete.

4 Q The first concrete?

5 A Yes.

6 Q How did you dig that out?

7 A Dug it out with shovels.

8 Q Hand shevels?

9 A Yes.

10 Q Went down twenty-five feet?

11 A That is the best I remember, something like that.

12 Q You were not there when it was filled up?

13 A They started filling it, and I helped fill it up probably
14 five or six feet.

15 Q Then you went away?

16 A Yes sir.

17 Q You know nothing about the excavation of the side of the
18 hill?

19 A Only what we had done up until then, and what it showed
20 when I went back later on. They had the dam quite a ways up.

21 Q How high up from the stream level?

22 A I would estimate twenty or thirty feet.

23 Q Did you have anything to do with anything above the
24 stream level?

25 A No sir.

26 Q Did no excavation, digging of any kind?

27 A No sir.

28 Q All your digging was below the stream level?

29 A Only on those walls when we was digging out. I
30 probably might have worked a little on the hillsides,

31 Q On the east hillside?

1 A On the east hillside and west hillside too.

2 Q What did you do on the east hillside?

3 A Just digging out this loose material, sand and gravel,
4 and on the east was shale, what we call shale.

5 Q How deep did you go into the hillside?

6 A Didn't go in at all, just the same as we had been doing
7 all the way along, digging out the loose material.

8 Q Scraping it off?

9 A Scraping it off, cleaning it off.

10 Q Were you there when they used the hose on it?

11 A No sir.

12 Q BY THE CORONER: How long were you there altogether?

13 A I haven't looked up any dates. The best I remember,
14 something like three months. The only thing I do remember is the
15 time I left there, that was the first of September, I was summoned
16 on a jury down here.

17 Q BY MR. SCOTT: How high was the dam when you left?

18 A They were pouring the concrete into the front trench.

19 Q BY A JUROR: In other words, you ~~XXXX~~ worked on what
20 was known as the cutoff wall there?

21 A Yes sir.

22 Q Any men working with drills or gads in there-- you
23 worked with shovel only?

24 A Yes sir, we were working under water quite a bit all
25 the time, had gum boots, hip boots, and it was all the way from
26 one to three feet deep under water, had to keep pumps going to
27 keep the water out of the way.

28 Q The men all had shovels in there, nothing else?

29 A Not that I remember of, couldn't use anything else.

30 Q Couldn't use any picks at all?

31 A No, we were told not to pick the solid rock, leave it,
32

1 leave the firm rock-- I wouldn't call it solid rock.

2 THE CORONER: That is all, you may be excused.

3
4
5 CHESTER SMITH, being first duly sworn,
6 testified as follows:

7 BY THE CORONER:

8 Q Please state your full name.

9 A Chester Smith.

10 Q Where do you reside?

11 A At the present time, living at Laguna Canyon, Laguna
12 Beach.

13 Q What is your business or occupation?

14 A Rancher.

15 Q Where is your ranch?

16 A I have four different ranches, I had a ranch at San
17 Francisquito Canyon.

18 Q Washed out by the flood?

19 A Yes sir.

20 Q Were you up there prior to March 12, this year?

21 A I was.

22 Q Were you up there on that date?

23 A I was.

24 Q Were you in the flood?

25 A I was.

26 Q Were you familiar with the conditions at the dam before
27 March 13?

28 A All I know, I passed over the road and went around the
29 dam on Saturday, and also passed over the dam on that road on
30 March 12, that is Monday. I think the dam went out about three
31 minutes to twelve, what I understand, that night.

32 Q How were you fixed that time?

1 A I remember very well.

2 Q Just describe to the Jury, in your own language all you
3 know about this.

4 A I should judge about a month ago, the water began seeping
5 on the west bank, left wing of the dam, which would be the west
6 wing, and I talked with Tony Harnischfeger about it. He was a good
7 friend of mine, and Tony didn't seem to be alarmed, because it was
8 only seeping a little then. He says "Well, if anything should
9 break, it will only be way up in the left wing, wouldn't flood you
10 people out below," and then on Saturday before the dam went out, I
11 went up over the dam and fixed a fence in "B" Canyon, to take some
12 stock. Harry Nichols went with me, he had been working for me, and
13 as we got up to near the dam, we looked over and saw considerable
14 water coming out on the west bank, stopped the car, took a look at
15 it, and as we stopped, I looked down and saw Jack Ely-- I guess he
16 was kind of assistant there, works under Tony-- I said in a joshing
17 way, "Ely, what are you sons of guns going to do here, going to
18 flood us out down below?" He replied in the same way, I know he
19 didn't mean it, in a joshing way, "We expect this dam to break any
20 minute." I know he didn't mean it. Well, I kind of talked a
21 little serious to him, I said, "Jack, I believe you had better
22 turn some of that water out, it don't look good to me." We went
23 on over the road, and on up in the "B" Canyon, fixed our fence, and
24 I judge about four or four thirty, we came back. As we went up
25 that morning, the wind was coming gently from the north, and the
26 water was splashing over the dam. It was running down in the
27 contour, not only from the water that was splashing over, but this
28 walk on the west side.

29 Q Water running out of the spillway?

30 A It was going over the spillway from the wind. Well,
31 when we came back in the afternoon, the wind had changed to the
32

1 north, and there was no water coming out of the spillway, that is,
2 out of these places here (indicating), but I looked over on the west
3 bank, and still saw a big leak.

4 Q Where were you then?

5 A On the east side, could look right across.

6 Q Quite a little distance over there?

7 A Yes, quite a little distance. Then, we went on down,
8 and below the power house, near where Mr. Berry lived, I could see
9 the water was muddy. The water might have been coming clear
10 through here (indicating). When it got down to Berry's house, it
11 had to go across the road. As I said, on Monday I crossed, drove
12 some cattle up this (indicating), and as we were going up the canyon
13 and above Drinkwater Gulch, at Berry's house, so much water was
14 coming down the canyon, it was overflowing these pipes (indicating)
15 that were in the road-- we had to jump in the automobile in order
16 to cross it. As we got on up the dam, there was still a north
17 wind blowing, and the water was coming over the spillway again, but
18 still I could see the big leak on the west side. Then after we
19 drove the cattle up, I judge we came back around four or four
20 thirty, the wind had changed again, and there was no water coming
21 over the spillway, but I could see still a big leak on the west side,
22 and when we got down to Berry's place, the water wasn't as great
23 in the creek as it was that morning, the water wasn't running over
24 the pipes.

25 Q Did you talk to Mr. Berry at that time?

26 A I didn't see him.

27 Q Did you see Tony Harnischfeger?

28 A I didn't.

29 Q Did you talk to anybody there?

30 A Didn't talk to anybody there except Jack Ely that
31 Saturday morning.

32 Q I mean Monday, did you talk to anybody?

1 A No.

2 Q Did you really feel any apprehension about the dam hold-
3 ing there on Monday?

4 A I was a little suspicious. To tell you the truth,
5 Mr. Coroner, I slept in the barn that night, in a double garage,
6 and left my door open, was changing help, and the people moved in
7 the house that was going to take Mr. Nichols' place. I slept in
8 the barn that night, and left the door open, was a little suspicious,
9 of course.

10 Q Why did you leave the door open?

11 A I had seen that leak, you know, a man---

12 Q Wanted to be able to get out in a hurry?

13 A I did, but I never thought the water would come down
14 like that.

15 Q Where was your house, how far from the dam?

16 A I should judge three or four miles below the dam.

17 Q Where in relation to the stream bed?

18 A One of the houses was up on a hill.

19 Q This building where you were?

20 A That was down in the bottom, and there was a little
21 house about a hundred and fifty feet north of the garage-- that was
22 also gone-- all down in the bottom. I ran when I heard that noise,
23 and the dog awakened me, I could hear it coming, hear the trees
24 breaking, and could hear a big pole snapping, could hear the wires
25 on the electric poles going. I knew what was coming, because I
26 had been in a flood once before, and heard the noise, and knew it
27 right away, and I ran a hundred and fifty feet towards Mr. Nichols',
28 where he was sleeping, and I hollered out to him, "The dam is
29 broke," then we ran a hundred and fifty feet to the hill, and as
30 we ran up the hill, the water was right behind us.

31 Q Did it catch up with you?
32

1 Q Have you seen Mrs. Nichols since this?

2 A I took her to my home in Laguna Beach.

3 Q Has she said anything about hearing any unusual sounds
4 that night?

5 A They said they heard the noise, but didn't know what it
6 was until I hollered at them and told them it was the dam broke.
7 They heard the rumble, the noise.

8 Q You have no positive opinion you can impart to the Jury
9 as to the exact cause for the dam breaking?

10 A I have no exact opinion, I am no expert, no engineer--
11 don't know of any reason why it should break or anything else, but
12 I was just a little suspicious that night, and was on my guard.

13 Q On account of the leak?

14 A On account of the leak. I stopped my car right down at
15 Berry's place to see the water that was coming.

16 Q That wasn't any nearer than a quarter of a mile from the
17 place?

18 A I don't know exactly the distance, but the dam just
19 above the power house, then you go around, make kind of a circle
20 to Berry's place-- Berry was below the power house I judge a quarter
21 of a mile.

22 Q You didn't make close observations, don't know positively
23 whether the water was coming out of the dam, through the dam,
24 whether that hill to the west side of the channel of the stream was
25 saturated with water, water oozing through there?

26 A I could see from the road that the hill on the left
27 wing of the dam was saturated with some water. There is one cor-
28 rection I think Mr. Van Norman wanted me to make. In his testimony
29 he said there was no water running through the dam on Monday. There
30 was only the natural flow of the stream, only about twenty or
31 twenty-five inches that was running into the dam, which was an over-
32

1 sight on his part.

2 Q BY MR. SCOTT: That is the water running into the dam at
3 the upper end?

4 A Yes, I think it was only about twenty or twenty-five
5 inches.

6 Q BY DISTRICT ATTORNEY: The water comes into that
7 reservoir from the aqueduct too?

8 A Yes sir, but there was no water from the aqueduct yet.

9 Q Do you know when they released water from the aqueduct?

10 A I know there was no water running in from the aqueduct
11 on that Saturday, because I looked.

12 Q It was immediately upon hearing the dog bark you heard
13 the roar?

14 A I knew what was coming, because I had been in one before.

15 Q When you saw the thing and talked with Tony, you never
16 dreamed that such a catastrophe ^{as this} would take place?

17 A I never dreamed it, never like this.

18 Q If you had dreamed of any such thing, I suppose you
19 would have given an alarm?

20 A I would if I could.

21 THE CORONER: That is all, you may be excused.

22
23
24 HUGH NICHOLS, being first duly sworn,
25 testified as follows:

26 BY THE CORONER:

27 Q Please state your name.

28 A Hugh Nichols.

29 Q Where do you reside?

30 A I live on Smith's Ranch, down with him at Laguna.

31 Q You are a rancher?

32 A Well, yes.

1 Q You were at Chester Smith's ~~XXXXX~~ ranch, in the San
2 Francisquito Canyon, when this dam broke?

3 A Yes sir.

4 Q You were with him on Saturday, the tenth, and twelfth of
5 March, when you passed the dam?

6 A Yes sir.

7 Q Did you see this water he mentioned in his testimony?

8 A Yes sir.

9 Q Did it look to you at that time that the dam was in
10 danger, because there was water running from it?

11 A I was a little suspicious, couldn't just exactly get it
12 in mind it was dangerous. I don't know, just had a little
13 suspicion of it. When that dog barked, I was wide awake, still I
14 didn't realize it was coming.

15 Q Were you wide awake before the dog barked?

16 A No.

17 Q You didn't hear any noise before the barking of the dog?

18 A No.

19 Q What noise did you hear then after you heard the dog?

20 A Rattling noise, like one of these big trucks, sounded
21 like a rumbling sound, and Mr. Smith hollered "The dam broke."

22 Q Didn't hear any sound like an explosion?

23 A No.

24 Q That didn't occur to you at all?

25 A No.

26 Q You did hear the breaking of trees, rumbling of passing
27 heavy stones?

28 A When we started from the house, grabbed my wife, and
29 started, couldn't hear nothing but just a roar.

30 Q The volume of water came down first. Immediately do
31 you recall whether it was a great, huge volume of water and a
32

1 larger ^{volume}/followed that?

2 A Kind of think larger following immediately. It was
3 dark, couldn't see the water at all, but could hear the noise.

4 Q You made for high ground?

5 A Made for high ground.

6 Q Couldn't see anything?

7 A Couldn't see nothing. We knew our directions, because
8 we lived there and knew where the hill was, holding my wife.

9 Q Have you talked with some of the ^{other}/refugees?

10 A Not to amount to anything, only just to say I didn't
11 think the dam ought to be that full, leaking a little.

12 Q Have any told you their experience as to the volume
13 that came down the canyon, whether it was first relatively small,
14 about as compared with the big one, the height of the flood?

15 A No, didn't seem to be anybody knew, couldn't see it.

16 THE CORONER: That is all, you may be excused.

17
18
19 CHESTER SMITH, having been previously
20 duly sworn, was recalled and testified as follows:

21 BY THE CORONER:

22 Q Mr. Smith, I neglected to ask if you recall whether the
23 first water that struck your place was relatively smaller than the
24 crest of the water as it came down?

25 A I couldn't tell.

26 Q You don't know whether it appeared that the opening--
27 was it first small, letting out a small amount, and later the
28 whole amount?

29 A I think yes, that the first wasn't as great as the
30 second, because there is a big power line that runs through the
31 place, and I could hear the trees breaking, power lines breaking,

1 and wires snapping, and after we got to safety, climbed up, some-
2 times you could see a big flash of lightning, and that would show
3 some of the water, and that showed a big stream of water. The
4 water-- I will say I was up there two days, trying to rescue what
5 was left, and I think the water must have gone a hundred and twenty-
6 five feet high at my place, I think it must have.

7 Q Did you keep on climbing after Hugh---

8 A We kept on climbing, we were pulling Mrs. Nichols up.

9 Q Was the house where they lived taken away?

10 A Oh, sure.

11 Q All your buildings taken away?

12 A All buildings, and I hollered at them to keep climbing,
13 because I was afraid there might be a landslide or something, water
14 wash around these hills.

15 Q For the benefit of the Jury, is it possible for you to
16 say whether, in your opinion, it appeared from the acts of the
17 water, first a small part came, and later a ^{large} part of the dam letting
18 out a greater quantity of water?

19 A I couldn't say, but I knew the water that was first
20 coming down was a tremendous force, or those trees wouldn't have
21 cracked-- the biggest electric poles were snapping right off, you
22 could hear them snap.

23 Q BY A JUROR: How long did that water continue to rise,
24 the first crest of the flood, how long, in your opinion, did it
25 continue to rise?

26 A I think it must have continued to rise for sometime, be-
27 cause it followed us kind of uphill-- we kept out of the way.

28 Q Did it rise all night?

29 A No, no.

30 Q Several hours?

31 A No, I don't think that. I saw after we got to safety,
32

1 seemed like these wires would make lightning, light up the country,
2 could see a big body of water.

3 Q How long did it hold the maximum height?

4 A I couldn't tell you that, after those wires had gone
5 out.

6 Q You didn't notice on the following morning whether the
7 water had begun to recede?

8 A The water was receding at daylight.

9 Q BY THE CORONER: Had the flood almost passed by daylight?

10 A It had passed by daylight. We were able to walk across
11 that stream. We were on the west bank, and some officers came
12 along, hollered at us to work our way south. We didn't have any
13 shoes, clothes, and we started out, but Mrs. Nichols couldn't walk,
14 because her feet hurt too bad. Mine were bleeding, but I could
15 walk in the soft dirt, as a matter of fact, I walked clear over the
16 hill barefooted, clear over to Dry Canyon, but by morning the flood
17 had passed. Of course, we could hear the noise there for a long
18 time.

19 Q BY DISTRICT ATTORNEY: You say it was twelve?

20 A I only know this from what some official told me, it
21 happened at three minutes to twelve.

22 Q About what time would you say it was at daylight that
23 the flood had passed, four o'clock?

24 A No, I think whenever it became daylight, I saw that the
25 water had receded.

26 Q Would it be as late as five or six?

27 A About five o'clock.

28 Q That flood took about four hours?

29 A I don't know, I had no way of telling, simply from that
30 time up on the hill in the cold.

31 THE CORONER: That is all, you may be excused.
32

1 DAVID C. MATTHEWS, being first duly
2 sworn, testified as follows:

3 BY THE CORONER:

4 Q Please state your full name.

5 A David C. Matthews.

6 Q Where do you reside?

7 A 217 Park Street, Newhall, California.

8 Q What is your business or occupation?

9 A I was rated as a laborer at Power House No. 2.

10 Q How long did you work there prior to March 13?

11 A Started to work for the Power and Light last June, and
12 worked up to the eighth of September.

13 Q You had nothing to do with the construction of the dam?

14 A No sir.

15 Q You were not working in the Water Department at the time
16 the dam collapsed?

17 A No sir.

18 Q Were you familiar with the conditions around the dam the
19 tenth, eleventh or twelfth of this month?

20 A Yes sir.

21 Q Did you notice any leaks there?

22 A Yes sir.

23 Q Where were they?

24 A On this west bank.

25 Q Can you point out to the Jury accurately where on the
26 west bank the leaks were seen by you?

27 A As Mr. Berry and I went up and inspected the dam
28 Saturday, where the old road went up there, it had all caved in, and
29 apparently that hill, west bank, was all saturated with water, ap-
30 parently coming out through the bottom of the hill, appeared to be
31 all soaked.

1 Q Was that west of the abutment on the west side of the
2 dam where it joins onto that shallower part of the dam?

3 A The main part, on over along where the old crooked road
4 went up.

5 Q How much water coming away from there?

6 A Prior to the breaking of the dam, I noticed a week or
7 ten days before the dam broke, the water was gradually increasing in
8 the concrete canal, and the water varied. On Saturday morning, I
9 was working out there by the club house, and noticed an extra amount
10 of water coming down the spillway, and I went to the Power House and
11 told Mr. Berry, and he says "Let's go up and look the thing over,"
12 so Mr. Berry got in the car, I got in with him, we went to the dam
13 to look it over, and I stood over on the east end of the dam and
14 looked at that hill for quite a long while, I should say ten or
15 fifteen minutes, talking about the condition of the leak there.

16 Q You didn't go down over to the west side?

17 A Didn't go down, stood over on the east end.

18 Q Was that Saturday or Monday?

19 A That was Saturday morning, but what caused that excess
20 flow that morning, we discovered the water was slopping over this
21 spillway at the time.

22 Q Did that wet that road?

23 A No, there was a natural flow there, besides this excess
24 water that was coming out by the slopping of the water over the top.
25 That was Saturday morning, and after the wind went down by noon, the
26 water went down again.

27 Q Were you up there Sunday?

28 A No sir.

29 Q Were you up again Monday?

30 A No.

31 Q Were you not up to the dam on Monday?
32

1 A No sir, I was working there at the Power House, on
2 Monday morning, when I noticed the excess water.

3 Q What were you doing at the Power House Monday?

4 A The first thing in the morning we burned a pile of
5 trash down in the canyon, right below the club house. Mr. Berry
6 come down and told me there was excess water coming down the canal.
7 He said them pipes down in front of his place were stopped up and
8 water was running down the road, and ordered me to come down, clean
9 out these pipes, quite a lot of debris and stuff gathered in the
10 pipes, and that the water was overflowing and run down the road.

11 Q When you examined this dam with Mr. Berry, did you im-
12 part to him you believed it was dangerous, any danger of going out,
13 any part of it?

14 A We thought it looked bad, that hill was all soaked,
15 didn't realize at that time that the dam was unsafe.

16 Q When did you realize it was unsafe?

17 A That evening.

18 Q Saturday evening?

19 A Monday evening.

20 Q Why did you feel apprehensive Monday?

21 A Monday afternoon about two thirty, I was fixing some
22 sand pipes in the yard, Mr. Berry come out and we went down to the
23 head gates there at the end of the canal, and he was looking for the
24 handle to open up these gates, and he asked me if I knew where the
25 handle was. I told him yes, Tony has the handles of these gates.
26 "Well," he said, "we got to put in some of these logs to stop the
27 water, but I don't know how many I will want in, probably three or
28 four," said "You boys can start putting these logs in, I will go
29 up, see Tony and get the handle." So us boys started laying
30 these logs, ties we call them, 4 x 6, six feet long, slide down
31 from these slots, started putting down those ties, don't know
32

1 about how many we needed to put each place, we had about twelve or
2 sixteen of those ties, so we could put about four in each place, and
3 directly Mr. Berry come back and seen Tony and Mr. Rising and Homer
4 Coe was down in the bottom, and I was letting the ties down to them,
5 and Mr. Berry come back and imparted some very valuable kind of in-
6 formation. He says "Put them all in", he called me to one side.

7 Q What did he tell you?

8 A Said "Dave, I will tell you something, the dam is not
9 safe," he says "We got orders to put all the logs in."

10 Q Into the tunnel?

11 A Put all the logs there was to stop the water from flow-
12 ing down the aqueduct.

13 Q Was anything else said?

14 A We went ahead and put all the logs in there was, and by
15 the time we had finished putting the logs in, before we finished
16 putting the logs in, Tony had come down, and Tony and Mr. Berry
17 opened these gates that led on down to the main canyon, and by four
18 o'clock we had finished putting in the logs.

19 Q Did you remain there after that?

20 A No, I started home immediately, and as I got down the
21 canyon, about at Harry Carey's place, I felt very nervous about
22 what Mr. Berry told me in regard to the dam, and then I seen
23 (witness weeping) my brother coming, and I stopped and I thought
24 it was my duty to warn him to get out-- my niece and his little
25 boy was with him, and I didn't want to warn anybody else, Mr. Berry
26 had told me not to tell anybody, so I called my brother out and
27 told him for God's sake to move his family out.

28 Q His wife and some children in the canyon there?

29 A His wife and the rest of the children were home at
30 that time.

31 Q What did he say?
32

1 A He says "Dave, I will move them to Newhall tomorrow."

2 Q You were living, your family was living in Newhall, and
3 you were going back and forth daily?

4 A Yes sir.

5 Q Did you speak about that condition to anybody else after
6 you got to Newhall?

7 A No sir, only my wife.

8 Q Did you notify the office in Los Angeles, the office of
9 the Water Department, any official about the condition you saw there?

10 A No sir, because I promised Mr. Berry I wouldn't tell
11 anybody in camp, but I felt it was my duty to tell my brother-- I
12 was out of camp at that time.

13 Q Did Mr. Berry say whether he had notified the main
14 office or not?

15 A No sir.

16 Q Did you talk to Tony yourself Monday afternoon?

17 A Yes, in an ordinary, friendly-- but nothing was said
18 about the dam itself.

19 Q Did Berry say he was going to get out of the canyon?

20 A No sir.

21 Q His home was right there?

22 A Below the power house about a quarter of a mile.

23 Q Did you see any water coming away from the east side of
24 the dam, any leak over there?

25 A To tell the truth, we didn't examine the east side,
26 because apparently that whole west hill was so saturated there and
27 looked so wet, and the road had caved down there, and they had
28 built a new road over there. We didn't go down to inspect it, we
29 never even noticed the east bank.

30 Q Do you know when the new road was built?

31 A Just lately.
32

1 Q Do you know how long that old road had been wet,
2 saturated?

3 A Only got in that condition since the dam was filling.

4 Q How long was that?

5 A They have been gradually filling the dam for the last
6 couple of months.

7 Q BY MR. SCOTT: Who was present when Mr. Berry and you
8 had this conversation?

9 A He called me to one side privately, because he is a
10 particular friend of mine.

11 Q Did he tell it to anybody else there?

12 A No sir.

13 Q That was where they stopped, by the aqueduct, below
14 Power House No. 2, or at Power House No. 2?

15 A Yes sir, right where the hole leaks in the canal there,
16 they can drain the water into the aqueduct.

17 Q You knew the St. Francis Dam was full?

18 A Yes sir.

19 Q And any flood waters that came into it would overflow
20 and come down and run into this place you had orders to stop up?

21 A Yes sir.

22 Q Did that arouse your suspicion because they put these
23 blocks in there?

24 A Yes sir.

25 Q Don't they always put them in during the flood season?

26 A I couldn't say that, because I wasn't there the year
27 before.

28 Q Where are those pipes you speak of, Mr. Matthews?

29 A One set of pipes I cleaned out, set in front of Berry's
30 house.

31 Q Pipes that go under the road, automobile road?
32

1 A Yes sir, main road.

2 Q Drainage pipe under the road?

3 A Pipes under the main traveled road.

4 Q How long had they been stopped up?

5 A They had stopped up sometime during the morning. As
6 quick as Mr. Berry was notified of it, he ordered me down to clean
7 the pipes out.

8 Q How much water was passing?

9 A As near as I could estimate, a couple of second feet.

10 Q At this point, where you were looking across the canyon
11 to the leak on the west side, could you see the color of water com-
12 ing out of the dam at that place?

13 A No sir.

14 Q About what quality was coming out at that leak?

15 A Couldn't judge where I was, only by being down below.

16 Q About how much?

17 A I should judge on Monday, it was around a couple of
18 second feet.

19 Q BY DISTRICT ATTORNEY: Was Mr. Berry sub-boss?

20 A Sub-boss.

21 Q Were they both drowned?

22 A Yes sir.

23 Q Did Mr. Berry say who had given him the orders to put
24 in those stop logs to you?

25 A Some of the higher up officials.

26 Q In this saturated soil, on this west side, did you
27 notice any coming out any points along the surface of that ground,
28 as if the water was coming through under a little pressure, any
29 pressure evident in that particular spot?

30 A No sir.

31 Q Just looked---

32

1 A Oozing out of that west bank all over.
2 Q Flowing gently out from the soil?
3 A Yes.
4 Q All the area, was that flowing more or less?
5 A As near as I could explain, from this point (indicating),
6 from this west wing here, I should say, to back about up into that
7 point (indicating), seemed to be saturated.
8 Q The water wasn't flowing all along out of the soil?
9 A No, it was all wet, and down towards the bottom, seemed
10 to be oozing out.
11 Q Flow of water along the toe?
12 A Up here (indicating) at the top, no sir, not that I
13 could see, it wasn't.

14 THE CORONER: That is all, you may be excused.
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1 Monday, March 26th, 1928, 9:30 A.M.

2 THE CORONER: Gentlemen of the jury, on Friday you visited
3 the scene of the St. Francis Dam, the scene of this disaster that
4 we are investigating. You all had a good look at everything that
5 is there in evidence, I suppose. I wish the reporter would note
6 that the jury visited the dam on Friday, the 23rd of this month,
7 and gathered evidence there for themselves.
8

9
10
11 DAVID C. MATHEWS, having
12 been heretofore duly sworn, was recalled and testified as follows:
13 BY THE CORONER.

14 Q In your statement--- in your testimony on Thursday,
15 Mr. Mathews, you referred to certain work that you were doing at
16 the order of your superior there at the dam, in relation to
17 plugging some tunnels, is that right?

18 A Yes sir.

19 Q Was there some other work that you were required to do
20 that day near or below the dam?

21 A About half past eight or nine o'clock Monday morning
22 there was an excess flow of water down the canyon, I should judge
23 in the neighborhood of two or three second feet, and the pipes
24 in front of Mr. Burns' house were clogged. That is about three
25 hundred yards below the power house and the water had kept in-
26 creasing the flow in the canyon and the debris had clogged these
27 pipes and the water was running over the road and down the road,
28 and Mr. Barry sent me down there to take the debris out of those
29 pipes, and I rolled my sleeves up to my elbows and it ~~took~~ took me
30 about an hour to take the debris out of those pipes. The water
31 was backed up and running all over.
32

Q Was there some other work that you were required to do

1 that day, some digging?

2 A Only digging out those pipes with my hands. I took
3 a hoe and shovel with me and I cleaned out those pipes.

4 Q Were those drain pipes that came from under the dam?

5 A No sir, across the road, on the main road from the
6 power house, about two hundred yards.

7 Q Have you not stated heretofore, not under oath, but
8 have you not made the statement that you were instructed to dig
9 some holes outside of the dam at either end of the dam on that
10 day?

11 A No sir, I never told anybody that.

12 Q Do you know of anybody that dug any holes to test the
13 condition of the dam, outside of the dam?

14 A No sir.

15 Q Have you been at the dam since it went out?

16 A No sir.

17 Q Was ^{Burns'} ~~Mr. Berry's~~ house the nearest house to the dam?

18 A No sir, his house was the last city house down the
19 canyon from the power house. There were four of the city houses
20 below the power house in the canyon, anywhere from a hundred and
21 fifty to three hundred yards down the canyon, and maybe a quarter
22 of a mile below.

23 Q How many were there between Mr. Berry's house and the
24 dam?

25 A The house ^{that} of Harry Mathis lived in and the house that
26 John Seddon used to live in, --- he had moved away the fore part
27 of January --- and Harry Burns, and another was a shack just be-
28 low the power house where Maxie Browaki and Earl Kerr slept, and
29 there was the clubhouse nearly opposite the power house, and
30 then above that the first house was Mr. Hughes' house and to the
31 left of Mr. Hughes' house was a little canyon that led off the
32 main canyon, where there were two old houses that were put up

1 during the construction of the power house.

2 Q Occupied?

3 A Yes, Homer Coe's family lived in one of those and the
4 next house was where Ray Rising lived with his family and the
5 next house was where Lyman Curtis lived. He was the road boss,
6 and the next house in that same canyon above Lyman Curtis was
7 where Lew Burns and his family lived, and in that main canyon
8 just above Mr. Hughes was where Mr. Weinland, one of the operators,
9 lived, and the next house above Mr. Weinland was where my brother
10 lived. He was relief operator, and above his house is where Mr.
11 Hopp lived, and his family, and a few yards above that was a new
12 school house built there a couple of years ago. That was all the
13 City houses, except some up at the dam, Tony's house, and several
14 others.

15 Q Tony's house was nearer to the dam?

16 A It was about a quarter of a mile below the dam.

17 Q Nearer to the dam than these other City houses?

18 A Yes, these other City Houses were all close to the
19 power house. Tony's house and the other little house where
20 Jack Ely and the other man that worked with him, lived, were
21 right close to the dam.

22 Q Were these houses in the low ground there, that is,
23 close to the water course, the natural water course, or up high-
24 er on the side of the canyon?

25 A Practically all of them were in the main channel of the
26 canyon, except these four that led off in that little canyon to
27 the left of Hughes' house. That was Coe's, Rising's, Curtis'
28 and Lew Burns'.

29 Q Were they not in a position that would subject them to
30 the water if any considerable amount came out or if it was ex-
31 tremely stormy weather or high water from any cause?

32 A They were protected in a certain way. In case of ex-

1 cess water they had a better chance to get out of there than
2 anybody on account of being out of the main canyon. I understand
3 Mr. Rising was living in that canyon and Mr. Curtis was living
4 in that canyon. I heard testimony that Mr. Curtis had kicked the
5 window out and set his wife and children out of the window and
6 they lit in the water and he went back after the other child and
7 never got out. Mrs. Curtis had got out with her baby and her-
8 self, but I think the way the water slopped over these houses
9 back at my brother's place, I have an idea it washed them up on
10 the hill there.

11 Q BY A JUROR: Were they saved?

12 A There were three there that were saved, Mr. Rising,
13 Mrs. Curtis and Mrs. Curtis' little baby. They were living in
14 that canyon to the left as you go up.

15 Q BY THE CORONER: There is no truth in the statement
16 purported to be made by you that you dug holes below the dam at
17 the west and at the east side, and found the water coming through?

18 A No sir, I never told that to anybody. The only digg-
19 ing I did was cleaning the debris away from these pipes on Mon-
20 day.

21 Q The water which was coming out there was coming through
22 the pipes?

23 A The water that had ologged those pipes up was coming
24 down the main canyon from the St. Francis Dam.

25 Q BY MR. SCOTT: How large are those pipes you speak of?

26 A There was four or five pipes under the road there, at
27 this particular point, and they were from twelve to sixteen inch-
28 es in diameter.

29 Q Was there more than one pipe at the same point?

30 A Yes sir, there were four or five laid right side by
31 side.

32 Q Were they culvert pipes?

A Yes sir.

1 Q To carry the water under the road?
2 A Yes sir.
3 Q You say they were about three hundred yards from the
4 dam?
5 A No sir.
6 Q Three hundred yards from what place?
7 A I said approximately three hundred yards below the
8 power house, right opposite Mr. Burns' house.
9 Q It would be about a mile and a half below the dam?
10 A Somewheres along there, yes sir.
11 Q What had occasioned the pipes to become stopped up,
12 if you know?
13 A With my experience around water, when the water is
14 rising in any stream it has a tendency to carry debris down the
15 canyon, and the water had just naturally increased its flow
16 there until it carried enough debris down there to clog those
17 pipes, that is the only answer I can give you.
18 Q How many were stopped up?
19 A They were practically all stopped up so that the water
20 was overflowing and running over the road and down the road.
21 Q About how long did it take you to clean them out?
22 A About an hour. At that particular time Mr. Hughes
23 had went down to Saugus after the school marm. She had missed
24 the bus that morning and when he came back he stopped and talked
25 to me when I was cleaning out the pipes.
26 Q What time of day were you cleaning out the pipes?
27 A Around 8:30 or 9:00 o'clock.
28 Q 8:00 or 9:00 o'clock on Monday morning?
29 A Yes sir.
30 Q Where was this water coming from, if you know?
31 A It was coming down the main canyon, down the concrete-
32 lined canal, and it went through the gates there, and came on

1 down the canyon.

2 Q Did any other water come into it from the point where
3 it came down the main concrete canal from the dam?

4 A No sir.

5 Q Any water from power house number two?

6 A No, absolutely none.

7 Q BY MR. DENNISON: You had been up there how long?

8 A Since last June.

9 Q And you had been up to the dam itself some time before
10 the 12th or 13th?

11 A I was up to the dam with Mr. Berry on Saturday.

12 Q Were you there Sunday or Monday?

13 A No sir.

14 Q When you were up there Saturday you had been up there
15 several times before that?

16 A Yes sir.

17 Q I want to attract your attention to a road, which
18 washed out there, do you remember when that was?

19 A That road caved in. It did not wash out, it caved
20 in on account of the bank being subbed with water. I come
21 from an irrigated country. That is why I use the word subbed.

22 Q Do you know when the water, when the water in this
23 reservoir was raised, that is, when it first commenced to have
24 any considerable depth of water in it?

25 A Yes sir, I knew just about the time that they started
26 turning in water from Power House Number One.

27 Q When was that?

28 A Along in the early or mid winter.

29 Q How much time between the turning in of this water
30 and the washing out of the road, or sinking of the road?

31 A The road did not cave in until after--- it was about
32 a month, as near as I can tell, before the reservoir broke, and

1 then they built a new road to the top of the dam.

2 Q Did you observe the formation of the west hill?

3 A Yes sir.

4 Q And you are a layman?

5 A Yes sir.

6 Q Will you tell this jury what you saw about it on Satur-
7 day, when you went up there--- just tell them the best you know
8 how?

9 A On Saturday morning when this excess water came down
10 and I reported to Mr. Berry, he asked me to get in the car and we
11 would go up and look the thing over, and Mr. Berry and I went
12 up that Saturday morning and looked the dam over and observed the
13 condition there. We saw that this hill was thoroughly soaked
14 and saturated with water and water was coming out of this west
15 bank right close to the main part and it was in a very soaked
16 condition. It looked muddy as if liable to give away any time.

17 Q When you say in a soaked condition, just tell the jury
18 whether it was mud or what it was?

19 A It looked muddy to us.

20 Q What was the color of that soil?

21 A A kind of reddish color.

22 Q How high up did that---- you know where the retaining
23 wall is there---^{how} high up did that soaking or saturation go?

24 A If I had a picture----

25 Q Will you point out to the jury generally what you ob-
26 served on the east hill, if you observed anything?

27 A The great soak, where the hill was the worst is right
28 down close to the main part, right down in there (indicating),
29 and, of course, along in here at the top (indicating).

30 Q BY THE CORONER: Indicating the west end of the dam,
31 the west end of the main section of the dam?

32 A Yes sir. The seepage was on the hill away up in here

1
2 (indicating), and the road caved in in here (indicating), and the
3 farther down we went the more muddy it looked, as if it was per-
4 fectly soft at the bottom.

5 Q BY A JUROR: But the water was clear when you saw it?

6 A No sir. We observed the water where it dropped over
7 the dam at the bottom and it was a very vile reddish color.

8 Q That was west though of the main part of the dam?

9 A Yes.

10 Q And not opposite what we would term the main part of
11 the dam?

12 A No.

13 Q It was west of this buttress (indicating)?

14 A Yes.

15 Q How many feet was that from the west abutment?

16 A This hill led down practically to the main abutment
17 there and all of that in there was saturated and thoroughly soak-
18 ed. It had a reddish color and it looked like to us that the
19 water was coming out all over and out of the hill.

20 Q Where was the main water coming from there?

21 A What we observed and gave us our fear of the thing be-
22 ing in bad condition was this whole hill and the farther down we
23 went the worse condition it was in. It looked like to us it was
24 coming out all over.

25 Q Was the water coming out from the base of the dam or
26 from this deposit?

27 A Most of it seemed to be coming out from that red ---
28 we were on this point of the dam and could see clearly there. It
29 was so muddy that we did not care about walking down there.

30 Q BY THE CORONER: You stayed over on the east side and
31 did not go to the west side?

32 A Yes sir.

Q BY MR. DENNISON: I am going to show you a piece of
earth or rock or whatever you call it, and ask you to look at it

1 and tell the jury whether or not that is the kind of formation
2 of that hill where you saw the water, when you speak of the red?

3 A (Witness examines a piece of rock and tests it with
4 his knife) Yes sir, that resembles that clay very much.

5 Q What did you notice on the east side of the hill, was
6 that the same kind of a formation?

7 A We did not look at that side so close on account of the
8 bad condition of the west side, which was interesting us the most.

9 Q You have not been up there since?

10 A No sir.

11 Q BY THE CORONER: Did you observe any leaks on the east
12 side at all?

13 A Yes, there were a few minor leaks there, but we did not
14 pay any particular attention to those because it was the west
15 leak that looked so bad to us.

16 Q BY MR. DENNISON: And you say that after the water was
17 raised in the reservoir that this road caved in or fell down?

18 A Yes sir.

19 Q Did you see any water punning parallel into that re-
20 taining wall?

21 A No sir, I never noticed that.

22 Q Did you ever see any cracks in the retaining wall?

23 A No sir.

24 Q Do you know anything about the character a crack being
25 in the retaining wall?

26 A No sir, that is a dyke along on top there.

27 Q Did you see any cracks along there at all?

28 A There were cracks in the main part of the dam.

29 Q Where were those cracks?

30 A On the main part of the wings, the main part of the
31 dam.

32 Q On the face of the dam or where were they, could you

1 tell from this picture where they were, approximately?

2 A No, I noticed two or three different cracks along in
3 here (indicating) and over on this side (indicating).

4 Q BY THE CORONER: Which way did they run?

5 A Down parallel, but I did not pay any attention to them
6 because they were such small leaks.

7 Q BY MR. DENNISON: Is that the color of the water that
8 was running down there (indicating a tumbler of dirty, reddish
9 colored water)?

10 A Yes, it resembles it. It had a reddish color to it.

11 Q What was the water level in the reservoir, approximate-
12 ly, along about the first of the year, if you know?

13 A I could not give you the exact figures on that. They
14 were running a large head of water at that time and the water
15 began to get pretty high by that time, but not so that we took
16 any particular notice of it. I did not start noticing these
17 things until about two weeks before the dam broke.

18 Q What did you notice then?

19 A We began to notice the increased leakage.

20 Q Can you tell the jury how you noticed that?

21 A I was working right there and going back and forth
22 around the power house and I was up and above this place, and in
23 going to my brother's place I had to cross this canal, and every
24 day noticed a little increase in the flow in that canal up to the
25 time that it broke.

26 Q BY A JUROR: How deep was that canal?

27 A That concrete canal that was used to convey the water
28 from the St. Francis Dam into the aqueduct under Power House No.
29 2, I should say it was approximately four or five feet wide on
30 the bottom and it slopes out, and it is probably sixteen or eight-
31 een feet wide at the top, and four or five feet deep.

32 Q Where is that located?

1 A It runs from the St. Francis Dam right in the bottom
2 of the canyon. It is to convey the water down.

3 Q How did you measure the amount of water? You say
4 there was between two and three second feet flowing, how did you
5 figure that?

6 A I have worked around water practically all my life and
7 lived in an irrigated country and can practically tell about the
8 amount that was flowing by the second feet on account of being
9 experienced with water. I lived in the Yakima Valley for thirty-
10 one years and you people may know that that is an irrigated
11 country in there.

12 Q Did you make a calculation as to the amount of water
13 or just sort of guess at it from looking at it?

14 A I calculated it was between two and three second feet.

15 Q How fast was it flowing?

16 A According to the lay of the ground.

17 Q Did you figure it in the ditch or in an open channel?

18 A At the time that I calculated it, was when we had
19 opened up these extra gates there, after we plugged the aqueduct
20 why, I think these gates were approximately six feet wide and
21 there were three of them and all three of them were opened up
22 and there was about two or three inches going over an eighteen
23 foot weir. Those three gates being opened and the water was
24 two or three inches deeper over that weir, and I approximately
25 guessed it at two or three second feet.

26 Q After it passed the gates did it slow normally or
27 fall?

28 A Just took a natural course down the Canyon.

29 Q Was it weir action or just a straight blow?

30 A It was a weir action and drop on the concrete run-
31 off.

32 Q BY MR. DENNISON: Are you employed by the Water Board

1 now?

2 A No ~~one~~.

3 Q When did you sever your connections?

4 A Last Friday.

5 Q Who was your superior?

6 A Mr. Ruble was the superior over Mr. Hughes.

7 Q What did you quit for, if you quit?

8 A The other day after the flood I reported to Mr. Ruble

9 and he said that he thought I knew too much and had better wait

10 until this thing was over before he put me back to work.

11 Q Then he paid you?

12 A No sir, I called for my time Friday.

13 Q And he paid you up to the 13th?

14 A He paid me up to the 13th, the day of the flood.

15 Q What is Mr. Ruble's first name?

16 A His initials are C.C.

17 Q What is his title?

18 A Superintendent of generation.

19 Q What is that?

20 THE CORONER: Generating power.

21 A He has supervision over all the power plants.

22 Q He had nothing to do with the Water Department?

23 A No sir.

24 Q BY MR. DENNISON: It was for the power people you were

25 working, rather than for the water?

26 A Yes sir.

27 Q That is a two-headed institution, is it?

28 A Yes sir.

29 Q Power and Light and Water and Power and one man has

30 one thing and another another?

31 A Yes sir.

32 Q BY A JUROR: This water that run over the road below

the power house, did any of that come from the spillway at the

1 dam at that time?

2 A Now, as for that, on Monday I did not go up to the
3 dam to look at that.

4 Q It might have been, might it not?

5 A Yes sir, if there had been any excessive wind it could
6 have run over.

7 Q BY MR. DENNISON: And the water that washed over the
8 spillway, that saturated those hills?

9 A No sir, because the spillways of the dam were in the
10 center of the main construction and where the hill was saturated
11 was over on the west bank, and it did not have any effect on it.

12 Q BY THE CORONER: The nearest spillway would be how
13 far from that bank, approximately; one hundred feet or more,
14 so that the water would naturally flow by gravity one hundred
15 feet or more east of the hill on the west side?

16 A I could not tell you because I never had any occasion
17 to measure that distance. When we were up there on Saturday
18 there was some water slopping over and it did not slop over on-
19 to that hill.

20 Q BY MR. DENNISON: Of course, it is only an opinion
21 of your own, but have you any opinion as to how the hill became
22 saturated?

23 A Yes sir.

24 Q Tell the jury what you feel about it and the reason
25 upon which you base your opinion, if you can?

26 A In my experience in handling water, the condition of
27 that hill and that soil---- it was very plain to me that the
28 soil was of such a nature that it would sub there, and after a
29 certain length of subbing, the whole thing would get soft.

30 Q Do you mean by that, that this great structure which
31 was placed upon the hillside there, had so pressed into it that
32 it opened the fissures of the hill, is that what you mean by

1 subbing?

2 A Subbing is the natural soaking of the water underneath
3 the hill. In handling water anywhere and putting in small dykes
4 or dams of any kind, my experience is when a dam or dyke be-
5 comes so soaked and saturated it will naturally become softer
6 and ^{softer} ~~safter~~ until it gives away.

7 Q BY THE CORONER: In other words, the formation under
8 the dam would become full of water and the water would seep out-
9 side?

10 A Yes sir.

11 Q You saw the water coming through?

12 A Yes sir.

13 Q Referring again to your instructions there on Satur-
14 day, the 10th of March, did Mr. Hughes ask you or anybody else
15 to sink some tunnels in the ground outside?

16 A No sir.

17 Q Do you know of Mr. Gardner B. Wood?

18 A I only knew him as a kind of agent.

19 Q Did you talk to him some time after the dam was out?

20 A Yes sir, I did.

21 Q Did you tell him that Mr. Hughes had told you and
22 some other boys to sink tunnels on the west side of the dam to
23 determine the condition of the ground?

24 A No sir, I never told anybody that.

25 Q That is not true?

26 A It is not.

27 Q You don't know whether, from testing the ground your-
28 self, where the water was coming through there that was merely
29 from the seepage from the hill nearest the abutment of the dam?

30 A That is all.

31 Q BY MR. SCOTT: at the time that you were up there
32 with Mr. Berry, I believe it was, were there men working there?

1 A I did not see any.

2 Q Were there any men working around there Monday?

3 A Up at the dam?

4 Q Yes. What time of day were you there Saturday?

5 A We were up there, I think it was in the afternoon. I
6 am not sure, though, but I knew it was Saturday, I would not say
7 whether it was the forenoon or afternoon.

8 Q In what capacity were you working for the Bureau of
9 Power, of Light?

10 A Only as a laborer. I was rated as a laborer.

11 Q How old a man are you?

12 A Forty-seven.

13 Q You just mean by that, that you were just doing odd
14 jobs around Power House No. 2?

15 A Yes sir, and I worked most of the time helping Mr.
16 Berry, as his helper.

17 Q What did Mr. Berry do?

18 A Power house mechanic. When Mr. Hughes was away he
19 was our boss.

20 Q What day was it that you had this conversation that
21 you have just related with Mr. Ruble of Power House No. 1?

22 A About three days after the flood.

23 Q Where did you have the conversation?

24 A On the side hill just below the surge chamber.

25 Q At what time of day?

26 A Right after dinner, somewhere around one or two
27 o'clock.

28 Q Was anyone else present?

29 A No sir.

30 Q BY MR. MOHR: Does that view enable you to explain to
31 the jury better than the other picture, where you saw that
32 water (handing a photograph to the witness)?

1 A Yes sir, that is the better picture.

2 Q BY THE CORONER: Do you know the date of that photo-
3 graph, Mr. Mohr?

4 A Yes.

5 MR. MOHR: This is a photograph taken of the St. Francis
6 Dam in the month of June, 1926. I give you that information as
7 it appears on the back and I presume that is so. Calling your
8 attention to that photograph, I will ask you if that illustrates
9 the condition that you have been speaking about in the bottom
10 of the canyon?

11 A Yes sir, that is the main canal leading down the
12 canyon. It did not run under the road, it stopped right there at
13 the power house.

14 Q On Saturday you were somewhere over on the east side
15 of the dam on the road passing the east side of the dam, over in
16 here somewhere, and you observed the water on this hillside
17 here, is that correct?

18 A Yes sir.

19 Q You observed the water down close to the canal, as
20 you call it?

21 A Yes sir, we could see where the water was coming into
22 the canal there.

23 Q ~~And~~ you observed it up towards the top of the dam, up
24 the hillside?

25 A Our particular attention was drawn to the fact that
26 the water seemed to be oozing out of that point all over, more
27 than any place else ^{the} and farther down we came the wetter it was.

28 Q Right up the hill it was all wet, this hill was all
29 wet, is that correct?

30 A Yes sir.

31 Q It continued to be wet right up to the dyke?

32 A Yes sir.

1 Q How far could you observe that that water was coming
2 from on the west side of the dam?

3 A It practically started at that point where the road
4 had caved in up there.

5 Q That is alongside of the dyke?

6 A Yes sir.

7 Q BY A JUROR: Do you mean by the road caving in this
8 portion here (indicating)?

9 A Yes, on account of it being soaked up there.

10 Q BY MR. MOHR: You have not been at the dam site, since
11 the flood, have you?

12 A No sir.

13 Q The road that you are referring to is the one which
14 is right alongside of the dyke going up to the top of the dyke?

15 A Yes, that is the old road that we used to go up.

16 Q The road shown there on the photograph (indicating)?

17 A Yes sir.

18 Q Do you know the distance between where you stood and
19 that hill, or the portion of the ground alongside of the dam
20 that you saw saturated?

21 A No sir.

22 Q Then, you could not tell from where you were standing
23 there that water was coming from a place alongside of the dyke,
24 or alongside of the dam proper, or any other part of that hill
25 which you say was saturated and was all wet?

26 A We could tell that the water was coming out of that
27 hill and the farther down the hill we went the wetter it was,
28 and it was more riley.

29 Q I believe that you said that you could not tell what
30 the color of the water was before it reached the bottom of the
31 hill and was proceeding into the conduit or the canal?

32 A It all seemed to have a reddish color coming out of

1 that hill.

2 Q Did you observe the color of it where it was running
3 down into the canal here or on the hillside?

4 A On the hillside and in the canal too.

5 Q It was running in streaks down the hillside?

6 A No, I did not say that. The whole hillside was satur-
7 ated and it was soaking out like water coming out of a sponge.

8 Q You don't mean to tell us that you could tell what
9 the color was as it was coming from that hillside?

10 MR. DENNISON: You are argumentative. He says that he saw
11 the color that the water was as it came from the hillside.

12 Q BY MR. MOHR: I want to know where you saw the muddy
13 water, whether you could tell the color that it was on the hill, or
14 whether it was where it was going into the canal?

15 A As it appeared to Mr. Berry and I----

16 Q I don't care anything about Mr. Berry. What you ob-
17 served yourself?

18 A That hill was so soaked with water it was apparently
19 coming out of that hill and was riley all over,, and of course,
20 we could see/^{that}when the water was all red and riley.

21 Q BY THE CORONER: In other words, the water as it came
22 out of the hill, was not clear as you saw it?

23 A I could not say that it was clear.

24 Q Do you know how long the main portion of the dam is?

25 A Something around six hundred feet.

26 Q And that was about the distance that you were from
27 the road to the hillside, was it not?

28 A No, it would be closer around there than from the arch
29 of the dam up there (indicating).

30 Q BY A JUROR: Could you take a pencil and point out
31 where you saw the water coming out?

32 A This whole hill all around from where it is caved in

1 there and the farther down the hill the wetter it was.

2 Q BY THE CORONER: Indicating from the west buttress of
3 the dam down to the stream bed?

4 A Yes sir, clear to that little draw down here.

5 Q BY A JUROR: Did you see any water coming out, from
6 the base of the dam itself?

7 A We could not notice any large stream there.

8 Q Did you see any stream?

9 A Only that it was in a very wet condition along there.

10 Q Adjacent to the dam?

11 A Yes, clear up to the dam.

12 Q BY MR. DENNISON: Do you know what he means by the
13 word adjacent?

14 A Yes sir.

15 Q BY A JUROR: You don't know that that point that you
16 are talking of is still there now since the dam has gone out?

17 A No sir.

18 Q BY THE CORONER: Are you acquainted with somebody, some
19 man who was in the camp that night and who was caught in the
20 flood and washed up over the hill and was afterwards rescued or
21 managed to save himself?

22 A Yes sir.

23 Q What is his name?

24 A Ray Rising.

25 Q Was he with you on the work which was done there on
26 Saturday, the 10th, and also on Monday, the 12th?

27 A I don't know about Saturday, but on Monday afternoon
28 he was with me. I was standing on top and Mr. Rising and Homer
29 Coe were down below putting logs in.

30 Q Was Mr. Rising with you when you examined this west
31 hillside that you have just testified about?

32 A No sir, Mr. Rising did not go up with us on Saturday.

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Q That is all.

MR. SCOTT: If the court please, we have copies now of all these photos which were in the binding and we desire to substitute as we promised the Court that we would.

THE CORONER: All right.

ANNA SCOTT, being first

duly sworn, testified as follows:

BY THE CORONER.

Q Please state your name.

A Anna Scott.

Q Where do you live?

A Mint Canyon at Hemby.

Q What is your occupation?

A Housewife.

Q You were not in the flood at the St. Francis Dam?

A No sir.

Q Were you in the canyon there shortly before it occurred?

A Yes sir, a little before sundown.

Q On Monday, the 13th of this month?

A Yes.

Q Who was with you at the time?

A Miss Cunningham.

Q Where did she live?

A In Los Angeles. She is staying with me now.

Q She was visiting you. Did you drive out there?

A Yes.

Q How did you go?

A We went down from my place, down to the canyon where

1 you turn off to go up Boquet Canyon, and met some little school
2 youngsters and we were driving along showing her the country
3 and I took these youngsters home and we went to Harry Carey's,
4 and went back up the canyon.

5 Q Where did you intend to go?

6 A If I had not taken the youngsters home we intended to
7 go up the canyon to see it.

8 Q To the dam?

9 A Just to show her the country.

10 Q How far did you go?

11 A I cannot tell exactly. To the first crossing above
12 Harry Reese's place.

13 Q What did you see up there?

14 A ~~There is~~ a beautiful little canyon and a great deal
15 of water.

16 Q Where was this water?

17 A In the river bed.

18 Q What was the color of it?

19 A Very muddy.

20 Q Had you ever been up there before?

21 A Yes, last Summer we went swimming up the canyon.

22 Q You were born up there?

23 A On the Newhall ranch.

24 Q You have known more or less about that stream for
25 many years, have you not?

26 A Yes sir.

27 Q You say that there was more water in the stream than
28 on usual on Monday afternoon?

29 A More than I had ever seen anywhere in those canyons
30 when there had not been a rain.

31 Q Were you able to estimate the amount of water there?

32 A No.

1 Q Did the presence of the water change the plans of your
2 trip in any way?

3 A Well, I was afraid to go up the canyon--- it seemed to
4 be such a lot of water and was going so fast--- it was, oh, just
5 rushing down.

6 Q Was it near the road?

7 A The whole culvert was full and there were very small
8 approaches.

9 Q It was running full?

10 A Yes, full.

11 Q What were you afraid of?

12 A The approaches are just shoveled up there and very
13 temporary affairs.

14 Q You were afraid the approaches might go out?

15 A Afraid the approaches might go out.

16 Q Did you see the dam?

17 A I never saw the dam.

18 Q Did you know that there was an unusual amount of water
19 and the road was in danger and you decided to turn back because of
20 that?

21 A Yes.

22 Q Had you ever heard from persons more closely associated
23 with the dam, than yourself, that they were apprehensive as to its
24 condition?

25 A I heard Mrs. Nellie Hanson make the remark that if the
26 dam ever went out she was just a gone goose, just in our little
27 community affairs.

28 Q When did she make that statement?

29 A We were making curtains for our little community club
30 at Saugus and I went to her sister's house to take down some cur-
31 tains off the line while the other lady stayed at the clubhouse,
32 and she made this remark.

1 Q Was there any discussion of the condition of the dam
2 at that time?

3 A No, none at all.

4 Q She merely said that if the dam went out she would be
5 in the path of the water?

6 A Yes.

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1 EDGAR A. BAILEY, being first duly sworn,
2 testified as follows:

3 BY THE CORONER:

4 Q Please state your full name.

5 A Edgar A. Bailey.

6 Q Where do you reside?

7 A 371 West California Avenue, Glendale, California.

8 Q What is your business or occupation?

9 A Assistant Engineer with the Bureau of Water Works and
10 Supply, City of Los Angeles.

11 Q How long have you been so employed, Mr. Bailey?

12 A With the exception of about a year and a half, since
13 1905.

14 Q And in that capacity, did you design the St. Francis
15 Dam?

16 A No, I didn't.

17 Q Who did design it, do you know?

18 A I was on the Colorado River, between Blythe and Los
19 Angeles, in 1923, and I am not familiar with the designing of any
20 of the dams, except earth dams of different types. The first hand
21 information I am not familiar with at all. Understand it was de-
22 signed by Mr. Wilkinson.

23 Q What is his full name?

24 A William Wilkinson.

25 Q Is he connected with your department?

26 A He is connected with the Bureau of Water Works and
27 Supply, yes.

28 Q You know that Mr. William Wilkinson designed the St.
29 Francis Dam?

30 A I don't know it as a fact, but I understand that is so.

31 Q Did you design a concrete dam of a similar type to the
32

1 one put in St. Francis?

2 A Yes, I had to do with the cross sectional transfer
3 profile of the Hollywood Dam.

4 Q Is that the same sort of dam, same type, general con-
5 struction as the St. Francis Dam was?

6 A I understand it is, but I have never made the comparison,
7 as a matter of fact.

8 Q You had nothing to do with the engineering or designing
9 of the construction of the St. Francis Dam?

10 A I didn't. I had to do with the survey of the reservoir
11 site in 1922, a couple of years before the construction of it, as
12 far as determining the capacity in acre feet at the various levels.

13 Q Did you have anything to do with the location of the
14 site of the dam?

15 A No, I didn't.

16 Q Making your survey of the reservoir site---

17 A We had tentatively drawn a line where the dam site was
18 previously, and computed the acre feet to that line.

19 Q Was that the line where the St. Francis Dam was after-
20 wards placed?

21 A That I don't know.

22 Q Were you in here at the time it was located?

23 A No, I was on the Colorado River.

24 Q You don't know of your own knowledge whether the St.
25 Francis Dam was exactly like this other dam?

26 A ~~Myself~~ I know of my own knowledge by examining
27 the drawings today that there were some changes. The radius was
28 fifty feet shorter than the Hollywood. The Hollywood was five
29 hundred forty-two feet on the axis; the St. Francis was four
30 hundred ninety-two feet. That was the radius from which the axis
31 was struck, the center point of an arc forming the dam.
32

1 Q Do you know what computations were made to determine
2 the factor of safety in this dam, St. Francis?

3 A I don't. I am familiar with the Hollywood.

4 Q Of course, we are interested in the Hollywood collater-
5 ally, but are not inquiring of the Hollywood at this time, we want
6 to know all the facts about the St. Francis Dam. You are unable to
7 give us the engineering data or the facts as to the design?

8 A Not for the St. Francis, but I can give you for the
9 other dam, similar, I understand to be similar.

10 Q BY MR. SCOTT: Can you produce Mr. Wilkinson here?

11 A Yes sir, I think Mr. Wilkinson is here.

12 Q BY DISTRICT ATTORNEY: We have in the evidence some
13 plans and specifications for the dam. It has been testified that
14 the dam was built according to these plans and specifications. I
15 want you to look at them and tell me what they are, if you know,
16 whether you prepared these.

17 A This is plan marked Drawing No. 10515, is apparently,
18 purports to be the cross section of a dam---

19 Q Did you draw it?

20 A I didn't, I never saw the drawing before.

21 Q Is it a copy of the drawing you made for Hollywood?

22 A No, it is not a copy of the drawing made for Hollywood.

23 Q All right, look at the next one.

24 A This is drawing marked 10490, profile of St. Francis
25 Dam, is apparently a profile of the cross section of the St. Francis
26 Dam, with a small plan in the upper right hand corner.

27 Q Did you draw it?

28 A I didn't.

29 Q Is it a copy of the plan you drew for Hollywood?

30 A No, it is similar in the steps on the lower toe, and
31 in the vertical sides at the top, and apparently in the batters on
32

1 the inside. This is drawing marked 10489, is a similar drawing to
2 the one previously described. It is apparently a stress diagram,
3 showing a small map on the side, shows the stress, the load in tons
4 per square foot at the two toes, and the width of the dam at the
5 various levels.

6 Q Is that a copy of the design that you made of the
7 Hollywood Dam?

8 A No, that is not a copy of the design, as far as I can
9 see, it is not the same drawing, it is very similar, however.

10 Q What is the base of that dam?

11 A It is written in here, is marked 176 feet, elevation
12 1625.

13 Q What is the height?

14 A The height is the difference between 1625 and 1815, plus
15 the height that isn't marked.

16 Q What would be the height in feet?

17 A The difference between that. I can't tell from the
18 drawing. This drawing marked 10503 is marked a profile of the
19 upper toe of the St. Francis Dam, showing bedrock, and constructed
20 concrete wall October 10, 1924. I am not familiar with this draw-
21 ing.

22 Q You made the survey from which that was made?

23 A No, I didn't.

24 Q Do you know who did?

25 A No, I don't. At that time, we were on the Colorado
26 River.

27 Q I understand you made a survey?

28 A The reservoir site along before 1922, not of the dam
29 site.

30 Q Can you tell me what the elevation at the head of the
31 reservoir was, at the dam, according to these plans?
32

1 A I would have to look them over, it doesn't appear on the
2 drawings I have so far examined. This drawing 10614-b, designated
3 crest construction, St. Francis Dam---

4 Q Is that the same crest construction as the Hollywood
5 Dam?

6 A No, it is not, completely different, except that the
7 thickness of the Hollywood Dam at the time is six feet, and this is
8 also six feet in net thickness.

9 Q What was the compressive stress of the Hollywood Dam?

10 A The stress in compression was limited to ten tons on the
11 lower toe, and twelve tons per square foot on the upper toe. These
12 are limiting stresses, and only become effective at the lower levels
13 at the dam. As you go to the top, they decrease.

14 Q That would be about how much a foot, about two hundred,
15 or two hundred pounds an inch?

16 A I would have to stop and figure it out (figuring)--- one
17 hundred and sixty-six and two thirds for twelve tons. I don't know
18 whether I testified to this drawing 10614-a. This drawing is
19 marked "Spillway construction, St. Francis Dam." That is not
20 familiar to me. The large drawing marked 1142 is a large scale
21 contour map of the dam site. This we had nothing to do with, the
22 scale one inch to twenty feet, and minute contour interval.

23 Q It isn't a copy of any such paper as you prepared?

24 A It is marked showing bedrock contours of St. Francis Dam.
25 This drawing marked 2149, with title, topography and location of
26 St. Francis Dam site is ^a rather large scale drawing of the dam site,
27 that is with the dam superimposed on the contours as shown.

28 Q That isn't a copy of the plan you made for the Hollywood
29 Dam, is it?

30 A No.

31 Q Or for any dam that was made by you?

1 A No, this plan was as I see it shows a five foot contour
2 interval, was the contour interval taken for laying out the scheme
3 of the dam. The other drawing I just previously had on a very
4 large scale shows bedrock conditions after the excavation of the
5 stripping of the surface and getting into bedrock just before con-
6 struction,

7 Q This is what you call a gravity dam?

8 A Yes, a gravity pipe dam.

9 Q Was Hollywood and St. Francis?

10 A Yes.

11 Q And they are also arched type?

12 A They are not strictly an arched dam, gravity type arch.
13 The arch in the opinion of the best engineering authorities would
14 add from six to ten per cent to the safety, strength of the dam.
15 There is this difference between an arch gravity and straight
16 gravity, a straight gravity dam, in similar cases as this, in case
17 of failure, would result in a catastrophe. Any arch set, in case
18 of failure, it would be a failure only after---

19 Q Do you remember what was the chord of the arc of the
20 Hollywood Dam?

21 A I think we used a twenty-five foot chord on a five
22 hundred forty-two foot radius. We may have used a twenty foot, ten
23 foot, or twelve and one half foot-- used very short chords.

24 Q What did the Hollywood Dam-- did the arch-- what did it
25 abut up against?

26 A Against a firm hard sandstone.

27 Q Do you remember the slope of the walls?

28 A Quite steep. The construction engineer who constructed
29 it, Mr. Henry Jacks, I consider very capable.

30 Q Had you ever been to the site of the St. Francis Dam?

31 A I was at the site when they made the survey of the
32

1 topography map, some months before the final construction. The
2 next time there was a dam there, and it was full of water, within
3 ten or twelve feet of the top.

4 Q Did you notice the west wall?

5 A I didn't. We came to take some photographs, in fact,
6 the large photograph you have I took, and we went up hastily. That
7 photograph I took myself, climbed up on the hill.

8 Q How many of this type dams have you designed and con-
9 structed?

10 A I have constructed none, have had nothing to do with the
11 construction of any, except being that the Hollywood Dam complied
12 with the profile that we had to work by.

13 Q Didn't I understand that you are the man that designed
14 the thing, the Hollywood Dam?

15 A No, I just testified I had to do with the design of the
16 transverse cross section profile of the dam, with certain limita-
17 tions. The dam was designed between Mr. Mulholland and myself.
18 Mr. Mulholland set the radius, picked the site, he picked the
19 abutments. We made one or two little changes upstream, to get a
20 radial bond.

21 Q Mr. Mulholland visited the site?

22 A Picked it, considered it suitable for a dam.

23 Q And that would be the place to put a dam, said "I want
24 you to draw me the plans and specifications for a gravity dam"?

25 A No, no specifications were written, it was to be done
26 by the department itself, certain dimensions to follow.

27 Q He gave you the radius?

28 A Yes.

29 Q That was five hundred ninety two?

30 A Five hundred forty-two feet.

31 Q And with the opening of the dam, the valley you had to
32

1 close, you then proceeded to make for him a design showing how he
2 should construct that dam, is that correct?

3 A In a way, and in a way not. I might explain that Mr.
4 Mulholland very critically studied our maps, picking the spot for
5 the axis of the dam. It was satisfactory to him, and I believe he
6 picked a very good location. Mr. Mulholland also set the radius.
7 There were certain phases of the design, limiting pressures for that
8 type of formation, and after a good deal of study, I took ten tons
9 and twelve tons, as large as we ought to place in that particular
10 locality for that particular sandstone, submit it to Mr. Mulholland,
11 and he thought it was a light load. I didn't increase it, however.
12 Mr. Mulholland also said there was another matter, the matter of
13 uplift. Engineering authorities, best men, have various ways of
14 handling the uplift. One way is a system of drain pipes near the
15 upper toe, another is by a gallery inspection, gallery with upright
16 pipes. All are considered as practical ways of taking care of the
17 uplift. It is a matter of opinion among the best authorities.

18 Q This compressive strength of the dam was twelve tons a
19 square foot?

20 A Yes, on the upper toe, ten on the lower, and that only
21 maintains at the lower levels of the dam.

22 Q What was the overturning moment?

23 A Factor safety of two inch resultant is at the lower
24 middle third.

25 Q What was it in tons?

26 A In feet?

27 Q In tons?

28 A Not in tons, it is in foot pounds. I am not clear on
29 just what you are asking, because moment is not computed in tons.

30 Q What is the length of it? (Mr. Dennison at blackboard)
31 This is the height of the dam, say this is one hundred feet, and the
32

1 pressure of the water is downward?

2 A Right angles to the surface.

3 Q Isn't the pressure of water down?

4 A No, the pressure is right angles to the surface, it is
5 pressing against.

6 Q When you get through you have a thing like that (in-
7 dicating). What is the density, what is the density of the
8 Hollywood Dam?

9 A It was designed for one hundred and forty pounds to the
10 cubic foot. The density, actual density was somewhat greater.

11 Q What was its relation to water?

12 A Water is sixty-two and one half pounds to the cubic
13 foot.

14 Q What about the relation of this dam to the water?

15 A Specific gravity?

16 Q No, water?

17 A The relation is the ratio of the density of the dam it-
18 self, one hundred and forty to one hundred and fifty to water, then
19 sixty-two and one half, divided by the specific gravity of the con-
20 crete, which is somewhat greater than two, it is a little above two,
21 the weight of concrete varies somewhat, the weight of water does
22 not.

23 Q You find, do you not, the principle on which you con-
24 structed that gravity dam to be this: that you take the height of
25 the dam that it is going to be, it is going to be one hundred and
26 eighty feet, and double the density and you extract the square root
27 of it, which would give you approximately two?

28 A Generally speaking height divided by the square root
29 of the density of the material into the base, width.

30 Q And that is the relation between the volume of water
31 represented by this line (indicating) and the volume of the cement
32

1 represented by this line (indicating), and in a dam one hundred and
2 eighty feet, the base shouldn't exceed ninety feet, except at the
3 expense of the strength of the material-- isn't that true?

4 A No, that is not true.

5 Q How many dams have you devised?

6 A That is the only gravity dam, was the Hollywood. I
7 made a study of the plans of a number of them.

8 Q BY MR. SCOTT: You made a study of the plans of dams?

9 A In years gone by.

10 Q And in the construction of the Hollywood, what com-
11 parisons were made with other structures, well known structures in
12 the country?

13 A In the construction of the Hollywood, after the design
14 was made, we looked around to compare it with other concrete dams,
15 most large dams are the concrete, either part concrete and part
16 sandstone or other material. We found Arrow Lake Dam, the com-
17 parison I have here in the drawing with me.

18 Q Exhibit that to the jury, explain it to the jury.

19 A This step line (indicating) shown in the blueprint, part
20 of the blueprint-- this is steps on the downstream toe of the
21 Hollywood Dam, the smooth line being part of the blueprint itself,
22 is the upstream toe of the Hollywood Dam, marked "Weed Canyon." The
23 line in green, the step lines, two given points, a given point was
24 taken at the upper inside corner of the dam. The line dotted in
25 green is an accurate representation of the profile of the Arrow Rock
26 Dam. The line shown in green on the upper toe is the upstream
27 profile of the Arrow Rock Dam at all points, and comes within the
28 cross sectional dimensions of the Hollywood Dam. The line shown
29 dotted in brown, on the downstream toe, is a cross sectional profile
30 of the downstream toe of the Elephant Butte Dam, at the upper turn
31 itself, without a turn of the Hollywood Dam, and then another turn,
32

1 Hollywood Dam, have a series of arches near the top, comes within
2 the twelfth section of dimensions of the Hollywood Dam, and sets
3 practically on the profile of the Hollywood Dam, until it gets near
4 the bottom of the cross section, where it comes further within the
5 Hollywood Dam, and goes on to a deeper level than Hollywood. The
6 line shown dotted in brown, on the upstream base, is Elephant Butte
7 Dam, ^{it} is a steeper, little more slope than the Hollywood.

8 Q Which does the Hollywood resemble most?

9 A Arrow Rock.

10 Q Where is that?

11 A Idaho.

12 Q That is a government reclamation project?

13 A Yes.

14 Q BY A JUROR: How much higher is that than the Hollywood?

15 A I believe Arrow Rock is one of the highest in the
16 country, three hundred and forty feet.

17 Q BY MR. SCOTT: Could you state how the plans, if you
18 know, were worked out of the St. Francis Dam from this Hollywood
19 design that was compared with the Arrow Rock Dam and the Elephant
20 Butte?

21 A I don't know of my own accord, I know it by hearsay and
22 discussion.

23 Q Do you know what changes or what differences there are?

24 A As I understand from examining these drawings that have
25 been before me, the coping at the top and fancy work was taken off,
26 the depth was increased I believe slightly higher than Hollywood,
27 and radius somewhat reduced. The top width was the same.

28 Q The safety factors, how did they compare?

29 A I didn't make the computations. If the resultant is
30 within the middle third at all points on the St. Francis, it should
31 be safe against overturning.

32 Q Mr. Dennison worked out a proposition on the board,

1 where is that in error?

2 A I wasn't quite clear as to what he was discussing, but
3 the common way, rough and ready way of computing the base width of
4 the dam, in a hurried way, as I imagine he was trying to do, was
5 take the height and divide it by the square root of the specific
6 gravity of the material of which it is composed, and he brought
7 that point out.

8 Q Is that accurate?

9 A That being a pure triangular form would be accurate.
10 For practical purposes, you have to have a walk way, roadway or
11 safety against wave action, against logs setting against it.

12 Q Would such a computation, one hundred and eighty feet
13 wide, one hundred ninety feet high, would that stand?

14 A One hundred eighty feet high and one hundred ninety
15 feet wide at the bottom for straight gravity dam would be less in
16 width than many gravity constructed dams that are standing today.

17 Q In your examination by Mr. Dennison, you gave some
18 figures of twelve tons to the square foot, what did you mean by
19 that?

20 A The way a dam is generally designed, of the gravity
21 type, first limiting pressures are set, the next thing the width at
22 the top is set, the width at the top being wider than the limiting
23 pressures, and against necessary overturn. The sides are carried
24 down vertically. It becomes necessary in doing that where on the
25 downstream toe, where water pressure against the dam and weight of
26 the dam reaches the middle third or lower middle third of the
27 transverse section, when it reaches that point the pressure on the
28 lower toe becomes double the average pressure, and pressure on the
29 upper toe becomes zero. Beyond that it is not safe, because the
30 tension would go on the upper toe. Good engineering practice
31 dictates that the resultant should always be within the middle
32

1 third, so the first stopping point in the designing of a dam is to
2 carry the sides vertically until the resultant reaches the upper
3 middle third. Then the next stage, having the dam either full or
4 empty, with the resultant in the middle third, is to keep the re-
5 sultant at this middle third point, carrying it on down until such a
6 time as the limiting pressure arrives, usually on one toe, at that
7 point on the outer toe, at that point there is a change and the
8 slope is increased, carrying down the sides until the limiting
9 pressure goes on the other toe, thereafter the sides are still in-
10 creased in dimensions and in slope, so as to maintain the limit
11 pressure at all stages and not exist beyond. This usually in-
12 creases the section of the dam so much that the resultant comes well
13 within the middle third and not at the middle third after that.
14 The outcome of it all is at any level the dam will not overturn,
15 will not crush.

16 Q In your drafting the design of the Hollywood Dam, did
17 you consult many authorities?

18 A Consulted all the authorities available at that time.

19 Q I will ask you to state whether or not that plan or
20 design or type or model and the various computations were made and
21 executed with engineering safety?

22 A They were. They were in accordance with the method of
23 design given in the text book by authorities-- Morrison and Brody
24 and by Weighman.

25 Q BY DISTRICT ATTORNEY: You speak of the factor of
26 safety. As a representative of the Water Board, you know any
27 gravity type dam, let the water level reach the top of the dam, the
28 application of safety is to have spillways at the top of the dam.
29 That is the first application, the application of safety. I am
30 asking you the question.

31 A The custom is to design a dam to the full height, and
32

1 set the water level at the same level below the height.

2 Q In the application of safety, spillways are built at the
3 top of the dam?

4 A Yes, usually at the top of the dam.

5 Q The atmospheric pressure is 1867 feet above sea level in
6 Los Angeles County?

7 A Is quite changeable. As I stated, I didn't design the
8 particular dam, am not qualified on that dam.

9 Q You took into consideration the atmospheric changes in
10 the Hollywood Dam?

11 A I did, and can testify as to the Hollywood Dam and the
12 conditions there.

13 Q Would you tell the jury what you did in relation, as a
14 factor of safety, the atmospheric conditions of Hollywood?

15 A With reference to the spillway?

16 Q With reference to the structure that you put up?

17 A In reference to the structure we put in Hollywood, the
18 atmospheric pressure on both sides of the dam was the same for the
19 same level, the weight of water in this particular altitude, and
20 for this particular temperature is about 62.4 pounds per cubic foot--
21 62.5 was used in the design. The spillway was designed by Mr.
22 Mulholland, which I had nothing to do with. I left the dam after
23 it was eighty feet high in its construction.

24 Q What other elements would you take into consideration,
25 in relation to the factor of safety?

26 A I would take in relation to the factor of safety, take
27 the situation below the dam site.

28 Q You cited Mr. Weighman on dam construction?

29 A Yes.

30 Q Isn't it a fact that Weighman and every other dam
31 builder lays it down as a proposition that a gravity dam can't be
32

1 safely constructed in such a gorge as the St. Francis Dam, except
2 the walls themselves are of solid rock, or of a substance equal to
3 the strongest shale?

4 A As to the St. Francis Dam, I am not familiar.

5 Q As to any dam, doesn't Weighman lay down the proposition,
6 and doesn't every other dam builder lay down the proposition that a
7 dam can't be constructed with a factor of safety, except the walls
8 to which it is anchored are of solid rock?

9 A They must be of rock.

10 Q Or of the strongest kind of shale?

11 A That is correct I believe.

12 Q When shale is used, they must go deeply into the walls?

13 A You are asking a question of which I have had nothing to
14 do with. It is a matter of good practice in the designing of dams,
15 or in the construction of dams, that they be constructed on a
16 foundation that is substantial for the dam.

17 Q And that is where the factor of safety is applied to
18 the dam?

19 A The factor of safety is applied as against crushing,
20 overturning, sliding on the foundation.

21 Q The overturning point of a dam is counteracted by its
22 moment of resistance?

23 A Yes.

24 Q It hasn't anything to do with the factor of safety, the
25 dam is constructed of---

26 A But the overturn moment, should the resultant fall be-
27 low the lower toe, the dam would turn over.

28 Q The lower toe, of course, is lower than the outer toe?

29 A Usually so.

30 Q What would be the effect of leaving the toe above the
31 heel upon the compressive strength of the thing?

1 A On the compressive strength, there would be a slight
2 increase in the compressive strength by elevation on the toe.

3 Q Assuming that the St. Francis Dam was built on a
4 gravity type plan, that it was a hundred and eighty feet high, that
5 it was one hundred and seventy-six feet at the base, that the toe
6 was elevated, the outer toe something like that (indicating), and
7 set on a side hill, that the volume of water it was ~~xxxx~~ designed
8 to support, built as a gravity dam, with a base of ninety feet,
9 would be one hundred and eighty feet, and one hundred and eighty
10 feet, the horizontal pressure that is here (indicating) would be
11 nearly nine hundred tons, wouldn't it?

12 A The horizontal pressure at one hundred and eighty feet
13 would be about---

14 Q Let us figure it out. If we multiply one hundred and
15 eighty by one hundred and eighty, would be thirty-two thousand four
16 hundred, and divided by two, would be about sixteen thousand two
17 hundred pounds, and multiplying that by sixty-two and one half
18 pounds, would give you the horizontal pressure?

19 A That is your computation. My own would be done in this
20 way: I would take the pounds per square inch or square foot at the
21 top and bottom, take the mean and multiply it by the area over which
22 it covers. The pounds per square foot or square inch varies as to
23 the height.

24 Q If the volume of water was inclined back eight or nine
25 miles, would it have any difference?

26 A No difference whatever.

27 Q If you wanted to make the load upon it so it would be
28 safe from overturning, you would increase this line (indicating) to
29 one hundred and seventy-six feet, rather than to ninety feet?

30 A For overturning, an increase in the base is an increase
31 in safety from overturning.
32

1 Q The moment you increase it at the base, you decrease its
2 resistance to the stress?

3 A No, we added an additional weight on the dam, additional
4 load.

5 Q And this load upon the dam reached a limit of elasticity--

6 A I think that is correct.

7 Q And you stay within the limit of elasticity-- you designed
8 this at Hollywood for twelve tons?

9 A Designed it for twelve tons per square foot in the upper
10 toe, with the reservoir empty.

11 Q I ask you what the compressive strength---

12 A Ten tons on the lower toe with reservoir full. It
13 didn't reach that however until it got almost to the bottom.

14 Q Would there be any reason why the St. Francis Dam, with
15 that long base, had water put in it before it was completed---

16 A I am not qualified on that.

17 Q Would it be possible that it was placed in there to keep
18 the dam from crushing at the rear end of it, at the heel?

19 A No, I wouldn't think that would be done at all.

20 Q As I understood you, in answer to your counsel, you said
21 when the dam was empty, the greatest crushing---

22 A On the upstream toe.

23 Q And when it is full, it is overturned?

24 A Transferred to the downstream toe.

25 Q When it is empty, built as this dam was built on a side
26 hill out of this material, wasn't it likely to crush down here (in-
27 dicating) unless you put something back of it?

28 A I am not familiar ^{how} ~~with~~ that dam was built.

29 Q It was built similar to that?

30 A That is your statement, I don't know as to the cross
31 section how it was built, I don't know.

32

1 Q BY THE CORONER: May I ask you what these lines on this
2 drawing (indicating) mean?

3 A These lines you ask for represent several steps shown in
4 the profile, each one showing at a different--- five foot contours.

5 Q What are these vertical lines (indicating)?

6 A These are the contours themselves.

7 Q In other words, these vertical lines indicate the sides
8 of the canyon there?

9 A They represent the sides of the canyon before stripping.

10 Q And the terminals, these horizontal lines running
11 parallel up to the top of the dam, indicate---

12 A The lines themselves represent the steps, terminals,
13 simply end at the contour before stripping. As stripped, they are
14 carried into the bedrock until such a point as considered firm.

15 Q Is it your understanding from this drawing, it was
16 planned to place the dam exactly as is shown on this drawing, or to
17 end steps at different places?

18 A No, no, this is purely a draftsman drawing of the dam on
19 the location for computing the volume of it. He had no way of tell-
20 ing how far they would go into firm bedrock.

21 Q So the construction engineer in building the dam would
22 follow?

23 A He would follow it as far as the terminal and beyond
24 until he thought it was suitable formation.

25 Q But he wouldn't be required in following this plan to
26 go as far into the hill?

27 A This plan and each one of the lines steps right at the
28 hill.

29 Q Does this show how deeply into the sides of the canyon the
30 ends were keyed?

31 A No.

32

1 Q I show you this photograph, does that show the ends of
2 the dam were keyed into the side of the canyon?

3 A Apparently it ^{does,} ~~was~~ I wasn't there at the time, so I
4 couldn't testify first hand, but apparently this is a dam and shows
5 in the midportion of it they have gone in further, a little further.
6 Whether that is the extreme limit, no way of telling from the
7 photograph.

8 Q BY A JUROR: Do you know what coefficient friction was
9 used in the St. Francis Dam?

10 A I don't in the St. Francis, sixty-six and two thirds on
11 the Hollywood.

12 Q Is it possible to get what the coefficient friction was
13 of the St. Francis?

14 A I imagine Mr. Wilkinson can.

15 Q I notice Mr. Bailey, in these other two dams, the Arrow
16 Rock and Elephant Butte, both built cutoff walls, both at the up-
17 stream toe, somewhere in between that and the downstream, is that a
18 quite common practice?

19 A That is common practice. The Hollywood on this
20 particular cross section has a cutoff wall near the upstream, just
21 didn't happen to be put on there. This was a cross section taken
22 for comparative purposes. The construction engineer who con-
23 structed the Hollywood, Mr. Jacks, will give you first hand in-
24 formation on that.

25 Q In designing the dam, you lay out the method of taking
26 care of shrinkage, stresses, keys and grouting?

27 A In the Hollywood, that was Mr. Mulholland's function
28 entirely. I had to do with the cross sectional profile, as you
29 see there.

30 Q You put the joints in the dam, that is as the concrete
31 is poured it shrinks?
32

1 A Usually shrinks.

2 Q And in shrinking, cracks are very likely to open up?

3 A Correct.

4 Q Isn't it customary in the drawings of a dam to prepare
5 certain intervals where this may take place, and these may later
6 be grouted in?

7 A Many drawings, plans of many engineers, plan shrinkage
8 joints, usually at intervals of about fifty feet, the theory being
9 when shrinkage does come in the cold weather, that to localize
10 joints to particular localities, particular planes, to facilitate
11 later on pressure, grouting. Mr. Mulholland's practice in all
12 his engineering career has been to not so much to let the shrinkage
13 take care of this, take care of it in these irregular tracks as
14 they come.

15 Q Then isn't it also quite customary in dam design to put
16 in certain water stops?

17 A That is so. It happens unfortunately the engineer--
18 don't know his name-- who defends that particular system of water
19 stops, and is very strong for it, is interested in the company who
20 produces the scheme of water stop. In other words, we have
21 another type of engineer, in the designing of dams, is very strong-
22 ly in favor of a certain type. That particular engineer controls
23 the patent of that dam.

24 Q Wouldn't you think if you saw a dam as a monolithic
25 structure, and you didn't prepare places in advance for the
26 shrinkage to take place, then if this dam cracked, any vertical
27 cracks, then that section should have been so designed so that each
28 vertical strip of that dam was secure in itself, that it couldn't
29 slide, couldn't overturn; that should be the case, shouldn't it,
30 each vertical strip should be secure?

31 A As to that Mr. Mulholland in these particular dams looks
32

1 after that particular point, and I wouldn't want to say that is
2 true as a statement, particularly when I know that others have been
3 designed without it.

4 Q Then the examination into the stress, which would take
5 part in that kind of analysis, wouldn't be the function of yourself
6 or Mr. Wilkinson?

7 A No, our function was the cross sectional profile. Tak-
8 ing care of the stress was entirely taken care of by the Chief
9 Engineer.

10 THE CORONER: That is all, you may be excused.
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1 WILLIAM T. HOKE, JR., be-

2 ing first duly sworn, testified as follows:

3 BY THE CORONER.

4 Q Please state your name.

5 A William T. Hoke, Jr.

6 Q Where do you live?

7 A R.F.D. Route 2, Box 62. It is at La Jolla, at the
8 upper end of the canyon.

9 Q What is your occupation?

10 A For the past year and a half I have been retired.
11 Previous to that I followed erecting machinery and structural
12 iron work and various heavy construction, and I have had a great
13 deal to do with mines, etc., for the past thirty odd years.

14 Q You are well acquainted with the St. Francis Dam, are
15 you?

16 A I have been acquainted with it for some thirty-five
17 years, with the San Francisquito Canyon, and was up and down and
18 in and around the dam before the survey there, and at the time it
19 was being made and at the time it was being constructed and up
20 to date, semi-weekly and sometimes daily, with the exception of
21 about six weeks in the month of June, 1926, I was detailed to
22 attend to the setting of some heavy machinery there.

23 Q You are not employed on it?

24 A No sir.

25 Q Did you say that you were there at the time that the
26 dam was located?

27 A I was up and down the canyon at the time the dam was
28 located and in and about the dam all during the time of its
29 construction.

30 Q Will you state to the jury the result of your observa-
31 tions as to the location of the dam, as to how it was keyed into
32 the canyon sides and the foundation at the bottom.

1 A Previous to answering I might state that I was parti-
2 cularly interested in the dam due to the fact that a man who had
3 been in my employ for some various times, named Eddy Hendrick,
4 was employed on the dam, and, naturally, following that particu-
5 lar line of work, I was very much interested in it. I moved in-
6 to San Francisquito Canyon in May or June, 1922. I was employ-
7 ed here in the city at the time and made weekly trips to my
8 place there and sometimes semi-weekly trips. On each occasion
9 going up and down the canyon I would make various investigations,
10 being interested in minerals, formations and so forth.

11 Q What was the formation at the site of this dam?

12 A I can answer that better by producing for you some
13 specimens that I have that were taken under the axis of the dam
14 on Saturday---- lets see, on Tuesday after the dam failed, and
15 on last Friday I picked these pieces up from the stakes, which
16 I supposed had been set by the engineers there as the axis of
17 the dam. Those specimens show the different formations that
18 are still there after the dam failed and were there at the time
19 that the dam was---

20 Q Point out to the jury where you got each of these.

21 A That would be almost an impossibility. All of this
22 material came from below the present westerly wing which is still
23 in place. From there down to the footing of the part which is
24 still standing. It has been said by previous witnesses that
25 there is no clay in the mountains there. I will submit that to
26 any geologist as to whether that is clay or not (witness holds
27 a specimen of rock in his hand).

28 Q Do you know whether it is?

29 A It is wood, which in time, as I have had explained, has
30 become Fuller's earth.

31 Q BY MR. DENNISON: That is what they put in candy. A
32 statute in this state forbids its use in candy?

1 A It is not in a state of perfection but age would bring
2 it gradually to what is known as Fuller's earth.

3 Q BY THE CORONER: That is pumice stone?

4 A It is a poorer grade of talc, which is known as soap-
5 stone, and there is some graphite. You can break it very
6 readily and it will dissolve in water, and it is very slippery
7 and slimy when it becomes wet.

8 Q This was all taken from the westerly wing of the main
9 portion?

10 A Yes sir.

11 Q From just east of the abutment at the side of the main
12 channel?

13 A Yes sir.

14 Q You say that was part of the foundation of the dam on
15 the west side?

16 A It is a part of it. It is there in places. That
17 formation can be found in abundance there, at this time.

18 Q AS the dam was being constructed and the first work
19 being laid there, did you notice how far into that formation
20 the dam was set?

21 A In one or two instances, I stepped and went in and
22 about the work, and I would say that, to the best of my recollec-
23 tion, that there was no hydraulicing done until the foundation
24 and curtain dam, as we often called it, had been poured up to
25 the level of the dam, or, in other words, to the valley floor
26 of the canyon. Then, from my observation, they hydraulicied
27 these both sides of the canyon, the walls of the canyon, took
28 them off very clean, as far as the hydraulic pressure would go,
29 and they, to my knowledge, from my observation, I don't think
30 that the dam was heaved or sunk in to any portion of the walls of
31 the canyon.

32 Q It was just laid up against the walls after they were

1 cleaned off?

2 A As I remember it, yessir, and I think that I remember
3 it clearly. I might add to that that there were some deeper ex-
4 cavations made on the westerly side of the canyon than where it
5 was left after the hydraulic apparatus had been used.

6 Q Did it occur to you, with your knowledge of such
7 things, at this time, that this dam was being installed in a
8 careful and prudent manner?

9 A I would, in answer to that, say this; that I don't
10 think after placering and driving drifts into the walls of that
11 canyon, going as far back as thirty odd years ago, that any rock
12 or formation in that canyon would support a dam of that size be-
13 low power house one.

14 Q By that, do you mean to say there is no safe location
15 for a dam of that size in that canyon?

16 A I would say that a cube of rock in that canyon cannot
17 be obtained that has not faults or fissures in it, that would
18 average
19 support ten tons.

20 Q You are not a geologist?

21 A I have no knowledge, only common knowledge, and re-
22 ferring to various engineering books, and data, that is often-
23 times referred to by engineers.

24 Q But you have had practical experience in mining?

25 A Yes sir.

26 Q And you know that country pretty thoroughly?

27 A I think I know it as well as anyone living soul today,
28 having been there since the age of six years old.

29 Q Up to the 12th day of March last, did you make any
30 special observations of seepages or leaks from the neighborhood
31 of the dam?

32 A I have a date fixed by a certain---- in a certain way
that I could refer to as the first of February. I noticed it
particularly at that time, and in and about that time, that some

1 time previous to that that the water had been turned into the
2 dam and it has raised to a greater height than it had at any
3 previous time during the past year, and I noticed on the westerly
4 side of the canyon that the seepage was gradually increasing.

5 Q I will show you this photograph. Will you indicate
6 just where you noticed that seepage? Here is a larger closeup
7 view of the same thing, and maybe you can see it better there.

8 A Yes sir, from that I can answer any questions you wish
9 to ask.

10 Q Where did you locate that leak or seepage that you
11 alluded to?

12 A Now, gentlemen of the jury, I would say that this is
13 the little house up on the top of the dam where the control of
14 the gates was taken care of. I would say somewhere in this
15 neighborhood right along starting about here (indicating) there
16 was such a crack as would naturally occur in concrete, being
17 jagged off in this westerly direction. There was a crack in here
18 (indicating), and quite a crack here (indicating) which had been
19 caulked with oakum and afterwards grouted, I believe. At this
20 point where this square abutment---

21 Q BY THE CORONER: Indicating the abutment at the west
22 end of the main structure?

23 A At this point right close to where the dam broke, from
24 this west wing, there was another crack. Any of these cracks
25 that I speak of, gentleman, you could easily put a pencil in,
26 from that on up you could put your little finger in that. There
27 still remains in this masonry another crack; I would say that
28 crack is in the neighborhood of one hundred or a hundred and
29 twenty-five feet in a westerly direction from this little square
30 abutment, which was set in back of the dam, and over here (indicat-
31 ing) is another crack still in evidence, and further on than this
32 little picture there are two cracks.

1 Q BY MR. MOHR: Referring to the west dyke?

2 A Both have been caulked with oakum. Now, to go over
3 there, I am going to tell you gentlemen, on Saturday previous to
4 the dam failing, I was in about this dam for reasons, which I will
5 explain to you later, and I noticed this: There was water, not
6 ebbing, but running out from here (indicating) down ^{through} to this can-
7 yon here on into the bottom here (indicating), and from this
8 little square abutment where the dam still stands, from there on
9 down clear to within twenty or twenty-five feet of the bottom,
10 there was a seepage all along this wall, and there was also a
11 seepage just beyond this, and at this point (indicating). I think
12 there is still evidence there. Right in here (indicating) on
13 this road this bank is entirely caved off and covers all of this
14 road. This road from here on down, on Saturday, to about this
15 point, was impassable to a pedestrian, due to the fact that these
16 banks had slid and the moisture was so pronounced, and it was
17 muddy and slippery, and on and in about this place here (indicat-
18 ing) down to this canyon which comes in from a westerly direction,
19 it was very moist. I did not notice only just a little bit of
20 seepage from the easterly side of the dam. Out here (indicating)
21 there was a coming a clear stream of water, which is the drain
22 pipe installed to carry away the seepage and relieve the pressure
23 on the dam, which I believe, is ordinarily installed on dams. I
24 am not an authority on dams--- and through this cement ditch which
25 was going down here (indicating), I should judge--- I have only a
26 little experience in measuring water--- the water here on Satur-
27 day was running about a foot deep and I would say six feet wide
28 in the ditch, carrying the water away from the dam. On Sunday
29 I came back between the hours of eight and eight-thirty and notic-
30 ed a great increase of water here and also a large increase of
31 water here (indicating). On Monday on returning to the city with
32 my mother, I noticed that the water was much muddier and the flow

1 at least seventy-five to one hundred percent greater than it had
2 been at any previous time, and went on down here (indicating) and
3 was decidedly muddy, and it was seventy-five to one hundred per-
4 cent more water than was running on Sunday. These specimens are
5 from directly under the axis of this dam, from this point to
6 here (indicating) and they are to be found there in abundance
7 to date.

8 Q BY THE CORONER: When you were there on Saturday,
9 Sunday or Monday, did you talk to anybody at the dam?

10 A I had a conversation there on Saturday.

11 Q Who did you talk to?

12 A A man by the name of Tony. We called him "Harnessmak-
13 er".

14 Q Were you well acquainted with him?

15 A I knew him for some two or two and one-half years.

16 Q Did you always talk to him when you went by there?

17 A Not always. I always talked to him when I stopped
18 there.

19 Q What did you stop to see him for on that occasion?

20 A I went there for a little social fishing. It was a
21 common custom for the employees around the power house to go
22 fishing in the lake, which, of course, was against the existing
23 ordinance. We cheated a little bit, but it was a common prac-
24 tice among we boys there.

25 Q What did you intend to do on this particular day?

26 A I had some friends coming from Bakersfield on the
27 following week and I thought I might arrange for a little fish-
28 ing party.

29 Q So you talked to Tony Harnischfeger at that time?

30 A Yes sir.

31 Q Did you talk to him about anything besides fishing?

32 A Well, as you do when you meet anybody. Nothing that I

1 can recall.

2 Q Did you have any conversation with him about the con-
3 dition of the dam?

4 A In some respects, I did, yes sir.

5 Q What was said?

6 A I said, If something don't happen between now and
7 Wednesday I will go down there. I said, She looks pretty rotten
8 and he says, Yes, she looks bad. I said, I am much surprised
9 that you boys are staying in and about under this dam, and he
10 says, I have made a few little remarks, perhaps I have talked
11 too much, it has been referred to me that if I keep on talking
12 in the manner I have, I might not retain my position.

13 Q Did he say who he talked to?

14 A No sir. He mentioned no name, and to corroborate that
15 statement I want to give you a man's name by the name of Henry
16 Hensinger.

17 Q Where does he live?

18 A In Culver City. He is now about forty or forty-five
19 miles from Ludlow and I think I am the only man that knows where
20 he is. We are on a mining proposition.

21 Q Just when did you talk to Tony, on Monday?

22 A Saturday. I had no conversation with him either on
23 Sunday or Monday.

24 Q Did he express any fear or show any anxiety about the
25 condition of the dam?

26 A Only said, if she is here Wednesday, why I will come
27 down and we will go out. I might make that a little clearer.
28 There are things that we ought not to do, which don't mean very
29 much. I am awfully sorry that Tony is not here. It was common
30 practice for myself and Mr. Lew Burns, the deceased, and an
31 uncle of mine from Bakersfield by the name of Edward Gibbet, and
32 others---- it was our practice to get the boat and go over on the

1 westerly side of the dam and stay there and fish, and Tony would
2 come back. If things did not look just exactly clear we would
3 go out there and Tony would stay there and fish.

4 Q We want to know what you observed there about the con-
5 dition of the dam. Was the dam, in your opinion, ⁱⁿ such an un-
6 sound condition that it seemed to be alarming to you?

7 A To confirm that, I am a little venturesome and don't
8 think I am chicken hearted--- on Monday morning, as I was coming
9 back with my mother down in Dry Canyon, my mother heaved a sigh
10 and I said, that is the last time I am going to drive up the San
11 Francisquito, and that night I went around Boquet Canyon, and the
12 next morning I was ready to leave for the desert when news came
13 to me around 6:30 or 7:00 o'clock and we proceeded to the scene
14 of the disaster.

15 Q Did you feel that the dam was so unsafe that people
16 living below it should be warned the last time you were up there,
17 before it went out?

18 A I talked to two or three of my friends, regarding the
19 dam, and they said I was getting childish.

20 Q What are their names?

21 A Lyman Curtis, Harry Burns and Lew Burns. I told them I
22 would get out of this death trap, it did not look good to me,
23 and they said, you are getting old and childish.

24 Q He evidently did not feel any apprehension?

25 A I think this feeling existed.

26 Q He did not say so?

27 A No sir. I think he had the utmost confidence in his
28 superiors to know whether that dam was safe.

29 Q BY MR. SCOTT: Did you ever do any masonry work on a
30 dam?
31

32 A Never had any connection with a dam in my life.

Q I believe that you said that you did some mining in that

1 canyon?

2 A I placered in there in 1910 and 1911 with a man by the
3 name of Leon Surray.

4 Q From what point?

5 A About the Ragia Place away on up the San Francisquito
6 Canyon to the summit of Bee Canyon, and on up to the old stage
7 Station, or in that vicinity, which is now the property of
8 Russell Lodge.

9 Q What method of placering did you use?

10 A By excavating to the hard surface, which is commonly
11 known to a place miner as bed rock.

12 Q Right in the stream bed?

13 A Yes sir.

14 Q Did you drive any drifts?

15 A Not at that time. I have driven drifts and I have been
16 in several drifts in and about the canyon a short distance from
17 the present dam.

18 Q You were in that canyon when they went to built the St.
19 Francis Dam, were you not?

20 A I was in and about the canyon.

21 Q You never notified Mr. Mulholland or anybody not to
22 build it there?

23 A I am not a meddlesome character.

24 Q Did you notify them?

25 A No sir.

26 Q Did you ever build a dam in your life?

27 A I said no, in answer to your previous question.

28 Q You believed this dam was unsafe the other day when you
29 were up there?

30 A I did.

31 Q You were pretty sure of it after you had talked to Tony?

32 A In my mind, I was.

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Q Pretty sure of it?

A Yes sir.

Q And you came back there on the following Wednesday with some friends, came up the whole length of that canyon and got behind the dam and got in a boat to fish?

A That was not necessary.

Q Were you going to fish in a boat on the dam?

A No sir.

Q You were uneasy about it?

A Somewhat, yes sir.

Q You had made arrangements to go fishing on the dam that you were uneasy about its going out?

A Yes sir.

Q On this very body of water?

A Yes sir.

Q You never notified anybody that the dam--- that you were uneasy about it and it might break at any time?

A I notified two parties that were coming down from a little town north of here, not to come. I wrote them on Sunday.

Q Which side of this dam went out first?

A I was not there, I did not see it. It was my opinion that the westerly side went at first.

Q BY MR. MOHR: Did I understand you to say that there was no hydraulic work done there until the curtain had been set in the canyon?

A To the best of my recollection, the hydraulic work and derrick work was done after the dam was brought up to the extreme level.

Q Do you know for sure?

A I am real positive about that.

Q Did I understand you to say that no hydraulic work had been done until after the curtain?

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A To my observation.

Q Were you away from it while that curtain was being built?

A If you will remember just what I said about weekly and semi-weekly trips to the canyon----

Q You don't know whether, as a matter of fact, there had been any hydraulicing done when you were away from the canyon?

A I said that I did not, to my observation, see any done.

Q BY MR. DENNISON: Have you been up there since?

A Yes sir, twice.

Q I want to ask you this: Have If you made any observations up there?

A I made observations on Tuesday, on the day that the dam failed. On the Monday, I think it was, the 13th of this month.

Q Did you see any of the pieces which were in the dam, down the stream or lying around there?

A Some quite a distance down and some on the easterly side, right up close.

Q Did you go right up close to any of these?

A Yes sir.

Q Did you notice any of the hill formation adhering to the concrete?

A Yes sir, particularly on Friday last.

Q Where was that piece of concrete that you noticed?

A You asked me if part of the bed rock adhered to it?

Q Yes.

A I wish to correct that answer--- I did not.

Q Did I understand your answer to the Coroner, that when this concrete was placed in there it was placed right up flat against the hill, just poured up against it?

1
2 A On the easterly side I think there were some precau-
3 tions taken but no key, as has been mentioned. The tunnel was
4 driven there without my seeing it.

5 Q I am talking about the west side, did they just put
6 the concrete up against the hill?

7 A It was cleaned off in a manner.

8 Q After it was cleaned off it was put up against it?

9 A Yes, it was poured against a formation such as still
10 exists.

11 Q Do you know what red porphyry is?

12 A I think I do.

13 Q Have you some there?

14 A There is none here.

15 Q That is what they call serpentine. Did you ever see
16 any of that up there?

17 A Yes, it exists in the San Francisquite Canyon.

18 Q Did you observe it there and where was it?

19 A There is quite a bank of it there on the dyke that
20 runs down on the westerly side of the canyon.

21 Q Where the dam was?

22 A No sir, not right where the dam is. I don't think it
23 exists there. If it does I did not observe it. I would say
24 for the jury's benefit that from my estimation, that on the
25 westerly side of the canyon seen from where the dam abutted to
26 the canyon wall, that since the dam failed there has been prob-
27 ably one hundred to a hundred and twenty-five feet of that hill
28 gone, that at the time when the dam was originally set in---
29 probably a hundred and twenty-five feet from where the dam was
30 tied into the original native formation, and on the westerly
31 side I would estimate that there is from fifteen to twenty-five
32 feet of the original dyke gone from where the dam sat originally
and from where the break is still standing the water is now
running from fifteen to twenty^{feet}/lower than the masonry, which is

1 now standing in the dam.

2 Q Do you know whether there were any slides of earth
3 that you observed previous to the 12th of March in or around or
4 about that dam anywhere?

5 A On the westerly side it slid into the road, that they
6 had in there for construction purposes.

7 Q I mean in the reservoir proper?

8 A Not in the vicinity of the dam, no sir.

9 Q On the east side you did not notice any cavein of
10 earth?

11 A No sir, the earth was not even cracked.

12 Q That road went over the dam on the east side?

13 A Yes sir.

14 Q Did you notice anything about the dam out of the
15 ordinary?

16 A Not at the dam site.

17 Q Above it?

18 A There has been an action there for four or five years
19 above that.

20 Q What kind of an action?

21 A It has slid from the mountain side into the reservoir
22 reservoir, and at the time the dam failed it slid on down for
23 perhaps eight feet further.

24 Q At this time that you were with your mother and your
25 mother heaved a sigh, you then, instead of coming to the dam,
26 you took another road?

27 A We were on our way to the city at that time and when I
28 returned I went around Boquet.

29 Q How did you get from where you were? What kind of a
30 road did you take?

31 A Up through the Boquet Canyon.

32 Q Where were you when your mother heaved a sigh?

1 A On our road to the city, on the summit between Dry
2 Canyon and San Francisquito Canyon coming in a southerly direc-
3 tion into the city. We came from Dry Canyon into Saugus and
4 through San Fernando down into the city, and on the return I
5 took the Bequet Road in going home.

6 Q And in order to do that you took the Bequet Road and
7 climbed over the hills?

8 A What is known as the Lafolla cut-off.

9 Q Is that a shorter road?

10 A It is to my home.

11 Q Did you take it because it was a shorter road, or be-
12 cause you were afraid of that dam?

13 A The distance is practically the same. I took it be-
14 cause I had told my mother it was my last trip up the San Fran-
15 cisquito Canyon.

16 Q BY THE CORONER: I will show you this piece of mater-
17 ial. Do you recognize that as part of the formation you found
18 up there?

19 A (Witness scrapes the specimen with his knife) I will
20 show that these two pieces of rock are of the same nature.

21 Q Is that like the formation which was under the west
22 wing of this dam?

23 A This piece came from under the west wing of the dam,
24 (At this point the witness put on a pair of colored glasses) No,
25 they don't resemble one--- (witness puts on Mr. Dennison's
26 glasses) Yes, I would still say they are the same nature.

27 Q BY MR. DENNISON: Did you say that that stuff you
28 have there will dissolve in water?

29 A This will dissolve in water. It becomes very soft.

30 Q What other parts?

31 A Any of them. This piece will dissolve in water. There
32 is only one piece here, I think, that will not. Like any soap-

1 stone or talc.

2 Q How about the big piece?

3 A I don't think that will so readily dissolve but it
4 softens. It becomes spongy. Not exactly spongy---- not
5 brittle. You would think that the water in a manner makes it
6 awfully easy to break.

7 Q BY MR. DENNISON: I don't quite understand where you
8 were when your mother heaved a sigh?

9 A You are familiar with the geography of the country.
10 In going to Harry Carey's Ranch you turn to the left and go into
11 Dry Canyon to the easterly side of the San Francisquito.

12 Q You did not give any particular weight to the fact
13 that your mother heaved a sigh, after what you said you observed
14 around there?

15 A Yes sir.

16 Q What was that?

17 A My mother had cautioned me as to her opinion as to
18 the dam's safeness, to travel in the San Francisquito, and when
19 she heaved a sigh I realized that she was mighty glad that she
20 had gotten out of the San Francisco Canyon.

21 Q BY MR. MOHR: Referring to photograph SF 52, I ask the
22 witness if he saw any trench work of that kind being done on the
23 west side?

24 A I would say that I seen this particular part, from
25 here up and down here, I would not say---- I will tell you why----
26 I made six or seven trips to that dam about the time that dam
27 was that height, regarding the purchase of some hay. I had about
28 a hundred and fifty tons of hay out from under cover and I never
29 seen Mr. Danham in these seven trips about the dam.

30 Q You observed no work of that kind being done on the
31 west side?

32 A Just the upper portion where the dam was filled in.

1 It was probably a third of the way up from the valley of the
2 canyon.

3 Q About these road slides, how far up north or in a
4 northerly direction from the dam site, were these road slides?

5 A Quite a little bit over a mile.

6 Q And these slides were there before the dam went out?

7 A Yes sir.

8 Q How long before did you notice that those slides occur-
9 ed in that road?

10 A I think it was the first time I went over it, which
11 was early in April. I had heard there was a slide there and it
12 was in a northern direction from the dam.

13 Q At that particular place, how far is that road from the
14 reservoir?

15 A Down to the water?

16 Q Yes, approximately.

17 A It is quite a distance. I would say that it was prob-
18 ably eighty or ninety feet above the level of dry water.

19 Q How far from the dam is the road back?

20 A In and around one hundred feet.

21 Q Did you notice any other slides in the road, or any
22 other breaks in the mountain side up there, beside this one?

23 A In along and about the road, no sir.

24 Q You don't know, of course, how that slide occurred?

25 A No sir, I do not.

26 Q In your opinion, how did it occur?

27 A Naturally there must have been something below there
28 that went out and left it without earth to support it and it slid
29 on down until it met with sufficient resistance to hold it.
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2 **PAUL H. CAUGHREN, being**
3 **first duly sworn, testified as follows:**

4 **BY THE CORONER.**

5 Q Please state your full name.

6 A Paul H. Caughren.

7 Q Where do you reside?

8 A 598 West Wilson, Glendale, California.

9 Q What is your occupation?

10 A I haven't any at present.

11 Q Were you in the St. Francis Dam disaster?

12 A No sir.

13 Q Are you a refugee?

14 A No sir.

15 Q Were you acquainted with the dam?

16 A I was on the dam on the Sunday prior to its going out.

17 Q How did you happen to be there?

18 A Just going up in the canyon and looking around.

19 Q Did you take any pictures while you were up there?

20 A No. I have a friend that did take a few pictures on
21 the dam.

22 Q Who was this friend?

23 A Mr. Allen.

24 Q Did he take any pictures of any leaks or any water
25 flowing from the dam?

26 A I don't think so.

27 Q Did you see any leaks while you were there?

28 A A few, yes sir.

29 Q Where?

30 A On the east side in particular, and on the west side.

31 Q How much water was coming from the place on the east
32 side of the dam?

A I could not say. Quite a little stream coming out on

1 the east side.

2 Q Coming through the concrete or coming from the hill
3 adjacent to the concrete?

4 A From the hill next to the concrete.

5 Q How high up was it?

6 A Approximately about eight or ten feet from the top of
7 the dam because I leaned over the rail and was watching it.

8 Q You did not go down into the canyon to observe this?

9 A No sir.

10 Q Did you have any apprehension that the dam was unsafe
11 at that time?

12 A No.

13 Q Did you talk to anybody up there about it?

14 A No sir.

15 Q You did not meet Tony Harnischfeger up there?

16 A I did not see anybody around the dam.

17 Q Were you surprised when you learned that the dam had
18 gone out?

19 A Yes sir.

20 Q You did not expect it to go out?

21 A I cannot say that I did.

22 Q You don't know anything about its construction, I
23 suppose?

24 A I happened to be up there several times while they
25 were building it, but did not pay any particular attention to
26 it.

27 Q You are not an expert in that line?

28 A No sir.

29 Q You don't know whether it was located there and con-
30 structed in a careful, skillful and prudent manner?

31 A I don't know, I am sure.

32 Q You were merely up there on a pleasure trip?

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A Yes sir.

BEN ALLEN, being first

duly sworn, testified as follows:

BY THE CORONER.

Q Please state your full name.

A Ben Allen.

Q Where do you reside?

A Saukecenter, Minnesota.

Q Where are you living here?

A Temporarily at 436 West California Street, Glendale.

Q What is your occupation?

A I am unemployed at present.

Q Were you with Mr. Caughren on the 11th day of this month at the St. Francis Dam?

A Yes sir.

Q Did you observe anything there that indicated that the dam was in danger?

A We noticed the water running out of the west side. We were on the east side side and did not pay any particular attention to it.

Q Was there much water?

A Oh, a small stream.

Q You took some pictures there?

A Three, yes.

Q Did you take any of this small stream that you mentioned?

A No, just two pictures out on the dam and one of the dam itself.

Q From what you saw there did you have any fear that the

1 dam was likely to go out?

2 A No, I cannot say that I did.

3 Q Have you had any experience in such matters?

4 A No sir.

5 Q And that is the only time you have been up there?

6 A Yes sir.

7 Q And you know nothing about its construction or founda-
8 tion, and so forth?

9 A No sir.

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13 AUGUST FERRIER, being

14 first duly sworn, testified as follows:

15 BY THE CORONER.

16 Q Please state your full name.

17 A August Ferrier.

18 Q Where do you reside?

19 A Newhall Avenue, Newhall, California.

20 Q What is your occupation?

21 A I am interested in oil lands and mineral lands, mining
22 claims and one thing and another.

23 Q Are you well acquainted with the St. Francis Dam?

24 A I have been up through the canyon and gone up and down
25 there for the past forty-five years.

26 Q Do you know when the dam was built up there?

27 A I do.

28 Q Did you see it under construction?

29 A Before construction and after construction. When
30 they were constructing it or since they have constructed it, I
31 have not gone very often up there.

32 Q You don't know how it was built?

1 A No sir, only by hearsay.

2 Q Were you in the flood caused by the breaking of the
3 dam?

4 A I was not.

5 Q Did you lose any property up there?

6 A No sir.

7 Q Were you at the dam just prior to the 13th of this
8 month?

9 A I was, yes sir.

10 Q What day were you there?

11 A I went through the canyon about the middle of December
12 of last year.

13 Q Was that the last time you were up there?

14 A Yes sir, about three months ago.

15 Q Was the dam leaking then?

16 A I noticed a crack in the dam and on the west side of
17 the dam in the wall alongside of the dam, I noticed a seepage of
18 water there that was the color of the stone, with a diameter of
19 twenty-five or thirty feet, more or less.

20 Q You ^{don't} mean that the size of the crack was thirty feet
21 in diameter?

22 A No, I was on the road at that time, and I suppose I
23 must have been away from that wall about three hundred feet, may-
24 be two hundred, and I noticed that about fifty feet from the
25 bottom of the runway of the dam or fifty feet up against the
26 wall there, it showed a seepage for about thirty feet in diameter.

27 Q You did not go over there to examine it?

28 A No sir.

29 Q You saw it across the canyon?

30 A I saw it across the canyon.

31 Q And that is the last time you saw the dam, three months
32 ago?

A Yes sir.

1 Q Do you think you know what caused this dam to go out?

2 A I don't know whether it was premonitions or other
3 things. I remarked to the man that was with me, a man by the
4 name of Joe Kidder--- he works for the Gas Trip Trumbull,--- I
5 said, "Joe, some day that dam will bust and there will be the
6 devil to pay".

7 Q When did you tell him that, last December?

8 A Yes sir.

9 Q Did you ever tell anybody else that?

10 A Well, I don't think I have.

11 Q Did you ever tell the officials of the Water Department
12 that you felt that the dam would break some day?

13 A No sir.

14 Q That was a premonition you had more than actual know-
15 ledge?

16 A Well, knowledge of the--- I had been going through
17 that canyon for forty-five years, and have been interested in
18 mining claims around there. I have got some about a mile and
19 a half southeast of the dam now, and I made a close study --- I
20 was interested in some oil lands in Section 26, of the same dis-
21 trict, and I made a close study of the geology of that canyon,
22 and know the topography of all that country surrounding that dam
23 there.

24 Q Are you a geologist?

25 A I am not. I am read up on geology but I have been in
26 the field studying up quite a bit.

27 Q You do feel that you do know the formations in that
28 particular canyon very well?

29 A Yes, in a general way.

30 Q Was it because of your knowledge of the geology of the
31 country there that you felt that dam would go out some day, or
32 was it just a premonition, as you said a few minutes ago?

1 A I knew that some thirty years ago very close to the
2 dam somebody put a tunnel there from four hundred to five hundred
3 feet further south of the site of the dam in a soft formation,
4 consisting of what we call Graphite and a low grade of talc.
5 We worked with a pick. In that slate formation there is a streak
6 of such stuff, sometimes a foot or two feet or more or less.
7 The proposition in that country and considering that formation---
8 the slate and the mica schist all may be broken and possibly
9 suspecting that there might be a chance of that under the wall
10 of the dam, that there might be one of those pockets, and taking
11 into consideration the infiltration of the water in that forma-
12 tion and the saturation of the soil, there was a possibility
13 that leak or that seepage might get bigger---

14 Q Did you ever give your ideas and opinions to Mr. Hul-
15 land or any members of the Water Board?

16 A No sir.

17 Q You knew that they were figuring on putting a dam
18 there so long before they started the work?

19 A Oh, yes.

20 Q But at no time did you attempt to advise them as to
21 the conditions you knew to be there?

22 A No sir.

23 Q Did you at any time warn any of the people who lived
24 below the dam, that the dam was liable to go out at any time?

25 A Two or three days before it went out there was one
26 woman,--- one of the Rivera Brothers had been married to a
27 woman by the name of Garcia, ^{that} He was working at the dam. I told
28 her, My child, you better come and live at Newhall. What would
29 you do if that dam should break, you will be drowned like a rat,
30 and she says, Papa, I can run. At any rate I will make prepara-
31 tions tomorrow to come to Newhall to look for a house and will
32 move to Newhall. This was two or three days before the dam

1 broke.

2 Q Was she lost in the flood?

3 A Yes sir, and her little boy.

4 Q From your knowledge of geology, although you don't pre-
5 tend to be an expert, I understand----

6 A No sir, I don't call myself a geologist.

7 Q From your knowledge of geology and the geology of that
8 particular location, did it appear to you that any expert should
9 know that that was not a suitable footing or foundation for a
10 dam?

11 A Well, I could not say what other people would know or
12 should know. I know that personally it was not advisable to put
13 in a dam there.

14 Q BY MR. MOHR: Did you have any placer claims in the
15 reservoir site itself?

16 A No sir.

17 Q In passing up the road above the dam site, did you see
18 the land slides and the break in the road?

19 A Yes sir.

20 Q About how far up was that?

21 A When we came down the last time I went up---- I have an
22 iron claim up there that I called La Jolla. We went up through
23 Hoquet Canyon and came back through the San Franciscoite Canyon.
24 Therefore, in coming down, Joe Kidder---- I made Joe Kidder notice
25 this slide. I told Joe Kidder, Look at that formation, how slipp-
26 ery it is, that slide occurring, and I think I mentioned that to
27 him, if we had a very rainy winter most of that road will go down
28 into the dam on account of the slippery condition of the ground.
29 That rock has more or less talc mixed up with it to make it
30 slippery, and graphite.

31 Q Did you see any other slides or breaks in the earth
32 formation up the canyon?

1 A Not as big as that. I don't believe I noticed any
2 other.

3 Q How full was the reservoir the last time you saw it?

4 A It looked to be twenty or twentyfive feet of reaching
5 the top, maybe five feet more or less.

6 Q Did you see the reservoir full prior to this time in
7 December?

8 A I have seen it about half full before it happened.
9 That was quite a bit before.

10 Q You have never seen it any fuller than ~~just~~ about half
11 full?

12 A Yes, at that time it looked to be about twenty-five
13 feet of reaching the top of the dam.

14 Q Now, from your knowledge of geology as a practical man,
15 will you give us your opinion as to which side of the dam went
16 out first?

17 A I don't know. In my opinion I should think that the
18 west side would go first.

19 Q BY MR. DENNISON: You base that upon something, don't
20 you?

21 A Upon ^{character} ~~the~~/~~rock~~ of the formation surrounding it, under
22 and surrounding the dam. The only solid formation in that
23 country is north of the dam. (At this point the witness pulled
24 a newspaper map out of his pocket and explained the formations
25 to the jury).

26 Q BY THE CORONER: What is this (handing the witness a
27 specimen of rock which the witness scraped with his knife)?

28 A It looks like clay, but I don't believe it is clay,
29 unless something else is mixed up with it. (Witness takes a
30 specimen out of his pocket) This is what we call mica schist.
31 This is what we call slate,

32 Q Where did you get that?

1 A Just a mile and a half southeast of the dam.
2 Q This did not come from the dam?
3 A No, that is from the top formation. This is in the
4 neighborhood of the dam.
5 Q Can you identify this piece of material?
6 A It looks like Fuller's earth. It is pretty gritty.
7 There might be some clay in that.
8 Q What is that red conglomerate you speak of?
9 A Like this (indicating).
10 Q The top formation then, on the west side of the canyon,
11 was like this (indicating)?
12 A Some kind of porous conglomerate. It is pretty red.
13 Q BY MR. DENNISON: What is the general course--- you
14 know where the dam was--- what is the general course of the grain
15 or fissures or strain or strata along there, if you know, or do
16 you know what I mean?
17 A Apparently there are three zones in there, starting at
18 Charley Canyon clear up to and running east and west, at least
19 fifteen miles, you will encounter first what we might call a
20 slate formation. After the slate formation comes that slide
21 formation. It is slightly broken--- it is very broken. Then
22 after that the next zone is a clay mica schist getting harder
23 as you near the granite. The clay mica schist will split and
24 you cannot find in that first zone of mica schist--- you cannot
25 find very big pieces. Two feet square is the most that you can
26 find.
27 Q Do you know what a fault is?
28 A Yes.
29 Q Was this dam constructed on what is known as a fault?
30 A If it is a fault, it is a very minor fault.
31 Q What is a fault?
32 A A fault is a break in the formation. A fault is a

1 slip or break in the formation. I don't know, except the San
2 Gabriel and the San Andreas fault---- I don't know of any other
3 fault.

4 Q BY MR. SCOTT: When you speak of faults, do you mean
5 earthquake faults?

6 A No sir.

7 Q Or just a break?

8 A A break in the formation.

9
10
11
12 FRANK LE BRUN, being
13 first duly sworn, testified as follows:

14 BY THE CORONER.

15 Q Please state your name.

16 A Frank Le Brun.

17 Q Where do you reside?

18 A Newhall, California.

19 Q What is your occupation?

20 A Laborer.

21 Q What do you know about the St. Francis Dam?

22 A I worked there for a while.

23 Q On the construction?

24 A Yes.

25 Q What work did you do?

26 A I was on the steam shovel, slumper on the steam shovel.

27 Q Do you know anything about the construction of the dam
28 that would indicate to you that it was weak in any respect, struc-
29 turally?

30 A I seen a leak on the west side after the water had been
31 turned in; at first it started leaking on the west side about sixty
32 to eighty feet from the top. It is a slate rock.

1 Q From the top or bottom?
2 A From the bottom up.
3 Q Towards the west side of the dam?
4 A Towards the west side of the dam.
5 Q Where did the leak appear to be, through the concrete
6 or at the end of the concrete?
7 A Between the concrete and the mountain.
8 Q Where the two came together?
9 A Yes.
10 Q Was it east or west of the abutment at the west end of
11 the main portion of the structure?
12 A That would be south of the abutment.
13 Q Will you point it out here on this photograph?
14 A About here (indicating) on the left side. It is a
15 slate formation.
16 Q How much of a leak was it?
17 A When I saw it it was not much of a leak.
18 Q When was that?
19 A About three months ago.
20 Q Did you see any stream of water coming through it?
21 A Not a stream, just a seepage.
22 Q How much of that ground was wet?
23 A Where this road went up on the west side and seeping
24 through almost to the road, it was wet.
25 Q Did you tell anybody about that condition when you were
26 up there?
27 A No, I could see across from the east side of the canyon.
28 Q Do you know Tony Harnischfeger?
29 A No.
30 Q Did you ever talk to him?
31 A No.
32 Q Did you talk to Mr. Ely about it?

1 A No.

2 Q Did you ever talk to any of the boys up at the dam?

3 A No, just went through there.

4 Q Did you feel any fear that the dam might go out because

5 you saw that leak?

6 A No.

7 Q Did you at any time express any fear that the dam might

8 go out?

9 A No.

10 Q Do you know any reason why it went out?

11 A Because they did not put the wings far enough into

12 the mountain.

13 Q How do you know that?

14 A Because I seen it excavated and there were no wings.

15 Q How were the ends of the wings placed?

16 A Hydrauliced and then removed the top just a little bit

17 and then just bared poured the concrete over it right next to

18 the hill.

19 Q Did you see any work like that? Did you see any ex-

20 cavation like that?

21 A I hardly understand it. That is an excavation by

22 the steam shovel under the dam.

23 Q The extreme west end is this wall that runs out to

24 the extreme west end of the canyon?

25 A I guess it is.

26 Q This high portion up to the abutment, did you say

27 that there was no excavation?

28 A Only about sixteen feet from the deepest part.

29 Q I am talking about the main portion of the dam?

30 A There was a little excavation done around here on

31 benches, and then it was cleaned off by hand.

32 Q Do you mean as each five foot form went in it was set

1 in a little bit?

2 A Yes.

3 Q How far did they go into the hill?

4 A Not very deep, not over sixteen feet.

5 Q Did it go as much as sixteen feet into the hill?

6 A No.

7 Q How far did it go?

8 A Accordingly. All the way from two feet to sixteen
9 feet. It varied. Some places was hard and some places softer.

10 Q Did it go to the hard rock?

11 A It was a sort of rock, but it was not hard rock. It
12 was more of a slate rock on the bottom and the top red clay.
13 They cut into the red clay as far as the shovel would go and then
14 cut it up by hand. What the shovel throwed out was clay.

15 Q And you were operating the shovel?

16 A No, I was a pit man.

17 Q And you were right there to see everything that the
18 shovel took out?

19 A Yes. That was all a sort of red clay there.

20 Q So that the west wing of the dam was set up on this
21 red clay?

22 A It went through the red clay and then they got to
23 this kind of a formation. That is where the concrete was put.

24 Q Do you know this? Are you sure that is the kind of
25 stuff that the concrete was poured against?

26 A Yes sir, that is the kind of stuff which was on top
27 of the ridge. From here up this way (indicating).

28 Q What is it down here (indicating)?

29 A (No response).
30
31
32

1 Q BY DISTRICT ATTORNEY: This ditch they dug twenty-five
2 feet wide along the hill---

3 THE CORONER: You can see that is the top of the hill.

4 THE DISTRICT ATTORNEY: The dyke as I understand ran along
5 the top of the hill, and then ran down the hill.

6 Q BY THE CORONER: What kind of material did you get when
7 you excavated for the footing on the west side of the main part of
8 the dam?

9 A Eighty feet from the bottom excavated by hand, hydraulic
10 that, then built the road, got up to the top on slate rock.

11 Q Didn't use the steam shovel at all?

12 A Not downhill, on the bottom of the creek used the steam
13 shovel.

14 Q Do you know the definite formation underlying the west
15 wing of the main portion of the dam?

16 A Right in here (indicating on photograph), this formation
17 was the same formation as we had awhile ago. First we got on top,
18 it was red clay. Right on top of this (indicating) is slate rock.

19 Q Did you see the forms poured for that all the way up the
20 hill?

21 A When I was working up here (indicating) I used to go up
22 and look over there.

23 Q How deep did it go into the rock formation on that west
24 hill?

25 A Not over six feet, not along in here (indicating).

26 Q Did any of these forms go in less than six feet?

27 A Forms five feet high.

28 Q How far did it go into the formation?

29 A To the edge of the rock.

30 Q Where it struck something hard, stopped there?

31 A Stopped right there.
32

1 Q BY DISTRICT ATTORNEY: You were pickman. What is a
2 pickman?

3 A When the shovel moves-- at the head of the tracks.

4 Q There is a photograph, it shows on this thing, "St.
5 Francis Dam, January 14, 1926," the extreme west end of the dam.
6 We have been talking about the dam, talking about the dyke, did you
7 see the steam shovel digging a ditch up that west hill?

8 A I was in the pit.

9 Q Is it true, or is it not, that they just dug a ditch
10 above the hill?

11 A Dug a trench on top of the hill, four by sixteen feet.

12 Q The hill comes down like Mr. Nance's desk. Did they
13 start down at the bottom of that hill and dig a ditch up to the top?

14 A No, right up here (indicating) to this abutment, and dug
15 up right over the hill.

16 Q I want to find out what was done coming down that hill?

17 A That was hydrauliced with water.

18 Q Do you know what that hill was composed of?

19 A Below from there (indicating) it was kind of rotten
20 slate rock.

21 Q What was the top of it?

22 A That other formation, red formation.

23 Q This red formation, can you see where it was on that
24 picture?

25 A Started about in here (indicating), all the way up, it
26 was red formation.

27 Q Was that true, the hill, right straight through ~~was~~ it?

28 A Didn't go clean through.

29 Q The full width of the hill?

30 A Yes.

31 Q How deep was that formation?

32

1 A The deepest part, sixteen feet.
2 Q Any excavation made on the hill?
3 A On the side of the hill, from here up (indicating).
4 Q BY MR. SCOTT: How deep did they dig to bedrock in the
5 center stream, on the bottom?
6 A The deepest place about thirty feet to bedrock.
7 Q Were you there then, did you see that work done?
8 A I did.
9 Q Did they do that with a steam shovel?
10 A The top of it, the lower side cut with a steam shovel,
11 and then went down by hand, went down to what they called bedrock.
12 Q You saw it?
13 A I was close there.
14 Q Was it bedrock?
15 A I say it was bedrock, kind of soft stuff.
16 Q Thirty feet down. Were you there when they poured the
17 cement on that?
18 A I seen it done.
19 Q What particular piece of work did you have to do?
20 A I was on the steam shovel close by, I was pickman, had a
21 steam shovel with a track on it, caterpillar track.
22 Q Then it would dig along there?
23 A Dig, and everytime it moved, I cleared ahead of it so
24 the steam shovel could move.
25 Q Did the steam shovel move uphill on the west side?
26 A Worked on the bottom at first.
27 Q Did you see them digging out, keying on the west side?
28 A No keys.
29 Q Did you see them dig to bedrock on the west side?
30 A Next to bedrock.
31 Q How wide was it going up the west side, as wide as this
32 room?

1 A I couldn't hardly say how wide it was.

2 Q Where they come out of the steep part of the canyon, as
3 wide as this room?

4 A Steam shovel didn't dig to the side, just dug to the
5 bottom.

6 Q How far towards the west side did the steam shovel dig?
7
8 A Lower end of the core.

9 Q The men dug with pick and shovels?
10
11 A Yes.

12 Q About how wide a place did they dig?
13
14 A About eight feet wide, went down about thirty feet in
15 the center.

16 Q I show you this, how wide is this here (referring to
17 St. Francis Dam, showing progress during construction, S.F. 42)?
18
19 A About one hundred feet across.

20 Q Did they dig it out above this place (indicating) with
21 pick and shovel, dig the rock out of the side of the hill?
22
23 A Hydraulised and then cleaned it off with pick and
24 shovel.

25 Q Then going back to that question, state whether or not
26 the men dug out with pick and shovels here, this rock on the west
27 side of the foundation for the dam?
28
29 A Yes.

30 Q How wide?
31 A The width of the dam.

32 Q About how wide was that?
33 A Guess started about one hundred feet wide at the bottom.
34 Narrowed as they went up.

35 Q How deep would they dig that, beginning from the bottom?
36
37 A It is pretty hard rock, wasn't over six feet that I
38 know of.

1 Q Would it vary at some places?

2 A Some places shallower.

3 Q And that was continued on until the top of the hill,
4 that was to the top?

5 A That was to the top.

6 Q From six feet to what depth onto the top of the hill?

7 A One place here (indicating). When they get up to
8 here (indicating), the steam shovel started here, and then they
9 cleaned up here (indicating) dirt, red stuff here (indicating).
10 The steam shovel took this and then cleaned it by hand.

11 Q From six feet to twenty-five feet?

12 A When it got up here (indicating).

13 Q BY THE CORONER: What is the extreme depth this was
14 bored into the hill there?

15 A No depth at all, just took the top dirt off and smoothed
16 it by hand, couldn't be over ten or fifteen feet, then it varied.

17 Q BY MR. MOHR: Were you on the top when they did the
18 hydraulic work?

19 A I was working around the steam shovel, working on the
20 road.

21 Q The road was built?

22 A Yes.

23 Q Were you there during the construction of the curtain?

24 A No, I don't understand.

25 Q After the road was constructed, what was the first work
26 done in the canyon?

27 A Hydrauliced the sides.

28 Q Hydrauliced the sides down before they did any digging?

29 A Yes, then the steam shovel took out what was
30 hydrauliced down to the bottom.

31 THE CORONER: That is all, you may be excused.
32

1 ROE FORSYTH, being first duly sworn,
2 testified as follows:

3 BY THE CORONER:

4 Q Please state your full name.

5 A Roe Forsyth.

6 Q Where do you reside?

7 A I am staying at Saugus now, been there for the past year.

8 Q What is your business or occupation?

9 A Cook.

10 Q Mr. Forsyth, were you at the St. Francis Dam just prior
11 to the time it collapsed?

12 A I was up there Sunday, the eleventh of March.

13 Q Who were you with?

14 A With my sister and niece, up there on a trip.

15 Q Had you been up there before that?

16 A I had been up there at Camp "C". You go part of the way
17 up and around the dam and on a hill above the dam.

18 Q On either of these occasions, at any time, did you notice
19 anything about the dam that looked suspicious?

20 A No sir, I didn't.

21 Q Did you notice any leaks?

22 A I noticed a seepage. I was right on the dam Sunday,
23 walked clear across it, noticed seepage on the west side.

24 Q About where (referring to photograph)?

25 A On the west side here (indicating), right along in there,
26 seepage I noticed, didn't pay any particular attention to it.

27 Q Was there much water coming out of it?

28 A No.

29 Q A stream of water?

30 A No.

31 Q Was there much in that formation shown on the west end
32

1 of the main portion of the dam, was it very wet?

2 A I don't hardly remember, only remember some seepage
3 there.

4 Q Did you notice close enough to satisfy yourself where the
5 water was coming from?

6 A No sir, never gave it a thought.

7 Q Didn't see the water coming through the concrete itself?

8 A No sir.

9 Q Did you talk with anybody up there except your own
10 party?

11 A No sir.

12 Q Did you know Tony Harnischfeger?

13 A No, I am not very well acquainted there, only just
14 around Saugus.

15 Q Did you have any fears, experience any fears in con-
16 nection with the dam?

17 A No sir.

18 Q Never heard any rumors about its condition?

19 A No sir, not until afterwards.

20 Q You don't claim to know anything about its construction?

21 A No sir.

22 Q Didn't work on it?

23 A No sir.

24 Q Have you any information that would help this jury to
25 decide what caused it to go out?

26 A No sir, I haven't.

27 Q BY DISTRICT ATTORNEY: Did you ever have any conversation
28 with your sister?

29 A Well, only just in a laughing and talking way. We were
30 just up there for a trip.

31 Q You had worked on a dam that fell once, yourself?
32

1 A No sir-- well, I lived up there.

2 Q Did you ever work on a dam that after it was completed
3 fell?

4 A No sir.

5 Q In Altonah County?

6 A In Duchesne County, there was a dam went out there, I was
7 about eight years old when it went out.

8 THE CORONER: That is all, you may be excused.

9
10
11 RUSSELL B. BURNS, being first duly
12 sworn, testified as follows:

13 BY THE CORONER:

14 Q Please state your full name.

15 A Russell B. Burns.

16 Q Where do you reside?

17 A Elizabeth Lake, California.

18 Q What is your business or occupation?

19 A Farmer.

20 Q Were you well acquainted with the St. Francis Dam and
21 its surroundings?

22 A I passed there several times.

23 Q When were you last there before the thirteenth of this
24 month?

25 A Saturday, March 10, about half past ten in the morning.

26 Q What did you see there on that date?

27 A My boy was talking. I went Friday night and stayed all
28 night, and coming home on the west side of the dam, there was half
29 the road where it used to run alongside of the dam caved in, about
30 half of it, and I says "Harry what is doing all that," some water
31 running down off the side. He says "That is a little seepage
32

1 through there." "Of course," he says "Oh you fools, it is silly."
2 I don't know anything about a dam, anything of that kind, but any-
3 body could see that road, had to build a road about fifty feet be-
4 low on up the hill.

5 Q Were any of your relatives in the flood?

6 A I had seven.

7 Q Was this son you speak of in it?

8 A Yes sir.

9 Q Was he employed there?

10 A Yes sir.

11 Q In what capacity?

12 A In the power house.

13 Q He had his family there?

14 A Yes sir.

15 Q When you spoke to him about the condition of the dam,
16 he didn't seem to feel any fear that the dam would go out?

17 A No, he made fun of us.

18 Q Did he say anything about how long that seepage had
19 been in evidence there?

20 A I asked him how long that road had been out. He says
21 quite awhile, didn't seem to want to talk to us at all, made fun
22 of us.

23 Q Did you know Tony?

24 A Yes sir.

25 Q Did you talk to him about it?

26 A No sir.

27 Q So far as you know then there was no general fear in the
28 camp about the condition of that dam?

29 A Never ^{heard} ~~heard~~ much talk about it.

30 Q How often did you see your son Harry?

31 A I would go down about once a month, then I would go to
32

1 the power house, stay over night, sometimes a couple of days, once
2 a month, sometimes twice a month.

3 Q At no time did they express any concern about the dam?

4 A No.

5 Q Have you any knowledge now that would assist this jury
6 in determining why it went out?

7 A No sir, I don't know a thing about it.

8 Q BY DISTRICT ATTORNEY: When you went up there Saturday
9 morning, was Atmore with you?

10 A Yes sir, Harry Burns and his wife and two children.

11 Q You were on the east side of the dam?

12 A Yes.

13 Q You looked over and saw the water?

14 A Saw that hole right close to the wing on the west side,
15 where the road used to be, a hole there looked like from the road
16 maybe ten feet across, couldn't see how deep. Asked him what
17 caused that, he says a leakage seeping through up there.

18 Q Then did you say you better get out of there?

19 A No, Atmore did, says "Harry, you better get out and
20 move your family, and Louis too."

21 Q Did Harry reply "I can't do it"?

22 A He says "You old people are getting foolish," Ted and
23 myself.

24 Q That was on the tenth?

25 A Yes.

26 Q Harry and his wife and children were drowned?

27 A Yes sir.

28 Q How old was Harry?

29 A Thirty-three.

30 Q How old was Atmore?

31 A Fifty or fifty-one.

32

1 Q BY THE CORONER: Your other son, Louis, was married also?

2 A Yes.

3 Q Any family?

4 A One child.

5 Q BY MR. MOHR: Did you notice a slide into the reservoir,
6 or the breaking away of a road northerly from the dam site?

7 A I know there was a place there, there was a slide, don't
8 know how far it was, had a danger sign there. You mean going up,
9 following the dam-- there was a danger sign there, and road fixed a
10 little further east.

11 Q How far was that from the dam site?

12 A I don't remember.

13 Q Approximately?

14 A Probably a mile. I was always kind of shaky when I went
15 over that road. My boy used to tell me "Why don't you shut the
16 door?" I would leave the door open.

17 Q Did you see any such other breaks in the road on the
18 mountain side, except that?

19 A Generally had a lot of people working on the road--
20 seemed like there was a slide there. There was a lot of people
21 working maybe a mile and a half or three quarters-- seen a lot of
22 shovels there, didn't see them working.

23 Q Have you been by the dam site since the dam went out?

24 A No, I was on top of the hill, spillway where the water
25 ran down.

26 Q Have you been on the west road or east road since the dam
27 went out?

28 A Yes, Tuesday morning I went down early, up to where the
29 water ran down to Power House 2, but you couldn't get the road where
30 the dam was.

31 Q Did you look across the canyon to see whether or not that
32

1 slide in the road you had noticed on Saturday was still there?

2 A It is right there now.

3 Q The slide in the road now is the one you were referring
4 to when answering Mr. Nance's questions?

5 A Yes sir.

6 Q BY DISTRICT ATTORNEY: Were you referring to the road
7 being out on the west side of the dam?

8 A Yes sir, about where the wing---

9 Q Will you point it out, point out to the jury where it was?

10 A This is it (indicating on photograph), this wing starts
11 up here (indicating), right along in here the road follows up, half
12 slipped out.

13 Q Do you remember looking at this portion of the hill (in-
14 dicating) when you were going up that morning?

15 A No, there was just one time, just happened to look across
16 there.

17 Q Your attention wasn't attracted?

18 A Wasn't paying no attention.

19 Q Did you see any water at all?

20 A Seemed to be some water running right down from inside of
21 here (indicating) close to the dam. Ted says "Look at that water."

22 Q Where was that water, was it along that thing on top of
23 the hill?

24 A Yes.

25 THE CORONER: That is all, you may be excused.

26
27
28
29 OLLIE BURNS, being first duly sworn,
testified as follows:

30 BY THE CORONER:

31 Q Please state your name.
32

1 A Ollie Burns.

2 Q You are the wife of Mr. Burns, who just testified?

3 A Yes sir.

4 Q Mrs. Burns, were you with your husband the last time he
5 made a trip up to the dam?

6 A No.

7 Q When were you last up at St. Francis Dam?

8 A Three weeks ago day after tomorrow.

9 Q Who went with you at that time?

10 A Louis Burns, I and Mr. Bross.

11 Q Did you go up to the dam at that time?

12 A Went up the road on the east side of the dam.

13 Q Did you observe anything about the dam?

14 A The only thing I saw was that red hill, looked like it
15 fell into the road.

16 Q Did you see much water there?

17 A Like that place on the wall (indicating), just like it
18 had seeped through the cement (witness weeping).

19 Q I show you this photograph of the dam. About where did
20 you see that water that appeared to be coming through the cement?

21 A Looked to me like it was right up in here (indicating).

22 Q Towards the west end of the main portion of the dam?

23 A Yes, and I said to Louis "Look at that water coming
24 through the cement," just a seepage, how it would be on the wall,
25 didn't seem to be any water running down.

26 Q What did he say when you made that remark?

27 A He didn't answer me.

28 Q Did you discuss it any further with him?

29 A Well, as we come down from the other side of the road,
30 from the dam this way (indicating), going north, there was one or
31 two places in the canyon where the road swerved around, looked to
32

1 me as though the water was about that high (indicating).

2 Q That was right by Harry Carey's?

3 A No, going north, going that direction home, going up the
4 canyon.

5 Q Did you have any discussion with any of your relatives
6 or sons or their wives about how they felt about the condition of
7 the dam?

8 A I said to Harry one time, "Supposing that dam will
9 break, what will you do?" He says "I will run up on top of the
10 hill behind the house," quite a little hill behind Harry's house.

11 Q Did you ever try to get him to move out of the canyon,
12 on account of the condition of the dam?

13 A Don't remember saying anything like that to him.

14 Q They expressed no fear to you?

15 A No.

16 THE CORONER: That is all, you may be excused.

17
18
19 HENRY L. KING, being first duly sworn,
20 testified as follows:

21 BY THE CORONER:

22 Q Please state your name.

23 A Henry L. King.

24 Q Where do you reside?

25 A I am above Saugus about four miles in a garage, staying
26 there.

27 Q What is your occupation?

28 A Mechanic.

29 Q Where were you at the time the St. Francis Dam went out?

30 A I was in Los Angeles.

31 Q Had you been up to the dam previously, soon before that?
32

1 A About three months ago, I went over the road above the
2 dam. The last time I seen any part of the dam to look at it was
3 about nine or ten months ago.

4 Q Do you know anything about its condition just recently?

5 A No, I don't.

6 Q Have you talked with anybody who worked up there, that
7 gave you any information about the condition?

8 A Not lately.

9 Q Did you have any reason to fear the dam might go out?

10 A No, I didn't have any reason that I was sure of, except
11 my own opinion.

12 Q How did you get your opinion?

13 A Working there.

14 Q What did you do?

15 A I was on the grizzly.

16 Q How long did you work on the grizzly?

17 A I worked for the City about a year and four months, and
18 most of the time put in on the grizzly.

19 Q What was there about that work that gave you an opinion
20 that the dam was probably not as it should be?

21 A There was considerable dirt in the gravel that was taken
22 out of the main canyon below the dam site. Of course, I don't
23 know anything about concrete, except that was the only job I worked
24 on concrete, except a few little jobs where we always used washed
25 gravel, and was sure it was clean.

26 Q What was your job on the grizzly?

27 A Breaking rocks part of the time, and part of the day
28 shevelled dirt through. We was supposed to keep the dirt out and
29 shovel gravel through.

30 Q Did you try to do that?

31 A We did it as near as we could.
32

1 Q Did some of the dirt get through in spite of your best
2 efforts?

3 A It stands to reason-- I didn't see the dirt go through--
4 didn't any of us see the dirt go through, but it stands to reason
5 dirt would get through.

6 Q You didn't see it?

7 A The gravel was dirty, I know that.

8 Q That was what kind of dirt, silt?

9 A Silt mixed with gravel.

10 Q A large quantity of that?

11 A No, any truck that was brought up with a large quantity
12 was dumped down below before it was brought up. We noticed it and
13 it was sent down below and dumped.

14 Q Did persons in charge of the work there endeavor to keep
15 the materials that went into the concrete as free from dirt as
16 possible?

17 A Yes.

18 Q In spite of that, some dirt got in?

19 A Yes sir.

20 Q You are sure some got in?

21 A I wouldn't swear to it, because the only way I could
22 swear to it was that the gravel was dirty. What we couldn't get
23 out would naturally go in.

24 Q That is your only reason for feeling there might be some
25 structural irregularity of the dam?

26 A I did work on the foundation part, didn't start to work
27 there until the dam was up about sixty feet, so I don't know any-
28 thing about the foundation under the main body, but the foundation
29 on the sides, the anchorage, the only way I figure it out was they
30 just cleaned the soft dirt out, and when they got down hard, where
31 they couldn't get it out with picks, called it bedrock.
32

1 Q Did they get into that bedrock or just pour the con-
2 crete against that rock?

3 A Looked to me like they poured the concrete against the
4 rock, didn't go into it.

5 Q Didn't make any excavation in the rock, other than take
6 out the outside surface, soil, loose rock, whatever might be there?

7 A That is all I could see.

8 Q BY DISTRICT ATTORNEY: When you saw that, did you have
9 any conversation with anybody at work about it?

10 A Just a general conversation between the men working
11 there.

12 Q Do you remember any particular ~~xxxxxx~~ individual that
13 you talked to about that thing?

14 A No.

15 Q Was your father working there?

16 A Yes, he spoke to me about it.

17 Q What did he say?

18 A He said he wouldn't live in the canyon if they gave him
19 all the ranches in there. He said he didn't think the sides were
20 put in bedrock as an anchorage, no foundation on the sides.

21 Q What was your father's business there?

22 A General laborer.

23 Q Do you know whether or not he has followed that kind of
24 work for any length of time?

25 A Not on dams, just laborer around concrete mixers and
26 things, buildings.

27 Q Did he quit there?

28 A Yes sir.

29 Q When?

30 A I believe it was September, 1926.

31 Q As I understand they just laid the thing up against the
32

1 side of the hill?

2 A Against the side of the hill, what they called rock.

3 Q What kind of rock did you see there?

4 A I couldn't tell you what kind, don't know anything about
5 rock, but looked to me it was red color, and when it got wet, seemed
6 to me kind of soapy, like clay.

7 Q That was the kind of thing they put the concrete against?

8 A Yes.

9 Q BY THE CORONER: Both sides?

10 A I never paid any attention to the east side.

11 Q BY DISTRICT ATTORNEY: Who was superintendent there?

12 A Stanley Dunham.

13 Q Was he there when they were doing that?

14 A Yes.

15 Q Who else?

16 A Bill Lindsay was head boss under Dunham, and Mr. Jackson
17 was my superior boss.

18 Q Do you know Mr. Mulholland?

19 A I seen him there, he wasn't there all the time, would
20 just come and go.

21 Q Were you there when it was cuddled into one of those
22 hills?

23 A No sir.

24 Q BY MR. MOHR: Showing you this photograph S.F. 40, I ask
25 you if you ever saw any excavation in the hillside such as shown on
26 that photograph?

27 A This is the east side. I didn't pay much attention to
28 the east side.

29 Q Did you ever see any excavation ~~xx~~ of that kind on the
30 top anywhere, east or west?

31 A Yes sir, that type of excavation, after they cleaned the
32

1 other side off, the west side, cleaned the dirt down about that
2 width, down to the rock as that shows.

3 Q You did see an excavation on the west side, some such
4 excavation?

5 A Such as I can make out on that.

6 Q Calling your attention to photograph S.F. 43, did you
7 see any excavation such as shown on the west side on that
8 photograph?

9 A Yes sir.

10 Q And you did see some excavation on the west side?

11 A Yes sir.

12 Q Calling your attention to photograph S.F. 35, did you
13 see any such excavation on the west side?

14 A I did on the main ditch, but there is a hole here (in-
15 dicating), don't remember seeing.

16 Q Then you did see some excavation on the west side?

17 A Yes sir.

18 Q Showing you photograph S.F. 55, calling your attention
19 to the excavation made on the side of the hill there, did you see
20 any excavation similar to that?

21 A It is similar to what I saw, but I can't quite make out--

22 Q You did see excavation such as you saw on the right hand
23 side of that picture?

24 A I seen excavation on that order, only it was further
25 back on top of the hill, instead of into the bank.

26 THE CORONER: That is all, you may be excused.

27
28
29 HENRY REIZ, being first duly sworn,

30 testified as follows:

31 BY THE CORONER:

32 Q Please state your full name.

1 A Henry Reiz.
2 Q Where do you reside?
3 A Staying in Saugus now.
4 Q Where did you live before the St. Francis Dam Broke?
5 A San Francisquito Canyon.
6 Q Where did you live in the canyon, how far from the dam?
7 A About four miles below the dam.
8 Q Were you familiar with the conditions at the dam just
9 before the thirteenth of this month?
10 A Yes sir, I passed there every day.
11 Q Did you work up there close to the dam?
12 A I was working in construction camp No. 1.
13 Q For the City?
14 A Yes.
15 Q What did you see there at the time, prior to the time it
16 broke, anything that made you feel uneasy?
17 A Yes, leakage on the westerly side there, kind of got on
18 my nerves for awhile, leaking badly towards the last, then there
19 was a leakage on the eastern side too, made me feel uneasy.
20 Q Did you examine those leaks yourself?
21 A I went up, drive a truck for this camp, brought the
22 school children down to school in the morning, came on down to
23 Saugus, went back up to the camp, then in the afternoon I came back
24 down after the school children. When I was going down after the
25 school children, it was a little early. Sometimes I stopped there,
26 went across the dam, looked at those leaks. Towards the last it
27 kind of got on my nerves, leaking so bad.
28 Q Did it seem to be leaking a greater quantity of water?
29 A Yes, then ^{when} I went back on the western, the ground was
30 soaked there, didn't like that very well, and the road was sliding
31 down too. The reason they was building the new road up there, I
32

1 guess was on account of this road washing away, falling down.

2 Q When you saw these evidences of the dam leaking, did you
3 speak to anybody about it?

4 A Only my folks.

5 Q Didn't speak to Tony?

6 A No.

7 Q You knew Tony?

8 A Yes.

9 Q Did you speak to anybody else there in authority at the
10 dam or at the power house?

11 A No.

12 Q What did you say to your folks about it?

13 A Told them it was awful dangerous there where they was
14 living.

15 Q You were living there with them?

16 A Yes, I stayed up in camp towards the last.

17 Q Where were you on the night of the twelfth?

18 A I was at the construction camp.

19 Q Is that above the dam?

20 A That is above the dam.

21 Q And your people were all out there but you, down in the
22 canyon?

23 A Yes sir.

24 Q And you were not in the flood yourself?

25 A No sir.

26 Q Did you ~~warn~~ warn your people that they had better get
27 out of the canyon?

28 A Yes, a lot of times, but they never thought, being the
29 power house, first would warn the power house and somebody from
30 the power house would warn them. They always thought that.

31 Q Didn't expect it to go out all at once and nobody have
32 a chance?

1 A No.

2 Q There had been quite a little discussion in your family
3 about it?

4 A Yes.

5 Q And there was some fear, apprehension that the dam might
6 break sometime?

7 A Yes sir.

8 Q Do you know whether that fact was ever communicated to
9 the people in charge of the water department of the City of Los
10 Angeles?

11 A I don't think it was.

12 Q You didn't notify anybody?

13 A No.

14 Q BY DISTRICT ATTORNEY: Mr. Reiz, how many of your family
15 were lost?

16 A Eight.

17 Q Did you work on the dam?

18 A Yes sir.

19 Q Do you remember when they were putting in the walls of
20 that dam, putting it up against the hill?

21 A Yes sir.

22 Q Did you have any conversation with anybody about it?

23 A No, I didn't.

24 Q You are sure of that?

25 A Yes sir.

26 Q Did you see how it was put up against the hill?

27 A I seen it was hydraulised up the sides, and then cement
28 was laid right up against it.

29 Q You mean by that they had a hose there?

30 A Yes sir.

31 Q How large a hose was it, a garden hose or fire hose?
32

1 A It was bigger than that.

2 Q Was somebody washing the hill down?

3 A Yes sir.

4 Q I am talking about the west hill, any excavation made on
5 that west hill, did they do any digging in it?

6 A On top of the hill.

7 Q I mean the incline of the hill?

8 A That was hydrauliced off.

9 Q Did anybody do any~~thing~~ digging in it, did you see any
10 digging being done in it?

11 A Not that I know.

12 Q Did you see the cement placed against it?

13 A Some of it.

14 Q Do you know what kind of stuff was on the top of the in-
15 cline there, kind of material?

16 A No, I wasn't up there. You mean on there---

17 Q My questions are nothing but about the incline of the
18 hill. Did you see what was on the top surface of that incline?

19 A Red rock or something, dirt or rock.

20 Q You were there when the dam was completed, finished?

21 A Yes sir.

22 Q Working there?

23 A Yes sir, I was driving a truck.

24 Q How long before the dam was completed was the water
25 turned into the reservoir up ^{against} ~~in~~ the dam?

26 A The dam wasn't completed when the water was turned in.

27 Q How long-- how near was it to completion, if you can
28 tell us?

29 A I don't exactly remember that.

30 Q But they turned the water in and kept going on up, putting
31 the cement against the side of the hill?

32

1 A Yes.

2 Q How much water did they turn in there?

3 A I don't know.

4 Q As high as a house, as high as the ceiling, or do you
5 know?

6 A No, I don't know.

7 Q Did you notice any leaks there at that time?

8 A No.

9 Q Did you see any bags put in there?

10 A No.

11 Q What did you see that day?

12 A You mean when the dam was getting built?

13 Q Did you ever notice any leak in the dam itself?

14 A Not until after the dam was completed.

15 Q Your name is Henry Reiz?

16 A Yes.

17 Q You made a statement to the sheriff of this county-- I
18 am going to read statement made March 19, 1928, "They started to
19 put water in while they were still building it, and the dam was
20 leaking then." Is that correct?

21 A I don't know.

22 Q Did you make that statement to the sheriff, and if you
23 did, is it true?

24 A Well, I recollect making the statement.

25 Q "Was there any seepage from the base?"

26 A "On each end of the base."

27 Q And did you say that to the sheriff?

28 A Yes sir.

29 Q "A Yes sir, and they put sacks to cork it. Q What
30 kind of material? A Rope." Did you make that statement?

31 A No, I didn't.

32

1 Q Have you told us all you know about this?
2 A Yes.
3 Q You remember making the statement to the sheriff?
4 A Yes.
5 Q Did you tell him everything you knew about it?
6 A Well, as far as he asked me.
7 Q Has anybody talked to you since from the Bureau of Power,
8 or any other source?
9 A No sir.
10 Q BY MR. MOHR: Has anybody from the Water Department
11 talked to you?
12 A No sir.
13 Q BY MR. BOTTORFF: Who was this man who interrogated you
14 and took the statement the District Attorney was reading from a
15 moment ago?
16 A I don't know the party.
17 Q You don't know whether he was the sheriff of Los Angeles
18 County or not?
19 A No.
20 Q Do you know whether he was an agent from the District
21 Attorney's office?
22 A No, I don't.
23 Q BY DISTRICT ATTORNEY: Where were you when you made this
24 statement?
25 A Newhall.
26 Q In what building or where in Newhall?
27 A Sheriff's office.
28 Q Do you know Mr. Hackett, of the Sheriff's office?
29 A I don't know him personally.
30 Q Did you know him on the day you made the statement?
31 A I seen him there.
32

1 Q Was he introduced to you?
2 A No, he just spoke to me.
3 Q Did he talk to you?
4 A Yes sir.
5 Q Did he ask you questions?
6 A Yes sir.
7 Q Did he have a stenographer there?
8 A There was a stenographer.
9 Q Taking down what you said?
10 A Yes sir.
11 Q How many other sheriffs there or deputies?
12 A Just him in the room and a stenographer.
13 Q Mr. Hackett?
14 A Yes.
15 Q Did you see anybody from the District Attorney's office
16 there?
17 A I wouldn't know.
18 Q Did you know anybody from the Water Department being
19 there?
20 A I didn't see any.
21 Q Or the Power Department?
22 A I didn't see any.
23 Q Or the City Attorney's office?
24 A I don't recollect.
25 Q He asked you the questions?
26 A Yes.
27 Q Did you read it ever afterwards?
28 A No, I didn't.
29 Q BY MR. BOTTORFF: This statement about the rope being
30 put in to fill the cracks, do you remember whether you made that
31 statement to this man or not?
32

1 A That statement was asked to me afterwards, after the
2 dam was completed, he asked me that, the statement if I knew any-
3 thing about rope being put in that dam.

4 Q Did you tell him you knew of such a thing?

5 A That I seen rope in the cracks.

6 Q Put in there to stop up the cracks?

7 A Yes sir, long after the dam was completed.

8 Q But not while they were building the dam?

9 A No.

10 Q BY MR. MOHR: Again referring to that rope, was that
11 rope in the cracks on the west dyke of that dam?

12 A No, it was right along in here (indicating), crack of
13 that dyke.

14 Q Were you there when that was put in, do you know whether
15 there was any grouting done on that after that rope was put in?

16 A No.

17 Q Do you know the purpose of that rope being put in?

18 A No.

19 Q BY DISTRICT ATTORNEY: Do you know a man by the name of
20 Jackson up there?

21 A Yes sir, Jackson was a construction foreman there.

22 Q What did he have to do about the sand or gravel?

23 A He had charge of the trucks mostly, and had charge of the
24 steam shovel, and sand and gravel was hauled up there.

25 Q When he would want sand, what did he say about getting
26 it?

27 A A lot of times he would say go out and get a load of
28 dirt, didn't know whether he meant it or not.

29 Q Didn't say sand?

30 A Sometimes he did, sometimes he didn't.

31 Q Where would they get this dirt?

32 A Down the river bed below the dam.

1 Q Do you know anything about him getting dirt out of an
2 alfalfa field?

3 A Used to be an alfalfa field before, and then they dug
4 sand out of that place, old man Copen had an alfalfa field there
5 before the dam was in there.

6 THE CORONER: That is all, you may be excused.
7
8

9 JAMES J. ERRATCHUO, being first duly
10 sworn, testified as follows:

11 BY THE CORONER:

12 Q Please state your full name.

13 A James J. Erratchuo.

14 Q Where do you reside?

15 A San Francisquito Canyon.

16 Q What is your occupation?

17 A Farming.

18 Q Had a ranch up in the canyon?

19 A Yes.

20 Q The ranch was washed out?

21 A Yes.

22 Q Were you in the flood?

23 A I sure was.

24 Q Just where did you live in the canyon?

25 A Just above Mr. Reiz' place.

26 Q Were you familiar with the conditions at St. Francis
27 Dam?

28 A I worked out there.

29 Q What work did you do there?

30 A All kinds of work, what they told me to do.

31 Q Did you do any construction of the dam?
32

1 A Just finishing up.

2 Q You didn't go up until it was almost finished?

3 A No.

4 Q Don't know anything about the way it was put up until

5 they got clear to the top?

6 A Near the top.

7 Q Were you up there recently before the twelfth of this

8 month?

9 A I went through there last summer, the last time.

10 Q You haven't been up in the last month or two?

11 A No.

12 Q Don't know anything about the conditions, of your own

13 knowledge, as they were just prior to the time the dam went out?

14 A No.

15 Q Did you have any conversation with anybody about it?

16 A No, not lately.

17 Q Did anybody ever warn you you had better get out because

18 the dam might go out?

19 A No, no one warned.

20 Q On Monday night, the twelfth of this month, you went to

21 bed as usual, feeling you were perfectly safe?

22 A Yes sir.

23 Q Then what did you realize after that?

24 A I realized the devil was on me.

25 Q Did you hear any noise?

26 A Heard the noise after it was right at the house.

27 Q Didn't hear any noise before that?

28 A No.

29 Q The first warning you had was the noise the water was

30 coming right close to your house?

31 A Yes sir.

32

1 Q Any chance to arouse your family?

2 A No, didn't give them a chance, started out with them,
3 but lost them in the water. The water was right on top, too deep.

4 Q How was your house located, down in the low part of
5 the canyon?

6 A It was right on the edge of the little valley, about
7 seven feet above the floor of the valley, the lowest point.

8 Q Can you help us find out what caused this dam to go out?

9 A Looked like to me it wasn't built strong enough, didn't
10 look good to me.

11 Q When they first built it, it didn't look good to you?

12 A No.

13 Q You said you were not working up there officially at all?

14 A When I seen the top, it didn't look good to me.

15 Q What was the matter?

16 A Just washed the dirt off, just like putting your finger
17 up against a board.

18 Q Was that true all the way up?

19 A I guess it must have been.

20 Q You don't know that?

21 A I seen several times, just the slope washed off.

22 Q Was this before you came to work there, that you had
23 observed that the ends of the dam were put up against the side of
24 the hill, without any channelling, trench or digging into the side
25 of the hill?

26 A Yes sir.

27 Q But in spite of that, you didn't take any precautions
28 to move out of the canyon?

29 A That was my home, and being the power house was there,
30 I thought everything would be OK, didn't realize how it was going
31 to go.

1 Q How long had you lived in the canyon?

2 A Five years.

3 Q BY DISTRICT ATTORNEY: You say you lost your wife and
4 how many more?

5 A A baby and my father-in-law, mother-in-law, sister-in-law
6 and brothers-in-law.

7 Q They were the Reizes?

8 A Yes.

9 Q Did you have any warning?

10 A No warning whatever.

11 Q Do you think if you had been warned on Saturday you would
12 have gotten out of there?

13 A Sure. My wife wanted to go up, and a week before that
14 if I went I might have seen it looked dangerous.

15 Q You were born in that country?

16 A Yes, born up above the dam.

17 THE CORONER: That is all, you may be excused.
18
19

20 ANDREW C. DONAHUE, being first duly
21 sworn, testified as follows:

22 BY THE CORONER:

23 Q Please state your full name.

24 A Andrew C. Donahue.

25 Q Where do you reside?

26 A Saugus, on the Ridge Route, a half mile from Saugus.

27 Q What is your occupation?

28 A Farming.

29 Q Were you familiar with the conditions at the St. Francis
30 Dam prior to the thirteenth of this month?

31 A No sir, I never seen the dam but once.
32

1 Q When was that?

2 A I should judge a couple of years ago, or a year and a
3 half.

4 Q Did you hear anything about its condition that would
5 give you any apprehension at all, any suspicion that something was
6 wrong with it?

7 A I had a suspicion there was something wrong, in fact, I
8 knew there was something wrong. I was farming, farmed Carey's
9 ranch, Carey didn't own only the last part of their ranch, but just
10 a little part where they had their Indian Village, and my son
11 rented that from the Newhall Company, and I farmed over there, and
12 he attended to the place over home, and I was very familiar, farmed
13 that land in 1906, '07, '08, '09, '10 and '11, and was very familiar
14 with the way the water run through that canyon in them years, and I
15 had seen the Otay Dam when it went out, the day after, as soon as
16 we could get to see it. I was at San Diego, and when I seen this
17 dam, in the first place, I and my boy drove up to it. He said
18 "Dad, does this look like the Otay Dam?" I said I never seen it,
19 but seen the wreckage of it. We talked about one thing and
20 another like that, but last winter, I moved there last winter, and
21 farmed, lived there in the house, had a house and barn, that is on
22 what we called the Carey Ranch. We moved away, never moved my
23 family in there, and I and the boys was over there, moved from
24 home, then I went back to harrow for his pasture, and moved on
25 Friday, that is the ninth or tenth, came home Friday and came home
26 every night, but when I was leaving Monday, told my daughter we
27 may stay over there and maybe not, I don't know. About eleven
28 o'clock the water had come down, wondered as to this, came down for
29 a month and a half, and I always supposed it was the San
30 Francisquito Dam, I didn't know. It was raining, a little creek
31 about twenty feet wide, maybe seven or eight deep-- would go down
32

1 to the creek and drink, and this day the water-- it hadn't been
2 raining for a long time-- down as far as my place ---

3 Q BY DISTRICT ATTORNEY: Which day was that?

4 A On Monday. The water hadn't run that far to my
5 knowledge for three weeks or a month. It was dry on Saturday. I
6 wasn't there Sunday. So, when we came back, I went to work and
7 seen the water shining in the creek about eleven o'clock, so I went
8 down, and my man, went over to see him, where we would run the
9 fence across, what tree. I said you can go over to that wire and
10 we will have that pasture all closed in, will bring the stock over
11 tomorrow. He said the water is pretty deep. I says how deep is
12 it? He says considerably deeper than it was last winter at any
13 time. I walked over, looked at it, and says it will be over your
14 boots, a little better, not a common thing. They will turn that
15 off, as I always understood the water came down was turned down
16 into Santa Clara or San Francisquite, surface water. I says we
17 will come over early in the morning, lay the fence across before
18 this water gets down, and I says you can fix up the gate, go up to
19 the house. I drove around the field, came around by the river,
20 and I noticed that the water was running a little more, quite a bit
21 more than it was any time in the winter. I used to drink that
22 water, but this day along about two o'clock, the water wasn't clear
23 by any means, it was very clammy, which it could be by dirt washing
24 in the road or creek.

25 Q BY THE CORONER: You didn't get to the dam itself?

26 A No. So, when I came around in the evening, we went
27 over to the creek, stopped there a minute, and I says to myself
28 there is something wrong somewhere, put my team up, got in the
29 machine and went home about half past five, and the water was run-
30 ning quite a stream of water, sixty feet wide and a foot and a half
31 deep in places.
32

1 Q Did you lose your stock?

2 A No, not there, my mules got out.

3 Q You left because you felt there was something wrong
4 above?

5 A Yes, felt there was something wrong, not knowing where
6 the water came from.

7 Q You didn't have any warning from anybody about the dam?

8 A I heard a young man say one night at Saugus, if I re-
9 member right, he mentioned a boy's name called Ed, heard two boys,
10 drove up in the machine, that is the only thing I ever heard. He
11 says "Well, goodbye Ed, I will see you again if the dam don't break."
12 They drove away and the other fellow walked the other way, and I
13 didn't think anything of it at the time. I didn't know who the
14 parties was, never saw them before. It was just a joking remark,
15 the way it was said. Of course, I saw that dam, the other one, and
16 knew what water could do. I was satisfied if this dam ever broke
17 there would be nothing left of my ranch.

18 Q BY DISTRICT ATTORNEY: As I understand, on this Monday
19 night, when you put your hand into the water, you say that the
20 stream was larger than it was accustomed to be. What was there
21 about the water itself, was it muddy?

22 A The water wasn't as clear as it had been other days when
23 it rained down there, it was of a muddier condition.

24 Q So you packed up and went?

25 A Yes.

26 Q You knew something was wrong somewhere?

27 A Yes, as I said, I thought there was something wrong at
28 the dam.

29 Q Did you connect the ~~fact~~ half in joking and whole in
30 earnest statement of the man at Saugus, that he would see him if the
31 dam didn't go out, did you connect that incident with the thing?
32

1 A Yes sir, I had that in mind. Twenty minutes after the
2 boy had left, I took it more serious at the time, in fact, I was
3 afraid last winter when we lived there. We didn't stay when there
4 was a storm, which I didn't have to. Whenever there was a heavy
5 storm, we came home, because there was nothing to make me stay
6 there.

7 Q BY MR. MOHR: Do you know where Drinkwater Canyon is?

8 A No sir.

9 Q Ever see any water come from any other places in the
10 canyon and flow by your place?

11 A For one year, I was never past the Carey Ranch.

12 Q You were never there to know where the water came from
13 past the Carey Ranch?

14 A No sir.

15 THE CORONER: That is all, you may be excused.

16
17
18 J. E. SHANKLAND, being first duly sworn,
19 testified as follows:

20 BY THE CORONER:

21 Q Please state your name.

22 A J. E. Shankland.

23 Q Where do you reside?

24 A Saugus.

25 Q What is your business or occupation?

26 A Really haven't got any business, taking care of some
27 rheumatism.

28 Q Mr. Shankland, do you know anything about the condition
29 of the St. Francis Dam prior to the thirteenth of this month?

30 A The only thing I know about the dam, I worked on the
31 dam from start to finish. I left there in September, 1926, when
32 it was finished, and went back about two months later, and never

1 been there since.

2 Q Do you know anything about the construction of the dam,
3 that would give us a clue as to why it fell?

4 A I know as much about it as my ability will permit to
5 know, because I looked into it all the time.

6 Q What did you do there?

7 A Everything.

8 Q You had no authority whatever in connection with the
9 work?

10 A No sir, no authority except over just a certain gang of
11 men.

12 Q You were there from the time the first work was done?

13 A Yes sir.

14 Q The laying on the foundation for the center of the dam?

15 A Yes sir.

16 Q All the subsequent work?

17 A Yes, right up to the completing of the conduits.

18 Q Was the dam set on bedrock at the bottom?

19 A It all depends upon what you call bedrock.

20 Q What do you call it, what do you call the foundation of
21 the dam?

22 A What I call it was the best material available, cleared
23 off down to what was as near solid rock as anything I ever saw.

24 Q What was that?

25 A It is schist.

26 Q Mica schist?

27 A I don't call it mica schist, I have heard it called
28 that, I don't. I might be wrong, I am not geologist enough. It
29 is shale, schist rock.

30 Q How deep was it below stream level?

31 A The deepest place was about that wall, went through I
32

1 judge about thirty feet, and the other was from thirty-- shallower,
2 went downstream.

3 Q How about the ends of the dam, the main portion of the
4 structure where it joined onto the sides of the canyon?

5 A That would work down in different ways, both cuts come
6 in. Take the east end, it was cut in, like this was the dam, like
7 that (indicating), I should say about twelve feet on the lower side
8 of the dam downstream. The upper side wasn't so deep, because
9 there was a canyon there. That was cut into the base on up to the
10 top of the dam. It just happened I did that work myself.

11 Q Was it uniform the distance you went into the hill, or
12 did it vary?

13 A No variation on that end whatever. It started from
14 where we first started and went up on a gradual slope.

15 Q A depth of twelve feet?

16 A It would be twelve to fourteen feet, something that way.

17 Q Twelve feet from the surface, including the dirt as well
18 on the outside, loose rock, or twelve feet into the solid rock?

19 A That included everything. You understand that had been
20 hydrauliced down.

21 Q Twelve feet after you hydrauliced?

22 A Yes, after it was hydrauliced.

23 Q How did you get into this depth of twelve feet?

24 A Pick, shovel, wheelbarrows.

25 Q Did you use any powder?

26 A No sir, used sledge hammers and barred a great deal,
27 crowbars.

28 Q The width of the excavation was what?

29 A That was pretty well up on ~~xxx~~ the dam. I think would
30 be sixty feet, I should imagine.

31 Q Was the excavation from the bottom to the top the same,
32

1 whatever the depth the dam was at that point?

2 A Yes sir graduated the same as the dam did, and tried to
3 keep this wall on the lower side as near as possible in a straight
4 line.

5 Q Did it look to you then like the east end of the dam was
6 securely anchored in solid rock?

7 A Yes, it did to me.

8 Q How about the west end?

9 A The west end was done similar to that, except the con-
10 ditions was different and everything was different, the ground was
11 different and conditions were different. You see that came down,
12 kind of a ridge into that point. They put a steam shovel in
13 there and throwed as high as they could with this shovel, don't re-
14 member just the distance. They put men in, I had to look after
15 that work a great deal. Mr. Menzies was crippled up, and I had
16 men on that for awhile. We went in there after the shovel was
17 out, and cleaned off everything that was loose, and then Mr. Dunham
18 came down. Like this was the cut (indicating), going up that
19 hill-- now in going up the hill until we got up to a certain
20 point, the cut wasn't so steep. Downstream side was a bank about
21 six feet. The upstream side, in going up this particular point,
22 was almost feather edged, but when it got up here (indicating),
23 it dipped out and goes out on a level. After we got up to this
24 point (indicating), which was about from where we started up here,
25 I would say about two to one slope. Then we got up here (in-
26 dicating), running level, then Mr. Dunham came around and had me
27 dig a trench on either side. This cut (indicating) was some-
28 wheres in the neighborhood of fourteen feet wide. He had me dig
29 a trench three feet deep, and clear along down here (indicating),
30 and clear over to the backside of that where it feathered out to
31 the extreme end. Now, you see here (indicating), this cut is
32

1 about twelve to fourteen inches and tapers off here. Here (in-
2 dicating) is where that starts out and goes off, and this (indicating)
3 is the deepest point in this out, and feathered off down there, went
4 down in here (indicating). That was a hole in the ground.

5 Q BY MR. MOHR: Referring to photograph S.F. 35---

6 A Coming out on this hill (indicating), these steps in
7 this, a bank on this side (indicating). It is not very heavy on
8 this side, about six feet into there. Coming out of here (in-
9 dicating), we went into this about six feet, washed, and then picked,
10 picked when it was dry-- lots of picks.

11 Q BY A JUROR: Did the water seem to soften that up?

12 A It did.

13 Q As you went down the base of the dam, did you pick into
14 hard material?

15 A About six feet into the hard material, that included the
16 hardest material there was on that hill.

17 Q How far did you say you went in total, including the
18 loose stuff?

19 A This full hill, it is all in practically the same
20 material. That hill is practically the same material after you
21 rinsed off just a little loose material, you get into it, it is hard
22 picking, hard with a shovel.

23 Q The total distance you went in was about six feet?

24 A On to here at this point (indicating) and right here
25 about fourteen feet at the highest point, and it feathered off there.

26 Q BY THE CORONER: This (indicating photograph) shows some
27 of your work there?

28 A Yes, that is the beginning (referring to photograph
29 S.F. 52). You can readily see that out went in, that looks all
30 right (referring to photograph S.F. 48, which is a photograph of the
31 incomplete dam, and incompleted on the west end).
32

1 Q BY DISTRICT ATTORNEY: You mean the dyke?

2 A The dam.

3 Q In the slope of the hill?

4 A No, it is not the slope of the hill.

5 Q What is it in then?

6 A It is not in anything. Part of the dam stands here
7 (indicating) and not completed going into that cut.

8 Q The cut is where?

9 A West end of the dam. Here (indicating) is where the
10 cut starts.

11 Q You are referring to the cut at the top of the hill
12 running in an easterly direction?

13 A No, westerly direction.

14 Q BY A JUROR: How would you explain the testimony of a
15 number of witnesses to the effect that the concrete was braced
16 against the side of the hill-- there was no cut made?

17 A I can't explain it, it is beyond me.

18 Q You were in position to absolutely know what was done?

19 A If I had brains enough, yes. As far as my power,
20 little brain went, I could. I saw it all. I was night watchman
21 for awhile at that time. I am an old time prospector, I knew
22 Bill Lindsay so well, all of them, and I had a gold pan. It was
23 my daily job to pan in the bottom of that for gold, so there was
24 very few days in this time I was on as night watchman. I went
25 down there panning for gold, was down there every day. You men
26 all know what a night watchman is.

27 Q You were running a crew of laborers?

28 A No, Mr. Lindsay and Mr. Dunham actually directed the
29 work.

30 Q Did you have any idea at the time when they were
31 hydraulicizing out on this westerly side that that wasn't a good
32

1 formation on which to put a dam, from the fact it would become soft?

2 A Will you allow me to make a little explanation? That
3 hydraulic has been awfully abused. You never hear anything about
4 the picks and shovels, and we did a lot of picking on this east end,
5 a lot of barring and picking. I would like to get that straighten-
6 ed out. I took a pride in that, it was hydrauliced before and
7 after we picked it.

8 Q Would you pick it, hydraulic it, and then pick it?

9 A Yes, anyway to get the dirt out. And another thing,
10 say for instance Saturday night, we would hydraulic it off. We got
11 a good hose, good hydraulic, good pressure, Monitor, regular outfit,
12 and if I could I would go in there and hydraulic that, wet it so as
13 to get a little off in the morning when the men came.

14 Q I would like to know whether the hydraulicing operations
15 there had a tendency to soften up this material you were working in?

16 A It did, yes.

17 Q I wondered whether or not it occurred to you at that
18 time that water would have any action upon this formation that you
19 were working in?

20 A It did, but not to the extent that it would ever soften
21 it up, never the least idea.

22 Q And make you think the dam wouldn't be safe on that kind
23 of foundation?

24 A No, I never thought the dam wasn't safe.

25 Q Did you think the water would percolate through that
26 shale?

27 A This wasn't shale, it was conglomerate, the only
28 material I would think was in it was clay, absolutely impervious. I
29 had nothing to say on this, that is my opinion.

30 Q How long did Mr. Dunham go over that job, how many times
31 a day?

1 A He was there all times of the day and anytime of the
2 day. He would go away and back. Mr. Lindsay was the man that
3 was right on the job all the time.

4 Q Would you consider Mr. Dunham knew his business?

5 A I do. I have known him since he was a boy, and he has
6 had what I would say an awful good training, because he started
7 right up on the preliminary survey when the aqueduct was built, as
8 a boy, and has been at the game all the way through, and I thought
9 he knew his business.

10 Q BY THE CORONER: How do you account for the dam's
11 failure?

12 A I don't account for it, don't know, I can theorize, but
13 I don't want to get started on that, because my theory isn't worth
14 that much. You people probably have one.

15 Q Did you see the leaks there at the west end of the dam?

16 A I saw leaks there, yes sir.

17 Q Did they cause any fear, did you feel any fear?

18 A Not in the least. I saw only minor leaks, nobody paid
19 any attention, little leaks. I remember picking a two inch pipe
20 in there, and holding a tin cup under it-- I am talking about a
21 year ago last September-- held a tin cup under a couple of seconds,
22 and you would get a drink.

23 Q Do you believe this water was coming under the dam or
24 through the dam?

25 A I am sure it wasn't coming through the dam.

26 Q That was from the reservoir?

27 A It come from the reservoir. I will tell you, on the
28 opposite side of the dam about a point here (indicating)-- this is
29 something I never speke about to anybody, except one-- don't amount
30 to anything, in my opinion-- right over this hill there is a ledge
31 that would crosscut right about through there (indicating), but we
32

1 never found any evidence of it in this cut.

2 Q The extreme westerly corner?

3 A That is right, and it was back over above this point in
4 depth about here (indicating). I remember that very distinctly,
5 because I had a brush crew working up in there.

6 Q Perpendicular?

7 A Yes.

8 Q What kind of a ledge?

9 A I would say sandstone.

10 Q How wide?

11 A About twelve feet wide. I wouldn't be positive about
12 the sandstone.

13 Q Did you cut through this ledge?

14 A Only there where we would have cut if we went straight
15 through.

16 Q BY A JUROR: Have you any suspicion that the dam might
17 have been tampered with?

18 A Well, no, I haven't.

19 Q BY THE CORONER: What is your theory about the failure
20 of the dam?

21 A I don't want to get mixed up in an argument. If you
22 agree not to criticise, it was either a fault in there, minor fault,
23 that is the hanging wall of a ledge of some kind slipping away. My
24 theory would be the hanging wall slipped down or the water soaked
25 through that under there and let that out, or tampered with.

26 Q BY A JUROR: What do you mean "Tampered with"?

27 A A few boxes of powder could get under there and help it.
28 I am not saying I heard anything about it, but I have three theories.

29 Q BY THE CORONER: Have you any facts that you can bring
30 here?

31 A Not one.

1 Q BY A JUROR: You say that the water run through there,
2 it got into the conglomerate?

3 A Yes, if it soaked through and loosened that up and get
4 it so loose, that would go all of a sudden, rush it out, but what I
5 can't get through my head is how the other end of that dam went out,
6 that awful structure as I saw it built.

7 Q The east end?

8 A East end, except the surge come out and washed out,
9 which I don't believe possible. That is the only thing that makes
10 me think the third theory-- I can't understand that-- I would ^{not} under-
11 take to blow that up and guarantee to do it with a hundred boxes of
12 powder.

13 Q BY THE CORONER: If the anchorage on the west side was
14 as strong as you believe it was on the east side, you think it would
15 take a lot of powder to blow it up?

16 A I would say so.

17 Q You believe the formation on the west side was not as
18 good as on the east side. You say it is possible that the water
19 could saturate the conglomerate under the west wing of the dam, so
20 it could have become so slippery that the pressure on the dam could
21 have pushed it out?

22 A It is possible, yes, that is just one of the theories.

23 Q BY A JUROR: When you were excavating on the west side,
24 did any of the engineers of the Water Department ever supervise the
25 job?

26 A They often did through Mr. Dunham.

27 Q Directly?

28 A Not to me.

29 Q Did you ever see them on the job?

30 A Many, many times.

31 Q On that part of the job?

32

1 A I have seen the chief go through there. Mr. Van
2 Norman was never there much, a lot of those crazy engineers sitting
3 over there (indicating).

4 Q BY MR. SCOTT: You are referring to Mr. Proctor?

5 A Yes, referring to Mr. Proctor.

6 Q BY A JUROR: Do you know whether any suggestions were
7 offered to Mr. Dunham the fact they might not be going deep enough?

8 A I don't know as there ever was.
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1
2 J. E. SHANKLAND, was
3 recalled and testified as follows:

4 Q BY MR. MOHR: Are you employed by the City, at the
5 present time?

6 A No sir, I am laying off. I don't know whether I have
7 been fired or not. I got knocked out by the rheumatism about
8 six weeks ago.

9 Q And you have not been employed since that time?

10 A No sir.

11 Q You mentioned yesterday about the possibility of there
12 being a minor fault which caused the collapse of the dam. Do
13 you mean by that a minor fault that is created at a time immed-
14 iately preceding the collapse of the dam, or one which had been
15 in existence for some time? What was your idea about that?

16 A My idea about that would be that it was the cause of
17 the collapse of the dam, that it went down and the dam went with
18 it.

19 Q Do you mean by that that the fault was created at that
20 particular time by an earth movement of some kind?

21 A Yes.

22 Q It was not a fault that you knew of being in existence
23 prior to that time?

24 A No sir.

25 Q You spoke of that stratum of sandstone on the east
26 side, what you considered sandstone?

27 A Yes.

28 Q Do you know whether that was a faulty condition there
29 at that particular point?

30 A It could have been caused--- you know there were two
31 walls there and with that ledge running through there--- though
32 I never was into it far enough to know.

Q As I recall it, when you were working on the west side,

1 you found no such condition existing?

2 A No sir, there was no such condition in the cut, noth-
3 ing that indicated that ledge.

4 Q About how high was the dam from the base of the canyon,
5 if you can tell, when you went on the job?

6 A I went on the job before the dam was started.

7 Q You were right there from the commencement?

8 A Yes sir.

9 Q Turning to the west side, in that construction work
10 that you have described, that you were describing yesterday, from
11 the foundation up, after that was hydraulised you said that you
12 went in there with picks, crowbars, and dug it out, is that
13 correct ?

14 A That was referring to the east end.

15 Q Will you explain to the jury what you did on the west
16 end, if you worked on the west end?

17 A I worked on the west end a while, and while one of the
18 men did have charge of that under Mr. Lindsey was away, crippled
19 up by an automobile accident, it was only enough to put this
20 out in.

21 Q That was after the dam had gotten up quite a little
22 bit?

23 A Yes.

24 Q Was the dam constructed to such a point that you saw
25 that blue clay in the structure?

26 A You never heard me speak of any blue clay in the struc-
27 ture.

28 Q BY THE CORONER: Did you see any clay there?

29 A I only saw what would be cementing material for that
30 conglomerate. It was all through.

31 Q Speaking of that cement material, that was a tie be-
32 tween two stratum of conglomerate?

1
2 A A tie of the entire conglomerate. The conglomerate
3 had been put in there and the clay was the only cementing mater-
4 ial.

5 Q Did you or your men work on part of the west side
6 while you were there?

7 A Yes sir.

8 Q Will you tell us what the action of that was--- the
9 reaction of that to the picks and crowbars which were used on
10 that side?

11 A It was very hard.

12 Q As hard as the conglomerate?

13 A That was a conglomerate, but there is a great variation
14 of conglomerate.

15 Q I understand, ^{but} ~~that~~ right where you were digging? Just
16 tell the jury the efforts that were made to dig into the forma-
17 tion where you tied into the conglomerate and the conglomerate
18 itself?

19 A It was very hard picking and a man would use about
20 five or six good, sharp picks during a shift, so it was very
21 hard picking.

22 Q BY A JUROR: Did you use gads and sledge hammers?

23 A In places we did use gads and hammers. There were
24 just a few places of that kind where either Mr. Lindsey or Mr.
25 Dunham came around and insisted upon digging out more. It left
26 a kind of hump.

27 Q When you put a gad in would it come out in large
28 chunks or fragments?

29 A No, sometimes there was a rock in there and we would
30 split that up.

31 Q BY MR. DENNISON: Do I understand that you had severed
32 your connections with the Water Board about six weeks ago?

A I left up there and came down kind of on sick list.

1 Q Are you drawing your pay now?
2 A I am not.
3 Q BY THE CORONER: Where were you working last?
4 A For the City?
5 Q Yes.
6 A At the Tinemaha Dam.
7 Q Did I understand you also to say yesterday that you
8 were a particular friend of Mr. Dunham?
9 A Yes, I am. I have known him since he was a boy.
10 Q Have you talked to him since this has happened?
11 A Not a word. I have not seen him.
12 Q Have you been up to the dam site?
13 A I have not and am not going.
14 Q BY A JUROR: Was the formation of the whole canyon the
15 same, or was it different on the east side from the west side?
16 A Different on the east side from the west side.
17 Q Was the east side harder?
18 A It was a different formation entirely. That was a kind
19 of a slippery rock.
20 Q On the east side?
21 A On the east side, and the other was a conglomerate en-
22 tirely.
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26
27 WILLIAM W. HURLBERT, be-
28 ing first duly sworn, testified as follows:
29 BY THE CORONER.
30 Q Please state your name in full.
31 A William W. Hurlbert.
32 Q Where do you reside?
A 4180 Woodlawn Avenue, Los Angeles, California.

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Q What is your occupation?

A Office Engineer, Bureau of Water Works and Supply.

Q Mr. Harlbert, what did you have to do with the planning of the St. Francis Dam, if anything?

A All the drawings, computations, in connection with that, were done under my supervision.

Q Who designed the dam?

A The dam was designed on the basis of studies which were made on the Hollywood Dam.

Q You took the plans for the Hollywood and remodeled them or followed that dam in constructing it?

A Yes sir, the studies on the Hollywood Dam, as fully explained by Mr. Bayley, were of a gravity type of dam, two hundred and ten feet in height, and the design on that dam corresponds to the same general conditions as on the St. Francis. One of them is 203 and the other 208 feet, and the studies were on the gravity type dam of 208 feet.

Q So that the same design as was used for the Hollywood Dam was employed for the St. Francis Dam, with certain changes and alterations to suit the location?

A Yes sir.

Q Was the St. Francis Dam longer or shorter?

A The St. Francis was 668 feet on the cross length and the Hollywood 890.

Q So you diminished the size?

A Yes sir.

Q In remodeling the dam to suit the purposes of the site of the St. Francis Dam, did you change your factors of safety in any way?

A No sir, the factors of safety were not changed. The lines of stress in all cases lie within the middle third, and are practically the same as that of the Hollywood. Some minor

1 changes, but as far as the engineering design of the dam were
2 concerned the lines of stress were entirely within the middle
3 third, and they are the governing feature of a design of that
4 kind.

5 Q Did you make the figures?

6 A No sir.

7 Q Where were they made?

8 A In the drafting room.

9 Q Who had charge of it?

10 A I had charge of it.

11 Q All the work preparatory to building this dam was done
12 in your own department?

13 A Yes sir.

14 Q You had no advice from the outside at all?

15 A Except our own engineering organization, the Chief
16 Engineer and his assistants.

17 Q And you did not have any advice or assistance from the
18 outside or outside of your department in designing the Hollywood
19 Dam?

20 A I did not have anything to do with the designing of
21 the Hollywood Dam.

22 Q So, it was all done in your department?

23 A Yes sir.

24 Q Now, there are certain facts that this jury would
25 like to know, some certain engineering facts, and I think you
26 would save their time and that of everybody else, if we permit
27 the jury to interrogate you for that purpose.

28 Q BY A JUROR: How did you determine the coefficient
29 of friction in the St. Francis Dam?

30 A The same general principals in the design of the St.
31 Francis Dam were used as were used in the Hollywood Dam, and the
32 general factors in the design of that dam were considered good

1 engineering practice, and they were corroborated by the Chief
2 Engineer. The details on that---- I don't have them at hand,
3 ^{if}
4 but ~~my~~ recollection is correct it was ten tons to the square
5 foot on the lower toe and twelve tons on the upper.

6 Q What was the coefficient of friction?

7 A I cannot give you the figures on that.

8 Q Was it not established?

9 A Yes sir, those things were all established.

10 Q Is it possible to get that figure?

11 A Yes sir.

12 Q I wonder who might give it to us?

13 A Whoever worked on the details of that can give it to
14 you. In the drafting room we can get those figures.

15 Q Would you mind getting them?~~th~~

16 A Yes sir, we will get them.

17 Q Were the computations made by one man?

18 A The computations, as I have stated, were on the design
19 of the Hollywood Dam, applied to the St. Francis. I said we
20 used the same general design and those computations were made
21 under Mr. Bayley's instructions in the design of that dam, that
22 same general design that was used on the Hollywood Dam was used
23 on the St. Francis, under the Chief Engineer's directions.

24 Q There were no new computations?

25 A They were not necessary because the dams were practi-
26 cally of the same height.

27 Q Did you check these computations ^{have} or/were they checked?

28 A They were all checked by individuals in the drafting
29 room. There were several men that worked on the computations.

30 Q Can you state who made the original computations?

31 A They were made by Mr. Bliss and Mr. Francis.

32 Q After you had changed the design to suit the different
conditions at the St. Francis Dam, were any check computations

1 made?

2 A There were no changes in the design to fit the
3 different conditions. I made the statement that the same de-
4 sign was used for the St. Francis Dam.

5 Q Was the radius the same?

6 A No sir, the radius was five hundred feet on the St.
7 Francis and Five hundred and fifty feet on the Hollywood.

8 Q Isn't it a fact, Mr. Harlbert, that the placing of a
9 wall or dam on different kinds of rock would necessitate your
10 using a different coefficient of friction against sliding?

11 A Why, yes, it would depend entirely on its height, what
12 the bed rock conditions would be.

13 Q It would depend upon the character of rock, which was
14 supporting the dam, the coefficient you would use?

15 A Yes sir.

16 Q If you designed the dam for one place and put it in
17 another place, that coefficient should be checked?

18 A Yes sir.

19 Q As far as you knew, that coefficient was never check-
20 ed?

21 A I did not say it was never checked, I said I could
22 not give you that figure.

23 Q Were any experiments made looking to establishing
24 some relation^{as} to slippage on that bed rock at the St. Francis
25 Dam?
26

27 A I don't know.

28 Q Was any effort made to determine just what the slipp-
29 age might be?

30 A I did not have anything to do with the field end of
31 the construction of the St. Francis Dam.

32 Q Did your department have a laboratory or some provi-
sion for making tests of that kind?

1 A Not to my knowledge.

2 Q Did anyone, to your knowledge, make such tests?

3 A I don't know anything about the field end of it.

4 Q Who would be the party who would probably make such

5 practical tests?

6 A Mr. Mulholland.

7 Q Was the question of moisture, infiltration of water,

8 through the foundations, ever taken into consideration, when you

9 were determining your coefficient of friction?

10 A Those instructions were all given out by the Chief

11 Engineer, and, naturally, they would be taken into consideration.

12 Q You have no knowledge as to whether they were or not?

13 A I have no definite knowledge, but that is good engineer-

14 ing practice, and the Chief Engineer would not proceed unless

15 that was properly taken care of.

16 Q What allowances were made for upthrust in the calcula-

17 tions?

18 A Allowances were made for upthrust.

19 Q What allowances were made at the different points, at

20 the down-stream tunnel and between?

21 A It was ten and twelve tons, as I stated.

22 Q That is the limiting pressure. I mean the upthrust?

23 A Due to hydrostatic pressure?

24 Q Yes.

25 A The plans call for the proper drainage pipes in the bed

26 rock there to take care of that.

27 Q Did you allow for one-half pressure at the down-stream

28 toe, or normal?

29 A Allowed for the full reservoir.

30 Q At the down-stream toe?

31 A I cannot answer your question on that.

32

1 Q What is your composite factor of safety on the gravity

2 A I did not, as I stated, make the design on that dam.
3 The design of the Hollywood Dam was made by Mr. Bayley, as I
4 said, and I said that the same section was ordered to be used,
5 with minor modifications, by the Chief Engineer. I did not make
6 the computations on that.

7 Q Then, you don't know what allowances were made for
8 upthrust?

9 A No, other than that they were made, naturally.

10 Q What I am trying to establish is whether or not a
11 proper allowance was made for upthrust in the calculations for
12 the dam?

13 A They were made in the one instance, and must have been
14 made in the other.

15 Q Is there anyone who knows definitely?

16 A The gentleman who made those computations, Mr. Bliss
17 and Mr. Francis.

18 Q BY THE CORONER: Can you give them here this morning?

19 A Yes sir.

20 Q BY A JUROR: Are they not a matter of record in your
21 office?

22 A The drawings and everything you have here, and the
23 annotations are copies of the official records in our office.

24 Q How about the computations?

25 A The complete computations were made on the Hollywood
26 Dam under Mr. Bayley.

27 Q Are those computations available?

28 A Yes sir, everything is a matter of record.

29 Q BY THE CORONER: Are they on these charts which we
30 here
31 have now?

32 A Everything, except the computations.

Q BY A JUROR: Have you seen these blueprints?

1 A Yes sir.

2 Q Are they copies of all the drawings that you had of
3 the St. Francis Dam?

4 A Yes sir.

5 Q Those are copies of all the drawings?

6 A Yes sir.

7 Q No actual record was kept of the base contour of the
8 dam when it was built?

9 A Yes sir, there is Drawing 1142 that shows the founda-
10 tion of the dam on the bottom and on the side walls, as excavated
11 in the bed rock.

12 Q Will you refer to that blueprint, please. What do
13 those contour lines there represent?

14 A They represent the actual bed rock, as excavated in
15 its,-- in the preparation of the foundation for the building of
16 that dam.

17 Q Was there any record kept of the position of bed rock
18 before it was excavated into?

19 A No, there is not.

20 Q There is no record to show how far you went into bed
21 rock?

22 A No, no record to show that. There is the actual con-
23 dition of the foundation--- bed rock was cleaned and excavated
24 into.

25 Q Then, the contour lines there represent the bed rock,
26 as the concrete was poured up against it?

27 A Yes sir.

28 Q And there is no means at present from any records that
29 the department has, of ascertaining the position of the bed rock
30 before the excavation was started?

31 A No, the only record that you have is that of the men
32 who actually worked on that work in the field. This is the re-
sult of the finished work into bed rock for the foundation and

1 that is the record which was taken.

2 Q It is unfortunate that the testimony we have had so
3 far has been absolutely contradictory in that respect.

4 A I don't know anything about that, but I do know that
5 this drawing here represents the foundation of the dam into bed
6 rock. I think the gentleman who was on the stand here before,
7 if I remember right, made a statement that working upon that
8 east side, that he went well into bed rock.

9 Q Do you know if you took vertical strips ^{each} of each section
10 of this dam, that each vertical strip would be staple in itself
11 as against sliding?

12 A In vertical blocks?

13 Q Yes, a vertical strip cut off up and down the dam.
14 Do you know whether there was any investigation to show if each
15 unit strip would be secure against sliding and overturning?

16 A I don't know. That whole mass was excavated into
17 bed rock and put into place as a unit mass.

18 Q If there were contraction cracks vertically up and
19 down the dam so as to divide the dam into sections?

20 A I did not understand you to say as to the dam. The
21 dam through its own design, would stand that way.

22 Q Then, each strip would be staple against sliding and
23 overturning?

24 A Yes sir.

25 Q How do you account for the dam going out?

26 A I have not been up there and I have not seen it.

27 Q You have no theory on that at all?

28 A No sir.

29 Q If there was a weak spot in the dam which would be
30 that spot, in your opinion? Would it be the east end or the
31 west end?

32 A I would not say that there was any weak spot in it as

1 far as the dam itself was concerned.

2 Q Do you know what the comparison is as to the formations
3 of the two dams that this same plan was patterned after, the
4 Mulholland Dam and the St. Francis?

5 A Do you mean the formations of the bed rock?

6 Q Yes.

7 A I know only through my casual visits there, that this
8 material here was largely schist, and that of the Hollywood Dam
9 is sandstone.

10 Q The Hollywood Dam is not so broken up?

11 A No sir, it is not.

12 Q Did you make any visits to this St. Francis Dam and
13 how often?

14 A Yes sir, probably a dozen times during its construc-
15 tion.

16 Q Were you ever consulted about the foundation?

17 A I was never consulted about the foundation, no. I
18 saw the foundation as excavated.

19 Q Was there any difference of opinion that you ever
20 heard of?

21 A I never heard of any difference of opinion.

22 Q Did you ever hear of anybody objecting as to that site
23 as being an unsafe site for a dam?

24 A I did not. No sir, I never did.

25 Q Have you any outside Board of Engineers to pass upon
26 any details of the dam?

27 A Not to my knowledge. Mr. Mulholland has built a great
28 many dams and this happened to be one.

29 Q How many gravity dams?

30 A Two.

31 Q How many other dams and of what type?

32 A Earth-filled and rock-filled.

1 Q But the Hollywood dam was the first concrete dam?

2 A I would not say that. As to my knowledge on our own
3 local work.

4 Q You would only know as to your department?

5 A Yes sir.

6 Q In your opinion, what would be the limiting values of
7 the coefficient of friction on different ^{classifications} / ~~classifications~~ of rock,
8 of low value and of high value?

9 A I have not gone into that at all.

10 Q You don't know anything about that?

11 A I am not prepared to answer that.

12 Q Then, we are to understand that the responsibility of
13 your department is limited to the computations for this structure
14 as a unit, without regard to the foundation upon which it was
15 placed?

16 A I would not say that. The Chief Engineer has desig-
17 nated that; the design of the structure was made after thorough
18 studies and the engineers designated what was to be done in
19 connection with any change that might be made there.

20 Q In computing a dam it would be important to know what
21 the conditions were outside of the lines of excavation in regard
22 to the allowable stresses that you transmit to the foundations?

23 A That is very true, and that was all gone into very
24 definitely by Mr. Mulholland.

25 Q Did you have any means of knowing whether or not this
26 dam was situated at a point where the bedrock had dropped off
27 very rapidly, immediately below the toe, either in the center or
28 at the abutments?

29 A I don't know. I think so. I think the explorations
30 would show if that was the case.

31 Q What explorations were made from the excavations to
32 determine the character of the bed rock?

1 A I am not connected with that end--- prospecting in to
2 determine that, but there were excavations made to determine that
3 feature under the instructions of the Chief Engineer.

4 Q Was it known that on the west wing of the dam, the dam
5 rested on a ledge?

6 A There was a dyke on the west end that rested on a
7 ledge, a continuation of the dam.

8 Q Before stripping, what was the material composing that
9 dyke?

10 A I did not--- there was a dense conglomerate in there
11 in which this excavated trench was dug through.

12 Q There was an over-burden of soil and soft formation?

13 A Yes, an over-burden. In some places the bed rock came
14 to the surface and in some places it did not.

15 Q Have you any record to show how much over-burden there
16 was, at a point, say fifty feet downstream from the toe of the
17 dam?

18 A Only from the rough topography, which was submitted
19 on the dam before it was constructed at all. This topography
20 is absolutely accurate. The other topography of the site it-
21 self was generally rough.

22 Q Were these contour lines carried to the limit of the
23 excavation?

24 A To the limit of the excavation.

25 Q Under whose directions were the computations made to
26 determine the depth necessary to key the dam in on the sides,
27 particularly on the west side?

28 A They were made under the direction of the Chief Engin-
29 eer.

30 Q In your office, under your direction?

31 A Under the direction---- the design of that ~~pk~~ type of
32 dam, as I stated before,----

1 Q I understand, but in this particular case were those
2 computations necessary to determine the depth?

3 A Whatever instructions were given on that definitely
4 were given by the Chief Engineer in connection with this dam.
5 He pays very close attention to the entire work, the details in
6 connection with the layout of that dam.

7 Q BY THE CORONER: You know about the construction of a
8 cutoff wall there at the base of the dam, when the work was
9 first started?

10 A You mean the up-stream face of it?

11 Q Yes sir.

12 A I know it was built there.

13 Q Do you know how long it was?

14 A Throughout the entire length in the bottom of the can-
15 yon in order to hold the water back.

16 Q It did not extend into the sides of the canyon?

17 A It extended over the excavated material into the bed
18 rock, up above what would be the natural surface of the stream,
19 so that the water would be held back.

20 Q If there was water to be held back there, why was it
21 not figured that it would be necessary to extend that cutoff
22 wall clear across the canyon?

23 A It was extended clear across the canyon at the base.

24 Q At the sides as well?

25 A As far as the natural flow of the stream, the eleva-
26 tion of the natural flow of the stream, you could not get any
27 water higher than that.

28 Q In order to protect the base at the point where the
29 water would come when the reservoir was full?

30 A I don't understand your question. Do you mean to run
31 a dyke clear across the canyon?

32 Q Yes.

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A There would be no necessity for that.

Q Would that have prevented the water from getting under the dam?

A No sir.

Q It was down at the same depth as it was at the base of the dam?

A It was carried across the up-stream face of the dam, at an elevation higher than the natural stream flow of the creek. That wall was put across.

Q If it had been extended clear across that six hundred feet---

A That would not have had any bearing on it.

Q That would not have protected the foundation of the dam?

A No, the foundation of the dam was in mass itself, and it was placed as a homogeneous mass in pouring the concrete, and had nothing to do with the cutoff wall on the sides. The only water that could get through there in excavating into bed rock in the preparation of that foundation would be in the bottom of the stream bed and that would be troublesome and in sections the cutoff wall was put there in order to aid in the excavation.

Q That cutoff^{wall}/is properly a coffer dam for the purpose of underwatering the excavation and is no part of the finished structure, is that right?

A Yes, it is part of the finished structure because it is incorporated into it.

Q Does it serve as a cutoff wall for the completed structure, that is, does it go below the bottom of the maximum section of the dam, as a mass?

A That cutoff wall was excavated well down into bed rock and it may have extended even this some distance below the main mass. I am not posted on that. The whole foundation site of

1 the dam there is naturally lying in a water-bearing strata. It
2 was a saturated mass above the bed rock, and in order to drain
3 that off it was necessary to put a cutoff wall in there in order
4 to work there.

5 Q And you have the records of the location of the drain-
6 age system of the dam?

7 A Yes sir. Those which have been testified to by Mr.
8 Kenberg here previously, are complete.

9 Q Do they extend up into the abutments?

10 A They went into the main mass of the dam.

11 Q What provision was there to limit the upthrust due to
12 hydrostatic pressure on each side of the central section of the
13 dam?

14 A Whatever the limiting area--- there would not be any
15 limiting area. These pipes are put down into that material to
16 take some of that upthrust, which would naturally relieve itself
17 through those pipes.

18 Q Can you indicate on drawings, which are present here,
19 the location of these drains?

20 A I don't know whether they are shown on these drawings
21 or not. They are not on these drawings.

22 Q BY MR. SCOTT: You said that Mr. Bliss and Mr. Francis
23 made the computations on the Hollywood Dam under Mr. Bayley's
24 direction, or did you mean that Mr. Bliss and Mr. Francis made
25 the computations on the St. Francis Dam?

26 A Made them on the Hollywood Dam and Mr. Stevens made
27 the drawings, the tracings, and computations in connection with
28 the St. Francis Dam. I said the computations that were made on
29 the Hollywood Dam were made by Mr. Bliss and Mr. Francis.

30 Q And those really just taken and adapted to the St.
31 Francis Dam by Mr. Stevens, a draftsman?

32 A No, those drawings were made up following the general

1 analysis which had been made on the gravity type section for the
2 Hollywood Dam under the instructions of the Chief Engineer, to
3 prepare the same plans, and adapt them to this site.

4 Q You will furnish this coefficient of friction?

5 A Yes sir.

6 Q BY MR. DENNISON: Do I understand that the--- you call
7 these blueprints?

8 A Yes sir.

9 Q These blueprints which are offered in evidence here,
10 are the only data or specifications or whatever/^{term} you may apply to
11 it, that you have in relation to the construction of the St.
12 Francis Dam?

13 A All the original drawings from which these blueprints
14 were made and any computations in connection with the design of
15 the gravity type section dam are on file in our offices.

16 Q Are there other blue prints in relation to the con-
17 struction of this dam?

18 A No other ones other than the ones you have here.

19 Q What other data have you in relation to the construc-
20 tion of the St. Francis Dam?

21 A The original records which have been submitted here by
22 various other witnesses who have been called, and the computa-
23 tion books on the design of the Hollywood Dam on which the basis
24 of the design of the St. Francis Dam was used.

25 Q Eliminating the computation books, what other records
26 are there?

27 A There are no other records on the construction of the
28 dam.

29 Q How many of these gravitydams have been constructed?

30 A I don't know, there are hundreds of them in the country.

31 Q I am only referring now to the Water Department of Los
32 Angeles County?

1 A There are two.

2 Q Just two? When was the Hollywood Dam completed?

3 A It was completed in March of 1924, if my memory is

4 correct.

5 Q And the St. Francis Dam in 1926?

6 A Yes sir, in 1926.

7 Q I want to know if I have this thing straight now. The

8 Coroner asked you this question and I don't think it has been

9 answered definitely; who designed the St. Francis Dam?

10 A The St. Francis Dam was designed under the instructions

11 of the Chief Engineer and based on studies which were made for a

12 gravity/ ^{type} dam, which was the Hollywood Dam, that is, the main study

13 is, ~~as I explained~~ that was made on the basis of a dam

14 two hundred and ten feet high and it was applied to both of the

15 studies in connection with that and were applied to both of these

16 dams.

17 Q Now, who designed the St. Francis Dam? Did you design

18 it?

19 A I did not.

20 Q Did Mr. Mulholland design it?

21 A It was designed under his instructions.

22 Q Then, as I to understand that Mr. Mulholland designed

23 the St. Francis Dam?

24 A It was designed under his instructions.

25 Q Did you design the Hollywood Dam?

26 A No sir.

27 Q Who did design it?

28 A It was designed under Mr. Mulholland's instructions,

29 and Mr. Bayley was detailed on that work, and other men made the

30 details under his instructions.

31 Q In the preliminary studies for the purpose of determining

32 the formations of the Hollywood Dam, was there a drill used and was

1 the cores retained by your Department?

2 A A drill was used on both the Hollywood and the St. Fran-
3 cis Dams.

4 Q And have you the cores?

5 A The cores were destroyed in this flood.

6 Q Were the cores from the Hollywood Dam and the St. Fran-
7 cis Dam kept underneath the St. Francis Dam?

8 A I did not say anything about the Hollywood Dam.

9 Q I am talking about the Hollywood Dam. Have you the core
10 now of the Hollywood Dam?

11 A I don't know where the cores are. They were made and
12 I think we still have them. They were drilled with a shot drill,
13 bought especially for that.

14 Q You made a log of these cores showing their location?

15 A I don't know.

16 Q Is there any way that you can search the records of the
17 Water Department and find them?

18 A These cores were taken and inspected on the ground by
19 Mr. Mulholland and others that had to do with the direct con-
20 struction of these dams.

21 Q I want to know whether or not there is, over in the office
22 where you are employed, a plan, a diagram, a log or by whatever
23 name you may call it, of the formations taken from the core of
24 the Hollywood Dam?

25 A I don't know whether it is there in the office or not.
26 It will show the same material as excavated, upon which the foun-
27 dation is placed.

28 Q Is there a log of the St. Francis Dam in the office?

29 A There is a record of these walls which were put in
30 there in connection with the drainage system under the dam. These
31 were drilled down away into bed rock.

32 Q Before the St. Francis Dam was built, that is, before

1 they put the foundation in, or before they did anything, didn't
2 somebody go up there and make an exploration for the purpose of
3 determining whether they could put a dam up there?

4 A I cannot give you the information on that because I
5 was not there at the time.

6 Q If they did go up there, they drilled into the ground,
7 didn't they, for the purpose of finding out what kind of a forma-
8 tion there was and whether there was any bed rock?

9 A That was done on the Mulholland and also on the St.
10 Francis Dam. I told you that the cores of the St. Francis were
11 stored below the dam on the east side.

12 Q From that core as it was taken out of the machine you
13 made a log?

14 A I did not make a log. I was not on the ground there.

15 Q It was brought down to your office?

16 A No sir, it was in the field engineer's office on the
17 job.

18 Q BY THE CORONER: Who was the field engineer?

19 A Mr. Hamberg was the engineer. He was on the surveying
20 and and the record end of that job.

21 Q Did he have charge of these cores?

22 A Yes sir, he had the record of them.

23 QBY MR. DENNISON: Do I get this correct? Is this in-
24 formation you are trying to give the Coroner: that Mr. Mul-
25 holland designed the Hollywood Dam, that is, he said that he
26 wanted a dam over there?

27 A He gave instructions for a dam to be designed with a
28 gravity type section, according to the best engineering practice
29 and it was assigned to Mr. Bayley to do that.

30 Q And Mr. Bayley had prepared the blueprints in accord-
31 ance with Mr. Mulholland's request for a dam?

32 A He prepared studies in connection with that, and, as

1 a result, the drawings were made.

2 Q And, then, when they wanted the St. Francis Dam, they
3 got out the old drawings of the Hollywood and revamped them
4 under your instructions and sent them up there?

5 A They got out the computations and the studies on the
6 Hollywood Dam, and the matter was gone into with Mr. Mulholland
7 and others at that time.

8 Q I want to know what the radius of the dam was?

9 A Five hundred feet.

10 Q What was the chord of the arc?

11 A I don't know.

12 Q Have you any way of knowing?

13 A It can be measured or computed.

14 Q Is it on these plans?

15 A No sir. The chord is not on there. That is the in-
16 tersection between the two radial lines. It is the horizontal
17 distance connecting the two radii, connecting the two center
18 lines of the arc.

19 Q What is the length of the dam?

20 A Six hundred and sixty-eight feet, the dam proper.

21 Q The circular part of it?

22 A Yes sir.

23 Q That is six hundred and eighty feet?

24 A Six hundred and sixty-eight feet.

25 Q Now, was it contemplated that that was to be a segmental
26 arch, or semicircular arch?

27 A It was a pure arch.

28 Q Semicircular or segmental?

29 A It is a pure arch with a radius of five hundred feet.

30 Q Can you have a radius of five hundred feet, with an
31 arch six hundred and sixty-eight feet, that was not segmental?

32 A Segments are taken at any place on that arch.

1 Q The six hundred and eighty-six means the segment of a
2 circle with a radius of so many feet?

3 A It means the length of the arc of that circle. A seg-
4 ment would be the portion between the chord and the circumference.
5 It is the length of the arc as subtended by that chord. I said
6 the length of that dam was six hundred and sixty-eight feet on
7 that circle and it is subtended by that chord, which you are
8 speaking about. I cannot tell you what the dimensions, but it
9 can be readily computed.

10 Q Will you compute it now?

11 A Not now, no.

12 Q Can you look at the blueprint and tell me what it was?

13 A No, it is not on the blueprint.

14 Q Can you now, look on the blueprint and tell what it is?

15 A The radius is given and with the radius you can compute
16 any of the elements of the circle.

17 Q Is the radius given on the blueprint?

18 A Yes sir, five hundred feet.

19 Q BY MR. SCOTT: You would have to have a logarithm book?

20 A Not the computations. The elements of the circle are
21 trigonometric and are computed by a series of logarithms them-
22 selves.

23 Q BY A JUROR: Is it multi-centered or single-centered?

24 A Single, with a constant radius of five hundred feet.

25 Q BY MR. DENRISON: By a constant radius, you mean from
26 top to bottom?

27 A Yes sir, on the center line of the dam.

28 Q Was the water face of this whole arch intended to lie
29 upon the water, or was the water intended to lie against the face
30 of the arch?

31 A Yes sir.

32 Q It was intended to lay against the face of the arch?

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A Yes sir.

Q On the whole six hundred and eighty-six feet?

A Yes sir.

Q That is all.

THE CORONER: That is all, you are excused. We will now take ten minutes rest.

EDGAR A. BAYLEY, was re-

called and testified as follows:

BY THE CORONER.

Q I think you said in your testimony yesterday that you did most of the work in the designing of the Hollywood Dam?

A I said in my testimony that I designed the transverse sectional profile of the Hollywood Dam.

Q We understand that the St. Francis Dam was an adaptation of the design of the Hollywood Dam?

A I have been told that it is.

Q I think that the jury would like to ask you some questions about engineering facts relating to the design of the Hollywood Dam, and possibly some other facts concerning the St. Francis Dam, and I think it would be proper for them to interrogate you at this time.

Q BY A JUROR: Can you explain what assumption you made in regard to upthrust?

A On the Hollywood Dam?

Q On the Hollywood Dam.

A As I testified yesterday--- there are several ways to take care of upthrust. One is by a gallery along the upper toe and another by a system of drain pipes and another by blocks of concrete to let the upthrust come where it will. In the Hollywood dam we took care of it by a system of drain pipes, and when

1 I left ^{there} ~~there~~/were many drain pipes installed.

2 Q The assumption was that the heel or the up-stream por-
3 tion of the dam would be made as nearly watertight as possible?

4 A Yes, and to do that a trench near the upstream or heel
5 of the dam was excavated.

6 Q And immediately downstream or at some point downstream
7 from this upstream trench a system of drain pipes was established.

8 A Was installed. Mr. Jacks, the construction engineer
9 that constructed that dam installed the drain pipes and could
10 give you first hand testimony as to what was installed in that
11 way.

12 Q Was it your expectation that this drainage system would
13 be carried up both abutments, well up towards the maximum water
14 line?

15 A To take care of upthrust in the proper way.

16 Q Is there any record of the log of the borings of the
17 St. Francis Dam?

18 A The borings were made by Mr. Jacks and the others----

19 Q BY MR. SCOTT: I think you misunderstood the question
20 on the St. Francis Dam.

21 A We have no log of the St. Francis Dam.

22 Q Do you know if there is any log of those borings?

23 A I do not.

24 Q Who would know?

25 A I don't know.

26 MR. MULHOLLAND: We will bring in the man who made them.
27 I think he is working for us down on Duocomen Street, in the yard
28 there.

29 THE CORONER: Will you do that, Mr. Mulholland?

30 MR. MULHOLLAND: Yes sir.

31 Q BY A JUROR: Where were you situated?

32 A In the State of California.

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Q In the University of California?

A At the old Throop, in the old days, and in the University of Southern California School of Law.

Q What do you regard as the limiting values of the coefficient of friction to be used in dam design?

A That depends upon the formation that the dam is to be placed on. On the Hollywood Dam, which is concrete on sandstone, it was computed to be two-thirds; that would be proper. In any dam which is constructed on a firm rock foundation the coefficient of friction will not come into play in the height that we had before overturning our other thrusts. Usually in the computations the depression in the overturning governs, but not the coefficient of friction, but that does come into play where they slope downwards towards the toe.

Q Would not those come into play where they go up the side of the hill?

A Ordinarily, if the section is radial, as it should be, and if the base is horizontal ^{is} or its equivalent by steps.

Q They would not be considered at all?

A Certainly, they were considered at every level, but ordinarily other factors would govern.

Q What we are trying to bring out is this point: Naturally one of the elements to be taken into consideration in designing a structure such as this, is to provide against slippage?

A That is correct.

Q One of the three cardinal points which has to be taken care of?

A That is right.

Q Foundations should be so laid as to provide a natural abutment due to excavation?

A Which would be radial, generally speaking, in a dam

1 which is built on an arch in form.

2 Q Precisely. In the absence of any such effort as in
3 this case of the St. Francis Dam, we are naturally interested to
4 find out what effort was made to meet that stress?

5 A Certainly. I have no knowledge on that matter on the
6 St. Francis.

7 Q Who would have that knowledge?

8 A Mr. Huribert is the office engineer under whom the de-
9 sign was made.

10 Q It was not a matter of design?

11 A The practical knowledge you are asking about?

12 Q It is a question of actual construction.

13 A I will try to help you all I can. I would say that
14 Mr. Proctor, who is an engineer of standing with the department
15 and who was there throughout the construction, would be the best
16 informed man to give you that information.

17 Q The jury would like very much to hear from Mr. Proctor.

18 Q Is Mr. Proctor present?

19 MR. SCOTT: Yes sir, he is.

20 Q BY A JUROR: Is it a matter of formal procedure to
21 make a definite log from the cores when you have made borings on
22 the axis of any proposed structure?

23 A It is. In the particular case of the Boulder proposed
24 dam sites, the logs were made and the record is preserved, and
25 particularly the cores are preserved. We took the cores and
26 preserved them for the government in Benning, California.

27 Q Then, you have for our inspection, cores taken from
28 the Hollywood Foundation and the St. Francis?

29 A As to the Hollywood, I left during the----

30 Q Not the cores, the log?

31 A Where the record is, I am not certain, but ordinarily
32 it is part of the office engineer's records.

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Q Is it the practice to keep a record of the cores?

A In good engineering practice it is a custom.

Q Then, if they were not destroyed in the flood, there should be a record of the cores?

A Yes.

Q At what height of a dam is the coefficient of friction a critical consideration? Is it in a low dam or an exceedingly high dam?

A With a low dam with a very heavy wide base it would not be critical. Generally in a high dam it comes into play. There is a terrific force and it comes into play.

Q If you took a slippery rock, the coefficient of friction would be low?

A It would be low and it would come into play very early and you should widen the base proportionately.

Q Here is what I have in mind: In construction, cracks took place in this dam that separated the dam, more or less, into individual units, and then the foundation, one particular unit here was built on a slippery formation and was cracked loose from the adjacent portions of the dam, then, if the coefficient of friction were low that might be a critical consideration in that portion of the dam, might it not?

A That is true. That is correct.

Q Have you seen the formation of the St. Francis Dam?

A I have not been there yet. I was only there a couple of times in my life, when I took some photographs and hurried away.

Q Did you see this conglomerate formation there?

A No, I never did. I never seen a core and was not there during the construction. Since the accident I have been very busy around Santa Paula.

Q Do you happen to remember what the coefficient of

1 friction would be on moist clay?

2 A Offhand, I do not, but it would be low.

3 Q Three-tenths?

4 A I imagine twenty-five hundredths or three-tenths, just
5 as an offhand estimate.

6 Q In applying this you would take the weight of the
7 structure less whatever provision you had made for upthrust, less
8 the coefficient of friction--- you would have to balance that
9 against the pressure of the water in the dam?

10 A That is the correct procedure.

11 Q But you don't know whether this was done in the design
12 of the St. Francis Dam?

13 A No, I do not.

14 Q Who would know?

15 A That is a hard question for me to answer, because I was
16 away during the construction.

17 Q As to the practice of the department?

18 A The practice of any proper department should be through
19 the office engineer.

20 Q As a matter of fact, is it not true that when you de-
21 signed the transverse section of that dam, you made it upon the
22 major assumption that a foundation would be properly provided
23 for it?

24 A Referring to the Hollywood Dam, after an examination
25 of the site, and the formations, the bed rock being exposed
26 right ^{down} at the surface, and it being sandstone, and knowing the
27 coefficient of sandstone, we took what we considered a proper
28 coefficient, and taking into consideration the tying in where
29 the coefficient does not actually come into play, I would con-
30 sider that by taking two-thirds we were amply safe.

31 Q You have every reason to believe that the designer of
32 the St. Francis Dam proceeded along those sound lines?

1 A I have no reason at all to doubt it.

2 Q BY MR. DENNISON: Who designed the Hollywood Dam?

3 A I have stated now twice in my testimony that the
4 sectional transverse profile, purely the profile and the stresses,
5 were by myself and under my direction, and checked by others, and
6 by myself.

7 Q You made a picture of the dam to be constructed?

8 A No, I made more than a picture. I made the profile,
9 the type profile that is suitable for a dam of that height, and
10 character. The detail of the steps---- we planned several dams
11 for the Hollywood, under several assumptions---- the detail of
12 the steps was an after thought. We first planned on straight
13 downstream slopes. Mr. Mulholland decided it was more practical
14 to step the downstream face. In making the steps we modified
15 our dimensions so that ^{with} the steps it would be as safe as without.
16 The detail of the ornamentation on the top was entirely by Mr.
17 Mulholland and his assistants, and the details of the outlet
18 pipes through the dam were entirely by Mr. Mulholland and the
19 place to put it, by him.

20 Q When you were making this cross sectional profile as
21 against the longitudinal, you had a log of the preliminary ex-
22 ploration, you had the log before you at the time that you and
23 they were making these things?

24 A Yes sir.

25 Q Do you know where it is now?

26 A The log of the tests on the foundation?

27 Q You made a preliminary exploration of the site?

28 A Of the site itself?

29 Q Yes.

30 A We took, in the first place, a photographic survey of
31 the site, and we made a preliminary location on this photograph-
32 ic map, as is the procedure done in most planning of dams, in

1 order to limit ourselves as to where we should make explorations
2 and not explore everything.

3 Q You made a cross section of the earth where you were
4 going to put the dam in?

5 A Yes sir, that is in the office of the Department of
6 Water and Power.

7 Q Who has custody of it?

8 A Mr. William Hemberg, the office engineer, I imagine.

9 Q Do I understand that Mr. Malholland and you designed
10 the Hollywood Dam?

11 A Well, in effect, yes. Mr. Malholland, the detail, and
12 myself the stress diagrams.

13 Q You have now heard the testimony of these various men
14 and witnesses here in relation to the fact that the St. Francis
15 Dam was a practical reproduction of the Hollywood Dam. You have
16 not been up to the St. Francis Dam but know that it failed. In
17 your opinion, now, is the Hollywood Dam---- what is the condition
18 of the Hollywood Dam now, in relation to safety?

19 A My information now on the Hollywood Dam in relation to
20 safety, is that it is absolutely safe.

21 Q How long, without any repairs, do you figure that this
22 dam will be in a safe condition?

23 A Repairs to the concrete or to the foundation?

24 Q Ordinary repairs.

25 A A dam such as that of concrete, will be standing there
26 as long as the concrete is good.

27 Q For ten years?

28 A The concrete should be good for hundreds of years.
29 Concrete has only been in use for a limited time, speaking geo-
30 logically.

31 Q I understand this is your answer: The first gravity
32 dam and the only gravity dam that you ever designed, was the

1 **Hollywood Dam?**

2 A Which was constructed?

3 Q Which was constructed. Had you ever had any work---
4 did you ever work in and about a gravity dam before you designed
5 the Hollywood Dam?

6 A I never worked in and about one, but I have been in
7 and about one.

8 Q Did you ever exercise---

9 A Not as an engineer.

10 Q You exercised no supervision over it?

11 A No.

12 Q What authorities did you consult other than Mr. Mal-
13 holland in the designing of this dam?

14 A I consulted the best text authorities that were avail-
15 able to me, such as Salomon, nationally known as a good authority,
16 one of the best, and many articles coming out in the Transactions
17 of the American Society of Civil Engineers on current practice,
18 by Datsley in particular, who is considered by Mr. Salomon as
19 one of the best authorities on arch dam construction, and
20 Morrison and Brady's text book on the design of gravity masonry
21 dams.

22 Q That is a text book which is recognized as an authority
23 among men doing this work?

24 A Yes. I consulted a text book by Mr. Creiger, who is
25 also considered an authority, and also a text book by Turner
26 Russel on public water supply. It is considered one of the best
27 text books on water supply that is published. I consulted other
28 books by English authorities.

29 Q Did you have any authority on this---- this was what
30 you call a horizontal gravity dam, or horizontal arch?

31 A No, this was what was called a gravity dam in section,
32 and arched. It was the consensus of opinion among the best

1 engineers at the time that it was designed that it was a gravity
2 type dam designed properly for gravity, on a proper foundation,
3 and arched, which would be stronger than one which is not arch-
4 ed. Since that time there has been raging in engineering
5 literature, the question as to whether that in reality is so,
6 Many engineers of prominence maintaining that little, if anything,
7 is gained by arching; Other engineers maintaining that con-
8 siderable is gained by arching. However, the feeling among
9 most engineers is that with the gravity dam in section and arch-
10 ed that should there be a failure, that the arch would only take
11 care of that ultimate catastrophe, which would immediately appear
12 and that the best practice would be to arch such a dam. Now,
13 the arch ordinarily, particularly where there are temperature
14 stresses and openings every forty or fifty feet, that is, no low
15 temperature, the arch ordinarily is little affected. However,
16 the wedge action due to the arch in a reasonably short, and
17 not too long a radius, should the dam loosen on its foundation,
18 the cantilever action, which is action normal in a gravity dam,
19 would have no effect, that the wedge action would have, in my
20 judgment, an arch effect, which would undoubtedly save the dam
21 from a catastrophe. Other engineers, adopting the theory that
22 an arch gains nothing over a straight gravity dam, have carried
23 it to the nth degree and have shown mathematically that if it
24 was arched downstream it would be stronger, if not safer. So
25 the theory that an arch is not good, would have to be based
26 upon the hypothesis that an arch so constructed, would not be
27 good.

28
29 Q Looking upon the St. Francis Dam there would appear
30 that there is standing upon the base, a structure which would
31 be the key of that arch, would it not?

32 A In a sense, yes.

Q I noticed from a birdseye view of that published Sun-

1 day morning in a paper, that the piece over near the wall, a
2 segment of the circle of the arch over near the east wall, was
3 shorter than the segment of the circle towards the west wall?

4 A I did not notice that. It would be surprising to me
5 if that is so.

6 Q Measuring from the center of the arch, that is standing
7 there--- measuring from the center of that standing piece of
8 this wall over here (indicating) it seems to me to be longer than
9 in measuring from the center over there (indicating)?

10 A In this drawing it appears that it would be possible,
11 though it would not be good practice, to construct such a dam.
12 It should be circular in form. It should be truly circular, be-
13 cause other stresses come in.

14 Q Looking at the birds-eye view of that, it would appear
15 that the dam was canted a little bit?

16 A Apparently, by the artist's picture, I do not have a
17 great deal of faith in artists' pictures. I think that measure-
18 ments will settle what that is.

19 Q I think some witness here at the first part of this
20 inquest, that his testimony disclosed that that piece which is
21 standing there, slipped on its base, that is, it twisted on its
22 base $3/7$ of an inch one way and $5/7$ in another way.

23 A JUROR: $3/10$.

24 A I don't know that.

25 A JUROR: But I was not sure of that.

26 Q BY MR. DENNIS: Is there any way, have you any record
27 in these profiles or anything that would show the distance from
28 the center of the arch to the west--- the length of the arch
29 to the west springer?

30 A Yes, that can be determined quite precisely from the
31 contour map, which was introduced in evidence, as showing the
32 one foot contours.

1 Q And that would show how far that are or what the ex-
2 cavation was into the west bank?

3 A They should show that, however, not to on-hundredths
4 of an inch, but as a contour map is made. I think that is in
5 evidence.

6 Q And it would also show the same length to the east wall?

7 A Not in dimensional form but it will be there subject
8 to measurement.

9 Q So, we can determine whether that standing piece was in
10 the center of the arch?

11 A Yes, but I would say that a blueprint is subject to
12 shrinkage and the original drawing should be used for that
13 measurement.

14 Q Would the fact that in this failure of this dam--
15 what would be the effect on the gates, would it crumple them, so
16 that they could not be opened?

17 A Within the parts that are still standing, or the parts
18 which went out?

19 Q Still standing.

20 A The force apparently-- from reading a description of
21 what happened-- the force was terrific and many things happened
22 that no man could imagine would happen, so I would not qualify
23 as to such a case.

24 Q The flood gates are now all closed and are closed in
25 such a way that they cannot be opened. Could that ^{have} happened in
26 this wrenching?

27 A It is quite possible, because gates on many dams, for
28 some reason or other unknown at the time they were installed,
29 have stuck and they could not be opened. That experience, I
30 think, is universal all over the country. Occasionally they
31 jam and you have a hard time to get them open.

32 Q That is due to climatic conditions?

1 A Yes, and many things that are unaccounted for. Friction,
2 that is one of them. It takes a great deal of pressure
3 to loosen them.

4 Q Then, as I understand it, a dam is just the same as a
5 T rail in a railroad. Heat expands it and cold contracts it?

6 A Yes, and particularly in some types of gates, the man-
7 ufacturers have gone to a great expense to make them so they
8 will not stick, but they have not been entirely successful.

9 Q What data have you in relation to computations in re-
10 lation to building these flood gates, to avoid their sticking?

11 A I have none on the flood gates. In fact, I have no
12 record of anything at all on the St. Francis. Most gates are
13 purchased from manufacturers and we think they are reliable and
14 install them. Sometimes you build them yourself.

15 Q Are the flood gates in the Hollywood Dam similar?

16 A I don't know. I left the Hollywood when it was about
17 eighty feet in height. There was an outlet gate.

18 Q Do you know now, if the Hollywood Dam was placed in
19 jeopardy of an earth movement or any other menace, and it became
20 necessary to open the flood gates, they could be opened?

21 A I don't know.

22 Q How long would it take to open them in case of an
23 emergency?

24 A It would take some little time to make that computa-
25 tion. It could be computed quite accurately as these things go.

26 Q Do you know whether your department has data showing
27 how long it would take?

28 A I don't know.

29 Q Do you know whether the department has any such data
30 in relation to the St. Francis Dam?

31 A That I don't know either.

32 Q This would be the situation, as far as you know, if

1 the water board were ^{confronted} ~~consulted~~ with the fact that the St. Francis
2 Dam was in a dangerous condition, that they would have no way of
3 knowing whether they could open the flood gates except by just
4 trying it?

5 A That I don't know.

6 Q Do you know, if that information came to them, how long
7 it would take or whether there is any information as to how long
8 it would take to empty the reservoir or reduce the pressure to
9 a point of safety?

10 A That is a computation that could be made from the
11 plans of the dam, the dimensions of the pipes and the length of
12 the pipes through the dam, and the length of the gates.

13 Q Is that ever there?

14 A I don't know.

15 Q Will you look and see whether it is?

16 A I will do that.

17 Q BY THE CORONER: Have you ever gone into the safety
18 device angle of dams, or do you know of any safety devices that
19 have ever been used or might be used in an emergency of this
20 sort, to warn the people who might be living below the dam of
21 anything an emergency?

22 A I have never heard of any such devices, but they would
23 be a very proper thing to have.

24 Q It could be worked out so that the excess pressure
25 exerted, or the changed condition, would operate an electrical
26 device, which would automatically warn the people living below
27 the dam of the danger?

28 A There would be no trouble in doing that at all. That
29 is a good suggestion and I believe it should be done, if there
30 is any amount of life below the dam. It should be required by
31 law, as I see it now. Of course, our afterthought is better
32 than our foresight.

1 Q BY A JUROR: Would it have been good engineering
2 practice to have continued this trench at the same level as the
3 creek bottom, clear across the wings instead of going up in
4 steps? Looking back at it now, would it have added to the fact-
5 or of safety?

6 A It would have made the amount of water under the dam,
7 from the inside toe to the outside toe, have a longer travel and
8 perhaps prevent seepage to that extent, and possibly uplift
9 getting over a large part of the area. As for strength against
10 overturning it would not be material. It would be ^{proportionate} ~~appropriate~~
11 to its weight to a small extent. As against sliding it would
12 have a considerable effect, depending upon the width.

13 Q If all of the formation under the wing was the same
14 clear to the center of the dam, for instance, and they had
15 made a cut at the same depth as the center of the dam, the
16 bottom of the dam clear through, considering that the formation
17 was all the same, would that be slower for the water to percol-
18 ate through?

19 A I don't know what the formation is there.

20 Q Assuming that it is all the same and all conglomerate?

21 A It would perhaps go a little slower into the hill,
22 but remember you still have your stresses and your water press-
23 ure on your section. How far you could go is a matter of judg-
24 ment. The established practice is to go to a solid foundation
25 and step it up a ways.

26 Q That is what they did in this instance, from what I
27 have heard?

28 A Yes sir.

29 Q That is considered good engineering practice?

30 A Yes.

31 Q What do you think about the practice of under-drain-
32 ing all of the dam, not just the bottom, but the side portions,

1 as well, to prevent erosion, supposing a leak starts in the up-
2 stream face, if there was a series of drainage pipes in there
3 to pick up that seepage and carry it to the canyon below, with-
4 out erosion, would that not be a measure for safety?

5 A I would consider that good practice as a measure of
6 safety.

7 Q In your researches in regard to the general practices
8 in dam design, about what ^{proportion} ~~percentage~~ of the dams of similar
9 design are built without expansion joints, in reference to the
10 total number built?

11 A That would be pretty hard to say. Dams go back into
12 history quite a while.

13 Q For instance, the Roosevelt Dam, has that expansion
14 joints, or not?

15 A I am not familiar with the Roosevelt, offhand. I
16 understand it has expansion joints. I think the prevalent
17 practice in current times, has been towards expansion joints.

18 Q In the Elephant Butte Dam?

19 A I don't know. I would imagine it would.

20 Q In the Arrowrock Dam, do you know anything about that?

21 A I don't know, no.

22 Q Did I understand you to say that the practice is
23 rather---

24 A Rather in the direction of expansion joints. We see
25 it in our highways and in concrete everywhere. The older dams
26 did not have them and the older dams show cracks. Expansion
27 joints will still show cracks, but-----

28 Q BY MR. DENNISON: At the present time, is there under
29 course of construction any such a dam as this, a concrete dam?

30 A As the St. Francis Francis?

31 Q Or the Hollywood. What is the one you are building
32 in Owens Valley?

1 A I am not building it. That is an earth-filled low dam,

2 Q Do you know of any other of these arched dams anywhere?

3 A There are a number. There is the Eschecker. There
4 was a lot of contention among engineers as to its strength,---
5 the Don Pedro, the Lancha Plana, and several in the San Joaquin
6 Valley that have been constructed.

7 Q How is the Paccima?

8 A I am not familiar with it except that I think it is a
9 constant angle arch dam. That is a different type of dam alto-
10 gether.

11 Q Are there not a number of arch dams in the flood con-
12 trol in these canyons?

13 A Yes sir, and I think the San Gabriel is a straight dam
14 similar to the proposed Boulder Dam in Black Canyon.

15 Q Do you know the Bear Valley Dam?

16 A Yes, the original one was very narrow and sixty-four
17 feet high. It was well built of masonry and stood for a great
18 many years. Since then another type was built below it and high-
19 er that is not affected. I think it is still under the water
20 there and has not been taken down.

21 Q Did you visit the site of the test dam which was built
22 back of Fresno?

23 A No, I did not. I was very much interested in the test,
24 but did not get to it. That was a very thin arched type and
25 should have the most excellent abutments to be a safe type.

26 Q What was the Calaveras Dam, do you know?

27 A I am not familiar with the Calaveras.

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R. R. FROCTOR, having
been heretofore duly sworn, was recalled and testified as follows:

1 BY THE CORONER.

2 Q What is your business, trade or occupation?

3 A Assistant Civil Engineer in charge of the field surveys.

4 Q There are certain facts that the jury want to get from
5 you. They may interrogate you at this time.

6 Q BY A JUROR: There has been a lot of conflicting
7 testimony as to whether this dam was stuck into the hill or not.
8 There have been men who worked on the job and said they went
9 down to the rock and quit, and somebody else would say that they
10 went anywhere from nothing to thirty feet into the hill. What
11 we want to get from you, are the facts in the case.

12 A The best answer I can give are the figures we have.

13 Q They really show very little?

14 A Unfortunately we did not take the actual topography
15 preliminary to the start of construction.

16 Q BY MR. SCOTT: Did you keep progress profiles?

17 A The drawing which we have here---- as I guess everyone
18 understands what that represents---- the one foot contours.
19 That represents the topography immediately before pouring the
20 concrete, taken from day to day in five foot layers.

21 MR. MOHR: If you are going to refer to the pictures I
22 would suggest, for the benefit of the record, that you refer to
23 the number.

24 A Yes. Referring to picture SF 21, St. Francis Dam,
25 July 21, 1925, east end, downstream face, elevation of concrete
26 1725 feet. This process of stripping was carried on in sever-
27 al different steps, the final cleaning out being done, as I have
28 illustrated on the blackboard in my previous testimony, each
29 five foot step was cleaned thoroughly, as will be testified to
30 by Mr. Lindsay who was in immediate charge of the construction.

31 Q This part here (indicating) is the elevation after it
32 was stripped?

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A That, I take it, is the ground after the hydraulicizing.

Q How deep is this?

A I would say it would run about ten feet at that point. There seems to be two forms there.

Q Perpendicular to the face of the bank?

A Yes.

Q Perpendicular to the face of the bank, how deep in is it?

A What do you mean, from the rock, after hydraulicizing?

Q Yes.

A I would say that would be about eight feet at that point, normal to the bank. It might be less. It might be seven. You understand that this cleaning out process is continuous and also there was a chunk in here (indicating), which has not been torn out. That distance may be more than I have given ^{and} it or no doubt it is. No doubt they were stripping in here (indicating) at the time. Referring to picture SF 48, this shows excavation at the western portion of the dam in the approximate location of the end to the portion now standing there.

Q BY A JUNIOR: On the east side or west side?

A On the west side. The starting of the end of the dyke is rather confusing because the same section of the dam was carried continuously to the extreme end. The portion up there was sixteen feet wide and straight down.

Q Now, the cleaning out here (indicating), this was not regulated as to any specific depth, only as to the formation that you encountered, is that correct? Whose judgment was taken, yours or Mr. Dunham's?

A I had nothing to do with the construction. I am here only to say what I saw as to these pictures which I took. Mr. Dunham was in charge of the construction and Mr. Lindsey was in charge under him.

1 Q It was really up to Mr. Dunham to pass upon the forma-
2 tion there as to the excavation?

3 A Well, Mr. Mulholland said that he came from time to time
4 and directed certain things to be done, but Mr. Dunham was really
5 in charge of the work. It was his job to construct that dam.

6 Q As to how deep or shallow that trench should be?

7 A Yes, of course, everything was subject to the direction
8 of the Chief Engineer.

9 Q You had no supervision over that work?

10 A No sir, Referring to picture SF 20, showing the east
11 abutment, elevation 1735, it is a companion picture to the other
12 one we looked at, except on the upstream face on the east side.
13 Apparently at this time they were still working there.

14 Q That shows them cutting into the hill?

15 A Yes, on the upstream side next to the hill. As I take
16 this picture, lying in there (indicating) must represent the ex-
17 tremes edge of the dam and apparently that has not been finished
18 yet. That is not cleaned in shape for the concrete. They were
19 working on it at the time that this picture was taken. This
20 would be broken down here (indicating) as much as possible, and
21 shoved over to one side. Referring to picture SF 21, this shows
22 the east end. I should say it is two-thirds of the way towards
23 the top from the bottom. It is elevation 1750. That would be
24 about half of the way. It shows that material has been moved by
25 the hydraulicing and the details of the pouring are not here.
26 They are hidden by the forms. I remember that bank as being
27 there when we made one of the maps. It is seventy feet below the
28 top.

29 Q Are we to understand that this dark area indicates the
30 limit of the hydraulicing?

31 A Yes, at that time. As I remember it, they came in and
32 cleaned the rest of it off.

1 Q The entire abutment was not hydrauliced down when they
2 first started, at one time?

3 A No, all stripping was done progressively. This hill
4 was so steep that it was dangerous to be on. Only one man could
5 work and no one could be above him. Referring to picture SF 19;
6 the elevation of the dam at this time was not given, but it is
7 well towards the bottom. There is a small canyon in here (in-
8 dicated) on which the dam overlapped on the east side. It is
9 understood that this loose material seen towards the top of these
10 pictures, was afterwards removed in each case.

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1 R. R. PROCTOR, having been previously
2 duly sworn, was recalled and testified as follows:

3 BY THE CORONER:

4 Q You had some photographs you wanted to show to the jury.

5 A (Showing jury some photographs).

6 Q BY A JUROR: Did you see the log of the borings?

7 A No sir, I am not familiar with that.

8 Q Was a record kept of the borings?

9 A Location only, I know the location and believe it is on
10 one of these prints that were here.

11 Q Was a drawing made of the borings, chart?

12 A Of the location. I intended to show this additional
13 picture, call attention to the large amount of waste material here
14 (indicating), showing drawing 2149. This drawing is primarily a
15 topographical map of the site.

16 Q A total of ten holes were drilled?

17 A Yes.

18 Q We would like to get the source of these logs, where
19 they are located, location of the borings.

20 THE CORONER: Mr. Mulholland said he could have these pro-
21 vided for us. Have you done that, Mr. Mulholland?

22 MR. MULHOLLAND: I don't believe there is a log of them. I
23 made inquiry, don't think there is a log of the borings, only of the
24 position, and there is nothing that I know of that I can remember,
25 except my own memory, and Mr. Lindsay and Mr. Dunham. There was no
26 change in the formation at all. We drilled down into the rock, it
27 didn't change.

28 A JUROR: How Deep, Mr. Mulholland, were these borings?

29 MR. MULHOLLAND: About thirty feet.

30 Q From the surface?

31 A From the surface of the bedrock, they are drilled from
32

1 the bedrock down.

2 Q How deep would that be from the surface of the stream
3 bed?

4 A Probably twenty-five or thirty feet.

5 Q A total of fifty-five or sixty feet from the surface?

6 A Yes, the formation remains the same all the way down, it
7 is a schist.

8 Q Did any of these holes show any of the serpentine con-
9 tact between the conglomerate and mica schist?

10 A No, they are all hard mica schist.

11 Q BY THE CORONER: Would you say, Mr. Mulholland, no
12 record was ever kept of the log?

13 A No sir, I wouldn't say there was none, but in the search
14 so far made in the office, there appears to be no record, unless the
15 surveyor located them, may have made some notes in his book about
16 that. Let me supplement something. North of the dam a very little,
17 about two hundred and fifty feet, there is an old mine, tunnel run
18 way into the ground. I think this man that was on the stand,
19 Mr. Hoke, that was here yesterday, I think he had an interest in that
20 mine, run a long ways into the mountain. I have been to that several
21 times, to get a look at the formation, and that was the same schist
22 all the way in.

23 THE CORONER (Addressing witness): That is all, you may be
24 excused.

25
26
27 WILLIAM W. LINDSEY, being first duly
28 sworn, testified as follows:

29 BY THE CORONER:

30 Q Please state your full name.

31 A William W. Lindsey.
32

1 Q Where do you reside?
2 A 1259 West 37th Drive, Los Angeles, California.
3 Q What is your business or occupation?
4 A General Foreman for the City of Los Angeles, Water
5 Department.
6 Q You were on the construction of the St. Francis Dam?
7 A I was.
8 Q In what capacity?
9 A General Foreman.
10 Q Were you there all the time the dam was being built?
11 A I was there before the dam started, I went up there,
12 Mr. Mulholland sent me there to build the road before they started
13 the construction of the dam.
14 Q Were you there when the first tests were made at the
15 site of the dam?
16 A I was.
17 Q Did you see the tests made, or did you make them?
18 A I had men dig these holes in the west side, at the top
19 of the hill.
20 Q What kind of test holes did you dig?
21 A Dug a series of holes, I judge four or five, not exactly
22 certain, probably a hundred and fifty feet apart from the point of
23 the hill back to the end of the dam, running down probably twelve
24 fourteen or sixteen feet deep.
25 Q By the end of the dam, you mean the extreme west end of
26 the dam?
27 A The west end of the dam, what they call the dyke, top
28 of the hill. This is conglomerate along here (indicating on
29 ~~photograph~~ blueprint). From this point (indicating) dug a series
30 of holes, don't remember, five or six.
31 Q Did you put any test holes from the top of the hill
32

1 down towards the stream bed?

2 A No.

3 Q It was tested in the bottom?

4 A Yes. The rock showed about halfway up that hill ex-
5 posed. Your creek bed run right along washed off.

6 Q Did you put any test holes in the extreme bottom of the
7 stream bed, the base of the center of the dam?

8 A After we cleared off the bedrock.

9 Q What test holes did you put down?

10 A Don't remember the exact depth of them, put a series of
11 holes down.

12 Q Did you take out a core there?

13 A Yes sir.

14 Q Did you see the core?

15 A Yes sir.

16 Q Did you examine it?

17 A Not particularly.

18 Q Are you familiar with the geological formations?

19 A No, I am not a geologist.

20 Q You couldn't tell the jury what the core consisted of
21 when it was taken out?

22 A I would say it was the same formation as the bedrock,
23 the schist formation on each side.

24 Q Do you know whether any record was ever kept of these
25 cores?

26 A I don't.

27 Q You didn't keep any?

28 A No sir.

29 Q Who actually did the work, who was in charge of the
30 work?

31 A Mr. Dunham.

1 Q You don't know whether he kept any record?
2 A No, I don't.
3 Q You were in charge of the concrete work there, as fore-
4 man?
5 A After that construction work was started, I was in
6 charge of placing the concrete on the dam.
7 Q Do you know about how the concrete was keyed on the
8 sides of the canyon?
9 A Yes sir.
10 Q Do you know to what depth extended into the mountain?
11 A The depth varied, but I would say from five to eight
12 feet on the east side.
13 Q How much on the west side?
14 A The west side was, I remember the key we put, top of the
15 hill, was fully twelve feet deep.
16 Q Was it that deep all the way down?
17 A Run down to the rock formation, down here (indicating),
18 about halfway above the dam, run right in there with the steam
19 shovel.
20 Q What was the color of that rock formation?
21 A Sort of grey right below the red conglomerate.
22 Q Did you pour concrete against the red conglomerate, or
23 clear that off and put it against the grey?
24 A Poured the concrete against the grey rock, and on the
25 red stuff.
26 Q How did you dig or make this trench on the east side?
27 A The east side, we first cleaned that by hydraulic,
28 nozzle. After we started to pour our concrete, cleaned that off
29 by hand, kept digging back, stepping it back.
30 Q About how high were these steps on the east side?
31 A I would say five feet-- our forms were five feet.
32

1 Every time we set a form, set it back in the hill.

2 Q It would run the full width of the dam?

3 A Yes.

4 Q And be set back in the hill about five feet?

5 A Yes, maybe more, until we hit the solid formation.

6 Q Each step would be about how many feet higher than the
7 other step?

8 A Our forms were five feet.

9 Q Was that done with steam shovel or by pick and shovel?

10 A By pick and shovel, gads.

11 Q Man power?

12 A Man power. Then we poured the concrete in each succeed-
13 ing step, kept going back into the hill. As I said before, kept
14 cleaning this hill off, and back to the solid formation.

15 Q Was it hard?

16 A Yes, hard.

17 Q What would you call it, bedrock?

18 A I would call it bedrock.

19 Q Did you continue to do that?

20 A Did that clear to the top, crest of the dam.

21 Q On the west side, describe how you made the excavations,
22 if any, you made to anchor the dam in on the west side?

23 A We made a cut with the steam shovel through there.

24 Q About how far up?

25 A I would judge twelve foot cut, twelve feet from the
26 surface of the hill down. We were anchored in the hill twelve
27 feet. After we got our shovel out, cleaned that bottom off by
28 hand, poured the concrete down to the solid.

29 Q Twelve feet vertically or right angles to the surface of
30 the hill?

31 A Yes, twelve feet down.

32

1 Q BY A JUROR: What we want to know is this particularly,
2 from this buttress (indicating) on downhill, you say they cut into
3 the side of the hill?

4 A I have already explained that we went in this rock and
5 took the steam shovel, and right on top of the rock went right in.

6 Q Did you have the steam shovel from the base of the dam
7 up this side hill (indicating), this part from the base of the dam
8 up the side slope, you say they excavated---

9 A By hand.

10 Q How far into the side of the hill?

11 A I would say four feet, that was rock in there.

12 Q Was that put in steps too?

13 A Put in the slope, slope of the hill.

14 Q BY MR. SCOTT: You mean four feet from what point?

15 A Sunk into the hill four feet.

16 Q BY THE CORONER: After it was hydrauliced or before?

17 A We couldn't do any hydraulicing on that part there, it
18 was rock, only washed the surface dirt off.

19 Q BY MR. SCOTT: You dug it out four feet, then laid a
20 layer of how much cement?

21 A Went up five feet at a time.

22 Q Next you dug in on the west side how far?

23 A Five feet, four feet.

24 Q Was four feet the minimum?

25 A It has been a long time---

26 Q But you were in charge of the men digging on that side
27 of the hill. Can you tell the jury each succeeding one of these
28 benches, how far you went in?

29 A AS we went up with the steps, we run our forms back in
30 the hill probably four or five feet each succeeding step. I
31 wouldn't say it was stepped, because the hill went up on a slope,
32

1 tried to get into it five or six feet.

2 Q BY A JUROR: Was it done this way-- you see this draw-
3 ing-- each one of these represent one lift. Did you carry this
4 down to a straight base there?

5 A No, tried to follow it in at x the natural slope of the
6 hill.

7 Q This represents the top of the hill. You cleaned that
8 off down to some place about like that (indicating), and then when
9 you went in here, you took out a little bit here (indicating), and
10 this is stepped about like that. Is that right?

11 A Yes.

12 Q BY MR. SCOTT: Did you increase the distance you dug
13 back in the hill on the west side as you neared the top?

14 A We had to, because the dirt wasn't near as hard.

15 Q It got softer as you went up?

16 A Yes.

17 Q Was that why you didn't dig deeper, lower down, was
18 because it was too hard; when you dug it four feet down there, why
19 did you stop digging it four feet?

20 A Because it was hard rock.

21 Q Could you dig any further than four feet?

22 A Without shooting it, you couldn't.

23 Q At the top, you said, I believe, you dug back twelve
24 feet on the west side-- you mean down or in?

25 A Straight down.

26 Q Were the men that did that excavation under your direct
27 supervision?

28 A Yes.

29 Q Who gave you the order, the distance to dig back in to
30 anchor the dam on the west hill?

31 A Dunham.

32

1 Q Do you know who he got his orders from?

2 A I suppose Mr. Mulholland.

3 Q Any stakes marked showing how far to dig back into the
4 hill; everytime you got to a point, you had to dig back again, did
5 you go to Dunham, see how far you went, then dig back into the hill?

6 A Used my own judgment about that. Dunham was there to
7 see that I did it.

8 Q What was your judgment about digging back into the hill,
9 why did you stop at four feet?

10 A Didn't want to shoot it, shake up the rocks.

11 Q Would it be necessary to shoot it, if you went deeper
12 than four feet?

13 A Certainly would.

14 Q BY A JUROR: Did you have any air equipment on the job,
15 air hammer?

16 A Yes, we used the air grills on the roads, not on the dam.

17 Q On this side formation here (indicating), did you notice
18 any effect the water had, whether or not it had a tendency to soften
19 that up?

20 A Sprinkled that before we concreted it.

21 Q In hydraulicing that at first, did the water seem to
22 have any action on that rock there (indicating)?

23 A The outside, washed off after we dug it off with pick.

24 Q It has been testified before that water was turned on
25 that part of the excavation with the idea of softening it before the
26 men went in there-- this would be done at night, water be used at
27 night, with the idea of helping to soften that up?

28 A I didn't see anything of that.

29 Q BY MR. SCOTT: I don't recall that fact, hearing that
30 from any witness.

31 Q BY A JUROR: This old gentleman that was on the stand
32

1 yesterday referred to that, that he used the water in there at night
2 to clean out with. Were you on the job continuously from start to
3 finish?

4 A I was.

5 THE CORONER (Addressing Juror): You are ~~for~~ referring to
6 Mr. Shankland's testimony. (Addressing witness) You were not away
7 for a time?

8 A On a two weeks' vacation.

9 Q BY A JUROR: This old gentleman that was laid up with
10 rheumatism, Mr. Shankland, said he went over onto the west side, that
11 that was the method he used of cleaning out at night time, after the
12 men were finished he would try to get the hydraulic in there to clean
13 out, save the labor, and also to soften it up.

14 MR. MOHR: That was after the dam got up quite a little bit.

15 Q BY A JUROR: Mr. Lindsey, right about half the height
16 of the main portion of the dam, how far in from the surface was rock?

17 A Rock was exposed there.

18 Q How far did you go in?

19 A I judge four feet, gadded it off and broke it.

20 Q BY MR. SCOTT: About what average from the bottom of the
21 canyon, going in this west hill (indicating)?

22 A It would be hard to strike an average.

23 Q What would remain, the difference between four and
24 twelve?

25 A That would be an average of six feet.

26 Q Would it increase over the four feet?

27 A After we got above the rock, it would increase in depth.

28 Q What do you mean by above the rock?

29 A I have testified three or four times, right about in
30 here (indicating). I think Mr. Prector has pictures of that streak
31 of rock, he can give us the right elevation.

1 Q What was there above that, any formation different from
2 the formation below that?

3 A I would say it was conglomerate above the rock.

4 Q Did you dig deeper into the conglomerate than you did in
5 the rock?

6 A I did.

7 Q About how much deeper?

8 A Hard to say. That was steam shovel excavation there,
9 I would say tapered from six to twelve feet, top of the hill.

10 Q BY A JUROR: Could you tell us just where you brought
11 the steam shovel in this hill, at what point?

12 A Went right up there (indicating).

13 Q In other words, you brought the steam shovel in at about
14 half the height of the dam?

15 A Yes sir.

16 Q And then started working. About how far did you go in
17 with the steam shovel?

18 A Went in right about into here (indicating).

19 Q About how deep would you say this cut is in the hill
20 here (indicating)?

21 A I would say six feet, and twelve at the top of the hill.

22 Q Do you remember the hole Mr. Mulholland dug in that con-
23 glomerate and filled it with water, to see what effect the water
24 would have on the conglomerate?

25 A Yes sir.

26 Q About where was that hole dug?

27 A On top of the hill.

28 Q Indicate on one of these photographs where it was.

29 A The hole he dug here (indicating) for a test hole, about
30 fifty feet from the point of the hill.

31 Q BY A JUROR: Maybe Mr. Mulholland can clear that up
32

1 himself, rather than Mr. Lindsey. Who else would have seen the
2 steam shovel working in that conglomerate?

3 A Men working there.

4 Q BY MR. MOHR: Calling your attention to photograph
5 S.F. 35, I will ask you to explain to the jury what that photograph
6 represents, if you can?

7 A That is excavating out here, crest of the hill where the
8 dyke is.

9 Q BY A JUROR: Is this the same general operation that
10 was carried on on the side of the hill?

11 A Yes sir.

12 Q BY THE CORONER: The depth varied from six to twelve
13 feet at the top of the hill.

14 Q BY A JUROR: After the steam shovel operation, did you
15 dig it out with picks and gads?

16 A Yes sir.

17 Q How deep did you go after the steam shovel get through?

18 A Two or three feet.

19 Q BY MR. MOHR: Calling attention to photograph S.F. 52,
20 I ask you to explain to the jury what that represents?

21 A That is ^{the} extreme west out of the dyke.
22 BY A JUROR:

23 Q That is the part of the dam still there?

24 A Yes sir.

25 Q BY MR. MOHR: Calling your attention to photograph S.F.
26 24, would you explain to the jury, if you can, from that photograph,
27 whether or not that is a steam shovel out at the end of the dam and
28 in that hillside?

29 A Kind of hard to tell by that picture.

30 Q If you don't recognize it, just say so, Mr. Lindsey--
31 you don't know whether that is a steam shovel out into the west side
32 of the hill or not?

1 A No, I couldn't tell.

2 Q Calling your attention to photograph S.F. 20, I will ask
3 you if the excavation made on the west side there was made by steam
4 shovel?

5 A West side where we went right in for the road with the
6 shovel, made this cut here (indicating).

7 Q BY A JUROR: That is the first step you went into with
8 the shovel?

9 A Yes sir.

10 Q BY MR. MOHR: Calling your attention to photograph S.F.
11 43, I will ask you to tell the jury if that cut on the west hill was
12 made by steam shovel if you know?

13 A This picture (indicating) will give you an idea of the
14 cut.

15 Q BY A JUROR: This is after you leave the dam site proper,
16 and started back on the dyke?

17 A Yes sir.

18 Q BY MR. SCOTT: Do you recall the effect of the water on
19 the conglomerate?

20 A No, I don't.

21 Q Did you make an examination of it?

22 A No, I don't think I did.

23 Q Did you bail the hole out or have it done?

24 A No, I didn't bail it out. It might have been done
25 while I was working on the other side.

26 Q BY DISTRICT ATTORNEY: I understood from you, in your
27 answer to the Coroner, that you poured this cement onto the red
28 earth there, is that right?

29 A Yes sir.

30 Q Where was that?

31 A On the west side.

32

1 Q Was it in the bottom of this ditch you dug up the hill?

2 A It was.

3 Q What was the length of the stretch of red conglomerate
4 in the bottom of the ditch you dug up the hill, that you peured this
5 cement into?

6 A I couldn't give you the exact length.

7 Q Was it near the top of the hill?

8 A Over halfway to the top, half the height of the dam.

9 Q Was it red stuff on either side of it?

10 A It was.

11 Q Have you been there since?

12 A No sir.

13 Q Haven't seen the pieces that came down with it stuck to?

14 A No sir.

15 THE CORONER: That is all, you may be excused.

16
17
18 WILLIAM MULHOLLAND, having been previous-
19 ly duly sworn, was recalled and testified as follows:

20 BY THE CORONER:

21 Q You were at the dam during its construction frequently?

22 A Very frequently.

23 Q And you observed all the formations there, all the work
24 that was intended before it was even started?

25 A Everything.

26 Q Will you answer some questions of the Jury, give them
27 the information they especially seek?

28 A JUROR: I wonder if Mr. Mulholland examined the holes,
29 after you put the water in to see the effect of the water on the
30 conglomerate?

31 A I ordered the holes in, was very much interested in
32

1 their behavior, put a big hole at the top, filled it full of water,
2 and it was there about two weeks, and the conglomerate was no softer
3 than it was afterwards, had to bail the hole out, the conglomerate
4 was very tight. We dug holes, had holes dug, I saw the holes,
5 holes dug into that red conglomerate all over, the north flank of
6 the hill. I can walk to every one of them, imprints where they
7 were dug and filled in. Had holes and tunnels dug in, two or three
8 tunnels up the right flank of that dyke, was very much interested in
9 that dyke to see if I could make a dam out of it, part of the dam,
10 it is part of the dam, and I thought, my conclusion was if I could
11 make a dam as good as that, I would be through making a dam, that
12 is permanent. They talk about that conglomerate part of the soil
13 laying on top of it. That has been utilized for vegetation. It
14 is pliable and reached to a depth of an inch, two or three inches.
15 It is hard, been wet for two and one half years, perfectly firm to
16 walk on. You have all been up there, perfectly firm, doesn't run
17 into mud, anything else. You will have geologists who perhaps are
18 better posted than I am. I have examined it under a microscope
19 and everything else. I know it is vitreous, not a clay at all.

20 Q In your examination of the result of your holes, you
21 felt from your experience that it would be good practice to erect
22 the dam at that site?

23 A Yes sir, and the behavior of the dam justifies that.
24 That part is there yet. I have been over that hill, not as much
25 as I would like to-- have only had time to go out twice since the
26 disaster-- all of you have been over it. It is not muddy, it is
27 firm stuff, doesn't make mud. If you go on the top soil where the
28 soil is not stripped away, a great many places there that will get
29 mud on your feet.

30 Q About halfway up the slope where it has been washed out
31 completely on the west side, on that rock point, there is a little
32

1 depression there, some of the water from the dam was retained?

2 A Yes.

3 Q I went in with my knife, and found my knife blade went
4 through one, what appeared to be the rock, that I could chip that
5 out. What significance is that to you?

6 A You are very likely near the original surface.

7 Q That point, Mr. Mulholland, is just about underneath,
8 under the center of the dam but about opposite this point here (in-
9 dicating), where the dam was carried out, and part of the rock ex-
10 tends down into the canyon, it is still remaining, some water re-
11 tained there, and that had seemed to puncture this conglomerate.

12 A Lance off the rock in the conglomerate, I suppose. Is
13 that where there is an old road runs around the point of the hill?

14 Q Between your road and the base of the dam. This
15 picture here (indicating), and it would be about opposite this point
16 here, right straight under the dam, it would be a number of feet
17 below the bottom of the dam, immediately under the west wing of the
18 dam.

19 A I think you refer to a projecting point there.

20 Q It is not on the road proper, it is north of the road
21 and directly-- this is it, the picture (indicating), right in there.
22 It is just a little depression right in here (indicating). That is
23 a point, and this drops down just on the other side.

24 A Is it out of the bed?

25 Q This all refers to photograph S.F. 100. It is out of
26 the bed of the stream.

27 A I don't know what it could be.

28 Q The surface was below the excavation?

29 A It must be a lance in the conglomerate. Is it this
30 low down?

31 Q Just about. Then it is not up to the contact, the
32 contact between the two formations was about where I point, where

1 the head of that track, shading, two rocks come together, contact--
2 this is schist, came over this far and projected beyond and under
3 this conglomerate, laps-- this stopped, turned to reddish.

4 A Rather soft material you will find. This is in
5 granites.

6 Q It was originally clay, vitrified by heat?

7 A Yes, or else aerial discharge, great tremendous beds of
8 tufts all over the country.

9 Q Mr. Mulholland, why didn't you underdrain?

10 A There was no water in the formation. That formation is
11 dry as a bone. We drove tunnels from miles above. It is an-
12 hydrous formation. There is another thing is a very convincing
13 fact, there was no leakage down in those riffling edges here at all.
14 This is anhydrous and there is no flowing there. The dryness,
15 aridity of this base there-- this is common where the stimulation
16 of heat will make any spot green that has a lot of moisture in it,
17 and there was no moisture there at the time, only simply the
18 moisture of the rain, neither one of those flanks.

19 Q We have the fact that the dam fell.

20 A I have a deep appreciation of the job before you,
21 gentlemen. Don't imagine for a minute that I would throw you off
22 the scent. I am willing to take my medicine like a man. If
23 there is anything I can say that will help you in your disclosures,
24 I will be the very first to point it out if I see it first. I have
25 nothing to conceal.

26 Q Would it have been possible if there were soft streaks
27 in this bank, a streak where the water softened it, and the water
28 stood-- in softening up the formation, wouldn't it-- suppose there
29 was some vitrified clay and water was up against this clay, there
30 was a streak through the dam. It would take a long time for water
31 to penetrate through clay?

32 A Yes sir. I have a very strong opinion myself as to

1 what was the approximate cause of that failure.

2 Q We would like you to tell us.

3 A We have three geologists, one of them one of the best
4 in the country, two of the best in the country, the third, I don't
5 know much about. I am talking now, I know some geology myself, and
6 I am very curious to see if they have the same knowledge I have.

7 Q BY THE CORONER: Who are these geologists?

8 A Three of them, one of them the very best in the union,
9 Mr. Hill.

10 Q Do you intend to have them impart information to this
11 jury?

12 A I intend whatever they find they will publish to the
13 world, or, at least, the board-- I think they will consent to that.
14 I am quite sure we have a public spirit in the matter, I know I
15 have (witness weeping).

16 Q BY A JUROR: When you were exploring that west side, do
17 you remember that serpentine contact between your schists?

18 A Yes sir, it is not serpentine, it is talcose, that is
19 the squeeze, sometimes very thin.

20 Q What was the appearance of that after the first
21 stripping, when you were making your preliminary investigation?

22 A Had a leathery, talcose.

23 Q How wide was it at that time?

24 A Almost disappeared.

25 Q Quite a notable showing of it at the present time?

26 A Yes, I saw that.

27 Q What was your estimate as to the width of that since
28 the failure?

29 A Really, my attention-- I knew it was there and passed
30 it by with a nod. You see, when I went up there, it was the second
31 time-- the first time was in the dead of night-- I was up there the
32

1 night of the tragedy, Mr. Van Norman and myself, had no chance to
2 observe the details. The second time, I ran over it as fast as I
3 could, and was somewhat exhausted, not in the attitude of mind. The
4 fact of the matter is, I promised myself for the last week to go up
5 and give it a close study for scientific reasons.

6 Q I would like to ask you-- it has been intimated to me
7 that for the last two, three or four years, you have been letting
8 up, and delegated more to your subordinates.

9 A I don't think anybody that has been associated with me--
10 I haven't been letting up-- I believe I have been working harder
11 than I ever did in my life. I haven't had a day off-- the only
12 vacation in my lifetime, about three months ago, the only vacation
13 I ever took, the only time I have taken a vacation in fifty years,
14 went through the Panama Canal to New York. I am the first up in
15 the morning, and the last to go to bed, with my men. There are a
16 very few beat me in the office in the morning. As far as letting
17 up is concerned, I wish I could. I believe I will have to very
18 shortly, this thing has get away with me.

19 Q I have asked that question because I have come in con-
20 tact with you in connection with the Water and Power Committee of
21 the Chamber of Commerce a great many times, and you have always been
22 in close touch with every question I have asked. I wanted to bring
23 that question out, because it has been intimated you have not been
24 active.

25 A Perhaps I welcome the news. If there is any inactivity
26 creeping over me, I will enjoy myself. I am the first at the
27 office in the morning. I go wherever the work is. Some things I
28 don't observe, the actual pipe laying, anything like that. I don't
29 like this anyway. Whether it is good or bad, don't blame anybody
30 else, you just fasten it on me. If there is an error of human
31 judgment, I was the human, I won't try to fasten it on anybody else.
32

1 Q BY THE CORONER: This morning we had Mr. Bailey on the
2 stand, to try to determine-- Mr. Bailey and Mr. Hurlbert-- to de-
3 termine who was the designer of the dam that was erected for the
4 St. Francis Dam. We learned it was an adaptation of the dam
5 originally designed for Hollywood, and, with some changes, the
6 general scheme was applied for the St. Francis Dam?

7 A Yes sir, very little difference.

8 Q Was that done at your direction?

9 A I think we all concluded that was the case. I can't
10 say the idea originated with me, we collaborated in the thing, as I
11 do with most of my work.

12 Q It was altogether wholly and exclusively a departmental
13 project, and all handled in your office?

14 A Yes sir, we don't let contracts.

15 Q And you had no inspection of the site by any state au-
16 thority?

17 A Yes sir, the State Engineer examined the site, examined
18 it carefully.

19 Q Who was the engineer?

20 A McClure.

21 Q He examined the site before any work was done?

22 A Yes sir, he was there. I think there was some little
23 excavation, and my men went around there, stumbled around there
24 over the country, and never had a word to say about it.

25 Q You are not required to have state inspection?

26 A No sir, not with us, we are not required to.

27 Q The law doesn't require municipalities to have state
28 inspection, but you had it anyhow?

29 A Yes.

30 Q Why did you call for state inspection when you didn't
31 require it?

32

1 A I am not a strict cavalier about the law, I like to
2 comply as far as I can and go over the mark in conformity to
3 the law, recognize there ought to be state inspection of such
4 things, whether it is a municipality or not.

5 Q BY A JUROR: How much time did Mr. McClure spend?

6 A Didn't spend but a half day.

7 Q This was the St. Francis Dam?

8 A Yes sir, and he saw all there was to see in a half day,
9 because there wasn't much to see. I think maybe Mr. Lindsey
10 remembers the tunnel that was driven. Mr. Lindsey, do you re-
11 member a hole, tunnel that Dunham had driven near the east end
12 of this dam?

13 MR. LINDSEY: I do.

14 Q BY THE CORONER (Addressing Mr. Mulholland): That was on
15 the east side?

16 A Yes sir, into the rock. There was a man testified that
17 that hole still is muddy in there, that is one of the reasons I
18 gave you for the anhydrous condition.

19 Q BY A JUROR: Did I understand there was a tunnel on the
20 west side?

21 A There was a tunnel transverse to that ridge, the north
22 flank, very steep, and we had a camp there, a building, you will
23 see the remains of that building there now.

24 Q That is what the foundation is standing there now?

25 A We had a camp there, the ridge in place of that, very
26 steep-- I had two or three holes driven into the side, examined
27 that, was called a conglomerate formation. I was sure that
28 would hold water, sure today it would hold water. I wish I had
29 as good a dam as that across the canyon.

30 Q BY A JUROR: This is the part that didn't go out?

31 A No sir, it didn't go out.
32

1 Q BY DISTRICT ATTORNEY: You haven't seen the dam since
2 its destruction?

3 A Yes sir, saw it twice. I was there the night it
4 went out, was there two o'clock in the morning, that morning,
5 within two hours after it went out, and waited until daylight,
6 until I could get a good look at it, then went up the next day,
7 I think, and went down into the bottom of the canyon, as you all
8 did.

9 Q I understand at the time the dam was constructed,
10 that there was a strata or streak of this red porphyry-- is there
11 any such thing as porphyry in the formation-- what is this red
12 stuff?

13 A Streak in the conglomerate, ~~xxxx~~

14 Q It is a conglomerate, was is it?

15 A Talcose stuff, one of the gentlemen just referred to.
16 It is in the schist. That is an igneous rock, but at the
17 joint, contact between the formation, there is a talcose material.

18 Q There is a picture, that is the end of the dyke (in-
19 dicating) wall that runs along, and this is the piece that is
20 torn off by the flood, what was left after the flood. Now,
21 what kind of material did you place this dam upon along there,
22 down that hillside (indicating)?

23 A Down to somewhere along here (indicating), the line
24 of contact, more than halfway down, we put it on a conglomerate.

25 Q BY THE CORONER: Is this the material (indicating)?

26 A No, let me tell you about that material-- a fellow
27 could talk-- that is a piece of one of the boulders in the con-
28 glomerate that appeared in that big red mountain above, and
29 scattered all through the formation. See the peacock color~~xxx~~
30 in it, that doesn't belong in the formation itself, vagrant, it
31 is an accidental thing, it is a piece of one of the boulders in
32

1 the conglomerate.

2 Q BY DISTRICT ATTORNEY: Is that the conglomerate (in-
3 dicating)?

4 A That might be.

5 Q Would you say that was the conglomerate upon which the
6 dam was built?

7 A That is a finger sample, I couldn't judge from that,
8 look at a big chunk.

9 Q I am going to ask you some things--- you have been up
10 there two or three times, down the canyon you saw some boulders?

11 A I didn't go way down the canyon.

12 Q A mile and a half down you saw great pieces of con-
13 crete?

14 A I saw that rolled away, I didn't go up, I saw the
15 pieces of concrete right at the dam where they fell.

16 Q If that were taken from the big piece of concrete
17 that is laying down in the canyon, it would be the thing upon
18 which you placed the dam?

19 A It would be a little bit of the big thing, yes.

20 Q Does that look like the thing?

21 A No, it doesn't.

22 Q Have you a sample of that?

23 A You can pick a sample, that concrete is made of the
24 gravel.

25 Q Not the concrete, but the thing upon which the con-
26 crete went?

27 A You can pick samples, any samples you like, out of
28 that wash.

29 Q BY THE CORONER: What is this (indicating)?

30 A A piece of tale, very condensed piece.

31 Q Any of that under the foundation of the dam at the
32

1 west side?

2 A I don't know of any.

3 Q BY DISTRICT ATTORNEY: You saw that piece I put in the
4 glass, what do you call that?

5 A A piece of dirt.

6 Q Is that serpentine?

7 A Very sandy dirt, not serpentine.

8 Q What was it?

9 A Didn't look very closely, like any piece of dirt.

10 Q BY THE CORONER: Referring to this piece of material
11 I showed ^{you}/you called tale?

12 A Looks that way.

13 Q That was taken by one of the Jurors the other day, has
14 a seam along the contact of the axis of the dam?

15 A I think that is right, looks like the character of
16 stuff you will find on any contact, but these contacts between
17 formations have had great abuse in their time, slip and crowded
18 together.

19 Q BY A JUROR: This larger piece you examined a moment
20 ago, you say this is probably a part of a boulder?

21 A Yes sir.

22 Q Would that be soluble in water, would you mind putting
23 a piece in water?

24 A That thing is vitreous, don't think it will soften.
25 These boulders are very common in that country, and you will
26 notice very high, monumental knobs.

27 Q Is that often gotten out of a piece of vagrant rock?

28 A Yes, that stuff is not solid. We have to deal in
29 this inquiry with very little of that, it may be in the con-
30 glomerate, and you will find many of them in the concrete.

31 Q I want to question Mr. Mulholland about the leakage
32

1 you observed there at the time of the last visit prior to the
2 accident. There has been a great deal of testimony in regard
3 to the seepage that was observed by various people that have
4 passed the dam, many below the dam and were victims of the
5 disaster. It seems most of these people observed leakage that
6 had its origin at the shrinkage or temperature cracks on the
7 dyke. As I recall, your former testimony, you stated there
8 was a leakage coming out near the junction of the dam with the
9 rock, at the west abutment, somewhat above the contact between
10 the two formations-- is that correct?

11 A I judge it now from memory, its proximity to that con-
12 tact, I judge it to be near that contact, that was clear water,
13 absolutely clear.

14 Q What would you estimate the amount of water coming out
15 at that new leak?

16 A I would say two or three miner's inches.

17 Q Represents the total of the new leak you observed that
18 trip?

19 A Yes, but there was another leak in addition to that,
20 not a new one. We were there twelve hours before the break,
21 and there was an acceleration of the leak a couple of times, a
22 little gradual tapering up.

23 Q What would you estimate the total amount of the ac-
24 celeration a ~~xx~~ matter of a few days ago?

25 A I think I testified about a second foot.

26 Q From that place?

27 A Not right from that place. There were two leaks
28 there, and we had piped-- leaked so much more had oakum in it.
29 It was simply put in there, it was a contraction break, perfect-
30 ly natural one, you will see in curbs on the street any place.
31 They occur in a straight line, and open up when the temperature
32

1 gets low, as the water got up to the dyke, there was a crack
2 there. It opened, we purposely left it open, it was doing no
3 harm, it was coming out on top of that dyke at the ridge, two
4 or three days. We told Berry to fix it up and drain it out and
5 pipe it. You have heard much evidence here, referred to as the
6 top along that dip, being soaked, wet. That was leaking there.
7 We didn't regard that to amount to anything. A curious thing,
8 the dam was as tight a dam as ever I saw, up to the time it gave
9 out, ~~xxx~~ as big as that, with as little leakage in it, but low
10 down leaks towards the bottom of the dam, as far as I ever ob-
11 served, and I observed, and went down there, Tony and I, many,
12 many times, there was no leakage we could ever discover under
13 the base of the dam, absolutely none.

14 Q BY THE CORONER: How did you get down?

15 A We looked along there. There is a bond on the fore-
16 bay you could walk along on the lower step of the dam, observe
17 it, no leakage in the bottom steps of the dam save from what
18 dripped from the cracks above, came down those steps.

19 Q BY A JUROR: Was the leakage from the dyke more con-
20 spicuous than the leakage from the dam proper?

21 A No, you collected all the water that came from the
22 dam proper. It was markedly more the dyke. The dyke was
23 wholly an unimportant thing, had no significance at all, leaked
24 up there and run, and was being led off.

25 Q The leakage from the dyke had saturated the hill be-
26 fore you put in that drain, and that was conspicuous?

27 A Yes.

28 Q And that is what many of the witnesses testified was--

29 A Yes sir, Van and myself knew of the conditions that
30 all these men were testifying to. Some of these fellows are
31 good men, and testified to what they saw, and tell you their
32

1 calculations or inferences about it.

2 Q BY THE CORONER: This schist disintegrates, couldn't
3 be solid rock, wouldn't be boulder?

4 A Yes sir, boulder, very old boulders, just the same as
5 other rocks. This is a hard flinty--- they split, break up,
6 and finally disintegrate--- igneous rock clearly.

7 Q If it is susceptible to water, why wouldn't it under
8 the dam?

9 A Yes sir, these things are scattered around in meagre
10 quantities. This is rotten quartz, I think, like other rocks
11 up there, loosened out of that conglomerate.

12 Q Would you say that was just an accident, wasn't the
13 character of all the formation under the base of the dam along
14 the west hillside---

15 A Not like that, this is a piece of fragment of rotten
16 boulder in the conglomerate, I judge to be, has the same
17 characteristics and same peacock color of all the boulders in
18 that country, stained with iron.

19 THE CORONER: That is all, you may be excused.

20
21
22 GUY D. LUNDY, being first duly
23 sworn, testified as follows:

24 BY THE CORONER:

25 Q Please state your name.

26 A Guy D. Lundy.

27 Q Where do you reside?

28 A 3849 Lankershim Boulevard, Los Angeles, California.

29 Q What is your business or occupation?

30 A Electrician at the Famous Players Studio.

31 Q Mr. Lundy, were you acquainted with the St. Francis
32 Dam?

1 A Yes sir, for four years, own a residence two and one
2 half miles below the dam.

3 Q Were you at that residence on the night of the twelfth?

4 A I wasn't, I was there in the morning.

5 Q The morning of the thirteenth?

6 A Yes sir.

7 Q What time in the morning?

8 A I got there about ten o'clock.

9 Q What did you do when you got there?

10 A I helped the police and sheriffs tie bodies on horses,
11 etc., and then we went on, searched up the canyon, finding others
12 right along. I seen thirteen persons, what I could help I would
13 do.

14 Q Did you do anything else up there?

15 A I went up as far as my cabin site, and by the time I
16 had helped the police, etc., I didn't have time to go clear to
17 the dam on Tuesday. I found when I got to my cabin big oak
18 trees were wiped off the map, water thirty feet, sand and gravel
19 over where my place stood, and it was sixteen feet above the
20 level of the canyon.

21 Q Did you take any photographs that day?

22 A I didn't.

23 Q Take any photographs anytime?

24 A No sir, I went up again the following Sunday, and the
25 following Sunday I went up there-- Haskell Canyon-- took me up
26 just above the dam, left my car just at the edge of Haskell
27 Canyon, went down the ropes to get down in the reservoir, and
28 owing to the fact everything I had was ruined, I made as close
29 an investigation as a man not an engineer could.

30 Q What did your investigation disclose?

31 A Three weeks ago, when I was up there, I went through
32

1 and noticed one new leak, that made two leaks. I saw one one
2 inch deep, twelve inches wide, looked to me.

3 Q Did you at that time take any photographs or have any
4 taken?

5 A I didn't, but went on down the canyon, and the piece
6 standing, remains standing there, the adjoining piece to that was
7 carried, would estimate about three quarters of a mile. I
8 measured it, it was 53 x 59 feet, and between forty-five and
9 fifty feet high, laying on its side with bottom exposed.

10 Q What did you see at the bottom?

11 A I took off a piece with my hands, found the concrete
12 was good, nothing the matter with the concrete. I couldn't
13 chip it, cut it, anything else. I took off patches, I will say
14 eighteen inches by fourteen in diameter, and there is where it
15 was fastened onto the cement of the dam, and that is the material.
16 I would like to tell you why I am here. I didn't want to get
17 mixed up in this, because the City of Los Angeles has manfully
18 taken the blame of it. I came down to find the District
19 Attorney's office, to find the right method to put in my claim
20 for damages, and he subpoenaed me.

21 Q Did you bring the photographs?

22 A I didn't. There are five or six more pieces on the
23 bottom of the dam you can get.

24 Q BY DISTRICT ATTORNEY: You broke this piece I have in
25 my hand?

26 A Yes sir, that broke off this piece in the hands of the
27 Jury.

28 Q Do you know whether that will dissolve in water or
29 not?

30 A I haven't tried it. I seen by the papers you did.
31 On Sunday before the dam broke, I was at my cabin, and in the
32

1 afternoon Tony Harnischfeger and his three months' wife and eight
2 year old boy came down to the cabin. Tony was always a friend
3 of mine and visited me. He wanted his wife to see the cabin.
4 They came in, stayed possibly an hour and a half, and Tony told
5 me, in the presence of three people, well, I would go up some
6 night, and wouldn't have any cabin-- in that water.

7 Q How far down below the dam was that piece of concrete?

8 A I would estimate about three quarters of a mile, maybe
9 a little less than that, going down the rocks it would seem
10 farther. It is the largest piece of concrete down there.

11 Q BY THE CORONER: Which side of the stream bed?

12 A Pretty near the center of the bed.

13 Q Could you tell by its shape or any other evidence just
14 where it came from?

15 A Looks like the adjoining piece left standing or part
16 of it.

17 Q Is this a photograph of that piece you described?

18 A No, I think this is the piece remains right at the
19 dam, if I remember. I think it is further down than that, I am
20 not sure from this photograph.

21 Q BY MR. MOHR: Calling your attention to photograph
22 E-1922, I ask you to examine that and point out to the Jury what
23 piece of concrete you refer to. There (indicating) is the dam
24 site, there is some of the concrete there, there is another piece
25 down there, and I think possibly you will see another piece right
26 there (indicating).

27 A That is the piece (indicating), the last piece you
28 put your hands upon.

29 Q BY THE CORONER: I show you a photograph in the March
30 22nd edition of the Engineering News Record, appearing on Page
31 470, at the left upper part of the page. This photograph (in-

32

1 dicating), is that the piece you refer to?

2 A Yes sir, and that is where that stuff came out of.

3 Q BY MR. MOHR: Referring to photograph E-1931, will
4 you explain what you are talking about?

5 A Tell me which way this runs-- this is the photograph
6 that I recognized.

7 Q Did you notice two large concrete pieces together?

8 A No, I didn't.

9 Q BY A JUROR: I can't see where this is of any material
10 benefit.

11 THE CORONER: We are trying to determine where this
12 material came from.

13 Q BY MR. SCOTT: Do you know whether or not the piece
14 you took off that piece of concrete was any place at the dam?

15 A Absolutely.

16 Q Do you know whether or not it was picked up while
17 that piece of concrete was rolling down the canyon?

18 A No chance for me knowing that.

19 Q BY THE CORONER: Did you see any formation like this
20 at the place where the dam stood?

21 A When I stood on top of the hill with Engineer Clarke,
22 it looked to me redder than that, where the dam was washed out,
23 darker red, and big erosion, places in the center of it, thought
24 maybe water coming through something, leaks.

25 Q BY DISTRICT ATTORNEY: I have three pictures which
26 were taken of this concrete going downstream. One is a picture
27 of a piece of rock in the distance, taken from some distance, do
28 you recognize that?

29 A That looks very much like the piece.

30 Q I want to show you a picture of, a closeup view of
31 that, did you see that?

32

1 A It didn't look the same to me.

2 Q I show you three pieces of concrete, with the camera
3 undoubtedly close to them, and ask you if you remember seeing
4 these?

5 A JUROR: We will take his word that he knocked it off
6 the bottom of the concrete.

7 Q BY MR. SCOTT: Did you see any schist embedded in any
8 of that concrete?

9 A I am not a mineralogist. Some people tell me that
10 is schist, I don't know.

11 Q BY A JUROR: Wouldn't you assume that a large mass
12 of concrete such as you saw down there would be apt, as it was
13 rolling over and over with that force of water, to pick up
14 something such as you have in your hand?

15 A This was so uniformly flat and laying there, looked
16 like to me that was what the dam was resting on. I don't know.
17 It is pretty hard to conceive a piece of concrete rolling down
18 as big as that was.

19 Q It had to get there some way, and we assume the force
20 of the water rolled it down.

21 Q BY DISTRICT ATTORNEY: Of course, you wouldn't know
22 what a hundred and sixty-seven thousand cubic feet of that con-
23 crete, what the pressure would be, and how much of that stuff
24 it would press, and how hard it would press into the hill with
25 water and how much would adhere to it, how much would be torn
26 out?

27 A I think it would take a pretty expert engineer to do
28 that.

29 Q If you found it adhered to the concrete, the red
30 porphyry, you would be absolutely sure, wouldn't you, as a reason-
31 able man, that the concrete was poured on the red porphyry and the
32

1 red porphry was adhering to it, and that the base was resting
2 upon water?

3 A To the best of my knowledge and belief, this was part
4 of the dam when it broke loose, I don't know and have no way of
5 proving it.

6 Q BY A JUROR: You say that this will dissolve in water.
7 We are demonstrating that with this sample in the glass. Now,
8 don't you feel that with the amount of water that was used to
9 carry that block of concrete down the stream, that if it is so
10 easily dissolved, if that had all been in place and had adhered
11 to that concrete in the first place, that with all this volume
12 of water, it wouldn't have been washed off?

13 A There might have been forty tons in the dam, and this
14 is what is left.

15 Q BY THE CORONER: Could you identify that particular
16 piece, what particular part of the dam it came from?

17 A I can identify it as coming off the piece you showed
18 me in the picture in the magazine. That is as far as I can go.

19 THE CORONER: The legend under this picture states the
20 fragment nearly a half mile below the dam, all that remains of
21 Power House No. 2, fragment believed to come from the west end
22 of the dam itself--- this piece was carried around two bends of
23 the stream, but there is nothing definite about it.

24 A JUROR: The gentleman testified practically 50 x 50 x 50
25 feet. It could have come from a number of different sections
26 from the west end that went out. The piece adhering to it
27 might have been on the side of the canyon.

28 A (By witness) No, I am under the impression as I looked--
29 the way these steps went up-- that dam was built in steps, five
30 feet up.

31 Q BY A JUROR: Did you take that piece off the steps?
32

1 A No, underneath, what I figured to be the bottom.

2 Q What part of this did you take this piece off?

3 A Right in there (indicating), down in the base here (in-
4 dicating).

5 Q BY DISTRICT ATTORNEY: As I understand, you pointed
6 this out to J. Gordon Clarke?

7 A No, Mr. Clarke was in such physical condition when I
8 met him, he couldn't go down in the canyon again.

9 Q Too fat?

10 A It was awful rough going, we met by chance as I was
11 going up, I met Mr. Clarke, he was awful tired and pretty well
12 blown going up that hill, so we stopped and talked, and he asked
13 me to point out where the leaks were, and to the best of my
14 knowledge as I remember, I pointed that out as well as I could.

15 Q Was it on this piece shown in the engineering magazine?

16 A Mr. Clarke met me just after I left this piece.

17 Q What piece was the erosion?

18 A On what is left of where the dam stood, don't know
19 whether the dam set on that or not.

20 Q BY MR. MOHR: About how high from the bottom of the
21 canyon did the erosion on the sides look to you?

22 A At my cabin, the water went eighty-five feet. My
23 cabin was sixteen feet.

24 Q How high is that from the bottom of the canyon?

25 A I would say eighty-five feet from the stream level to
26 where she got at my place.

27 THE CORONER: That is all, you may be excused.

28

29

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32

FERDINAND CASPROVITZ, being first
duly sworn, testified as follows:

1 BY THE CORONER:

2 Q Please state your full name.

3 A Ferdinand Casprovitz.

4 Q Where do you reside?

5 A 251 East 31st Street, Los Angeles, California.

6 Q What is your business or occupation?

7 A My occupation is form builder in the concrete line.

8 Q Do you know anything about the St. Francis Dam?

9 A I have been out there during the time it was under
10 construction.

11 Q Have you been out there since it was finished?

12 A I have.

13 Q Since it went out?

14 A I have tried to be out there since the time it went
15 out, but I couldn't make it.

16 Q You volunteered to give testimony about certain con-
17 ditions out there?

18 A At the time I seen the St. Francis Dam under con-
19 struction, I have noted the footing of the St. Francis Dam,
20 also the footing of the Mulholland Dam, and I have worked on
21 dams before, and I know the way we put the footings on the other
22 dams, and if these other dams' footings was meant to hold, this
23 will not hold.

24 Q On both the Mulholland and St. Francis?

25 A Yes.

26 Q Why?

27 A They are not deep enough into the hills, the way I
28 have looked at the ground. There was no solid rock in there.

29 Q Were you there when the concrete was poured for the
30 ends of the dam up against the hill?

31 A Yes sir.

32

1 Q How deep were the trenches in which the concrete was
2 placed?
3 A Trenches was in places from two to four feet. Some
4 places there was no trenches.
5 Q Were you out there all the time, or just occasionally?
6 A I was out there different times.
7 Q You didn't work on the job?
8 A I didn't.
9 Q You can't say you watched it very closely. How many
10 times were you there altogether?
11 A About twenty different times.
12 Q Why did you go out there so often?
13 A I live in Lankershim, North Hollywood now, and many
14 times I didn't have anything to do, and I would go out and
15 watch this, and was interested in the construction work.
16 Q Did you see the formation before any concrete was
17 poured at the ends of the dam?
18 A Yes.
19 Q Do you know what the formation was on the west side?
20 A It was sort of shale formation, sort of slate.
21 Q Do you know what mica schist is?
22 A I don't.
23 Q Do you know what conglomerate is?
24 A I don't.
25 Q You are not a geologist?
26 A No sir.
27 Q What did you see there? You didn't analyze it, try
28 to attempt to find out what it was?
29 A I took some in hand, playing with it, breaking it
30 open.
31 Q Did you get that in the place where the concrete was
32

1 poured or some material that was thrown out?
2 A I got that where the concrete was poured.
3 Q You say it was soft and red?
4 A Yes sir, it was brownish red.
5 Q Which side did you get that from?
6 A West side.
7 Q Did you know anybody on the job out there?
8 A I didn't.
9 Q Ever work for the City?
10 A No sir.
11 Q You don't know what kind of material that concrete was
12 poured against, what kind of rock, if any?
13 A It was that slate rock, soft stuff.
14 Q Didn't you tell me this morning you had experience
15 building dams?
16 A I have.
17 Q Not engineering experience?
18 A Just form building.
19 Q You don't pretend to be an engineer or geologist?
20 A No sir.
21 Q Do you pretend to be an expert in dam building?
22 A I don't, only from form builder's experience.
23 Q Do you know especially what caused the St. Francis Dam
24 to go out, or have you just an opinion about it?
25 A I know that hadn't had solid footing.
26 Q You believe it didn't have solid footing?
27 A I am pretty well satisfied it wasn't.
28 Q All the way across, or only part of it?
29 A I wouldn't say all the way across it didn't have
30 solid footing.
31 Q But you haven't that opinion from any scientific
32

1 knowledge, merely your opinion from observation?

2 A The way I watched there, couldn't see where there was
3 any solid foundation under the dam.

4 Q Do you think the dam tipped over, pushed out or just
5 fell down?

6 A Broke out on the sides.

7 Q Do you know what caused it to break on the side?

8 A No footings on the side, that is my idea about it,
9 soaked in under and that slate soaked up and the dam broke away.

10 Q Did you ever hear that the dam was in danger before
11 it did go out?

12 A No, I didn't.

13 Q You were not expecting it to go out?

14 A I wasn't expecting either one of the dams to go out,
15 no.

16 Q BY MR. SCOTT: Are you sure you have told us every-
17 thing you know about this matter?

18 A Yes sir.

19 Q You haven't held anything that might enlighten the
20 jury?

21 A No sir.

22 Q BY DISTRICT ATTORNEY: You said you compared what you
23 saw at the St. Francis Dam and the Hollywood Dam with what you
24 saw at some other dams?

25 A Yes sir.

26 Q What other dam anything like this did you see?

27 A Taloma Dam in Central Oregon.

28 Q How big a dam was that?

29 A Don't exactly remember the dimensions. It has been
30 quite a few years ago, a little over eight years.

31 Q How old are you?
32

1 A Twenty-nine.

2 Q You were about twenty-one years old?

3 A Yes sir.

4 Q How much time did you spend in and about that dam in
5 Oregon?

6 A I was there better than eight months on the con-
7 struction of the dam.

8 Q Did they go into the side hill?

9 A On one end it was abutted into the side hill, on the
10 other end it was abutted into a cliff.

11 Q Did you notice how they did it?

12 A Yes sir.

13 Q Have you seen any other dams other than the one in
14 Oregon constructed?

15 A I haven't.

16 Q Have you any interest in the outcome of this?

17 A Yes sir.

18 Q What is your interest?

19 A My interest is that I have a mother and father in
20 this city, and have loved ones, and wish to do what I can to
21 avoid any such more disasters.

22 Q You have no other interest except in coming here as
23 a patriotic citizen, and whatever enlightenment you can give to
24 the jury you will give it?

25 A That is all.

26 Q BY MR. MOHR: You are sure you haven't anything else
27 you want to tell this jury?

28 A All I wish to say is this, Mulholland Dam to my es-
29 timation is not safe for public lives.

30 Q BY DISTRICT ATTORNEY: What do you base that on?

31 A On the foundation of it.

32

1 Q What is there about the foundation that you now recall
2 that would make that dam unsafe?

3 A It is not deep enough in the side hills, and that rock
4 they have it up against is not solid rock. Some places had a
5 lime line shot up against the side of the hill, and Mexicans
6 scraped the dirt and poured it up against what they thought was
7 solid rock.

8 Q BY A JUROR: Did you work on that dam?

9 A I haven't.

10 Q You got permission from the boss to go in these
11 trenches?

12 A I wasn't barred. I was out there ~~xxx~~ many times and
13 spent two Sundays looking the place over. I never was barred.

14 Q Do you know sandstone when you see it?

15 A Sandstone, yes.

16 Q Different qualities?

17 A Not different qualities, I wouldn't say.

18 Q BY MR. SCOTT: How long has the Hollywood Dam been
19 there?

20 A Been built about 1924.

21 THE CORONER: That is all, you may be excused.

22
23
24 EDGAR A. BAILEY, having been pre-
25 viously duly sworn, was recalled and testified as follows:

26 BY THE CORONER:

27 Q I think it would be well to have some expert advice as
28 to how the Mulholland Dam or Hollywood Dam was constructed. I
29 understand you have more accurate knowledge of that dam in its
30 present condition than anybody else.

31 A In determining the proper cross section for the dam,
32

1 we were a little in doubt as to what load would be suitable for
2 sandstone such as was there. We had tests made. Our tests
3 ran from ninety to about one hundred and five tons to the
4 square foot. We had one sample a foot square, the largest
5 testing machine in town couldn't break it at all. That sample
6 is still with us, and I think the fragments of the others are
7 with us in the department. On the strength of the tests, we
8 lowered the load about ten tons on the lower toe, tapering to
9 twelve tons on the upper toe. That is how the load was de-
10 termined. Parts of the sandstone ran very firm, hard sandstone,
11 variation some places, some was unusually hard. The dam was
12 constructed by Mr. Henry Jacks, who constructed the aqueduct,
13 many towers for our various earth filled dams. I ^{always} observed
14 Jacks' work to be the very best in concrete. Jacks was what I
15 considered one of the best concrete constructors I knew of. In
16 making the bond after clearing away the debris, getting down to
17 the excavation, Jacks personally, almost invariably, the bond
18 part of the concrete adjacent to the sandstone, Jacks was
19 personally there, saw to it, was cleaned out, swept out, rinsed
20 out with a hose, to get a clean, perfect contact. He was very
21 conscientious about it. I was there on and off quite often
22 during the construction of the dam, until it reached about a
23 height of eighty feet. By that time I was transferred to the
24 Colorado project, and had to do with the location of the
25 aqueduct between the Colorado River and Los Angeles. To take
26 care of the possible uplift, a great many dates made in the
27 file, a record kept of the formation, it was all of sandstone,
28 Mr. Jacks has that record, and through the bottom of the dam,
29 also through the concrete, it was the system to take care of
30 the uplift for sliding. I stated in my previous testimony my
31 recollection was sixty-six and two thirds per cent coefficient.
32

1 Since then I want to make a correction, the design was for
2 sixty per cent. We got in a few places overturning the section
3 base on a straight gravity type, was still within the middle
4 third, using a limiting weight of concrete of one hundred and
5 forty pounds to the cubic foot. We had a test of a cubic foot
6 of concrete at one time when I was there of one hundred and
7 fifty-two pounds, and for overturning with a base of one hundred
8 and forty pounds, we were still within the middle third, and
9 down near the bottom quite near the middle third section. The
10 dam was as described by earlier testimony was arched to a
11 circular radius, embedded as near as practical radial in the
12 side hill. Mr. Mulholland used a unique type, what he calls
13 a fig system of concreting, like you would pack a lot of figs in
14 a box. Whether that system was used in the St. Francis or not,
15 I am not certain. The ice thrust wasn't taken into account.
16 The dam was computed, water standing at the over top of the
17 middle third.

18 Q BY A JUROR: Where is the spillway?

19 A The spillway was constructed while I was away. I
20 haven't been up to it recently.

21 Q BY THE CORONER: What would you say about the present
22 condition of the Mulholland Dam and its security?

23 A To my mind, as I stated this morning, in my judgment
24 it is safe for all time, however, that is my judgment based on
25 the observation of it, construction knowledge of the stresses
26 that were used, and the method of constructing. Perhaps it
27 would be advisable at some such time, as I understand there has
28 to be an investigation of all the dams in the city, to make some
29 particular tests in that particular dam as to the possible
30 situation in the sandstone, sometime when the reservoir is lower
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1 down, to excavate, see how far the water would penetrate in the
2 sandstone, testing that, compare to that some data to base a
3 judgment on.

4 Q BY A JUROR: These tests at the Osborne Laboratory,
5 they were made dry?

6 A Yes, no penetration. These tests were made as a
7 matter of prudence, considering that the other dam went out,
8 and considering, as I have stated two or three times, that there
9 are certain indeterminate stresses in dams, they are not a new
10 question among the best engineers, one engineer maintaining one
11 theory and some another, some that you compute on radial lines,
12 others on parallel lines. All this I would say as a matter of
13 prudence that perhaps it would be advisable to lower the water
14 level in the reservoir to such a level that under any theory of
15 any prominent engineers, it would come within the safe estimate
16 of their theory.

17 Q BY MR. BOTTORF: You know that has been done?

18 A Yes, I know that the water has been lowered. For
19 instance, there is one theory that uplifts should be taken care
20 of by perhaps two thirds of the pressure at the upstream toe,
21 tapering to nothing at the downstream toe, ignoring such arch
22 thrust as you would. That theory is considered sound. If
23 that theory would show water should be lowered a little to get
24 within that, I would say that was in the realm of prudence.

25 Q BY A JUROR: The St. Francis Dam, as has been shown,
26 has the west abutment on a ridge. The Hollywood Dam occupies
27 a very different situation?

28 A Well, I have never seen the St. Francis--- have seen
29 pictures, and know it is on a ridge. The Hollywood abuts into
30 the sides--- our first axis along the two wings points on the
31 opposite sides of the canyon, that would show the minimum
32 yardage in a dam of that design. After giving it a good deal

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3 of consideration, we decided to throw it upstream and press it
4 around the side of the canyon at all practical points, and you
5 will observe it is carried around the ends and toed in that way,
6 adding, of course, for additional yardage.

7 Q The sandstone, does that have a bedding plane,
8 cleavage plane?

9 A Some cleavage plane.

10 Q How is the dip, upstream, downstream or sideways?

11 A My recollection is there is some dip sideways in the
12 center, somewhat of a downward dip. I would have to verify
13 that by comparison with our notes.

14 Q Was there any portion where the dip was downstream?

15 A I don't remember.

16 Q BY MR. SCOTT: In designing the Hollywood Dam, were
17 all the well known principles of dam construction for safety
18 taken into consideration?

19 A I didn't design it, I made the profile.

20 Q Did you design it or not?

21 A No, I designed the stress diagram of it. A design
22 in its full definition would include all the dam, longitudinal
23 profile development of the top steps, arrangement of the gates.

24 Q You are familiar with the design?

25 A Yes, in a general way.

26 Q Then I will ask you, assuming that you are familiar
27 with it, were all the well known principles of dam construction--

28 THE DISTRICT ATTORNEY: He said he went away---

29 A I left when it was eighty feet high. Up to that
30 stage, I thought it was an excellent job, I was proud of it.

31 Q BY A JUROR: As I understand, you have taken one unit,
32 just a cross section through the dam or profile of the dam, and
analyzed that profile as to the susceptibility?

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A Yes, correct.

Q Have you as yet been able to get from your records the coefficient of friction that was used on the St. Francis Dam?

A No, but that is being done this afternoon by our boys.

THE CORONER: That is all, you may be excused.

1 MR. DEEHISON: Who read the meter which was up there, that
2 clockwork arrangement that showed the---

3 A That records a pencil line on a piece of paper. It is
4 not a matter of reading. It makes its own records.

5 Q BY MR. DEEHISON: Does it show when the water started
6 to flow, when the flow increased?

7 A Yes, an hour is only one-tenth of an inch on it.

8 Q Does it show any increase along about half past eleven,
9 any perceptible increase?

10 A Well, not very much. You can see for yourself when it
11 comes in.

12 A JUROR: Can you tell us how many acre feet went in the
13 reservoir between the elevation of the spillway and three-tenths
14 of a foot below, from that curve?

15 A We have a typewritten sheet giving the capacity to one-
16 tenth of a foot.

17 Q You have the various elevations of the dam?

18 A Yes.

19 Q The maps will give the elevations of the spillway?

20 A Yes.

21 Q And from them you will be able to ascertain just exact-
22 ly what that is?

23 A Yes. This table is the area in acres, 615 acres at
24 elevation 1835.

25 Q That is the spillway capacity?

26 A Yes. One foot would be 61.5 and three times would be
27 three-tenths, that is, 184½, I believe.

28 Q If three-tenths of a foot ran out in half an hour,
29 approximately, and you had a uniform acceleration--

30 A Where did you get the three-tenths of a foot?

31 Q From a newspaper.

32 A You are quite in error in taking what the newspapers

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say.

Q You saw the flow meter record?

A Yes.

Q How much decrease in depth was there from 11:30 to 11:50?

A Oh, very little, scarcely any.

Q It showed less than three-tenths?

A Yes, less than one one-hundredth of a foot. In fact, the difference is so little that it could easily be accounted for by the wind changing ^{direction,} ~~direction,~~ very easily.

Q The flow meter is not accurate, then, is it?

A Yes, it records the elevation very accurately. It is installed for the purpose of determining how much storm water we had accumulated in the reservoir belonging to the entire valley.

Q It would vary some according to the direction of the wind?

A I imagine it would.

E. F. SCATTERGOOD, being

first duly sworn, testified as follows:

BY THE CORONER.

Q Please state your full name.

A E. F. Scattergood.

Q Where do you reside?

A 1415 Berkshire Avenue, Los Angeles, California.

Q What is your occupation?

A Electrical engineer.

Q For the Bureau of Power for the City of Los Angeles?

1 A Bureau of Power and Light, you sir.

2 Q Had you anything to do with the selection of the site
3 of the St. Francis Dam?

4 A No.

5 Q Did you examine the site for any purpose whatever?

6 A No sir, I did not.

7 Q Did you ever express any opinion as to the site being
8 proper for the situation of the St. Francis Dam?

9 A No, I never have.

10 Q Was this St. Francis Dam and the reservoir there, a
11 part of the power or power unit of the City Corporation?

12 A No, it was a purely emergency reservoir for providing
13 water in the event of extraordinary emergencies, as a water
14 supply.

15 Q Did you ever entertain any opinion that the dam site
16 was not a proper or a safe site, or did you ever express such an
17 opinion?

18 A No, I never did. I never went over the site or look-
19 ed at it.

20 Q As far as you know, the dam was all right, was it?

21 A Yes.

22 Q And you never examined the formation there or criticized
23 ed it?

24 A No, I never did. I have been on the dam while it was
25 there, but I never examined the site; I am not an expert on dams
26 and never had anything to do with the planning of dams.

27 Q The reason I have called you here today is because it
28 has been reported to me that you had examined the site and did
29 not approve of it, and I wanted to get it into the record, the
30 actual facts?

31 A No sir, I have not examined the site before the dam
32 was built or since, with any such view in mind, or at all, and

1 I never expressed any such opinion that it was not a proper dam
2 site or any opinion regarding it, as proper or improper, as a dam
3 site.

4 Q BY MR. DENNISON: You are the engineer in charge of what
5 part of the power and light. There is a department over there
6 and it has two heads?

7 A The Department of Water and Power has two branches;
8 one the Bureau of Water Works and Supply, of which Mr. Malholland
9 is the head, and one the Bureau of Power and Light of which I am
10 head, under the direction of the Board.

11 Q Does this Bureau of which you are the head, erect dams?

12 A No sir.

13 Q You don't have anything to do with that?

14 A No. I made one little regulating reservoir at the
15 head of the pipe line of Power Plant Two. You might call it a
16 reservoir. It has less than one hundred acre feet or thereabouts,
17 and it is more a regulating puddle than a reservoir.

18 Q And you had nothing to do with the selection of this
19 site?

20 A No, I have not been consulted in any capacity in regard
21 to it.

22 Q And your advice was not taken on it?

23 A No sir.

24 Q You did not see it before it was constructed?

25 A Yes, I have been up and down that canyon many times,
26 but have never stopped and examined the site for any purpose.

27 Q AS an engineer, do you think you would be capable of
28 selecting a site?

29 (No response)

30 MR. SCOTT: I think the witness has stated that he had
31 nothing to do with the dam.

32 MR. DENNISON: Assuming now, that you were called upon to

1 build a reservoir up there. You have seen the place and you
2 would make some exploration preliminary to doing it?

3 (No response)

4 MR. SCOTT: What do you want to bring out. We want the
5 light here, but this character of examination is uncalled for, I
6 think.

7 THE CORONER: Mr. Scattergood has said that he has never
8 been engaged in building dams or selecting sites for dams, and
9 that is out of his line.

10 MR. DENNISON: I will withdraw the question if he don't want
11 to answer it. Do you think you are capable of answering it?

12 A I did answer the question. I said I would make a
13 thorough investigation, the same as I would in selecting a power
14 house site, or any other site.

15 Q Would you mind telling me how you would make that in-
16 vestigation?

17 A Not being an expert or having had experience in the
18 construction of dams, I would, of course, consult those who have,
19 the same as any manager would employ experts, even though he was
20 an engineer and engaged along a line in which he had no exper-
21 ience.

22 Q Do you mean by that that you would call in geologists
23 to tell you what kind of soil and formation it was?

24 MR. SCOTT: I think we are taking too much time here.
25 What someone else would have done--- we are trying to find out,
26 Your Honor, why this dam went out, and what someone else has done
27 would have nothing to do with that investigation. I don't know
28 what counsel's purpose is, whether to get publicity or get the
29 light. I feel that he is not exactly adhering to your Honor's
30 ruling.

31 THE CORONER: I think you are correct.

32 MR. DENNISON: If the Pennsylvania Railroad was to build a

1
2 dam or the Southern Pacific Railroad, as I understand the pro-
3 cedure, it would be to first make a preliminary exploration to
4 determine whether or not a dam should be constructed in that
5 place, and if it were necessary they would call in the assistance
6 of geologists to determine the formation of the soil and deter-
7 mine where the bed rock was, and whether it would be safe to
8 erect a dam upon that site;

9 THE CORONER: Do you wish to answer that question?

10 A I have already said that I would ask the advice of
11 someone who had experience in the construction of dams and what-
12 ever they did--- because I would be in the capacity of a manager
13 and not as an expert or engineer, and what I can say here, would
14 not be of any value as far as I can see, any more than if you
15 asked the manager of the Southern Pacific, he would call in an
16 expert, and that is what I would do.

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20 CLYDE C. RUBLE, being
21 first duly sworn, testified as follows:

22 BY THE CORONER.

23 Q Please state your full name.

24 A Clyde C. Ruble.

25 Q Where do you live?

26 A 1464 Arroyo, Los Angeles, California.

27 Q What is your occupation?

28 A Superintendent of the operation of power plants, Bureau
29 of Power and Light.

30 Q Were you in charge of Power Plant No. 3 of the Bureau
31 of Power and Light?

32 A Yes sir.

Q That was located just below the St. Francis Dam?

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A Yes sir.

Q Were you located at that place?

A I have never lived at that particular plant. I lived at Power House No. 1 for a number of years.

Q Where were you on the 12th day of this month?

A At Los Angeles.

Q Were you notified of any serious condition at the St. Francis Dam, just prior to the time it went out? Did you know anything about it?

A Not a thing was reported to me.

Q Did you give any instructions for any special work to be done up there on the 10th, 11th or 12th, anticipating a flood or anything of that sort?

A On the 12th there was instructions issued to the Assistant Chief Operator at Power House No. 1, Harley S. Berry.

Q What were his instructions?

A The instructions were to put in the stop logs at the entrance of a diversion tunnel from this cement ditch, which comes from the St. Francis Dam, also to open the gates across the main canyon, which were used as diversion gates.

Q What was the reason for the instructions?

A The possibility of a storm in the canyon raising the reservoir height and overflowing and putting excessive water down this ditch, and also at the time there was mentioned the possibility of a north wind piling up the water at the dam, and bringing down rock and different rubbish, which was in the ditch, and, not wanting it in the main aqueduct system, it was arranged to have it flow down the main canyon.

Q Not because you felt that the dam might fail and that the flood waters from the dam would plug up your tunnels?

A That never entered my mind.

Q You never had any intimation that there was any weakness

1 at the dam?

2 A No.

3 Q BY MR. SCOTT: Mr. Berry was lost?

4 A Yes.

5 Q Did you know Mr. Dave Mathews?

6 A Yes. He worked at Power House No. 2 for some years.

7 Q Dave Mathews testified before this jury, that you told
8 him that he knew too much and that he was going to be fired.
9 Did you have any conversation with Mathews in which you told him
10 that he knew too much and was to be discharged?

11 A No, I don't think anybody ever accused him of knowing
12 too much.

13 Q Did you ever state to him that he would be laid off on
14 account of anything that he had said?

15 A There was absolutely nothing said regarding laying him
16 off at all.

17 Q Was he discharged from the employment of the City, or
18 did he quit of his own accord?

19 A I understand that he quit of his own accord. There
20 was something said--- he came to the office on a Friday and I did
21 not get all the conversation. Mr. Martindale, my immediate super-
22 ior, probably can give you a report as to the detail of that.

23 Q What do you know, if anything, about Dave Mathews want-
24 ing to get a house to live in in the canyon, prior to the time
25 that the dam went out?

26 A Dave Mathews worked directly under Mr. G. C. Hughes.
27 Mr. Hughes was Chief Operator at Power House No. 2, and Mr. Mat-
28 hews never came to me directly regarding any accommodation, a house
29 or anything, but he had taken it up with Mr. Hughes on at least
30 two different occasions, once probably in the latter part of 1927
31 and then, I should judge, towards the latter part of January of
32 this year. There being a vacant house in camp, he had requested

1 Mr. Hughes for the use of that house and to move his family into
2 the canyon. I am not positive as to any of these dates. These
3 matters are just in the ordinary day's business and I decided
4 these things and did not remember the dates of them.

5 Q And the reason he was not residing in the canyon at
6 the time of the breaking of the dam was because there was no
7 house there that he could occupy?

8 A There was a house there, but not for him.

9 Q It was held for an operator?

10 A Yes, I intended to transfer a power house operator from
11 another point to this station and was holding the house for him.

12 Q When did you first receive notice that the dam had
13 gone out at Power House No. 1?

14 A My first call was some time probably after 12:30 on
15 the night of the trouble, but I received no notice of it, and at
16 that time no one seemed to know what the trouble was, and I immedi-
17 ately left Los Angeles for the work up there.

18 Q Then, you were here in Los Angeles and not at Power
19 House No. 1?

20 A Not at Power House No. 1.

21 Q Is there a recording instrument in Power House No. 1,
22 that would record the time that the high line went out immedi-
23 ately below the dam?

24 A We have a complete record of all cases of interruptions
25 that night and the supposition is that the first case of trouble
26 just before twelve o'clock was called caused by one of the Edison
27 lines going out just below the dam.

28 Q Is it an Edison line or City line below the dam?

29 A The first power line below the dam was an Edison line.

30 Q Do you know the time--- was there anything in the Power
31 House No. 1 that would record the time of the Edison line going
32 out?

1 A This affected all the Edison and City systems. The
2 systems running in parallel any trouble on their lines would also
3 affect our systems too.

4 Q What is the exact time that it is recorded that the
5 Edison line went out immediately below the dam?

6 A I am not exactly sure, but think it was 11:57½.

7 Q When were you last on the St. Francis Dam structure?

8 A I believe on the Sunday before. I am not sure, a few
9 days before this.

10 Q Did you notice it leaking on the west side?

11 A I noticed the ground being damp there but did not
12 notice any excessive water, no more than usual. In fact, the
13 water in the ditch below the dam looked about the same as it did
14 before.

15 Q Was it clear or muddy?

16 A Clear.

17 Q BY MR. DENNISON: When was it that you talked with Mr.
18 Matthews?

19 A Regarding what?

20 Q Did you have some conversation with him recently?

21 A It might have been probably on a Wednesday or Thursday
22 after the disaster, Wednesday, I think it was.

23 Q Where were you talking to him?

24 A At Power House No. 2 on the trail between the surge
25 chamber and the side of the plant.

26 Q Did he call for his time on that occasion?

27 A No, at no time has he ever called for his time.

28 Q When did he call for it, if he called for it?

29 A In Martindale's office, I think, on Friday morning.

30 Q And you paid him up to what date?

31 A I don't know what arrangements were made to pay him.

32 Q Did you have anything to do with the keeping of his

1 time?

2 A No sir.

3 Q When did he start working?

4 A He was supposed to work on the date of the 12th and
5 left camp at the quitting time at four o'clock in the afternoon.

6 Q He did not have anything to do the next day?

7 A The trouble happened that night and he did not show
8 up on the job.

9 Q Did you talk with him on Friday?

10 A He was in Mr. Martindale's office.

11 Q Did you talk with him?

12 A I had no conversation with him.

13 Q Did he talk to you?

14 A Not to me directly. He was talking to Mr. Martindale.

15 Q What did you hear him say?

16 A I am not exactly sure as to his words, but there some-
17 thing said regarding that he did not think that the city would
18 care for his services any longer, something to that effect, and
19 also he mentioned something about not caring to work for Mr.
20 Mulholland any longer.

21 Q Anything else?

22 A I believe that is all that I got of the conversation.

23 Q You have given us all the conversation now that you
24 heard?

25 A That was directed not exactly to me, but Mr. Martindale.
26 Mr. Martindale was in the office behind the desk and I was over
27 to one side.

28 Q BY MR. SCOTT: As a matter of fact, he has never
29 been working for Mr. Mulholland, has he?

30 A No.

31 Q He is in the Bureau of Power and Light under Mr.
32 Scattered?

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A Yes sir.

Q How long have these logs that are used in stopping that tunnel, been in existence?

A Since 1920.

Q Prior to the building of the St. Francis Dam?

A They were put there during the construction of Power House No. 2.

Q That has been the usual method in the course of stopping that, for years?

A Yes. When we had to divert water from the canyon into the tunnel, we got these logs as a method of regulating that.

Q BY MR. WENNINGER: What time were they put in on the 18th?

A I could not say the exact time. I think I called Mr. Berry at ten o'clock in the morning, probably before that.

Q Why were they put in on the 18th?

A Instructions from Mr. H. A. Van Norman that we might have a storm in the canyon--- the dam being almost full it might overflow and bring this rock and other brush and stuff into the aqueduct system.

Q BY A JUROR: The Wilson high line that you have mentioned below the dam, about what distance would you say it was below the dam?

A Very close, probably less than one-eighth of a mile.

Q You say that went out about 11:57?

A Yes sir.

Q As I remember it, about three days after this disaster there was a high line still in place not a great distance below the dam, probably about one-eighth of a mile, do you remember that?

A A wooden pole line?

Q I would not say as to that. Was that put up since the dam went out?

1 A No, there have been no lines been put up by anybody.
2 I am sure as to that.

3 Q BY THE CORONER: Then, if the power line went out at
4 11:57 $\frac{1}{2}$ the dam must have broken a little before that?

5 A Well, it would be hard to figure the time as close as
6 that. That is the only method we have of determining it.

7 Q Have you fixed any definite time as the time the dam
8 must have broke?

9 A No, the only thing are these records of interruption
10 ~~from~~ on the transmission line.

11 Q How many feet was that line from the bottom of the
12 St. Francis Dam?

13 A I could not say.

14 Q Give you best judgment?

15 A I would rather not state.

16 Q BY A JUROR: Is that the line which is now buried in
17 the slide, which extends across the face of the dam?

18 A Yes.

19 Q BY THE CORONER: How far is it from the dam, about?

20 A JUROR: Where the line crosses about five hundred feet
21 below the lower side of the dam.

22 THE CORONER: It would not take very long for the water to
23 get to it. 11:57 would be about the time that the dam went out,
24 then?

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28 EARL A. MARTINDALE, be-
29 ing first duly sworn, testified as follows:

30 BY THE CORONER.

31 Q Please state your full name.

32 A Earl A. Martindale.

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Q Where do you reside?

A 2702 Mass Avenue, Los Angeles, California.

Q What is your occupation?

A Electrical engineer.

Q Were you in charge of Power Plant No. 2 of the Bureau of Light and Power?

A Yes, I am assistant operating engineer in charge of power plants and transmission lines.

Q Did you have any intimation of the condition of the St. Francis Dam before it went out?

A Not the slightest.

Q You were not near there at the time, I suppose?

A No, I was in Los Angeles.

Q You knew Dave Mathews, did you?

A The first time I ever met him was when he came into my office the first part of last week. I don't know what day.

Q What conversation did you have with him at that time?

A At that particular time he came in and did not feel like he could work any more in the canyon and wanted to know if he could work some place in the city. I was sympathetic with him naturally-- he had lost a brother, and told him that I would try to arrange for him to work here in the city, as soon as we could take it up.

Q Did you tell him not to talk about this disaster?

A No. He told me a little bit about what he had observed, as to whether he should get some legal advice or not, as to what he should say, and I told him I did not think that was necessary that we were all anxious to know the exact truth, that if he would tell us just what he had observed, we would be anxious to have it.

Q Did you caution him not to speak publicly or tell what he knew?

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A No.

Q Was he discharged finally, or is he still in the services?

A He came into last Friday, I believe, and asked about his check and I told him that the regular time of issuing the checks would be the following Monday, that is, Monday of this week, that he would have to wait until that time and he seemed to want his money right away, and thinking it was important in some way I told him that he could get his time and that was the only way that he could get his check that morning, and he wanted to do that, and I told someone in the office to let him get his time.

Q Have you any work for him now? Could you put him back to work or would you care to?

A Yes. I told him that morning, the last thing before he left, that when he was ready to go to work we would put him back to work.

Q BY MR. SCOTT: Then it is not true that he was told that he knew too much and that his services were going to be dispensed with by the City of Los Angeles?

A I did not tell him that.

Q BY MR. BERNISON: What day did you pay him up to?

A I don't know. That was turned over to the office in the regular routine, and he would be paid up to the last time-card that was turned in. On account of the chaos since the disaster has happened, I don't know what timecards would come in.

Q He says on the witness stand that you paid him up to the 15th?

A I could not tell you.

Q Does anybody know?

A Mr. Arthur.

Q Who kept Mr. Mathews time?

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A Mr. Hughes would turn in his timecards,

Q To whom?

A To our office.

Q Who got them in your office?

A That would naturally come to Mr. Joe Scott, Chief Clerk in our division. They are generally two, three or four days getting in.

Q Did you have anything to do with the checking of time?

A No.

Q Did he ask you for his paycheck?

A He wanted to know if he could get his check and I told him that the only way that he could get it that morning would be to ask for his time.

Q Who did you direct to give him his check?

A One of the clerks in the office.

Q What is his name?

A I don't remember.

Q BY MR. SCOTT: State what he said, if anything, about what he did not want to work for Mr. Mulholland?

A He came in that morning, Friday morning I believe, and without any particular announcement he blurted out that he did not want to work for Mr. Mulholland any more, and I assured him that he had not been working for Mr. Mulholland, that he had been working for the operating division. He was in somewhat of an antagonistic mood that morning.

Q Mr. Hughes was lost in the flood?

A Yes.

Q Were his time records of the crew up there saved?

A That is why there is an uncertainty about his time. I could not say what records were saved.

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ELI MUMF, being first

duly sworn, testified as follows:

BY THE CORONER.

Q Please state your full name.

A Eli Mumf.

Q Where do you reside?

A Elizabeth Lake, California.

Q What is your occupation?

A Rancher.

Q Do you know anything about the condition of the St. Francis Dam prior to the night of the 12th of this month?

A Well, I don't know anything about the condition of it. I was there on Sunday before it went out. As far as I could see everything looked all right. Of course, I don't know anything about it.

Q Did you talk to Tony Harnishfeger?

A Yes.

Q Did you talk to him about any leaks that you saw there?

A I did; not about leaks, but about water. There was some water running in the ditch and we were right alongside of the ditch, and I did ask Tony if he was discharging some water through the flood gates and he said, No, there were just a few leaks.

Q That is the concrete ditch?

A Yes.

Q Did Tony express any fear as to the condition of the dam at that time?

A He said there was absolutely no danger whatever.

Q Did you see the dam on Monday?

A No, between twelve and ^{one} o'clock ~~midnight~~ on Sunday.

Q **BY MR. SCOTT:** About how much water would you estimate

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was passing down that canal?

A Just a small stream, about fifty or one hundred inches.

Q You have had some experience in judging water in irrigation here in Southern California?

A Yes, I have been irrigating on the ranch there for years.

Q You estimated the water at one time on Sunday?

A Between 12:30 and 1:00 o'clock.

Q You estimated it between fifty and one inches?

A That is what I would judge, yes.

Q BY MR. DENNISON: What was the last time you saw Tony alive?

A Between 12:30 and 1:00 o'clock on Sunday.

RAY E. RISING, having

been heretofore duly sworn, was recalled and testified as follows:

Q BY MR. SCOTT: Were you present when some stop logs were being put in under Mr. Barry's direction near ^{House} Town/Now No. 27?

A Yes sir.

Q On what day were they put in?

A The 12th of March.

Q State whether or not Mr. Barry made any explanation to you and Mr. Coe and Mr. Mathews, about why you were putting in those stop logs?

A He made an explanation to us why we were putting them in, but I don't know whether Mr. Mathews heard it or not, but Mr. Coe and I were down in this kind of a basement where we were putting in the logs, and Mr. Mathews was on top, and we were dis-

1 cussing why we put them in and he said that the reason we were
2 putting them in was in case there was a heavy wind came up from
3 the north and piled the water up against the dam, and it came
4 over the spillway down the canyon, and we put the logs in to
5 keep the debris and stuff from going down the tunnel.
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10 DEAN E. KEAGY, being
11 first duly sworn, testified as follows :

12 BY THE CONCHER.

13 Q Please state your full name.

14 A Dean E. Keagy.

15 Q Where do you reside?

16 A 4651 Paulhan Street, Los Angeles, California.

17 Q What is your trade or occupation?

18 A I am in the warehouse of the Bureau of Power and Light.

19 Q BY MR. SCOTT: Where were you about 11:30 o'clock on
20 the night of March 12th, 1928?

21 A I crossed over the dam or right on the road alongside
22 of the St. Francis Dam.

23 Q How do you know it was that time?

24 A I left Bangus about eleven o'clock, or Newhall about
25 eleven o'clock, and it usually takes about that time to cross
26 over, to get that far.

27 Q Do you know where the water runs under the road near
28 Lower House No. 2?

29 A Yes sir.

30 Q When you crossed there between 11:00 and 11:30 on the
31 night of March 12th, 1928, did you see any unusual amount of
32 water running under the road?

A I never noticed any, no sir.

1 Q AS you went up the canyon were you near this canal
2 carrying the water?
3 A Yes sir.
4 Q Did you hear or see any unusual amount of water in that
5 canal between 11:00 and 11:30?
6 A No sir, there was nothing any different from any other
7 time.
8 Q Was anyone with you?
9 A Yes sir.
10 Q At what time, then, did you pass the nearest point to
11 the dam, the foot of the dam?
12 A The road goes along the west end.
13 Q Did you go along there?
14 A Right along the road up over the side of the dam.
15 Q Over the crest of the dam?
16 A Yes.
17 Q At that point did you hear any unusual amount of water
18 running down the side of the dam into the canyon?
19 A Nothing unusual at all.
20 Q BY THE CORDER: Did you see any light on the dam or
21 anybody on the dam?
22 A No, the only light was down in the canyon in a sort of
23 a camp.
24 Q There was nobody up on the dam with any light or guard?
25 A No light or guard on the dam whatsoever.
26 Q You are positive about the time, 11:30?
27 A Yes sir.
28 Q Where did you go after you passed there?
29 A Up to Power Plant No. 1, construction camp.
30 Q About how far?
31 A About seven miles.
32 Q Where were you approximately at 12:00 or a few minutes

1 before?

2 A I just got in bed.

3 Q You had made the distance up to power house No. 1 in
4 fifteen minutes or less?

5 A Yes sir.

6 Q What were you driving?

7 A A Ford coupe.

8 Q Did you hear any noise, any crushing sound or any
9 other kind of a loud noise as you drove along the creek before
10 you go to Power House No. 1?

11 A No sir, I never heard a thing.

12 Q Did your Ford make a good deal of noise?

13 A I had the cutout open.

14 Q You did not feel any earth tremor either, I suppose?

15 A No sir.

16 Q That was a pretty dark night, it was not moonlight?

17 A There was no moon out.

18 Q Do you know when you passed Harry Carey's place?

19 A Yes sir.

20 Q You did not notice as you went out over these culverts
21 a considerable amount of water in the stream?

22 A No sir.

23 Q You did not notice the culverts at all?

24 A No sir.

25 Q How fast were you driving up the canyon?

26 A Around thirty-five miles an hour.

27 Q Did you increase your speed after you left Carey's?

28 A No sir.

29 Q Did you make as good time as you get up the canyon?

30 A Yes sir.

31 Q When you crossed the culverts you did not even notice
32 the culverts?

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A No sir.

Q BY MR. SCOTT: Was there anyone else that you know of that came up the canyon behind you that night and before the dam went out?

A I did not know of anybody at the time, but I heard that a boy on a motorcycle did come up after me.

Q Who?

A Ace Hopewell. He worked at the camp as a carpenter.

Q At what time did you hear that he came over?

A I heard afterwards that he was at the other end of the lake and he said that he heard a rumbling noise but did not pay any attention to it, and came on up to camp.

Q BY THE CORONER: Was he at the north end of the lake?

A Yes sir.

Q Where is he now?

A I could not say. I think at camp, at Power House No.

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Q BY MR. SCOTT: About how far behind you was he?

A I could not say.

Q BY MR. DENNISON: I understand that you came up on the west side and crossed the dam to the east road?

A Yes sir.

Q There were no lights on the dam?

A Yes sir.

Q Nobody around there?

A Nobody that I saw.

Q Then, you continued on home?

A Yes sir.

Q When did you first hear that the dam had washed out?

A They called us about ten minutes after twelve. Mr. Hegan, the superintendent, called us.

Q And you had just gotten into bed?

1 A Yes.

2 Q Had you gone to sleep?

3 A No sir.

4 Q You were awake?

5 A Yes.

6 Q Who was the first person that you told that you crossed

7 the dam, was it Regan?

8 A No, I don't believe I told any one person.

9 Q I understood you to say that you drove across the dam?

10 A The road goes on the west end of the dam. You could

11 not drive across the dam itself. The road ran along the west

12 end. I took the only road that led to camp.

13 Q Where did you cross from the west side to the east side?

14 A There is no crossing except on foot over the dam. It

15 was the road on the east side of the canyon, going up.

16 Q Where were you coming from?

17 A Saugus.

18 Q Did you meet any conveyances that night?

19 A Coming down I passed one machine but not no one going

20 up.

21 Q You did not look down and see the water?

22 A No sir.

23 Q Did you see any water coming over the spillway?

24 A Yes sir.

25 Q It was just as it always was?

26 A Just as it always was.

27 Q How did you fix the time as eleven-thirty?

28 A We figured afterwards, I and the boy who was with, that

29 it was 11:30.

30 Q Who was the first person that you told it was 11:30?

31 A After the camp was aroused I did not tell any certain

32 person.

1 Q You have been interviewed by people, have you not?
2 A Yes sir.
3 Q By whom were you interviewed?
4 A I forget the boy's name. He was up at camp, at Surge
5 Chamber 2.
6 Q Did you tell him it was 11:30?
7 A Yes sir.
8 Q Or did he ask you if it was about 11:30?
9 A No sir.
10 Q Did you have a watch?
11 A Yes sir.
12 Q Do you remember looking at the watch when you got home?
13 A Yes, I looked at it when I got home, and it was a
14 quarter to twelve.
15 Q Where did you put the Ford?
16 A Outside.
17 Q BY THE CORONER: Did you see any vehicles or any
18 machines of any kind, between the dam and Power House No. 1?
19 A No sir.
20 Q Where is that road that goes from Power House No. 1
21 that goes to Elizabeth Lake?
22 A It goes to Elizabeth Lake, Mann Ranch.
23 Q Did you see anybody after you left there?
24 A No sir.
25 Q Could you see the dam clearly as you passed?
26 A Yes sir.
27 Q It was a dark night. How could you see it?
28 A I saw it because it was white.
29 Q Could you see anybody, if there was anybody around
30 there?
31 A Yes sir, unless they were hiding behind bushes or
32 like that.

1 Q If they were in automobiles around there, could you
2 have seen them?

3 A Yes.

4 Q Had you gone to sleep at ten minutes past twelve?

5 A No sir.

6 Q Do you know if any automobiles passed Power House No.
7 1 or passed along the road there after you got into the house
8 and before you were aware of this accident?

9 A No.

10 Q Did you see any automobiles after you came out of the
11 house after you were aware of the accident?

12 A No sir.

13 Q Would you say that there were no automobiles passed
14 along that road from the time that you left the dam until ten
15 minutes after twelve?

16 A Do you mean following me up?

17 Q Yes, going in the same direction as you were.

18 A I would not say there was nobody following, but no-
19 body that I saw.

20 Q If one or two or three automobiles had passed the camp
21 there, would you have known about it?

22 A After I got into camp?

23 Q Yes.

24 A No sir.

25 Q How far is your house from the road?

26 A It is the end of the road, when you get up to the camp.

27 Q Does it not go beyond there at all?

28 A You turn and go up to the top of the construction camp.

29 Q How far is the road to Elizabeth Lake from the camp?

30 A I imagine about a mile.

31 Q BY A JUROR: May we have the witness point out on
32 the photograph there, just where this road was?

1 A It comes right up from the bottom of the canyon to the
2 top of the dam.
3 Q Are there any flood lights lighting up the base of the
4 dam at that time?
5 A The only lights are down in this canyon below the dam.
6 Q That did not light up the base of the dam?
7 A No sir.
8 Q BY MR. MOHR: Referring to photograph B-1924, will you
9 point out the road that you are speaking about, to the jury, on
10 that photograph?
11 A Right along here (indicating) past the power house and
12 on up the canyon.
13 Q BY A JUROR: Did you hear any of the employees at Power
14 House No. 1 say that they had heard any noise that sounded like
15 an explosion?
16 A No sir.
17 Q Was the wind blowing very strong that night?
18 A No sir, it was not blowing very strong.
19 Q BY MR. DENISON: Which way was the wind?
20 A I could not say.
21 Q BY A JUROR: Were you driving a coupe or open car?
22 A Coupe.
23 Q What make was the coupe ?
24 A 1923.
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2 KATHERINE SPANN, being first duly
3 sworn, testified as follows:

4 BY THE CORONER:

5 Q Please state your full name.

6 A Katherine Spann.

7 Q Where do you live?

8 A Live in Construction Power Plant No. 1, Bureau of
9 Power and Light.

10 Q What is your occupation?

11 A I was nurse in charge of the hospital, Power House No.
12 1.

13 Q BY MR. SCOTT: Did you know a Mr. and Mrs. Berry at
14 Power House No. 2?

15 A Knew them very well.

16 Q Were you with them on the night of the disaster?

17 A Yes.

18 Q Parts of March 12 and 13, 1928?

19 A Yes.

20 Q What time did you meet them that night?

21 A I went down the canyon between seven and seven thirty,
22 for a ride, and went down to Mr. and Mrs. Berry's home, who
23 lived a little beyond Power House No. 2, and Mr. Berry said "I
24 am glad you came down, I bumped my head today, and its hurts
25 pretty bad." I looked at it, he was sitting there listening
26 to the radio.

27 Q What time of the night was this?

28 A About eight o'clock. He left his house ten minutes
29 to nine, or about nine.

30 Q Going where?

31 A Towards Newhall.

32 Q Did you take Mrs. Berry with you to Newhall?

A Yes.

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Q Who was with you?

A Mr. Helmer Steen.

Q And you took Mrs. Berry for a ride down to Saugus?

A As far as Newhall, and we got some gas, put air in the tires and came back.

Q What time did you arrive at the home of Mr. and Mrs. Berry?

A Mr. Berry was sleeping when we got back, left a light burning on the porch for her, says "Come in and have a cup of coffee and a sandwich."

Q What time was that?

A Don't know the time. Mr. Steen said I will. He got out of the car to let Mrs. Berry out. I said "Mrs. Berry, what time have you?" She said "I think I lost my watch." Mr. Steen pulled his watch out and said "It is only twenty minutes after eleven, plenty of time for coffee." I said "No, we will go home-- I will give you a sandwich and coffee."

Q At the time you met Mr. Berry that night, did he express to you any uneasiness about the St. Francis Dam going out?

A Nothing, we were talking about different music, different makes of radios. He seemed very happy.

Q Did Mrs. Berry express any uneasiness?

A Never.

Q Did you notice any coming down, any unusual amount of water in the canal, leaking from the dam?

A No, I had been down Friday afternoon, Saturday afternoon, Sunday afternoon, and Monday afternoon, but there was nothing, any more than a very light clear stream of water in the spillway. It was always there.

Q Coming back from Saugus that night, any place you came across the road, did you notice any greater amount of water coming under the road?

1 A No water at all.

2 Q Then what time would you say it was after you left the
3 Berry's home when you passed along the road near the St. Francis
4 Dam?

5 A It wasn't more than five minutes after he looked at
6 his watch.

7 Q That would be what time?

8 A About twenty minutes after eleven.

9 Q Did you hear any noise after you left there?

10 A No, nothing. I saw several men coming out of the
11 power house, evidently going off duty, and the lights were all
12 lit. It was very quiet.

13 Q All the way going up the road, you never noticed any
14 unusual amount of water in that canal?

15 A No, it was perfectly dry.

16 Q When you passed near the dam, did you hear any falling
17 water, noise of water running?

18 A Nothing. I said to Mr. Steen, "It is quite spooky
19 tonight, terribly quiet," no car in sight, no air, breeze or any-
20 thing, unusually quiet.

21 Q Where did you go?

22 A We went up to Power Plant No. 1, I live there.

23 Q You drove along the east side of the lake?

24 A Yes, the only road they have.

25 Q Did you see this young man Tecky?

26 A I went into the kitchen of the plant, and the baker
27 had just finished making doughnuts. He looked at the clock,
28 it was ten after twelve.

29 THE CORONER: That is all, you may be excused.

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1 J. H. BOUEY, being first duly
2 sworn, testified as follows:

3 BY THE CORONER:

4 Q Please state your name.

5 A J. H. Bouey.

6 Q Where do you reside?

7 A 14238 Friar Street, Van Nuys, California.

8 Q What is your business or occupation?

9 A Construction Superintendent, San Fernando Valley Dis-
10 tributing System and Aqueduct north to St. Francis Dam.

11 Q Were you at the St. Francis Dam on the twelfth of this
12 month?

13 A I wasn't.

14 Q When was the last time you were there before the dam
15 fell?

16 A Friday night.

17 Q Did you observe anything unusual about the condition
18 of the dam at that time?

19 A No sir.

20 Q Give anybody instructions to do any unusual work there
21 to determine the condition of the dam, the footing around the
22 dam?

23 A No sir, we was working on a road at that time, had a
24 bunch of men working there.

25 Q On the west side of the canyon?

26 A Yes sir.

27 Q What was the purpose of that road?

28 A We were building a road directly up the canyon, instead
29 of around the turn where the high winds the week before had been
30 spraying water over the top, and along with some seepage in
31 there, caused a slide in the canyon. That had been filled at
32 the time the old road was built and slid off. It was impassable.

1 We was building a new road up the canyon to the west wing of the
2 dam.

3 Q Do you think it would endanger the dam in any way?

4 A No sir.

5 Q Did you feel any apprehension at all the dam might not
6 be safe?

7 A I didn't. I inspected that hill several times from
8 bottom to top, looking for any new leaks or tracks that might
9 have appeared, and could see no movement of any kind.

10 Q BY MR. MOHR: Do you know anything about putting the
11 drain in to drain off the water on that hill?

12 A Yes sir.

13 Q Calling your attention to panorama photograph, will
14 you explain to the jury just where the drain was put in?

15 A This is the abutment standing in place there now (in-
16 dicating). This drain started possibly seventy-five or one
17 hundred feet west of this abutment. We carried that water
18 over to this point here (indicating), and turned it down this
19 canyon.

20 Q Calling your attention to Photograph S.F. 62, can you
21 describe on that photograph where that drain pipe was carried
22 to?

23 A It was carried back-- carried that drain pipe from
24 the abutment west back to this dip you can see, also laid a
25 drain pipe from this under, and the water carried down this
26 way (indicating), come down this canyon, and the muddy water you
27 talk about in the ditch--- the drain pipe we laid was eight
28 inch concrete. Up to that time the water had it drained
29 off the side hill through an inch galvanized pipe.

30 Q You say you inspected the dam?

31 A I did, was all over that hill Friday.

32 Q Was that your job, inspector of the dam?

1 A My job was maintenance of the system. I was looking
2 all over it Friday, and was there practically three and one half
3 hours Friday. Tony Harnischfeger and I walked practically all
4 over the hill.

5 Q Walked on the ground on the lower toe?

6 A Yes sir, all around the point.

7 Q BY MR. MOHR: I call attention to photograph-- point
8 out to the jury where that drain pipe emptied this water into
9 the canal?

10 A I don't believe you can see it on this photograph.
11 The drain that emptied into this ditch from this drain we spoke
12 of came into the ditch a little below where this photograph
13 would show.

14 Q That seepage you were speaking about was seepage on
15 the west side?

16 A Yes sir.

17 Q BY MR. SCOTT: Did you ^{ever} observe any seepage that came
18 out on the hill on the east side?

19 A Yes sir.

20 Q Describe that to the jury.

21 A We had a small weir at the bottom that picked up all
22 this water that came down from the west side. That was in-
23 stalled there either late in '26, or early 1927. That measured
24 about an inch and a half of water at this weir, and that had in-
25 creased a very little, couldn't say the exact amount, after the
26 elevation of the water had got above the elevation we had last
27 year. The weir measured, was an inch and a half or an inch and
28 five eighths up to the time the last reports. There was possi-
29 bly an inch and three quarters at that time.

30 Q BY MR. MOHR: Calling attention to photograph S.F. 68,
31 will you point out to the Jury where that was located?

32 A The weir-- from the east side the principal part of

1 the leak was on the second step from the top here (indicating).
2 The weir was located just below this tree (indicating) against
3 the feet of the dam there, toe of the dam.

4 Q BY A JUROR: That was to catch the east side?

5 A On the east side.

6 Q Did you see any leaks in the bottom of the dam on the
7 west side?

8 A No sir.

9 Q Were these gates working?

10 A Yes sir. A short time before the break, turned a few
11 second feet of water down to wash some gravel that accumulated
12 in the ditch below.

13 Q Did any gates jam?

14 A No, not that I know.

15 Q I understood you to say you saw no leaks on the west
16 side?

17 A Not at the bottom.

18 Q Up the hill?

19 A Up the hill.

20 Q How many leaks did you see up the hill to the abutment?

21 A Wouldn't say how many, there was a few leaks. We
22 have had leaks along that west abutment continuous, small leaks.

23 Q Did you ever notice whether there was any changes in
24 the condition of those leaks?

25 A Not to my knowledge, some places no change.

26 Q No new leaks?

27 A No new leaks, except on top of this west wing that
28 is still in place, we drained water after the water got up to
29 a certain elevation.

30 Q Was it pretty muddy as you walked along the ground?

31 A Wet, yes sir-- not muddy, but wet.

32 Q Slippery under feet?

1 A Yes sir, very steep there.

2 Q How did you get up?

3 A The last time I was up along the dam on the end of the
4 steps.

5 Q Did you have steps?

6 A Concrete steps on the dam.

7 Q BY MR. MOHR: Calling attention to photograph S.F. 63,
8 will you explain to the jury on that photograph just what you
9 now stated you did?

10 A On that day, my last day there, we were working on
11 this road in there (indicating). I drove my car down to the
12 foot of the grade, and walked up this ditch. Tony Harnischfeger
13 was working on this first turn, and I called to him, and he came
14 down and we walked up to this point (indicating), and directly
15 up all the way beyond this abutment, got over the dam, and we
16 was back on this road, and also down along this hill (indicating),
17 was there from nine in the morning until one o'clock in the after-
18 noon, stayed around that hillside practically all the time.

19 Q BY A JUROR: Was there any particular alarm that
20 caused you to make this particular examination?

21 A No sir, when I drove into the canyon, first at the
22 power house, I noticed extra water coming down. The reason I
23 started in that way, when I got where I could see the spillway,
24 I could see water running over.

25 Q Did you notice any leaks on this turn about halfway
26 up the hill?

27 A Right about this point of the hill (indicating) the
28 water was up that elevation, a small leak, another place in
29 here (indicating), had water we had to drain down along here
30 (indicating). This hill showed a seepage in different places,
31 in fact, all along.

32 Q It was rather moist, the whole hill?

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A Moist, yes.

Q It was slippery, I suppose?

A Yes.

Q BY MR. SCOTT: Was there anything in the appearance of these leaks, or the water coming from the leaks, or the increase of water coming from the dam that would cause you to be apprehensive that the water should have been lowered to relieve the pressure?

A No sir, the water was perfectly clear in all these leaks at all times. We watched that very close, because the first indication of a ground movement to any of us would be muddy water, and I haven't seen any muddy water anytime I have been there coming from near the dam.

Q You were in charge of the maintenance of the St. Francis Dam?

A Yes sir.

Q And these weirs, how often did you report into the main office the amount of water flowing through these weirs, or the leakage of the St. Francis Dam?

A The report on measurement, Tony turned in every morning the measurement of these weirs, don't know how often it was turned into the main office. Mr. Lane and McIntyre kept check on this to the main office every morning. Tony used to give me the measurement on the phone.

Q Did Tony report to the main office every morning?

A I don't know.

Q How was that reported in, the water readings of the leakage of the St. Francis Dam?

A I don't know about that report to the main office, who turned that in, whether McIntyre.

Q Was turned to McIntyre by Tony?

A Yes sir.

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Q Was it turned in daily or weekly?

A I don't know about that. Tony used to give it to me every morning, but it isn't recorded on my elevation reports.

Q Have you got it for the morning of the eleventh?

A I haven't the measurement of the weirs.

Q Were you talking to him over the phone the day before?

A I was talking to him on the twelfth, twice, morning and afternoon, with reference to conditions.

Q He reported to you daily over the phone?

A Yes. In the afternoon he called me about some powder to do some more shooting on this road, spoke to me about Mr. Van Norman and Mr. Mulholland being up there, and things were the same as they were the last report, had nothing new to report to me.

Q Had he ever reported to you he was afraid the dam was going out?

A No sir.

Q Where was that powder being used on the road?

A On this new road we were building.

Q Any blasting going on the day before?

A He. Possibly on Thursday was the last shooting done.

Q On what part of the road was the blasting done?

A Down on this turn, this new road on this turn (indicating).

Q BY THE CORONER: Where did you use the powder?

A Right along this heavy bank (indicating).

Q How far from the dam?

A I judge about three hundred feet.

Q BY A JUROR: How much powder?

A Very little. The longest drill we was using was four foot drill, possibly a stick and a half of powder in the hole.

1 Q Did it shake any rocks down from the adjacent hill-
2 sides?

3 A No.

4 Q Did you cover it up?

5 A Had them in holes, what we call lifters.

6 Q What elevation was that relative to the base of the
7 dam the horizontal projected into the lower toe?

8 A Possibly a little above the center line, it is on
9 this point here (indicating), this elevation here is a little
10 higher than that, so it would be probably about the elevation
11 of the dam.

12 Q You shot here, projected right into the base of the
13 dam, a line perpendicular to the axis of the dam that was below
14 the foundation of the dam?

15 A Yes sir.

16 Q How far would you say it was, twenty feet, thirty feet?

17 A Yes sir, along there.

18 Q How many shots did you put in?

19 A I don't remember how many.

20 Q Did they make any water, your lifters?

21 A No water there, dry there, never any water at that
22 point.

23 Q After you uncovered it?

24 A No sir.

25 Q Did you strike any talcose streaks?

26 A All that red conglomerate along there.

27 Q You didn't examine the material you were shooting?
28 You said some was pretty hard, some was pretty soft?

29 A Yes.

30 Q And it was more of a surface stuff under?

31 A Solid rock into that place.

32 Q Why did you shoot it if there was no solid stuff?

1 A Did you ever try to move any of that stuff with a
2 grader? It is pretty near impossible to move it without shoot-
3 ing it.

4 Q Will you point out on this photograph where there are
5 any temperature cracks in the dam proper?

6 A There was, don't know the exact location, but along
7 at this point (indicating).

8 Q Any leakage through that crack?

9 A There was leakage underneath a little bit, but nothing
10 through the crack above.

11 Q Is that the only one you remember?

12 A The only one in the dam out there. There was a small
13 crack here some place at the weir.

14 Q Any caulking in that?

15 A Yes sir.

16 Q Grouting?

17 A Yes.

18 Q About when did that crack open up?

19 A About as well as I remember, don't remember the time
20 of year, but it was the first ~~month~~ year after the dam was
21 constructed-- whether it was the first of the year or after, I
22 couldn't say.

23 Q It leaked after it was grouted?

24 A Under the leak, that is all.

25 Q Any water in the dam when it opened up?

26 A Yes sir.

27 Q Did it leak badly?

28 A The water was below that elevation when the cracks
29 first opened.

30 Q About a year ago the dam was fairly high?

31 A It was at the peak on May 10, a year ago.

32 Q Did you notice any progressive change in the appear-

1
2 ance of the base and foundation, about the foundation in that
3 period of a year?

4 A No sir, no change you would notice.

5 Q No slides?

6 A No slides, there was no movement in the earth any
7 place I could see except for this little place upon the road
8 that happened during that high wind about three weeks previous
9 to the collapse of the dam.

10 Q What is your theory as to how the dam went out?

11 A I haven't theorized much on it.

12 Q Any theory that would help us, any idea you could give
13 us that would help us?

14 A I don't know of any.

15 Q How much shooting altogether from the time you began
16 your duties of maintenance and repairs, how much shooting took
17 place around that dam?

18 A The only shooting that has been done there was on this
19 road I spoke of. Don't know how many holes were put in along
20 there, but there were possibly two and one half blocks of
21 powder, two hundred and fifty pounds, blocks of powder used up
22 on this job.

23 Q Have you ever noticed any earthquakes up there?

24 A I haven't.

25 Q Anybody else?

26 A Not that I know of. Of course, I haven't any record
27 of anything, mostly trips through the mountain. I haven't
28 noticed anything of that kind, at least, I have never been able
29 to feel it in the car.

30 Q You shot black powder?

31 A Dynamite, forty per cent stuff.

32 Q You backed off as you shot, you backed away to get out

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of danger?

A Yes sir.

Q How far?

A One hundred feet possibly. Tony was doing the shooting, but I was there at the time he was doing it.

Q That shooting was about thirty-five or forty feet from the dam?

A About three hundred feet.

Q BY DISTRICT ATTORNEY: When did the old road wash out?

A It didn't wash out, it is there yet.

Q Part washed out?

A No, just a small slide in it. It was impossible to get over with the car.

Q That slide came from the stream that was pouring out of the dam?

A Partly and part from the spray coming out from the high winds.

Q These streams that came out of the dam are closed up now?

A Yes sir.

Q BY MR. MOHR: That slide that occurred there, what kind of material was that?

A Filled, was dumped in with a steam shovel.

THE CORONER: That is all, you may be excused.

E. H. THOMAS, being first duly sworn, testified as follows:

BY THE CORONER:

Q Please state your name.

A E. H. Thomas.

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Q Where do you reside?

A Surge Chamber No. 2, Power Plant No. 2.

Q That is located along the side of the hill there?

A On top of the hill above No. 2.

Q Were you there on the night of the twelfth of this month?

A Yes sir.

Q Did you observe anything unusual that night?

A No sir.

Q Around midnight?

A My mother woke me up, she thought it was an earthquake, and then the lights went out, and that is the time she woke me up.

Q Do you know exactly what time that was?

A It was approximately when the lights went out, I should say five minutes past twelve.

Q Where did you get your lights from?

A From Power Plant No. 2.

Q Located about how far below the dam?

A Approximately one mile.

Q You didn't look at a watch or clock to definitely ascertain the time?

A I don't remember at that time looking, but when I ran down the hill to my phone-- it was dead-- I wanted to determine what the trouble was, I ran down the hill and when I got to the bottom where the water was, it was just exactly a quarter past twelve, because I turned my flashlight on my watch. The power house had gone at that time.

Q How much water in evidence?

A I don't know how high them water tanks, supply tanks are, but it had been up within ten feet of the bottom of them

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2 tanks, and I should judge they are close to ninety or a hundred
3 feet above the canyon bottom, and it had receded when I got down
4 there twenty feet.

5 Q Could you see the dam or any part of it at that time?

6 A No, not from where I was.

7 Q The surge chamber is how far from the dam?

8 A Approximately the same distance as the power house.
9 The ^{power} house is at the bottom, and the surge chamber is on top.

10 Q Did you hear any noise of any kind?

11 A Not any other than the house trembling. My mother
12 woke me up.

13 Q Any crashing, anything that sounded like an explosion?

14 A No, it must have been the first when the dam went out,
15 she woke up, but we didn't notice any, didn't notice any right
16 then, but she was looking for another shake. She thought it
17 was an earthquake, and presently the house just started to
18 tremble, the windows and doors just trembling, and it gradually
19 died out as the water went down.

20 Q Have you ever experienced any earthquake shocks?

21 A Yes sir.

22 Q Did you get the same feeling from this shock that you
23 felt as an ordinary earthquake shock?

24 A I thought of an earthquake.

25 Q Where did the movement seem to come from, which di-
26 rection?

27 A That would be hard to determine.

28 Q BY MR. MOHR: Calling your attention to photograph
29 E-1924, point out to the jury just where your home was located
30 on that photograph.

31 A JUROR: We were out there.

32 Q BY MR. BOTTORF: Do you know whether or not there was

1
2 an earthquake in the neighborhood of this dam last summer?

3 A There was, we did have a trembler there last summer
4 once.

5 Q You experienced that, remember that?

6 A Yes sir.

7 Q About what time was that?

8 A I couldn't state definitely, but I believe it was in
9 July sometime.

10 Q BY DISTRICT ATTORNEY: You were home?

11 A Yes sir.

12 Q And felt the vibrations in your house?

13 A Yes.

14 Q You don't know whether guns were being fired out in
15 the ocean or not?

16 A Yes.

17 Q When they fire guns in the ocean, you feel a vibration?

18 A Yes, but it is different, the vibrations are not quite
19 as quivery, steady. An explosion from a gun would be different,
20 it would be a sudden rumble and probably be over.

21 Q Last summer sometime you felt a vibration in the
22 house, and thought it was an earthquake?

23 A Yes sir.

24 Q You felt a vibration this night?

25 A Yes.

26 Q How long did that continue?

27 A I should say ten minutes.

28 Q BY A JUROR: Did I understand you when you stated
29 when you got down to the surface of this water it had receded
30 twenty feet?

31 A Yes sir.

32 Q That was about fifteen minutes past twelve?

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A Yes.

Q BY MR. SCOTT: Was the club house gone at that time?

A Oh, yes, everything went with the first rush of the water.

THE CORONER: That is all, you may be excused.

FRANK RAGGIO, being first duly sworn, testified as follows:

BY THE CORONER:

Q Please state your name.

A Frank Raggio.

Q Where do you reside?

A 2536 Wabash Avenue, Los Angeles, California.

Q What is your business or occupation?

A Rancher.

Q Have you ranched up in San Francisquite Canyon?

A Yes sir, three and one half miles below the dam.

Q Did you work at the dam?

A I did.

Q Were you employed by the Water Bureau?

A Yes.

Q What did you do?

A I teamed.

Q Were you at the dam on the twelfth of this month?

A No sir.

Q When was the last time you were up there?

A It has been two and one half months ago.

Q You didn't know anything about the conditions of the dam just prior to the time it fell?

A Only hearsay.

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2 Q Of your own knowledge, did you know anything about the
3 dam which would lead you to believe it was unsafe?

4 A Yes, in the laying of the concrete foundation on the
5 hillside.

6 Q What do you know about the foundation on the hillside,
7 which side?

8 A West and east side wings.

9 Q All right, tell us.

10 A I could tell better by a photograph (witness referring
11 to photograph). This (indicating) is the east side, this is
12 the west side. I went to work there about the time the con-
13 struction work was going on, about here (indicating), a camp.
14 At that time, they was laying it on this slope (indicating), was
15 going into it, taking off the loose material, what they called
16 bedrock, putting it in from four to six feet so on up the hill
17 to this point (indicating). They went deeper up to a point
18 about here (indicating), ranging about three feet to something
19 like ten or twelve feet. The dyke on top of the hill, dug that
20 out with shovel, the shovel was placed about here (indicating),
21 that is the way the concrete was set into this hill, and this
22 other slope of the hill practically done the same thing, going
23 into this, we called it schist formation. I have worked in
24 this schist formation since I was old enough to work in the
25 canyon. Water would penetrate into it. I have a quarry three
26 quarters of a mile below this dam. This stuff I took out was
27 barred, wouldn't stand blasting. On Thursday before the dam
28 went out, I was up to the quarry, noticed water in the ditch,
29 concrete ditch leading from the dam, had increased very bad.
30 During the winter it was running something like ten or fifteen
31 inches. About the last week before the dam went out, the water
32 had increased up to Thursday something like seventy-five to one

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hundred inches. The water on Thursday was very muddy, we couldn't drink it, used to drink out of that ditch when I was at that place quarrying out rock.

Q Do you know anything about the formation on the west side?

A The formation on the west side of the dam to a point in here (indicating) is schist from there down (indicating) then she starts, a reddish formation from then on up. The bottom of this dyke is sandstone, hard pan, as we called it.

Q BY MR. MOHR: Do you know where Drinkwater Canyon is?

A Yes sir.

Q Is that above where you saw this water coming in?

A Drinkwater is below.

Q Below where you looked at the water?

A Yes sir.

THE CORONER: That is all, you may be excused.

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R. R. PROCTOR, was re-

called and testified as follows:

BY THE CORONER.

Q Mr. Proctor, will you give us the pressure record as shown, of the St. Francis Dam?

A These are two copies of the same thing, one is an enlargement.

Q I don't think it is necessary to mark it. We will not use it as an exhibit in the transcript.

A The piece of paper marked St. Francis Reservoir, water stage record, signed by P. G. McIntyre, hydrographer; the vertical scale of this chart is one-tenth of one foot between the smaller spaces, the smallest space being one-tenth of a foot vertically, and the smallest space horizontally being one hour of time. The marking on the lower center of Figure 12 would be for twelve o'clock noon on March 12th. The time increases towards the right of the chart. The larger print bearing only the figure 1835 in the upper left hand corner is a photostat enlargement of the first mentioned chart.

Q BY MR. SCOTT: Describe the gauge and the place where it was set on the dam?

A The gauge--- the recorder was a Stevens Continuous Recorder. It was situated on the upstream side of the portion now standing of the dam. The movement of the pencil line is recorded in--- any appreciable movement downward would be shown towards the bottom of the chart. Upon reaching the bottom the pencil automatically reverses and the following upward movement as shown on the chart indicates a downward movement of the water. Upon reaching the top the pencil automatically reverses again going downward on the chart, also indicating a downward movement of the water, until a point in the bottom was reached where the float apparently swept away and the chart went out of commission.

1 Q BY THE CORONER: Does that give the time when the
2 abrupt change occurred?

3 A Yes sir.

4 Q What does it indicate as to time?

5 A Twelve o'clock. Yes, the time element on this----
6 the pencil would cover approximately one tenth of an inch per
7 hour, making it impossible to determine the time within a few
8 minutes.

9 Q BY MR. DENNISON: What time do you determine the dam
10 as going out, from that?

11 A This shows twelve o'clock, as near as----

12 Q Between 11:50 and 12:00 o'clock---- does that diagram
13 show an increase in the flow?

14 A Very slight. It cannot be said definitely that it is
15 an increase in the flow. This clock is subject to slight
16 fluctuations with the wind blowing across the reservoir or the
17 wind ceasing to blow.

18 Q BY MR. SCOTT: Does the chart show a decrease between
19 11:50 and 12:00?

20 A About one- one-hundredths of a foot, I think. About
21 one-eighth of an inch in the reservoir height.

22 Q BY MR. DENNISON: Could you estimate from that map how
23 long before the flood itself, that there was any increase in the
24 flow?
25

26 A It would be very difficult.

27 Q You could not do it from that map?

28 A You could not say positively that such was the case.

29 Q Could you say whether it was or was not?

30 A You could calculate according to the trace as shown,
31 assuming----

32 Q Has it been calculated for any investigating body?

1 A This chart was turned over to the City Engineer, but
2 what calculations they made, I don't know.

3 Q But it was not calculated by your department?

4 A No.

5 Q Are you able to calculate it?

6 A I could.

7 Q Could you determine whether or not, from that map,
8 there was an increased flow from 11:30 to 12:00 o'clock?

9 A According to the trace of the pencil it appears as if
10 there were, but, as I have previously stated, it is not a positive
11 fact.

12 Q BY MR. SCOTT: That curve can be accurately calculated
13 mathematically, to determine the rapidity that the water went out,
14 can it not?

15 A The curve as shown can be accurately calculated.

16 Q For the purpose of the record I will ask you to state
17 whether or not it did go out---- the mark upon that record shows
18 that it went right down suddenly?

19 A The record shows a strong increase, a strong flow, at
20 twelve o'clock, but it apparently shows the peak flow at 12:45,
21 which is in variance with the testimony of eyewitnesses. It is
22 barely possible that the shock of this structure giving away
23 caused the clock to show an accelerated motion of time, due to
24 tension in the paper, which may have evened up, making it appar-
25 ent that the flow was less than it was.

26 Q What hour does the chart show that the clock ceased
27 to register?

28 A At 12:45, I believe.

29 Q BY A JUROR: This is a regular Stevens Recording Gauge,
30 actuated by a float and weights, the recording roll was con-
31 trolled by weights and by tension on the paper. Any calibration
32 or interpretation on this small scale would be subject to such

1 errors in the matter of an hour, that it would be difficult to
2 determine?

3 A I should say so. The clock was reported by Mr.
4 McIntyre to be very accurate as to time, from week to week, and
5 Mr. Harnischfeger used to check the time on this daily.

6 Q How did wave action affect its accuracy?

7 A The waves themselves apparently do not show, but it was
8 thought that the height would raise slightly or lower, according
9 to the direction of the wind. I have not anything definite on
10 that, but I was told that such was the case. There seems to be
11 a line at approximately twelve o'clock that shows upon the photo-
12 stat, which I did not notice upon the original record, a line
13 such as would indicate a downward movement at 11:30, is the one
14 I speak of.

15 Q BY MR. MOHR: Will you explain the time on this en-
16 larged sheet again?

17 A That is a photograph of the other.

18 Q Show me exactly what the horizontal spaces mean?

19 A On the enlarged picture, which I identify as having
20 the figure 1835 in the upper left hand corner, the unit of space
21 to the right indicates the time of one hour, and the unit of
22 space vertically indicates a depth of one-tenth of one foot. I
23 would say that this line could not be an indication of the flow,
24 due to the fact that it is horizontal for fifteen minutes and
25 indicates no flow, which could not be the case. That maybe a
26 mark of the instrument caused by jar. (At this point the jury
27 examined the records, under a magnifying glass)

28 Q BY THE CORONER: Have you positive figures on the
29 coefficient of friction?

30 A I don't have anything to do with that.
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EDGAR A. BAYLEY, was re-

called and testified as follows:

BY THE CORONER.

Q Have you the figures that the jury require on the coefficient of friction?

A I have.

Q Will you please explain them?

A There are two sections in the St. Francis Dam, one the spillway section and the straight section. I started computing the stresses and pressures at elevation 1834.75, that being three inches below the lip, and, as I understand it, the height of the water before the overflow--- I did not compute the water clear to the top, for, as I understood it, it had nothing in particular to do with the failure of the dam. With that, we start in. ^{two} ~~The~~ run very closely together in either section. At elevation 1830, which is with a light head of water--- we have a coefficient of 116. This is the theoretical coefficient and it is set within the limiting coefficient. (The witness reads as follows:)

St. Francis Dam - Coefficient of Friction, Spillway

Section.	<u>ELEVATION</u>	<u>f</u>	Max. Water Surface.
	1834.75		
	1830.00	0.116	
	1825.00	0.201	
	1820.00	0.277	
	1815.00	0.346	
	1810.00	0.403	
	1805.00	0.452	
	1800.00	0.491	
	1795.00	0.522	
	1790.00	0.546	

	<u>ELEVATION</u>	<u>f</u>	<u>Max. Water Surface.</u>
1			
2	1785.00	0.565	
3	1780.00	0.579	
4	1775.00	0.591	
5	1750.00	0.618	
6	1725.00	0.629	
7	1700.00	0.635	
8	1675.00	0.633	
9	1650.00	0.622	
10	1625.00	0.603	

St. Francis Dam - Coefficient of Friction, Concrete Section
at one side of the spillway section.

	<u>ELEVATION</u>	<u>f</u>	<u>Water Surface.</u>
14			
15	1834.75		
16	1830.00	0.041	
17	1825.00	0.104	
18	1820.00	0.171	
19	1815.00	0.239	
20	1810.00	0.303	
21	1805.00	0.360	
22	1800.00	0.408	
23	1795.00	0.446	
24	1790.00	0.480	
25	1785.00	0.507	
26	1780.00	0.528	
27	1775.00	0.545	
28	1750.00	0.592	
29	1725.00	0.613	
30	1700.00	0.624	
31	1675.00	0.625	
32	1650.00	0.616	
	1625.00	0.599	

1 These are the coefficients of friction on the sections above
2 given.

3 Q That is the coefficient of each step of five feet?

4 A Yes.

5 Q What is the coefficient between the foundation on which
6 the dam rests and the dam itself?

7 A As I have never seen the site, I believe I am not
8 qualified to testify as to that.

9 Q But you did establish the coefficient of friction as
10 six-tenths, on the Hollywood Dam?

11 A Yes, that was theoretical in making the theoretical
12 section, but in making practical studies we did get up to .63 in
13 one spot.

14 Q Was there any such a coefficient made on the St.
15 Francis Dam?

16 A I don't know.

17 Q Is there not someone in the office who should know?

18 A Mr. Huribert is the Office Engineer and should have
19 that.

20 Q (Addressing Mr. Mulholland) Mr. Mulholland, will it
21 be possible to get that coefficient of friction that you used on
22 the St. Francis Dam?

23 A (By Mr. Mulholland) Oh, yes.

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27
28 H. L. TATE, being first
29 duly sworn, testified as follows:

30 BY THE CORONER.

31 Q Please state your full name.

32 A H. L. Tate.

Q Where do you reside?

1 A Power House One.

2 Q Are you a power house operator for the Bureau of Light
3 and Power?

4 A Relief operator.

5 Q Were you at Power House One at the time that the St.
6 Francis Dam went out?

7 A I was.

8 Q On duty?

9 A I was.

10 Q Did you have any warning of any kind that something had
11 happened or was about to happen?

12 A I did not have any warning of any special significance.
13 We have log book records in regard to it, and according to our
14 time it was 11:57½. We got what we call a nibble or fish bite.
15 Everything was clear and there was no indication of any trouble,
16 and according to our time, at 12:02½ it went down in a heap. In
17 other words, everything went black.

18 Q The power was all gone?

19 A Power all gone.

20 Q How did you account for that without knowing what had
21 happened?

22 A Sylvia was on the board and I was working on the floor.
23 I went up on the board. There was nothing especial to do on the
24 work at the time. We did not have any load and there was a
25 ground on the system and we could not pick up any kilowatts. I
26 watched the operations on the board and the operator could not
27 do anything. There was just a dead short, and he turned around
28 to me and said, did you ever see anything like that, and I said,
29 No, and he said, I never did either, it has got me stumped. He
30 worked a little bit longer and he never could do anything at all.

31 Q Did you get a report up there that the dam had gone
32 out?

1 A Well, after we went through the regular procedure of
2 operation--- all our telephone communication was out and we
3 could not get anybody north or south, so all phases were tested
4 out. We tested out two phases on one line and no relays would
5 operate and there was a short to ground all the way through, and
6 we told the dispatcher of the conditions and we called for help.

7 Q Have you any record of the exact time that your whole
8 load went down?

9 A The switchboard log book gives you full records in re-
10 gard to the trouble.

11 Q What was the record at the time the load went off?

12 A I have practically all the record. We get our first
13 intimation at what we called 11:57½.

14 Q When the whole load dropped, how long was that after-
15 wards?

16 A According to our time, 12:02½.

17 Q How do you account for the time on that record? What
18 happened at 12:02½ to cause your load to drop?

19 A Well, in Power House Operation, in case a tower goes
20 down or somebody gets in the lines, or any condition that will
21 cause a ground, there is a bump. If the tower goes naturally
22 you have a short to ground and you cannot pick up any load on
23 that line.

24 Q Did you have a line from Power House One?

25 A The City has two lines from Power House One into the
26 city.

27 Q Across the canyon below the dam, or attached to the dam
28 in any way?

29 A In a general way, as far as I know, the lines follow
30 a comparatively straight line towards the city--- that is, in a
31 general way, and two taps take off of the line near Power House
32 Two. Power House Two leads in on the same line.

1 Q Have you discovered, since the dam went out, that your
2 lines were destroyed?

3 A No, no lines were destroyed, as far as I know.

4 Q The St. Francis Dam was not a power unit, and had
5 nothing to do with the power house?

6 A It is not a power unit and it has nothing to do with
7 Power House One, other than storage, as far as I know, but the
8 two taps off the line, the 110,000 volt line, come into Power
9 House Two. When the water hit Power House Two and swept it out
10 why naturally those 110,000 volt lines were in the flood, and
11 connections were made with the busses on the generator, and so
12 forth, and you get the full short to ground on your full 110,000
13 transmission line.

14 Q And it is your conclusion that 12:02½ is the approximate
15 time that the flood struck Power House Two?

16 A Well, that is logical that 12:02½ is the time that
17 Power House Two went down, as far as we could observe, as oper-
18 ators.

19 Q Did you hear any noise like that of an explosion or
20 any other noise?

21 A I did not hear anything or see anything other than
22 the station trouble that I have just told you of.

23 Q You know nothing of the insecurity of the dam prior
24 to that?

25 A I did not know anything regarding the dam other than
26 by casual observation of it, and I had never heard anything re-
27 garding the dam that would make me suspicious of the dam.

28 Q BY A JUROR: Have you, in the power house, graphic
29 volt meters and wattmeters?

30 A We have a graphic voltmeter and we have graphic
31 ammeters on all four machines. The voltmeter is just on the
32 buss. Of course, the voltmeter chart will show you when the

1 trouble hit and the way the trouble was handled.

2 Q Is that the way that the information that was recorded
3 in the log book was obtained, from the graphic charts?

4 A No, not necessarily so. In operating you cannot go
5 just by one thing. Sometimes you have a chance to see something,
6 and sometimes you see something else, but operators, as a rule,
7 in my experience, they check up---- they look at the time if they
8 have a chance to observe the time, and we have charts from which
9 you can arrive very closely at the time, and you can check up
10 with the other operators as to what time they went on, and with
11 the dispatcher, and all of us will probably have the same time,
12 and if a man is off a little bit you can check up.

13 Q When you have serious trouble in the power plant, you
14 don't have time to look at your watch sometimes, and you have to
15 check with graphic meters occasionally?

16 A You have to check with graphic meters as close as you
17 can. Of course, a man has not time to calibrate the time or
18 anything like that, but as a rule a man knows about what time it
19 is, especially at 12:00 midnight when you are taking a reading
20 and changing charts and things of that sort.

21 Q This log book agreed substantially with the graphic
22 records?

23 A I never made any close examination of it. I looked
24 the charts over and I looked the log book on the board over, and
25 so far as a man could see they checked. The clock and the chart
26 had fluctuated a little bit. You could check that down to a
27 quarter or fifteen seconds, or anything like that---- it is very
28 close.
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1 EARL A. MARTINDALE, was

2 recalled and testified as follows:

3 BY THE CORONER.

4 Q I think that you have certain records of your office?

5 A I have.

6 Q What are these records?

7 A These records will be the voltage charts in our dis-
8 patcher's office, that records the electrical break as occurring
9 at 11:57½ and 12:02½. The first chart is the trouble that
10 occurred on the Edison-Saugus-Lancaster line, which has one pole
11 directly below the east abutment and crosses below the dam over
12 to about a quarter of a mile below, and has another pole, which
13 was washed out. It is impossible to determine, which of these
14 two breaks occurred at 11:57½. We examined the conductors to
15 try and determine that, but it cannot be determined.

16 Q BY MR. SCOTT: State to the jury which side these
17 poles were on, was it the east or west wing?

18 A Edison-Lancaster 68,000 line, comes down San Francis-
19 quite Canyon and is on a pole directly below the east abutment,
20 which is now in the slide, and it crosses over the canyon to the
21 west side and I believe there are three or four poles still
22 standing there, before you come to the poles which were washed
23 out. One of these poles caused the trouble at 11:57½, as in-
24 dicated on this chart. This chart indicates the distance per
25 hour. The other case of trouble is indicated on charts from
26 the dispatcher's office, in a similar manner. At approximately
27 two and one-half minutes after twelve, at that time Power House
28 Two was washed out, because both our 110 transmission lines
29 going up the canyon were in trouble simultaneously. We have
30 very sensitive relays in these lines, so that a quarter of a
31 second's difference it will relay one line and lock the other
32 one in. In this particular case the trouble occurred simult-

1 taneously on the two lines. The lowest elevation at which live
2 conductors come down into Power Plant Number Two, is about fif-
3 teen feet or an elevation roughly as 1575. These ^{records} ~~records~~ are
4 taken in our dispatcher's office. We have two clocks, one a
5 Western Union and another one is the building clock, and the
6 interruptions are very accurately timed even to half a second.
7 The next interruption occurred apparently when the Big Creek
8 lines were washed out at the Edison-Saugus Substation. Con-
9 ferring with the Edison Dispatchers, the best that we could de-
10 termine, is that the east Big Creek line went out at 12:39, and
11 the west Big Creek line at 12:41, and the Saugus Substation at
12 12:45. The workmen at this point probably first noticed the
13 water at about 12:30, and probably at 11:57½ it blew up an oil
14 switch at this station, and the workmen were busy ^{restoring} ~~restoring~~ this
15 switch when they first noticed the water coming in. The water
16 must have been near its crest some time about 12:45, that is,
17 when the station went out of business. Relying on a 60,000 K.V.
18 line back at McNeil in the San Fernando Valley, the Big Creek
19 lines, of course, were dead at that time. That station, however,
20 energizes only to 60,000.

21 Q BY THE CORONER: How far is it from the dam to the
22 Saugus Plant of the company?

23 A These distances are taken from the Government photo-
24 graphic sheets, scaled the best we could do it, and they are
25 only approximate, and it is impossible to determine the exact
26 path of the water, whether you would take the shortest line or
27 follow the stream, at the cross elevations, it is impossible to
28 determine exactly, but we estimate about one and a half miles
29 from the dam to Power House No. 2, nine and one half miles to the
30 Saugus substation, eighteen miles to the Edison Construction Camp,
31 Fifty-one and one-half miles to El Rio Bridge, and fifty-six
32 miles to the ocean.

1 Q Did you get the rate of the stream flow between those
2 different points?

3 A That is only approximate. The rate of flow in the
4 first two miles in the canyon is impossible of determination,
5 but taking the first hour, it is about eighteen miles per hour,
6 the second hour is approximately twelve and one-half miles.
7 These figures are not very accurate, because we have only three
8 or four points and it is difficult---- they are taken from de-
9 structive waters, rather than the first waters. The first
10 waters we have only one point. That is apparently at the Saugus
11 substation. The crest waters probably ^{arrived} there from fifteen
12 to twenty-five minutes later. It is difficult to determine
13 exactly on account of the station going out. The other points
14 which I have given were the extension to the ocean or probably
15 something like crest waters, they are destructive. For instance,
16 the El Rio Bridge and that was washed out.

17 Q BY A JUROR: Let me get that clearly. You have the
18 evidence of the first flow, which was not the crest flow?

19 A Yes.

20 Q How was that described, that first flow, to be follow-
21 ed by this crest flow?

22 A The way the men described it, that is, of course at the
23 Edison-Saugus station, they were working on this switch, which
24 blew up at 11:57 $\frac{1}{2}$, and at first they noticed something like an
25 inky blackness creeping up on them rather slowly, then a little
26 series of little waves coming up. They seemed to have plenty
27 of time to get their families out of the camp. As near as we could
28 determine the water was fifteen to twenty-five minutes in arriv-
29 ing at its crest at this place.

30 Q Have you any evidence farther up the river?

31 A There are only two points, one that Mr. Thomas, the
32 attendant at the Surge Chamber, testified to this morning. He

1 went down over the penstock and at that time, 12:15, the water
2 had raised twenty feet. It was still about twenty feet above
3 Power Plant No. 1. The other is the interruption, the elec-
4 trical trouble on the two taps of our 110 K.V. lines, that go
5 into this power house, and the lowest point of the live con-
6 ductors is fifteen feet above the ground on lightning arresters.
7 The attendant on the hill noticed that his lines first went to a
8 dull glow and then went out. He was fed from the generator
9 running in the power house carrying about 5,000 Kilowatts load,
10 and apparently the generator maintained power longer than the
11 110 transmission lines.

12 Q For what length of time?

13 A That I can only determine from the attendant and with
14 him it is a matter of a very short time. I would say probably
15 not over a second or two.

16 Q You had a twenty minute interval, practically at
17 Saugus, a fifteen or twenty minute interval?

18 A From the best information we can obtain, they had that
19 sort of an interval.

20 Q And about a fifteen minute interval, ^{more} or less, at
21 Power Plant No. 2?

22 A The water had raised by 12:15, if his watch was right.
23 He testified this morning that it was five minutes after twelve
24 when the exact time was at 12:08 $\frac{1}{2}$ --- and then he made the other
25 observation at 12:15, and the water had raised twenty feet and
26 it indicates that it went down very rapidly.

27 Q BY MR. SCOTT: Are you the electrical engineer that
28 was in charge of the operation at the time of the breaking of the
29 dam?

30 A Yes, I am Assistant Operating Engineer of the Bureau
31 operating division of the Bureau of Power.

32 Q This memorandum you just made up from other data, did

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you?

A Yes sir.

Q Do you want to insert that into the record?

A It is at your pleasure, if you want to use it. It is as near correct as we can make it.

Q It is correct and made under your supervision?

A Yes sir.

Q You may hand the reporter a copy of it. These two lines from Power Houses 1 and 2, furnish a hundred and ten thousand volts to the City of Los Angeles?

A Yes sir.

Q And were furnishing that amount of power on the night that it went out?

A Yes, they were energized at the time.

Q And when that went out it was hitched up with the Edison people?

A Yes, we run parallel with the Edison.

Q And immediately if there is any trouble on the line you are called out, no matter what hour it is?

A Yes, if it is serious trouble.

Q You were called in this case at what hour?

A At ten minutes after twelve.

Q And you were in touch with the situation from that time?

A Yes.

Q And notified Mr. Van Norman?

A Yes. He left and I notified the Sheriff's office.

Q BY MR. DENNISON: I notice on this report which you offer in evidence here under March 13th--- 1892^{1/2} A.M. short circuit occurred in the City System, and then a note, Power House No. 2, was undoubtedly washed out at this time, and the ^{surge} ~~third~~ chamber attendant at power plant No. 2 reported that the lights first dipped to a dull glow and shortly after went out, is that

1 correct?

2 A Yes sir, that is what I explained a moment ago. He
3 was energized from the generator itself, 6600 volts, and that
4 apparently hung on a little longer on account of the non-automatic
5 relays.

6 Q This Power House No. 1 is approximately a mile and a
7 half below the dam?

8 A Approximately. The nearest live conductor was fifteen
9 feet from the ground. Just what time it washed out it is im-
10 possible to determine.

11 Q Do I understand from that that the plant itself had
12 been washed out or something, between that and the dam?

13 A The plant itself?

14 Q The plant itself was washed out at 12:02½?

15 A Yes, approximately.

16 Q BY MR. SCOTT: Are you a surveyor from Power Plant 2 ?

17 A Not the Power Plant, from the camp.

18
19 "March 27, 1928. Memorandum to Mr. E.F. Scattergood; Memo-
20 randum concerning destruction at San Francisco Power Plant No.
21 2 and St. Francis Dam - March 13, 1928. The following details
22 are taken mostly from notes in the Dispatcher's Log Book and
23 worked into this memorandum in order that we may have a permanent
24 record: March 12, 1928. 11:57½ PM - Edison Company reported
25 a short circuit on their system causing the voltage at our R.S.
26 "A" to drop to 85 for 2 seconds and at R.S. "B" to 105 for 2
27 seconds. Note -.The Edison Saugus - Lancaster 60 KV line that
28 caused this electrical trouble runs through San Francisco Can-
29 yon, and this circuit was afterwards found to be broken in two
30 places; one, in a slide directly below the east ^{dam} abutment, and
31 the other was caused by a pole being washed out by the water
32 about 1/4 mile below the dam. An examination was made of the

1 copper conductors at both of these breaks and it is impossible
2 to tell which break caused the bump on the electrical system.

3 March 13, 1928. 12:02½ AM - A short circuit occurred on
4 the City system, causing the city and Edison systems to separate
5 on the tie lines at R.S. "A", but the east and west 110 KV lines
6 did not relay either at Power Plant No. 1 or at R.S. "A", indic-
7 ating that the trouble hit both 110 KV lines at the same instant.
8 An attempt was made to build up on these lines from Power House
9 No. 1 but this was unsuccessful. Note - Power Plant No. 2 was
10 undoubtedly washed out at this time, and the surge chamber atten-
11 dant at Power Plant No. 2 reported that the lights first dipped
12 to a dull glow and shortly after went out, indicating that the
13 6600 volt supply from the one generator that was running hung
14 on slightly longer than the 110 KV lines.

15 12:05 AM - The operator at Power Plant No. 1 reported that
16 he was not able to build up either the west or east 110 KV lines
17 and that all telephone lines were out to Power Plant No. 2. It
18 was also reported that when the trouble occurred at 11:57½ P.M.,
19 the telephone lines to Power House No. 2 flashed and bells rang
20 as though the lines were in trouble, and this afterwards proved
21 to be Edison 60 KV lines dropping on the aqueduct telephone lines.
22 Power Plant No. 1 tried to get Power House No. 2 at 12:00 mid-
23 night but could not raise them on account of the telephone lines
24 being out. The last time operators at Power Plant No. 2 were
25 in touch with either the dispatcher or Power Plant No. 1 was at
26 approximately 11:47 PM, March 12th.

27 12:10 AM - The system load dispatcher advised Mr. Joyce and
28 Mr. Martindale of the trouble on the east and west 110 KV lines,
29 and sent a man to Sylmar to open the lines at this point so that
30 they could test with Power Plant No. 1.

31 12:20 AM - At this time the Edison Dispatcher reported
32 their trouble at 11:57½ PM, March 12th, to be on the Lancaster -
Saugus 60 KV lines and that someone reported lots of water some-
where in the territory around Saugus which was probably reported

1 by workmen at the Edison Saugus Sub-station. At this time the
2 City and Edison load dispatchers began to suspect trouble at the
3 St. Francis Dam or the Los Angeles Aqueduct on account of the
4 telephone lines that were reported to be out. Our dispatcher
5 advised the operator at Power Plant No. 1 to send someone down
6 the canyon to make an inspection.

7 12:35 AM - Spainhower and Lindstrom left Power Plant No. 1
8 to make an inspection trip.

9 12:39 AM - It is believed by the Southern California Edison
10 Co. that their East Big Creek line went out at 12:39 and the west
11 line at 12:41. The Lancaster - Saugus line relayed on the
12 11:57½ PM trouble, and blew up an oil switch at the Edison Saugus
13 Sub-Station and the whole camp was aroused. Several workmen
14 were striving to get this switch back into service when they
15 noticed some water coming in very slowly at first, and then
16 building up in small waves at a rapid rate. Apparently the water
17 must have been from 15 to 25 minutes in building up at this point
18 to its highest elevation, approximately 55' above the creek bed.
19 The Saugus Sub-Station itself was put out of service at 12:45 AM,
20 the 60 KV lines supplying this station with power relaying at
21 McNeil. Mr. Joyce and Mr. Martindale were notified of the
22 trouble on the Big Creek lines at this time. Note - Mr. Van
23 Norman, Mr. Garlett and Mr. Ruble were advised to stand by and
24 wait for further developments.

25 12:51 AM - Edison dispatcher advised us to pick up what load
26 we could on R.S. "B" system as L.A. #3 was still dead.

27 12:56½ AM - R.S. "A" was picked up by the Edison the lines
28 with low voltage and speed, apparently being supplied from Long
29 Beach.

30 12:59 AM - Mr. Ruble left his home in Los Angeles for Power
31 Plant No. 2.

32 1:00 AM - Spainhower reported from Power House No. 1 that

1 the St. Francis reservoir was empty, and that he would soon leave
2 with a party of men for Power House No. 2 surge chamber over the
3 transmission line route. Directly after this the dispatcher
4 called Mr. Martindale, and Mr. Van Norman was notified of the
5 trouble and requested that a warning be sent out throughout the
6 Santa Clara Valley.

7 1:15 AM - Miss Hibbard, Chief Operator of the Pacific Long
8 Distance Telephone Company, was requested by both our dispatcher
9 and the operator on Metropolitan 4200 P.B.I. to send a warning
10 wherever possible throughout the Santa Clara Valley. At this
11 time the Sheriff's Office, the Red Cross and the Southern Pacific
12 Railway Company were notified of the dam break. The local radio
13 telegraph operator was also notified and asked to get in touch
14 with someone in the Santa Paula Valley. Mr. Joyce reported to
15 the dispatcher that he was leaving for Power Plant No. 2. After
16 approximately one hour the long distance telephone operator re-
17 ported that all cities had been notified of the impending flood
18 waters. Note - At this time Robertson, West, Foster, Garlett
19 and many others in the Department of Water and Power were noti-
20 fied to get on the job and to be ready to do anything possible
21 in the way of relief or repair work. Some time later a request
22 came from the Sheriff's Office to send some automobiles, trucks,
23 axes, rope and tackle to Newhall in order to start relief work
24 as soon as possible. All this equipment was promptly dispatched
25 as requested by the Sheriff's Office. All telephone lines lead-
26 ing to our Power Plants and the upper portion of Santa Clara
27 Valley were still out, and the only communication was through the
28 Power Bureau's carrier current to Power Plant No. 1, and the in-
29 stallation of this communicating system certainly saved many
30 lives and enabled us to issue warning in time to be of much help
31 in the Santa Clara Valley extending from Pima to the ocean.

32 1:19 AM - Mr. Cagnacci left Sylmar for Power Plant No. 2.

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1:38 AM - Mr. Scott left Bequet Canyon for Tower #44.

1:45 AM - Mr. Ruble reported from Power House No. 3 going to San Francisquito Canyon.

2:34 AM - City of Pasadena paralleled their steam plant with R.S. "A" system to help out.

3:44 AM - Power House No. 1 reported that Mr. Ruble ordered all water to be shut off at River Power Plant and that he would notify Haiwee to shut the water off at Haiwee.

4:17 AM - The East 110 KV line was energized between Power House No. 1 and R.S. "A" with #3 generator floating on the line. Power House No. 1 was instructed not to pick up any load until more facts could be obtained regarding this disaster.

4:48 AM - The water was shut off at Haiwee.

6:05 AM - The water was shut off at River Power Plant.

7:30 AM - Spainhower reported that when he arrived at Power Plant No. 2, shortly after 2:30 AM, going down over the penstock from the surge chamber, that he found #2 generator still rolling and burning.

The Power Construction Division ordered all their men from Power Plant No. 1 camp to assist in rescue work, but little could be done until daylight.

By daylight practically all of the automotive equipment of both Bureaus had either departed for the devastated area or were waiting for instructions. The warehouses of both Bureaus had already sent out such materials as telephone wire, axes, rope and equipment to pull the debris apart as soon as it was light enough to work.

Every effort was made to make the warning as thorough as possible and to keep in almost constant touch with the Sheriff's Office, to re-establish telephone communication and, in general, to render every assistance possible. Early in the morning a portable radio telegraph station was dispatched in order to

1 establish temporary communication with our radio telegraph set
 2 here in the building.

3 The following approximate data was obtained regarding the
 4 flow of the flood waters to the ocean:

	<u>Distance</u>	<u>Elapsed time from Creek to point given or destructive waters.</u>
St. Francis Dam to Power Plant No. 2	1½ miles	5 Min.
" " " "Saugus Sub- station	9½ "	22½ - - 47½ "
" " " "Edison Con- struction Camp	18 "	1 Hr. 27½ "
" " " "El Rio Bridge	51½ "	4 Hrs. 47½ "
" " " "Ocean	86 "	5 Hrs. 37 "

15 The water at one time was approximately 120' above the
 16 generator floor at Power House No. 2. The bottom wire on the
 17 transmission tower just outside of the Power House was approximate-
 18 ly 5' lower than the landing rack on the Power House and in all
 19 probability the tower crumbled before the Power House, thus caus-
 20 ing the electrical failure at 12:08½ AM.

21 Water was apparently first noticed at the Edison Saugus Sub-
 22 station at approximately 12:20 A.M. The East Big Creek line was
 23 out at 12:39 AM and the West Big Creek line at 12:41 AM and the
 24 Castaic Sub-Station was put out of commission at 12:45 AM. Water
 25 was reported as high as 15' in the old sub-station building.
 26 The time of the water arriving at the Edison Construction Camp
 27 was based on watches that were found which stopped at 1:25 AM.
 28 The time of the water arriving at El Rio Bridge was a little un-
 29 certain but was placed by several people at approximately 4:45
 30 AM. The time of the water arriving at the ocean was observed
 31 at approximately 5:30 AM. The first water according to this
 32 limited data was observed only at two points, - the Saugus Sub-

1 station and the ocean. Destructive waters are the most accurate-
2 ly timed. The crest waters were not observed at any point. The
3 attendant at the surge chamber at Power House No. 2 claimed that
4 by the time he could go from his cottage down over the penstock
5 the flood waters had receded 20' below high water line. He
6 glanced at his watch at this time and it indicated 12:15 AM."

7
8 JAMES H. HATCH, being
9 first duly sworn, testified as follows:

10 BY THE CORONER.

11 Q Please state your full name.

12 A James H. Hatch.

13 Q Where do you reside?

14 A 1501 North Allen Avenue, Pasadena, California.

15 Q What is your occupation?

16 A Civil and Mechanical engineer.

17 Q Where did you receive your education as an engineer?

18 A In the University of Michigan.

19 Q And you have been actively engaged in engineering in
20 recent years?

21 A Yes, all the time up to within the last two or three
22 months.

23 Q Did you make an independent investigation of the
24 collapse of the St. Francis Dam?

25 A Yes, after the accident.

26 Q When were you up there?

27 A I was up there on Thursday, the 15th, and on Saturday
28 the 17th.

29 Q You went up there independently and was not employed
30 by anyone?

31 A Independently.

32 Q Are you willing to give the jury the benefit of your

1 deductions after having examined that location and tell them
2 everything you saw there, as an engineer?

3 A Yes sir.

4 Q All right. I will be pleased to have you do so at this
5 time.

6 A I went up to the dam by the way of Bequet Canyon, and
7 down from LaJolla Lodge, and got there about noon time on Thursday
8 and examined----- I came ⁱⁿ from the north and examined the dam as it
9 was standing and went on down the canyon for perhaps half a mile.
10 I found about seventy-five or eighty feet of the central portion
11 of the dam still standing and both wings out. The west wing was
12 entirely washed out and washed down the stream. The east wing
13 was collapsed and lying beside the standing portion. I found
14 pieces of the west wing as far as over half a mile down the stream,
15 some very large pieces. I took some photographs and have some
16 samples, Mr. Coroner.

17 Q All right. We will look at the photographs. (The
18 photographs are viewed by the jurors)

19 A I have eleven pictures.

20 Q Did you say you had some material from up there?

21 A Yes. Do you want me to tell now what I think happened?

22 Q Yes.

23 A In my opinion what happened was that the rock and earth
24 underneath the west wing gave away, letting the west wing collapse
25 and that was carried down stream. As soon as the water began
26 running through there, it made a swirl and eddies and washed the
27 side of the hill over on the west side, undermined that, until
28 it all slid down until it finally let the foundation ^{out} from under
29 the east wing, and that collapsed. That must have been some
30 little time after the west wing ^{went} was let out, because that broken
31 concrete there is practically clean. It does not show that the
32 water went over it at a high level.

1 Q What caused the west wing to fall in the first place,
2 in your opinion?

3 A In my opinion it was the failure of the earth under-
4 neath the foundation.

5 Q The pressure of the dam was so great that it crushed
6 the foundation beneath it?

7 A No, I don't think that. I think the foundation be-
8 neath it was destroyed in some manner.

9 Q That it was undermined?

10 A Probably so. I would expect that was the probable
11 cause. It is now gone and a very large amount of it has been
12 carried away and the formation beneath it, which is in sight
13 now, is of a soft nature.

14 Q Are you a geologist?

15 A No, only what I have had to use in engineering.

16 Q You don't qualify as a geologist?

17 A No.

18 Q Did you examine the formation there ^Aas geologist?

19 A Yes sir, I did.

20 Q You said that you are not a geologist, but you have
21 brought in some material which you say was part of the founda-
22 tion?

23 A This piece was gotten from the east side, right where
24 the dam was up against the wall. That was a fair sample of
25 what I found.

26 Q Do you know what that is?

27 A I would not have known except that I have heard have
28 that they call it schist. I would have called it slate. This
29 I picked off of one of these blocks which I found down the stream.
30 Where it shows a dark spot that was bedded from the concrete and
31 was broken from the dam.

32 Q Do you know what part of the dam that concrete had

1 originally been, could you identify it?

2 A It had every appearance of that, which was resting
3 up against the ground. It is a piece that looks as if it was a
4 part that went against the ground, because it is rough, and
5 jagged, and could not have been either the top or either of the
6 faces. I got these pieces from right under the edge of the---

7 Q BY A JUROR: I am trying to figure out from the
8 statement that you just made, that you considered that the
9 foundation was faulty--- isn't it a fact, that if water had
10 penetrated there there would have been some evidence on the down-
11 stream face of the dam? Would not the water have had to have
12 gotten through there in order to make that failure? The water
13 would not have got through at one time, would it not have had
14 to percolate through?

15 A Yes, it would have to get started through.

16 Q Why would there not have to be some evidence of that
17 water percolating on the day previous? On your theory that
18 the foundation gave away the water could not go through there
19 at one time, it would take a considerable length of time?

20 A No, not with that pressure, after it got started it
21 might go out like a shot--- ten thousand pounds to the square
22 foot pressure.

23 Q I understand you, but at the same time you are not
24 going to move a mass of concrete a hundred and seventy feet
25 thick without giving it some sort of start. You have to have
26 water percolating under there in order to loosen it up?

27 A I was not there before or afterwards. I only know
28 that a great mass of that rock has been carried away.

29 Q There was no water percolation showing as coming from
30 under the dam on the night before?

31 A I have only my opinion that it was pushed out.

32 Q BY THE CORONER: Do you believe it first broke loose

1 from the standing portion there, sinking through some settlement
2 of the foundation, or did it slip forward?

3 A My opinion is that the foundation came out from under
4 and the concrete broke down of its own weight.

5 Q How and where did the foundation come out, was it wash-
6 ed out gradually or all at once?

7 A I don't know. In either case, if the foundation were
8 washed out from under it, that great long cantilever of three
9 hundred feet, would break down of its own weight and the shear
10 is vertical. There is only twelve feet at the top.

11 Q Do you think this shear was made after the undermining
12 on the west side? Do you think this crack occurred after---

13 A That would be my opinion.

14 Q Your theory is that there were no expansion cracks at
15 all in this dam?

16 A I did not see any.

17 Q Did you see any indications of any cracks in the re-
18 maining portion?

19 A No, I did not see any.

20 Q Did you ever try to compute what the shear stresses
21 would be from the dead weight of this portion when it is hanging,
22 without support?

23 A I did roughly.

24 Q What do you get the amount of stress to be?

25 A I would not want to say because I did not have the
26 thickness of the walls and could not figure it accurately. It
27 would be an enormous figure.

28 Q Then, I take it, after all this earth underneath this
29 dam for ten or fifteen feet, fell out, these various cracks
30 appeared in the dam itself and then it went out, is that your
31 idea?

32 A No, not exactly.

1 Q Will you explain the effect that would have on that
2 portion of the dam after all this had gone out?

3 A After the foundation from under the whole wing was out
4 the wing would break down.

5 Q Just how would it break?

6 A As a cantilever would split straight down.

7 Q Just a straight shear?

8 A No, a lump broke off the top first, and then it crack-
9 ed on down.

10 Q Then, if it spread apart, why has not the abutment at
11 the top or at the end of the dyke, been shoved out of the way?

12 A The east wing still stood.

13 Q The abutment at the end of the dyke still stands.
14 There is no evidence of any crushing at that side. There is just
15 a crack. Why was that not shoved out of the way? As the arch
16 was flattened it would elongate, would it not?

17 A Not if it dropped ordinarily vertically.

18 Q How could it drop vertically?

19 A It could have a sheering action. It would be a bend-
20 ing action.

21 Q Just how would this bending action take place?

22 A (Witness draws a diagram on the blackboard). I have
23 no way of knowing what it is up there because I don't know the
24 outline of the dam before. If the foundation all went out from
25 under these (indicating), that weight being something like----
26 three hundred feet---- that weight would cause a tension here
27 (indicating), and it would begin to split here and would go right
28 on down.

29 Q Where would these cracks occur in that wing?

30 A I don't know. After that splits down it would break
31 up in all sorts of pieces.

32 Q BY MR. DENBISON: Did you find anything to support

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your theory?

A Only that the foundation is not there.

Q Is this the wing that would be the dam proper, the wing that is standing up?

A These two lines (indicating), as far as I drew them.

Q Did you see a stream of water flowing down the hill there that had cut into that bank,?

A Into the masonry?

Q Yes.

A Not into the concrete, no.

Q Did you see any evidence of a water flow there?

A Yes.

Q How deep did that dig into the stream bed there?

A I don't know.

Q Did you measure it?

A No.

Q If a gopher ~~sk~~ had crawled along through that bank six months ago, it would have opened a hole, through which the water could have flowed?

A Yes.

Q And if the water flowed through the natural erosion would gradually eat away this bank underneath the masonry structure?

A Yes.

Q And when the bank was eaten away by the water the great weight on this triangular piece of concrete would cause it to fall and break up into pieces?

A Yes.

Q And you would expect to find adhering to that piece of the structure, some of the thing upon which it rested?

A Yes.

Q Did you find such?

1 A Yes.

2 Q Where is it?

3 A I have a picture here and these pieces here (indicat-

4 ing).

5 Q Have you ever constructed a dam?

6 A No, not anything of this nature at all.

7 Q As an engineer, if you wanted to build a dam similar

8 to that, ^{how} would you take care of that water seepage there?

9 A I would not want to answer that question because I

10 have not had time to study that condition.

11 Q BY MR. MOHR: What would happen to the gopher that

12 Mr. Dennison was talking about, if that should happen?

13 A I don't know.

14 Q Do you know whether or not that substance that you

15 have there, was picked up by that concrete while it was going

16 down the canyon?

17 A It was imbedded in the concrete and I had to take a

18 rock to knock it out with.

19 Q It would not be possible for that spot of earth, for

20 that to be picked up by a huge piece of concrete of that size?

21 A No.

22 Q BY A JUROR: Would there be an arch action in there?

23 A Do you mean-----

24 Q Just as it stands there at the present time, before

25 it failed, would there be any arch action in this direction

26 along this axis?

27 A Not in my opinion.

28 Q Bearing in here (indicating) and here (indicating)?

29 A Oh, if it was bearing there.

30 Q You say this all came down and broke up into a dozen

31 pieces?

32 A There would be a beam action.

1 Q Would there not be any arch action with a thrust against
2 this point (indicating) and this point (indicating)?
3 A Yes.
4 Q Then, it should not have failed if it was an arch action?
5 A That failed there (indicating).
6 Q It is still standing?
7 A Do you mean where it broke off?
8 Q No. Where it broke off it has not moved a bit, as far
9 as we know?
10 A I don't know when the piece broke up.
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2 WILLIAM HURLBERT, having been
3 previously duly sworn, was recalled and testified as follows:

4 BY THE CORONER:

5 Q Mr. Nelson has asked for some information concerning
6 the coefficient of friction.

7 Q BY A JUROR: I would like to know what the coefficient
8 of friction was on the St. Francis Dam, whether it was a varying
9 coefficient or not?

10 A It is a varying coefficient, depending upon the depth
11 of the column of water. That variation was as shown by the
12 design of the dam from thirty-four one hundredths to sixty-three
13 and one half.

14 THE CORONER: That is all, you may be excused.

15
16
17 M. H. SLOCUM, being first duly sworn,
18 testified as follows:

19 BY THE CORONER:

20 Q Please state your full name.

21 A M. H. Slocum.

22 Q Where do you reside?

23 A 395 Sturdevant Road, Sierra Madre, California.

24 Q What is your business or occupation?

25 A Construction Superintendent.

26 Q Are you familiar with the St. Francis Dam?

27 A I made two visits there.

28 Q Before or since the disaster?

29 A Since.

30 Q What examination did you make when you were there?

31 A I did like most other spectators, I walked up the sides
32

1
2 of the hills, looked at the rocks, that red formation that the
3 dam was setting on, inspected the west wall of concrete left,
4 went up and down stream to see where the rest of the concrete
5 went to.

6 Q Are you an engineer?

7 A No sir.

8 Q Or a geologist?

9 A No sir.

10 Q You were not familiar with the formations you saw
11 there then?

12 A Only by experience.

13 Q You didn't analyze them scientifically?

14 A No, I am not capable of doing that, I haven't got that
15 education.

16 Q Did you reach an opinion as to the cause of the fail-
17 ure of the dam?

18 A Well, I think anybody that went there probably reached
19 an opinion, men who are far more capable of expressing an
20 opinion than I am said what they thought of it.

21 Q You don't feel qualified to state what caused the
22 failure of the dam?

23 A In my own mind I can state what caused the failure of
24 the dam. Whether it would be of any value, I am unable to
25 determine. My opinion is that the ground it was set on was
26 improper to put a structure of that kind on. It probably be-
27 came saturated, and owing to the uplift and the weight behind
28 it, probably some portion of it pushed it off the hill, allow-
29 ing some other sections to go on down.

30 Q Which hill do you refer to?

31 A West bank.

32 Q You have no knowledge of the conditions up there prior

1
2 to the thirteenth of this month?

3 A No sir.

4 Q And all your observations are from what you saw up
5 there on two visits since the dam went out?

6 A Yes sir.

7 Q When were you up there?

8 A I was up there Thursday following, and I was there
9 yesterday. I might state that my reasons for going there on
10 both times were that I am engaged in that line of work, con-
11 struction of dams, and naturally I had a very intense interest
12 to see if possible I could learn anything from what happened.

13 Q Have you built any dams?

14 A Had charge of the supervising in a construction
15 capacity at eight or nine dams.

16 Q In this country?

17 A Yes sir, the Exchequer Dam, Snow Mountain Dam,
18 Gibraltar, Lake Hodges, placed the original concrete and pre-
19 pared the foundations for Hetch-Hetchy Dam, full charge of the
20 Henshaw and Emigrant Creek in Oregon, and Sierra Madre Dam for
21 Los Angeles Flood Control.

22 Q Are any of those gravity type dams?

23 A Yes sir.

24 Q How many of them?

25 A The Exchequer is the outstanding one, approximately
26 four hundred thousand yards of concrete, three hundred and
27 thirty feet high. Hetch-Hetchy is three hundred and thirty-
28 five feet, approximately three hundred and seventy-five thousand
29 yards of concrete, Snow Mountain probably one hundred and ten
30 thousand yards of concrete, and one hundred and ten feet high.

31 Q Did you have anything to do with the formations for
32 these dams?

1
2 A That doesn't come within the construction superin-
3 tendent's duties. The duties of a construction superintendent
4 are to build the dam as to the plans the engineers give you.
5 Naturally you examine them and know what it looks like.

6 Q How did the concrete in the St. Francis Dam look to
7 you?

8 A The concrete in the St. Francis Dam looked over sanded,
9 but plenty strong-- for the type of structure probably had a
10 much greater factor of safety than would have been called to
11 use.

12 Q As far as the construction of the dam itself is con-
13 cerned, you found there was no weakness that caused its failure?

14 A As far as the concrete part is concerned, I can't see
15 anything wrong with it.

16 Q You attribute the failure to the foundation?

17 A My own mind, yes sir.

18 Q On the west side?

19 A Yes sir.

20 Q How do you explain that?

21 A My opinion is that the ground became saturated, the
22 type of ground that that was seemed to become, when it became
23 wet, like clay, and very slippery or slick. The water un-
24 doubtedly was percolating through to some extent, and I think
25 the dam on the arch must have been setting on a slight slope
26 downstream, and the combination of the uplift ground becoming
27 wet and slick, probably slid off in one section, allowing the
28 other section to break loose vertically from the west under
29 that that is still remaining.

30 Q BY A JUROR: What did you see that led you to believe
31 there is a slope downstream on part of the foundation?

32 A I merely judge that from the fact that you look at

1 that section that is still standing and that mound of rock that
2 goes up through the center of it-- you must remember you are
3 looking at the dam as it came up this way (indicating), and
4 that shows one place, a section coming down, pointing downstream
5 off that rib that came up this way (indicating), continued all
6 the way through the dam, naturally would upset it. From the
7 looks of the other ground, I imagine it might have had a slight
8 slope downstream, which is not uncommon.

9 Q From the ground itself, you saw no indication?

10 A No, I couldn't tell. Naturally there was several
11 feet the water had taken off and washed away.

12 Q BY THE CORONER: In your opinion, how could under-
13 mining of the foundation have been prevented?

14 A On other work of such a character with which I have
15 been connected, it has been done by putting in drainage holes,
16 connected up to a drainage gallery which intercepts the water
17 practically at the upstream base, taking away the uplift and
18 letting it run off downstream without any pressure. Possibly
19 it could have been down there the type of ground is such that on
20 the west side that I don't believe you could grout, which is the
21 common way of doing on different projects.

22 Q BY A JUROR: Is it common practice to run the drainage
23 lines you are speaking of pretty well up the sides of the hills?

24 A Drainage galleries in Exchequer, Hetch-Hetchy, Snow
25 Mountain run to all intents and purposes to the top of the dams,
26 clear to the top. There was a small drainage gallery, small
27 drainage channel.

28 Q Have you ever seen or heard of a dam which you con-
29 sidered to be a safe and properly designed dam, which didn't
30 provide some means of draining up the sides?

31 A I have been to a great many dams, and to my memory I
32 can't remember of any that haven't had drainage, drainage

1 galleries in them of the gravity type, not of strict arch type,
2 this was a gravity type.

3 Q In these various dams, were there predetermined ex-
4 tension cracks in all these dams?

5 A Yes sir, they are sealed off with copper colored
6 galvanized water stop, sometimes with asphalt-- different ways
7 of putting it in, but these are put in and determined, and
8 usually owing to the thickness of the concrete as you get up
9 here (indicating) thicker, it is further apart.

10 Q Where these cracks are determined, are they straight
11 cracks or jagged?

12 A Occasionally they are straight, I can't remember of any
13 that are straight. All I have had experience with had offsets
14 in them. Some even had grout pipes inserted, so that the cold
15 period of the year, after the concrete has received its full
16 amount of contraction, they can be grouted.

17 Q That was the case in the Exchequer Dam?

18 A No, they were not grouted at the extension joints.
19 The grout was in the cutoff trenches at the dam, and in any
20 springs or leaks that might occur as you are making the excavation.
21 For instance, Hetch-Hetchy there were quite a number of springs
22 had to be carried up in pipes and pipes carried outside the con-
23 crete and grouted through afterwards. Exchequer was grouted
24 through these pipes, and the matter of construction was to
25 control your grout hole and grout it, then between the grout
26 holes to control your drainage holes after the grout holes were
27 grouted.

28 Q Would you consider that a dam could be properly con-
29 structed without providing extension joints?

30 A I think it is a disputed question among engineers. As
31 I have just said, I don't think my technical training is such
32 that my opinion would be worth anything on it. My personal

1
2 opinion is I think they should be put in.

3 Q You saw that ground on the west side?

4 A Yes.

5 Q About how far would you consider it was necessary to
6 key into the sides?

7 A I would consider it would have been necessary to take
8 all that red stuff off and gone down into that sort of more or
9 less solid formation that underlaid that.

10 Q You wouldn't have hesitated about putting a dam on
11 that side?

12 A If I had gone into that other foundation, no sir,
13 taken all the red stuff off, would put one in without hesitation,
14 think it would have undoubtedly stood there, it has been proved
15 by what has been left.

16 Q What would you say if they discovered they had gone
17 to the solid rock on the side?

18 A I would say the dam was all right.

19 Q Then what caused it to go out?

20 A My opinion, it wasn't carried down to that hard rock,
21 that is as hard a rock as there is in that country.

22 Q Are you familiar with that country?

23 A Only from going up and looking at it the two trips
24 was all. I have gone around in the course of my business, in-
25 spected probably fifty different dams.

26 Q BY MR. SCOTT: You are assuming in your opinion the
27 concrete was laid only against the west hill and the force of
28 the water pushed it off?

29 A That is my opinion, the combination of being slick,
30 and the uplift just happened to occur.

31 Q And the force of the water pushed it off the side of
32 the hill?

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A Yes sir, that is my opinion.

Q And that occurred suddenly?

A Yes, if it once would start, I believe it would go. By the time it became saturated, I think it would go right out.

Q If a hole ten by ten was opened up, the whole west wing---

A It would go out, that red formation it was setting on, so rapidly you couldn't keep track of it, in my opinion.

Q So, your whole opinion as to how it went out is based on the assumption that the dam was just set up against---

A I think it was setting on the red conglomerate, yes sir.

Q And just pushed off?

A Yes sir.

Q BY DISTRICT ATTORNEY: The red conglomerate is still there?

A Quite a lot of it, yes sir. From the appearance, must have been cut off by the course of the water coming down over the hill, must have taken off whatever was there.

Q BY A JUROR: Do I understand you have the idea that the schist would make a satisfactory foundation, but the red conglomerate wouldn't?

A Yes, I think that schist, as a matter of fact, I believe, is as good a foundation as the Snow Mountain Dam is set on, which has been completed since 1921.

Q On the west bank, the red conglomerate goes to a great depth?

A The indication of it is that it goes to a great depth.

Q When you said if the dam hadn't been carried ^{through} ~~xx~~ this soft formation to a hard formation underneath, what did you mean?

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2 A That is what I meant, cut through that red formation
3 and get down to that other stuff, I believe it would have been
4 all right. However, as I say, that doesn't come within our
5 jurisdiction.

6 Q What you meant when you said you go down through to
7 the hard formation, gets to the schist on the west abutment, as
8 well as the east?

9 A Yes sir.

10 Q It has been shown here that the schist stops at the
11 contact with the red conglomerate that pitches towards the west,
12 that would call for going through a very great depth?

13 A Yes sir.

14 Q Would make it practically prohibitive?

15 A I don't think I am competent to state whether it would
16 be prohibitive or not.

17 Q BY THE CORONER: It is your opinion this red material
18 was not the proper foundation for the west end of that dam or any
19 part of it?

20 A Yes sir, that is my opinion.

21 Q And if it wasn't proper foundation, it wasn't the
22 proper place to put the dam?

23 A Proper foundation is the first thing you have to have.

24 Q BY A JUROR: If you had gone into that deep enough, it
25 would have been proper?

26 A I believe so. As I said, I am not an engineer.

27 Q You think then, considering that you have that red
28 conglomerate down there a great depth, if you had gone down in
29 the red conglomerate as you saw it, deep enough into that same
30 formation, that the dam would have stood there?

31 A I couldn't say, I think it might have if it had
32 drainage to intercept whatever water, all that sort of thing---

1
2 that I can't tell.

3 Q BY MR. SCOTT: Did you say you worked on the Henshaw
4 Dam?

5 A Yes sir.

6 Q Where is that?

7 A San Diego County.

8 Q Built in 1923?

9 A Finished in 1923.

10 Q Is that a masonry or earth filled?

11 A Earth filled, combination earth filled and hydraulic
12 filled-- upstream third and downstream third dry filled and
13 middle section hydraulic.

14 Q Is that formation as hard as that conglomerate out
15 here on the west side?

16 A That formation there was sort of disintegrated
17 granite. The center was kind of green sort of rock which the
18 cutoff wall was put into, but the general territory was sort of
19 disintegrated granite. As you get down to five, sometimes
20 fifteen feet, it became relatively hard and tight.

21 Q Is it as tight as this conglomerate on the west side?

22 A I would say it was, yes sir. Possibly the con-
23 glomerate would have a little the best of it in tightness.

24 Q Where is Snow Mountain?

25 A On the Eel River.

26 Q Is that a masonry dam?

27 A Yes sir, masonry dam.

28 Q The site there, in your judgment, is no better than
29 the site at San Francisquito?

30 A The site there, as I remember, called it tight black
31 shale, most of it in the cutoff trench. We couldn't shoot,
32 had to just dig that, picks and shovels, dig it out in that way.

1
2 as anyone familiar with that job, or could see in the Engineer-
3 ing News Record, would find there had been quite a slide on one
4 end of that job.

5 Q Considered soft formation?

6 A Yes sir.

7 Q BY MR. MOHR: Do I understand it is your opinion that
8 west side went at one time?

9 A I think it went off of there in maybe two, possibly
10 three sections.

11 Q Are you familiar with the breaking of concrete?

12 A Not particularly, merely as you would see it broken
13 in the testing laboratory. It is crushed, not broken straight
14 off, that is sheered straight off.

15 Q How do you account for that?

16 A I would say that probably cut off some of that con-
17 glomerate and left an end sticking in, and probably broke right
18 straight off.

19 Q That is the way it would break off?

20 A That is a pretty hard thing to say, I am merely stat-
21 ing what happened.

22 Q From your experience, wouldn't you say it would sheer
23 rather than break off the way it did?

24 A I don't know.

25 Q BY A JUROR: Don't you think there was extension
26 cracks along that entire dam?

27 A I am quite sure there must have been.

28 Q How many do you think there would have been in the
29 main dam itself?

30 A I don't know, probably judge came somewhere between
31 sixty and eighty feet.

32 Q Did you know anything at all of this site, any dis-

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cussion of this site at the time they were building the dam?

A No, I merely knew the dam was being built, and as the
bunk gossip goes, move the equipment and some men went up there.

THE CORONER: That is all, you may be excused.

ALLEN E. SEDGWICK, being

first duly sworn, testified as follows:

BY THE CORONER.

Q Please state your full name.

A Allen E. Sedgwick.

Q Where do you reside?

A 237 South Hobart Boulevard, Los Angeles, California.

Q What is your trade, occupation or profession?

A Consulting engineer and professor of geology at the University of Southern California.

Q You are a graduate of a school of geology?

A I am a graduate of the University of Southern California.

Q How many years experience have you had in geological work?

A About twenty.

Q Have you made a geological study of the formations about the site of the St. Francis Dam?

A Yes sir.

Q Will you give the jury the benefit of your study?

A Do you mean as to the type of the formations around the St. Francis Dam?

Q Yes sir.

A Beginning on the easterly side the rock is a mica quartz schist dipping northeasterly and the mica quartz schist continues across the stream bed to the west and up the bank to a contact with the conglomerate. The mica quartz schist, I believe, is Franciscan schist. The conglomerate, I believe, to be the base of the Sespe formation.

Q Those are all the formations that you found there?

A The major formation. There is a small formation in between the schist and the conglomerate which is probably the

1 reworked top of the schist. The top of the schist carries a
2 great deal of basic rock or material which has been reworked
3 probably and formed a top layer, which is very dark colored and
4 is at the contact of the schist and the conglomerate.

5 Q Is this schist impervious or pervious?

6 A Along the bedding planes it is quite pervious. At
7 right angles to the bedding planes it is rather impervious, but
8 not entirely so.

9 Q How about the conglomerate?

10 A The conglomerate is so badly weathered that it would
11 take up water very freely.

12 Q If it has absorbed water what would be the nature of
13 it?

14 A It would soften it and make it rather weak.

15 Q Would it have a tendency to be easily depressed or
16 would it become slippery or what effect would it have upon an
17 object standing upon it?

18 A It would be very weak and would not sustain great
19 loads after it had been weathered.

20 Q Is that formation, either the mica schist or the con-
21 glomerate, what is considered as bed rock?

22 A The mica schist might be considered as bed rock, but
23 most of the conglomerate, in fact, practically all of it as ex-
24 posed is so badly weathered that it would hardly be considered
25 bed rock.

26 Q Did you examine the footing beneath that portion of
27 the dam which is still standing?

28 A Yes sir.

29 Q Is that of the same character as the mica schist?

30 A The mica schist underlies the standing center section
31 and the conglomerate underlies the wing portion of the dam which
32 is still standing.

1 Q I think it would be proper at this time to permit the
2 jury to interrogate the witness. There are certain facts they
3 want to get at and they are experts along these lines generally.

4 Q BY A JUROR: What would be the resistance to erosion
5 of the matrix, the cementing material, in the conglomerate, pre-
6 suming that a flow of water took place at some point in the con-
7 glomerate, what would be the progressive effect of such flow on
8 the cementing material of the conglomerate--- I am referring, of
9 course, to the granite boulders and other boulders that form a
10 part of the conglomerate itself, but more particularly the
11 cementing material--- the action of water after the point of
12 saturation is reached? In other words, what would be the
13 probable progressive effect of the flow of water progressively,
14 through that material?

15 A The conglomerate has been so badly weathered that
16 the cementing material has practically been removed. A further
17 stream of water would soften it further and remove more of the
18 cementing material; the cementing material mainly is argillaceous
19 with some limestone and some limonite and the argillaceous
20 material would be rather rapidly removed by further erosion.

21 Q Does that apply to that talcous material in the con-
22 tact line between the two formations?

23 A I would not call it talcous material. I believe that
24 is a reworked portion of the top of the Franciscan formation,
25 and has softened by the movement of water through the contact.
26 It is rather a gouge, in the miner's term, of an argillaceous
27 nature rather than talc.

28 Q How wide was that contact according to your observa-
29 tion?

30 A About from a foot to eighteen inches, to two feet.

31 Q Did you see any evidence of the flow of water through
32 that conglomerate?

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A Yes. It was very evident that water had flowed through all of it because it is so badly disintegrated.

Q To the extent of having recently carried off any of the cementing material, matrix?

A It is very possible that recent flows have carried off some of the cementing material and a large portion of the cementing material has been carried off during a period of many years.

Q Referring to recent months the probability is that a limited amount only of that material has been carried away through flood waters?

A It seems that under the dam there has been a flow of water that has removed some of the cementing material in the conglomerate recently.

Q How recently would you presume that that had taken place?

A That I could not say, but probably within the time since the dam has been constructed.

Q In your references to weathering, you don't mean to infer, or do you, that the weathering took place when the dam went out, due to the flow of the water or before?

A No sir, I mean through the years previous to that.

Q Would it have weathered even though it was covered with top dirt?

A The top dirt is the product of weathering there.

Q I believe you said that the schist dipped northeasterly ?

A I believe the schist on the easterly side of the bank dips northeasterly on the easterly side of the river. The schist on the westerly bank dips southwesterly or westerly.

Q Is the dip approximately parallel with the contact, the dip of the contact?

A The strike of the beds is, but the dip is away from the bank, into the bank.

1 Q Does that contact represent a non-conformity?

2 A I believe so.

3 Q The sliding action of the concrete against the schist
4 would offer what resistance, do you think?

5 A I think the sliding action of the concrete against the
6 schist would be resisted better by the concrete than by the
7 schist.

8 Q Within what you think would be a coefficient of fric-
9 tion between the two materials?

10 A There was certainly an adhesion of the concrete to the
11 schist, which was stronger than the adhesion between the bedding
12 planes, or planes of schistosity.

13 Q In other words, the weakest portion lies below that
14 plane which is under the schist itself?

15 A The weakest portion of the schist lies in the bedding
16 planes of the schist itself.

17 Q In the conglomerate that same action, what effect
18 would it have?

19 A The conglomerate was so badly disintegrated that it
20 would not sustain the load.

21 Q What underlies the conglomerate at that point?

22 A I believe the Franciscan schist.

23 Q Which would be the extension of the mica schist as you
24 found it?

25 A Yes, the Franciscan is a mica schist.

26 Q At what depth would you find it at the west abutment,
27 for example, of the dam structure?

28 A The dip is about 32 degrees and at any point west of
29 the dam abutment you could compute it by taking that approximate
30 dip and making the computation.

31 Q And calculate ^{it} from the contact?

32 A Yes sir.

1 Q In other words, it would be at a lower level on the
2 west wing than in the center and east?

3 A Do you mean the conglomerate?

4 Q No, the schist.

5 A The schist is on both sides. It is on the easterly
6 side and on the westerly side. On the easterly side the schist
7 makes the whole bank and on the westerly side the schist under-
8 lies the conglomerate.

9 Q About how far under would you estimate the schist,
10 how far would you have to go through the conglomerate to reach
11 the schist?

12 A At the point of contact they are together and exposed
13 on the westerly bank and the schist dipping to the west, any
14 distance west of the contact that you go back--- the distance
15 to the schist could be computed by simply taking the angle of
16 the dip and computing that as a triangle to get the altitude
17 from the surface and the incline of the schist.

18 Q I understood you to say that you made an examination
19 of the schist or the bed rock at the portion of the dam that is
20 now standing?

21 A On the westerly side there is some of the schist ex-
22 posed and I made an examination of that schist.

23 Q You did not go down below the bed of the stream any
24 distance at all?

25 A We could not.

26 Q How long, in your opinion, would it take the water to
27 have seeped through this conglomerate formation under the head
28 of water which was behind the dam?

29 A Relatively I think it would seep very rapidly.

30 Q Is that geologically speaking?

31 A No sir. I could not compute the number of days but
32 it is a rather large amount of water.

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Q If there was a hundred foot head of water it would seep through in a few hours?

A No, I think it would seep through in time. It certainly did seep through in the time that it had.

Q How long, do you think, a year?

A I would not be able to say.

Q Have you any idea, professor, as to the rapidity of flow which might be established, assuming a definite pressure through that conglomerate?

A No sir.

Q Have you any ideas as to the speed of flow which might be set up under such a condition?

A No, I have made no tests on that rock for the speed of flow through it.

Q Has anyone of your board made any such estimates or tests?

A I believe not.

Q I, personally, am very much interested to determine some way that the speed of flow through that conglomerate can be determined. Of course, we know that the water flowed through it. What was the speed of the flow? What was the capacity of that water to carry the cementing material out from under the base of the structure?

A We made no tests on that.

Q BY THE CORONER: Is there any way to determine it?

A Yes, I think it could be ascertained, but it would be rather a difficult experiment. You would have to put it under pressure.

Q How long would it take?

A Depending upon how long it would take the water to go through the conglomerate. It would take ^{some} time to set up such an apparatus.

1 Q Could it be known by Monday or Tuesday?

2 A I think not. I doubt it.

3 Q If it is important, we would like to have the test
4 made, so we can have an answer before we get through with this
5 hearing?

6 A At present, or when we were at the dam, they were tak-
7 ing some measurements of the amount which was stored in the hills
8 or sides of the reservoir, what they call bank storage.

9 Q BY A JUROR: Did you make a test along the west bank
10 to determine the depth of penetration of the water into those
11 banks over the period of years that the water has been stored
12 in those banks?

13 A I examined the banks above and below the dam site, and
14 at the dam site, and they were all so badly disintegrated that
15 we could get no information from them.

16 Q Did you dig into it so as to determine what that might
17 be?

18 A No sir.

19 Q Don't you think it might be wise to get into that, so
20 that---

21 A I think at the top of the hill it is clear through the
22 hill.

23 Q Do you mean
24 Under the portion of the dyke, which is standing there---
25 we call the dyke the westerly portion of the concrete which is
26 standing there--- under that concrete wall?

27 A I think that is practically disintegrated or weathered
28 clear through.

29 Q Would you call that conglomerate an indurated conglom-
30 erate?

31 A It has been an indurated conglomerate, the cementing
32 material having been weathered out.

Q Weathered to what depth, in your opinion?

1 A As far as we could find it in the conglomerate, it was
2 weathered out.

3 Q How far were you able to find it?

4 A I walked clear across the whole Sespee formation to
5 its contact with the overlying stratum. The conglomerate is
6 the basal portion of the Sespee and is probably only two hundred
7 feet or so thick, and before we could get back into any of the
8 overlying portions of the conglomerate at the surface, it was
9 weathered so badly that we could not get a solid sample of the
10 conglomerate.

11 Q Have you any ideas as to how deep you would have to go
12 to get beyond the weathered zone at that point?

13 A No, I believe it is rather indefinite. It is a pro-
14 gressive weathering at the dam site. At the contact it is
15 rather more weathered than it is just above it. The progress
16 of weathering is swifter at the contact than it is between the
17 weathering and the schist, getting harder as you go up the hill
18 to the point where the little basin is, and then it begins to
19 soften from the normal weathering up to the top of the hill.
20 The basin---- I don't remember the exact elevation below the
21 wing portion, which is now standing, but that was the most solid
22 portion of the conglomerate. From there down it was weathered
23 due to circulation along the contact. That would probably give
24 you some idea of the depth of weathering.

25 Q In other words, somewhere about midway of the section
26 now standing under the west abutment, was the point where there
27 was less weathering, from a superficial examination, had taken
28 place?

29 A Apparently so, yes.

30 Q That would be a little bit west of the contact between
31 the two formations?

32 A Quite a little ways.

1 Q As I understand it, you are going back up there to get
2 some other information to present to us Tuesday?

3 (No response)

4 THE CORONER: I would like very much to get that test if
5 it can be done.

6 Q BY A JUROR: Would it be possible to determine the
7 penetration of water at the different elevations, say, ten or
8 twenty feet, elevations directly below the dyke on that hill?

9 A That would necessitate cutting out large sections and
10 getting them whole without cracking them, which, on account of
11 the disintegrated nature of the material, would be difficult.

12 Q I want to find out how far the water had penetrated
13 through this hill during the period of years that the water has
14 been in the reservoir. Has it gone straight through?

15 A It is almost impossible to get, on account of the
16 nature of the material. It would be very difficult to get a
17 block out of that top material, which would stand transportation.

18 Q As you go in from the outside surface, it is going to
19 be dry on account of the water going out of it, but as you keep
20 going into the interior it will get more and more damp, other-
21 wise it would go right straight through?

22 A I don't know as I understand what you mean.

23 Q The circulation in the schist itself there or the con-
24 glomerate, will show, will it not, as you go in?

25 A The outside will be dry, slightly, from exposure, but
26 the whole interior will be moist.

27 Q I think he wanted to find out how far that moisture
28 penetrated?

29 A It goes clear through the hill. The moisture has
30 gone through the hill, as evidenced by the fact that it is dis-
31 integrated.

32 Q BY THE CORONER: Can you determine that without tunnel-

1 ing through that formation to see if it is wet or not?

2 (No response)

3 Q BY A JUROR: The reason we are bringing that out is be-
4 cause some of us have an idea that the penetration has not gone
5 clear through?

6 (At this point one of the jurors went to the blackboard and
7 drew a diagram)

8 Q This is the dyke and there is the formation on that
9 side, which is the reservoir side. In the period of years during
10 which this has been filled with water, there has been a certain
11 penetration into this hill. I am trying to determine whether
12 the penetration was all through this entire mass or was the pene-
13 tration something like that (indicating) in this area right here.
14 Is this dry in here (indicating) or is it moist the entire dis-
15 tance through that hill?

16 A It is disintegrated from weathering over the period of
17 years, practically clear through the hill, close to the dyke, as
18 you call it, the wing dam, but what the penetration has been, due
19 to the reservoir, could only be determined by tunneling into it.

20 Q That is what I am very anxious to know, is if there is
21 a dry area in here which has resisted this penetration coming
22 through here (indicating), and just what has happened. Now, if
23 it had come through this entire hill here (indicating), that is
24 something I would also like to know?

25 A That could only be determined by borings or by tunnel-
26 ing.

27 Q BY MR. DENNISON: That is, borings made along the crest
28 or ridge of the hill?

29 A Along the side of the wing dam.

30 Q What you have reference to is that long hill (in-
31 dicating)?

32 (No response)

1 Q BY A JUROR: This portion down below the abutment here
2 (indicating)?

3 A That could only be determined, I believe, by borings or
4 by tunneling.

5 Q Do you believe you could get that accurately or a real
6 record by boring? Don't you think it would have to be done by
7 tunneling?

8 A I think so. It would be very hard to get that without
9 tunneling. I think there is practically no dry area in the
10 sense of ^{it} being dry underneath that, because that is above the
11 pool.

12 Q That is above the point of contact?

13 A No, above the little pool. It lies in a shoulder just
14 below the wing dam. Below it seems to be disintegrating clear
15 through the hill.

16 Q Would not the appearance of this conglomerate have
17 been very different before it was subjected to moisture? Would
18 it not appear like a very hard, impervious material?

19 A Yes, just as clay or adobe appears hard before it is
20 wet.

21 Q Does it not have somewhat the appearance of a vitrified
22 clay before it has been subjected to moisture?

23 A I would not say vitrified clay, but would say it would
24 appear a little harder when dry than when moist.

25 Q To what do you attribute this peacock color on the
26 rocks?

27 A Do you mean the black stain on the conglomerate?

28 Q Yes.

29 A That is known as desert varnish. These pebbles which
30 form the inclusions in the conglomerate were exposed to weather
31 over a great period of time, and the moisture in the atmosphere
32 in the evening was absorbed by the rocks, and in the daytime the

1 sun beat upon the rocks and heated them and they expanded on
 2 the outer surface and the moisture was pulled out and in the
 3 evening the rocks contracted and the moisture in the evening air
 4 went back into the rocks, and as the rocks contracted the mois-
 5 ture was put under slight pressure and dissolved some of the
 6 constituents in the interior of the rock below the surface, and
 7 one of them was iron oxide and on the succeeding days when the
 8 moisture was pulled out it contained iron oxide and the water was
 9 evaporated leaving a stain of the iron oxide upon the outer sur-
 10 face of the rock and through a period of perhaps thousands of
 11 years that stain built up the black stain noted upon these
 12 pebbles, and it is called a desert varnish.

13 Q Can that stain be attributed to these rocks having
 14 been red hot?

15 A No sir.

16 Q ~~Can-~~ It has been shown quite conclusively here that
 17 the amount of leakage through and under the dam was relatively
 18 very small up to within a few hours of the failure of the dam;
 19 also that there were a number of leaks through the dyke and the
 20 westerly extension of the main dam, which had been discharging
 21 water from the flank of the hill upon which the west wing of
 22 the dam rested. Do your conclusions take into account that
 23 fact that the downstream---- the portion of the hill below the
 24 dam was saturated from leakage---- known leakage from cracks in
 25 the dam itself?

26 A To you mean cracks in the concrete?

27 Q In the concrete.

28 A No. I think the leakage is due to progressive break-
 29 ing down of the cementing material in the underlying conglomer-
 30 ate.

31 Q Could you form an opinion as to the depth of the mica
 32 schist section of the rock ?

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A The Franciscan schists are anywhere from two thousand to four thousand feet in different sections of the territory. I have no idea how deep it is at that point.

Q In your opinion, just exactly what ^{was} the progressive method of the failure of the dam? Where did it fail first, and where next, and so on?

(No response)

MR. DENNISON: Pardon me! This is a geologist; Mr. Mayberry, the other consulting engineer will give you that information Monday, if you would just as soon defer your question until then.

THE JUROR: I will withdraw that. It is your opinion that that conglomerate formation was not an ideal site for a dam, is that correct?

(No response)

MR. DENNISON: Is that a question for engineers?

A JUROR: I will put it in this way: Would you be satisfied to build a heavy structure on that formation, if it was a structure that you were going to construct for yourself?

A No sir.

Q In your opinion, would tests made at the time, or before the dam was constructed, have disclosed the softening effects and weakening in that west rock?

A Yes sir.

Q Have you any reason to believe that the Franciscan rock, if it had been exposed on the extreme western end, for example, lying perpendicular to the western abutment as standing now, would it have been any different from that exposed in the bottom of the bed of the stream on the east side, any different from the characteristic deposit generally at that point?

A The schist, the mica schist, the Franciscan schist on the westerly side of the stream bed is disintegrated at the

1 contact due to the circulation of water through the schist at
2 that point.

3 Q What was your opinion as to the character of this
4 schist westerly perpendicularly under the west abutment as stand-
5 ing?

6 A Along that plane I think you will find it badly disin-
7 tegrated, due to movement.

8 Q At the same level as the bottom of the center part of
9 the dam?

10 A Taking a horizon of a few feet in width and carrying
11 it down approximately parallel to the dip, I think you will find
12 it weathered.

13 Q Practically ^{proportion} in ~~proportion~~ to its nearness to the con-
14 tact?

15 A To the contact, yes sir.

16 Q Did you examine the pieces of concrete apparently from
17 the west side, which were carried a half or more miles down the
18 stream?

19 A Yes.

20 Q Did you notice any of the red conglomerate adhering
21 to the apparent bottom surface of the blocks?

22 A On the piece farthest down my assistant said that
23 he found conglomerate. I did not see that piece.

24 Q BY THE CORONER: Is that Mr. Johnson ?

25 A Yes sir.

26 Q BY A JUROR: It seems rather unreasonable to me that
27 the conglomerate could have adhered to the piece of concrete as
28 it was rolled down the canyon. It must have been washed off
29 or broken off by contact with the dirt?

30 A I did not see the conglomerate adhering to the concrete,
31 but Mr. Johnson says that he did.

32 Q BY THE CORONER: Is this the conglomerate that you

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1 speak of?

2 A That looks very much like the material from the con-
3 glomerate, yes sir.

4 Q BY MR. DENNISON: The material from the conglomerate?

5 A Yes sir, from that formation.

6 Q BY THE CORONER: Can that, in any way, be considered
7 as pieces of a rotten boulder?

8 A I think that is part of the cementing matrix, the
9 cementing material that cements the pebbles together.

10 Q Here is a piece of material which was submitted here
11 by Mr. Lundy, which he said was a piece of material taken from
12 a section of the dam three quarters of a mile below the dam site,
13 Will you state what that is?

14 A That appears very much like the argillaceous portion
15 of the conglomerate, which surrounds the pebbles and cements
16 them together.

17 Q Did you see that formation at the side of the west end
18 of the dam?

19 A Similar.

20 Q BY A JUROR: Isn't it also a fact that this conglomerate
21 carries on down the canyon as you go on down south?

22 A Yes, the contact dips to the southwest apparently and
23 dips under the hills, so that the conglomerate is carried be-
24 neath the hills, and as you go down the stream you will get into
25 the higher horizons of the Sespee, which is across the sandstone of
26 the portion that forms that same formation overlying the con-
27 glomerates.

28 Q Is there any evidence of any movement in the contact
29 of recent years?

30 A No sir.

31 Q Did you see any evidence of any earth movements?

32 A Might I qualify that? There is no evidence of recent

1 movement along the fault lines, but there is evidence of recent
2 movement along the planes of schistosity of the schist.

3 Q Within what limit of time?

4 A Apparently quite recently.

5 Q How was that indicated?

6 A By striations of grooves upon the bedding planes of
7 the schist.

8 Q Have you any theory as to why that took place?

9 A Yes.

10 Q What is that, might I ask?

11 A Close to the contact there is a fault crossing the dam.
12 That fault has allowed water to percolate through the fractures
13 and has softened the schist along that fracture. The schist is
14 dipping into the bank. The striations on the bedding planes, or
15 planes of schistosity, are apparently downstream, and they were
16 so soft that we could erase them with our fingers, and, therefore,
17 I infer that they were quite recent and more than that there was
18 considerable evidence of recent limonitization or deposition of
19 limonite along these planes, which was rather dusty and could be
20 easily dusted off, rather more than in the surrounding schist in
21 the country surrounding the dam. For that reason we believe
22 that there was slight recent movement in the schist under the dam,
23 near the plane of contact.

24 Q How close to the plane of contact---- what would be the
25 limit of distance from the plane of contact, from the evidence
26 which you saw?

27 A That point, I believe, is about forty feet from the con-
28 tact towards the river, more or less.

29 Q Easterly from the contact?

30 A Easterly, yes sir.

31 Q You did not find any such evidence from the true schist
32 underlying the section now standing?

1 A Yes sir.

2 Q At what point did you find it?

3 A Immediately above the dam site, at the river level on
4 the easterly bank.

5 Q How wide was that evidence as you saw it?

6 A There were slight grooves showing movement either up-
7 stream or downstream across the bedding planes, at the easterly
8 bank, which, I believe, was due to the weight of the pieces of
9 concrete as it moved upstream at the time of the failure. They
10 were very slight but fairly evident.

11 Q That movement, however, did not change the character
12 of the rock itself?

13 A Only to fracture it. Evidence of fracture after or
14 during the failure.

15 Q Are your theories so basic that they would not permit
16 of a difference of opinion by any other geologists or would it
17 be reasonable for other geologists to have a different theory
18 from you in regard to the geology of the soil?

19 (No response).

20 MR. DENNISON: I don't know whether a man can answer as to
21 whether another fellow would have a different opinion. In
22 other words, you want to know whether geology is an exact science.

23 A JUROR: Whether it is so basic that it would not permit
24 of another opinion by another geologist?

25 A I think I could take a geologist or a layman and con-
26 vince him of these deductions.

27 Q In the large part, what is the cementing material of
28 that conglomerate?

29 A Mostly argillaceous with some calcite and some limonite.
30 It is mostly argillaceous. I tested it quantitatively and
31 found some calcite.

32 Q Evidence of considerable calcite?

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A I would not say considerable, but sufficient to show plainly in a quantitative analysis.

Q That would be a percentage perhaps within one percent?

A Of the whole rock?

Q Of the whole rock.

A I would not want to guess. There was sufficient calcite, sufficient to show up plainly in a quantitative analysis.

Q BY THE CORONER: What are the properties of calcite?

A Calcite is limestone.

Q Does it have a tendency to become softened?

A Softened in water, yes sir, if given sufficient time.

Q BY A JUROR: What is the nature of this argillaceous material, is that all the same as clay?

A All the same as clay, yes.

Q Was there any rock movement also that contributed to the failure of the dam?

A I think so.

Q Is the nature of the rock there in that fault, such that it would be impractical to rebuild the structure or another one of the same design in that vicinity?

A Will you say that again?

Q Are these faults of such a nature as it would be impractical to rebuild the dam or another one in that vicinity?

A I do not believe there was movement along the fault lines that precipitated the failure. In answer to your previous question I referred to the circulation of water along the fault lines, which disintegrated the underlying rock, rather than to any movement along the fault lines.

Q BY THE CORONER: A witness, Mr. William T. Holt, Jr., furnished these samples and testified that he took them from the west side of the site there. What are those?

A That is so badly disintegrated that I would hesitate

1 to try to say what it is without analysis. Evidently it is an
2 argillaceous material that is stained with limonite. It con-
3 tains fragments of other disintegrated material including, appar-
4 ently, pieces of sandstone, but it is so badly disintegrated
5 that without microscopic analysis I would hesitate to say what
6 it is.

7 Q Did you see any of that at the dam site?

8 A I don't remember any of this particular type.

9 Q BY A JUROR: Do you think that a dam could be built
10 on that site now and be safe?

11 A Do you mean directly upon that site?

12 Q Oh, no. Say one hundred feet upstream or one hundred
13 feet downstream?

14 A Yes sir, at considerably more expense.

15 Q Could not a dam have been built on this site at con-
16 siderably more expense, that would have stood?

17 A I would hesitate to put a dam on that immediate site
18 without excavating into the conglomerate far below any disin-
19 tegration as shown upon the hillside.

20 Q But, if you did that you feel that it would be a firm
21 foundation?

22 A I don't know how far down you would have to go. You
23 might have to go down many feet. It might be economically
24 impractical.

25 Q Aside from the question of economics, then, is it
26 possible?

27 A I suppose that with the expenditure of sufficient
28 money it would be possible to excavate to a point where you
29 could get hard rock. I fear that that would be quite deep, and
30 particularly along that contact it would require considerable
31 grouting.

32 Q What would you say, just in figures, about how far,

1 off hand?

2 A I should go below the bottom of the canyon and that is
3 practically one hundred and ninety to two hundred feet below
4 the crest of the dam.

5 Q Are there no earthquake faults, then, that would de-
6 ter you?

7 A There are two faults crossing that dam site.

8 Q Earthquake faults?

9 A Earthquakes, of course, are located upon faults.
10 Earthquakes are simply the release of stresses in the earth's
11 crust along planes of weakness, and the planes of weakness
12 happened to be on fault lines. All faults, seemingly normally,
13 have movement of the walls at some time in their history and
14 these movements may or may not cause earthquakes, as you mean
15 them, but there are two faults crossing the dam site along the
16 walls of the western differential motion. The contact is
17 parallel to one of the fault planes, presumably, so may repre-
18 sent a portion of the fault. A fault is not just one single
19 break. It is a zone of fracture with several fractured planes
20 across the zone of fracture. Fault zones have width. Some of
21 them are many feet wide, some of them less and the fault must
22 not be considered as just one single fracture, but rather a
23 series of fractures, often in echelon, approximately parallel.

24 Q Are these faults indicated on any geological maps or
25 surveys, which are in existence now?

26 A I think the fault, which is approximately parallel to
27 the canyon, is mapped.

28 Q These faults are in the schist?

29 A Yes sir.

30 Q Have you made a record of the results of your study,
31 a graphic record?

32 A I have not completed a report, no sir.

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Q When, approximately, would that report be completed?

A We hope to have it completed by Monday.

Q BY MR. SCOTT: About how far does that mica schist extend in that east hill? Is it all composed of mica schist?

A Practically all composed of mica schist.

Q About how far down, in your opinion, does the mica schist extend before the formation changes?

A I have no way of telling. I presume it is rather deep.

Q Is this mica schist laid on conglomerate? Is conglomerate under it?

A I would doubt very much that there was conglomerate at the base of the mica schist, but the mica schist is buried perhaps many hundred feet below the river bed, so it would be very difficult to determine.

Q Does Mica schist make a very good foundation for a dam?

A Mica schist could be used safely for the foundation of a dam if it was properly keyed into it, and the weaker side was where the conglomerate was. That was the weaker side, I believe.

Q And you think the water would percolate through that conglomerate and find its way out on the other side?

A I think the water did percolate through the conglomerate underneath the dam and found its way out on the other side.

Q And have caused the dam to break?

(No response)

MR. DENNISON: He is only here as a geologist. He don't know how the dam broke.

MR. SCOTT: I withdraw that question. Was the water disintegrating---- was the ground disintegrating if the water came through clear?

1 A Clear is rather a relative term. It might be appar-
2 ently clear and might be disintegrating and yet carry so little
3 in a unit of measure that you would detect it only by some meas-
4 uring method rather than by the eye.

5 Q BY MR. DENNISON: Is this conglomerate a kind of a
6 sandstone?

7 A A conglomerate is a sedimentary rock composed of
8 pebbles, cemented together by some cementing agency, and the
9 interstitial spaces would be filled with sand, which would also
10 be cemented together and the whole, the sand and the cementing
11 material surrounding the pebbles, would be together.

12 Q You see, I don't know much about this geology business.
13 Is red porphyry a form of sandstone?

14 A No sir.

15 Q Is it a form of limestone?

16 A No sir. You might have porphyritic formations that
17 carry limestone, but usually not.

18 Q What you mean in answer to this engineer's statement,
19 is this: That hill there upon which that structure is erected---
20 they call it a dyke, I believe,--- has been there for a long,
21 long time, and the natural waters--- that being a water shed
22 up there, isn't it?

23 A Yes sir.

24 Q --- have eaten through the hill, is that right?

25 A It has disintegrated the rock to a considerable depth.

26 Q Has rotted it?

27 A Disintegrated it.

28 Q They have something in geology, it is called what?

29 A Disintegration.

30 Q A rock is just the same as a tree or a man or anything
31 else. It grows up and decays, doesn't it?

32 A Yes.

1 Q And these rocks on the top of the hill, because it is a
2 water shed of the elements, have decayed, is that correct? Isn't
3 that what you mean by weathering?

4 A Decay is rather an organic term and this is an inorgan-
5 ic material, and we use the word disintegrated.

6 Q All the way, as the fellow says, it is rotten anyhow.
7 All right, anyhow, that is all.

8 Q BY MR. SCOTT: What are earth dams built of?

9 A Earth.

10 Q Is that a disintegrating material?

11 A Soil is material that has already disintegrated, and
12 the humus in it probably would please Mr. Dennison.

13 Q Are earth dams tight?

14 A Watertight?

15 Q Yes.

16 A Sometimes. I guess you want me to answer the question
17 by explaining the percolation of an earth dam. Take an earth
18 dam with a water height at a certain level, to make that dam
19 safe the percolation line should be at an incline so that where
20 it comes out at the toe of the dam or the downstream face, would
21 be below the grade level or stream bed at that place. If that
22 percolation line is above that it establishes seepage lines
23 through the dam which might be serious. If below that, it per-
24 haps can be controlled.

25 Q BY MR. MOHR: Professor, you spoke of there being
26 two faults in the canyon and mentioned where one was. Will you
27 be good enough to tell the jury where the other one is?

28 A There is another fault that crosses the canyon diagon-
29 ally beginning at approximately three hundred to four hundred
30 feet below the easterly abutment and crosses the canyon at a
31 point about a hundred and twenty-five feet below the westerly
32 edge of the standing section, and cuts up the hill across the

1 wing portion of the dam or just below it.

2 Q BY A JUROR: How wide is that fault zone?

3 A It is a very old fault and the fault zone, I think, is
4 rather narrow, only a few feet. The disturbance did not show
5 any width over eight or ten feet anywhere.

6 Q What formation does that fault occur in?

7 A It cuts through the Franciscan formation, that is, the
8 mica schist, with a displacement of from three to five feet, and
9 where it enters the Sespee or the conglomerate the displacement
10 is very much less, measured by a few inches, apparently, indicat-
11 ing that the adjustment along that fault line was practically
12 complete before the Sespee formation had been laid down upon the
13 schist.

14 Q Was this an ordinary displacement?

15 A It was thrown along the strike and dip of the fault.
16 Just what the heave would be I did not determine. That would be
17 the vertical displacement.

18 Q How did you develop that the fault was there?

19 A I could see it.

20 Q What is a fault?

21 A A fault is a rift in the earth's crust along the walls
22 of which there has been differential motion.

23 Q BY MR. MOHR: You might explain the difference between
24 a dead and a live fault now?

25 A Faults are due to stresses within the earth's crust,
26 which become relieved through the motion forming these rifts or
27 cracks. When the stresses are completely relieved the motion
28 practically ceases and when the motion has ceased it is termed
29 a dead fault, and where the stresses are not relieved and the
30 motion from time to time is continuous, then it is said to be a
31 live fault.

32 Q Was this a dead or a live fault?

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A There is no indication of its having moved recently. In fact, it seems to have practically extended, to have practically relieved the stresses before the conglomerate was laid down upon it, because the conglomerate is faulty, but a very few inches, as compared to three to five feet in the schist.

Q That conglomerate was laid down upon it ages ago, wasn't it?

A Yes sir.

Q When we speak of recent or live or dead faults, it would mean that it has been either alive or dead for ages?

A Yes sir.

Q From a geological standpoint it is very difficult to determine with any degree of accuracy, whether a fault has ever become a dead fault?

A It is very difficult and only by comparison, perhaps, or by motion through recent formations. There is no motion along that fault where the roadway cuts it. I examined the roadway very carefully for any displacement along that fault and found none.

Q This may be impossible, but can you, with any degree of accuracy, tell the effect of a so-called earthquake upon faults, and, if so, what effect it might have had-- what effect a so-called earthquake in or near that territory might have had upon either of those two faults?

A An earthquake, by releasing the pressure along some other fault line, would not be indicated by any movement along that fault line. A movement along that fault line, if rapid enough, would produce, perhaps, an earthquake, the intensity depending upon the amount and the rapidity of movement. There is no evidence along this fault line of any recent movement.

Q BY A JUROR: Reverting back to this question of the flow of the water-- the capacity of a fluid to carry matter in

1 suspension is a function of its velocity?

2 A Yes sir.

3 Q As you examined the matrix of that conglomerate did
4 you formulate any general idea in your mind as to what speed of
5 flow would be necessary through that to carry away any apprecia-
6 ble quantity, that is, any quantity beyond what might be appar-
7 ent, by water, that would appear crystal clear at a distance or
8 unfiltered---- did you form any idea as to what the carrying
9 capacity of that would be as to the speed of that flow?

10 A Indirectly, yes. The carrying capacity of water varies
11 as the sixth power of the increase in the velocity, that is, if
12 you double the velocity of the flow of water, you will increase
13 its carrying capacity sixty-four times, but the movement of
14 water itself through the conglomerate, was so slow that it would
15 carry in solution more than in suspension. Very fine particles,
16 almost colloidal, of the argillaceous cementing material, so
17 that the movement through there would scarcely carry particles
18 until the leak developed, which then might have carried particles
19 of size.

20 Q What proportion of the matrix would be the colloidal
21 portion, just roughly?

22 A A small percentage because the matrix is made up of
23 sand grains, large pebbles and grains of other siliceous matters
24 cemented together with the cementing material. The cementing
25 material would fill the voids around the sand grains, and the
26 cementing material and the sand grains together, would fill the
27 voids around the large pebbles, so that the cementing material
28 would not form a large percentage of the material itself.

29 Q May I take it that you believe the cementing material
30 was largely this material of a colloidal nature?

31 A I think it was largely argillaceous, that is, claylike.

32 Q If that is true, an appreciable flow would not carry

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an appreciable amount of material in suspension?

A Not a great deal, only in exceedingly fine particles, that would appear almost colloidal.

Q If that is true, the flow of several years duration, which took place in that section of the foundation of the bed rock, carried relatively little matter away?

A It would carry away very slowly the argillaceous material and the limonite, the limonite staining the soil red, which can be seen on the upper surface. The wash, of course, would take away a great deal of the fine argillaceous material and deposit it, perhaps, as silt down the canyon.

Q We have the evidence that there was a characteristic flow through that material, and it has been indicated that there was a substantial increase in the flow within a few days of the failure. Would you anticipate that there would be a sudden increase in that flow?

A Yes sir.

Q Through a period of two or three years, as the case may be?

A It is very possible. The infiltration would be gradually breaking down the cementing material until it got to the point where the ^{hydraulic} ~~the~~ pressure was sufficient to carry away that which remained, and then the flow would begin to increase.

Q Without indicating from the color of the water that the movement was taking place?

A I think when the flow became rapid there would be some indication in the color of the water.

Q At what speed would you expect that might be?

A So that it would flow as a stream from the side of the dam.

Q Through the transverse section of the dam?

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A Yes sir.

Q A flow of one foot per minute?

A Do you mean one cubic foot per minute of water?

Q No. One foot of speed of flow per minute.

A That is pretty slow. I should say that if there was any rapid movement of water such as was described as a leak that it thought to show some color.

Q Assuming that the flow was one hundred miners inches at its maximum from the last observable point, and the flow took place generally through that entire section, the speed would be very slow, would it not?

A Yes.

Q The speed figures less than one foot per hour on that basis. Would you think a flow of a foot per hour would have a disintegrating tendency that would culminate quickly in failure?

A It would have a disintegrating tendency but would not necessarily culminate in failure. As I understand, your point is as to whether disintegration is shown by discoloration of the water. I think when the flow started ^{there} should be some discoloration, but the channels could be very quickly, with a large flow or a comparatively large flow, relieved of their coloring material, and only sand grains carried in suspension, and perhaps some of the limonite in small quantities, which might or might not show discoloration, and according to the scouring in the channel, which had taken place previous to the time it was observed.

Q There should not be much scouring at the speeds indicated from the time the flow began until the failure?

A No.

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LOUIS Z. JOHNSON, being

first duly sworn, testified as follows:

BY THE CORONER.

Q Please state your full name.

A Louis Z. Johnson.

Q Where do you reside?

A 2181 West 11th Street, Los Angeles, California.

Q What is your occupation?

A Consulting geologist.

Q Where did you receive your education in geology?

A I am a graduate of the Vienna University of Austria, also had two years course in Jena, Germany, and completed in the Imperial Polytechnic Institute of Moscow, in Russia.

Q How many years experience have you had in practice?

A Twenty years.

Q Have you examined the site of the St. Francis Dam?

A Yes sir.

Q Will you state your findings to this jury, please?

A To get down to the start of the geological formation we had a schist which forms the basement upon whose eroded edges were deposited sediments of the later ages. The late age to which the conglomerate and the intercolated shell streaks belong, is the oligocene age and Sespee epoch. The conglomerate forms the basement of the Sespee and it is composed of rounded pebbles, sand and fragments of clay and also of irregular pieces of these materials. The cementing material of conglomerate is limonite and an oxide or hematite. Different measurements show distinct bedding cracks. These bedding cracks are, as a rule, filled with gypsum and show infiltration of secondary waters through the formation. That is a very important point. All the formations on the particular point of the dam site are tilted north 15 degrees east. The bedding cracks and the

1 bedding plane or top of the formation are tilted ^{at} SE degrees south-
2 east. In other words, the bedding cracks are tilted from the
3 reservoir site downstream. I will illustrate it. This is the
4 Hillside and all the beds tipped from the reservoir down towards
5 the stream.

6 Q BY MR. DANNISON: Can you explain that on the board?

7 A Yes. Limonite is the iron sulphite. This is the hill
8 and here is the water. The beds dip this way. Now, you have
9 the bedding cracks that come just like that. In other words,
10 they are all open to the water there.

11 Q BY A JUROR: Do you refer to the conglomerate now or
12 the schist?

13 A I am going from upwards down. The schist is the same
14 way. The schist is tilted the same way. You have no bedding
15 cracks in the schist, but partings.

16 Q That is the west section?

17 A Yes sir, just below the dam, below that hillside there.
18 Right on the top of this conglomerate you have the alluvium, about
19 ten feet of alluvium, which is just plain dirt. That is as far
20 as the geology goes. I will give you the age and all that. May
21 I have my notebook please? I am going to give you the north and
22 south sections on the west side. Now, you have up here the slope
23 going south below the wing of the dam. Right here, this is the
24 alluvium. This alluvium goes this ten feet here (at this point
25 the witness draws a diagram on the board, showing the different
26 strata of the earth). This here is exposed, a forced member of
27 the conglomerate. It is a brownish grey conglomerate which is
28 surrounded by limonite. Then you have right below here, it is
29 exposed farther and this is the reservoir site right below that
30 bed, you have a streak of twelve feet of shale. It is not in
31 a sense a shale such as a mud, but it is practically a fine sandy
32 shale, the greatest portion of it is sand, and it is cemented by

1 the clay, argillaceous material or clay. Next below this one
2 it is thirty-six feet of red conglomerate.

3 Q BY THE CORONER: Is that what you mean by conglomerate?

4 A No, that is a brownish forced member. This is the
5 alluvium right on the top and this is a brown conglomerate here.
6 This is the shale. Now, we come to the red conglomerate. Then
7 we have three feet of shale again. Now, this shale is red.
8 It is mostly sand. It is cemented together by the argillaceous
9 material.

10 Q BY MR. DENNISON: Is this gneiss?

11 A No, there is no gneiss there. Twenty-five feet of
12 schist here, which is brownish grey schist.

13 Q Is that what is known as grey wackey?

14 A No, I don't know what that is. We have twenty-five
15 feet of this brownish grey formation and it shows some induration.
16 In other words, it is harder than this particular member. It is
17 similar to this member up here and then you have six feet of
18 shale again which is stained with that limonite which is yellow,
19 alternating with the blue and yellow.

20 Q BY A JUROR: These dimensions are at right angles to
21 the bedding planes?

22 A Yes, at right angles coming down the face of the hill.
23 Then below this one you have a ten foot bed of schist again, and
24 it shows schist with quartz seams. Then you have---- I will
25 have to go up this side again. All right. Right here in the
26 shale below this schist here you have five feet of crushed shale
27 which is very dark or black. It looks almost like coal. Right
28 below this one here is a seam nine feet of talcous schist, mica,
29 with steatite. It is pre-eminently argillaceous, that is,
30 clay. Right below here we have another bed of fourteen feet of
31 schist bedded with quartz seams. Right down here are nine feet
32 of the blue grey schist. That is from the top of the hill right

1 down to the bottom of the creek bed.

2 Q BY MR. DENNISON: How many feet is that altogether?

3 A JUROR: One hundred and thirty-nine feet.

4 A JUROR: Professor----

5 A I am not a Professor.

6 Q BY A JUROR: Mr. Johnson, just where was the great-
7 est amount of infiltration or where would it occur?

8 A Right in this red conglomerate because this material
9 is softer than this bed or this one here (indicating). Right in
10 between these two beds. As I said, they are all dipping this
11 way and here is your reservoir, and this is just in a form like
12 if you made a brick wall and tilted it at an angle of fifty-two
13 degrees and laid your bricks on top of each other,--- some of the
14 layers---- supposing you put mortar in them and the rest just
15 laid loose, the water percolating or running down these seams
16 is more or less pretty rapid because it is open and exposed and
17 there is nothing there to hold the water. Of course, you have
18 cross beddings down there. The cross bedding will be very
19 likely made of very sandy shale cemented with the clay. What
20 will happen, this will follow this seam, it will follow the
21 bedding cracks and that continues right to the hill alternating
22 with those bedding cracks, some of them filled with thin streaks
23 of shale. These seams between these blocks are filled up mostly
24 with gypsite, but mostly it is open, just the blocks against each
25 other with nothing in between. Just like the mud when it is
26 drying up it cracks,---- except that in a crack the mud is lying
27 flat and this is buried tilted. As I previously pointed out
28 these beds originally laid horizontally. All this is tilted at
29 32 degrees and this is the water side here facing the wall of the
30 dam. The water began to percolate through these bedding cracks.
31 Also the formation in itself permitted water to go through. In
32 other words, on account of the weathering by erosion or corrosion,

1 which has taken out the cementing material of the rock, it help-
2 ed to disintegrate the formation very rapidly. Now, I have a
3 piece here which I want to show to you. This is taken out of
4 that pool. They are standing just like this. The formations
5 dip in just like this. The water keeps coming right through
6 here on the side. The water was coming down here and hit a
7 streak of the shale and she commenced to cut the shale out.
8 Ninety percent of it is the sand. It is loosely cemented and
9 hardly coherent with the clay. That cuts out rapidly. The
10 channeling is augmented so that most of these joints come to-
11 gether. It was a distinct channeling through the hill, and they
12 all converge to that point and that was a shale streak on all
13 these different seams, and that streak was going right under the
14 foundation of the dam. You see all these seams converge down to
15 that common point. Just like an underground stream was running
16 down that hill. Of course, the water was running pretty rapidly
17 through and disintegrating very rapidly that stuff.

18 Q Where was this point of convergence?

19 A About fifty feet above the present stream bed, fifty
20 feet up the hillside.

21 Q In the vicinity of the pool?

22 A Yes, you see, the pool in itself was formed by the
23 percolation of the water. One stream was at the pool and the
24 other up on the dam, and one was almost twenty-five feet below
25 the base of the dam, and all these streams were converging at
26 one point.

27 Q BY A JUROR: You said that that pool was the result
28 of the erosion at that convergence point?

29 A Yes.

30 Q Isn't it true that the pool was eight or ten feet be-
31 low the foundation of the dam?

32 A More than that. It is about fifty feet or more below

1 the foundation.

2 Q Below the foundation of the dam at that point? I am
3 referring to the horizontal distance from that point to the pool?

4 A About fifty feet or more.

5 Q The vertical line from the present pool as it is there,
6 to the bottom of the concrete as placed,----- in other words,
7 from some foundation of the dam to that location of this pool?

8 A I should judge it must be about one hundred feet. Our
9 maps are not completed yet.

10 Q Did the scour from the flow produce the pool?

11 A Yes.

12 Q Here is your hill here (indicating). Say right here
13 is the foundation of the wing of the dam, right on the top.
14 The pool will be approximately right down here. Now, we have
15 the streaks of the shale through which the water was going
16 through-- I will not say percolate through that type of mater-
17 ial. The one thing is that the finer the material and the
18 capillary attraction--- it is greater. In other words, the
19 water going through that material will go through very much
20 easier than anything else. That is from the experience in oil
21 wells, that if the material is pretty tight we always carry the
22 water faster through it than when it is loose, on account of
23 the capillary attraction. We have a streak of shale running
24 down here and one streak here and one is down here. Here is
25 the stream bed. There are two streaks of shale, you see trees
26 growing right in it. This was exposed to the water. The
27 capillarity of this material led the water through.

28 Q What is capillarity?

29 A It is this--- we call it the percolation of the water
30 through the material. The water was going right through it.
31 It was not stepping or percolating through it. It was just
32 like the oil going through a wick. We have one here and one

1 down here and one up above here. Now, all these come in in this
2 shape. Now, we have another streak between the conglomerate and
3 the schist. That streak comes down this way. Each streak was
4 carrying water. That was one process of the saturating of that
5 hill and the water ~~was~~ also going through these shales ^{streaks} and
6 practically softened all that hillside. Now, we have a crack
7 here running approximately just like that from the base of the
8 dam down through here, all these dipping this way. These are the
9 bedding cracks, ~~dipping~~ dipping this way down this side, are the bedding
10 cracks coming this way. This was the pool. The water was per-
11 colating through these bedding cracks to the formation on this
12 side here. The connection between this shale streak here, which
13 was on another bed of the shale, which is very much stained with
14 limonite---- that yellow streak. Right on the bottom of the
15 stream bed we have a slaty grey shale running this wise. This
16 is what happened: There is your water running right through.
17 It was running a stream over this shale bed, which rapidly erod-
18 ed away from the foundation of the dam. What happened? You can
19 draw your own conclusions.

20 Q BY MR. DENNISON: Tell us.

21 A This is pretty near dry now. That was very much dis-
22 integrated. The pressure of the water just commenced moving
23 those blocks of which the hillside was composed, and pretty soon
24 they were so saturated with the water they commenced to move,
25 and the next step that happened, this portion here, which is the
26 weakest point in that hill, was simply washed from under the
27 foundation. The cut is sixteen feet this way and forty-two feet
28 this way. Sixteen feet high and forty-two feet long. That is
29 what cut out ^{right} from under the dam and left the foundation of the
30 dam sixteen feet up in the air and that stuff out out quick. Is
31 that clear?

32 Q Have you made an estimate as to the area of those

1 various passages through which that water is flowing?

2 A Yes, this particular streak is running on the top. It
3 varies with the thickness of the shale. It is a very sandy shale
4 from six inches in some points and at this point it is about
5 four feet wide and I let a plumb bob down 25 feet. That was
6 as much spring as I had. This crack is open in the hillside and
7 I was examining it and dropped the plumb bob just to see how far
8 the crack extended. I had a string 25 feet long and it went in
9 twenty-five feet, perhaps it is more.

10 Q Was that just recently?

11 A It was yesterday.

12 Q Was that near the axis of the dam?

13 A Yes. This crack practically crossed the full abut-
14 ment on the wing of the dam. This shale streak comes this
15 way crossing the central portion of the dam.

16 Q What was the area flow before---- you have these
17 various channels---- you are establishing that there was a flow
18 through various sections---- what was the total area of the flow
19 before the failure?

20 A I cannot tell you that. The only thing I can tell
21 you is how wide these cracks are.

22 Q What is the aggregate area of all of these?

23 A I did not calculate that. I have not completed that
24 yet.

25 Q Have you any idea as to the speed of flow before the
26 failure through them?

27 A No, it was pretty rapid. After the water once had a
28 channel through it it was very rapid, just like through a hose
29 or trough.
30

31 Q The only point you are making is that it was saturated?

32 A I am trying to tell you that the water was running

1 through the common channel of these bedding cracks and it was
2 running very fast.

3 Q Is that so?

4 A Yes.

5 Q You say the flow was---

6 A I would just have to guess at it. You have to follow
7 the angle of the dip of this thing here, and it is a matter of
8 how much water was in it.

9 Q We assume that the dam was making two second feet at
10 that point on the day before it failed?

11 A Yes.

12 Q What was the speed of flow in making those two second
13 feet that day?

14 A I could not tell you.

15 Q Would you not have an idea as to what that speed was?
16 It was evident to me that there was an outside flow of water
17 through that. Was that manifesting itself at the feet of the
18 dam?

19 A No, it was coming right out at the toe of the dam.
20 The toe of the dam was across this shale streak right here.

21 Q Had it been very very slow, there would have been
22 practically no erosion?

23 A It was rapid. I am not in hydraulics and don't know.

24 Q Is that a part of our problem, the speed of flow there?

25 A Yes sir, because you want to determine the speed of
26 the flow?

27 Q BY MR. DENNISON: Can you determine that?

28 A Yes, it can be calculated.

29 Q How long will it take?

30 A I would have to go back there and measure all that
31 thing. It would take some time again to do it.

32 Q These cracks are evident, too, are they not?

1 A Yes. These things down here let the water through
2 and they vary in thickness from six inches up to several feet,
3 and we have to figure the area of all these streaks and must
4 know the tightness of the material and know just how fast it was
5 running through.

6 Q After you did that it would be conjecture?

7 A An assumption, sure, ---- we don't know.

8 Q The presence of water under that foundation is one thing
9 and the speed of flow is an entirely different thing?

10 A Certainly there is a distinction between the two. This
11 was the flow and this the percolation and in these shale beds
12 there is capillary attraction for the water.

13 Q You would not take percolation as having any scouring
14 action, would you?

15 A No. The water was percolating through the bedding
16 cracks but the water through these shale streaks did not percol-
17 ate but just went as the action of oil in a lamp wick.

18 Q If the cause of the failure was a blowout it involved
19 the speed of flow?

20 A Yes.

21 Q And it would have to build up very rapidly for a
22 typical blowout?

23 A Yes.

24 Q Did it build up in speed?

25 A Certainly. The sun on the shale eroded it and natur-
26 ally the water had a greater channel to run out, and it would
27 come to a point where it would run rapidly through there.

28 Q There has been no evidence that there was a lot of
29 water?

30 A It shows by the erosion down here.

31 Q I understand it was an internal bleeding. It flowed
32 down there and hit that shale under the dam and did not come out

1 and was not visible?

2 A Some of it did come through.

3 Q BY MR. DENNISON: What is that thing that you have
4 here?

5 A I have here, right-----

6 Q Do you think that 16 x 2 tank went right at once?

7 A It did not go right away, but went very fast. The
8 pressure of the water was so great that the material could not
9 stand it and it just simply went out.

10 Q You think that would probably take at least some few
11 minutes, the whole mass did not flow out all at once?

12 A It was just the same as if you had a dyke of dirt and
13 it went out. It was not a very long period of time until it
14 went out. It was very rapid.

15 Q BY A JUROR: I want to know the strike of that?

16 A North three degrees east of the crack. Here is a big
17 pool. Here is your contact between the conglomerate and the
18 schist. That contact also was carrying water. This channel
19 was down here and hit a little harder streak of the conglomerate
20 which formed a shelf, and here is that channel and that channel
21 hit this particular contact. We have another crack coming
22 through here and it was connected to this one like that. All
23 these connected with the shale bed which is at the base of the
24 dam. Right on the bottom of the hill we have a shale bed and
25 it is cut out about a 25 foot portion--- this particular shale
26 bed is glancing--- it is not continuous straight through. It
27 is wider at one point than another. This lens extended under
28 the base of the dam. The water running through this channel
29 hit this lens and that is made of very soft shale and just wash-
30 ed that lens out, also the base of the dam did not have support
31 at this particular point.

32 Q Is this underneath the dam?

1 A Yes.

2 Q The portion that is left standing there?

3 A No, it is the section next this portion which is stand-
4 ing now.

5 Q That is underneath where the crack is running now?

6 A Yes.

7 Q How did you find that?

8 A It is exposed on the surface.

9 Q It shows itself?

10 A It was a big hole scooped out in this shape.

11 Q When did that become dislodged?

12 A When the pressure of the water was greater and it
13 could not resist. As that washed out that particular portion
14 which was over the shale, did not have any support, the same as
15 this portion over this pool, was left up in the air sixteen feet.

16 Q What are the dimensions of that kidney?

17 A Twelve feet high by twenty-seven feet wide. There is
18 no thickness because it is tipped at 32 degrees. You cannot
19 show the thickness. It goes under the hill maybe five or six
20 miles, under the hill. She broke inside under the hill, and
21 this particular portion was resting on the foundation of the dam.

22 Q It broke against itself?

23 A Certainly, broke against it.

24 Q How did it go out?

25 A It is just a matter of erosion, gentlemen. This It
26 happened that this water was running through that channel. Just
27 kept washing and scooping out that particular lens.

28 Q That did not go out until the surrounding matter went
29 out?

30 A It is a logical deduction that it would be. It did
31 ^{show}
32 not/go on the surface because the dam was right above it.

Q Would you think that there would be some showing of

1 material being carried before the failure?

2 A I could not tell you because I could not tell you just
3 how much was silt in the bed above.

4 Q Was there any evidence that any appreciable amount of
5 material had escaped at any time?

6 A I could not tell you.

7 Q That did not come out and away before the failure?

8 A No.

9 Q It was a progressive failure?

10 A Yes. My conclusion is that this part up here went out
11 first. This particular spot was far down the stream. It went
12 down twenty-two hundred feet and I found it imbedded in the silt
13 in the bed of the present stream.

14 Q And when the dam went out the flood waters flowed over
15 the place where that kidney was and left that hole full of water?

16 A Yes. That pool is still remaining because the water
17 itself is pretty thick right in the bottom of it. It is silt.
18 The silt in itself, in going through those cracks will feel them,
19 but that water is gradually going away. Of course, the pool in
20 itself is still fed a good deal by the water coming down in
21 those bedding cracks beyond yet.

22 Q It would be very interesting to develop your idea of
23 the increase in flow of that water through these various lenses.
24 I would like your estimate as to the speed of flow?

25 A That could be determined. It is just a matter of
26 calculation.

27 Q Could you do that in the course of an hour?

28 A No, it cannot be done inside of an hour because you
29 have to figure it this way---- the worst mark was in the red con-
30 glomerate and the bedding cracks, the water was running ^{through} ~~through~~
31 that conglomerate seeping through the cracks alongside, and then
32 it commenced channeling and as more water came the channeling

1 was greater until it came to this point and there was a con-
2 siderable stream running here.

3 Q. When I was up on that hill I got my hands all stained
4 red by that conglomerate in that pool?

5 A. Yes.

6 Q. If that was running out could it have helped but
7 show a color in the water as it was coming out of the dam?

8 A. The question is at which point the water was running
9 through the dam.

10 Q. At that point which you indicate, there was evidently
11 a leak in that part of the dam, but that water was coming out
12 clear from all the evidence we have received here. If it was
13 coming from that little lens, that little lake, that water was
14 all colored, it was very red.

15 A. Yes, but the water was standing in that pool and was
16 up to a couple of days ago.

17 Q. Yes, but before the dam went out all the soil and con-
18 glomerate was saturated and would naturally show colored water,
19 while the dam standing?

20 A. No. This particular material was weathered for a
21 long time before the dam was built. It is so small an amount
22 that it would not color it. The character of the rock is
23 practically clay. It is leached, except that in bedding cracks
24 you have iron oxide. There is a ferrelly right below the toe of
25 the dam. There was a settling point there where the water went
26 through the measuring weir, through the open conduit. R

27 Q. Had any appreciable amount of material come through
28 there, if there had been any erosion or not?

29 A. Yes.

30 Q. There has been no showing as to whether that took
31 place?

32 A. Here is what happened: The water in itself was run-

1 ing through with no color at all. She carried this sediment, or
2 particles of sand, ^{or} particles of material, which would naturally
3 be deposited right down here. The water running under the dam
4 tee would be running right down ^{to} through the bedding cracks and
5 would not catch much of the material because these blocks in
6 themselves----

7 Q You are assuming that these caverns are more or less
8 caverns in the beginning?

9 A They are not caverns.

10 Q They were filled with material?

11 A Yes.

12 Q And the minute you began moving that you had to move
13 it out to the outside or move it downward?

14 A Yes.

15 Q And it did not move downward through any vertical
16 seams or lines of cleavage, through the earth, one hundred feet
17 deep? It came out through the lower tee of the dam?

18 A Yes. All right. What you will find in this particu-
19 lar crack is that whenever there is a piece of conglomerate or
20 pebble in this particular crack there is silt right on top of
21 it. You will find it in these, in very thin streaks of mater-
22 ial. It was just like going through a sluice and these pro-
23 jections were just like baffle bars where they have the baffle
24 to catch the gold and it was getting in those that way (indicat-
25 ing).

26 Q BY THE CORONER: Was it like water seeping through a
27 sponge?

28 A Yes.

29 Q What was the action of that water there?

30 A The water was percolating through all that hill there.

31 Q How fast?

32 A I don't know.

1 Q Like the lampwick that you have mentioned?

2 A Yes. There were three different movements depending
3 upon the material. The water in those shaley streaks was very
4 slow, just like the water through the bedding cracks had no re-
5 sistance, and was going very fast.

6 Q And the total was two second feet of water?

7 A I don't know how many feet of water there were.

8 Q How much material would a flow of two second feet of
9 water carry in suspension?

10 A It depends on the kind of material and the rate of the
11 flow.

12 Q Naturally, that is a function of your cross-sectional
13 area. What was your cross-sectional area?

14 A I am not a hydraulic engineer and I don't know.

15 Q All this water was percolating down there, running
16 back under the dam into that kidney and accumulating, and when
17 the dam burst it came out, but no water came out from the foot
18 of the dam until it was all over?

19 A I don't know. I was not there before the dam broke.
20 Assuming this is your bed rock, here is the schist. The bed of
21 the stream was covered with alluvium and this was below the de-
22 bris and also below the toe or foundation of the dam. Now,
23 whether this was exposed before the dam burst or not, I don't
24 know, I was not there.

25 Q I asked the question because we have had no evidence
26 to indicate that there was any sogginess or wet ground right at
27 the toe of the dam, on the side of the hill where the road had
28 caved in there was. This particular lens that I am speaking of
29 was saturated and the water is still in it.

30 A Don't you think it would be wise to build some tunnels
31 or drifts in there to tell exactly what has happened inside. You
32 have taken the surface and we want to know what is inside.

1 MR. DENNISON: How did you determine that?

2 A We have this big tunnel down here and we know also just
3 how that formation was laid. That was facing the wall side.
4 Naturally, if it was open the water would run through the cracks.
5 That is logical. Where did that water go?

6 Q That is what we want to know.

7 A I keep telling you it keeps percolating through the
8 cracks and percolates down to the stream bed.

9 Q According to that there would be a volume of water?

10 A Yes.

11 Q Where did it go?

12 A It was lost in the sand in the stream bed, assuming
13 that the stream bed was covered with silt, and I don't know how
14 thick that alluvium was right in the bed. If it was of consid-
15 erable thickness you would not be able to see that water at all.
16 It would be following the schist and could not be seen on the
17 surface and would come out in the stream some place away below.

18 Q BY A JUROR With all due respect to you, I don't
19 believe that little place up there or that little basin was
20 there until after the dam went out?

21 A It was caused by erosion and the running waters over
22 that substance, and the water which is there now was left there
23 in that hard pan from the flow of the water over the dam. You
24 will find seepage of water through these bedding cracks, right
25 at the present day. Right above the basin the water is still
26 seeping very slow, just drop by drop. Where did that water
27 come from? It must have been right down there in those bedd-
28 ing cracks, would it not?

29 Q What is your idea as to the point below the dam in
30 the stream bed that this flow reached? Just presume it was
31 a subterranean flow and did not appear at the surface, how far
32 below the dam do you presume it got into the gravels, and passed

1 ON DOWN THE VALLEY?

2 A Do you mean that this flow that I am speaking of coming
3 down that crack there?

4 Q Yes.

5 A It came down right under the dam there in that shale
6 bed and you ask me whether that would show on the surface?

7 Q What is your idea as to the point that it reached
8 there as a surface flow or subterranean?

9 A It would be percolating right through the gravel.

10 Q At what point, some miles below?

11 A No, right at that schist down here where the foundation
12 of the dam is standing now. The water is percolating through
13 that schist and naturally would follow the schist, but would not
14 come back against to the surface and it would be running a long
15 ways down the stream and perhaps at some point down the stream
16 side might come out again in the form of a pool or something in
17 the river bed.

18 Q BY MR. MOHR: Say that is a kidney down there and
19 one down here, and assuming that the water was coming from some
20 place in here, that gradually washed out the material?

21 A Yes.

22 Q Would the water in that fill up after all that material
23 had been carried out, take the place of the material in the dam--
24 would the water in there carry the weight of the dam, the water
25 that displaced the material---- would it not carry the weight of
26 the dam, just like the material would?

27 A How could it?

28 Q I am asking you.

29 A Of course it could not carry the weight of the dam, no.

30 Q As I understand it, this was a kidney down here which
31 was filled continuously from that?

32 A Certainly.

1 Q If the weight of the dam was on that water, would
2 that not shut that water out?

3 A No.

4 Q And then it would carry the weight of the dam?

5 A No. Here is your foundation of the dam and this is
6 the lens right down here in the schist. What would happen if
7 this material would was washed away, it would just leave a hole
8 down here and the base of the dam would not be supported on this
9 side and this side at all. The time would come that the dam
10 would give away at some other point and it shows plainly how
11 the water, when it was going down the hillside after this sec-
12 tion went out, how the water channeled a cut into the formation.

13 Q In other words, there had to be this weakness up in
14 the upper west corner where the abutment is, before this weak-
15 ness down here would affect the dam?

16 A If you had a weak point up here, what would happen is,
17 the water would cause it to loosen down there and it would
18 commence washing out the formation, and that is the reason with
19 no support underneath it would collapse, would it not?

20 Q If the arch would not hold it, it would.

21 Q BY A JUROR: If there was displacement of that mater-
22 ial under the dam it had to go somewhere?

23 A Yes.

24 Q That flow is a subterranean flow?

25 A It certainly was.

26 Q So it was flowing in a subterranean cavity or in the
27 gravels of the stream bed below the dam?

28 A Yes. Mind, gentlemen, here is the difference:
29 This stuff here was saturated with the water just like a sponge
30 and shows at the present time. It is soft and full of water,
31 at the present, where it is exposed. What might happen is
32 this: As the water was percolating through that bed down there

1 it was gradually cutting it out. The water was running right
2 out of it. Then, when the water rushed from above here and out
3 the formation down here and opened the lens, the lens went out
4 right there.

5 Q It came out to the surface?

6 A Yes. All that alluvium and debris was cleaned out to
7 the bed rock and so this would come out also.

8 Q How big is that lens?

9 A 12 x 27 feet.

10 Q In what relation is that to the dam itself?

11 A It is right at the base of the dam.

12 Q And the dam is one hundred and seventy-six feet wide
13 on the bottom?

14 A Yes.

15 Q And that was at the base of the dam at the original
16 elevation?

17 A Yes.

18 Q Draw a section of the dam and show the position of
19 this lens under the dam?

20 A All right. (Answer continued on next line)

21 She is standing in this shape. I can show you by the
22 maps. They will be completed on Monday. The only way you can
23 prove^{it} will be by driving a tunnel.

24 Q BY MR. DENNISON: Could that be done in any other way
25 than by a tunnel?

26 A No, a core drill would not show you anything.

27 Q BY A JUROR: Then, you don't think there is any dry
28 area in there?

29 A No, not in that hillside. Here is one point I want
30 to bring out also (the witness draws a diagram on the black-
31 board). What happened is this: I told you that this crack
32 was running down this way, a crack in the formation. You have

1 dips running this way and down here it is saturated up to a cer-
2 tain point on the face. So the water, naturally, would not
3 flow going up the dip. It would flow down the dip and the water
4 was running down the crack.

5 Q (Addressing Mr. Mulholland) Mr. Mulholland, these
6 drainage pipes underneath the dam, were they working?

7 A (By Mr. Mulholland) Yes sir.

8 (The witness) Here is your formation dipping down this
9 way, so the water coming down here came down this crack to that
10 shaley lens under the foundation of the dam and the water was
11 lost in the stream bed.

12 Q Yes, but still I don't see where you are getting any
13 saturation in back of the dam?

14 A You don't get any saturation from the back of the dam.
15 It cannot be because water will not go uphill, will it?

16 Q Then, your theory is that it was entirely dry in the
17 back of the dam?

18 A No, not necessarily. It is still wet, as far as we
19 can trace it going clear back to the end of the hill.

20 Q Then, your theory is this, that the gradual soaking of
21 the rock and the material under the foundation, ^{gradually} ~~naturally~~ got up
22 to a point of saturation, and it began to run off in greater and
23 greater quantity and run off into a subterranean channel.

24 Q That did not appear in the vicinity of the dam itself
25 at all, is that the point?

26 A Yes.

27
28 MR. MULHOLLAND: No sir. There was an excavation made
29 there and that was from two hundred to two hundred and fifty feet
30 long and maybe twice a week I walked along the edge of it to see
31 if there was any drip from the side of the mountain and no water
32 passing around the ends of the dam, as there is in almost all
dams, and it was absolutely dry. There was two little streams

1 that were low down and that place was full of clear water, so
2 clear that the algae could be plainly seen and it used to be in-
3 teresting to watch the little fish breed in there and they were
4 perfectly visible and it was visited often by people who came
5 there for recreation and they walked around that basin--- it was
6 always clear and no water in it except what was coming from the
7 leaks in the dam and the ground was dry and the dam was tight and
8 underneath the dam it was especially tight and as to water under
9 the dam we definitely knew at all times how much it was, because
10 we put in logs there to shut that water off and put in pumps and
11 the pumping did not increase much more than what water flowed
12 on the surface, and there was not half an inch difference in the
13 two volumes, and I know from experience it is a delusion as to
14 how much water runs in sand and gravel under the surface, and it
15 has led to a lot of idle expense in this country--- sub-dams to
16 develop water in canyons. The quantity is very low. Away back
17 thirty-five years ago Mr. Creeker and I had a contract and we
18 put a tunnel across the bed of the San Gabriel River on the bed
19 rock with about eighty feet of gravel over our heads, and the
20 whole development did not amount to thirty feet of water in the
21 whole San Gabriel Valley, and I saw another put in at Pacima,
22 and they are a delusion and a snare. I put another at the Saw
23 Pit Dam and we could hear the stream running over our heads, and
24 it did not leak in there and drown us out. Water is very feeble
25 in its flow through even the most open material.

26 Q If this rate of flow were small, an area of 20 x 22
27 feet, it would be a very small area--- a flow of one foot a
28 minute--- and it would not have enough movement to carry anything.
29 It would be the leakage from the west side of the dam on the day
30 before the dam broke?

31 A Yes. If this flow happened to be in a long gravel
32 channel there certainly would not be enough speed to carry any
material.

1
2 ROBERT H. WRIGHT, being first duly
3 sworn, testified as follows:

4 BY THE CORONER:

5 Q Please state your name.

6 A Robert H. Wright.

7 Q Where do you reside?

8 A 419 West Pioneer Drive, Glendale, California.

9 Q What is your business or occupation?

10 A Chief Criminal Deputy, Los Angeles County.

11 Q As Chief Deputy, you have charge of all criminal
12 records?

13 A Yes.

14 Q There have been some rumors, suspicions that dynamite
15 might have caused the destruction of the St. Francis Dam. Have
16 you any clues or information in your department with regard to
17 the matter?

18 A We haven't.

19 Q Is there any information at all on which the assumption
20 could reasonably be based that dynamite caused the destruction
21 of the dam?

22 A Not to my knowledge.

23 Q And if there was any such information in your depart-
24 ment, you would have knowledge of it?

25 A I have reason to believe I would.

26 Q BY DISTRICT ATTORNEY: Can you give to the jury any
27 information as to how any such rumor could have come into
28 existence?

29 A The only thing I could attribute a rumor of that
30 particular character is the fact that I recall, it was about a
31 year ago, an officer received a telephone message from some
32 unknown party stating that there were men on the way from Inyo

1
2 County for the purpose of dynamiting St. Francis Dam, told us to
3 be sure and get some officers on the way as quick as possible,
4 which we did, kept them there for about ten days. During that
5 time there was nothing transpired in any way, shape, manner or
6 form that would cause us to believe such was true. Outside of
7 that, I don't know of anything.

8 Q Were you ever able to trace the source of the
9 anonymous communication?

10 A No sir.

11 Q BY A JUROR: What about this paper was found in
12 Hollywood, had the place marked to dynamite a dam?

13 A I have seen such a paper, but I didn't consider it
14 other than a paper found any place else, some markings on it,
15 printing, might have been dropped there by anybody, it might
16 have been dropped there out of a man's pocket that had been
17 drawing something for his own amusement, I don't know. It was
18 a long ways from the dam.

19 Q BY THE CORONER: Did he mention the name St. Francis
20 Dam?

21 A No sir.

22 Q BY A JUROR: Did you submit it to a handwriting expert?

23 A The man ^{that} brought it into the office was a handwriting
24 expert for the City of Los Angeles.

25 Q He was unable to identify it with any record which you
26 have?

27 A He thought there was a slight comparison of other
28 writing he had seen in Inyo County, of one person that was
29 suspicious of dynamiting some of the aqueduct.

30 Q Did the investigation, so far as that was concerned,
31 stop at that point?

32 A No, I can't say it did. Any real intelligent con-

1
2 nection with the dynamiting of St. Francis Dam, it is impossible
3 for me to find anything in connection with what I have seen or
4 heard.

5 Q In your opinion, do you feel there is enough to start
6 on to justify the City of Los Angeles to put that into the hands
7 of people who can make it their sole business---

8 A It is already in the hands of men employed for that
9 purpose.

10 Q I don't want to ask you about anything you are doing
11 new in that line, because it might upset some work you have, but
12 I want to know whether investigation is being carried on at the
13 present time?

14 A To the best of my knowledge, it is.

15 THE CORONER: That is all, you may be excused.
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Monday, April 2nd, 1928. 10:00 A.M.

1 THE CORONER: Mr. Dennison, are the engineers representing
2 the District Attorney ready to make their report?

3 MR. DENNISON: No, Mr. Coroner, I have just had a message
4 from Mr. Mayberry and he said that they have worked night and
5 day since they have been up there and finished last night at
6 twelve o'clock, and have their report in a draft, and Mr. May-
7 berry says that he would like to have a night's sleep before he
8 faces this inquisitorial body of scientists. He states that
9 the report will be completed on Wednesday morning and they will
10 have gone over it and there will not be any mistakes in it.

11 THE CORONER: Is that satisfactory to you, Mr. Scott?

12 MR. SCOTT: We have no objections.

13 THE CORONER: You will have some testimony?

14 MR. SCOTT: Yes, but we are not prepared at this time to
15 present that. If we had known that Friday or Saturday we would
16 have been prepared. I think our evidence will be better under-
17 stood following the evidence of the engineers.

18 THE CORONER: Then, gentlemen, there is nothing for us to
19 do but take an adjournment until Wednesday morning at 9:30 A.M.
20 The motion pictures are related to the report that the engineers
21 are going to make. I had a preview of these pictures on Saturday
22 morning and Mr. Mayberry said that he would like to use these
23 motion pictures as a demonstration of his report. There are only
24 four hundred feet of the motion pictures and they will be inci-
25 dental to the report.
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April 4th, 1928. 9:45 A. M.

EDWARD L. MAYBERRY, be-

ing first duly sworn, testified as follows:

BY THE CORONER.

Q Please state your full name.

A Edward L. Mayberry.

Q Where do you reside?

A 1230 East Ocean Avenue, Long Beach, California.

Q What is your occupation or profession?

A Architect and structural engineer.

Q Where did you receive your education in engineering?

A University of California and Massachusetts Institute of Technology.

Q You have spent some years in the practice of engineering?

A Twenty odd years.

Q Were you employed by the District Attorney of Los Angeles County to make an investigation of the St. Francis Dam, and the cause of its failure?

A Yes sir.

Q Have you prepared a report at this time?

A Yes sir. This is entitled "Report to Mr. Asa Keyes, District Attorney, Los Angeles County, California, on the failure of the St. Francis Dam, by Edward L. Mayberry, Walter G. Clark, Charles T. Leeds, Engineers, Allan E. Sedgwick, Louis Z. Johnson, Geologists, April 4th, 1928." (Above entitled report is attached hereto and made a part of this record.)

(After the reading of the above report four hundred feet of motion picture film were shown illustrating the St. Francis Dam after its collapse, and thereafter a number of stereopticon slides were shown in illustration of, and in connection with the report submitted by Mr. Mayberry and his associates.)

April 4th, 1928. 2:00 P. M.

1 EDWARD L. MAYBERRY, hav-
2 ing been heretofore duly sworn, was recalled and testified as
3 follows:

4 BY THE CORONER.

5 Q Gentlemen of the jury, have you any questions you wish
6 to propound to Mr. Mayberry relative to the report that he made
7 this morning; any particular phase of this report that you wish
8 to discuss with him at this time?

9 A JUROR: Yes. Did you make an analysis of a section of
10 the dam, that is, a cross section?

11 A Yes sir.

12 Q How did you find it?

13 A As stated in my report, as to overturning, it has a
14 factor of safety of not less than two.

15 Q Did you take uplift into consideration?

16 A That was without the consideration of uplift, because
17 it had bleeder pipes.

18 Q How about the planes up on the sides?

19 A They did not have bled pipes, but the stratification
20 would not have any uplift.

21 Q How do you account for the movement of the section now
22 standing on the downstream side?

23 A As the break occurred I think there was a snap to it,
24 and a pushing over, a movement down.

25 Q Do you mean the entire dam itself moved over?

26 A There was a tipping forward, a rocking on the toe.

27 Q If the dam was stable and the water was quiet that
28 would not take place?

29 A Yes, the impact, so to speak.

30 Q In making an analysis of this section, when the dam
31 was full the reservoir passed within the middle third?

32 A Within the middle third.

1 Q At the base of the dam?

2 A At the base of the dam.

3 Q Another thing I would like to know---- to illustrate
4 on the blackboard---- showing the plan of the wall and the dyke---
5 just where these faults cross the dam itself?

6 A Letting this diagram represent diagrammatically the
7 curved arched dam, the east wall of the canyon, the buttress and
8 the west dyke and this representing the contour lines of the end
9 of the spur from the west, the cross fault that I showed you as
10 continuing up by the crack, up towards the buttress, or rather
11 across from that coming down into that cross fault. That cross
12 fault comes up in this direction ~~and then~~ and then the other
13 fault going up parallel to the stream of the canyon runs up just
14 immediately west of the standing section, the corner of the fault
15 being a hundred and twenty-five feet below the standing section.

16 Q Now, is it possible that where they all converge at
17 one point there, due to the saturation, that there might have
18 been a movement that it is not possible to record?

19 A I prefer to have Professor Sedgwick answer that ques-
20 tion. This is the condition as he pointed it out to me, on the
21 ground.

22 Q BY A JUROR: Would there be any possible movement in
23 these faults where all these lines join that could not be record-
24 ed?

25 A (By Professor Sedgwick) That would have a bearing
26 on the failure of the dam?

27 Q Yes sir.

28 A I think not.

29 Q These come very close together at one point and due to
30 the saturation of these faults---

31 A There is no indication or any break across these faults
32 that indicates any recent movement whatsoever.

1 Q When these became thoroughly saturated would it not
2 have a tendency, the very form of it there, to swell?

3 A Do you mean the conglomerate?

4 Q Yes sir.

5 A Possibly.

6 Q Would that not have a tendency to move the mass?

7 A No, not along the fault line above it.

8 Q Would it not have a tendency to move that whole line?

9 A I think not, because you have a spur which is rather
10 narrow at the top.

11 MR. S. B. ROBINSON: We expect to call a witness to show that
12 surveys have been made in the last day or two and are still in
13 progress. We expect to show that the result of very careful ob-
14 servation shows that there has been some slight change in posi-
15 tion on the two sides of the canyon.

16 THE CORONER: (Addressing Professor Sedgwick) Did you
17 observe any such movement?

18 A No sir.

19 Q What was the last time you were there?

20 A I think a week ago Sunday, a week ago Sunday, yes sir.

21 Q BY A JUROR: Would it have been possible to have ob-
22 served the location of these fault lines previous to this secur-
23 ing?

24 A Yes sir.

25 Q Both upstream and downstream?

26 A The reservoir would hide the indications upstream.

27 Q Previous to the construction of the reservoir at the
28 time of the selection of the site, itself, it was all open coun-
29 try?

30 A Yes sir.

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1 the conglomerate. Why is it so? Because these cracks were
2 deposited by material coming from the beds above the conglomerate.
3 There is no question of that, but that material there was
4 not cemented. In other words, it was just in a loose condition
5 so there is one crack running down the hill and another one this
6 way (indicating). It was filled with water. Your bedding
7 cracks are shrinkage cracks in the formation, as I told you the
8 other day, and dip thirty-two degrees from the reservoir under
9 the foundation of the dam down towards these cracks. The water
10 began to percolate and seep through these two major cracks just
11 the same as on a building you have a large spout to carry the
12 water down and it goes into a bigger one. It plainly shows in
13 these two big cracks that the material which was deposited in
14 the cracks was washed out. That is plain evidence that the
15 water was running through these big cracks.

16 Q BY MR. DENNISON: Did you find any evidence of gold
17 there?

18 A Yes.

19 Q Do you generally find gold in a conglomerate formation
20 such as that?

21 A The gold that I found was just about half a mile below
22 the power house in the alluvium which was deposited by the last
23 flood, and the gold, perhaps, was in the silt in the reservoir,
24 and came out from the hillside. I found gold in the contact
25 between the conglomerate and the ~~subject~~. Of course, it is not
26 very much. Just in a handful of the dirt that I washed out
27 there was a small speck about the size of a pinpoint.

28 Q BY A JUROR: Up to 11:30 that night there was no per-
29 ceptible increase in the flow of the water running down the
30 cement channel below the dam. All of this seepage must have
31 occurred between 11:30 and the bursting of the dam. That is,
32 the seepage had been contained in the hill and under the dam,

1 and did not burst out until the time that the dam gave away, is
2 that your theory?

3 A No. The seepage or running of the water was contin-
4 uous, as I explained to you the other day. The water coming
5 down these cracks lost itself in the silt of the bed. Now,
6 according to the Water Board plans, the forebay is put on the
7 bed rock. In other words, on a schist, before but the silt was
8 twelve feet thick. In other words, you have twelve feet of
9 this silt in the river bed, so the water running through, natur-
10 ally, the crack was right below the silt. The water was coming

11 Q You are not answering my question. I wanted to know
12 where all this water went to and where it came out again. We
13 have evidence that the City wasted one thousand miners inches
14 of water that did not go back in the creek. There was no
15 additional water over 3700 miners inches, which was the collec-
16 tion of all the leaks flowing up to 11:30 that night. Now,
17 where did this water go? Where did it come out?

18 A It came out right in the stream bed.

19 Q There was no evidence?

20 A I know, but I said it was running over the silt.

21 Q Have you computed the amount that was running under the
22 silt?

23 A It states there in the report, according to the gauge,
24 how much water has been running before the dam went out. Some
25 millions of cubic feet were running out before the dam broke.

26 Q Why was there not some evidence of that running out?

27 A It had to go somewhere.

28 Q Where did it go, up in the air?

29 A No, it followed the stream bed and very likely came
30 out miles from the dam site.

31 Q In other words, in a subterranean river?

32 A No river.

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Q It went right straight down?

A No, some followed the bed of the schist and some followed the stream bed. The only thing I know is what is recorded by the gauge. As far as anybody saw the water running, I cannot answer.

Q Would the float on that gauge account for that whole difference in measurement?

A I don't know.

Q The measurement is not a precise measurement?

A I don't know about that.

Q Do you think that it is reasonable to believe that there was a flow of nine hundred second feet of water through any reasonable period of time, such as an hour, through the major break?

A Yes.

Q Nine hundred second feet?

A I think so.

Q Of course, that could not be through any silt. You don't get any such flow through silt?

A I am speaking of the condition of the seepages. That the water was running through these formations.

Q BY A JUROR: We see that it is a question of how much and at what time it ran through the formation and what kind of a formation it ran through?

MR. DENNISON: Where is the testimony of nine hundred second feet?

A JUROR: The report by Mr. Mayberry indicated a very big flow of water. Mr. Johnson, suppose there was a submerged dam across the canyon one half or three quarters of a mile below the dam, and that cutoff wall was carried from rock wall to rock wall of the canyon, right under the surface, would that have brought the water to the surface of that dam?

A Perhaps and perhaps not. It might if the water was

1 running through the bedding cracks of the schist, and would not
2 be shown on the schist at all.

3 Q Do you know whether it might have gone down and joined
4 the subterranean reservoir of the whole valley?

5 A It is very possible because the schist was deep right
6 from the reservoir down the stream.

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10 WALTER GORDON CLARK, be-
11 ing first duly sworn, testified as follows:

12 BY THE CORONER.

13 Q Please state your full name.

14 A Walter Gordon Clark.

15 Q Where do you reside?

16 A 4121 Wilshire, Los Angeles, California.

17 Q What is your occupation or profession?

18 A Consulting engineer.

19 Q Where did you receive your education?

20 A University of California, Columbia University, and in
21 practice for thirty-one years.

22 Q You have been associated in this investigation here with
23 Mr. Mayberry?

24 A I have.

25 Q Will you explain the point which has just been under
26 discussion here?

27 A One of the prints submitted to us is 10568. It shows
28 the depth of the sand between the surface and bed rock. I found
29 as we went downstream it was increasingly deeper, so there is a
30 considerable area of sand. This was the condition before they
31 started building the dam. So, there was, at this point, twenty-
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1 nine feet, and at this point twenty-five feet down to bed rock.

2 Q This water could have gone underneath and right on down
3 through?

4 A Yes. As Mr. Johnson stated there was evidence of
5 cracks in the formation so it is possible that a submerged dam
6 carried down to bed rock would not have brought that to the sur-
7 face.

8 Q How much could you expect bedding cracks to carry
9 away in a case like that?

10 A Depending upon the size of the bedding cracks.

11 Q From what you observed there as to the size of the
12 cracks?

13 A I did not observe the size of the cracks.

14 Q Did you not observe the formations around the dam?

15 A Yes. If you observe the size of a crack on the sur-
16 face it is anybody's guess as to what size it would be below.

17 Q You think that is what did happen?

18 A I am not expressing that.

19 Q All you stated is a possibility?

20 A I am stating that the change in the level of the lake
21 indicates that that much water flowed out during that period of
22 time.

23 Q And you are basing that entirely upon the record as
24 shown by the gauge, are you not?

25 A Yes.

26 Q Did that show how much that drop was in the surface of
27 the reservoir at the dam, did it indicate how much?

28 A In twenty-three and one-half hours it would require
29 twelve and nine-tenths cubic feet per second to account for it.
30 Over the period of the last three and one-half hours it would
31 require an average flow of possibly seventy-four feet, to account
32 for it.

1 Q About how much drop is that in surface elevation of the
2 water?

3 A Thirty-five thousandths of one foot over the last three
4 and one-half hours.

5 Q Could not a slight change in the velocity of the wind
6 or direction of the wind, have accounted for still more change in
7 the surface than that?

8 A I don't think so. I made pretty careful inquiries
9 as to the wind at that time and found nobody that thought there
10 was any considerable amount of wind. I have allowed for the
11 maximum amount of evaporation that might have taken place during
12 that period of twenty-three and one-half hours. If you will
13 look at that record you will see that it is a question of measur-
14 ing it over a particular period of time. The light line passing
15 through there is the record. I came to the conclusion that
16 after 11:30 the record was of no value. At that time it repre-
17 sented not the level of the water in the lake, but at the face
18 of the dam where it was going out. It would be impossible to
19 move the entire body of water in that lake at that rate of speed.
20

21 Q We have witnesses here who were below the dam. Would
22 there not have been any evidence of the showing up of that water?

23 A I did not hear the testimony.

24 Q The testimony was that they were at Power House No. 2
25 at 11:55?

26 A I don't know. There are places where the underground
27 gravels would take care of a considerable flow if they are not
28 saturated. If it continued long enough it might come to the
29 surface. I know of one place in Florida where there is a con-
30 siderable flow that comes up in the ocean.

31 Q Does that come through the sediments or the calcareous
32 limestone?

A No, down there it is through the glacial moraine.

1 Q BY THE CORONER: Are you familiar with Lydie Creek in
2 California?

3 A No, I am not.

4 Q BY A JUROR: Wherever that exists it is known. It is
5 not known that that condition exists here?

6 A I would question that. The Santa Clara River at the
7 lower end flows a considerable amount of water and at the upper
8 end it is perfectly dry.

9 Q What would you consider a reasonable estimate of the
10 average flow through the gravels and sands such as exist in the
11 San Francisquito Canyon?

12 A I have not sufficient information to give an estimate
13 on that.

14 Q Would a submerged dam have brought the water in the
15 gravels to the surface?

16 A If it was in the gravels, yes, but if it was following
17 any seams in the gravel it would not have been brought to the
18 surface.

19 Q BY MR. DENNISON: There is some testimony here---- he
20 was a witness who lived up there and had rented a piece of land
21 which had received a natural flow of water. On Monday, at
22 five o'clock he noticed that the water was of a muddy appearance.
23 He noticed that it was a good deal higher flowing past there,
24 than was customary, this being below the dam----

25 A JUROR: And it was below the Power House, was it not?

26 MR. DENNISON: Yes----- and he took the precaution to get
27 out of there---- that would be consistent with the theory that
28 this dam was leaking considerably, would it not?

29 A It would.

30 Q BY A JUROR: How much of a flow would 1500 miners
31 inches show in the stream, in such a stream as these California
32 dry creeks---- it would be a pretty wide stream, about sixteen

1 inches deep?

2 A I am accustomed to thinking in second feet, myself.

3 Q If 1500 miners inches had been released from the aqua-
4 duct and had been wasted down the river because they had plenty
5 of water in the reservoirs below, that would make quite a stream,
6 would it not?

7 A Quite a stream, yes.

8 Q The water going down these faults might be considerable?

9 A The conclusion that I arrived at was that the faults
10 right under the dam---- the water through those under ordinary
11 conditions in the past, would be rather slow, but the water per-
12 colating through the contact between the schist and the conglomera-
13 ate and washing out the matrix material, could run up to a con-
14 siderable amount, and that might and probably did flow along the
15 schist and pass in the gravel and flowed down to the stream bed.
16 There is quite a volume of sand and gravel in this canyon bed and
17 it could have taken care of a considerable amount of water. It
18 requires a considerable amount of water to saturate that vast
19 amount of material, before it would flow rapidly.

20 Q But it is your assumption, then, that this cutoff wall
21 that they put in there at the time that the dam was constructed
22 did not, in reality, cutoff the flow of water?

23 A No, I am not so justified testifying.

24 Q Have you a personal opinion as to the action of this
25 water when the dam went out?

26 A As to the actions of it?

27 Q Yes. A personal opinion?

28 A I have.

29 Q Will you state it?

30 A As expressed in the report.

31 Q Any opinion of your own?

32 A That is an opinion of mine, and the opinion of the entire

1 board. I am entirely in accord with the opinions expressed in
2 the report.

3 Q And according to that report it went out in a bunch,
4 unless it fell, because of an underground lake or reservoir, that
5 could not be seen from the surface?

6 A This flow preceding the failure of the dam?

7 Q Yes.

8 A I carried that through for the period of twenty-three
9 and one-half hours, and for the last period I worked it over
10 very carefully, and used the microscope, and, after an entire
11 night of study on the record, I came to that conclusion.

12 Q What was the flow for the three and one-half hours
13 preceding that?

14 A To get rid of that much water---

15 Q Would it require seventy-four second feet?

16 (No response)

17 MR. DENNISON: An that could have saturated the hill it-
18 self?

19 A Yes.

20 Q You don't claim that the water that poured out from
21 the dam poured down so that a lady coming from a dance could see
22 it?

23 A I think that the water would pass right beyond the hill
24 and being in the stream bed.

25 Q BY A JUROR: But the water coming from that hill went
26 right down that crack and into the kidney underneath the dam?

27 A (No response)

28 Q When the kidney broke where did the water go?

29 A (No response)

30 MR. DENNISON: It seeped into the hill until the hill be-
31 came saturated and eventually the weight of it pushed the water
32 out.

1 Q BY A JUROR: This matter of seventy-four second feet
2 of water----- I think that, perhaps, as engineers, we visualize
3 that flow. That is a great deal of water and that flowed for
4 three and one-half hours in the vicinity of the dam.

5 Q BY ANOTHER JUROR: How much water?

6 A (By a juror) 3700 miners inches flowing for three
7 and one-half hours through some crevices, which, so far as the
8 testimony is concerned, did not have very much of a cross-section-
9 al area, taking them throughout---- one hundred feet .

10 MR. CLARK: I think the Juror is assuming that we are under-
11 taking to claim that it did go through these crevices. I am not
12 making that claim at all.

13 THE CORONER: You are only positive that it left the reser-
14 voir because the chart that recorded the flow of the water, in-
15 dicates that it did?

16 A Exactly.

17 Q If there were discrepancies in the instrument which
18 recorded that flow of the water it would-----

19 A JUROR: What we are trying to bring out is the evidence
20 to support a claim that such a large amount of water disappeared
21 from the reservoir and did not make itself known in such a manner,
22 that somebody would not have observed it, at some time up to
23 11:30 on the night of the failure.

24 MR. SCOTT: You are aware that there was a cement-lined
25 canal prior to the failure, from the bottom of the St. Francis
26 Dam down to Power House No. 2, and when you speak of water run-
27 ning in a creek channel where there are pebbles and rock, you
28 don't mean that literally, because all the water coming from the
29 St. Francis Dam, the testimony heretofore has shown, goes in a
30 cement-lined conduit or canal, to Power House No. 2.

31 MR. CLARK: Just how does it get into that? Suppose it
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1 comes down a side wall and did not reach the channel? I am not
2 prepared to say where this seepage reaches the bottom of the can-
3 yon.

4 MR. SCOTT: You are aware that there was a channel existing
5 there at the dam before it went out?

6 A I am informed so, but not of my own personal knowledge.

7 MR. DENNISON: Do I understand you correctly that for twen-
8 ty four hours preceding the going out of that dam, that this
9 water, as shown by the chart, was gradually increasing in flow
10 away from the reservoir?

11 A The record shows that the amount, that the lake lower-
12 ed that amount after allowing for the evaporation. I still have
13 that amount of water to account for and am unable to account for
14 it anyway, except that it left the dam and passed out below the
15 dam.

16 Q The record shows that for twenty-four hours there was
17 an increase?

18 A A gradual increase.

19 Q And that three and one-half hours before the failure of
20 the dam, this gradual increase had increased very rapidly, did
21 it not?

22 A From the record, yes.

23 Q Three and one-half hours is---

24 A It would cause a flow at the rate of seventy-four feet
25 a second.

26 Q How much is that?

27 A Seventy-four cubic feet each second.

28 Q A stream like out of a hose?

29 A Very much larger than that. It would be a channel
30 seventy-four feet wide and one foot deep, flowing at the rate of
31 one foot a second.

32 Q BY A JUROR: In other words, it would fill up the can-

1 you pretty well?

2 A No, I am not sure that it would.

3 MR. DENNISON: This is generally the form of the dam, isn't
4 it, and this is a hill over here on this side, and this is the
5 water down here. How long would it take that flow of water if
6 it flowed through the hill, and washed to wash it out, how many
7 hours, could it be computed?

8 A It would be rather difficult to compute it, but I
9 think in this case it took three and one-half hours.

10 Q To wash the hill out?

11 A To wash it out to such an extent that the dam fell.

12 Q From this record which you examined regarding the flow,
13 did you notice at approximately 11:30 a sharp drop caused by a
14 straightening out of the line?

15 A No sir, not a straightening out of the line. ^{sharp}
16 A/drop and then a waver and then a vertical drop, which indicated to me
17 that the record in the recording meter, after 11:30, would not
18 be dependable, but would represent the fall of the float of the
19 meter and not the flow of the water.

20 Q On the chart which was passed to us, it showed appar-
21 ently a dropping before it flattened out.

22 Q That is why I consider it of no value. The movement of
23 a piece of apparatus of that kind has a certain amount of inertia.
24 It might drop down a little too far and then might straighten out.

25 Q That movement was about .05 in half an hour, was it not?

26 A I would have to go back and work that over again. It
27 is pretty difficult to see, but it can be seen on this. I think
28 that is a wobble in the apparatus.

29 Q BY A JUROR: I don't see why that gauge should be
30 affected any more after 11:30 than before ten o'clock?

31 MR. DENNISON: The pencil running along there is not very
32 accurate?

1 A With a flow movement it is quite accurate and with a
2 rapid movement when the dam went out, you would get a record of
3 the elevation there, which would not represent the entire eleva-
4 tion of the reservoir.

5 Q BY A JUROR: You assume that there would be a certain
6 suction due to the flow of the water under the dam?

7 A You could not start the entire mass of water in the
8 reservoir moving at one time. There is a time element there.
9 Even if you took the entire dam away the extreme back end would
10 not begin to flow as soon as the section next the dam. I think
11 that is an indication of the water level at the dam and does not
12 represent the level of the reservoir at the time.

13 Q That is a half hour?

14 A I am not talking about half an hour. I am talking
15 about the record at the time of the apparent failure of the dam.
16 It requires an average of seventy-four second feet to account
17 for this record of the gauge.

18 Q That would be approximately 7,000,000 gallons of water?

19 A 934,500 cubic feet.

20 Q That amount of water did not show up at all between
21 the dam and Santa Paula and the ocean, to anybody's knowledge.
22 It seems rather as if that water would have showed up some place.
23 It would have been remarked?

24 A I did not have any difficulty in finding it.

25 Q BY THE CORONER: If it did show up, where did it show
26 up?

27 A It would be third-hand testimony. He came to me volun-
28 tarily and told me that the dam attendant had reported to a
29 gasoline station attendant out there, that there was a heavy flow
30 on and that sometimes the water ran muddy and sometimes it clear-
31 ed up.

32 Q Who was this gasoline station attendant?

1 A I don't know his name. The gasoline attendant where
2 the dam attendant filled his car with gasoline.

3 Q BY MR. DENNISON: Do you know whether that gasoline
4 station was washed out or not?

5 A I understood not.

6 Q BY A JUROR: We had some heavy testimony from a sew-
7 ing circle the other day too. We cannot take such testimony
8 in a matter such as this.

9 THE CORONER: Can you account for the disappearance of the
10 water from this dam, in any other way except as you have stated
11 here?

12 A No, I cannot. I think that the water went into the
13 channel and flowed down the channel.

14 Q Do you know of any reason why the instrument was any
15 less accurate during the last three and one half hours that you
16 spoke of, than before?

17 A No, I don't think so. Upon my inquiries they stated
18 that the instrument had been there for a long period of time,
19 and that they regarded it as being accurate.

20 Q Taking your facts from the chart as you found it, you
21 believe this seventy-four cubic feet of water was leaving the
22 dam by some means which was not apparent on the surface?

23 A I do. I think it was not a steady flow over that
24 period of time, that it increased up to the time of the failure
25 and that before the failure a few minutes, or a number of minutes,
26 the flow was very great.

27 Q BY MR. ROBINSON: This will be true, will it not,
28 that this additional flow that the gauge record seems to indicate
29 in the last three and one-half hours, must do one of two things,
30 must come to the surface and appear in the channel below the dam
31 or else find its way through underground channels, either through
32 the silt, getting into it under this channel or through fissures

1 in the rock, which, up to that time, had not been adequate to
2 carry that water, that is, must somewhat suddenly, three and one-
3 half hours before the failure---- unless it came to the surface--
4 these underground channels somewhat suddenly must have opened up
5 to allow that amount of water to escape underground?

6 A I would not state that.

7 Q Would that not necessarily be true?

8 A At the beginning of this three and one-half hours the
9 rate may have been very low. It may have been eight or ten or
10 six second feet and then rapidly increasing in flow from that
11 time up to the time of the breaking of the dam.

12 Q Regardless of the rate at which it flowed ^{there was} the only two
13 places where that water could go, either appear on the surface
14 or underground?

15 A Yes sir.

16 Q If it was underground these underground channels would
17 have had to develop in capacity over a very considerable area to
18 carry away that water?

19 A I don't know the capacity of the channels.

20 Q But the reservoir had been full continuously for some
21 little time before?

22 A Yes.

23 Q And whatever underground possibilities of escape there
24 were prior to three and one-half hours before the collapse, had
25 not permitted more than twelve and nine-tenths second feet to go
26 out of the reservoir?
27

28 MR. MOHR: 12.9 is the total amount to account for in the
29 drop in the lake for twenty-three and one-half hours. It might
30 have started with a very slight flow and have increased up to the
31 point of the failure.

32 Q If you spread it over the whole twenty-three and one-
half hours, and assume that the increase occurred gradually dur-

1 ing the twenty-three and one-half hours you still have to assume
2 that these underground channels, including whatever they might
3 be, figures or coarse soil, had to increase in their carrying
4 capacity during that twenty-three and a half hours to the extent
5 of carrying twenty-three second feet?

6 A I am not prepared to make that statement.

7 Q Does that not necessarily follow?

8 A No.

9 Q Unless the water came to the surface?

10 A Unless the water came to the surface.

11 Q If the water did not come to the surface is that true
12 that the underground channels would have had to take care of that
13 ^{than}
14 much more/before?

15 A That should not be taken because that is the average
16 over twenty-three and one-half hours. It might have been only
17 a very small fraction of that from the beginning of the twenty-
18 three and a half hours, and a very large fraction at the end.

19 Q In order to avoid having it appear in the channel it
20 would have had to travel underground at least as far as Power
21 House No. 2, would it not, because this concrete channel extend-
22 ed from under the dam to Power House No. 2?

23 A If you are going on the assumption that the water got
24 away from below the dam, it would be reasonable to assume that
25 it went through this concrete channel.

26 Q I am assuming all along that there are two possibilities,
27 either that it will go into the channel or it will not. Of
28 course, if it got into the channel that is another thing alto-
29 gether, but we meant an increase in the carrying capacity of
30 these underground channels?

31 A Up to the capacity of the underground channels.

32 Q And these underground channels had been under the same
hydraulic head for some time before?

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A Not that I know of.

Q The water stood at the same height in the reservoir?

A Yes, but it might not have been coming out from under the reservoir, and not have affected these channels at all.

Q But there had to be some opening up along that line and it had to get away through some lines, before it came to the surface?

A After getting away from the dam, channels under the surface or on the surface, had to take care of it.

Q BY A JUROR: There was a large pool at the foot of the dam where all of these leaks converged and where the weep holes emptied their water into it. This pool was in the natural formation and was not concreted. If there was a channel that would carry the water which was coming through these fissures parallel to the concrete ditch, would not this water which had been standing in this pool have found this channel and drained that pool?

A Which pool?

Q Right at the top of the dam that they call the forebay.

A If the water had reached the canyon beyond that, of course it would not have gone into it. The possibility was that it could have gone down through the conglomerate and reached the canyon some distance below, so it would not have reached that pool at all. If the water was coming down there under the conglomerate it would not have reached this pool at all.

Q Where was the location of this lower lens or kidney?

A I don't know. That lens was composed of shale. I did not see that that was the cause of the failure of the dam, but thought it was one of the contributing causes of the failure.

(BY MR. CLARK)

This would be running practically parallel to the canyon, so what was going down there would not be picked up in the canyon.

1 MR. JOHNSON: The beds dip three degrees west down there.

2 Q BY A JUROR: what would a shaft develop down here
3 (indicating)?

4 A Not very much because it would be still in the schist.
5 All of this hill is falling down. In a very short time, in the
6 next few months, perhaps, all of this hill will be gone. With
7 a few good rains it will all fall down. All of this conglomerate
8 is going to be in the bottom of the canyon in a very short time.

9 Q BY A JUROR: I mean the conglomerate, not the schist.
10 What period of time do you think it took to make that saturation?

11 A (BY MR. JOHNSON) I could not say, but it was a very
12 long time. It was absorbing water more and more. Up here
13 (indicating) it is practically loose sand. The cementing
14 material was leached out and weathered.

15 Q BY THE CORONER: Can you account for the loss of the
16 water from the reservoir as shown by this chart?

17 A Well, of course,---- it is an assumption or theory
18 that the water must have gone through either the conglomerate or
19 the schist, whether it was following the bed of the stream or
20 whether lost in the formation.

21 Q Can you account for this running more rapidly during
22 the last three and one half hours, than before?

23 A I don't know, in the first place, just how fast the
24 water started, but we might assume this, that the channels might
25 have been there already opened, and the water increased gradually
26 and was lost in the channel or else presume that such water was
27 running and did it channeled more and more.
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31

32 CHARLES F. LEEBES, being
first duly sworn, testified as follows:

1 BY THE CORONER.

2 Q Please state your full name.

3 A Charles T. Leeds.

4 Q Where do you reside?

5 A 640 La Loma Road, Pasadena, California.

6 Q What is your trade, occupation or profession?

7 A Consulting engineer.

8 Q Where did you receive your education?

9 A The United States Military Academy at West Point, and
10 the Massachusetts Institute of Technology.

11 Q And you have had some years of experience in practical
12 work?

13 A Since 1908.

14 Q You have assisted in the preparation of this report?

15 A I did.

16 Q BY MR. DENNISON: Can you throw any light on that
17 diagram, that water gauge diagram?

18 A Personally I think it has been given more importance
19 than it really merits. Such a rapid movement as occurred in
20 that gauge has a tendency to be less accurate than a slow move-
21 ment. There may have been some wind at that time, which may
22 not have been sufficiently noticeable to be reported. Further-
23 more, the movement of water which has been given here as running
24 out, is the average over that period. We have no means of
25 knowing, and I personally think it is very doubtful if that went
26 out, if that flow could be described as increasing by that
27 straight line diagram. In other words, I don't believe that the
28 flow at the end of half the time was half the amount that it was
29 at the end of the time. That, at the beginning of that period
30 it was increasing very slowly and at the end was increasing very
31 rapidly.
32

Q BY THE CORONER: Where did the water go to?

1 A It went out of the dam. From that point I question if
2 it is pertinent.

3 Q We have the testimony that no stream of water flowed
4 in the stream down the canyon. Where did it go?

5 A If that amount went out----

6 Q BY MR. DENNISON: I understand that during the twenty-
7 three hours immediately preceding the failure of the dam, there
8 was a certain amount of water which left the dam as indicated by
9 that diagram. Is that correct? When that water left it is
10 an utter impossibility to tell, except that it flowed out. Dur-
11 ing the last twenty-three hours there was apparently a greater
12 flow than during the previous time. You don't know how much
13 previously and how much during the twenty-three hours?

14 A I think that is the significant fact, if over a relative-
15 ly long period of time there was a less rapid flow and over a
16 short period of time there was an increasing flow, showing that
17 it was increasing in a mathematical ratio, and something greater
18 than that.

19 Q Would the flow be an unknown quantity?

20 A Not an undeterminable quantity because the surface of
21 the reservoir at the end certainly was not level, there was a
22 much greater drop at the dam.

23 Q And this seventy-four second feet disappeared in the
24 bowels of the earth in the last three and one-half hours?

25 A No sir, I did not say that seventy-four second feet
26 went out.

27 Q The witness before you said that seventy-four second
28 feet----

29 A Seventy-four second feet is not a measure of volume,
30 but a measure of the rate of flow, and the average rate, as in-
31 dicated by the gauge, was seventy-four second feet.

32 Q We are mystified as to where that water went to?

1 A I think that we should not take that 74 second feet
2 as any too accurate.

3 Q What would you take to be the accepted error in the
4 reading of that register through that period of time? Would you
5 consider the wear of the lead in the pencil over the period?

6 A Not having seen even the instrument or determined how
7 recently that crayon was sharpened, I am not in a position to
8 say.

9 Q Do you think calibrating that record would more or less
10 lead to uncertain results?

11 A I should think there would be a certain amount of un-
12 certainty.

13 Q BY THE CORONER: Are you familiar with any other
14 streams in California where the water flows under the surface?

15 A Yes sir, I think that is quite common.

16 Q Is it your opinion that the water could have flowed
17 under the stream bed so that persons passing by there and casually
18 observing it would not know that the water was running out through
19 subterranean channels?

20 A To a certain extent.

21 Q BY MR. ROBINSON: You would consider it possible that
22 such channels could develop suddenly?

23 A No sir, but I think that they might not have been fill-
24 ed to their capacity previously. In other words, that a small
25 flow might be coming out and partially filled those channels.

26 Q But, if you have a hydraulic head back of the second
27 pipe, using pipe in the xxx sense that I think you used it, some-
28 thing that contains water, not necessarily an iron pipe, to in-
29 crease the flow without any change in the head, you would have
30 to have either a removal of the obstruction or an opening up and
31 increasing of the pipe all the way along. Do you think it is
32 reasonable to assume that there were underground passages capable

1 of carrying any such quantity of water as is involved here, or
2 were merely plugged up and the sudden breaking of the plug opened
3 it up for miles?

4 A No, I don't think that is true, but I don't think it is
5 necessary to take that hypothesis. In other words, there may
6 have been channels leading out from under the dam. By channels,
7 I mean fissures, none of which might have been filled to capacity.

8 Q That would have to assume, would it not, that these
9 channels have capacity enough to take this amount of water that
10 was released by the sudden opening up of the obstructions?

11 A If I understand your question right, it still assumes
12 that that flow was 74 second feet and went out entirely through
13 these channels.

14 Q I am assuming for the purpose of the question, only
15 assuming that it is established that there was apparently an in-
16 crease in flow in the surface channel?

17 A Do you mean in the subterranean channels, but close to
18 the surface?

19 Q No. I am assuming for the purpose of the question,
20 that it was established that there was no such increase in the
21 surface flow as would account for the outflow of that quantity
22 of water from the reservoir. Under those conditions it would be
23 necessary that these underground channels are opened up sufficient-
24 ly to take care of that ^{an} amount of water, is it not?

25 A That is probably true but I should first want to dig
26 very carefully into the accuracy of this gauge, more accurately
27 than there has been opportunity to do to date, and the accuracy of
28 the wing record and the other records which we have not yet seen.

29 Q Is it not true that the supposition that the water was
30 running out in some manner in a greatly increased volume for three
31 and one half-hours preceding the final collapse, is based on this
32 gauge record?

1 A The chief significance to my mind of this is that there
2 was a progressive increase in the flow out from the dam, which
3 increased at a very much more rapid rate at the end than at the
4 beginning.

5 Q You base that on this gauge record?

6 A I base it on that gauge record.

7 Q BY MR. DENNISON: And that is all that the gauge record
8 discloses?

9 A Practically so.

10 Q BY A JUROR: For the twenty-three hour period, what is
11 the actual difference in the elevations, as shown on the gauge,
12 that is, in that record?

13 A From the period of midnight on March 11th, to 11:30
14 P.M. March 12th, the water level dropped .05 of a foot. This change
15 in water level means 1,336, 114 cubic feet which passed out of
16 the reservoir during the twenty-three and one-half hours or at
17 the rate of 12.9 feet per second. If we assume that the rate
18 was not a steadily increasing rate, it seems to me entirely con-
19 ceivable that for the first half of that time that the rate would not
20 have been more than between one and two cubic feet per second and
21 then increase it more rapidly because in the next three and one-
22 half hours, you have to jump up, according to the indications,
23 to seventy-four cubic feet per second.

24 Q BY A JUROR: I don't think you understand my question.
25 I wanted it in terms of an inch on the diagram. As I understand
26 it, you are reading differences there that amount to a little
27 more than the width of the pencil line, and the percentage of
28 error may be fifty or seventy-five percent?

29 A I am glad you brought that out.

30 Q And all these hypotheses about the dropping of the
31 water are all based on the width of a pencil line?

32 A Exactly.

1 MR. CLARK: We went further and magnified by a microscope
2 and measured it to the middle of the pencil line. It is not a
3 regular increase. If you assume that it is a regular increase
4 you are entirely wrong. That is why it is put in the report
5 that way, that during the first twenty-three and one-half hours
6 the water level dropped .05 of a foot and during the last ten
7 minutes it might have been three-quarters of that amount.

8 Q BY A JUROR: I understood that perfectly and asked
9 the question as applying to the beginning of that twenty-three
10 and one-half hour period, and at the end?

11 A After I get to Heaven I will ask God and will tell you.

12 Q You used a microscope and---

13 A It is utterly impossible to come to such a conclusion
14 as that.

15 Q BY MR. SCOTT: Could you estimate what it would have
16 been at 11:30?

17 A No.

18 Q BY MR. ROBINSON: I am under the impression that there
19 is a misunderstanding of the juror's question. He wants to
20 know what the scale of the diagram is.

21 MR. CLARK: The whole purpose of that was to show that it
22 was an increasing rate of flow.

23 MR. SCOTT: What was the estimate made of the water that
24 was going down about 11:30? According to the scale worked out
25 here, what amount was flowing in the concrete canal from the St.
26 Francis Dam to Power House No. 2, at 11:30?

27 A There is no means of telling that because this gauge
28 simply shows the level of the water in the reservoir at 11:30.

29 Q If there was a change of shift in Power House No. 2
30 at 11:30 that night and the men had to pass the channel in which
31 there was seventy-four second feet, and if there was a report by
32 telephone from Power House No. 2 to Power House No. 1, ten minutes

1 before the dam went out and nothing was said by about 74 second
2 feet passing there, we might assume that there was not 74 second
3 feet of water passing in this canal to Power House No. 2?

4 A No, I don't think I might assume any such thing, be-
5 cause the men in the power house might not have been out to ob-
6 serve the water at that time.

7 Q I said, assuming that he goes over and went on shift
8 at 11:30---- he crosses this channel, the only place where that
9 water could come down, and there was 74 second feet flowing, and
10 if there was a report by telephone from Power House No. 2 to
11 Power House No. 1, ten minutes before the dam went out, and
12 nothing was said about it, I think we might assume that there
13 was not 74 second feet flowing in the channel to the power house,
14 might we not?

15 MR. DENNISON: That is not an engineering question. That
16 is to determine if these people were telling the truth.

17 THE CORONER: If you feel competent to answer that question,
18 you may answer.

19 A Personally I think that that is pertinent but I want
20 to refer to the report. I still think it would be perfectly
21 possible, taking into account the inaccuracy of this gauge, and
22 the various records and the fact that it was 11:30 P.M. and very
23 dark and over a road that the man was accustomed to walk every
24 night, so that he could probably walk it with his eyes shut, I
25 think there is very little significance to it myself.

26 MR. DENNISON: Mr. Mulholland testified that twelve hours
27 before the failure of this dam he, in company with Mr. Van Norman,
28 went to the dam and they found the west hill ^{saturated} saturated; That
29 they saw a new leak coming from the dam. Mr. Mulholland went
30 within ten feet of it. Mr. Van Norman examined it. Mr. Van
31 Norman stated on the witness stand that the water was clear,
32 that is, that it was not muddy. Mr. Sedgwick testified that

1 water coming from this reservoir could be clear and at the same
2 time carry the ingredients of the hill in suspension. Another
3 witness, Dave Mathews, testified that he was there in the after-
4 noon and saw the hill saturated, that he saw a flow of water com-
5 ing from the reservoir on the west hill. Would that be thorough-
6 ly consistent with this record showing a gradual flow of water
7 from this reservoir?

8 A I think so, decidedly.

9 Q Decidedly so, would it not?

10 A Yes.

11 MR. DENNISON: That is all.

12 MR. MOHR: It could not come from any other place than
13 from the reservoir, could it ?

14 A No sir. It could come from no other place than the
15 reservoir.

16 Q It was not raining and there were no mountain streams
17 coming from any other place?

18 A No sir.

19 Q BY A JUROR: Mr. Dennison, you said that Mr. Mulholland
20 testified that he found the hill saturated when he was there?

21 MR. DENNISON: (Reading) "Q Was not all the west side
22 saturated?"

23 A It was."

24 MR. DENNISON: I am reading from the testimony given by Mr.
25 Mulholland before this jury at the opening of this inquest.

26 MR. MULHOLLAND: That is a mistake.

27 MR. SCOTT: He did not understand the question that way.

28 MR. MOHR: The question also included as a fact, relative
29 to Mr. Mathews' evidence, which was not a fact, and that is that
30 the water was coming from the reservoir. Mr. Mathews testified
31 that he saw the water coming down the hillside, that he did not
32 know where it was coming from and did not cross over the bridge

1 to see where the water was coming from, that he stayed on the
2 east side.

3 MR. DENNISON: He identified a piece of the schist taken
4 from the formation of the hill, and when it was dissolved in
5 water he said that it came from the dam site.

6 THE WITNESS: You don't mean schist. You mean conglomerate.

7 MR. DENNISON: You concurred in this report?

8 A Yes sir.

9 Q And that is true of you, Mr. Johnson?

10 MR. JOHNSON: Yes.

11 Q Mr. Sedgwick?

12 MR. SEDGWICK: Yes.

13 Q And Mr. Clark?

14 MR. CLARK: Yes.

15 THE WITNESS: (Mr. Leeds) As a matter of fact, when we
16 were up there after the dam had broken, the west spur of the hill
17 above the level that the flood water had reached, still had a
18 very considerable amount of water seeping out of it. In other
19 words, the flood level only reached the bend in the old construc-
20 tion road below the buttress. There was no mark of any erosion
21 above there. Just below that you could still see where the
22 grass had been laid open. There was a very considerable amount
23 of water seeping out of the hillside at various places above
24 that. That was three days after the collapse of the dam.

25 Q BY A JUROR: Mr. Leeds, then how high would you say
26 that the flood waters rose or how high were the flood waters?

27 A At that point?

28 Q What would be the elevation?

29 A My recollection is that it was 1770, because we made a
30 note of that, but I am not positive, if my memory is correct at
31 the moment, without looking at the pictures. Mr. Hayberry says
32 as near as he could get it, 1765. I would say that it was be-

1 between 1765 and 1770. For a very considerable distance along the
2 top of the hill just below and just south of the dam extension,
3 and open drain pipe had been laid and back filled very recently.

4 Q BY A JUROR: Could that seepage have come from the
5 cracks in the dyke?

6 A It could have come to a large extent from that, but I
7 don't think that the seepage going into the drain--- but I don't
8 think there was enough seepage coming from these cracks, from the
9 amount in there, and still draining out three days afterwards. I
10 think there would have been more of an erosion channel out by it.
11

12
13
14 MR. WILLIAM MULHOLLAND, was
15 recalled and testified as follows:

16 BY THIS CORONER:

17 Q Mr. Mulholland, would you like to correct the record as
18 to your testimony on this point?

19 A Most assuredly. That ridge is one-eighth of a mile
20 long and we had been working all over that with teams and tractors
21 and it certainly was not saturated.

22 Q Did you state in your original testimony that it was
23 saturated?

24 A It is surely a mistake. I have been all over that hill
25 and the road has been traveled by us and used by the teams that
26 were at work.

27 Q Will you state what you did see there?

28 A This is crack which has been referred to in that dyke,
29 it was all saturated.

30 Q How far was that before the crest of the dam?

31 A About a hundred and thirty-five feet. It was one of
32 these shrinkage cracks. It is six hundred and thirty or six
hundred and forty feet, and naturally in setting up it would have

1 some cracks and we would repair them. They were caulked with
2 oakum and there was a drain laid from it and it was finished the
3 day before.

4 Q BY A JUROR: How long had that been leaking before you
5 put in the drain?

6 A About, I would say, two or three weeks. A small leak-
7 age from there. It was all represented by the flow from that
8 drain pipe, and in quantity it represented about one-third of a
9 miners inch, about three gallons a minute.

10 Q BY MR. DENNISON: In answer to the Coroner's question
11 at that time, you stated---- I will refresh your recollection----
12 that you received a notification from Tony that the water was
13 muddy--- on Page 14?

14 A Yes sir.

15 Q And that was a new leak?

16 A Yes. That is lower down. It is away down low.
17 That ~~xxxxxxxxxxx~~ is about over where the so-called fault line,
18 the contact line between the two formations is.

19 Q That leak had to come out through the soft dirt of the
20 new---

21 A It was following through the soft dirt of a road and
22 the water was clear until it got to the road and it ran off the
23 road through that dump and that made the water muddy.

24 Q Was all that west side saturated, and your answer was,
25 it was. You say that it was not at the time?

26 A It certainly was not.

27 Q How much of it was saturated?

28 A Of that whole hill?

29 Q Yes.

30 Q From there back to the little dam on the west side is
31 about a hundred and fifty feet, but when you get to it the water
32

1 ended and there was no more water.

2 Q Then, you further, in answer to one of the questions
3 by counsel for the Water Board, you went to the board and made a
4 cross on the board where that leak was?

5 A Yes.

6 Q And you made it within the radius of that dam?

7 A Yes, in front of that abutment. I think it was 60 or
8 70 feet to the east of that abutment.

9 Q Towards the dam?

10 A Yes sir.

11 Q Now, here is a picture taken by a tourist on Saturday,
12 the 10th of March. It was developed and discovered by the
13 Sheriff. I want to call your attention to what apparently----
14 this thing is about---- what are those steps, five feet high?

15 A Five feet.

16 Q Do you remember seeing a leak in the bank. Did you
17 see that white mark there?

18 A Yes sir.

19 Q Which indicates a stream flowing out of the west bank?

20 A Yes sir, that is the one that Mr. Van Norman and I went
21 up to look at.

22 Q That is the one indicated by that white mark?

23 A Yes sir.

24 Q At the time that you told the Coroner's Jury that you
25 remained about ten feet from it?

26 A Yes.

27 Q But apparently to you the water was clear?

28 A Yes.

29 Q And Mr. Van Norman went up and examined the water?

30 A Yes sir.

31 Q Whether the water was carrying---- if that water was
32 coming out of the dam, whether it was carrying part of the hill

1 with it, you don't know?

2 A I know, certainly. It was too clear to do that. If
3 it was a mineral solution it would be such an infinitesimal quan-
4 tity it would take a long time to fill up a leak.

5 Q What do you say to this learned gentleman, Mr. Sedg-
6 wick, who says that water could be clear and carry such matter
7 in suspension?

8 A Perfectly clear, yes, but in suspension, no. In sus-
9 pension you can see it but in solution you cannot. It would
10 be ^{an} infinitesimally small quantity.

11 Q If it was in suspension you could see it?

12 A Certainly, it would muddy the water.

13 Q He says that if the solution carried a pigment it would
14 color it?

15 A Yes, and there was limonite in the hills and that was
16 pigment that you showed in the water here.

17 Q So that water could be coming out of the dam on Monday,
18 the 12th, at twelve o'clock, when you and Mr. Van Norman were
19 there?

20 A It was not. It was clear then.

21 Q It could have been and could have started an erosion?

22 A It could not have.

23 Q Where was it coming from?

24 A From the reservoir.

25 Q How did it get down there?

26 A It came through the leak, through the dam there, the
27 leak there, we said that.

28 Q Did it come through the formation under the dam?

29 A No sir. I could not say that. I was right there.
30 It was coming out close to the dam on those steps.

31 Q This would be the hill?

32 A That is a hell of a hill. It looks more like a wart.

1 Q If the water that you saw pouring down that hill at
2 twelve o'clock had opened away through the dam, and was coming
3 through there---

4 A I did not say it had opened a way through the dam.

5 Q Under the dam?

6 A It was pouring off of those steps on the dam.

7 Q Was it coming under the concrete or through the con-
8 crete?

9 A It was very likely that there was a small crack there
10 in the concrete.

11 Q Mr. Van Norman went up and looked at it?

12 A Mr. Van Norman and I were there together almost shoul-
13 der to shoulder part of the time.

14 Q BY THE CORONER: Could you tell whether the water was
15 coming through the concrete or through the natural formation?

16 A I would say it was coming through the concrete there.
17 There is a small zone of leakage there that has been there for a
18 long time, that you can see on the dam there.

19 Q BY MR. DENNISON: That was a new leak that Tony told
20 you was muddy?

21 A It was not, a new leak coming out of the dam.

22 Q Tony told you it was muddy?

23 A Yes.

24 Q And when you got up there you found it was not muddy?

25 A Yes.

26 MR. SCOTT: Is counsel going to introduce this photograph
27 and show when it was taken?

28 MR. DENNISON: I want to have the jury have everything
29 that they can get hold of. I will bring the Sheriff up here
30 to show when it was taken and where he got it. There is a nota-
31 tion on it that Captain Harry Bisphan of the Sheriff's Office,
32 vouches for the absolute authenticity of this photo. It was

1 taken by Dr. Grant of Bath, Maine, a tourist, on March 10th,
2 1928.

3 MR. MULHOLLAND: I think that is a picture of it and that
4 shows it coming off of the steps just as I said it was.

5 MR. DENNISON: All right. I offer it in evidence.

6 MR. ROBINSON: Will you state what the effect of wind over
7 a reservoir or any body of water is, if anything, on a recording
8 gauge, such as has been described here?

9 A If the reservoir has any length the recording gauge
10 there is a slow amplitude of movement, that is, changing .01,
11 .02 or .03 of a foot a day, it is useless in a windy country.
12 This country here is extremely windy. It is right in a wind gap,
13 and they sometimes amount to seventy or eighty miles an hour.

14 Q When you say, "This country", what country do you mean?

15 A Where this reservoir is located.

16 Q In your experiences what differences in gauge readings,
17 due to wind, did you observe?

18 A Oh, 3/10 of a foot. In other words, a gauge for a
19 reservoir might record a gain of several hundred zero feet in a
20 day, and it would be actually losing.

21 Q BY MR. DENNISON: Are the winds that prevail up there,
22 down the canyon?

23 A Yes, nearly always. Those heavy northerers.

24 Q And that would be towards the dam and would pile the
25 water up on the dam?

26 A Yes sir, right towards where that gauge was.

27 Q Did you take into consideration, in the erection of this
28 dam, what would be the effect of the oscillation from these winds?

29 A Yes, we have a factor of safety of two there, and they
30 are competent men. I knew that, some of them.

31 Q Do you think there would be anything in the winds
32 oscillating this dam?

1 A No sir. The wind went over it. The water was up
2 high and the wind would slide right over the dam.

3 Q What would be the effect of five foot waves on the
4 pressure on the dam?

5 A I don't think they would have much effect. They would
6 oscillate slowly.

7 Q BY MR. ROBINSON: After one of these winds had been
8 blowing down the canyon returned to quiet and normal, what would
9 the effect on the gauge be?

10 A You would have a gradual correction of the misreading
11 on that day or the last time that the wind occurred.

12 Q BY MR. DENNISON: Did you know, when you erected this
13 dam there, that it was in a fault zone?

14 A Why, I have testified truly as to that. I know you
15 can scarcely find a square mile in this part of the country that
16 is not faulty. It is very ^{rumpled} crumbly and twisted everywhere. I
17 have dug underground, I suppose, seventy-five or eighty or one
18 hundred miles of tunnels, had them in my charge, and everywhere,
19 without exception, even in the granitic rocks and in the igneous
20 rocks, without exception there are faults and slips and crumples
21 without exception. Look out of the window here at that bank
22 (pointing) and you will see a formation that necessarily was laid
23 down flat. It is a water formation. It is formed at the bottom
24 of deep water and they are tilted up at about thirty degrees,
25 and the same condition is found all over the country.

26 Q Then, it is necessary to build these structures so they
27 will stand considerable horizontal pressure?

28 A No, that is allowed for in the weight of the water.

29 Q I mean in the fault zone?

30 A The dam is not buried in the ground.

31 Q But it rests on the earth?

32 A Yes.

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Q And is anchored in the hills?

A Anchored in the hills. It is subject to some stress but nobody has ever been able to compute those stresses.

Q If it was in a fault zone----

A They are all in a fault. The City of San Francisco reservoir is in a fault zone. The Haiwee Reservoir that supplies this town lies in a fault.

Q Engineers have to build them so as to make them fault-proof, don't they?

A They try to.

Q They do it?

A I have built nineteen of them ^{and they are} all fault-proof. I have built more than almost any other engineer who has testified here. I am very sure of that. I have been consulted for as good as nineteen more.

1
2 JAMES P. BROME, being first duly
3 sworn, testified as follows:

4 BY THE CORONER:

5 Q Please state your full name.

6 A James P. Brome.

7 Q Where do you reside?

8 A 231 South Johnston Street, Los Angeles, California.

9 Q What is your business or occupation?

10 A Secretary of the Board of Water and Power Commission-
11 ers of the City of Los Angeles.

12 Q How long have you been such secretary?

13 A Since February, 1902.

14 Q Were you Secretary of the Board at the time the
15 St. Francis Dam was first contemplated?

16 A Yes sir.

17 Q And all the original proceedings are of record in
18 your office?

19 A Yes sir. I only keep the minutes.

20 Q Who were the members of the Board of Water Commission-
21 ers at the time the dam went out?

22 A I guess I would have to refer--- I have a record---
23 the first reference I have in the minutes of the Board was
24 December 29, 1922, as far as the St. Francis Dam itself was
25 concerned, not as to the purchase of land.

26 Q With reference to the location and construction of
27 this dam, your first minutes are December 29, 1922?

28 A No, that is an application to the U. S. Department of
29 Agriculture covering proposed reservoir site in San Francisquito
30 Canyon, in connection with the Los Angeles Aqueduct.

31 Q Who were the members of the Board at that time?

32 A R. F. Del Valle, President, A. G. Bartlett (deceased),
John R. Haynes, Lester L. Robinson and E. R. Young.

1
2 Q I think the witness is reading for the wrong year, I
3 think the witness is reading for the fiscal year June, 1922.

4 A The motion was made by Mr. Robinson, and seconded by
5 Mr. Young.

6 Q That was for the resolution---

7 A (Reading) "BE IT RESOLVED, that application be made
8 by this Board, acting for and on behalf of the City of Los
9 Angeles to the United States Department of Agriculture, cover-
10 ing a proposed reservoir site in San Francisquito Canyon, for
11 use in connection with the Los Angeles Aqueduct: that the
12 President and Secretary of this Board be, and they are hereby,
13 authorized to sign in the name of this Board said application
14 and all papers necessary in connection therewith." Mr.
15 Robinson made the motion, seconded by Mr. Young, and carried.

16 Q BY MR. SCOTT: You have at the bottom of the page
17 members of the Board at the time that action was taken?

18 A Yes.

19 Q BY THE CORONER: What record have you of the adoption
20 of the site for St. Francis Dam?

21 A The only other record appears, outside of the purchase
22 of land, are the approval of the annual reports of the Board to
23 the Council, and I have it compiled complete. As to the
24 matter of authority, the Board of Water Commissioners are the
25 highest authority in connection with water in the City of Los
26 Angeles.

27 Q BY MR. MOHR: I believe the charter would be the best
28 authority for an answer to that. I don't feel he is qualified.

29 Q BY THE CORONER: Was this Board still in office and
30 having charge of the Water Department at the time the St.
31 Francis Dam was first started, the same members you mention?

32 A No sir, they change each year, even in the middle,

1
2 the next year two went out.

3 Q What is your record at the time the engineering was
4 done on the St. Francis Dam?

5 A The record shows that the preliminary surveys were
6 made in September, 1922. The actual work on construction began
7 September, 1923. The actual work on the dam started August,
8 1924, and the dam was completed in May, 1926. That I got from
9 the records.

10 Q From your minutes, have you any record showing any
11 specific instructions given by the Board of Water Commissioners
12 to the Chief Engineer, as to how he should proceed there, what
13 precautions he should take?

14 A No sir, not outside of the approval by the Board of
15 the annual reports to the City Council, which contained the re-
16 ports of progress by the Chief Engineer, and contemplated ex-
17 penditures.

18 Q Was there any report filed by the Chief Engineer for
19 the fiscal year 1923 - 1924, covering the St. Francis Dam pro-
20 ject?

21 A The 1922 annual report of the Board of Water and Power
22 Commissioners was approved January 2, 1924.

23 Q The fiscal year runs from July 1 to June 30, 1924?

24 A I have what there is. The report always is prefaced
25 by a letter from the President of the Board transmitting, and in
26 the letter to the Council of July 15, 1923, "The Board of Public
27 Service Commissioners herewith respectfully submits its Twenty-
28 second Annual Report, for the fiscal year ending June 30, 1923.
29 Detailed surveys of the new St. Francis Reservoir site have been
30 completed. This reservoir site is located approximately one
31 mile north of the lower San Francisquite Power Plant and will
32 provide a storage of 30,000 acre feet." Then follows a picture,

1
2 a photograph, showing letter "A", the approximate location of
3 dam.

4 Q Was that report presented by the Chief Engineer to the
5 Water Board?

6 A Yes sir, they approved the report, then following that
7 picture in which Mr. Mulholland shows the valley and the place
8 proposed, installation of the dam, then follows the Bureau of
9 Water Works and Supply Reports: "The Honorable Board of Public
10 Service Commissions. Gentlemen: Herewith is presented,
11 annual reports of the different branches of the construction and
12 operating departments of the Water Works Department of the
13 Service." "Bureau of Water Works and Supply, Engineering De-
14 partment, 1923 - 1924 Contemplated Improvements and Operating
15 Expenses, Item 20. - San Francisquite Reservoir and Dam Con-
16 struction \$100,000.00." Then comes "Report of the Office
17 Engineer, July 1, 1923. Mr. William Mulholland, Chief Engineer,
18 Bureau of Water Works and Supply, Los Angeles, California.
19 Dear Sir: Following is presented a review of the work of the
20 Engineering Department for the fiscal year 1922 - 1923. NEW
21 RESERVOIRS. Detail topographic surveys and plans for the San
22 Francisquite Reservoir have been completed together with pre-
23 liminary designs for a gravity-type masonry dam. The dam site
24 of this reservoir is located in San Francisquite Canyon, one
25 mile north of Sewer Plant No. 2. The major portion of this
26 reservoir site is owned by the City on property that is known as
27 the Saint Francis Ranch and Le Brun Ranch, totaling approximately
28 480 acres, all other land in the site belongs to the United States
29 Government, the City having filed on same up to the 1825 contour.
30 The floor of the canyon at the dam site is at elevation 1660
31 feet above sea level and at elevation 1800 provides a storage of
32 21,000 acre feet and at this elevation the water surface will

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2 cover 400 acres, while at elevation 1825, with a dam 165 feet
3 high, the capacity is approximately 30,000 acre feet. This
4 reservoir is by far the most important storage basin at this
5 end of the Aqueduct, it will derive its supply from the surplus
6 water of the Aqueduct used for power during the winter months,
7 which water during the past years has been wasted into the
8 Santa Clara and Los Angeles Rivers. The reservoir will also
9 derive a supplemental supply from the high mountainous country
10 which it will drain by the natural run-off from a drainage area
11 of 37½ square miles, on which the mean annual rainfall is ap-
12 proximately 20 inches. Respectfully submitted, W. W.

13 Hurlbut, Office Engineer. Note: - At the time the above
14 action was taken the Commissioners were R. F. del Valle,
15 President, Jas. B. Baker, John A. Burton, C. A. Dykstra,
16 John R. Haynes." Then "From Twenty-Third Annual Report of the
17 Board of Public Service Commissioners of the City of Los
18 Angeles (Approved by said Board on August 15, 1924). Letter
19 to City Council, Los Angeles, Cal., August 1, 1924. To the
20 Honorable, the Council of the City of Los Angeles. Gentlemen:
21 The Board of Public Service Commissioners takes pleasure in
22 submitting herewith its Twenty-third Annual Report, being for
23 the fiscal year ending June 30, 1924. Construction work has
24 also been started on the 32,000 acre foot capacity St. Francis
25 Reservoir. With this additional program of storage facilities
26 completed and well under way it can be positively stated that
27 the Department has been actively engaged in safe-guarding the
28 supply, as well as increasing the storage facilities. Re-
29 spectfully submitted, Board of Public Service Commissioners of
30 the City of Los Angeles, by R. F. del Valle, President."

31 Q The same Board?

32 A Except I want to state this, the charter 1925 took

1
2 over and became successor of the Service Commissioners.

3 Q Let me understand the organization, who does the
4 Chief Engineer report to?

5 A To the Board of Public Service, now the Board of
6 Water and Power Service Commissioners, then the Board of Public
7 Service Commissioners.

8 Q And to no one else?

9 A He don't have to.

10 Q Are these in these minutes any record of any in-
11 structions given the Chief Engineer as to how he should proceed
12 about the location of this dam, and building it, and any ap-
13 proval of his plans?

14 A Only through these annual reports, which continue
15 along this line, nothing special outside of the approval of the
16 annual report.

17 THE CORONER (Addressing the Jury): Gentlemen, do you
18 want to hear any more of these read? If not, I think we will
19 file these and let the Jury read them at their leisure, however,
20 we will copy them in the record. "Report of the Chief
21 Engineer, July 1, 1924. The Honorable Board of Public Service
22 Commissioners. Gentlemen: Very considerable progress has
23 been made, as outlined in former reports, in adding to the
24 storage facilities within the City limits and adjacent thereto,
25 and work of construction has been started on the St. Francis
26 Reservoir, with a capacity of 32,000 acre feet. When these
27 facilities have been put into full commission, the whole City
28 will have been safe-guarded by a storage at or near the south
29 end of the aqueduct, with a full year's supply of domestic
30 water. The following table summarizes the construction of
31 the work accomplished in the last year. St. Francis Reservoir
32 \$82,000.00. There is herewith presented a budget of the

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2 prospective work for the coming year. Respectfully submitted,
3 Wm. Mulholland, Chief Engineer." "Bureau of Water Works and
4 Supply Engineering Dept. 1924 - 1925. Contemplated Improvements
5 and Operating Expense. Item 8 - San Francisquito Reservoir and
6 Dam Construction \$800,000.00." "Report of the Office Engineer.
7 July 1, 1924. Mr. William Mulholland, Chief Engineer, Bureau
8 of Water Works and Supply, Los Angeles, California. Dear Sir:
9 In the following paragraphs is presented a brief review of the
10 work of the Engineering Department for the fiscal year 1923-24.
11 At the Saint Francis Reservoir the dam site has been cleared,
12 test wells dug and the foundation trench started; also ap-
13 proximately two and one-half miles of road have been built
14 around the east side of the reservoir above the high-water line.
15 All concrete placing equipment has been contracted for and it
16 is expected actual work of pouring concrete will start in ap-
17 proximately ninety days. Additional detail topographic sur-
18 veys have been completed and discloses a storage capacity of
19 32,000 acre feet at elevation of 1825 feet above sea level.
20 Respectfully submitted, Wm. W. Hurlbut, Officer Engineer."
21 "Note: - At the time the above action was taken the Commission-
22 ers were R. F. del Valle, President, Jas. B. Baker, John A.
23 Burton, C. A. Dykstra, John R. Haynes." "From Twenty-Fourth
24 Annual Report of the Board of Public Service Commissioners of
25 the City of Los Angeles, (Approved by said Board on April 13,
26 1926). "Letter to City Council. Los Angeles, Cal., August
27 1, 1925. To the Honorable, the Council of the City of Los
28 Angeles. Gentlemen: Herewith submitted please find the
29 Twenty-fourth Annual Report of the Board of Public Service
30 Commissioners for fiscal year ending June 30, 1925. A re-
31 view of the report (Chief Engineer) will show that the City
32 has a supply from all sources of approximately 300,000,000

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2 gallons per day and this coupled with the completion of the St.
3 Francis Dam will give a total storage of approximately 160,000
4 acre feet. Board of Public Service Commissioners of the City
5 of Los Angeles, by R. F. del Valle, President." "Report of
6 the Chief Engineer, July 1, 1925. The Honorable Board of
7 Public Service Commissioners, City of Los Angeles. Gentlemen:
8 In presenting this Twenty-fourth Annual Report of the Bureau of
9 Water Works and Supply, the various phases and subjects are so
10 well presented herein as to afford a complete condensed study of
11 the work of the Department for the past fiscal year. The whole
12 range of the City's water works activities are definitely
13 covered in the body of this report. Respectfully submitted,
14 Wm. Mulholland, Chief Engineer." "Bureau of Water Works and
15 Supply - Engineering Department - Engineers Estimate of Con-
16 templated Improvements, Fiscal Year 1925-1926. 5. - St. Francis
17 Dam, reservoir and outlet works \$500,000.00." "Report of the
18 Office Engineer, July 1, 1925. Mr. William Mulholland, Chief
19 Engineer, Bureau of Water Works and Supply, Los Angeles,
20 California. Dear Sir: Herewith is presented a review of the
21 work in the Engineering Department for the fiscal year 1924-1925.
22 (Next follows photograph of St. Francis Dam under construction,
23 June, 1925). "St. Francis Dam. At the St. Francis Reservoir
24 the first concrete was poured in the core wall trench during
25 August last and the total amount of concrete placed in the
26 structure up to June 30th was 72,800 cubic yards, the dam being
27 approximately 55% complete at this date. Additional surveys
28 and changes in the plans for this reservoir have disclosed the
29 fact that at crest elevation 1835 feet above sea level the
30 reservoir will have a capacity of 38,000 acre feet. With the
31 completion of the St. Francis Dam the total available storage
32 in all reservoirs in the system will be 156,000 acre feet, of

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2 which 89,000 acre feet are at this end of the Aqueduct. Re-
3 spectfully submitted, W. W. Harlbut, Office Engineer." "Note:

4 At the time the above action was taken the Commissioners were
5 R. F. del Valle, President, Jas. B. Baker, C. A. Dykstra, John
6 R. Haynes, Wm. P. Whitsett." "From Twenty-Fifth Annual Re-
7 port of the Board of Water and Power Commissioners of the City
8 of Los Angeles, (Approved by said Board on March 25, 1927).

9 "Letter to City Council, Los Angeles, Cal., August 1, 1926. To
10 the Honorable, the Council of the City of Los Angeles.

11 Gentlemen: The Board of Water and Power Commissioners herewith
12 presents its Twenty-fifth Annual Report, for the fiscal year
13 ending June 30, 1926. Board of Water and Power Commissioners
14 of the City of Los Angeles, by R. F. del Valle, President."

15 (Next follows photograph of St. Francis Dam and Reservoir,
16 Crest Elevation 1,835 Ft. Above Sea Level). "Report of the
17 Office Engineer. July 1, 1926. Mr. William Malholland,

18 Chief Engineer and General Manager, Bureau of Water Works and
19 Supply, Los Angeles, California. Dear Sir: Herewith is
20 presented a brief outline of the works of this Division for the
21 fiscal year ending June 30, 1926. Saint Francis Reservoir.

22 The Saint Francis Dam was completed May 4th and contains
23 167,000 cubic yards of concrete of which 94,000 yards were
24 placed during this fiscal year. The maximum height of dam is
25 208 feet. The maximum width is 169 feet and the length is 668
26 feet with an additional length of dyke of 613 feet. The de-
27 sign of the dam is the gravity type arched for additional safety.

28 Water was diverted from the Aqueduct into this reservoir on
29 March 1st and at the present time there is stored 13,000 acre
30 feet, or approximately one-third of its capacity. The opera-
31 tion of the Transportation Division with headquarters at
32 Ducommun Street Shops, embraces the following: St. Francis

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2 Dam, Touring 2, Work Cars 3, Trucks 9, Total 14. Respectfully
3 submitted, W. W. Harlbut, Office Engineer." "Bureau of
4 Water Works and Supply - Engineering Division Engineers Es-
5 timate of Contemplated Improvements Fiscal Year 1926-27.
6 19. - Diversion Dam, outlet conduit and Keepers Home at St.
7 Francis Dam \$90,000.00." "Note: At the time the above action
8 was taken the Commissioners were R. F. del Valle, President,
9 Jas. B. Baker, C. A. Dykstra, John R. Haynes, Wm. P. Whitsett."
10 "St. Francis Dam. Preliminary surveys, September, 1922,
11 Actually began construction in September, 1923, Actual work on
12 Dam started in August, 1924, Dam completed May 4, 1926."
13 "From Minutes of Meeting of the Board, May 11, 1926. "The
14 Chief Engineer brought up the question of having a proper in-
15 scription placed on the St. Francis Dam, and, after some con-
16 sideration Mr. Baker moved that the matter be referred to the
17 President, the Chief Engineer and the Director of Personnel and
18 Efficiency for consideration and report. Seconded by Mr.
19 Whitsett, and carried by the following vote: Ayes, Messrs.
20 Baker, Whitsett, the President; Noes - None." "Board of
21 Public Service Commissioners for Fiscal Year ending June 30,
22 1922. R. F. del Valle, President, A. G. Bartlett, (Deceased),
23 John R. Haynes, Lester L. Robinson, E. R. Young." "Board of
24 Public Service Commissioners for Fiscal Year ending June 30,
25 1923. R. F. del Valle, President, Jas. B. Baker, John A.
26 Burton, C. A. Dykstra, John R. Haynes." "Board of Public
27 Service Commissioners for Fiscal Year ending June 30, 1924.
28 R. F. del Valle, President, Jas. B. Baker, John A. Burton,
29 C. A. Dykstra, John R. Haynes." "Board of Public Service
30 Commissioners for Fiscal Year ending June 30, 1925. R. F.
31 del Valle, President, Jas. B. Baker, C. A. Dykstra, John R.
32 Haynes, Wm. P. Whitsett." "Board of Water and Power

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2 Commissioners for Fiscal Year ending June 30, 1926. R. F. del
3 Valle, President, Jas. B. Baker, C. A. Dykstra, John R. Haynes,
4 Wm. P. Whitsett."

5 Q BY A JUROR: Are we to understand this is all the
6 records, contact between Mr. Mulholland and the superiors from
7 the time this matter was first breached?

8 A As far as I am able to find, outside of the right of
9 way and property.

10 Q During the construction of this dam, Mr. Mulholland's
11 superiors were the Board of Public Service Commissioners?

12 A Correct.

13 Q And these members during the time of the construction
14 of the dam were---

15 A They vary each year. You will see they changed
16 materially since it was started and while it was being built.
17 You will see one member went out each year, and one was deceased.

18 Q The construction started September, 1923, and closed
19 May, 1926?

20 A Yes, excepting these preliminary surveys.

21 Q Could we have Senator del Valle testify here?

22 MR. SCOTT: He will be here tomorrow morning, he was here
23 this morning.

24 Q BY DISTRICT ATTORNEY: Who employs the subordinates
25 or office help of the Engineering Department?

26 A It is changed somewhat.

27 Q At the time of the erection of this dam, who employed
28 them?

29 A It would be recommended by Mr. Mulholland and the Board
30 would approve it.

31 Q Mr. Mulholland recommended all the employes in there?

32 A The principal ones.

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Q I want to find out whether Mr. Mulholland was the Board, or the Board was the Board?

A It is quite obvious the Board was the Board.

Q Did Mr. Mulholland change the plan of this dam?

A I am sure I can't tell you, I have no record in the minutes.

Q In reading your record, you said it would be a certain height?

A I have in there description showing as it progressed it increased a little bit. It is in the record there, but I didn't read it.

Q BY MR. SCOTT: They are under Civil Service?

A Yes, the employes, with the exception of Mr. Mulholland.

Q The engineers, under Mr. Mulholland, are under Civil Service?

A Yes sir.

Q BY MR. MOHR: And the charter itself regulates the Civil Service?

A Yes sir.

Q Who appoints the commissioners of the Bureau?

A The mayor appoints them, confirmed by the council.

Q BY DISTRICT ATTORNEY: The men who go in the Water Department are examined by Civil Service, and they are selected from the list, one of three?

A Excepting day laborers.

Q He couldn't go out and select anybody else?

A No, not that class.

Q BY MOHR: If the Jury wants the charter, I will be very glad to supply it.

THE CORONER: That is all, you may be excused.

1 ALLEN E. SEDGWICK, having been pre-
2 viously duly sworn, was recalled and testified as follows:

3 BY THE CORONER:

4 Q Mr. Sedgwick, yesterday afternoon we had some
5 testimony that brought forth quite a little discussion on a
6 point not entirely clear to me, and perhaps not to the Jury,
7 relative to the amount of water that was indicated by a chart as
8 leaving the reservoir--- what is your explanation of that chart,
9 what it shows?

10 A You refer to the amount of water, that seventy-four
11 second feet of water that was lost somewhere--- I don't think it
12 was there.

13 Q Why do you say that?

14 A Perhaps I could better explain that on the board.
15 (Witness at the blackboard). According to that chart, which
16 was given to the board as correct, and which now has been
17 attacked, that there was certain pencil marks which were not the
18 result of carbon. There was apparently a line which I will
19 draw, which ran approximately parallel to the ruling line of the
20 chart, and it seemed to fall slightly, and at some places fell
21 enough to coincide with this line here (indicating), and was
22 lost in that line, then it fell suddenly to a distance like that
23 (indicating), indicating that at eleven thirty--- at that time a
24 lot of water at the base of the dam, subject to rapid falling,
25 made the telltale or flow inaccurate, so from then on it couldn't
26 be considered as accurate. This time, from twelve o'clock, is
27 naturally the division of time from midnight to midnight, since
28 the failure occurred approximately at midnight, and is the
29 natural time to have started investigating that graph. From
30 this time up to here (indicating) it was stated in the report
31 that based upon the graph, there would be about twelve second
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2 feet, I think, from this time, and that was taken from here (in-
3 dicating) to midnight, from twelve o'clock to eleven thirty, the
4 average fall would be about twelve second feet. There was
5 about twelve second feet from twelve midnight to eleven thirty.
6 If the graph were correct from twelve midnight until sometime
7 here (indicating), which we don't know, from eleven thirty to
8 eleven fifty-seven, there was an average of twelve second feet
9 went out of the reservoir, and between eight o'clock and eleven
10 thirty, there was an average of seventy-four second feet, and
11 we had a picture yesterday of seventy-four second feet of water
12 coming down, a crack somewhere, which, of course, led to some
13 discussion and rightly so. If the telltale were correct, then
14 by photographing it and getting an enlargement of it, we have
15 from this time on a tremendous amount of water coming out. The
16 amount we don't know, but it was a tremendous amount, and if
17 that amount of water coming from there, from eleven thirty to
18 a certain time, which we don't know exactly when it was, within
19 a few minutes, somewhere from eleven thirty to eleven forty-five.
20 That amount of water went out if spread out would amount to
21 twelve second feet. That total amount of water, if spread over
22 this amount of time, would amount to seventy-four second feet.
23 I don't think that twelve second feet was lost from twelve
24 until eight, or that seventy-four was lost from eight until
25 eleven thirty. It simply means that after eleven thirty, there
26 was a great amount of water went out between that time and the
27 time of the collapse. In reality this line (indicating) is so
28 faint and so unreliable that it only indicates there was an in-
29 crease in the loss from eight thirty or nine up until the time
30 of failure, and that increase or loss we believe was due to a
31 progressive increase, ninety-five or ninety per cent of it after
32 or just previous to the time of failure, and so close to the

1 time of failure that it wouldn't have had time to reach the
2 power house and be noticed, and the men who went on the shift at
3 eleven thirty, if they crossed the drainage before eleven thirty,
4 probably would not have had an opportunity to see that, because
5 it probably wouldn't have reached that point at that time.

6 Q BY A JUROR: If you had been on the dam at about eleven
7 o'clock, do you suppose you would have noticed anything of that
8 kind, that water coming out?

9 A I think we would have noticed a leak, but not in any
10 such quantities as stated yesterday.

11 Q Did you try any former graphs the previous twenty-four
12 hours?

13 A No, only from twelve midnight until eleven thirty.

14 Q We are interested to find out just what ^{the} error in the
15 graph was, the variation from mid noon until midnight, what the
16 average error was, taking into consideration the effect of the
17 wind, shrinkage, and the natural errors of the machine itself.
18 That, I think, will throw some light on the interpretation of
19 this graph for this particular period?

20 A I think there was a correction made in that amount of
21 water, for evaporation, so that eliminates that. There, of
22 course, would be some seepage, but it would be small. When you
23 fill a reservoir, there is bound to be some loss in seepage.

24 Q Was there wind action?

25 A Mr. Mulholland testified yesterday, and correctly, that
26 wind would pile water up against the dam and raise the water
27 level there, and that raise might ^{still} have been in the area of the
28 graph. It is a fact that reservoirs that are delivering water
29 in considerable quantities, due to the wind, will actually show
30 water being put into it, when, as a matter of fact, it is losing
31 water all the time.

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2 Q Would you expect a declining course from midnight
3 until eleven thirty?

4 A I would expect an increasing course from the time the
5 wind came up until it went down, but the width of the line and
6 error of the graph in reading it would compensate for any error
7 that might have been made in the deductions yesterday.

8 Q In effect, that means it is unwise to give too much
9 importance to this graph?

10 A Other than that there was considerable water started
11 leaking just before the dam went out.

12 Q BY MR. MOHR: Calling your attention to the bottom of
13 the pool, No. 15, you have been at the dam site recently, as-
14 suming that water is still there, which I am informed it is, can
15 you explain if it is possible, why the conglomerate in which
16 that pool exists, doesn't absorb and allow that water to flow
17 through it, as the testimony shows the conglomerate did allow
18 water to flow through it before the dam went out?

19 A During the scouring of the flood, this being one of
20 the softest places at the bottom of that pool, and the over-
21 lying material is sandstone, with a great deal of clay, and
22 that sandstone would settle into itself, tend to keep them up,
23 and the conglomerate above that district is still moist, looped
24 up, so that the only explanation I can give, it is not that
25 which caused the absorption.

26 Q Why wouldn't that also apply to the conglomerate as
27 it existed prior to the time the dam went out?

28 A Because it was under eighty foot head before, as
29 against no head now.

30 Q Assuming there was a hydrostatic pressure behind the
31 dam, and the water was going through seepages, as has been in-
32 dicated, what evidence of that seepage with the hydrostatic

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2 head in back would there be upon the south side of the hill?

3 A Probably would show moist, or even a leak.

4 Q If there was a direct channel connecting one side of
5 the hill with the south side of the hill, with that hydrostatic
6 head, there would be a spout of water?

7 A I think there was immediately previous to the failure
8 of the dam.

9 Q At what point?

10 A I didn't see it, but I would assume close to the
11 neighborhood of the pool or below it.

12 Q BY THE CORONER: Spalling of the standing section
13 there, that is---

14 A The spalling on the downstream side at the heel--- I
15 can show you better at the blackboard (witness at blackboard).
16 Assume this is a section of the dam, and that the spalling was
17 across some point like that (indicating), that is the approxi-
18 mate location of that piece that is spalled off. When the dam
19 is built, it is built to resist a turning moment around some
20 point, perhaps the toe, which, unless that toe is sufficiently
21 thick, it is not the correct place to assume, but, for the
22 purpose of argument, let's assume it to be that the stresses
23 are so arranged that we have a weight at this point (indicating),
24 and we have a greater weight at this point so we can form---
25 supposing that the increase of stress towards the heel of the
26 dam would be the distance this is (indicating) from here down.
27 That would give us the increase. Now, we have in the report
28 set up a theory or fact that from the break easterly and
29 westerly, there was a cantilever, and the total force of that
30 cantilever would be thrown upon such section, such as the span
31 section, tending to move it or tip it this direction (in-
32 dicating), and downward to lift this up and tip it in that

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3 direction (indicating). As it lifted this up, then that
4 lifted it high enough so there was no pressure there, then our
5 graph would have been noticed, it would have increased the
6 stress at the heel--- that actually lifted itself off the
7 ground--- this would be in tension, so that our ground would
8 look more like that (indicating), and we would have the stress
9 increased upon this portion by that amount (indicating). If
10 that increased stress due to the tipping existed, we would have
11 such a tremendous stress under this section here (indicating),
12 due to that lifting that is represented by the increase in this
13 line (indicating), and overcoming the sheering strength of the
14 concrete, it would spall it off at that point (indicating)---
15 that would account for the spalling.

16 Q BY A JUROR: How do you get a dry joint in tension?

17 A I can't see how anybody could get any dry joint in
18 tension. At the time of the failure, there would be tension
19 here (indicating), lifting this.

20 Q How do you get tension on the heel of the dam?

21 A Because it was lifted. The whole pressure of the
22 water in the reservoir was against that. If it actually did
23 lift it, then there would be no compression, no weight until
24 you got some place under the dam.

25 Q What I am asking, you have no materials there that
26 can take tension; how are you going to display tension?

27 A That is the reason, it would tip off. There wasn't
28 sufficient materials to hold it down, it would tip.

29 Q But there would be no tension?

30 A Yes, tension enough to lift it up. The cracks in the
31 rocks show that.

32 Q What I mean---

A Tension simply means pulling away. You can't have

1
2 tension--- when I put my two fingers together and pull them
3 apart, I have no tension between my fingers.

4 Q BY A JUROR: He means tension between the material
5 itself?

6 A Here is the dam (indicating), and it lifted like
7 that, and as it lifted there it would put more pressure here
8 (indicating).

9 Q Balancing your two forces, the weight of the concrete
10 against the weight of the thrust below, and assuming your center
11 of thrust, the actual point of overturn was out there one hundred
12 and five feet--- I computed the sheering stress, and it only
13 figured a little over fifty pounds to a square inch.

14 A The only thing that could have sheered it was the
15 rock action of the dam, put excessive pressure upon the toe of
16 the dam.

17 Q BY THE CORONER: What, in your opinion, was the
18 action, if any, on the fault lines?

19 A After putting instruments on it, and not having points
20 fixed before the dam--- not anticipating the failure, I had no
21 points, but from all ~~indirect~~ investigation on the ground, I
22 found no indications of major earth movements, such as
23 seismograph records would indicate. I believe major earth
24 movements had no effect on the failure of the ground. I be-
25 lieve schist immediately underneath the dam, laying in between
26 the fractured planes that radiated from the fault, and through
27 which solutions had circulated and altered or disintegrated,
28 that the pressure of the water on the dam during failure
29 slightly moved these schists out or close to the surface and
30 along these fractured planes, as indicated by silk schist and
31 other striation marks upon the clay or the silk schist, and
32 these were parallel to the direction of the stream, rather than

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2 parallel to the planes of bedding or planes of silk schist it-
3 self.

4 Q You heard Mr. Mulholland testify yesterday it is
5 rather common practice to place dams in such locations where
6 fault lines are known?

7 A Yes sir.

8 Q Have you observed that to be true?

9 A Yes sir.

10 Q Is it in your opinion a dangerous practice to follow?

11 A It depends upon the type of dam and direction of the
12 fault with relation to the dam. In the case of a gravity dam,
13 if that were placed over an active fault so that the active
14 fault would pass longitudinally through the dam, I would con-
15 sider it very dangerous. I can illustrate that (witness going
16 to blackboard). Let us assume this is our section of the dam,
17 and that there is a fault line going through some such point as
18 that (indicating). Fault lines, as a rule, don't go vertically,
19 more liable to be in that direction (indicating). We have the
20 stress here (indicating), and have the weight of the dam and
21 center of gravity of the dam, and this overturning moment is
22 resisted, and the whole weight is taken from the whole section
23 of the dam. If there were a fault movement enough to crack
24 that dam like that (indicating), and the weight of this section
25 would now be out, and the center of gravity instead of being
26 there (indicating) would be lifted to some place like that (in-
27 dicating), so our lever arm would be that level from there to
28 there (indicating), and we would have reduced the resistance in
29 overturning by the shortening of that lever arm around the toe,
30 so that a live fault running through the dam longitudinally in
31 the case of a gravity type dam would be exceptionally dangerous.

32 Q That wasn't true in this case?

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2 A No sir, they were directly under the dam, running
3 transversely, not longitudinally.

4 Q BY A JUROR: Will you explain briefly just what a
5 fault is?

6 A A fault is a rift in the earth's crust along the
7 walls of which there has been differential motion.

8 Q BY DISTRICT ATTORNEY: In the earth there were certain
9 strata of rock which continued along in direct lines?

10 A Yes sir.

11 Q An upheaval in the earth caused these things to change
12 like that?

13 A Yes sir.

14 Q So that this finger that represents this strata is
15 down here (indicating)?

16 A Continuity of the stratification is disturbed.

17 Q In this particular case, the difference between that
18 is what is called a pro?

19 A Yes sir, along the line of the fault.

20 Q And this line that runs through like that (indicating)
21 is the fault line?

22 A Yes sir.

23 Q And that runs horizontally in this instance?

24 A No sir.

25 Q To the dam?

26 A No sir.

27 Q Which way?

28 A It runs in an inclination, it is inclined, goes
29 diagonally up through the dam site.

30 Q Up through the hill?

31 A Yes sir.

32 Q So, if there was an agitation of those things, and it

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was horizontal, what effect would it have on the dam?

A It would probably fracture it.

Q When they build earth dams, they build them with some kind of clay, isn't it, and it would be safe to put an earth dam on one of these kind of faults?

A The fault through the earth--- the earth being soft would simply take up the displacement by the soft earth, and would be much safer.

Q In other words, it would kind of stretch a little?

A And fill in again, yes sir.

Q BY THE CORONER: By that you draw the deduction an earth dam would be safer here?

A No sir, an earth dam would have been of such great dimensions up stream, I doubt if it would have been much safer, because it would have to be filled in around the arch instead of on top of it.

Q BY DISTRICT ATTORNEY: I suppose all engineers, ever since it has been a science, engineers in the erection of structures upon these faults, take them into consideration in the erection of their structure?

A They should.

Q And they build them earthquake proof?

A They didn't.

Q They have?

A I don't know. In San Francisco they were destroyed.

Q Ordinary checks that come in the zones there are contemplated in the erection of the structures, by engineers?

A They should be.

Q And they are quite successful in being persistent, that is the buildings are strong enough and the structures, so that the horizontal pressure put on them doesn't injure them?

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A What type of building?

Q Any structure above ground?

A That depends upon the intensity of the earthquake movement.

Q I will read something copied from a paper.

A JUROR: What paper?

THE DISTRICT ATTORNEY: The Record. (Reading) "Buildings can and should be built which are 'earthquake proof.' In tremor belts the world over, there is no excuse for the erection of flimsy buildings bound to tetter with the slightest quake. Just a bit more care and expense would produce buildings impervious save to the most severe shocks. All that is necessary, say construction engineers, is that the building be able to resist a horizontal pressure of at least one-tenth its own weight. It can be even stronger, but this construction will be adequate in most earthquake belts. The finest earthquake building ever built will be the new Mitsui building in Tokio. Like feudal castles of old, it has been designed to withstand the worst assault that can possibly be made upon it. It is noteworthy that some localities now have earthquake building codes which restrict the construction of non-earthquake proof structures. More places in the fault belts are coming to it." Is that correct?

A There is some grain of truth to that. A well constructed concrete building, and well constructed steel building, or perhaps one or two story frame buildings probably wouldn't fall, but two or three story brick buildings are dangerous, and the inference then is to build as low as you can in an earthquake zone, and don't depend upon brick construction to support your house.

Q BY MR. MOHR: Do you know of any living engineer that

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2 can absolutely say that any structure is absolutely earthquake
3 proof?

4 A Certainly not.

5 Q If I remember correctly, when you testified before,
6 you told us the two faults in the canyon were dead faults, not
7 active?

8 A I testified, I believe, that I found no evidence of
9 recent movement along these faults.

10 Q As far as our knowledge goes, as far as you have been
11 able to ascertain, these faults are considered dead faults?

12 A I wouldn't take it that far, would say, as far as my
13 knowledge went, as far as I put on it without instruments, I found
14 no evidence of movements within those fault lines. Understand
15 I mean mass movement rather than movement of the schist in the
16 fractured planes.

17 Q Geological reports on these faults declare them to be
18 dead faults?

19 A I have never seen a report from anyone on the cross
20 fault. The one diagonally across the canyon I believe is the
21 San Francisquite fault, is supposed to have the stresses re-
22 lieved.

23 Q BY DISTRICT ATTORNEY: A dead fault, as I understand,
24 is a fault, when the geologist examines it, he doesn't find
25 there has been a recent movement?

26 A There should be more than that to call it a dead
27 fault. A formation not having moved over a period of several
28 million years, we would assume it was a dead fault.

29 THE CORONER: That is all, you may be excused.
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2 R. F. del VALLE, being first duly
3 sworn, testified as follows:

4 BY THE CORONER:

5 Q Please state your name.

6 A R. F. del Valle.

7 Q Where do you reside?

8 A 3508 South Figueroa, Los Angeles, California.

9 Q What is your business or profession?

10 A Attorney.

11 Q You are also President of the Water Commission, City
12 of Los Angeles?

13 A Yes sir.

14 Q And you have been president of that commission quite
15 a number of years?

16 A Yes sir.

17 Q You were president of that body at the time the St.
18 Francis Dam was first contemplated?

19 A Yes sir.

20 Q And presided at the meetings when the plans were all
21 discussed?

22 A Yes sir.

23 Q What procedure was taken by your commission to adopt
24 the plan-- first the site, then the plans for building the St.
25 Francis Dam-- in other words, who did you direct and what di-
26 rections were given to any one about the selection of this site
27 and preparation for building the dam, and any specific in-
28 structions that were given?

29 A The first action taken was permit requested from the
30 government. Subsequent to that, the matter has been left en-
31 tirely in the hands of Mr. Mulholland, to submit to the board
32 such matters as he desired from time to time in connection with

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2 it. We approved the preliminary survey he made, and subsequent
3 to that other reports yearly and the budget, and all suggestions
4 made by him in connection with the building of the dam.

5 Q Have any members of your board since the inception of
6 the St. Francis Dam project been engineers, men who had
7 practical scientific knowledge in the construction of dams?

8 A None at all.

9 Q Did your board at any time instruct the Chief Engineer
10 as to any assistance he should employ, expert assistance,
11 geologically or in an engineering way from the outside, outside
12 of your department?

13 A Mr. Mulholland has had charge of the department ever
14 since its inception, built the aqueduct prior to that, for the
15 last forty-five years has been identified with the management
16 of the Water Department of this city. During that time he con-
17 ceived the construction of the aqueduct, built it, has built
18 nineteen dams for the department, and during that whole time,
19 the board has found that he has used the proper judgment, has
20 been competent, efficient in every manner, and therefore the
21 matter of detail as to whom he should consult--- he consulted
22 with the department occasionally--- as to whom he should consult
23 or what he should do in detail, has been left entirely to his
24 judgment, because the board has had the utmost confidence, and
25 has now, in his ability as an engineer.

26 Q At any time prior, or just prior to the time the St.
27 Francis Dam was contemplated, did Mr. Mulholland tender his
28 resignation to the Water Commission?

29 A No sir.

30 Q He has been active continuously during these forty-
31 five years or more?

32 A He has supervised the operation and construction of

1
2 every one of the reservoirs, in fact, every detail and every
3 department of the aqueduct, bringing forth the largest in-
4 stitutions in America to the present time.

5 Q Had you not had such confidence in his judgment,
6 would you have suggested the employment of outside assistance?

7 A No doubt we would.

8 Q You believed he was competent so that it was not
9 necessary to employ outside assistance?

10 A I did, and believe so now.

11 Q The question of economy-- was it for any economy he
12 didn't employ outside assistance?

13 A No sir, not only in this particular proposition, but
14 anything in connection with the survey, preservation and furnish-
15 ing of water to the City of Los Angeles, the men on the board
16 generally are men connected with financial interests of this
17 city, and therefore have in no wise been penurious, nothing
18 was attempted to reduce the expenses necessary for the preserva-
19 tion of water interests in this city.

20 Q BY DISTRICT ATTORNEY: Do I understand the Water
21 Board had ample means to employ geological experts to make
22 surveys of these dams?

23 A Yes sir.

24 Q But no such were employed?

25 A If anything of that kind was necessary--- we left
26 that entirely to Mr. Mulholland.

27 Q Nor were any hydrostatic engineers employed?

28 A Not by the board.

29 Q And it was never suggested to Mr. Mulholland that
30 in the construction and building of these mighty stupendous
31 structures might require the assistance of other men--- you
32 left it--- he had the whole responsibility?

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2 A Yes sir. I will also remark, up to this time the
3 State of California didn't even consider the examination of
4 reservoirs for that purpose.

5 Q Do you think a preliminary exploration by geologists
6 should be now employed in the erection of these kind of
7 structures?

8 A There is never any fear of utilizing trained men for
9 the purpose of making a thing more secure, if it is possible to
10 make it.

11 Q And you believe you have ample means to do these things
12 if it was suggested?

13 A Yes sir.

14 Q How old a man is Mr. Mulholland?

15 A Mr. Mulholland, I think, is seventy-three or seventy-
16 four.

17 Q This has been his first mistake-- if it is a mistake?

18 A This is the first accident that occurred to any of
19 these institutions/^{with}~~the~~ which he has been connected.

20 Q BY A JUROR: What is the appraised valuation of the
21 entire water system?

22 A That is a very difficult thing to state. At the
23 present time, from memory, I would say that the Water and Power
24 Department has a valuation to this city today, would be one
25 hundred and twenty-five million dollars, and all of it has been
26 developed by the construction of the aqueduct, and the develop-
27 ment of power with the aqueduct.

28 Q And the value of the dam is about one one hundredth
29 part of the valuation?

30 A I think the dam cost a million or two million dollars.

31 Q BY MR. SCOTT: The water works alone would be valued
32 at about eighty million?

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A Eighty or eighty-two million dollars.

Q BY A JUROR: Did Mr. Mulholland ever ask for assistance or counsel in making decisions relative to these important structures?

A He didn't. I would say individually, as far as personal recollection or information, I have even seen Mr. Mulholland with engineers of prominence, such men as Professor Davis, and I would say that he has also other men of that standard in consultation with him in regard to the structures he was building. I will say further--- I believe it is information you desire--- that Mr. Mulholland, as far as his knowledge, which, of course, we have to trust, as a member of the board, and the interests of the Water and Power Department of this city, we have naturally to be very careful in regard to ourselves in the discharge of duty, and to fortify us in the faith we have in Mr. Mulholland, I would say that his services are not only required by us, but they are sought by men of great ability in the country, in charge of various institutions. I will say that up to a few days ago, he was one of the advisers of the East Bay Water Company, of Oakland, before they performed any great acts there. He is one of the officers of the Spring Valley Water Company, San Francisco, and is sought by Arthur P. Davis, also adviser of the Sacramento Utility District, at the present time, also member as consulting engineer of the Board of State Water Resources, State Board of Public Works, participating during his spare time. He is very often wanted, and they seek him as adviser on these municipal dams and reservoirs.

Q BY A JUROR: Did you ever ask to see complete plans and specifications of any of these structures before their erection was begun?

A Mr. Mulholland has shown them very often to us, and

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2 very often we would talk it over. None of the members of the
3 board are experts on this question, there are no engineers in
4 the department.

5 Q You made reference to Arthur P. Davis. Do you know
6 his experience in the matter of building large works, dams?

7 A Arthur P. Davis has been head of the reclamation
8 service of the United States, is the man who first reported on
9 the question of the Colorado River works.

10 Q Is it a fact, the East Bay Utility District, that
11 Davis as engineer and general manager, considered it good policy
12 to employ as consulting engineers Mr. Mulholland and General
13 Goethals?

14 A I think that is correct.

15 Q Then the City of Los Angeles didn't consider it neces-
16 sary to follow a similar policy and employ men of equal standing
17 to advise with it in regard to projects of major importance?

18 A For two reasons, first, as I said, a man who had
19 already built eighteen dams successfully, and who had the power to
20 consult anyone he desired in regard to this matter, we left it
21 entirely to him, and he had built these eighteen dams success-
22 fully and had participated, to my certain knowledge, in the
23 building of other dams of the different water departments of the
24 state, to which I refer.

25 Q You know how many of these dams were masonry dams?

26 A I couldn't tell you.

27 Q Did you know up to the building of the Mulholland and
28 St. Francis Dams there had been no masonry dams built?

29 A Perhaps not. We had full information on these facts,
30 and, as I say, Mr. Mulholland has always surrounded himself---
31 even I have seen Professor Davis, Doctor Mead, men of that
32 standard with Mr. Mulholland, in connection with the future

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2 Colorado River Dam, and men who have charge of that matter, from
3 Mr. Mead down, have been in consultation often.

4 Q As a matter of fact, Mr. Mulholland is subservient to
5 the water commissioners?

6 A Absolutely so in every particular. He also ex-
7 presses whatever is improper. He is a servant of that com-
8 mission, and in the twenty years I have served on the commission,
9 I have never seen anybody connected with the institution that
10 more willingly took orders from his superiors.

11 THE CORONER: That is all, you may be excused.
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15 WILLIAM MULHOLLAND, having been
16 previously duly sworn, was recalled and testified as follows:

17 MR. MULHOLLAND: I want to supplement something. It is
18 true that I was employed as assistant to Arthur P. Davis, my-
19 self and Senator Geethals, now dead, in the development of the
20 utility district for Oakland. I want to say, however, I wasn't
21 consultant, and he has no other consultants than the ones he
22 picks up, as I pick them up, skilled men. With regard to the
23 engineering features of the work, the political features,
24 economy features, we assisted in the selection of water sources,
25 and Mr. Davis has no consultant in the connection you are in-
26 quiring into now, anymore than I have in the past. I have had
27 consultants, have insisted that the board employ, in the case
28 of the aqueduct, three engineers, and after painstaking
29 selections of people, got Frederick P. Stearns, John E. Freeman,
30 and John D. Schuyler. They went over the general plan, didn't
31 go over the detail plan of construction, to pass on the
32 feasibility of the project at that time. Being a very large
project, and very important to the City of Los Angeles, and

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2 incidentally important to me, because I was staking my very
3 professional life on the success of it, I insisted that the board
4 get three engineers to pass on it. I have had other engineers
5 to consult with on various other critical things, and Arthur P.
6 Davis has been our payroll until recently as consultant, but in
7 general, for the last ten or twelve years, I haven't consulted
8 with anybody, or but very few. I have frequent calls, frequent
9 consultations with engineers, visiting engineers. This city is
10 probably visited by more engineering talent than any other city
11 in the world, on account of its unique difficulties with regard
12 to the water supply. It is the most difficult city to supply
13 in the world with water, far and away the most difficult, go two
14 hundred and fifty-five miles for water, preparing to go two
15 hundred and fifty miles in another direction across deserts. It
16 is a fact it only rains fifteen inches on an average, and fre-
17 quent years we have only seven or eight inches, and naturally
18 it excites curiosity, wonder where we get our water. It doesn't
19 fall here, we have to import it, excites the curiosity of
20 engineers, and for that reason we have many visitors from all
21 over the world, England, East India, Japan, China, hardly a week
22 passes but there is a delegation, but professionally, in the way
23 of employ, I have had very little, I have had a very open ear,
24 counsel.

25 Q BY A JUROR: Did you have any counsel from geologists
26 in regard to the foundation of the dam site?

27 A Not at that point. I had been right over that site.
28 Doctor Branner, who is dead now, I had a very intimate ac-
29 quaintance with him, and even far back, Joe La Conte. I didn't
30 associate so much with geologists, I was somewhat infected with
31 the geology idea myself.

32 Q Did you have geologists on this site?

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A Not La Conte, Branner.

Q He is an eminent geologist?

A He is looked upon as head geologist of the United States.

Q He thought it was feasible to erect a dam on this site?

A I wouldn't say that, the site wasn't open, explored at that time, but he knew precisely where the joint between the two rock formations was, he knew that of old.

Q He knew of the faults?

A He knew the contact there between the two formations.

Q BY THE CORONER: He couldn't know the nature of the formation without boring into it?

A He knew one side was schist and the other side conglomerate.

Q Did he ever discuss the inclination of that conglomerate to absorb water?

A No, I don't remember. I know it was full for two and one half years, it would absorb water then.

Q You never had any discussion about that before the dam was located?

A Yes, dug holes in it and filled them with water, practical tests.

Q BY A JUROR: You also testified that the State Engineer had passed upon this?

A Yes sir, went on the ground, looked the thing over.

Q BY THE CORONER: That was Mr. McClure?

A Yes sir.

Q He didn't make any geological test?

A Don't know what you call it, looked as I did, exposed rock, excavations that were made. I don't really know if he

1
2 is a geologist or not. He examined the exposure there, and it
3 was his official business.

4 Q BY A JUROR: Was he acting in an official capacity?

5 A Yes sir.

6 Q Didn't you testify you were not subjected to any in-
7 spection by the State Engineer?

8 A Some question brought out the fact. I said I was
9 willing to be subjected to any inspection, I believe if you re-
10 member.

11 Q He actually did spend a half day at the dam, but it
12 wasn't his duty to do so?

13 A No sir.

14 Q BY THE CORONER: Did he come at your request?

15 A Yes sir, came there by my request.

16 Q BY A JUROR: With the specific object of examining the
17 dam?

18 A Precisely. I don't like to be stubborn about things,
19 I wouldn't think of telling him it was none of his business, I
20 did insist it was his business.

21 Q BY THE CORONER: Although it was not required by law,
22 to be inspected by the State Engineer?

23 A No sir.

24 Q BY A JUROR: Did Mr. McClure see the finished work?

25 A I think he has, pretty sure he has been down here
26 several times while they were working on it.

27 Q BY MR. ROBINSON: You made a study of geology, as well
28 as engineering?

29 A Naturally taking in rocks all the time along in the
30 country, particularly the new geology of the country, drove
31 eleven miles of tunnels right along in that canyon.

32 Q What is the total mileage of tunnel work on the

1
2 **aqueduct?**

3 **A Fifty-three miles.**

4 **Q Didn't you have something to do with the organization**
5 **of the seismological society?**

6 **A Yes. Ralph Arnold Branner and twelve or fourteen**
7 **others were the originators of the society. I might say I was**
8 **honored by having conferred upon me the LL.D. degree of the**
9 **University of California, so don't call me colonel any more, I**
10 **am a doctor.**

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12
13 **H. B. HEMBORG, having been pre-**
14 **viously duly sworn, was recalled and testified as follows:**

15 **BY THE CORONER:**

16 **Q Have you a survey made of the standing portion of the**
17 **dam?**

18 **A I have a report of methods used in making the test.**

19 **Q Will you read that?**

20 **A This is "Movement check system at St. Francis Dam and**
21 **record of observations taken of standing section after failure.**
22 **The movement check points of St. Francis Dam were put in on the**
23 **center line of crest, at every one hundred foot station, as**
24 **soon as the top roadway slab was finished. This work was done**
25 **on April 23rd, 1926, after a careful triangulation check of the**
26 **main reference station - radial 10 had been taken. Holes were**
27 **drilled at every even station on the main dam structure, be-**
28 **ginning at Sta. 7 and continuing through to Sta. 12, these**
29 **holes being filled with lead and into which copper tacks were**
30 **driven for station points. The locations of these points were**
31 **then referenced out by a series of intersecting lines whose**
32 **bearings were as nearly radial and lateral as the lay of the**

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2 surrounding hills permitted. This system of checking is
3 graphically shown in Field Book 1823, Pages 18 and 19, a
4 photograph of which is included in this report. After the
5 failure of the St. Francis Dam, an accurate check was made of
6 the standing section by noting the movement of Sta. 9, which
7 fortunately was left intact. A ten second Berger transit was
8 used for these observations. The instrument was set up over
9 radial reference station number "9 F", sighted at triangulation
10 point St. Francis and two points set on this line on top of the
11 dam. The instrument was then set up on reference point "9 P",
12 sighted at permanent sight and two points set on this line.
13 The resulting intersection showed a total movement of .7 of a
14 foot; the lateral motion in an easterly direction of .315 of a
15 foot and a downstream motion of .645 of a foot. In order to
16 check the movement of the base of the dam, a point was set in the
17 bed rock on the west abutment of the dam site and cut in by
18 triangulation. From this point a short traverse was run to
19 two nails and tins that were found on the 1720 elevation step.
20 These points I mention were used during the construction of the
21 dam to set the forms from and were located on radial stations
22 8=87.50 and 9=37.50. The total motion radially and laterally
23 of these points was found to be .49 and .67 of a foot res-
24 pectively. A sketch showing the bearings of these movements
25 as well as the field work involved is included with this report."

26 Q BY MR. SCOTT: Could you illustrate that on the
27 blackboard to make it clearer than you have?

28 A JUROR: It is clear.

29 Q BY MR. SCOTT: Did you do any other work?

30 A We took a triangular check of the system we used in
31 construction of the dam to note any movement of the points.

32 Q Explain that fully to the jury.

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2 A I could explain that better on the blackboard (witness
3 drawing diagram on blackboard). In the construction of the dam,
4 we used triangulation control, and one of the triangulation
5 points is point "B" located on the dyke, ~~xxx~~ at the westerly
6 extremity of the dyke. Another point "C" is an iron pipe in
7 the knoll about four hundred feet below the dam, downstream,
8 and to get in these points, we used the base line from "A" to
9 "B", and turned this angle first, and then using "A" "B" as the
10 base line, we cut in "B", and there is another point called
11 "St. Francis", this being the main triangulation sight, "St.
12 Francis", "A" and "B". I turned the angle from "B" to "St.
13 Francis", at "B" to "A", to see if there had been any movement
14 within the points of the main system. I checked this angle as
15 to where it had been turned in 1923, by two tenths of a second,
16 then I went to triangulation point "A" and turned the angle from
17 "B" to "St. Francis", and got three and one tenth from what it
18 had previously been turned, then I cut in triangulation point
19 "B" and "C", and we found a difference in movement-- I have it
20 on the map-- (showing map to Jury). This (indicating) is the
21 base line we used from "A" to "B", and my check I mentioned
22 first was to see that there had been no movement between these
23 points, and my triangulation showed there had been no movement.
24 I am showing diagram of triangulation point "B" and "C". "B"
25 is on the dyke, west abutment, at the westerly extremity,
26 westerly end of the dyke, about six hundred feet---

27 Q BY A JUROR: Where is "A" located?

28 A Here (indicating). You know that construction road
29 you go over to get to the dam site, right above that road.

30 Q How far from the dam?

31 A About seven hundred feet.

32 Q Which one moved twelve one hundredths?

1
2 A "B" moved twelve one hundredths, "C" moved nine one
3 hundredths.

4 Q BY MR. ROBINSON: Will you tell us what the diagrams
5 show, that the points of the compass are the same?

6 A I will plot this on, approximately like that (in-
7 dicating).

8 Q You now made marks on the larger of the two diagrams,
9 which I understand indicate the direction of the movement?

10 A On the smaller diagram.

11 Q BY A JUROR: The amount of movement?

12 A Twelve one hundredths and nine one hundredths.

13 Q That movement is to the east?

14 A Yes sir. I closed this triangle to two seconds, and
15 the other to four seconds.

16 Q BY MR. ROBINSON: State in detail the previous method
17 you used in making these observations as indicating the degree
18 of accuracy of the work?

19 A We used a ten second Berger transit, and turned each
20 angle twelve times in repetitions of three times, four sets.

21 Q Is that the method ordinarily used?

22 A Yes sir.

23 Q And this instrument, is that a high grade instrument?

24 A Yes, very high grade instrument.

25 Q BY A JUROR: Did you do all that work?

26 A Yes sir, I was out at the dam doing this work, lo-
27 cated these points when they were put in. When I left the
28 dam, that was the final test, then I did it after that failure.

29 Q BY MR. ROBINSON: Within the limits of error of that
30 method of observation, what would be the possible error in your
31 opinion, in your conclusion as to the total movement? As I
32 understand it, at point "B" your observation indicates a move-

1
2 ment of twelve one hundredths, point "C" nine one hundredths.
3 Under the conditions as they exist there, and under the methods
4 of surveying you used, what was the possible error in these
5 observations?

6 A Given the worst possible conditions, one or two one
7 hundredths would be the limit of error.

8 Q The greatest possible error would be, twelve one
9 hundredths would be reduced to ten one hundredths, reduced or
10 increased, and nine one hundredths reduced as the utmost limit
11 to seven one hundredths, or increased to nine?

12 A Yes sir.

13 Q BY A JUROR: You did that work?

14 A I checked against Imbertson's turn of the main
15 triangulation system.

16 Q BY MR. ROBINSON: When were these triangulation points
17 first established, the controlling ones?

18 A Before the construction of the dam, the first points
19 were put in-- if Imbertson-- he located them first.

20 Q Did you have access to his field notes?

21 A Yes sir.

22 Q After the construction of the dam, did you check
23 these points yourself?

24 A Yes sir.

25 Q Was that at the time you established the points on
26 the crest, on the dam?

27 A That is the same time I established the points I
28 mentioned.

29 Q The controlling triangular points were established
30 by this other man before construction began, and after con-
31 struction you rechecked his work, re-established the accuracy
32 of it, so you yourself checked what these measurements were

1
2 after construction and set the points on the crest of the dam
3 and on the parapet wall?

4 A Yes sir.

5 Q Then, after the failure of the dam, you made this
6 recheck of this other man's work which had been previously
7 checked by yourself?

8 A Yes sir.

9 Q And these limits of error you speak of is the
10 maximum?

11 A Yes.

12 Q That is the limit of error between your recheck upon
13 the completion of the dam and your work now after the failure
14 of the dam?

15 A Yes sir.

16 Q BY A JUROR: Can you illustrate on the blackboard
17 within that triangle "A", "B" and "C" just where the fault lines
18 go?

19 A Yes, I can. Here is the fault line that has been
20 plotted (indicating).

21 Q BY MR. ROBINSON: Will you indicate on this diagram
22 which is the dam as distinguished from the wall, and which is
23 the wall?

24 A Yes, there is the dyke (indicating).

25 Q What is the trend of the canyon, the direction of the
26 canyon at that point?

27 A It runs sort of southwesterly.

28 Q So that this one you have already pointed out is the
29 fault parallel to the direction of the canyon?

30 A Yes. I might mention at this point there is an iron
31 pipe buried in the ground.

32 Q BY A JUROR: This iron pipe you found it had moved?

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A Yes sir.

Q Indicating that the whole hill had moved?

A I checked this and these two points (indicating)-- it moved in the direction indicated.

Q Would that indicate the whole hill had moved?

A I would say it had.

Q Had the water been over this pipe?

A No sir.

Q Not disturbed?

A No sir.

Q How far is this triangulation point (indicating) below the dam?

A About fifteen hundred feet.

Q There was no movement there?

A No sir, that was my first check, to try to find a movement within the limits of this system.

Q "C" is what?

A About four hundred feet from the dam.

Q Was there any evidence of disturbance at the triangulation point?

A None I could find.

Q BY MR. ROBINSON: Did you do any work in the way of establishing levels of points?

A Last Friday sent two parties up, naturally all the bench marks had been washed out.

Q In what way?

A Around the dam site, so we ran a chain of levels down from approximately a mile north of the north end of the reservoir towards Power House No. 1.

Q From what point did you run this line of levels?

A That is where we started.

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Q Was there a bench mark there?

A Yes sir, U.S.G.S. bench mark, not disturbed, and we sent three parties down with instructions as to the accuracy, one of the most accurate levels run, and running down to the dam, they did that, and checked flat at the bench mark. We stood at the dam, ran to the top of the dyke, found the dyke moved upwards twenty-eight one hundredths of a foot.

Q At what point on the dyke was that?

A Opposite triangulation point "B", that is the westerly extremity.

Q Did you make any observations on other portions of the dyke?

A No sir.

Q Then, as I understand your work establishes at that point where point "B" is set, there appears to have been a rise of level since the prior survey of how much?

A Twenty-eight one hundredths of a foot.

Q That is approximately how much in inches?

A That would be about three and one half inches.

Q Is the work of checking these observations against other bench marks still in progress?

A Yes sir, we are checking against a bench mark at Harry Carey's Ranch.

Q So that by the time the work is completed, you will have run from one government bench mark to another?

A Yes sir.

Q And this testimony you are now giving is based on the work as carried over carefully from the bench mark above the reservoir site, but does not include the element of checking through the other bench mark?

A No, they haven't completed that yet. I might say on

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2 this turn the greatest error we found would be two one
3 hundredths, and then it would compensate again.

4 Q BY A JUROR: What is your idea as to the probable
5 error in these elevations?

6 A I couldn't say as to that, I am giving you how ac-
7 curately they were run. They are run by two parties, ~~xxxxxx~~
8 an independent chain of levels, each one.

9 Q How close?

10 A They closed flat.

11 Q That is from upper point No. 1?

12 A Bench marks about a mile north of the extremity of
13 the reservoir site.

14 Q BY MR. ROBINSON: Did you do the level work at the
15 time these points were originally set?

16 A Yes sir.

17 Q What method were these points set originally?

18 A We ran a chain of levels against two U.S.G.S. bench
19 marks.

20 Q The same ones?

21 A One. One had been washed out. We started at
22 Harry Carey's and ran a chain of levels up to a bench mark
23 above Power House No. 1, Power House No. 2, in the bottom of
24 the canyon, from there on continued levels up to the bench mark
25 just mentioned.

26 Q Was the method used in this rechecking the same as
27 the method used in the original work?

28 A Yes sir, we threw the rods against any shrinkage,
29 anything that would cause an accumulative error, adjusted the
30 instruments, and gave instructions as to balancing the sights.

31 Q What instruments did you use in making this?

32 A One Dumpy level, one Berger.

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Q A high grade level?

A Yes sir.

Q BY A JUROR: The crest of the abutment is standing, have you checked it since the disaster?

A Say that this (indicating) is a cross section of the dyke, or triangulation "B", the dyke goes up a little, a concrete gutter in the roadway, another little gutter, and down this dyke (indicating), constructed about 1838.06, and I run the levels up to that point again and found 1838.345, a difference of .285.

Q That doesn't answer my question-- you have the elevation of point "B" now checked over?

A Not the elevation of point "B".

Q The bench mark in that vicinity?

A We set a bench mark-- all the ~~xxxx~~ bench marks were gone-- I am taking what this dam was constructed at.

Q Evidently there is a difference of .285?

A This point (indicating) was constructed to 1838.06. We find it now 1838.345.

Q How about the easterly end?

A We haven't run over to the easterly end of the dyke.

Q BY THE CORONER: That is the extreme west end of the dyke?

A Yes sir.

MR. ROBINSON: No doubt all these observations will be made. He is giving the testimony of what has been done now.

Q BY DISTRICT ATTORNEY: Where was this point "C" located, in the conglomerate?

A Yes sir.

Q What was the elevation of that?

A We never had an elevation on point "C".

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Q When you made the original check of Imbertson, what method did you pursue?

A Turned the same triangles he had turned to check him and established the coordinate of "B" and "C".

Q How many times?

A Closing the triangles as I mentioned, but we use the method of turning each angle a total of twelve times.

Q Checked it the same number of times when you made the original check?

A That is the method we always use.

Q Did you use it on the original check?

A Yes sir, I use that method all the time.

Q What month did you run the levels in the first time?

A About September, 1924.

Q BY A JUROR: The original typographical map showing the original ground level and the map showing the detour lines at bedrock were made by you?

A No sir, I made the bedrock detour, that is all.

Q Who made the original?

A Mr. Prector would know that.

Q Were these two men considered accurate?

A As I understand it, the first detour map was just a rough topography.

Q How about the second one?

A The second map was ^{as accurate} ~~as accurate~~ as possible to make.

Q Does anyone know as to the correctness of the first map?

A I think Mr. Prector can tell you that.

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2 R. R. PROCTOR, having been pre-
3 viously duly sworn, was recalled and testified as follows:

4 MR. PROCTOR: Referring to drawing 2149, the purpose of
5 this map was to furnish an estimate of the number of yards of
6 concrete which would be required in this structure, for the
7 purpose of keeping the percentage of progress, ordering cement
8 and other purposes-- it was hurriedly made after the work of
9 stripping this side ~~stripping~~ wall of the canyon with the
10 hydraulic giant had started. I did the work myself, the whole
11 thing in one day, and probably describe the accuracy better
12 than anything else, that is the main canyon was done in one day,
13 not intended as an accurate representation, unfortunately it
14 was given out as such.

15 Q BY A JUROR: What would you consider its possible
16 error might be?

17 A We are dealing in this place very close to one to one
18 slope, about ten feet I should say.

19 Q Vertically?

20 A Yes.

21 Q Is there no accurate map showing the original ground
22 service?

23 A The only one we have is on a scale one inch to two
24 hundred feet, that is the reservoir map-- has not been reduced
25 here. I might state at the time of checking this map, the dam
26 had already been located. The original location of the main
27 body of the dam was projected on two hundred feet to the inch
28 map, and marked out on the ground by the surveyors, and upon
29 inspection it was thought and believed by Mr. Malholland much
30 better to move one end of the dam I believe fifty feet up-
31 stream, in order to give the best possible tie in to the hill-
32 side on the east side of the canyon. The bedrock detour map

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2 is taken by use of the most precise method we know for making
3 such maps.

4 Q BY MR. ROBINSON: That map was made for special
5 purposes which required really observations only as to the area
6 extremely within the dam site, and only approximate accuracy
7 above there, so that there was no reason, so far as the purpose
8 of that map was concerned, for any accuracy behind the actual
9 site?

10 A No sir, we didn't anticipate the washing out of this
11 dam at that time.

12 Q Isn't it a fact this photograph indicates that the
13 hillside on the east of the dam is considerably rounded where
14 the detours on this map extended beyond the dam is approximately
15 straight?

16 A At the time of making this map, filled material from
17 the road had been dumped on.

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19
20 H. B. HENBORG, having been pre-
21 viously duly sworn, was recalled and testified as follows:

22 Q BY MR. ROBINSON: Will you take this photograph,
23 which is one of the exhibits, and point out if you can where
24 these points, where you observed the movement, both horizontally
25 and vertically, was?

26 A Triangulation point "B" I mentioned is about there
27 (indicating) where this crosses, and triangulation point "B",
28 iron pipe in the ground, about over in there (indicating).

29 Q BY A JUROR: What was the elevation of point "G"
30 from the stream bed?

31 A I can only give you an estimate.

32 Q Is it two hundred feet above the stream bed?

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3 A I think this point, this knoll (indicating) I should
4 say that was one hundred and fifty feet.

5 Q The movement eastward of point "B" and "C"?

6 A That is the triangulation point (indicating) and these
7 pencil lines are approximate lines--- this one is "B", moved
8 twelve one hundredths, and this one "C" nine one hundredths of
9 a foot.

10 A JUROR (Addressing Mr. Sedgwick): If the evidence as the
11 witness states is a fact, how would you account for the raise in
12 that hill?

13 MR. SEDGWICK: Of course the evidence apparently is to
14 establish mass movement-- I would say that an error---

15 (Addressing Mr. Hemborg) How long was that check line?

16 MR. HEMBOURG: From "A" to "B" fifteen hundred feet.

17 MR. SEDGWICK: Makes a field error of about one in six,
18 seven or eight thousand on points that have been set two or
19 three points apart--- might be all right, but, of course, there
20 is a question about that. It was on conglomerate. Taking
21 different methods of the way conglomerate is, rather absorbent
22 could move straight up and down, whether it was dry or wet.
23 The worst thing of all is they are trying to establish an up-
24 side movement in a downside fault.

25 MR. ROBINSON: We are not trying to establish anything,
26 are trying to put on the facts.

April 5th, 1928. 2:00 P.M.

1 R. R. PROCTOR, was re-
2 called and testified as follows:

3 Q BY MR. SCOTT: Describe to the jury the clock and
4 also the stilling well that held the float of the gauge which was
5 on the dam.

6 A I believe I covered the mechanism of the clock before.

7 THE CORONER: Are you all satisfied as to that instrument,
8 gentlemen?

9 A JUROR: We have not heard about the stilling well.

10 A A twelve inch pipe sealed at the bottom, welded, one
11 inch hole is cut in the side of the pipe near the bottom by an
12 acetylene torch.

13 A JUROR: Directly in the bottom?

14 A In the side, I understand.

15 MR. SCOTT: What is the size of the pipe?

16 A A 12 inch pipe.

17 Q How is it fastened together?

18 A Welded, I presume.

19 Q What kind of a pipe?

20 A 12 inch steel pipe, according to my understanding.

21 A JUROR: The effect of that stilling pipe was any sudden
22 movement of the water could not affect the gauge?

23 A The purpose was to quiet the wave action.

24 Q That when its hole was in the bottom, not on the side?

25 A In the side.

26 MR. SCOTT: In other words, it was not open in the bottom
27 and the rapid decline of the water in the reservoir would not
28 immediately
29 / ~~immediately~~ register above?

30 A No.

31 Q BY A JUROR: It was open at the top?

32 A Yes.

Q Have you the old records of that gauge from time to

1 time?

2 A I have ^{them} been in our office.

3 Q What are the characteristics, if any, of that record,
4 during the daytime as against nighttime?

5 A That I could not say. There are some irregularities
6 in them, due to wind action.

7 Q What is that?

8 A I would have to bring these here for you to see them
9 yourself.

10 Q All right. I would like them very much for several
11 months back.

12 A Yes.

13 Q What were the limits of this gauge? Did the float go
14 on through the stilling well or was it working in the stilling
15 well?

16 A Working in the stilling well.

17 Q Then, it could not get below the limit of the pipe?

18 A It could not. As a matter of fact, I believe that the
19 apparatus went out of commission after some fifteen feet of reser-
20 voir drop or thereabouts.

21 Q According to this picture it shows that it was fasten-
22 ed at this point. Would you not assume that would be the end
23 of the line?

24 A There was seventy- feet of pipe only. It is not
25 clear to me as to whether this was the end or whether there was
26 some more pipe than is shown there.

27 Q It extended down from the top of the dam seventy feet?

28 A Yes.

29 Q What do you think about the record which was obtained
30 on that gauge from 11:30 or thereabouts until 11:57?

31 A I think that will be covered a little bit later by a
32 special ^{photograph} investigation of the chart. A photograph that was
taken with color filters to eliminate the lines of the chart it-

1 self.

2 Q What would prevent the waves from washing the float up
3 against the dam and injuring it?

4 A It was inside the pipe. It was a tight pipe in the
5 water with a small one inch hole to allow the fluctuations of
6 the reservoir to show, and at the same time it would not allow
7 such fluctuations as those of a wave to record.

8 Q Did that float run on a rail on each side?

9 A I think it was simply a float inside the pipe connect-
10 ed with wires at the top. To the float was attached a flexible
11 cable of wire and that went down again and was connected to a
12 counterweight of the same weight as the float.

13 Q BY MR. ROBINSON: Isn't it a fact that the gauge
14 would register within the limits of the accuracy of the mechanism
15 the height of the water in the stilling well, rather than the
16 height of the water in the reservoir, immediately around the
17 stilling well?

18 A Yes.

19 Q So that so long as the fluctuations of level were the
20 ordinary, very slow and gradual fluctuations, the gates would
21 show these fluctuations with substantial accuracy?

22 A Yes.

23 Q And it was a very sudden dropping of the water which
24 might exceed the rate at which the water would run out of this
25 pipe to a 12 inch hole?

26 A That is it exactly.

27 Q So, in that event, if you assume a very sudden drop of
28 the water in the reservoir from any cause, from that point the
29 record would be a record of the water inside the stilling well,
30 rather than the falling of the water outside?

31 A Yes.
32

1
2 ACE L. HOPEWELL, being
3 first duly sworn, testified as follows:
4 BY THE CORONER.

5 Q Please state your full name.

6 A Ace L. Hopewell.

7 Q Where do you reside?

8 A 1020 South Mariposa, Los Angeles, California.

9 Q What is your occupation?

10 A Fern carpenter.

11 Q Are you employed by the Bureau of Power & Light?

12 A Yes sir.

13 Q BY MR. SCOTT: Where were you about ten or eleven
14 o'clock on the night of March 12th?

15 A At about ten o'clock I was on the road between Universal
16 City and Saugus and I continued on up the canyon.

17 Q How were you traveling?

18 A On a motorcycle, and I stopped at Saugus and took some
19 coffee. I never noticed the exact time, and the night was cold,
20 and I got some coffee and never noticed the time when I went on
21 up the canyon. I never met anybody in going up the San Francis-
22 quite Canyon and I would judge just by estimating my running
23 time--- I was driving slower that night than usual, but as an
24 average thing I make it in about an hour and three-quarters from
25 my home. I figure that night it took me about two hours.

26 Q At what time did you leave your home?

27 A A little after nine and stopped at Universal City, and
28 left Universal City about half past nine.

29 Q How long did you stop at Saugus?

30 A At a rough guess, twenty minutes.

31 Q Do you recall crossing the road this side of Power
32 House No. 2, crossing the place where the water runs under the
road?

1 A There are several of them there.

2 Q Did you encounter any water before you reached Power
3 House 2, in the road?

4 A No, there was no water in the road.

5 Q Between Power House 2 and the dam did you notice where
6 any water had run over the road?

7 A No, there was no water on the road.

8 Q How often do you go up and down there?

9 A For a while I was traveling it every day and night.

10 Q Did you have occasion to observe this water in the
11 canal between the St. Francis Dam and Power House No. 2?

12 A Yes sir.

13 Q Did you look at it that night?

14 A I never noticed it in particular that night. It was
15 dark.

16 Q You heard no unusual noise from the water flowing in
17 the canal?

18 A No, there was no disturbance of water at all, along
19 the canal, that made any extra noise.

20 Q At what time of night would you say you passed the dam?

21 A Just giving a rough guess it would be between 11:30
22 and 12:00 o'clock.

23 Q Describe how close the road was to the dam, where you
24 were going on your motorcycle?

25 A I went right at the end of the dam on the east side.

26 Q After you left the dam did you hear any noise of any
27 kind?

28 A I heard a rumbling noise. At least I thought I did,
29 and I stopped the motorcycle, and while the motorcycle was still
30 running---- I left the motor running---- I was positive that I
31 heard a rumbling noise.

32 Q About how far north were you from the dam?

1 A I imagine about half way up the lake, about a mile and
2 a half or around that.

3 Q Did you get off of your machine?

4 A Yes, I got off and smoked a cigarette.

5 Q Did you hear the noise before you stopped?

6 A I heard a sort of noise, but thought it was rocks
7 rolling on the hill, and that is what made me stop and look up
8 on the hill.

9 Q What time do you think that was?

10 A I have given the time, as near as I can get at it.

11 Q Do you know whether or not you were in front of Green
12 and Miss Span or behind this fellow Keagy?

13 A There were two cars considerably in the lead of me,
14 which had turned into Power House Construction Camp No. 1, be-
15 cause I seen the lights, although I did not see the cars.

16 Q How long would you say it took you that night running
17 at the rate of speed that you were running with your motorcycle,
18 to travel from the nearest point where you passed the St. Francis
19 Dam to this place a mile and a half, where you heard the rumbling
20 and stopped?

21 A I have never timed myself over that road. I would
22 say ten or fifteen minutes, because that is a crooked road and
23 a fellow cannot ride fast with a sidecar.

24 Q It would be 11:45 or 11:50 when you passed the dam,
25 you think?

26 A I think it was around between half past eleven and
27 twelve. I have no way of checking the correct time.

28 Q In coming up that road, could you have heard any large
29 amount of water if it had been in the channel below, running
30 down in the regular channel below the St. Francis Dam?

31 A Any body of water, yes.

32 Q As much as twenty-five second feet over and above the

1 ordinary leakage?

2 A I think if there had been any extra amount of water
3 going down that canyon that night I would have noticed it.

4 Q How far does the road run from this channel that runs
5 from the St. Francis Dam to Power House No. 2?

6 A You are fairly close to it all the way up the canyon.

7 Q Does your light occasionally shine on the water in
8 front of you?

9 A Yes, the light on a motorcycle turns with the handle-
10 bars, and it travels over a considerable space of country.

11 Q And you would have seen this water?

12 A Yes.

13 Q Say, fifty second feet--- if it had contained fifty
14 second feet between 11:30 and 12:00 o'clock that night, do you
15 think you would have noticed it?

16 A Well, I am a poor hand at estimating water but I know
17 if there had been any extra amount running down there, I would
18 have noticed it.

19 Q There was no water going across the road at any place
20 as you went up?

21 A Absolutely not.

22 Q BY THE CORONER: Did you cross on the dam itself?

23 A No, I go beside the dam, the road that leads along the
24 east side of the dam.

25 Q You ~~were~~^{not} ever towards the west end of the dam?

26 A No.

27 Q Was there any light on the dam?

28 A No light. I think I would have noticed it.

29 Q Could you see the dam except by your own headlight?

30 A Not except by my own headlight.

31 Q It was very dark?

32 A Extremely dark.

1 Q If there had been any persons around there you would
2 not have seen them?

3 A I could not have seen them.

4 Q You did not stop at the dam?

5 A I did not stop at the dam.

6 Q This rumbling noise that you heard you say you thought
7 was a rumbling noise from rocks on the hillside?

8 A Yes, and after I stopped I thought it was nervousness.

9 Q Did you turn your lights on the water in the lake?

10 A No, I did not notice it.

11 Q You think you were about a mile and a half north of
12 the dam at the time that you heard this?

13 A I think so.

14 Q Is Power House No. 1 situated at the head of the lake?

15 A It is some distance.

16 Q BY A JUROR: Do you know what time it was when you got
17 up to Power House No. 1?

18 A No sir.

19 Q BY MR. DENNISON: How long would it take you to go from
20 Power House No. 1 to the dam itself?

21 A I never have timed myself.

22 Q Was it by Power House No. 1 that these people who were
23 ahead of you, that these people turned in?

24 A The people that were in the lead of me turned in at
25 Power House No. 1.

26 Q Then you passed the dam, is that right?

27 A No, it was while I was along the dam there that I seen
28 the lights turning into the camp.

29 Q You figure it must have been about ten minutes to twelve
30 when you passed the dam---- is that your best calculation now,
31 looking back at it?

32 A My best calculation.

1
2 Q You feel that you must have gone about a mile and a
3 half in ten minutes on your motorcycle?

4 A Yes.

5 Q Do you know what that would be in an hour?

6 A That is a mountain road. I can make sixty miles an
7 hour in the open, but a car can beat me on that road.
8
9

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11
12 **ELMERE E. STEEN, being**
13 first duly sworn, testified as follows:

14 BY THE CORONER.

15 Q Please state your full name.

16 A Elmere E. Steen.

17 Q Where do you reside?

18 A 135 Hazelton Street, Hawthorne, California.

19 Q What is your occupation?

20 A Rigger.

21 Q Are you employed by the Bureau of Water & Power of Los
22 Angeles?

23 A The Bureau of Power & Light.

24 Q BY MR. SCOTT: Where were you on the night of March
25 12th, 1926?

26 A I went down the San Francisquito Canyon.

27 Q Where do you work?

28 A At Power House 1, in the construction camp.

29 Q Who did you have with you in going down San Francis-
30 quite Canyon that night?

31 A Miss Span.

32 Q Were you driving her automobile?

A I was.

Q To what place did you drive it?

1 A To Mrs. Berry's.

2 Q Then where did you go?

3 A To Newhall to get some gas and oil.

4 Q How long did you stay at Newhall?

5 A About half an hour. Time enough to gas up and oil up.

6 Q When you get back to Mrs. Berry's place, it was about
7 what time?

8 A 11:30.

9 Q Do you know where the end of the canal is, at Mr.
10 Berry's place, the creek bed?

11 A It is right in front of the house.

12 Q How many feet from the place where you stopped your
13 car in front of Mr. Berry's house on the night of March 12th?

14 A Fifty feet.

15 Q What time was it when you let Miss Span out of your
16 car at that time?

17 A When I looked at my watch it was 11:30 and we stayed
18 there probably five minutes after that.

19 Q Did you have occasion to look over at this creek?

20 A We were sitting alongside of the machine and talking
21 for five or ten minutes.

22 Q Did you see any unusual amount of water in this creek
23 bed?

24 A There was nothing unusual. We crossed it many times
25 in going to Newhall.

26 Q Was it running in the natural channel at that point?

27 A The natural creek bed.

28 Q That is below Power House No. 2?

29 A Below Power House No. 2.

30 Q Was there as much as twenty-five second feet of water
31 passing at that point; if there had been would you have noticed
32 it?

1 A I think so.

2 Q If it had been as much as fifty second feet, would you
3 have noticed it?

4 A I think it would have run over the road.

5 Q Assuming there had been seventy-four second feet of
6 water there at twenty-five minutes to twelve o'clock, at that
7 point, you would have noticed it?

8 A The canyon would not have accomedated it at that point.
9 It would have gone over the road.

10 Q When you left there at 11:25, what time did you arrive
11 at the dam?

12 A Probably thirty-five or forty.

13 Q Did you have occasion to look at the channel bed as
14 you went up?

15 A The road is parallel with the concrete channel there.

16 Q How far from it?

17 A Probably ten or twenty feet.

18 Q If there had been as much as twenty-five second feet at
19 any place between Power House No. 2 and the St. Francis Dam,
20 would you have noticed it?

21 A I think I would.

22 Q Did you notice any such amount of water?

23 A Nothing unusual at all.

24 Q Even right at the dam, did you notice anything unusual?

25 A No, I did not.

26 Q BY MR. DENNISON: Did you pass the dam frequently?

27 A Nearly every day.

28 Q When was the road closed across the dam? When did they
29 put those barriers up?

30 A It has never been closed when I have been up there.

31 Q Did you see any barriers on the road which crosses the
32 dam itself?

1 A Do you mean over the crest of the dam?
2 Q Yes.
3 A I was never over on the other side of the dam.
4 Q Just about how much water---- did you notice that water?
5 A I did not notice any in there.
6 Q Did you see any water at all?
7 A No.
8 Q Was the creek dry?
9 A No, there is water coming through there all the time,
10 a few inches.
11 Q How much less than there was on the day before?
12 A I did not pay any particular attention to it.
13 Q You did not pay any particular attention to it at any
14 time?
15 A I would have noticed if there was anything unusual.
16 Q BY THE CORONER: How wide are the culverts crossing the
17 stream?
18 A We put in some a couple of months ago, which were about
19 four feet in diameter.
20 Q As you crossed over these coming back from Newhall that
21 night, you did not notice the water?
22 A I did not.
23 Q And the bridges or culverts were not wet on the surface?
24 A No.
25 Q BY MR. SCOTT: Do you know whether young Ace Hopewell
26 was ahead or behind you?
27 A I think he was probably behind me. There was myself
28 and Keagy were the two last ones into camp.
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30
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32

C. C. RUBLE, was recalled

1 and testified as follows:

2 Q BY MR. SCOTT: You are connected with the Bureau of
3 Power & Light at Power House No. 1?

4 A The All power plants of the Bureau.

5 Q And you have charge of them?

6 A ----- of power and light.

7 Q Were you the Chief Operator?

8 A Superintendent of power plants.

9 Q I have a map here that I would like you to identify.
10 What does this map, L-150, represent?

11 A It is a blueprint of our survey of the canyon, especially
12 of the buildings and contour of the country around Power House No.
13 2, before this dam was built.

14 Q Were the men employed in Power House No. 2, domiciled
15 in the clubhouse?

16 A Single men only.

17 Q At what time did the shift change that night?

18 A 11:00 P.M.

19 Q Where did the men reside that changed on that shift at
20 Power House No. 2?

21 A One of the men, a single man, lived at the Clubhouse,
22 and L. Burns, working on the switchboard shift, was living in
23 this house and Carl Mathews here.

24 Q There were three men working there?

25 A Yes, in the shift.

26 Q Where would they cross San Francisquito Creek or the
27 channel at that point, to go to work?

28 A These men living at the clubhouse would not cross the
29 channel at all.

30 Q And the other two men?

31 A These men would go down this side of the canyon and
32 cross on a concrete bridge here over the conduit, and the road

1 of this man would be here, crossing in the same place.

2 Q Would there be any light on that bridge?

3 A One light.

4 Q What was the capacity?

5 A 200 watts.

6 Q Would that be sufficient to light up the water in the
7 channel?

8 A Yes, that section was ^{very} well lighted up by a 200 watt
9 light.

10 Q Was the watchman on duty at this point?

11 A Not at this point. The watchman's station was at the
12 clubhouse when he patrolled the section.

13 Q Where did he report in?

14 A To the operator at Power House No. 1.

15 Q But in the event of any trouble down there?

16 A Still report to the operator on shift and they would
17 report to control station No. 1.

18 Q What was that watchman's duties?

19 A To patrol the camp and watch for anything unusual and
20 see that the lights were turned on in the evening and turned off
21 in the morning, and to look out for fire.

22 Q BY THE CORONER: Did his patrol also extend to the dam?

23 A No. This map represents the territory of the Bureau
24 of Power & Light.

25 Q BY A JUROR: This watchman was lost in the flood?

26 A Yes sir.

27 Q BY MR. SCOTT: Describe the road where it crosses the
28 creek down below and describe it all the way up?

29 A This map, although accurate, has the date on it of 1923,
30 and there is one change in the road down here (indicating). We
31 have rerouted this in after years. This point is where the Water
32 Department's conduits ended. There were diversion gates here to

1 divert the water.

2 Q BY MR. MOHR: Do you know anything about the diversion
3 of the water on the day preceding the failure of the dam, on the
4 afternoon that the logs were put in?

5 A That putting in of those stop logs had nothing to do
6 with any diversion. That was a precaution in case of a high
7 wind piling up the water behind the dam and carrying rubbish
8 down into the aqueduct.

9 Q As a result of that operation was there any increase
10 of the water below that point?

11 A No. There were stop logs across the bottom of this
12 opening all the time.

13 Q Do you know whether there was any discharge of water
14 through Drinkwater Canyon?

15 A There was slightly over one second foot that was due
16 to some water which was taken from the underground flow of the
17 canyon during the construction days in an agreement with the
18 ranchers. After measuring the water every month over a period
19 of two years, we decided to leave them that amount as agreed
20 upon down here.

21 A JUROR: I wanted to get the capacity of those ten pipes
22 to carry water before the disaster. When was that water turn-
23 ed into the stream bed?

24 A I have no record of that.

25 MR. ROBINSON: That power house was of the turbine type?

26 A Yes. There was twenty-five feet between the floor
27 level of the generator room and the turbine.

28 Q BY MR. SCOTT: Give the length of these three ten
29 inch pipes under the road where the creek crosses the road?

30 A I believe they were fourteen feet long.

31 MR. ROBINSON: Aside from those three pipes, did the road
32 embankment constitute a dam across the creek? Was there any
other opportunity for the water to cross that canyon other than

1 either to go through the pipes or else to flow over the crossing.
2 is that correct?

3 A Yes.

4 Q Will you describe the form of the cement conduit above
5 Power House No. 2?

6 A I have nothing to do with the construction or operation
7 of that end of the work and cannot give you that.

8 Q BY A JUROR: When these stop logs were put in here, it
9 caused all the water to go down the creek bed and pass through
10 these pipes?

11 A Yes.

12 Q And if there was an extra heavy flow of water it would
13 flow over that bridge?

14 A Yes sir.

15 Q BY MR. MOHR: If there was fifteen second feet of
16 water turned into Santa Clara Creek, the aqueduct or the St.
17 Francis Reservoir would have been turned in at this point down
18 here (indicating)?

19 A Yes. In fact, the crossings below this point have
20 larger pipe in them.

21 Q BY MR. SCOTT: Did you ever notice any water whipping
22 over the top of the dam in the month of February and note its
23 effect on the chart or gauge that the City maintained on the top
24 of the St. Francis Dam?

25 A Yes, I made a note. In fact, I kept a daybook of the
26 events of each day, in connection with my work, and I believe on
27 February 26th I made a note of some special work that I had done
28 at Power House No. 2 and in coming down the canyon on that day
29 I noticed quite a bit of water whipping over the dam and there
30 was a heavy north wind blowing and that being a Sunday I came
31 into Los Angeles that night and at the offices in the morning I
32 checked up the elevation and found the elevation was approximate-

1 ly a foot and a half below the crest of the dam, and remarked at
2 the time that it was building up quite a bit to throw a stream
3 of water over the top.

4 Q You say that during the wind the water built up at the
5 end of the dam, a foot and a half?

6 A Not as a solid stream. Just the crest of the waves
7 whipping over, but the total length of that crest amounted to
8 quite some water.

9 Q Did you ever examine the charts of that day to deter-
10 mine what effect it had registered on the chart?

11 A I asked for that chart yesterday and noticed that it
12 checked with my observations. The mark on the chart ^{showed} an
13 irregular line on the chart on that day. It showed an unevenness
14 on the chart.

15 Q BY A JUROR: Within what range?

16 A I did not estimate that, not knowing the scale.

17 Q What is the recording length of that chart itself in
18 the machine? How long is the duration of that chart?

19 A (By Mr. Robinson) It is a continuous sheet for one
20 year.

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25 CHARLES H. LEE, being

26 first duly sworn, testified as follows:

27 BY THE CORONER.

28 Q Please state your full name.

29 A Charles H. Lee.

30 Q Where do you reside?

31 A Berkeley, California.

32 Q What is your occupation or profession?

A Consulting hydraulic engineer.

1 Q Are you identified with the Bureau of Light and Power
2 of Los Angeles?

3 A Only as consulting engineer.

4 Q BY MR. ROBINSON: Will you please state, Mr. Lee,
5 briefly, your experience as an engineer and your past connections,
6 and so forth?

7 A I have had some twenty-five years experience as a
8 civil and hydraulic engineer. The experience has included em-
9 ployment in the United States Geological Survey on stream gaug-
10 ing work and general hydraulic work and also for the City of Los
11 Angeles, Aqueduct Bureau, on both civil engineering and hydraulic
12 engineering work. Since 1912 my engineering experience has been
13 as a private consulting engineer, and also as a civil and hydrau-
14 lic engineer until the present date, and has included activities
15 throughout the State of California and on irrigation and hydro-
16 electric power and municipal water supply and also over two years
17 service during the War.

18 Q In what capacity?

19 A As Captain in a water supply regiment, eighteen months
20 of service in France.

21 Q Will you state briefly some of the companies or interests
22 for which you have done consulting work in recent years, since
23 you have been in general consulting practice?

24 A The Spring Valley Water Company of the City of San Fran-
25 cisco, the Vulcan Water and Land Company, in San Diego County-
26 County the Sweetwater Water Company and the Guaymas Water Company.

27 Q Have you not also had some work recently on San Fran-
28 cisco Bay?

29 A During the past two years I have been consulting
30 engineer for the City of Oakland and also for Berkeley in the de-
31 sign of storm sewers.

32 Q Where do you maintain your office?

1 A In San Francisco.

2 Q Have you at any time held any official position in
3 the State Service?

4 A Yes, for two years I was President of the State Water
5 Commission of California and later Chief of the Division of Water,
6 of the Department of Public Works, State of California.

7 Q In the practice of your profession you have devoted a
8 very considerable time to the study of the flow of water?

9 A Yes, both surface and under-surface flow.

10 Q And have made some various very extensive studies along
11 that line?

12 A Yes.

13 Q Have you made any computation as to the carrying
14 capacity of the pipe lines referred to by Mr. Ruble, as existing
15 under the road in the San Francisquito Canyon at the two cross-
16 ings at which there were ten inch pipes, fourteen feet long,
17 buried approximately a foot below the surface of the road?

18 A Yes. The capacities of the pipes, of the three pipes,
19 at each crossing, would be from ten to twelve cubic feet per
20 second, depending upon the submergence.

21 Q If more than ten cubic feet per second were passing
22 down that creek at the point of either of these crossings, what
23 would be the effect?

24 A The water would be raised to the surface of the road
25 and would flow over the road.

26 Q Have you made any study of the length of time it would
27 take these increased flows down the conduit from the St. Francis
28 Dam to Power House No. 2, to travel down that conduit, supposing
29 there is an increase in flow at the dam,---- have you made a
30 study to determine how long it would be before that increase
31 would appear at Power House No. 2?

32 A Yes sir.

1 Q Will you state what these studies have been and what
2 they show?

3 A The studies consisted of an examination of the design
4 drawings and also a confirmation of the fact that the canal as
5 constructed from the St. ~~Francis~~ Francis Dam to Power House No. 2,
6 was in accordance with these drawings, and a hydraulic study of
7 the section and determination of the velocities of the various
8 flows in the canal. The result of such studies indicate that a
9 flow increasing from the normal flow which, as I am informed, was
10 a two or three second foot flow, increasing to twenty-five second
11 feet, would reach Power House No. 2 opposite from the St. Francis
12 Dam in about eighteen minutes and would reach the first culvert
13 crossing below in about nine additional minutes, a total of about
14 twenty-eight minutes; from the dam to the first culvert an in-
15 creasing flow up to fifty second feet would reach Power House No.
16 2 in about sixteen minutes and the first culvert crossing in about
17 twenty-four minutes; a flow increasing to seventy-four second feet
18 would reach Power House No. 2 in about fourteen minutes and the
19 first culvert crossing in twenty-two minutes, and a flow increas-
20 ing to one hundred second feet would reach Power House No. 2 in
21 about thirteen minutes, and the first culvert crossing in about
22 twenty minutes.

23 Q That is as far as you carried these studies?

24 A I have carried them to the second culvert crossing be-
25 low.

26 Q As far as increasing quantity rather than distance?

27 A Yes, I made some studies of the amount up to the capacity
28 of the canal.

29 Q What was the capacity of the canal?

30 A The capacity of the canal was 1580 second foot flow
31 without any freeboard. The time for passage of water with a full
32 section would be in the neighborhood of seven or eight minutes.

1 Q So that as the quantity increased the time element
2 would be shorter?

3 A Yes, the time for the full section from the dam to Power
4 House No. 2 would be seven or eight minutes for a full section.

5 Q If it was assumed that seventy-four or seventy-five
6 second feet of water began somewhat suddenly to pass under or
7 around the St. Francis Dam, and, from your knowledge of the con-
8 ditions in the canyon, would you say that it was possible for that
9 quantity of water to so pass without the greater part or sub-
10 stantially all of it appearing in the surface channel below the
11 dam?

12 A No, the water would appear in the surface channel there.
13 That formation would be such that it would be unable to carry the
14 water without it showing either in the walls of the canyon in the
15 west conglomerate or on the east in the schist or in the gravel
16 beds.

17 Q Without going into minute detail or any such thing, can
18 you give some sort of an idea to the jury of the extent to which
19 you have studied and investigated the question of the movement of
20 waters through the ground?

21 A I have measured the movements of water through the
22 ground by the accepted methods, electrical contacts, with wheels
23 in the path of the underground current and am familiar with all
24 the various methods of making it, and also familiar with the water
25 plane and saturation of various formations.

26 Q Isn't it probably true that you have devoted at least
27 as much, if not more, time to the study of underground waters than
28 any other engineer in the State of California?

29 A More than half of my experience of twenty-five years has
30 been on underground water.

31 Q You have specialized very decidedly in that branch of
32 engineering work?

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A Yes.

Q BY A JUROR: Was that ^{uniform} ~~a~~/gradient from the dam to Power House No. 2?

A No, the gradient varied. It was .010 from the dam to about 1600 feet, and from there on it was steeper and the gradients, as I have computed them, were for the first 1600 feet, the flatter section, so that the velocities would be greater for the balance of the distance and the time consumed less, but the determinations which I have given you are for the first sixteen hundred, the flattest grade.

Q You had expected to produce here in connection with this testimony, a map showing the grade of that conduit, but, inadvertently, it has not been brought. Can you illustrate on the blackboard the shape of that?

A (Witness draws a diagram on the blackboard) I am now drawing on the blackboard the approximate shape of a cross section of the concrete canal, and am showing the concrete lining, and the bottom section.

Q The increase in the flow in such a channel as that would be very much more noticeable than in a narrow channel?

A Yes sir.

Q BY A JUROR: Have you given thought to the matter in which fifty to one hundred second feet of water could escape from the dam, without notice over a period of some hours?

A I have given considerable thought to it.

Q What ideas have you formed as to the possibility of that having occurred?

A My view is that it could not have occurred.

Q In your studies of flows through gravel beds--- I am not referring to limestone cavernous passages, but to the gravel stream beds of California--- what has been the fastest speed of flow that you have recorded that might be comparable to this

1 St. Francis Dam Channel?

2 A Do you refer now to the gravel field of the canyon
3 bottom?

4 Q The gravel field flow.

5 A My observations---- actual results indicate velocities
6 of three to four feet per day on a slope not quite as steep as
7 that canyon. The highest recorded rate---- recorded in any
8 engineering report or literature on the subject is ten feet per
9 day in a rather steep gradient and rough, coarse and porous
10 material of fairly uniform size. The range from that highest
11 one on down can be found where the conditions permit. It depends
12 upon the local conditions. With the slope of that canyon and
13 the material which formerly occupied the canyon bottom possibly
14 six to ten feet a day might be possible.

15 Q Regarding the flow through the fault lines which might
16 not be ~~kit~~ noticed running through the valley, more or less in
17 the bed of the valley or partly on the hillside, do you think it
18 would be possible for a substantial flow to be set up through a
19 fault line, fifty to one hundred second feet of water?

20 A Not in the fault lines which I observed there. I
21 examined the faults which have been uncovered by the flow of
22 water at the dam site, within the past two weeks. I have exam-
23 ined them and they are filled with very tight material, which
24 the geologists call gouge, and there is no appearance of open
25 spaces in the faulty pieces between the two materials, so that
26 the opportunity to flow within the space between the two forma-
27 tions would not occur in there at all.

28 Q Did you have an opportunity to make any study of the
29 possible velocity of the water through the western wing of the
30 dam, through the conglomerate?

31 A I have given attention to that, yes.

32 Q Did you form any opinion or come to any conclusion?

1 A The material which has been termed the red conglomerate
2 is not porous at all. It is what you call a very tight material.
3 The porosity of these samples is from two to three percent an
4 hour stream gravels in Southern California and throughout the
5 state run from thirty to thirty-five percent, so that material
6 is what we would call a very tight material; one in which there
7 is a percentage of very fine clay. The movement of water
8 through the clay is exceedingly slow, a matter of a few feet
9 inches a year, and with the percentage we know exists in that
10 red conglomerate and the low porosity it is my idea that the move-
11 ment of water through that material in its solid state would be
12 very slow indeed, a matter of just a few feet or inches a year.

13 Q Then, that being the case, if you were to drive a
14 tunnel into the western side you would find it dry inside?

15 A That would depend entirely upon whether there were
16 fractures or seams. A fracture or seam might permit of the en-
17 trance of water at a more rapid rate. When I speak of the
18 material it is in the unbroken formation. I refer to a block
19 of material without seams or fractures. If a tunnel should be
20 run into the hill from the west side of the dam or just under
21 the dam, it would undoubtedly show moisture, in my opinion.

22 Q BY MR. ROBINSON: Are the rates of movement of water
23 through soil, controlled at all by the hardness of the soil or
24 rock or whatever it may be, or is it controlled by the size of
25 the grains, so to speak?

26 A The rate of movement is controlled by the size of the
27 grain and the slope of the saturated plane. The top surface of
28 saturation.

29 Q So that an exceedingly hard formation might permit
30 water to pass through and an exceedingly soft one might be very
31 resistant to the transmission of water?

32 A That is true. That depends entirely upon the existence

1 of fine material.

2 Q BY A JUROR: In your investigation did you notice a
3 crack that ran directly down from the end of the abutment to the
4 base of the dam, twenty-five feet deep that you could drop a
5 plumb bob down? Was that crack wide enough for a large velocity
6 of water to go through?

7 A I did not see that particular crack.

8 Q Did you see any cracks there?

9 A Nothing of that kind. I saw seams. The rock was
10 seamed in different directions.

11 Q Did you make an examination for cracks?

12 A Yes, I examined the western face for possible seaming
13 or cracking.

14 Q There was testimony that there was a crack that you
15 could drop a plumb bob down with a twenty-five foot string on it
16 and running directly down from the top of the abutment and that
17 the water converging through that crack from the seepages through
18 the conglomerate and accumulating in that crack, could come down
19 to the foot of the dam. Did you see any indication of that
20 crack or a crack which had been scoured out by the water?

21 A No, no such crack as that.

22 Q What has been your experience in the leaching of
23 cementing material by water, at very slow velocities, ^{through,} ~~due,~~ per-
24 haps, material somewhat similar to this matrix that was the
25 binding material in this conglomerate? In other words, the
26 rate of leaching, the rate of dissolving of such material?

27 A In order that material may be dissolved it must be
28 what we call soluble in water, and the matrix or cementing
29 material of the conglomerate seemed to be more of a clay nature,
30 which is not soluble. Clay to be removed would require a
31 certain velocity of movement, which is considerably greater than
32 any possible rate of movement through that formation.

1 Q Assuming that the leakage amounted to two second feet?

2 A If the leakage amounted to two second feet, and assum-
3 ing that that was the total throughout the length of the dam?

4 Q No. Centered at a point---- one second foot at one
5 point, for example?

6 A One second foot gathered at one point from a number of
7 different fissures?

8 Q That would probably be in the foundation itself.

9 A That would represent the flow through certain seams
10 undoubtedly, and if the flow was from a width of, say, the west
11 abutment west of the fault line.

12 Q Assuming that the velocity of the water was an inch a
13 second, for example, over that section, would you expect the
14 erosion or scouring to carry away the cementing matrix of the
15 conglomerate?

16 A An inch a second would be five feet per minute. Ordin-
17 arily the surface flows in canals of five to six feet per second,
18 will move ordinary conglomerate; will begin to cut it. Where
19 it is flowing through a formation, as the assumption is here,
20 and it is the fines that are to be removed, ^{rather} than the masses, as
21 a whole that velocity would be less, possibly half a foot per
22 minute or a foot per minute. Velocities ^{that} in/ the neighborhood
23 might be begin to move those fines. That assumption would have
24 to be made regarding any actual movement there or any other
25 matter.

26 Q It is your opinion--- you have seen the west side of
27 that west embankment---- is it your opinion that that would be
28 dissolved in a period of one or two years of rains?

29 A It is my opinion that it would not be dissolved in one
30 or two years of rain, and my opinion is based on the fact that
31 there are cliffs and domes that have been standing there since
32 long before the country looks like what it is now.

1 Q Are you a geologist?

2 A Insofar as ground water is involved, I have studied
3 geology and the bearing of water on the earth formations, both
4 rock and alluvial formations, and that has necessitated geological
5 studies, and I have made it a part of my equipment.

6 Q Have you ever been consulted about the geology of a
7 site where it was contemplated to build a dam?

8 A No, not specifically.

9 Q In your opinion, do you think that the leakage in this
10 particular case through that conglomerate in the west wing did
11 actually take out the cementing material from that conglomerate
12 to the extent of weakening it in order to induce failure?

13 A Not the cementing material in the conglomerate itself.
14 No, in these fines, there is clay, which is the cementing material
15 of conglomerate.

16 Q Anything else besides the cementing material, which
17 might have been taken away?

18 A The passage of the water through the seams did not re-
19 move any of the fines, judging by the statements which I have
20 heard, that the water was clear. The fines as they came out,
21 would begin to show cloudy and muddy and if that water was clear
22 the fines were not being removed. If there was any soluble
23 material in the seams that would not show muddy, of course. That
24 might be in the water if it was clear.

25 Q It is your information then, that this formation, such
26 as shows out there, is something that would be suitable to build
27 a structure of this kind on, is it?

28 A I have not formed an opinion upon that.

29 Q BY THE CORONER: Did you form an opinion as to the cause
30 of the failure of the St. Francis Dam?

31 A No, I have not; there are several ways by which it might
32 have failed, but I have not formed an opinion as to how it did

1 fail.

2 Q Are you employed by the Bureau of Water Supply of the
3 City of Los Angeles, to make an investigation of that failure?

4 A I am employed as consulting engineer by the Bureau on
5 other matters, and was in Los Angeles and have been in Los
6 Angeles, for the last two weeks, and incidentally have been ask-
7 ed about specific things, making investigations of them, but
8 not of the St. Francis Dam, as a whole, or the failure of the
9 as a whole, but there were certain specific things.

10 Q BY A JUROR: Considering the west hill ^aas/whole, as
11 you have seen it and perhaps knew it before the dam was construc-
12 ted, would you consider the water might seep through the various
13 cracks that you might find in such a hill? Might possibly
14 soften the hill to some extent?

15 A That is a possibility. I have not examined any
16 samples---- that is, which I have placed in water. I have not
17 made any examination of samples placed in water, so that I cannot
18 give give a definite opinion upon it as to whether it would be
19 softened in water or not.

20 Q Would you consider that the hill might possibly become
21 saturated by water, if not softened, considering all the cracks
22 which you would expect to find in a hill of that character?

23 A If the hill became saturated--- and by the hill, I pre-
24 sume you mean that portion of the hill beneath the dam on the
25 west side---- if it became saturated water would appear ultimate-
26 ly at all points along the base or, I should say, a moisture
27 and a seepage, along the ^{downstream} /downstream toe of the foundation beneath
28 the dam, if it became completely saturated. I did not examine
29 the dam before the failure and don't know the condition along
30 the full length of the toe. If it became saturated it certain-
31 ly would show along its length. The water, if it did show,
32 would have seeped up along the toe of the dam. That is, from

1 beneath the dam having saturated to the downstream toe, and the
2 water would then appear by flowing up along the face and out on
3 the steps, and that would appear throughout the full length.

4 Q Would the water be muddy?

5 A It would depend entirely upon the movement through
6 the ground. If the velocity was such as to move the fines it
7 would be muddy, and as long as the water was clear it would in-
8 dicate that the clay was not being moved.

9 Q Small areas may have become saturated without it show-
10 ing as a muddy effect?

11 A The areas beneath the formations within the dam may
12 have become saturated---- if these small areas of, say, ten to
13 fifteen feet in length, extended across the dam---

14 A Yes, as I understood it, there were certain cracks
15 that appeared on the downstream toe and that meant, of course,
16 that there were zones or strips or areas behind these leaks which
17 were saturated. How far they extended out on either side of a
18 seam or line of seams it is impossible to determine.

19 Q Could there be any estimate that you might make on
20 that?

21 A I could not make such an estimate as I did not see the
22 leaks or the conditions before the dam failed. I had never seen
23 the dam prior to its failure.

24 Q BY MR. DENNISON: A hydraulic engineer, as I understand
25 it, is one who has to do with the mechanical action of water?

26 A Yes, if the term mechanical includes water at rest and
27 water in motion.

28 Q And with the mechanical action of water upon this forma-
29 tion up there, the hydraulic engineer has nothing to do with that,
30 has he?

31 A A hydraulic engineer who practices in underground water
32 and in municipal water supply does come into contact with the

1 mechanical action of water.

2 Q What would be the mechanical action of water on that
3 hill?

4 A As I have explained, the hill is made up---- I presume
5 you refer to the west hill?

6 Q Yes.

7 A It is made up of a conglomerate with some fine clay in
8 it and the action of water, the mechanical action of water,
9 upon the conglomerate and upon clay, is nothing. There is no
10 action that I know of.

11 Q You did not make any test of it?

12 A No.

13 MR. SCOTT: I desire to offer in evidence the profile in
14 plan of the outlet conduit No. 2 of the St. Francis Dam. It is
15 made by the Engineering Department.

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18
19 HENRY SILVEY, being

20 first duly sworn, testified as follows:

21 BY THE CORONER.

22 Q Please state your full name.

23 A Henry Silvey.

24 Q Where do you reside?

25 A Power House No. 1.

26 Q What is your occupation?

27 A Operator.

28 Q BY MR. SCOTT: Where were you on the evening of
29 March 12th, 1928?

30 A About 6:30 or 7:00 o'clock I was in Santa Paula, Ven-
31 tura County.

32 Q At what time did you reach the San Francisquito Canyon?

1 A I reached Saugus about eight o'clock and stayed in
2 Saugus approximately ten minutes and then continued on up the
3 canyon to Power House No. 1.

4 Q Did you note any water over the road at any point
5 going up?

6 A No sir.

7 Q Did you note any extra amount of water in the conduit
8 on San Francisquito Creek?

9 A No sir, I did not. I had a good chance to observe
10 it at that time, because there was a car following fifty or
11 seventy-five feet behind me and on the curve just above the
12 plant his headlights fell directly on the ditch and I was watch-
13 ing the approach of this car behind me, and incidentally looked
14 at the ditch.

15 Q At what time of night?

16 A About nine o'clock.

17 Q Did you stop at power house No. 2?

18 A No sir.

19 Q You continued to where?

20 A Power House No. 1.

21 Q At what time did you arrive at Power House 1?

22 A About 9:25.

23 Q At what time did do you think that you passed the St.
24 Francis Dam?

25 A It must have been around nine o'clock.

26 Q Was anyone with you?

27 A My wife and children.

28 Q What position do you hold there at Power House No. 1?

29 A Operator.

30 Q Did you have any occasion at 11:47 P.M. on March 12th,
31 1928, to talk from Power House No. 1 to Power House No. 2?

32 A Yes sir, I did check the load with Power House 2,

1 Q Explain what you mean?

2 A We have a system of balances over there between the
3 two plants. We have a high mark and a low mark on the surge
4 chamber of Power House 2, or did have at that time, and we would
5 check the load at Power House 1 and two, and maintain it between
6 those two levels.

7 Q Do you know what time of night it was that you were
8 talking over the phone?

9 A Yes sir, 11:47.

10 Q How do you know?

11 A I was looking directly at the clock and made a state-
12 ment to Lou Burns of the fact, and he said it would make no
13 difference about changing the load at that time, because we would
14 have to do it at midnight anyway.

15 Q Lou Burns?

16 A Yes, the operator at Power House 2.

17 Q What, if anything, did he say to you out of the ordin-
18 ary?

19 A Nothing.

20 Q Tell the jury what the conversation was?

21 A Just ordinary conversation. He was joshing me about
22 my day off. There was nothing pertaining to business except as
23 to the water level at Power House No. 2.

24 Q BY MR. DENNISON: You had passed the dam about nine
25 P.M.?

26 A Yes.

27 Q Did you notice whether that road that crosses the dam
28 had been closed up?

29 A No sir, I did not.

30 Q Have you a baremeter at Power House 2?

31 A I don't know.

32 Q Where do you work?

1 A Power House 1.
2 Q Have you a baremeter there?
3 A Yes sir.
4 Q Were you expecting any storms?
5 A Not anything---- not a great disturbance of any kind.
6 The barometer was dropping slightly.
7
8
9

10 FRANK RIEBER, being first
11 duly sworn, testified as follows:

12 BY THE CORONER.

13 Q Please state your full name.

14 A Frank Rieber.

15 Q Where do you live?

16 A Berkeley. My office is in San Francisco, 170 Second
17 Street, San Francisco.

18 Q And what is your business, occupation or profession?

19 A Consulting engineer, specializing in geophysics.

20 Q BY MR. SCOTT: From what school are you?

21 A University of California.

22 Q How long have you been specializing in geophysics?

23 A About five years.

24 Q And that field includes what?

25 A In general, the application of physics to the study
26 of the earth's crust.

27 Q Have you made a study of the St. Francis Dam disaster
28 at the request of the Department of Water & Power?

29 A I have.

30 Q Are you now prepared to present the result of your
31 studies on that subject, to the jury?

32 A The studies are still continuing to some degree, but

1 I could present what I have arrived at to date, yes.

2 Q I wish you would do that now, in your own way.

3 A I had this model made to illustrate because I found
4 great difficulty myself in trying to identify some of the facts
5 there. This model represents the dam as it is now fractured.
6 The red parts represent the parts that we have not account^{-ed}/fer
7 at all. They may exist in large or small fragments down the
8 stream or they may be buried. In studying the possibilities
9 here I was told, first, of the rather widely accepted theory,
10 which has a number of possible points in its favor, that this
11 material had fractures in it and that the fractures permitted
12 the passage of water, and that the water came through there very
13 slowly at first and then for some reason increased and dug out
14 the sides of the dam; that later the water came around here and
15 undercut the dam in some way and this part (indicating) fell in.
16 After a while I began to see some points that did not seem to
17 indicate that that had happened and I thought that before trying
18 to place a first cause for this thing, it might be well to see
19 what happened before that and what happened before that, to see
20 where the first action took place, if there was any way of reason-
21 ing it out from the pieces and if we could see where the first
22 action took place it might be possible to at least infer some of
23 the causes which could have made that first action. The con-
24 clusion that I came to after a great deal of study of this thing,
25 and trying all sorts of hypotheses, is that the initial failure--
26 I realize that this is not a theory contest, and feel a certain
27 amount of diffidence in presenting a radical departure from the
28 accepted ideas. I have not reached this conclusion in an inflex-
29 ible way. The first thing I noticed was that on the front of
30 this standing portion in the center of the dam there was a piece
31 of casing which had formerly contained the stilling well. That
32 seemed to be broken and the extremities of it were pointing east.

1 One way of accounting for that was that the water had pushed
2 the pipe out in that shape. Later I found that the pipe had
3 originally been longer than that. There was about thirty feet,
4 more or less, of additional pipe below that, which had formed
5 the complete well, the part of it in under the lower bracket.
6 The lower pipe and lower bracket has gone. That might easily
7 have occurred by a heavy flow of water rushing west and twisting
8 the lower end of the pipe around leaving the piece in the position
9 you now see it. If that was broken by an eastward flow the
10 water could not have been very high in the dam. The westward
11 flow would probably have occurred after the water had gone down
12 under the dam. I don't think it was broken in ~~any~~ exactly way.
13 That inference is very hard to support as an absolute fact, but
14 my opinion is that the break either occurred when the water was
15 down about eighteen or twenty feet, maybe less, and from an east-
16 ward flow or when the water was at thirty-five or forty feet and
17 from a westward flow. Another thing I noticed was that the
18 ~~steam-in-there~~ steam shovel filled in the end of the road and
19 presuming that this wing had gone at first, or as a unit in
20 some way the curve of the water would most certainly cut away
21 that road and the road was not cut away. Therefore, the water
22 must have got down by some other means or it would have cut that
23 road. That would place that distance as about thirty-five or
24 forty feet because you have to allow for the curvature of the
25 water as it comes over the lip of dam. That means that the dam
26 must have lost its water in some way without the failure of the
27 wing. If it did, it possibly could have lost it underneath
28 here in some way. That led to a study of the water chart. I
29 made a study particularly of the exact region of the break. The
30 theory ~~that~~ that there had been a leak which gradually increas-
31 ed in size would dictate that you would have to have ^a ~~the~~ the final
32 record of level going down just before twelve. There would

1 have to be some increase in slope gradually. I was not satisfied
2 with the examination of the original chart and had it under the
3 microscope and had a filter made that would suppress those red
4 lines and it was apparent from that record, after I had had it
5 photographed, that the drop between eight and twelve P.M. had
6 been as nearly uniform as it is possible for a drop to be. There
7 is exactly the same drop between eleven and twelve as between
8 eight and nine. There is no change in that slope at all. Right
9 at the place where the curve turns suddenly downward I found an
10 additional pencil line and my guess as to how it got there is in
11 the manner that it almost got on while I was looking at the
12 record. Somebody might have made a mark on it. The main
13 curve can be seen very distinctly at each place where the curve
14 crosses the red line. The camera was able to remove the red
15 line, but wherever the red crosses the pencil line it is very
16 plain. At twelve o'clock one of the horizontal lines came in
17 and it is wider and you have nice triangular sections where the
18 pencil line overlies the red line. Where the red line was in-
19 terfering it gave a very definite impression that the end of
20 the curve had gone down in this manner, which would have furnish-
21 ed some justification for the idea that however the loss had
22 occurred it had been cumulative. I began to wonder if the
23 failure had not been a little more sudden than that and when I
24 was told that various witnesses had come up the canyon and had
25 not got their feet wet, I began to wonder if the water was run-
26 ning out of the dam at that time. If that original slope from
27 eight to twelve had meant water, it is very funny where the water
28 went. I cannot see any place where it could have gone if it
29 had left the dam. I have not got any much better explanation
30 of that than that the wind pressure against this face had raised
31 the water level slightly. I was told that water was seen dash-
32 ing over that day. If we go back to noon of that sameday and

1 use the microphotograph, which is apparently an easier way of
2 establishing things than by inspection, we find a rise from twelve
3 to two o'clock and then it goes level and then it goes down from
4 eight to twelve. The rate at which that water was rising from
5 twelve to two is exactly the same as the level was from eight to
6 twelve, and if we must get curious about that record it might
7 devolve upon us to explain how that water came up between twelve
8 and two. That water cannot hardly be expected to run into the
9 reservoir and then suddenly stop. There is another possibility.
10 These are only speculations---- that the whole banks of the
11 reservoir might be absorbing water. This reservoir had been
12 filled to the brim for several days and it might have been per-
13 colating into the walls of the reservoir. I don't really feel
14 that that feature is material except as to the relevance, as to
15 the sharpness of that break. If you have a hole being bored by
16 a stream of water you expect that hole to be enlarged and this
17 did not seem to happen. One of the most impressive things about
18 this thing is the difficulty there is in getting it out of there.
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Q BY A JUROR: These were big pieces?

A There is thirty-four and forty-four are down here (indicating), and referring to this (indicating)--- these don't appear in this identical part at all. Forty-four is questionable, the lower part in here (indicating). Thirty-four has not been obtained yet. We are trying to get more evidence on this, trying to make a solid model of that.

Q Did you identify any of these pieces, the large ones, coming from the east side?

A Some of the larger pieces came from the east side. These two (indicating) have been identified, this is thirty-five. There are no large ones down the stream that can be identified as coming from the east side. There is a question on this one (indicating). This piece in here is given as thirty-two. In case that was there, that would be downstream.

Q Where was this white piece, do you know, on the end?

A That was downstream, that is number forty, thirty-two and thirty are downstream.

Q Where was that pile of dirt?

A On that fill, you can see the water cut right along, right this side of it is the road.

Q Where is the dirt?

A This dirt is the road itself, the fill they made to make the road. The highest place you can see is sixty-five feet below the top of the dam.

Q Where is that other picture?

A Right here--- I have three exhibits, here is the enlargement made, here is the tracing I made.

Q BY DISTRICT ATTORNEY: When did you make this photograph?

A Clark Sellers.

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Q A Private detective, Mr. Sellers?

A He is a document expert.

Q He is a detective?

MR. SCOTT: No, I think he is not.

DISTRICT ATTORNEY: I found out he is a private detective.

Q BY MR. ROBINSON: May I suggest to Mr. Rieber that he illustrate on the blackboard what he meant by his rather brief explanation as to the method by which the blocks can be identified, by what he referred to as the radial marks?

A The man to explain that is the man that knows the most about it. Here is Mr. Proctor.

MR. ROBINSON (Addressing the Coroner): Do you wish to have that now?

THE CORONER: If you think it fits in here now.

MR. ROBINSON: I think it will tend to show what certainty there is in the identification of the blocks.

R. R. PROCTOR, having been previously duly sworn, was recalled and testified as follows:

MR. PROCTOR: I will draw a sketch of only a short section of the dam. (Witness at blackboard drawing a sketch). I have drawn a section of the dam illustrating the top roadway and a few steps, downstream face of the dam. To construct this dam, it is necessary to have definite points around the arc, and various circles, in order that they may be constructed properly. The length of twelve and one half feet along the center of the top section or roadway was adopted as a base--- that would be twelve and one half feet. Now, the entire structure being radial, on a given radius point, as these points were set, the various elevations, twelve and one half feet would become less.

1 I will draw another view of the structure at a certain elevation--
2 the distance between points set would be twelve feet, certain
3 elevation would be 11.9 feet or thereabouts, and by means of the
4 distance between these construction points, which are still
5 visible, we are able to determine the exact elevation in that
6 particular step in the structure without any doubt.

7
8 Q BY THE CORONER: Have you examined the report sub-
9 mitted by Mr. Mayberry yesterday, showing the position of these
10 blocks he identified?

11 A I haven't.

12 Q You don't know whether he is correct in these iden-
13 tifications of these parts of the dam or not?

14 A The only time I saw them was on a stereopticon, and
15 seemed to coincide approximately with one case I believe.

16 Q BY DISTRICT ATTORNEY: Have you been up there?

17 A Yes sir.

18 Q Did you see that big piece of triangular formation,
19 weighed about twelve thousand tons?

20 A Point out the piece on the photograph, and I will
21 tell you if I saw it.

22 Q I will point it out on the diagram, the big one
23 downstream about a mile and a half.

24 A I saw that piece, maybe I have the sketch. This has
25 been introduced in evidence.

26 MR. RIEBER: (Illustrating on model of dam) That, right
27 here (indicating), the white piece right here. If that model
28 is correct, the lower corner ought to be about the original
29 junction of the conglomerate and schist.

30 Q BY DISTRICT ATTORNEY (Addressing Mr. Rieber): Where
31 did you find that piece?

32 A Way down stream.

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Q How far?

A Didn't pace it off, quite a ways down, I couldn't tell you.

Q BY THE CORONER: Would it be a half mile?

A I can scale it off on the map. If this distance is important, I want to be fairly sure--- around fifteen hundred feet.

THE CORONER: We will now adjourn until nine o'clock tomorrow morning.

FRANK RIEBER, having been previously duly sworn, was recalled and testified as follows:

MR. RIEBER: Resuming what I was saying, I want to go over it again. If this east side piece had gone out first, in some way we might consider that it had been broken into rather small fragments--- had just as much right to consider that as anything else. If it was in a big piece it could have been found. Right after that, this piece could have gone out (indicating), and in going out I think we have to assume this schist had been loosened, took all this out (indicating), this must have gone over before the water level had gone very far down. Further, I can show you two profiles, one of the original dam. There has been a total of fifty feet of erosion on this side (indicating), and undercutting it would have increased the erosion at the upper end, still undercutting it couldn't have made the erosion very deep here (indicating).

Q BY A JUROR: You say the erosion was how much?

A About fifty feet in depth.

Q How can you tell?

A They made a profile of the loose rock and everything

1
2 else-- I will show you a little later. This whole level (in-
3 dicating) is down at the bottom.

4 Q What is the depth of the erosion over here (in-
5 dicating)?

6 A Around thirty feet, I think. I don't want to be
7 responsible for figures. You can see there was quite a bit of
8 erosion on that side (showing diagram). That could be accounted
9 for by the fact it slid off.

10 Q What map is that taken from?

11 A This has just been prepared. The original was taken
12 from the approximate map which isn't any too good, so we have to
13 allow that fifty feet, plus or minus five or ten.

14 Q You could use the bedrock contours?

15 A I did do that. ~~That was the case~~ This piece
16 (indicating) came out. You have a relatively low velocity of
17 water coming through. It may be fast enough in here (indicating).
18 This piece (indicating) simply rolls out of the stream, rolls
19 down to here (indicating). No reason for that going downstream,
20 because we haven't got much stream going to take it down. After
21 that, assuming this stuff was loosening (indicating), we could
22 have had two things happen to this, could have had this end (in-
23 dicating) push out something, tending to make the upper end clean.
24 That was the way it looks and cut the notches, otherwise this
25 could have rolled out like this (indicating), turned over again,
26 and come down by some possibility. If it did that, there might
27 be some chance for accounting for that ~~fall~~ fall on that, from the
28 impact of this thing, might have started a crack from that.
29 After that, these pieces (indicating) are found way downstream.
30 We have now a much higher velocity going through, smaller pieces.
31 I would like to deal with this up and downstream thing. This
32 thing, as I think I said, can't be treated as a shotgun. We

1
2 have got to consider the pressure of the water, maybe breaking
3 here (indicating) after these things are broken and moved out,
4 the thing moves them downstream-- is the size of the thing flow-
5 ing in the channel, therefore, a large piece flowing in a small
6 stream would stand still, but small pieces flowing in a large
7 stream would go down, so considering the stream as the train on
8 which these things ride, we would expect the greatest amount of
9 transportation to take place after the greatest amount of water
10 started to flow in the channel, also we would expect at that time
11 the smaller pieces would go further downstream, as a general
12 rule, than the large ones. Almost all transportation we have to
13 deal with doesn't come up to boulders the size of a house, so we
14 can simply have the general rule, a great deal of water would go
15 faster than a small amount of water, and the smaller particles
16 would go farther than the large. If you examine the distribu-
17 tion the particles downstream, you will find the small ones are
18 further down, and any large ones down there have rolled at a time
19 I am presuming when there was a fair amount of water in the
20 stream. This piece (indicating) comes out at a time when we
21 have quite a little water going through this out, and when this
22 stuff has been eroded away, and this piece and this piece (in-
23 dicating) underneath are found further downstream than any that
24 have been found. After that happened, the undermining continu-
25 ing could have toppled this way (indicating). If it toppled
26 over at that time, it might have fractured enough into cross
27 pieces to go a good distance. That leaves this piece (in-
28 dicating)-- this piece, if there was any undermining here, might
29 tip over this way and been released from the other. There is a
30 fracture at the back, and which may have helped--- lots of things
31 I haven't a very satisfactory explanation for-- I don't know
32 about them, I am simply going to leave that. Now, if this thing

1
2 had tipped over this way (indicating) a little bit--- these
3 pieces seem to separate fairly readily. We now find it this
4 way--- I am not quite sure when that occurred, think it oc-
5 curred rather late, because there was a lot of schist here (in-
6 dicating), must have been removed by water, and these edges are
7 fractured, don't seem to be badly eroded, and I would assume
8 that hadn't happened until nearly the last thing, the very last
9 water that came out of that reservoir. That released this
10 (indicating)-- this arch possibly is standing on material with
11 a rather lower coefficient of friction-- we have been told so
12 anyway, and can assume the geology on that explanation furnishes
13 the way of the explanation we have here. If this is slippery
14 (indicating), it is in the position of a man being pushed
15 through a door--- he has on roller skates, and the door is not
16 wide enough for him to get through. This stuff (indicating)
17 simply goes down here (indicating)-- we had a lot of water here,
18 possibly rather small particles and everything after being
19 broken goes downstream, not because it was pushed out more
20 violently, but because the particles were small, and because
21 there was plenty of water here, and more water here (indicating),
22 and the total velocity of that stream was something terrific.
23 One piece, this piece (indicating) seems to have rocked and
24 come back a little. That has been used as a basis for the
25 fact it got there by rocking this way (indicating). It might
26 have happened, but it seems to me to involve a little more than
27 to think it just got pushed. That was bedded on rather ir-
28 regular material, and in an irregular bed would tend to settle
29 back into that same place, unless it was pushed along the same
30 time. I think that was lifted up, I think it tipped a little
31 this way, and then slid over downstream. Now, when that
32 settled back again, we have a funny thing--- there is a carpen-

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2
3 ter's ladder, seems to have been lying on the bottom, which had
4 some iron and some wood in it. Why it was on the bottom, I am
5 not sure, it was lying on the floor of the dam upstream, a
6 broken ladder. It might have had a little concrete on it, the
7 iron might have been enough to hold it, might have been water
8 logged and sunk, must have been stuck on the bottom. This
9 thing settled down a bit, the ladder. On examination you will
10 find the ladder was about three inches thick, but the part that
11 got in that crack has been beaten down to several times the
12 thickness of blotting paper.

13 Q BY A JUROR: Couldn't that ladder have been washed
14 down from the upper end of the dam?

15 A But how could it have been in there and been beaten?
16 There may be some explanation how that thing could have got
17 rocked over and back at the time of low water. On the other
18 hand, you wouldn't have any violent stream of water tending to
19 push it, and if that west wing had failed, the ladder wouldn't
20 have gone in here (indicating), the ladder would have washed
21 right through instead of going in here (indicating), that is the
22 biggest hole.

23 Q How did the ladder happen to be on the bottom?

24 A I don't know about that, there are a number of ex-
25 planations as to how a piece of ladder could be there. Here
26 is some stuff I mentioned yesterday, that pipe was twisted and
27 broken.

28 Q BY DISTRICT ATTORNEY: When were these taken (re-
29 ferring to photographs)?

30 A The first ones were taken at the time the whole
31 library was taken, I think a week ago Sunday.

32 Q BY THE CORONER: Did you see that ladder there?

A Yes, other photographs were taken last week, I would

1
2
3 say possibly Wednesday of last week. As to that pipe, they
4 checked with those furnished me by the Bureau when I got here.

5 Q BY DISTRICT ATTORNEY: How long after the dam went
6 out did you get here?

7 A I came down Sunday a week ago.

8 Q Who sent you?

9 A The Bureau.

10 Q Who wrote you?

11 A Nobody. Mr. Sweet came up, under the employ of the
12 Bureau, and asked me if I would be willing to come down here.

13 Q Did he ask you if you had a theory?

14 A No, I had a theory when Mr. Sweet came up, which was
15 very much from what I heard from Mr. Johnson, Geologist of this
16 City, had given a talk. I heard that and felt rather impressed
17 by it.

18 Q From whom did you get the photographs to compare these?

19 A These photographs were taken by a photographer in
20 town, I couldn't tell you, at the request of the Bureau. Some
21 of the airplane photographs were taken by the Fairchild Aerial
22 Service.

23 Q You had seen what purported to be a picture of the re-
24 constructed dam?

25 A I saw one picture which was made by the Governor's
26 Committee, photostatic of that was given me, the Governor's
27 Committee mailed it to me, when, I couldn't quite tell you, I
28 think last week.

29 Q And with these parts and the view of the reconstructed
30 dam, you constructed this dam?

31 A I constructed an approximation of this, and Mr. Fowler
32 has been out with some of the men of the Bureau, personally,
checking all the fragments that could be identified, and between

1 them they furnished me a revised sketch of the dam site. This
2 is only an approximation to illustrate a sequence, and as nearly
3 as we could identify these blocks we put in there. Those we
4 couldn't identify, we painted red.

5 Q BY DISTRICT ATTORNEY: That isn't made to any scale?

6 A That is made to an approximate scale of 26.6 to an
7 inch.

8 Q Did the Bureau of Power and Light furnish you a map?

9 A We had a map of the dam, but didn't have time to find
10 how thick a stack of that fibre board would be-- it was a
11 little thicker than we thought.

12 Q How about your arch and chord of your arch, is that
13 distorted too?

14 A The only distortion I know of is this dam is a little
15 higher scale to scale than the original dam would be.

16 Q As I understand, your whole testimony is then, having
17 seen what was a view of the reconstructed dam, as reconstructed
18 by the governor's geologists and engineers, you had a theory
19 which you proceeded to construct this little model?

20 A No, I didn't, I went out there with the theory of the
21 geologists and other people that examined this place before me.
22 I went out to see what I could do, and formed ^{no} theory of my own,
23 which I expressed or entertained. I was out there two days,
24 Sunday and Tuesday all day, and the rest of the time I spent in
25 the office working over drawings, that Mr. Fowler and the
26 engineers brought in to me, but I formulated no sequence until
27 after that time. I think it is a mistake to start with a
28 theory, then go looking for facts. Very often you are inclined
29 to bend some of the facts.

30 Q You didn't have any theory at all?

31 A No theory whatever.

32 Q When did you first talk to Clark Sellers?

1 A I couldn't tell you.

2 Q He advanced a theory to you?

3 A He didn't, furthermore he tried to tear my own theory
4 down in every possible way. He tried to reason on this thing
5 to show that was impossible. I found him very fair and reason-
6 able.

7 Q When did you first get this map?

8 A I think I was shown that the day after I had been out
9 to the dam, went out Sunday a week ago, I think that was shown
10 me Monday a week.

11 Q Who was present at that time?

12 A Mr. Hurlbut, Mr. Angelie, and I believe Mr. Lee.

13 Q BY A JUROR: I would like to have him finish.

14 A Having gone through what presumably happened, I think
15 there is some reason--- we are forced to conclude that the
16 failure took place up here (indicating) at or near the east end,
17 I would say that it was in this distance here (indicating).
18 That to me would explain more clearly what happened than if the
19 failure happened anywhere else.

20 Q BY THE CORONER: What do you think happened?

21 A Only two things I think could have happened. One is,
22 by some earth movement, tremendous slide of schist-- there have
23 been slides of schist in other places-- my reason for rather
24 feeling that isn't the best explanation is this, the bedding
25 planes of that schist are too parallel to the end of the dam,
26 and if we had that end of the dam in place up here (indicating),
27 the water pressure acting on the arch would have been holding
28 that pretty firmly against here (indicating), so wherever the
29 schist slid, I wouldn't expect it to slide where it was being
30 held tight against the wall. The rapidity with which that
31 came out rather leads me to feel the schist might have been
32 very intensely shattered. If you had a slide first, the water

1 would have taken out the slid material out there. In any
2 event, I think one of the best explanations, if it were not for
3 the almost incredibly human side of it, I think if we had a
4 charge of dynamite and placed in here (indicating) and shattered
5 that schist, it would shatter it for some distance around here
6 (indicating). Such a charge, if of the proper size and proper
7 kind of explosive, wouldn't throw out the dam bodily.

8 Q What if it was put at the other end of the dam instead
9 of the east end?

10 A There is a possibility--- we are studying now the
11 friction of friction planes, and the number of fractures. The
12 study is very, very difficult, by the fact we assume all these
13 pieces have been bumped and rolled to the bottom of the canyon.

14 Q Didn't Mr. Sellers tell you they found a note giving
15 some directions, which purported to be a charge of dynamite at
16 the west end of the dam?

17 A I have heard these things, but tried to disregard
18 that.

19 Q If the instructions in that note were followed, the
20 charge would have gone in the west end of the dam?

21 A I will show you. There is one place where some of
22 the fractures are suggested. Some people familiar with the
23 situation have examined this, but we are not prepared to say
24 that. Our strong inferences carry us beyond the point that
25 failed first. Over here (indicating), we have a pool--- that
26 pool happens to be as nearly as we can place it at the inter-
27 section of two triangular fractures, which you can see from
28 this go very approximately at the location of the center that
29 that pool would have radiated from. We don't want to pretend
30 that there is any positive certainty contending this kind of
31 process, but at least it might weaken or strengthen the in-
32 ference with regard to explosives. (Witness at blackboard).

1 If you dig a hole in the ground and put down in that hole a
2 charge of explosive, and fire that charge, you will get two kinds
3 of fractures, radiating, cleavage planes this way (indicating),
4 and ordinarily you will get many fractures of that kind. That
5 is the typical pattern you will see traced through a window,
6 someone shoots a bullet through it. It is not characteristic
7 of slow burning powders of any kind. I would attribute a
8 fracture like that more to one hundred percent gelatin, high
9 percentage gelatin, maybe nitroglycerine, but where you have
10 slow powders, the tendency is to excavate-- high explosives just
11 fracture. We have in the ground above the dam, the earth has
12 been eroded down to this depth (indicating). Right about in
13 here (indicating) in the earth, we find this pool. We are
14 turning the face of the dam the other way, where these two
15 fractures would have started on the upstream side. Here is the
16 pool (indicating), what is left of it, and this might have been
17 a series of excavations that way (indicating), weaken the plane
18 in the earth--- that would excavate fairly readily. This might
19 have been a fracture which extended further, clear up through
20 that arch--- we haven't the rest of the pieces, we can't tell.
21 These are only absolutely unsupported inferences, just a little
22 bit of evidence to lead us along a possible theory, they are not
23 to be accepted, and are not to be rejected.

24 Q Did you find on any piece, any evidence of fracture?

25 A On this piece (indicating).

26 Q Where was that?

27 A This was up here on this side (indicating). We
28 haven't found anything here (indicating) that would evidence
29 that except this piece which I am having further measurements
30 made on. This corner (indicating) on that upper side is
31 buried. That will take quite a little while to get that. On
32 this side here (indicating), considering the possibility of

1 both wings having been shot, which we might include over on this
2 side (indicating), there are a couple of fractures that seem
3 very, very likely to radiate down to a focal down here (in-
4 dicating). There is a little place out of here--- when you
5 piece them together, you get the makings of one of these star
6 shaped pieces on that side (indicating). I don't think we
7 should disregard dynamite as a theory.

8 Q But we haven't any facts to support it?

9 A We haven't any facts, but the dam went out. The dam
10 would have gone out in this manner from anything that would
11 loosen schist up here (indicating).

12 Q Will you tell me the location of these smaller pieces,
13 the ones you have recovered on the west side?

14 A This is one of the particles (indicating), quite a
15 distance down the stream, this is the one Mr. Dennison referred
16 to yesterday as being the one that weighed so much, and found it
17 fifteen hundred feet down.

18 Q What is the approximate size of that you found
19 fifteen hundred feet down?

20 A Guessing at that thing, looks to me as if it was about
21 ninety or one hundred feet, that dimension when it was originally
22 in the dam, how much has been broken off, I can't tell.

23 Q A very heavy piece?

24 A Yes, very heavy.

25 Q Would it be approximately ten thousand tons?

26 A I will have to leave that to a concrete estimator, it
27 is down on this side of the stream (indicating), about fifteen
28 hundred feet down.

29 Q Would it be directly behind pressure necessary to
30 carry it there?

31 A Yes, don't know if it is possible to tell just what
32 might have happened.

1 Q Was it carried across the stream diagonally?

2 A Unless the stream curves around, I don't seem to re-
3 member it that way, think that is the one in this drawing, level
4 twenty-nine, and so far as the canyon goes, it would seem to be
5 in the center of the canyon. There has been a bend in the
6 canyon, however, before you get there. Anything might have
7 been influenced going around corners. Number twenty-nine is
8 the piece I refer to.

9 Q Is it in the position it would naturally be in if
10 picked up by the crest of a wave or major portion of the flood,
11 when it started out it would be carried directly out probably in
12 the line of angle it appears to be in the arch?

13 A No, there is a corner it is going around, which would
14 disturb any possible calculations.

15 Q Which part went out first, the east side?

16 A My conclusion certainly is that this part went out
17 first (indicating).

18 Q Would ^{not} that release an enormous body behind it, and if
19 it did, why didn't these pieces on the east side go downstream?

20 A I tried to explain that. If the east side had gone
21 out first, if it went out progressively, we would have first
22 only a moderate stream, later larger. The distance downstream
23 of these particles would correspond to the size of the stream
24 that carried them.

25 Q Both sides went out?

26 A Yes, certainly.

27 Q If you weakened the east side, it would go out pro-
28 gressively, then the west side didn't go out progressively?

29 A I think the west side fell altogether, the pressure
30 was being released, not that the water was down here (indicating),
31 had to be big enough to push that out (indicating) and had to be
32 forty feet from the top or down in the road. After it goes out

1 the head of the water behind it has nothing to do with what is
2 going downstream, the total stream will take it down.

3 Q BY A JUROR: How much of a charge would you estimate
4 necessary?

5 A I would think anything over one hundred and fifty
6 pounds of one hundred percent blasting gelatin, two hundred
7 pounds probably.

8 Q BY THE CORONER: Do you recognize this photograph (in-
9 dicating), see conglomerate or some loose material lying here
10 (indicating)-- wasn't that washed off?

11 A This schist there, that schist was cut from the east
12 wall, as far as I know, and may have been put on there fairly
13 late in the arrival. If it was there at the beginning, it
14 would probably get washed off. As long as the water was above,
15 it is possible it was still carrying schist out of there-- it
16 would still be putting schist down-- as long as the water was
17 turned this high, it would still put schist on there.

18 Q BY A JUROR: As I understand, you claim that piece now
19 lying downstream from the dam went out early?

20 A I feel that went out early.

21 Q And the size of that piece is very large, wider than
22 the standing portion?

23 A Yes.

24 Q And approximately in the middle of the canyon-- how do
25 you explain the fact that that lies there in a position where it
26 would be naturally moved by a heavy blow through either side,
27 and stayed in place, while a very large fragment carried two or
28 three thousand feet downstream?

29 A In the first place, I think it got out of here (in-
30 dicating) some way and let the water out. The water probably
31 circulated around here (indicating), and this part being in
32 place-- as long as you have a stream where particles can edge to

1 one side, can stay there-- this piece is lying here (indicating)
2 this way with the top I think a little bit lower-- it would be
3 the natural place where water would go over and press it down.

4 Q Why does it now lie in position where there is a
5 chance to undercut-- it isn't imbedded in the stream at the
6 present time?

7 A No, I think the water goes around it and cuts around
8 there. I have an airplane photograph of this.

9 Q Why isn't the schist washed off?

10 A That schist was coming all the time, and was probably
11 put on there.

12 Q You had experience with explosives and are posing as
13 expert?

14 A I might qualify as an expert, I have used about a car-
15 load a week of blasting gelatin, in explorations up in the
16 valley at certain times, a quarter to a half carload a week,
17 been going at it for a couple of weeks. So far as blasting
18 gelatin goes, I know a little about it, I have seen a lot of
19 tricks explosives will do.

20 Q What size of charge would be required to blow these
21 pieces out?

22 A I don't imagine a charge of high velocity powder would
23 blow the pieces out, think it would cause fractures and cause
24 crumbling of the immediate pieces.

25 Q Assuming that the dam was ~~twenty-five~~ twenty-five feet
26 long at that point, how much T.N.T. would be required to extend
27 the fractures?

28 A Through the dam I think you could fracture through
29 that dam with less than fifty pounds under that much water, at
30 least, you could create potential fractures. If you use one
31 hundred percent powder in quarrying dimension stone, you can
32 split out the stone but you also cause little microscopic

1 fractures in the thing. They either use a lower velocity powder
2 there or put rope or something in the hole to absorb the sudden
3 abrupt effect. The prime way is to put the powder under water.
4 The distance to which you can send vibrations of that stuff
5 under water is something terrific.

6 Q BY THE CORONER: Suppose a charge of fifty pounds of
7 T.N.T. exploded, fractured the dam, how long would it take for
8 the dam to go out after that was done?

9 A Depends largely on how much of a piece could be pushed
10 out directly. That is largely a matter of fractures, which way
11 they go. The thing most impressive about this is how fast this
12 must have taken place to get all this out before the water had
13 gone out forty feet.

14 Q Don't you think it would be possible to discover some
15 mark of injury to the concrete, that would indicate a charge of
16 powder had been placed?

17 A We are looking for that now, tunnelling under this
18 place right here (indicating). When we find that, which will
19 be sometime yet, I will want to make some careful measurements
20 before I state the precise degree of probability. This isn't
21 a thing I like to go in and make a claim that can't be sub-
22 stantiated without reasonable evidence.

23 Q BY A JUROR: How about any chemical impregnation of
24 any particles?

25 A I doubt if there is any chance for identification
26 that way.

27 Q An ordinary case of blasting rock?

28 A That would be a different thing. This has been
29 sometime since that happened, and lots of things happened to it.

30 Q What is your idea as to the height from the foundation
31 at that point, which this explosive charge might have been?

32 A It would be on the bank level about sixty feet under

1 water.

2 Q How far from the foundation of the dam?

3 A Right against it, under water.

4 Q The bottom of the dam?

5 A No, on the up face side, wouldn't have to be buried.

6 The focal point happens to be where I supposed the water line to
7 be, about ten feet up from the edge, the way the thing seems to
8 trace back now, also this point over here (indicating) on this
9 side.

10 Q Have you examined carefully that larger piece, so
11 called---

12 A Ten thousand ton piece down the canyon?

13 Q Have you found any suggestion as to radial lines
14 there?

15 A Just this, just where it converged, quite a little
16 bit, at this side (indicating) a little bit more--- come to-
17 gether about like that (indicating) and this corner (indicating)
18 where you can't get at it again-- all the things you want to
19 see are under mud.

20 Q You say this portion of the road is standing?

21 A Yes.

22 Q What would be the action of the water coming around in
23 here (indicating)--- if this opened up first, wouldn't ^{it} destroy
24 that road?

25 A Not nearly as suddenly and surely as this way (in-
26 dicating).

27 Q Just the minute it came down in bulk, naturally it is
28 going to back up, and the crest is going to come around here
29 (indicating)?

30 A If it opens up, your water can never go as high on
31 this side (indicating).

32 Q When you get a volume of water here (indicating), it

1 is going to back up?

2 A After it begins to meet resistance it might back up.

3 Q This (indicating) is quite out of the flow of the
4 water?

5 A The early period, the water would come down like this
6 (indicating). If this piece (indicating) was taken out bodily
7 at that stage of the game--- if you look on the airplane photo-
8 graphs--- if you assume a failure under here (indicating) which
9 was able to sap the water level down, that would be all right.
10 (Jury looking at photographs). You will find this edge (in-
11 dicating) is way below the top of the dam.

12 Q In other words, you are making an assumption this came
13 out (indicating) and as this came out, this came out here (in-
14 dicating)?

15 A I am assuming that this (indicating) came out gradually,
16 and worked down, and while this is falling and the pieces are
17 coming out, the level must be dropping. This level comes down
18 to about forty feet from the top. All of these are gone---
19 this fellow has no neighbors to support it. Maybe it was
20 fractured, maybe it had contraction checks in it. Certainly if
21 the geologists are correct, this was on slippery ground, and
22 with that water forty feet from the top, that is not supported
23 (indicating).

24 Q You start to straighten this arch out, what effect
25 would it have on this here (indicating)--- this is a terrific
26 water--- would it have a tendency to kick this out (indicating)?

27 A No, I don't think so. About this arch on here (in-
28 dicating), supposing you had a contraction check in there, if
29 this tried to rock it would push on that and go like that (in-
30 dicating).

31 Q Not when this--- this has to kick against---

32 A That isn't a complete arch.

1 Q But you are continuing your arch through here (in-
2 dicating)?

3 A What I am talking about, the rest of the arch is not
4 in place, and this thing could have been and was moved, and
5 something pushed it, and the only thing I know of that was big
6 enough to push it was this arch, that cantilever action.

7 Q What is this piece (indicating)?

8 A That piece is the one right here, number twenty-nine.
9 Forty-four I don't think has been identified. I will proceed
10 with the water record, I will get out again the tracing I made.
11 We have the original here also for comparison.

12 Q Have you the original record?

13 A I have the original record. I want you to see that
14 other at the same time, so you can compare the photographs with
15 the original. The record is right here (handing it to Jury).

16 Q BY MR. ROBINSON: We have a photostatic copy of it if
17 you desire.

18 Q BY DISTRICT ATTORNEY: Is there a name on it?

19 MR. ROBINSON: I am informed the man who did the actual
20 photostating is in the room and can be produced as a witness,
21 also the man in charge of the reading of the record, maintaining
22 the clock, and so forth. Mr. P. T. McIntyre had charge of the
23 copying of the record and P. S. Grant was the man who took this
24 to the photographer.

25 Q BY DISTRICT ATTORNEY: Do you know the name of the
26 man who manipulated the camera?

27 A VOICE: Mr. Rice.

28 THE CORONER (Addressing witness): That is all, you may
29 be excused.

1 (Witness is exhibiting several airplane views through the
2 stereoscope to the jury.)

3 Q BY MR. SCOTT: Will you illustrate on the board the
4 reason of the pipe being turned towards the east, when you say
5 that the water level was twenty-two feet from the top, the water
6 was then running out of the east side?

7 A Here is the standing fragment from the dam site. Com-
8 ing down here is a piece of that stilling well and it bent over
9 here and there was another bracket here. Formerly fastened onto
10 this was an additional length of about thirty feet, which used
11 to be fastened to a bracket down here. It exactly corresponded
12 to this piece here. Either there was water flowing in this
13 direction when the water level was up here, in order to cause
14 that break, or there was a strong flow in that direction when
15 the water level was below the point. The flow in that direction
16 would have swung that lower part around and raised this up, and
17 shown us what we see, or would have swung it in that direction.
18 Either is possible.

19 Q Was the bracket turned?

20 A It was a flat piece of stuff and was twisted around
21 here (indicating).

22 Q And when the water was running it would necessarily
23 have to flow from the west side to the east side to bend that
24 pipe in that direction?

25 A That would be my inference, yes. That is a twelve
26 inch diameter piece of pipe about sixteen gauge sheet iron. The
27 joints were riveted together. I have the information on that
28 from the rigger that put the pipe up.

29 Q BY A JUROR: How long have you been practicing?

30 A As an engineer?

31 Q Yes sir.

32 A Since 1915.

1 Q Are you any relation to Professor Rieber out here in
2 the University?

3 A Yes, I am his son.

4 Q BY THE CORONER: Did you graduate?

5 A I followed almost all of my course as an electrical
6 engineer and changed over and graduated in physics in the last
7 year.

8 Q BY MR. DENNISON: Does that mean that you graduated
9 as a mechanical engineer?

10 A I got the degree of B.S.

11 Q Did you make any special study or take any course in
12 explosives?

13 A No sir, but I have been using a carload of explosives
14 every two weeks or so during the last two years in the San
15 Joaquin Valley.

16 Q Supposing that the explosive had been placed where you
17 say, would it have blown a block out?

18 A No, if it was a high speed, but not a low speed.

19 Q BY A JUROR: What would be the effect of a depth
20 bomb placed there, such as was used in the war?

21 A That would be about the effect that happened, some-
22 thing settled down there at that end, if dynamite was used.

23 Q BY MR. SCOTT: This point that you say that it might
24 have been shattered on the east side, how close was that to the
25 road on the east side of the dam?

26 A It was about two hundred feet, out on the dam, at this
27 point, a hundred and fifty to two hundred feet, about sixty feet
28 under water.
29

30
31
32 EDWARD L. MAXBERRY, was

1 recalled and testified as follows:

2 BY MR. DENNISON.

3 Q You are one of the engineers who has made the report
4 here and you have heard the explanation and the theory of Mr.
5 Rieber. Is there anything that you desire to say to enlighten
6 the jury at this time or that was suggested by this----

7 A I can only say in accordance with our report, that the
8 theory that the Board arrived at was that the failure occurred
9 first on the west side and I believe from the way that the blocks
10 lie in the stream and below the dam, and the evidence that we
11 have found bear out that theory. The fact that the red conglom-
12 erate on the west abutment---- it being fractured badly and ab-
13 sorbing percolating waters softened and finally gave away and
14 allowed the failure to take place at that side. The portion of
15 the dam as shown in the diagram as I showed on the screen, the
16 blocks marked H and I, ^{being} H means the key block and I being the one
17 immediately adjacent east of it, between key block H and the
18 standing section of the dam, the failure took place at that point.
19 The block H being the largest block below the dam in distance,
20 being carried approximately half a mile, the block I immediately
21 adjacent to it, was carried some five hundred feet further, and
22 I judge was approximately two-thirds its size. The blocks on the
23 east end of the dam that were in contact with the schist abutment,
24 the larger block E which lies immediately in front of and against
25 the main section apparently was carried by the slide of the earth,
26 bouyed up by a slide of earth and water and pushed down in front
27 of the standing section, and the slide continuing after that and
28 spreading more or less talus or debris on the top of this section
29 E. I attribute the fact that the talus remains there--- the
30 point that the talus remains there and the fact that the water
31 had materially lowered in the dam and permitted that material to
32 remain on top of this section---- if that section had gone out

1 very early when the water was still very high, the face of that
2 section E, would have been entirely covered with water, and the
3 small fragments would have been washed away and floated away.
4 The two sections, one of which I have marked G on the diagram,
5 which lies immediately back of the block H, the key block, as we
6 term it, and which I believe, came from a point below Block E at
7 the east end against the schist was apparently not one-fourth of
8 the size of the key block G. Another piece was perhaps a hun-
9 dred and fifty or two hundred feet further, coming from the east
10 abutment with mica schist clinging to it, of approximately the
11 same size, and approximately coming from about the same locality.
12 The two largest sections, as I said, H and the key block I, the
13 block immediately adjacent to it, are farther down the stream
14 than any block comparatively of their size at all. There
15 is one section of the face of the dam which we are unable to
16 identify, which is very close to the key block G, but there was
17 no means by which we could identify it at that time. I am of
18 the opinion that it came from the west side. The position of
19 the rocks in the bed of the stream seem to me to be indicative
20 of the sequence of failure, because it would take a larger
21 volume of water to carry the larger blocks, the greater distance;
22 some of the smaller fragments which were identified as coming
23 from the east abutment are further down the stream, which would
24 be natural. The smaller fragments would not require as large a
25 volume of water or the velocity to carry them the same distance.
26 The extreme west end of the dam, taken to the buttress and the
27 west wing dam, ~~the~~ referring particularly to the bank immediate-
28 ly in front of it, which does not show any evidence of water
29 pouring over the top of it or over the old road bed immediately
30 below it, seems to me to be conclusive evidence that that section
31 immediately at the west end did not go out until the water had
32 lowered considerably. The key block going out and leaving that

1 section supported until such time as the water escaping had
2 secured out sufficient of the supporting structure below to per-
3 mit that block to break as a cantilever. That end of the dam
4 remaining in position would have the effect of deflecting the
5 escaping water across the toe of the dam in accordance with the
6 report, making it impinge upon the east abutment, undercutting
7 the same and causing the slides which, in turn, would cause the
8 failure of the east portion of the dam.

9 Q / Yesterday There was an engineer who gave some points--- or a
10 surveyor--- that were A, B, and C, one on the west and one on the
11 east side of the dam and one down the stream in front of the fail-
12 ure. It appeared from the testimony, I think, of somebody, that
13 this remaining ^{structure} ~~sector~~ ever here had been moved, according to
14 them.

15 THE CORONER: That was Mr. Hemberg.

16 MR. DENNISON: That is correct. Now, can you estimate
17 what was the weight in tons of this structure, as an engineer or
18 did you make any calculation?

19 A I did not make any calculation of the whole mass. I
20 estimated the pressure around thirty thousand per square foot at
21 the base.

22 Q That would be an enormous weight?

23 A Yes, a very great weight.

24 Q After this was washed out what would be the tendency?
25 Would the hills upon which it was resting rise or fall?

26 A The saturated conglomerate over there, would have a
27 tendency to swell a little bit, due to the water percolation and
28 the relief of pressure. Following the break there might be a
29 depression there to relieve the pressure.

30 Q Did you see these points that they made yesterday?

31 A I read something in the paper.

32 Q Would you be capable of giving an opinion as to whether

1
2 or not that would be the case?

3 A I do not----

4 Q Mr. Mulholland told us here on the witness stand that
5 the winds coming through that canyon from the south, were quite
6 strong there, that they undoubtedly had some effect upon this
7 register of the water---- this machine that measured it up there,
8 and there has been some testimony introduced here and some appar-
9 ent attack on the part of the Water Board of the veracity of the
10 record.

11 MR. MOHR: What is that?

12 MR. SCOTT: When was that?

13 THE CORONER: When do you refer to?

14 MR. DENNISON: I refer to the whole testimony that has been
15 taken during two or three days.

16 MR. SCOTT: I will ask the gentleman to withdraw his remarks.

17 MR. DENNISON: I will not withdraw any remarks. The report
18 shows that some great amount of water, I think 9,000 cubic feet
19 went out. Is there any explanation that you want to offer to
20 the jury in relation to that report?

21 A That report was taken from a photograph of the record
22 of the recording float and it showed a perceptible and gradual
23 increasing drop in the line of the record, which would indicate
24 that a considerable volume of water was escaping from the reser-
25 voir. The effect of any wind down the canyon would be to pile
26 the water up, so to speak, against the face of the dam where the
27 float was located and raise that water level instead of lowering
28 that water level.

29 Q BY A JUROR: That would depend upon which way the wind
30 was blowing?

31 A The testimony as I heard it from Mr. Mulholland indicat-
32 ed that the wind came from the north.

MR. DENNISON: The testimony of Mr. Smith and Mr. Nichols

1 was that the wind rose in the morning and blew the water over
2 the dam and about four o'clock in the afternoon the wind had
3 subsided. What is this and has it anything to do with this
4 dam? Will you tell the jury what it is?

5 A This is a bar of iron that I picked up near one of the
6 large concrete blocks which corresponds to the bars of iron that
7 are now anchored in those blocks of which the photographs in the
8 record show many instances. The bar had been pointed and
9 apparently driven into the schist of the abutments about that
10 distance (indicating) as shown.

11 Q About two feet?

12 A About twelve inches in this particular case although
13 they were anywhere from nine to eighteen inches. This portion
14 of the bar being in the concrete. I cannot say for sure whether
15 this bar was incased in concrete. The head of the bar is not
16 jammed particularly. There are several photographs showing the
17 ends of the bars sticking out of the concrete blocks ~~as~~ through
18 the schist formation where they were pointed and had been driven
19 into the schist.

20 Q BY A JUROR: Don't you think that could have been
21 driven in there to tie the dam at one end?

22 A I could not say. The only object of that would be to
23 show the softness of the formation.

24 THE CORONER: Are you an expert on the action of explosives?

25 A No, I am not. I have used them somewhat but—

26 MR. DENNISON: As I understand, based upon your years of
27 experience and your knowledge as an engineer, and the facts and
28 circumstances that you found there, it was your opinion that the
29 sequence of the failure of this dam was ^{that} ~~at~~ the west side went
30 out first?

31 A Yes sir.

32 Q That is not any theory?

1 (NO response).

2 Q BY THE CORONER: That is based on fact. What fact do
3 you base it on?

4 A I cannot say exactly that it is a fact, I base it on
5 the theory that the west abutment was saturated by water as now
6 in evidence, or the upper portion there is still showing saturation,
7 and that this went out allowing the dam to collapse.

8 Q Could you say specifically just how the west wing went
9 out or what was the first thing to happen there in its failure?

10 A I consider that the first thing that happened was that
11 the underlying formation under the dam was saturated by water to
12 such a point that it could no longer resist the hydrostatic pressure
13 and was forced out under the dam. That force would carry
14 out the material supporting the dam and as that was increased by
15 the force of water scouring through there the surrounding material
16 at that point and adjacent soft schist would create a large crack
17 and the dam would break of its own weight.

18 Q BY A JUROR: You say that this conglomerate underneath
19 the west side there, due to the absorption was washed out. Naturally,
20 the assumption---- I take it from what you said you mean
21 that that was washed out and through underneath the dam?

22 A Underneath the foundation of the dam.

23 Q And carried on down the stream?

24 A As the water percolated through the fractured seams ^{of} the
25 conglomerate it widened the seams to such a point that the hydro-
26 static pressure would force out a portion of the material immediately
27 underneath the dam. That may have been only a foot square
28 but whatever it was it would produce an opening for the waters
29 and due to the pressure would increase rapidly in size until the
30 dam could no longer support itself and the key blocks H or I broke
31 out almost simultaneously.

32 Q I realize that point now. We are going upon the record

1 we have here and the only real record we have is this clock record
2 and between 11:30 and 12:00 is when all this took place?

3 A Between 11:30 and 12:00?

4 Q Yes.

5 A Just what time that actually took place would be hard
6 to say. Evidently a very large failure took place at that time
7 because there was a very large increase in the water that escaped.

8 Q If that did take place, why was there not some kind of
9 evidence in the stream bed below showing that this water was going
10 out? We have had people who crossed over down below there after
11 that time, and they say there was no increase in the water?

12 A I understand also that there has been testimony by
13 people who did cross over at that time that there was a big in-
14 crease in water.

15 MR. DENNISON: There is a photograph that shows that on
16 Saturday afternoon there was a stream as big as your leg, and Mr.
17 Malholland said it was running muddy on that day.

18 Q BY A JUROR: And they said that right up at the toe
19 of the dam the water was not muddy, that it was perfectly clear?

20 A The water went out of the dam apparently, according to
21 the gauge. The blocks are in the position they are in the stream
22 and the conglomerate on the west side bank is of a nature due to
23 its geological formation and the fracture planes through it, that
24 absorbs water easily and softens.

25 Q Would it not be possible for that gauge from the flow
26 on either side, to have recorded the water going out on the top
27 due to the terrific flow of water at that place, and show a
28 straight drop in the instrument?

29 A I think, as Mr. Richer has stated, there are two
30 theories there. One is that at the upper elevation---- the first
31 arrow---- that the force of the water broke the pipe at that
32 point and swinging it to the east, and the other is that it broke

1 the pipe and swung it to the west, which would kick the pipe to
2 the east. That was a sixteen gauge pipe, which is rather heavy
3 metal. I cannot quite satisfy myself in my own mind that just a
4 mere flowing of the water in that pipe would have that effect.

5 Q That is true, but just the minute that that pipe open-
6 ed the recording gauge would show a direct drop in the water?

7 A Well, assume first that the upper arrow is correct,
8 which is some twenty odd feet, I understand, below the top of
9 the dam. If there had been a considerable break on the west side,
10 and the vibration of the structure of the dam broke the abutment
11 on the east embankment and threw the rush of water from the
12 break on the west side, which was deflected by the remaining
13 section of the dam, by the west abutment, which, incidentally,
14 shows to my mind a tension break downward, and not swinging down-
15 stream. The water escaping there and impinging on the east bank
16 and undercutting the formation there, then permitted the failure
17 of the east bank and the flow of water around that point. The
18 upper crest of the dam, as you will notice by the diagrams, the
19 blocks G and H, did not continue clear to the top of the crest.
20 They are down below, which would be the section which would break
21 out and form an arch there temporarily and then the water would
22 lower and tak tear away the bank on the other side, causing a
23 failure there. That failure of the east abutment, I am satis-
24 fied, was the first in the upper section, taking a portion of the
25 crest with it, which would create a flow along the level to the
26 east. The first failure on the east embankment was in the upper
27 section near the crest.

28 Q The point I am trying to bring out is the reliability
29 of the gauge itself. Just the minute that the water started to
30 flow indicating a straight drop, would be when it dropped below
31 the crest of the dam. This would pick this float up and pull it
32 out straight and that would indicate a downward flow of the water?

1 A After 11:30 I don't think it was dependable because
2 the rush of water was so rapid that I could not say what happened.

3 Q Did you discuss that with Mr. Harlbert at the time
4 that you got the maps?

5 A I did.

6 Q BY MR. ROBINSON: If a wind from the north caused a
7 banking up of the water at the south end of the reservoir, then
8 a receding of the water due to the cessation of the wind, would
9 cause a lowering corresponding to the----

10 A Yes, if that wind continued for any length of time it
11 would show a higher level on the gauge, and naturally as the wind
12 went down that would be the effect.

13 Q I believe that you said that the large block that lies
14 below the standing sector, in your opinion, came down quite late
15 in the order of sequence?

16 A No, I did not say that. I said that came down after
17 the first failure of the west end first, and then this east end
18 of the dam failed and that block came down on the slide and the
19 volume of water supporting it with the water mixing with the
20 slide and came over into position, other slides continuing, and
21 coming over onto that dam, it possibly fell in an arch between
22 the eastern abutment and the east line there, which would grad-
23 ually scour out.

24 Q If that was the sequence of the events, that the west
25 side went out first and then the swelling and cutting caused an
26 undermining of the east bank, that would mean that this slipping
27 down of this block would not occur until first the west side had
28 gone out, then sufficient undercutting had occurred on the east
29 side to cause a slide and so release the block on the extreme
30 east?

31 A That does not mean that the entire west end went out.
32 A section of the west end went out first.

1 Q I am trying to get at your sequence of events. I am not
2 attempting to question your statement that a portion or all of
3 the west side went out, but the sequence under the theory that
4 you believe in. The sequence of events would be that first some
5 portion of the west side went out and then some cutting occurred
6 and then a considerable portion of the east side slipped down
7 so as to release the east end?

8 A Yes.

9 Q That sequence would have brought the sliding down of
10 this large block pretty well along in the sequence, would it not?

11 A Well, That is pretty well along. It may have been
12 fifteen or thirty minutes.

13 Q I will show you this photograph and ask you if you
14 recognize what it is?

15 A That is the end of the block that is in front of the
16 standing section, the face of that block which was against the
17 abutment.

18 Q But it is a photograph of that block?

19 A It is a photograph of that block.

20 Q Now, calling your attention to the upper portion of it
21 upon which the light falls directly, as distinguished from the
22 base which is in shadow, what action is indicated by the appear-
23 ance of that face?

24 A An indication of considerable scour in the upper corner
25 which could easily be occasioned by the schist slide which came
26 down apparently after this block was in position and over this
27 block and the rushing of the water by there would scour off that,
28 and the other sections between this section and the section which
29 fell upstream, which piece I was unable to identify. This piece
30 could have later broken these corners off.

31 Q That indicates, does it not, that the large block fell
32 at an early enough stage in the sequence of events so there was a

1 very considerable evidence of scouring and washing over that
2 block?

3 A I think you could make that statement almost in connec-
4 tion with any block downstream. They all show more or less ero-
5 sion or scouring due to the impact with the bed of the stream as
6 they were rolled and pulled down stream and due to the pounding of
7 one block against another, and due to the scouring effect of the
8 material which was being carried in suspension in the water.

9 Q As to the blocks which previously stood next to the
10 central section?

11 A That came later in the sequence.

12 Q And that does not show any such erosion as this?

13 A It does not.

14 Q The collapse of the piece which lies immediately in front
15 of the dam?

16 A I think that followed very closely the collapse of the
17 west end.

18 Q Did you observe the crack which has been testified to
19 and shown in several photographs, where the ladder is trapped in
20 the crack?

21 A I saw that crack and it had considerable debris in it.

22 Q I understand that the debris was cleared away later so
23 it can now be seen very much more plainly than it could at first?

24 A Yes.

25 Q At the time that you did observe it, were you able to
26 observe the condition of that ladder accurately?

27 A I did not look at the ladder particularly to see.

28 Q Testimony has been presented here that the other side
29 of the ladder than the one which appears on the face, is clear
30 within the crack and that the three inch side of the ladder has
31 been crushed to such just a little more than the thickness of
32 paper. Would you say that that indicates that the central block

1 tipped?

2 A I think that is carried out in the report and I think
3 in my former testimony I said so. That it rocked on its toe.
4 Evidently it raised sufficiently to permit this ladder, which
5 apparently was held in the lower basin of the reservoir, by some
6 mass or other---- when that went forward the ladder went into
7 that crack and when the block settled back into position it
8 crushed it.

9 Q That really accords with your testimony as to the rock-
10 ing of that central block?

11 A Yes.

12 Q The movement of the block, as you understand it, was
13 in a southerly and easterly direction, the difference in position
14 between the original position and its present position shows, as
15 you understand it, a schist in a southeasterly direction, does
16 it not?

17 A ^{does} It/~~shows~~ a tipping forward of the top and twisting of
18 the west side, from the records furnished us, a little farther
19 down stream---- relatively farther down than on the east side.

20 Q If the west side went out first leaving for the moment
21 the east side intact and resting against the schist formation on
22 the east side, what force could that possibly have been suffi-
23 cient to move that central block in a southeasterly direction
24 and tip it enough to admit this ladder at the northwest corner?

25 A As I stated before, I think it was the vibration set
26 up in the structure due to the successive breaking of the por-
27 tions of it, which, when the arch of the dam was broken, would
28 allow any part of it to act as a cantilever and it was swung down-
29 stream.

30 Q If this portion were intact would it not have acted
31 as a buttress to prevent the easterly movement?

32 A No, I think it would act just the other way. If this

1 west section of the dam, after failure here, should break, as
2 this broke here, you would get a cantilever action that way.
3 Now, there are evidences of contraction shrinkage joints on this
4 upstream face of the standing section. The downstream face evi-
5 dently is a tension break, some compression, but it is not a
6 sheering break. It is not ground, it is broken this way (in-
7 dicating) and this way (indicating) and the same thing is true
8 at the west abutment, the break is down. The contraction joints
9 here that are stripped down are broken down and still show por-
10 tions in the angles of the joints. The cantilever action would
11 tip this and twist it.

12 Q If there were a contraction crack representing approx-
13 imately what is now the west face of the central standing por-
14 tion that would represent the line of weakness in the dam?

15 A Represent a line of weakness.

16 Q Was that any cantilever action from a relatively small
17 remaining block being carried by the force of the stream, against
18 it, which I understand is the force you are contemplating, would
19 have had to exert enough pressure to break the large central
20 block loose from the schist formation, so that, on that theory,
21 would not the force of the water on a relatively small block,
22 have had to be sufficient to break that large central mass off
23 from the block or break some of the rock ^{off} with it?

24 A That section went out. This portion here, which re-
25 presents roughly the position of block H, which we are satisfied
26 is the first section that went out, left a section here. When
27 that went out then the east end was torn loose and the water
28 came across and tore this out and this section fell in front of
29 it. This joint here shows quite a large water stain through
30 that joint. After this block went out then that arch action is
31 completely gone. These blocks H and I could have gone out to-
32 gether. H, I feel positive, is the first which went out, and I

1 shortly afterwards. The arch might have remained in place or
2 might not. When this block went out the arch was broken.

3 Q The straightening out of a portion of an arch such as
4 that, assuming for the moment that this western face shown here
5 as identified as to how it broke up, assuming that that cracked
6 in the middle and straightened out, that would exert a tremendous
7 easterly thrust on the central block, would it not? Isn't that
8 the effect of any arch?

9 A Undoubtedly it would show that. This block undoubtedly
10 ly rocked south and to the east because it broke and diagonally
11 fractured across this way, which would be a tension break.

12 Q Is there any force that you can imagine that would be
13 great enough to break off that central face piece and give it
14 that thrust in that direction, other than the straightening out
15 of this western portion of the arch?

16 A The straightening out of that, as I say, probably
17 occurred after this block had gone out, but this is where it went
18 out first and this followed later.

19 Q BY A JUROR: If this straightened out here, would the
20 force here not have been great enough here to destroy the abut-
21 ment rather than moving this, that is, a soft formation?

22 A There has been an apparent displacement of that abut-
23 ment to some extent. Just whether the abutment is displaced or
24 the wall immediately in front of it, I don't know, but there is a
25 crack two and one-half inches wide between the west wing dam and
26 the face of the buttress. There is also, along the downstream
27 face of the west wing dam, apparently a movement there of the
28 earth and whether the whole structure went down and then settled
29 back part way, I don't know, but this, of course, might occur
30 from a dozen different reasons.

31 Q On that same theory, as a matter of fact, as it shows
32 there today, that abutment there--- the east end of the abutment

1 has dropped instead of being pushed away or anything else.

Q 2hat is quite a noticeable crack on the floor of that west abutment
3 which has opened up since the dam went out?

4 A There is apparently a tension crack at this point.

5 Q I am talking about a new crack that developed there
6 since the dam went out?

7 A There is an old crack here which had been caulked up.
8 There is a fresh tension crack about half way between there and
9 the abutments. There has been a water course coming out from
10 under that wing dam. Now, whether that crack took place after
11 the water had gone out and had washed out under the wing dam,
12 and there had been some slight settlement causing that crack,
13 or whether that crack is due to the assumed fact that this sec-
14 tion of the dam, which in our estimation, remained after this
15 portion went out, as it is not eroded by the flood waters, that
16 when that block went out after the failure, after the portion of
17 the supporting structure underneath had been scoured out, immed-
18 iately adjacent to the scour pool in breaking down and acted as
19 a cantilever or created tension on that mass and opened up a
20 tension crack there and finally breaking at this point here,
21 which it did approximately half way on the buttress.

22 MR. ROBINSON: If we assume that the east side went out
23 first and then the straightening out of this arch occurred,
24 necessarily involving a fracture of the arch to permit the
25 straightening, would not all of the hill westerly of the frac-
26 ture and all of this long masonry wall, concrete wall, act as a
27 buttress to take the westerly thrust of the straightening out
28 of the arch as against the central portion take the easterly
29 thrust?

30 A Naturally it would if this was gone that west end
31 naturally would have to take any thrust due to the straightening
32 of the arch.

1 Q In considering the opposing thrusts should we not
2 also consider not only the concrete here, but all the hill upon
3 which the portion westerly of the break was resting?

4 A If it was capable of resisting that, which I don't
5 think it was, due to its saturated condition.

6 Q Its position would be such that if it had any resist-
7 ing power it was in position to resist any thrust?

8 A Due to the inclination of it it would not give much
9 resistance. It might give some. Due to the material it was
10 made of I don't think it would give any.

11 Q BY A JUROR: What was the movement of that central
12 portion?

13 A I think forward and slightly to the east.

14 Q How much?

15 A As we checked the present position is 7.8 and 7.6 from
16 the other survey, from the top out of position.

17 Q If that westerly portion had felt any arch action, how
18 much of a movement of the central portion would have been
19 necessary to enable it to straighten out to such an extent that
20 it could have fell in that direction?

21 A I don't know.

22 Q Would it have been more in that distance?

23 A Oh, yes. That would have exerted a force more to the
24 east than downstream.

25 Q Would it have been very much more than the distance
26 which measurements show that the central portion moved?

27 A I am afraid that you are confusing something there.
28 The position of the central section is now .7 of a foot. That
29 is, the top of the central portion is now .7 of a foot farther
30 down stream than originally. Now, how far that went downstream
31 during the failure, I don't know, or anybody.

32 Q How far ^{has} the bottom of the central section been moved?

1 A The record furnished us was to the effect that the
2 lower west upstream corner was approximately out of position .77
3 of a foot, I believe it is.

4 Q Who made your surveys?

5 A Mr. Hall and also my man, Mr. Tracey.

6 Q Of course, it is a matter of record here, but to save
7 time, did your measurements substantially check with the measure-
8 ments testified to by Mr. Hemborg?

9 A Mr. Hall had .6 of a foot and Mr. Tracey got .8 of a
10 foot.

11 Q Do you remember how that checked with Mr. Hemborg's
12 measurement?

13 A He had .7, right between them, as I understand it. He
14 went on top of the section and located the exact point and had
15 more exact data.

16 Q Both your own statement in connection with your report
17 and also the evidence of the ladder trapped in the crack, indic-
18 ate, do they not, as you have just indicated in your testimony,
19 that there was a greater movement of that block by rocking or
20 otherwise during the course of the failure than the resulting
21 change in position?

22 A There is no doubt of that.

23 Q Then, you were asked a little while ago as to whether
24 the removal of the dam might not have caused a sufficient re-
25 leasing of pressure to account for the change in elevation, which
26 has been testified to, and I believe that you stated that you had
27 not heard the testimony, but if the testimony were that the
28 point observed was at the west end of the parapet wall some five
29 hundred or six hundred feet away from the dam proper, and that
30 the measurements disclose a rise of .28 of a foot, would you say
31 that there was any possibility of the removal of the load of
32 the dam from the structure, causing a rise of something over

1 three inches at this extreme western point?

2 A I would not anticipate anything of the kind unless the
3 whole wall was displaced---- that I don't know.

4 Q You testified a while ago about the increasing flow
5 indicated by the chart. Do you know of any other fact or cir-
6 cumstance indicating that there was a greatly increasing leakage
7 other than the record of the chart? In other words, was not
8 your conclusion as to a greatly increased leakage during the last
9 three and one half hours, based entirely upon the clock record?

10 A As far as the lowering of the reservoir prior to the
11 break, yes.

12 Q BY A JUROR: Did your engineer, Mr. Hall, take the
13 same pains in turning the angles twelve times in checking this?

14 A I don't know how many times, but I know that he check-
15 ed it two or threetimes because I questioned him. I also had
16 my man Tracey check them. Three surveys checking so closely I
17 am satisfied not only with the evidence of the shearing of the
18 face of the dam, that it would only be accounted for by the rock
19 shearing off of the face and the further fact of the horizontal
20 crack following the stream bed on the west of the standing sec-
21 tion---- the fracture in the structure, in the material, that
22 is rock adhering to the base of the dam, as separated from the
23 rock, which is in place in a perceptible crack, that is, from the
24 toe to the upper face of the dam.

25 A JUROR: (Addressing Mr. Rieber) You say in an arch
26 action of small section there would not be as much movement?

27 A That is correct.

28 Q The moment arm is less in proportion?

29 A The smaller piece has to straighten out and go down.

30 Q The less moment arm would cause failure?

31 A Yes. There may have been any amount of friction cracks
32 that nobody knows about there.

1 Q BY THE CORONER: Did you ever, in your engineering ex-
2 perience hear of an explosion of dynamite placed at that east end
3 of the dam, raise that hill at the end of the dam?

4 A No, I would not expect it to.

5 Q The statement was made here yesterday by the surveyor
6 that there had been an elevation at the extreme end of the dam.
7 Could that, in your opinion, have been caused by an explosion of
8 dynamite at the east end of the dam?

9 A No, I would not expect it.

10 Q BY MR. MOHR: It has been testified to here that the
11 west hill was thoroughly saturated, the saturation probably going
12 on during the period that the reservoir was filling up, and at
13 the time of the break that hill was thoroughly saturated. You
14 know that as a fact, and also your theory of the failure of the
15 west side and the velocity of the water being greatest there,
16 can you account for the small amount of erosion of that conglom-
17 erate and that schist on the west side, which is supposed to have
18 been saturated by that water?

19 A The saturation of the conglomerate on the west abutment
20 does not mean that the entire hill from the surface down to fifty,
21 sixty or one hundred feet, was saturated. The saturation was
22 taking place through the weathered section of the conglomerate or
23 the upper portion. The lower portion of the formation, naturally,
24 would be harder and would not absorb the water as much as the
25 weathered upper portion of the formation, and, naturally, would
26 resist the scouring a great deal more.

27 Q Did you notice in making your investigations, the amount
28 of scouring on the east side?

29 A I presume that that presages the fact that I knew the
30 exact condition of the bank on the east side, and the only thing
31 I have for that is the contour or the contour survey as furnished
32 by the Bureau and the photographs. I did not run a line up the

1 east embankment. There has been a very heavy slide on that east
2 embankment which, due to the nature of the material and the schist
3 formation, could very easily take place. In fact, the wind was
4 causing slides there continuously all the time I was standing
5 there at the dam site, some five days, with the rocks and dirt
6 continually rolling down so it would not take a great deal,
7 apparently, to cause a slide or the erosion which would take
8 place there with the water rushing out, it would be quite rapid,
9 and the undercutting of the toe would cause it. Continuous
10 undercutting when the water was comparatively low would still
11 cause slides from the east abutment.

12 Q So far as the scouring is concerned, as I understand
13 your report, the scouring occurred behind the dam by the west
14 side going out first?

15 A That is on the downstream side of the dam, yes.

16 Q Did you notice whether there was any difference in
17 the scouring on the upstream side, on the upstream side, on the
18 upstream bank?

19 A On the upstream side?

20 Q Yes.

21 A The downstream side. You could not observe the con-
22 dition at any time when I was up there, because it was all
23 covered by slides.

24 Q Did you observe the scouring of the sides on the up-
25 stream side?

26 A There had been a considerable scouring.

27 Q Is it of any value, in your opinion, to compare the
28 scouring on the east side and the scouring on the west side?

29 A The nature of the materials is so different that it
30 would be a difficult thing, to my mind, to set up.

31 Q In other words, you don't believe that the velocity
32 of the water on the west side would cause a greater amount of

1 scouring there than would be apparent on the east side?

2 A I believe that the west end of the structure remaining
3 in place, that is, that portion of the structure west of the
4 break, that allowed block H to go out as indicated to this
5 point (indicating), and that would deflect that water and carry
6 it across and impinge that entire volume of water on the east
7 side, followed by the failure of the east sector of the dam.
8 That water coming through a joint this water would naturally
9 not only create a great deal more scour, but a surging which
10 would increase the scour.

11 Q Would that not be greater on the downstream side than
12 any possible scour that could take place on the upstream side?

13 A That would depend entirely upon the softness of the
14 formation. Undoubtedly there was scouring took place at the
15 bottom of this broken section, as this section fell upstream,
16 and I believe was undermined at this corner there (indicating).
17 The northeasterly corner^{of} was this broken section.

18 Q As I understand it, your opinion is that a portion of
19 this went out before the main section went out?

20 A That I cannot say. I am only positive that the fail-
21 ure occurred in the foundation material in this section of the
22 dam immediately adjoining the contact plane between the schist
23 and conglomerate.

24 Q And you do not attempt to express any opinion as to
25 where the greatest amount of velocity of water was at the west
26 bank?

27 A I naturally would think it was here (indicating) and
28 that it was deflected across the stream.

29 Q Is there anything shown on the west side to show that
30 there was any greater velocity at any one point on that west
31 side any more than at any other point?

32 A The scour of the schist formation immediately ^{below} the con-

1 glomerate which was formed of competent material, portions of it
2 would have taken more scour to have taken that out, than it
3 would take for the conglomerate and there was undoubtedly a very
4 high velocity through this opening, whether it was greater there
5 than here, I don't know.

6 Q BY MR. ROBINSON: Would it take a greater velocity to
7 scour to the same extent the schist than the conglomerate?

8 A That would depend upon the bedding of the schist and
9 what condition it was in.

10 Q Generally speaking the schist is a firmer material?

11 A It is a firmer material. The conglomerate had been
12 saturated.

13 Q BY MR. MOHR: Assuming that this profile is correct
14 and made in accordance with correct surveys, does that tell us
15 anything? The surveys were made after the failure and the sur-
16 vey lines are those, of course, from the plans we have now?

17 A The line here, I think, is marked "foundation line",
18 which I assume is the surface upon which the dam was cast. Is
19 that correct?

20 Q Will you explain that?

21 A I think the point that he wishes to bring out, is the
22 fact that there is a larger amount of material displaced on the
23 east bank than on the west bank.

24 Q How do you account for that?

25 A I don't know as to the velocity on those sides. As I
26 have tried to point out three or four times, I am satisfied that
27 there was a convergence of water from the west side against this
28 bank, against the east bank, with the water coming through on
29 the east bank. The two together would, naturally, scour more
30 here than on the west.
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HAROLD B. HEMBORG, was

recalled and testified as follows:

Q BY MR. ROBINSON: Since you were on the witness stand the other day, has the work, as to which you testified, namely, the continuous check of the elevations on down to the canyon to the government bench mark near the Carey Ranch, been completed?

A Yes sir.

Q Will you state the result of that check?

A The check on the elevations is .04 between the two U.S.G.S. bench marks.

Q That is to say, in carrying your line you came out within .04 of the government measurements?

A Yes sir.

Q So, that even if you assume that that entire error occurred at the observation point, at the west end of the dyke, that would reduce your observation or change your observation--- first, of all, which way was it?

A I don't know which way the error went, plus or minus. Supposing all of the error was at that point on the dyke that would reduce the elevation, the vertical rise, by one half an inch, making it two and three-quarters of an inch instead of three and one-quarter of an inch.

Q Carrying it through in the same manner that you described the other day?

A Yes sir.

Q Have you had any report yet as to any observation as to whether or not the line of the dyke---- has there been any rise or fall at any other point?

A A party was sent out this morning to do that, and as soon as I get through testifying I am going down to find out if they have called in yet.

Q Here is a diagram which was referred to in connection

1 with some of the other testimony. Can you tell whether or not
2 that diagram which purports to show the foundation profile and
3 the surveys after the break----- whether or not that is substan-
4 tially and correctly shows the things it purports to show?

5 A I made the bed rock contours on which the dam was con-
6 structed, but not the profile after the dam went out.

7 Q Your work then, related to the bed rock?

8 A Yes, to the original bed rock profile.

9 Q Did you observe the work of the preparation of that
10 profile?

11 A Yes, after it was being done and how it was being done.

12 Q The other day you testified as to ^{limits} the/elements of
13 accuracy on that check of the horizontal movement based on tri-
14 angulations. What is the customary range of accuracy in that
15 class of work?

16 A I would like to explain that and the method of the
17 triangulation. To show an accuracy of one in 7,000 or 8,000 is
18 not a triangulation accuracy. The first order of triangulation
19 permitted by very precise theodolites is one in 200,000. It
20 would ~~range~~ from one in 50,000 up to one in 125,000. Also I
21 want to point out that an angle of one second is subtended by a
22 chord of one half hundred in 1,000 feet.

23 Q Your work was of what you call this second order?

24 A Yes sir.

25 Q With limits of one in 50,000 to one in 20,000?

26 A Yes sir.

27 Q BY MR. DENNISON: What was this, ^{topographic} a/photographic survey?

28 A That I am explaining?

29 Q Yes.

30 A No sir.

31 Q Geographic?

32 A A second check, a triangulation check.

1 Q And what you call this triangulation is a geographic
2 survey?

3 A It was a check to determine if any of our triangula-
4 tion points had moved. It could not be topographic.

5 Q What other line did you get in a geographic survey to
6 determine to determine this accuracy?

7 A Triangulation is taken off of a base line and project-
8 ed. They take a base line where it is easy to measure on level
9 ground and carry it on. This has been taken off of the U.S.G.S.
10 base line and carried up.

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14 GEORGE VEJAR, being first
15 duly sworn, testified as follows:

16 BY THE CORONER.

17 Q Please state your name.

18 A George Vejar.

19 Q Where do you reside?

20 A 428 West Second Street, Los Angeles, California.

21 Q What is your occupation?

22 A Chauffeur for the City of Los Angeles.

23 Q BY MR. ROBINSON: You have driven Mri Mulholland for
24 some time?

25 A Yes sir, three years in September.

26 Q Did you drive the car on the 12th day of March, taking
27 Mr. Mulholland and Mr. Van Norman to the St. Francis Dam in the
28 middle of the day?

29 A Yes sir.

30 Q On that trip when you went to the dam on which road
31 did you go actually to the dam?

32 A Up the west side, to a little concrete dyke over here

1 (indicating), and there is a new road there, and pulled the car
2 up pretty near to the concrete dyke and then Mr. Mulholland and
3 Mr. Van Norman got out and I backed the car on out and then they
4 walked on down to the dam and I turned the car there and I walk-
5 ed up to the dam there myself, and Tony was working up here (in-
6 dicating) on the dam.

7 Q Then, did Mr. Mulholland and Mr. Van Norman get out of
8 the machine at the same point?

9 A Yes sir.

10 Q They walked along near the parapet wall?

11 A Near here (indicating) and down here (indicating). I
12 walked down here (indicating).

13 Q You are indicating down the hill near the westerly end
14 of the dam?

15 A Yes sir. Mr. Mulholland sent me back after the car
16 and I came on down the road and there is another road up here
17 (indicating).

18 Q And old construction road?

19 A Yes, and there is a little sanyon there that I backed up
20 to turn around. Then I backed the car up here (indicating), as
21 far as I could. When I came to this (indicating) the water had
22 undercut the road to here, (indicating), and I backed the car up
23 as far as I could there.

24 Q As to these roads on the hill that you went over, and
25 also this road^{on} which you approached near the base of the dam, did
26 you observe the roads as you drove?

27 A Yes sir.

28 Q What was the condition of the road with reference to
29 being dry or wet?

30 A It was dry.

31 Q Does that answer apply to all of the roads that you
32 traveled over?

1 A Yes sir. I went over a new road to that dyke.

2 Q BY A JUROR: What kind of a car were you driving?

3 A A Marmon sedan.

4 Q A large heavy car?

5 A Yes sir.

6 Q BY MR. ROBINSON: Did you walk around on the hill in
7 the vicinity of these roads?

8 A Yes, part way down here, after Mr. Mulholland.

9 Q What was the condition under feet?

10 A It was dry. It was a kind of loose dirt or rock or
11 shale, or whatever you call it.

12 Q BY A JUROR: When you backed up here (indicating), did
13 you notice any slipping motion of your rear wheels?

14 A No sir.

15 Q You got easy traction?

16 A Yes sir.

17 Q How close did you get when you stopped?

18 A This had been washed out, about to here (indicating).

19 Q / About
20 How many feet was that from the dam, or yards?

21 A I guess it would be about fifty feet.

22 Q What was washed out?

23 A These gates here and this had been washed out (indicat-
24 ing). They had a weir here (indicating).

25 Q In the section there which was dedicated to----

26 A Yes sir, just here (indicating), and they had a weir
27 here (indicating), and a concrete foot bridge and a concrete
28 ditch from there.

29 Q A sort of pond?

30 A Yes.

31 Q Was it washing out the dirt on that side where you
32 stopped?

A It had washed that out.

1 Q Up this far (indicating)?
2 A Oh, no, no, on the lower road here (indicating).
3 Q And you were about here when you stopped?
4 A Yes.
5 Q Did Mr. Mulholland walk up to the dam at this point?
6 A I don't know.
7 Q Did Mr. Van Norman?
8 A I could not say because I went back after the car.
9 Q Where were they when you left to get the car?
10 A Walking down in here (indicating).
11 Q Did you see them over in here (indicating)?
12 A I did not, ~~xxxxx~~ because I went to get the car on the
13 lower road and came back, and when I first seen them they were
14 sitting here (indicating) resting.
15 Q How long did it take you to get your car and come back,
16 half an hour or ten minutes?
17 A I don't think it would be half an hour, fifteen minutes
18 probably.
19 Q Did you see any loose dirt there which had been deposit-
20 ed by a steam shovel?
21 A Yes, from where this road turned here (indicating).
22 Q Did that show any indication of having been washed?
23 A Not that I seen, no sir.
24 Q There was no water running down at that time?
25 A Not that I noticed.
26 Q In this small pond, that is where the water had washed
27 out the old road?
28 A Yes.
29 Q About how high was that above the stream bed on this
30 side here (indicating)?
31 A Four or five feet.
32 Q BY MR. DENNISON: Was that on Monday?

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A Yes sir.

Q Were you there on the previous Thursday?

A I don't remember.

Q Don't you remember when you took Mr. Mulholland up before that?

A No, I don't.

Q How long before that were you up there with him?

A I could not swear to that.

Q Have you no recollection?

A No sir.

Q Do you remember when they built the new road there?

A Yes, I remember when they were working on it.

Q You took him up there then?

A Yes sir, several times.

Q On this occasion did you hear Mr. Mulholland and Mr. Van Norman, on this Monday, having any discussion about the leak in the dam?

A No sir.

Q Was anything said in your presence?

A No sir.

Q Anything said by Tony in your presence?

A No sir.

Q Did you see any water coming out of the dam?

A No sir.

Q Did you see any water coming out of the hill?

A No sir.

EDWIN C. STARKS, being

first duly sworn, testified as follows:

1 BY THE CORONER.

2 Q Please state your full name.

3 A Edwin C. Starks.

4 Q Where do you reside?

5 A Stanford University.

6 Q What is your occupation or profession?

7 A Professor of zoology.

8 BY MR. ROBINSON:

9 Q / Does your work in connection with the Department of
10 Zoology at Stanford University include the study of fish life?

11 A That is a thing that I have specialized in for a good
12 many years.

13 Q About how many years?

14 A Thirty-five or nearly forty.

15 Q Were you requested by the Department of Water of the
16 City of Los Angeles to come to Los Angeles and to the San Fran-
17 cisco Canyon and make an investigation of fish in the canyon
18 in ponds and stranded in the canyon?

19 A Yes, I arrived on the 23rd of last month on a Friday.

20 Q Will you please state what inspection and investigation
21 you made and the results of it, stating it just as briefly as is
22 consistent with accuracy?

23 A I found a good many fishes. It is so long since the
24 catastrophe that the fish were in very poor condition. The
25 only thing which might show as to an explosion would be shatter-
26 ed bones. I saw nothing of that sort. The fishes were simply
27 reduced to empty skins or skins filled with maggots.

28 Q Did you find any live fish in any of the ponds down
29 the channels?

30 A No, we found fishes in the ponds in a good deal better
31 shape. They had not been pliable but they were reduced to con-
32 siderable decay. ^{It} / They had been a week or ten days, of course.

Q From the fact that you found no live fish, were you

1 able to draw any conclusion or deduction?

2 A It looked suspicious, to say the least, to find no
3 live fish in these practically clear pools. There were only,
4 in my mind, two or three things which could have killed them. It
5 might have been an explosion or they might have been killed by
6 silt or by rushing waters, but the last I rather refuse to be-
7 lieve, knowing as I do the very swift waters that fish live in
8 in surf and mountain streams.

9 Q What kind of fish did you find?

10 A Two kinds, black bass and carp.

11 Q Were they a strong resistance fish that would stand
12 a good deal of battering around?

13 A The carp is a very strong fish. It is a favorite fish
14 for physiologists to use in cutting nerves and letting them re-
15 cover and doing experiments. It will live without much oxygen
16 and oxygen would be the thing that would kill those fishes in
17 the pond, the lack of oxygen.

18 Q That is, if they had survived?

19 A Yes, and had gone into the pond, either from over-
20 crowding or silt getting into their gill filaments and so stopp-
21 ing them from getting the proper amount of oxygen.

22 Q In the event of the death of fish from silt, is there
23 any evidence of that which is observable in the dead fish?

24 A As far as I know there is always. In these cases you
25 can find the silt still in their gills. Their gills are covered
26 with a sticky mucous and this fine mud mixes up in the gills and
27 it stays there and their gill openings are open to the widest
28 extent and their mouth is gaping, the purpose being to spread
29 these gill filaments out so that they will be in contact with the
30 greatest amount of oxygen.

31 Q Then, as I understand it, your conclusion from what
32 you observed, was, from the fact that nothing but dead fish were

1 found, might be explained by either of three causes, either by
2 being battered around by the rushing torrent----

3 A Not battered around because if they had been thrown
4 against obstacles that would have been shown. Under the skin
5 would be found contused areas.

6 Q Did you find any such?

7 A None such at all.

8 Q You thought that the death from the rush of the water
9 was improbable?

10 A I should think so.

11 Q And you failed to find the things you usually find as
12 a result of death from silt?

13 A Yes.

14 Q Did you make any observation of significance as to any
15 fish which were found stranded, either in the reservoir site or
16 in the pool---- either one of the pools?

17 A I opened a great many of them to see if I could find
18 any shattered bones. I found the vertebral column apart, but
19 that could be explained by decay, just as well as by dynamite.

20 Q Is that a condition which might be caused by an ex-
21 plosion?

22 A It certainly is.

23 Q But, on account of the decomposed condition, you were
24 unable to determine what caused it?

25 A It might have been either.

26 Q Did you make any observation as to the condition of
27 the fish so stranded that seemed of any significance?

28 A Those in the reservoir on the upstream side of the
29 dam were almost invariably headed away from the dam, but I fail-
30 ed to see any great significance in that. They would not have
31 been so headed if they had not been alive when they were strand-
32

1 ed. They very apparently drifted down the stream---- that is
2 just the way a fish always drifts and when finally stranded they
3 were so exhausted they did not have strength to throw themselves
4 about and died where they landed.

5 Q You noticed the circumstance that the fish practically
6 all lay with their heads upstream and tails downstream and don't
7 know what conclusion to draw from that?

8 A Yes sir.

9 Q In the case of these, did you observe as to whether
10 the gills were expanded or not?

11 A No, ^a the fish in the air may die with the gills expanded
12 or not. If it is exhausted it probably will not.

13 Q Have you had any experience in the effect of a dynamite
14 explosion in a body of water?

15 A Yes, in small amounts of dynamite. It is the favorite
16 way of collecting fish for scientific purposes.

17 Q Have you employed that method yourself?

18 A Yes, in various tropical places where there are coral
19 or other reefs, a stick of dynamite will bring up to the surface
20 a great number of fishes over an area as big as this room or
21 more.

22 Q Have you had any experience of the effects of the ex-
23 plosion of a considerable charge of explosive in a large body of
24 water?

25 A None whatever. Two sticks, I think, is the most I
26 have ever used.

27 Q Your experience as far as the actual observation of
28 the area over which destruction would occur, is based on the
29 use of small quantities for scientific purposes?

30 A Yes. I am told that within a confined area such as
31 a reservoir, any amount of dynamite exploded would have a very
32

1 decided increasing action by the reflected waves impinging on the
2 sides of the reservoir and going back much more than in the open
3 sea, and consequently we might look to see every fish in the reser-
4 voir ~~shocked~~ to some extent from the explosion.

5 Q Your experience, as far as the actual application of
6 explosives is concerned, has been in the ocean or large bodies of
7 water?

8 A Yes, and over reefs where perhaps the fish were in
9 crevices or where a small amount of explosive might have had a
10 greater effect than if they were in the open water, but, of course,
11 some were in the open water. Some of them were suspicious and
12 are only found in the open water.

13 Q BY THE CORONER: Did you find any fish on the hillsides
14 below the dam?

15 A No, I looked for them very diligently thinking that
16 if any fish had been injured they would go out with the first
17 rush of water and I also looked for them in the canyons, but did
18 not find any, but found some at the mouths of these tributary
19 canyons, showing that they had come into these canyons and with
20 the subsiding water had become stranded.

21 Q BY MR. DENNISON: You have done some fishing in your
22 lifetime?

23 A Yes, in a wholesale way, not fly fishing.

24 Q When you use dynamite in a pond they come to the sur-
25 face?

26 A If they have air bladders and they are not ruptured.

27 Q Some sink and some come up?

28 A Yes.

29 Q The great majority of them have air bladders?

30 A You cannot say that. A great many do and many do not.

31 Q Can you say which ones have air bladders, and which do
32 not?

1 A You cannot say which groups have.

2 Q BY THE CORONER: Can you say whether carp or bass have?

3 A Both of these have. Our mackeral has an air bladder
4 and the East Coast ^{mackeral} ~~makeral~~ has not.

5 Q And if dynamite is exploded where they are, they will
6 come to the surface and you would look for them down the stream?

7 A Yes.

8 Q You went up in the reservoir itself and found some dead
9 fish?

10 A Yes.

11 Q And they were decayed?

12 A Yes.

13 Q You could not get anything from them?

14 A No.

15 Q But from the way they were lying in the stream you de-
16 duced the fact that they were traveling upstream?

17 A Yes.

18 Q That is the way they always travel?

19 A Yes, they did-not went down tail first.

20 Q Now, a carp is a lake fish or sluggish water fish?

21 A Yes.

22 Q BY MR. DENNISON: And they would drown in a pool of
23 water?

24 A They might, if there is no oxygen.

25 Q So, in a pond of water they would drown?

26 A We found no carp inside the reservoir. They were all
27 in pools.

28 Q What is the difference between bass and carp, as to
29 being lake fish?

30 A They are both fresh water fishes.

31 Q Some fishes inhabit swift running streams and some
32 sluggish water?

1 A The carp is more of a sluggish water fish.

2 Q Isn't the bass too? What kind of bass were they?

3 A I think small mouth, black bass.

4 Q How large?

5 A Perhaps a foot long. I don't remember any longer than

6 that. One or two of the carp were longer.

7 Q How far below the dam did you find any fish?

8 A As far as we looked. It was perhaps a couple of miles.

9 The last canyon we looked into was below Power House No. 2, below

10 Drinkwater.

11 Q Did you find any fish?

12 A Yes.

13 Q What did you find?

14 A Down in that direction is where we found the carp as

15 well as the bass.

16 Q How many carp did you find?

17 A Four or five.

18 Q Were they decayed?

19 A Yes, just the same as the bass.

20 Q You could not get anything from them?

21 A The flesh was more or less firm so that we could cut

22 them up and examine the bones.

23 Q Did you examine them?

24 A Yes.

25 Q What did you find?

26 A Nothing in the way of shattered bones. We found in-

27 flamed areas around the bones, which would be a very suspicious

28 thing if they were fresh fish. In a dynamited fish there seems

29 to be a little motion in the fish so you get the broken capillar-

30 ies and the inflamed areas.

31 Q What would be the habit of bass that were occupying any

32 such a place as the reservoir up here, in the nighttime, being

1 near the wall itself?

2 A I don't know anything about it, and I don't believe
3 anybody does.

4 Q You have fished some?

5 A At night you can always catch them at night, sometimes
6 better than in the daytime.

7 Q If you were going up there to fish just about what part
8 of the place would you look for these bass?

9 A For weedy areas, almost anywhere in the reservoir.

10 Q Would you not look out in the center?

11 A I don't know why not.

12 Q BY A JUROR: You say you found no live fish?

13 A None whatever.

14 Q In your entire investigation how far below the dam did
15 you go?

16 A I suppose a mile or two. I looked up the canyon sides
17 all the way. The next day the ponds were sand and we found very
18 deep ponds, which is an added mystery as to ^{there} why/they were not
19 live fishes.

20 Q What is your opinion as to what caused the death of all
21 these fishes?

22 A There are only two or three things that I can believe.
23 I don't believe it was the rush of water. It might have been
24 the silt. I believe it might have been an explosion.

25 Q You were not satisfied that the silt killed them all?

26 A I was not satisfied that it killed any of them. The
27 ponds were all perfectly clear but whether it had been in suspen-
28 sion long enough I don't know.

29 Q The only way you could account for the fact that they
30 were dead fish, was because there was some shock?

31 A Yes.

32 Q Such as a landslide?

1 A Not unless it slid on them.

2 Q Could an earth movement kill the fish?

3 A I don't think so. You can dynamite the land right
4 alongside the water and not kill the fish at all.

5 Q What other observations have you relative to that
6 point?

7 A Nothing except I saw a ledge dynamited and it did not
8 affect the fish, and I have talked to men about it, as to whether
9 there was any possibility of a dynamite explosion in the lake
10 affecting the fish alongside, and they were very confident that
11 it would not.

12 Q Would it have been reasonable to have expected to find
13 live fish in these remaining pools below the dam?

14 A I think so. That is the mystery, why they were not
15 alive. They were perfectly clear pools and they could not have
16 been killed in the rush of water.

17 Q There were live fish in these pools below the dam pre-
18 vious to the dam's failure?

19 A There were not pools there, as I understand it. I
20 don't know. I suppose these pools were washed out by the scour
21 of the water. I suppose that they were simply depressions left
22 by the water.

23 Q BY MR. DENNISON: You understood that the pools were
24 made by the flood waters?

25 A I had that in mind. I did not question that.

26 Q Would you expect this pool of water--- to put clear
27 fresh water into that pool?

28 A They were clear when I saw them. They had been full
29 of silt.

30 Q What would their condition the next morning after the
31 flood be?

32 A They were would be muddy.

1 Q The silt would be in there?

2 A Yes.

3 Q And they could not live in there at all?

4 A It depends on the amount of silt.

5 Q How much silt would be in one of these pools the next
6 morning to safely permit a fish to live?

7 A I should imagine it would sink pretty rapidly.

8 Q These fish that you found in the reservoir above the
9 dam were dead?

10 A They were on land.

11 Q They were dead?

12 A Yes.

13 Q How far up?

14 A Several--- I don't know how far up.

15 Q Just how did they come to die?

16 A They were on land.

17 Q The water went away and left them and they died?

18 A Yes, but the fact that they were pointing upstream may
19 indicate that they were pretty badly weakened.

20 Q BY A JUROR: In breaking out pieces of that very mass-
21 ive structure, there would unquestionably be some very severe
22 vibration along those very large fracture planes. Do you know
23 whether or not the vibrations transmitted through the water
24 would have any effect on the fish?

25 A I don't believe it, but I don't know this beyond my
26 own experience. It is pretty difficult to believe that even two
27 great rocks coming together would make enough concussion to kill
28 anything in the water.

29

30

31

32

R. R. PROCTOR, was re-

1 called and testified as follows:

2 Q BY MR. ROBINSON: Were there any ponds in the San Fran-
3 cisquite Canyon between the St. Francis Dam and a mile below
4 Power House No. 2 prior to the going out of the dam?

5 A Yes, only a slight depression made by the steam shovel
6 in excavating gravel. These were not at the location of the
7 present pools.

8 Q How big are any of the present pools?

9 A Some are, I imagine, five hundred or six hundred feet,
10 and there are two in the canyon at present which it is almost im-
11 possible to get around on foot.

12 Q They occupy practically the whole floor of the canyon?

13 A Yes.

14 Q Have you any information as to the depth of the water
15 in these pools?

16 A No.

17 Q BY A JUROR: Were there live fish in these small pools
18 prior to the failure of the dam?

19 A I could not say.

20 Q Were there live fish in the forebay below the dam?

21 A I could not say as to that.

22
23
24
25 ZATTU CUSHING, being

26 first duly sworn, testified as follows:

27 BY THE CORONER.

28 Q Please state your full name.

29 A Zattu Cushing.

30 Q Where do you reside?

31 A El Paso, Texas.

32 Q What is your occupation?

1 A Explosives, for twenty-two years.

2 Q BY MR. ROBINSON: What has the nature of your connec-
3 tion with explosives been?

4 A Technical.

5 Q Will you, as briefly as you can, indicate the nature
6 of your activities connected with explosives?

7 A To specify explosives for certain work and watch the
8 effects of explosives.

9 Q By whom are you or have you been employed during most
10 of this time?

11 A Up to 1913 I was with the Dupont Company and when the
12 government split them up I fell with one of the subsidiary com-
13 panies, known as the Atlas.

14 Q Have you had any military experience?

15 A During the war I was Inspector of Explosives for the
16 Government.

17 Q With what rank?

18 A They appointed me a Major, but I did not wear a uniform.

19 Q What position did you hold in the army?

20 A Inspector of Explosives for the Ordnance Department.

21 Q For what division?

22 A Chicago.

23 Q Give, very briefly, some indication of the nature of
24 your work as Inspector of Explosives for the army.

25 A Being familiar with the formulas, I would go over the
26 formulas and see that the explosives being shipped to France, were
27 regular in shape and color.

28 Q As I understand it, this work that you speak of, in ad-
29 vising as to the use of explosives, you mean by that as a repre-
30 sentative of the powder company by which you were employed, you
31 would advise them in the use of explosives, as to the proper
32 methods of handling them for mining and tunnels, and so forth?

1 A My studies have been along the resistance of rocks and
2 materials, advising as to the amount of explosive to move that
3 material with the least expense.

4 Q Were you at any time in a position to observe, or did
5 you have anything to do with the use of explosives in connection
6 with the construction of the Los Angeles Aqueduct?

7 A Yes sir, I was four years on the construction of the
8 Los Angeles Aqueduct.

9 Q By whom were you employed?

10 A The Du Pont Powder Company, but the firm which was a
11 subsidiary. I had to remain here under the directions of Mr.
12 Mulholland.

13 Q You were sent out to supervise the use of explosives on
14 that particular job?

15 A Yes.

16 Q Has your experience in the directing of the use of ex-
17 plosives been widespread at all?

18 A In the Hawaiian Islands, Alaska, South American, Panama
19 Canal. I was sent everywhere.

20 Q At whose request, if anybody's, or how/^{do} did you happen
21 to be here at present?

22 A I was intensely interested in the dam disaster and I was
23 acquainted with the aqueduct, friends with everybody on it and I
24 read in the paper that Coroner Nance had picked up a piece of ^{concrete} ~~clay~~
25 that crumpled in his fingers, and I told my wife that Mr. Mul-
26 holland never made any such concrete as that and that the only
27 thing that would crumble concrete would be a shock by explosives,
28 and I was coming over here to see that myself.

29 Q As I understand, you came here of your own accord to
30 investigate conditions?

31 A I did.

32 Q Since coming here have you made any investigation of

1 the conditions at the St. Francis Dam Site?

2 A Yes sir.

3 Q Are investigations being prosecuted under your super-
4 vision at present?

5 A Yes sir.

6 Q Have they been completed to a point where you are pre-
7 pared to express any opinion?

8 A No sir.

9 Q Have you made any observation of the schist formation
10 on the east side of the San Francisquito Canyon at the dam site?

11 A Yes sir, I made the observation on what is left, and,
12 in addition to that, I am well acquainted with the schist because
13 of the tunnels that were run by the aqueduct.

14 Q One of the tunnels from Power House 1 to Power House
15 No. 2 goes through this hill country somewhat above the St. Fran-
16 cis Dam site, is that correct?

17 A Yes.

18 Q Did you have any opportunity to make any observation
19 of that schist formation at the time of the construction of these
20 tunnels?

21 A Yes sir. That was the formation that I suppose caused
22 the aqueduct officials about as much worry as any place they
23 ever ran.

24 Q Did you observe the effect of explosives on those
25 tunnels?

26 A They were using 40% dynamite on these tunnels and it
27 would fracture them so badly that I advised the use of 20% powder
28 in these tunnels.

29 Q What conclusion did you draw from that, as to the abil-
30 ity of that formation to stand explosive shocks?

31 A It will not stand any explosives.

32 Q Have you observed the hillside at the east side of the

1 dam in the course of your investigations?

2 A Yes sir.

3 Q What, if any, conclusions or inferences that are sig-
4 nificant here, can you state from your observations?

5 A There is nothing left on the hillside to indicate any
6 use of explosives, if I catch your question right.

7 Q As to the material that is there in the slides?

8 A The material is schist and easily shattered by explo-
9 sions. One other thing I will add there. The dip of the
10 schist seems to be to the northwest slightly and that will help
11 the explosive to scatter in a motion towards the south, I think.

12 Q In your opinion would the placing and exploding of a
13 fairly large charge of dynamite at a point near the east end of
14 the St. Francis Dam and within the water, well under water, cause
15 an explosive scattering of the schist formation at that point?

16 A Yes sir.

17 Q Have you had any experience with reference to the effect
18 on fish life of the explosion of large charges of explosives with-
19 in good sized lakes?

20 A Not personally, but I know of a case.

21 Q Has it come within your observation in the line of your---

22 A Not within the line of explosives.

23 Q Within the line of your studies?

24 A No sir.

25 Q What knowledge have you?

26 A I just happen to know of a case. There is a lake in
27 New Mexico, a Lake Cavereste, and it was noted as a trout lake,
28 and as young people we used to go up there fishing every summer,
29 but some coal miners came along one time and could not catch the
30 fish by flies so they brought a case of dynamite and put it on a
31 raft and set it off in the middle of the lake and I don't think
32

1 I ever heard anybody say that there were ever any fish in the
2 lake afterwards. They were washed up from five to six feet on
3 the shores of that lake. Now, that the State of New Mexico has
4 hatcheries they have restocked the lake.

5 Q BY MR. DENNISON: Have you been told that when dyna-
6 mite is exploded in a lake like that the fish come to the surface
7 and are dead?

8 A No, I have never been told that.

9 Q BY MR. ROBINSON: What do you know about it?

10 A I know that these fish were washed up on the shores.
11 I don't know whether they came to the surface. I have always
12 understood that if their bladders were bursted they came to the
13 surface.

14 Q BY MR. DENNISON: Do you think that the explosion of
15 dynamite in and about where this dam was located would have con-
16 siderable effect upon the schist formation there?

17 A Yes sir.

18 Q There is some evidence here that several days before
19 the failure of this dam, some thirty or three hundred feet below
20 the dam they were blasting there, just below the dam on the west
21 side, to build a new road. Do you think that would have any
22 effect upon that formation there?

23 A No sir, because I investigated that phase of it and
24 they were only using about two sticks at a time on that road, and
25 it was not in the schist. It was in the conglomerate.

26 Q You don't think that would have any effect at all?

27 A No sir.

28 Q BY THE CORONER: Dynamite will move any kind of stone?

29 A Yes sir, but this schist formation is very susceptible
30 to fracture.

31 Q You know the dimensions of that dam?

32 A No.

1 Q I understand that dam was a hundred and sixty-nine feet
2 at the base and over two hundred feet high from bed rock at the
3 center, and stepped up in five foot steps, and sixteen feet wide
4 at the top. How much of a charge of dynamite, in your opinion,
5 would it have taken to blow that dam out?

6 A To blow a hole through that concrete?

7 Q Yes.

8 A I don't know. Maybe a carload would crack it.

9 Q How long would it take to rig up a carload sufficient
10 to crack that dam?

11 A I would say that even as low as twenty-five pounds
12 placed on the bottom of that dam would fracture that schist clear
13 through the width of the bottom of the canyon. I am not talking
14 about blowing the concrete, I am talking about blowing the schist.

15 Q Just where could it be put to effect the foundations
16 of the dam so that it would go out?

17 A Anywhere from in twenty feet of water on down.

18 Q BY A JUROR: What would be the audibility from that
19 charge?

20 A None whatever, just a grunt. You would not hear it.

21 Q What would be the effect as to depth?

22 A The deeper you got it the more force it would have.

23 Q The greater penetration?

24 A Yes sir.

25 Q You would need more powder, I presume, the wider the
26 section?

27 A Yes. I was thinking of a maximum quantity of fifty
28 pounds of gelatine put in there that would blow a hole through
29 that formation.

30 Q Would it do the same on the west side?

31 A When it comes to an explosive standpoint, the strong
32 point is that it would radiate through this stuff, it would pot.

1 Q You would undertake to blow it up from the east end
2 rather than from the west side, if you had the job of blowing it
3 up?

4 A Yes. I would do it here (indicating).

5 Q Did you find any pieces of concrete up there that
6 looked like they had had explosives set up against them?

7 A Yes sir, I have.

8 Q BY THE CORONER: What were the evidences you saw?

9 A This crack in one of the concrete blocks. A crack
10 in this special block set in the bottom of the dam and the crack
11 is possibly three feet from the face of the dam, and from the
12 bottom ^{for} up/4~~4~~-is possibly three feet it is very much shattered.
13 You can see the little fine seams of scattering. Back from
14 that to the north and inside I am sorry to say that the tourists
15 have taken nearly all of that now, but when I first saw it it was
16 badly shattered; not very high up but the shattering extended
17 clear through the block.

18 Q What makes you think that was caused by an explosive?

19 A My experience has been that dynamite is the only thing
20 that would disintegrate concrete.

21 Q Would that fall in?

22 A You can go all over the other cracks----

23 Q Have you a sample?

24 A I have a sample of it.

25 THE CORONER: Contrary to my general opinion as to the
26 accuracy of newspapers, this was an error and I never had any
27 such particle of concrete in my possession, nor do I know now
28 that it will crumble. What paper did you see that in?

29 A In the El Paso Times.

30 BY MR. DENNISON:
31 Q/ By whom are you employed now?

32 A No one.

Q Didn't you say you were making an investigation of this

1 formation?

2 A Yes.

3 Q And you came here at your own expense?

4 A Yes.

5 Q And you do not expect to get any pay for it?

6 A I don't.

7 Q Where was this block from which you took this sample?

8 A Immediately in front of this dam.

9 Q Who was with you at the time that you took it?

10 A Mr. Robinson.

11 Q BY MR. MOHR: Regular D.A. tactics.

12 MR. DENNISON: When did you take that?

13 A Last Tuesday.

14 Q BY A JUROR: When do you expect to complete your
15 studies?

16 A I don't know. They have to goad their way through the
17 rocks and I have given them positive instructions not to use any
18 explosives.

19 Q Are you being paid for that work?

20 A No, the City is paying for that work.

21 Q You are just watching the work for the City?

22 A Yes.

23 Q BY MR. ROBINSON: This work is being done by the Water
24 Bureau?

25 A At my suggestion, yes sir.

26 Q BY A JUROR: Where are you making this investigation?

27 A In this block to see where the crack goes in relation
28 to the face.

29 Q BY MR. MULHOLLAND: Some of my men are digging there?

30 A Yes sir.

31 Q Some men from the San Fernando Valley?

32 A Yes sir.

1 Q That is the first I knew of it. I did not know he was
2 digging up there. I knew he was here.
3
4
5

6 HALBERT P. GILLETTE, be-
7 ing first duly sworn, testified as follows:

8 BY THE CORONER.

9 Q Please state your full name.

10 A Halbert P. Gillette.

11 Q Where do you reside?

12 A Chicago, Illinois, although I have a winter home in
13 Souther Pasadena, California.

14 Q You are living here now?

15 A 707 Benita Drive, South Pasadena.

16 Q What is your occupation?

17 A Civil engineer and editor and consulting engineer.

18 Q Where did you graduate?

19 A Columbia University, New York City. I took a course
20 in mining engineering and graduated in 1892.

21 Q BY MR. ROBINSON: Will you please state what your ex-
22 perience in engineering matters and so on has been?

23 A Then, entered civil engineering shortly afterwards, my
24 first work being for the Fairhaven Water Company, located in
25 Puget Sound. I have been there consulting chief engineer for
26 some thirty years. Shortly afterwards I engaged in contracting
27 work in that section of the country and when the bank failed I
28 went east to New York State and for a short time taught surveying
29 at Columbia University and then passed a Civil Service Examina-
30 tion and was appointed Assistant Engineer to the State Engineer
31 on the Erie Canal work, which was then just beginning, a deepening
32 of the canal. I spent two years there as assistant state

1 engineer and then went into the contracting business again, build-
2 ing one dam across the Saranac River for the state, and did
3 miscellaneous contracting until about 1903, and then I entered
4 the publishing business for a short time and was one of the assis-
5 tant editors of ~~Engineering~~ News of New York City, and then start-
6 ed a publishing business of my own, and consulting engineering
7 business, and in 1906 I became Chief Engineer of the Washington
8 Railroad Commission and did the first appraisal work for them in
9 1906 and 1907, and following that did a great deal of appraisal
10 work for Water Works and Light and Power and other public utility
11 companies right down to date. That, in a nutshell, is the gener-
12 al character of my work. I am editor of Engineering Contractor
13 and the other ^{water} is/works.

14 Q Published where?

15 A In Chicago.

16 Q Are you a member of any technical societies?

17 A Yes, a member of three civil engineering societies, the
18 American Society of Civil Engineers, the Western Society of
19 Engineers, and the Association of Engineers, which is not alto-
20 gether civil, and a past member of the American Institute of Min-
21 ing Engineers.

22 Q As a matter of fact, you are one of the few engineers
23 who are listed in "Who's Who in America"?

24 A I have never looked it up, but somebody said I was.

25 Q Have you done any ~~kit~~ writing on technical subjects?

26 A Yes. One book on rock excavation, one on earth works
27 and embankments, and two or three hand books on methods of con-
28 struction and costs.

29 Q Have you had any experience in the construction of
30 dams, either the actual construction work or appraisal work?

31 A Of course, in preparing articles for magazines, of this
32 kind, I have visited a great many dams and in my personal work

1 have carefully examined many more in New York State, have apprais-
2 ed all the properties of the Nevada Power Company. That company
3 has many rock dams on the east slope of the Cascade Mountains,
4 and all the properties of Stone & Webster, and have just finish-
5 ed an appraisal for the Philadelphia Electric Company, where
6 they are completing now the great Conwengo Dam across the
7 Susquehanna River and the Ashoagan Dam.

8 Q Will you state the circumstances under which you
9 happened to be here and became interested in the problems of the
10 St. Francis Dam?

11 A I was in Texas at the time of the failure of the dam
12 and did not get back for about twelve days after its failure,
13 and then went up to view the dam.

14 Q Back to where?

15 A To this section of the country, to South Pasadena where
16 I live, at the present moment, and I went up there to prepare an
17 article for two of my magazines. Of course, I had read some
18 fragmentary newspaper articles of what had been presumed to be
19 the cause of the failure, and I made three trips to the area of
20 the failure, one below the dam and two to the dam, and am prepar-
21 ing an article. I have a few additions to make to it after hear-
22 ing this testimony, which I have written.

23 Q Did you do that in the usual course of the preparation
24 of material for your magazines?

25 A Yes sir.

26 Q Are you in any manner whatsoever, employed by the City
27 of Los Angeles or its Department of Water and Power?

28 A No sir, and never have been.

29 Q Your interest is wholly that of an editor of technical
30 papers?

31 A Yes, purely.

32 Q I understand you have written a paper for publication

1 in one or more of your magazines?

2 A Yes sir.

3 Q Does that paper correctly state your observations and
4 opinions with reference to the St. Francis Dam catastrophe?

5 A I think I have given the salient data and expressed
6 some opinions of my own, after reading the testimony and viewing
7 the dam site.

8 Q The matter expressed in the magazine are your opinions?

9 A Yes sir, absolutely.

10 Q Have you a draft of that paper with you?

11 A Yes sir, I have.

12 Q Would you be willing to read it?

13 A Yes sir. (The witness reads as follows:)"The Cause of
14 the St. Francis Dam Failure, by H.P.Gillette, Editor. At 11:57
15 P.M., March 12th, the St. Francis dam went out, releasing nearly
16 12 billion gallons of water, causing the death of about 450
17 people and a property loss of about \$7,000,000. This dam was
18 part of the water storage system of Los Angeles, and was design-
19 ed to impound 38,000 acre-feet. It was almost full at the time
20 of failure. The dam was across San Francisquite canyon, 45 miles
21 northwest of Los Angeles. The suddenly released water swept
22 down the canyon for 9 miles, and then down Santa Clara river for
23 another 47 miles to the sea, destroying hundreds of buildings in
24 several towns and many farms. Warnings did not reach several
25 hundred people in the path of the flood, which is estimated to
26 be about 500,000 cu. ft. per sec. at its maximum. The depth of
27 the flood was about 125 feet at its highest, 3/4 mile below the
28 dam.

29 In the bed of the canyon, 1.5 miles below the dam a hydro-
30 electric power station was destroyed by the flood 5 mins. after
31 the dam burst, so that the water traveled that distance at the
32 rate of 18 miles an hour. The following table gives the distance

1 from the dam to five points below, and the time elapsed between
2 the bursting of the dam and the arrival of the flood.

	<u>Distance Miles</u>	<u>Time</u>
3		
4 Power Plant No. 2	1.5	5 mins.
5 Saugus substation	9.5	47 mins.
6 Edison construction camp	18.0	1 hr. 28 mins.
7 El Rio Bridge	51.5	4 hrs. 48 mins.
8 Ocean	56.0	5 hrs. 37 mins.

9 The greatest question that confronts hydraulic engineers is
10 the cause of the disaster. Four theories have been suggested:
11 (1) A natural landslide on the eastern or left-hand side of the
12 dam. (2) A softening of the conglomerate under the west end
13 of the dam due to seepage, and a slipping of the west end of the
14 dam on or with the softened foundation. (3) An explosion at
15 one or both ends of the dam. (4) An earthquake or other major
16 earth movement.

17 According to newspaper reports, the landslide theory seems
18 to have presented itself first to William Mulholland, chief
19 engineer and builder of the dam, when he first viewed the wreck.
20 Although the editor had not read or heard this theory, it was the
21 one that first suggested itself to him as he looked upon the
22 scene shown in Fig. 1. Staring the observer in the face is a
23 great landslide on the east or left-hand bank, which might easily
24 have caused the dam failure. The yardage that moved in this
25 slide may exceed the original concrete yardage in the dam. As
26 an engineer looks on this slide he naturally infers that it may
27 have carried part of the east end of the dam into the canyon,
28 leaving it below the concrete monolith that remains standing in
29 the center of the canyon. Fig. 2 shows that this is exactly
30 what happened.

31 Than as an engineer considers what other inferences are to
32 be drawn if the east side failed first, he concludes that some-

1 where down the canyon he may find at least one chunk of the east
2 end lying immediately below a chunk from the west end. And this
3 inference also is confirmed, for there are two such chunks which
4 are seen in Fig. 1, and are marked 1 and 2. Chunk No. 1 is the
5 size of a small house, and there adheres to it part of the cutoff
6 wall from the west end of the dam. Chunk No. 2 is somewhat
7 smaller and lies a short distance from No. 1 in such a position
8 that it must have been deposited before No. 1 arrived. No. 2 has
9 adhering to it the gray schist that is characteristic of the east
10 bank and of the bed of the canyon. A survey by the engineering
11 committee of investigation appointed by the governor has confirm-
12 ed the editor's conclusion that chunk No. 2 is from the east end
13 and chunk No. 1 is from the west end of the dam; but the committee
14 seems to have seen no significance in the position of these two
15 chunks of concrete. Perhaps their failure to note the signifi-
16 cance is attributable to their strong belief in the theory that
17 the failure of the dam is ascribable to the softening of the con-
18 glomerate rock on the west end, due to water seepage. They say in
19 their report that: "With such a (soft conglomerate) formation
20 the ultimate failure of this dam was inevitable, unless water
21 could have been kept from reaching the foundation."

22 This is pretty cocksure language and it seems likely that
23 cross-examination of the authors of any such statement would re-
24 sult in many a qualification as to the "inevitability" of this
25 failure. First, there is the fact that the dam had been in ser-
26 vice for two years and had held water long enough to have soften-
27 ed the conglomerate many months ago to a point of failure if all
28 that the committee says about this rock is true. Second, there
29 are hundreds of dams founded on soft earth of all kinds, still in
30 service in spite of the alleged inevitability of failure if soft-
31 ness and clay-likeness of the foundation lead inevitably to dam
32 failure.

1 The writer had passed by the dam several times during the
2 construction and since it was finished, and had stopped to see the
3 nature of the construction. The rock foundation appeared solid,
4 and the seepage after completion was not in the least alarming.
5 Engineers who have seen many rockfill dams and earth reservoirs
6 would regard the normal seepage under the St. Francis dam as be-
7 ing trivial. Whether there was abnormal seepage just prior to
8 its failure, the writer cannot say of his own knowledge; but can
9 only weigh the testimony, which indicates nothing abnormal.

10 The mere fact that water had been seeping through the con-
11 glomerate is not sufficient evidence that this caused the dam to
12 fail. Water frequently seeps through concrete itself, following
13 horizontal seams between successive layers of concrete. Yet no
14 engineer views such seepage with alarm, for it can neither erode
15 any of the concrete nor reduce the sliding friction sufficiently
16 to be dangerous. Similar seepage through the rock foundation of
17 a dam is not more serious than seepage through the dam itself,
18 unless it scours away the rock or reduces the friction. Many
19 rock-fill (uncemented rock) dams and most earth dams are founded
20 on earth. Seepage is common through and under such dams. There
21 is little or no cohesion of the material of which such dams are
22 made or of the material on which they rest. They resist destruc-
23 tion only because the force of friction is greater than the pres-
24 sure of the water, for there is usually no cohesion of the mater-
25 ial to aid appreciably in withstanding the water pressure. Hence
26 it follows that even were the entire mass of conglomerate at the
27 St. Francis Dam so soft as to be easily picked out, that in it-
28 self would not be conclusive evidence that the dam had failed be-
29 cause of foundation softness. But the conglomerate now visible
30 is far from being earth-like, except in relatively small areas;
31 and in those places the editor could see no indication that the
32 softness was responsible for the failure.

1 It is amazing to read in that committee report that the con-
2 glomerate should not be called rock at all. The editor picked
3 in this rock at enough places to satisfy himself that, while it
4 has very soft spots, their area is relatively small. The worst
5 parts are along a fault between the conglomerate and the schist.
6 But this fault dips into the west bank in such a way that no
7 sliding down the fault could have occurred. On the other hand,
8 the schist on the east bank dips into the canyon in such a way
9 that a slide could occur; and no one denies that slides of the
10 schist did occur on such a scale as to destroy the east side of
11 the dam. Those who espouse the soft conglomerate theory think
12 that the slides of schist followed after a break in the dam on
13 the west end, the flood water eddying around the east end of the
14 dam serving to cut away the rock toe and produce slides of the
15 schist. Perhaps. But observe that this explanation rests on
16 three assumptions: First, that the conglomerate at the end of
17 two years had softened enough to slip or blow out. Second,
18 that the mass of conglomerate under and below the dam, aided by
19 the weight of the dam, was insufficient to resist the lateral
20 pressure. Third, that the schist on the east bank was quickly
21 scoured away by an eddy at its toe and slid.

22 Perhaps the most singular feature of the St. Francis Dam
23 failure is the fact that both ends failed, leaving the center
24 standing as a great monolith about 100 feet along the top and
25 85 along the bottom, and 205 ft. high. Measurements indicate
26 that this monolith was moved about 8 inches southeasterly.

27 If we assume that a landslide, whether natural or caused by
28 an explosion, first swept out the east end, then it is easy to
29 explain the subsequent failure of the west end. The initial
30 breach thus caused would set a large volume of water in rapid
31 motion. Its eroding action would cause a series of slides
32 tending to dam up the breach in the dam. Even a partial damming

1 of the breach would suddenly reduce the velocity of the stream
2 and thus create a prodigious water hammer on the remaining dam and
3 a great surge of water up the dam and sides of the canyon. The
4 water hammer would probably breach the dam at some other point,
5 since it was then an arch with one abutment gone.

6 Although the schist slide rock has been mostly washed away,
7 there lies across the eastern breach a great section of the dam
8 that fell away from the center toward the east bank and somewhat
9 upstream (Fig. 2). Although fallen this piece towers about 60
10 ft. above the bottom of the canyon. That it aided in creating
11 a water hammer can scarcely be doubted. But it seems probable
12 that the enormous rock slides on the east side were much more
13 effective in damming the breach.

14 As evidence that a strong current of water flowed at a very
15 early stage toward a breach on the east side there is to be seen
16 a 12 in. pipe that has been broken about 25 ft. below the crest
17 of the dam, and bent toward the east end. This pipe was the
18 "stilling well" for the water gage, and is to be seen in Fig. 3,
19 which also shows the fallen concrete that dammed the eastern
20 (or left-hand) breach.

21 An automatic water gage or register was housed above this
22 pipe, and it showed a rapidly falling water level beginning
23 about midnight. The graphic record ceased to be taken about
24 12:45. The governor's committee doubts the accuracy of this
25 clock, but there seems to be no reason for doubting that it was
26 within a few minutes of the true time, unless the doubt arises
27 from entertaining a theory of rapidly increasing seepage of
28 water through the conglomerate on the west end.

29 The seepage theory of the dam failure was perhaps the first
30 to be voiced strongly in the newspapers, for one of the employees
31 at the dam testified before the coroner's jury that he had been
32 very apprehensive that the dam would fail because of the leakage

1 through the conglomerate at the west end. He testified that he
2 had warned his brother to leave the canyon. On the other hand,
3 Mr. Mulholland and his principal assistant, Mr. H.A. Van Norman,
4 testified that they visited the dam the day before failure, and
5 that the seepage was not abnormal and that the seeping water was
6 clear.

7 That some seepage was occurring Mr. Mulholland did not deny,
8 but he said that the St. Francis Dam was the driest of the 19
9 dams that he had built.

10 Two geologists were on the governor's investigating committee.
11 The committee's report states that specimens of the conglomerate,
12 which appeared quite hard when dry, softened and crumbled when
13 placed for a short time in water. They do not state that these
14 specimens were typical of the entire foundation. If most of the
15 wet conglomerate was as soft as they indicate, the question arises
16 why the conglomerate was not eroded more than the schist along
17 the fault line between the two. The fact is that they were
18 about equally eroded on opposite sides of that fault line by the
19 torrent that swept over them. Furthermore, the deepest channel
20 cut by the waters was entirely in the schist, next to the west
21 end of the standing monolith. If the wet conglomerate was the
22 mushy stuff that the committee paints it, why did it resist
23 erosion fully as well as the schist which the committee calls a
24 hard rock? Why did no observer discover such a mush anywhere
25 along the bank above or below the dam? We fear that the
26 committee's theory outran the facts.

27 Coming now to the third theory, is there any evidence of an
28 explosion? None has yet been found, but uncovering of the con-
29 crete fragments that lie scattered along the canyon bed may
30 possibly give such evidence. Within the last 45 months the Los
31 Angeles aqueduct has been dynamited 15 times. Some of the
32 alleged dynamiters are now under arrest. The St. Francis dam was

1 destroyed at midnight. A few boxes of dynamite lowered into the
2 water above the dam would have breached it when fired. The
3 water would have made an excellent "tamping". The muffled
4 grunt of the explosion would have been lost in the roar of fall-
5 ing concrete and sliding hillside. Seismographs 40 miles away
6 would probably not have registered such a shock. The explosion
7 theory should not be lightly brushed aside, much less ignored by
8 investigating committees.

9 The two geologists on the governor's investigating committee
10 state that the fault between the conglomerate and the schist,
11 which runs lengthwise of the canyon, shows no sign of recent
12 slippage, and is not directly responsible for the dam's failure.
13 They say that crushing of the rock along the fault line produced
14 a "gouge" that lacks cohesion and that the conglomerate seems to
15 have been weakened for some distance from the fault.

16 The following facts about the dam are of interest. The St.
17 Francis Dam was not built by contract but by the forces working
18 under the direction of the engineers of the Los Angeles Bureau
19 of Water and Supplies. The dam contained 175,000 cu. yds. of
20 concrete and it cost \$1,250,000. It was designed to impound
21 30,000 acre-feet. The concrete aggregates were river gravel and
22 sand (pit-run except for removal of gravel over 6 ins. diameter),
23 and 1.12 bbls. of cement were used per cubic yard of concrete.
24 The main dam was 700 ft. long at the crest, 205 ft. high in the
25 center, and was arched upstream with a radius of 500 ft. A low
26 concrete wing wall extended from its west end for several hun-
27 dred feet.

28 Before final judgment is passed on this failure, there
29 should be a much more exhaustive study of facts than has yet
30 been made. Many weeks might profitably be spent in piecing to-
31 gether the puzzle of broken blocks of concrete, in digging away
32 the debris on the east bank, in testing the bearing power and

1 permeability of the much criticised conglomerate, in searching
2 for evidence of an explosion, and in investigating whether a
3 ground movement along the fault has occurred.

4 It is easy to conjure up conditions that might have caused
5 the dam to fail. It is quite another matter to find evidence
6 that the imagined conditions actually existed. In other words,
7 a theory of the failure is readily framed; but a verification
8 of the theory by observable facts is another thing altogether,
9 and it is altogether the most important thing.

10 Next to determining whether an explosion destroyed the dam,
11 one of the most important questions is whether the great land-
12 slide on the east end occurred before or after the initial breach
13 in the dam. Was this a natural slide that no man could foresee,
14 such as occurred only the day before at Santos, Brazil, or was it
15 artificially caused? At Santos, where men had lived as far back
16 as 1543, many lives were destroyed when a large part of a moun-
17 tain slid out. Perhaps the St. Francis dam was destroyed in a
18 similar manner.

19 Many engineers, including the late William F. McClure, form-
20 er state engineer, had viewed this dam site before and during
21 construction, and none had condemned it. Evidently they had
22 foreseen neither failure by landslides, nor because of other
23 defects of the natural foundation.

24 Since the foregoing conclusions were reached, the editor
25 has seen the map of a triangulation survey that seems to settle
26 the question of the cause of the failure of the St. Francis Dam.
27 This survey shows that two triangulation points on the west bank,
28 several hundred feet from the western break in the dam, have
29 moved more than one inch toward the eastern bank. This move-
30 ment of a great area of the conglomerate toward the schist on
31 the east would grip the dam as if it were in a mighty vise, and
32 since no masonry dam is designed to resist such a thrust, it

1 would fail either by the breaking of the concrete or by a move-
2 ment upon or with its rock foundation, or both. It is the
3 editor's belief that the initial failure of the dam occurred on
4 its east end, for the reasons previously given, and that the dam
5 and its rock foundation were slowly compressed by this earth
6 movement until some part yielded under the enormous stress.

7 The geologists had apparently excluded from consideration
8 an earth movement of this character because seismograph records
9 showed no recent earthquake. Evidently sight was lost of the
10 fact that a slowly developing squeeze might either produce no
11 earthquake at all or one so slight as not to be registered by
12 the seismographs, the nearest of which was about 40 miles away.
13 Now, that a survey has established the fact of such an earth
14 movement, it is probable that geologists will discover evidences
15 of it.

16 As to this triangulation survey we are dealing with facts
17 that are susceptible of only one interpretation. Since two
18 triangulation points have each moved on lines almost parallel and
19 directly toward the fault, it is evidence that slippage has
20 occurred in such a way as to lift the conglomerate or cause it to
21 slip upward on the dip of the fault. Hence, it is to be inferred
22 that levels run from established bench marks should show a
23 considerable lifting of the concrete dike on the west bank, and
24 this is exactly what they do show. The concrete dike several
25 hundred feet from the west break in the dam has been lifted about
26 3 inches near a triangulation point that has moved nearly 1.5
27 ins. eastward. W&M When we consider that the two triangulation
28 points moved eastwardly in nearly parallel lines toward the line
29 of contact between the conglomerate and the schist, and when we
30 consider that such a motion, if due to slippage on the fault
31 plane in the direction of the dip, would also lift the conglomer-
32 ate mass, and when we find that it has actually lifted at one

1 point 3 ins., no great doubt as to the cause of the dam failure
2 remains. The editor examined the surveying methods used by the
3 engineer who made the triangulation, Mr. H. B. Hemberg, and is
4 satisfied that he has so carefully conducted and checked his
5 survey that the probability of material error is negligible.
6 Mr. R.R. Prector, the engineer in general charge of this triangulation
7 and the levelling, said that levels run by two levelling
8 parties had agreed almost exactly, and indicated a rise of 0.28
9 ft. in elevation of the point on the concrete dike.

10 It should be added that the precise location of the dam
11 during construction was established by triangulation and that
12 only one of the triangulation stations was carried away by the
13 destruction of the dam. A transit reading directly to ten seconds
14 and by estimate to five seconds, was used; and repetition measure-
15 ments insured extreme accuracy. The accuracy was of course in-
16 sured also by the closing of each triangle within the permissible
17 limit of error.

18 Two other important pieces of information were secured from
19 the engineers of Board of Water and Supplies. The engineers
20 have located a concrete chunk from the east end of the dam about
21 3500 ft. down stream. This is the most distant piece of con-
22 crete thus far discovered.

23 The engineers have prepared a drawing that shows not only
24 the shearing off of the lower steps of the concrete monolith
25 (Fig. 2), but also the line of the shearing of the steps on the
26 adjoining section on the east. This shear line runs almost
27 horizontally for a distance along the face of the standing mono-
28 lith and then curves upward extending almost to the top of the
29 adjoining section that now lies in the eastern breach (Fig. 3).
30 The shearing off of these steps on the lower face of the dam has
31 been somewhat of a mystery. One of the engineering witnesses
32 explained it as being due to the forward rocking of the monolith

1 on its toe. It now seems to be explained, at least in part, by
2 the compression of the dam as it was squeezed between the opposite
3 sides of the canyon. Other similar puzzles are likely to be
4 solved now that the fundamental cause of the failure is probably
5 established; such, for example, as the wedge shape of the stand-
6 ing monolith."

7 Q BY MR. ROBINSON: Did you make any particular field
8 examination of the fault that has been testified to here, where
9 the contact between the schist and the conglomerate was?

10 A Yes sir.

11 Q Is it practicable, from such an examination, to determine
12 whether or not an existing fault is a normal fault or a thrust
13 fault?

14 A It might be in the hands of those thoroughly skilled
15 in doing it. It is difficult there, I should say.

16 Q Did you make any such examination?

17 A Yes, I did.

18 Q Did you come to any determination?

19 A No sir. About the accuracy of this survey I especially
20 talked with Mr. Hemborg about the method used to determine----
21 if he had used the most accurate methods available for this
22 class of work. The repetition method, 12 repetitions in sets of
23 four each, reading to ten seconds, would give very accurate re-
24 sults, and then presuming, as he had also done, an error of one
25 second of arc, would make 1/100 of a foot in 5000 feet. These
26 measurements must have been very close, within 2/100 of a foot
27 at least. I also took his bearings of those two men, as taken
28 from his map. I have said they are roughly parallel. They
29 are exactly as shown on the map. The point B shifted in the
30 direction south 48 degrees 21 minutes and fifty seconds, a dis-
31 tance of .12 of a foot. The point C south 32 degrees, no minutes,
32 20 seconds east, .09 of a foot. The difference between these

1 two angles is about sixteen degrees and taking the fault line
2 strike on the map, the main fault that runs up and down the
3 stream, I found the first of these two lines almost exactly per-
4 pendicular to it and the second about sixteen degrees off. Now,
5 if it was a mere chance that either of those two points had moved
6 towards those faults, lets see what the probability is. What is
7 the probability in an arc covered by sixteen degrees. The prob-
8 ability that either one of those points moved in that direction
9 by chance is only one in 22. The probability that both of them
10 moved in that direction is the square of 22 which is 484. There
11 is only one chance in about 500 that those two points moved in
12 that direction by chance. They could only move by the sliding
13 of the conglomerate up on the side and, therefore, you would ex-
14 pect to find an upward lift of that material. It might have
15 been either up or down. There is only one chance in 1000 of all
16 three of these things, that they would occur as indicated. The
17 dam is not constructed to resist an end thrust. I don't know of
18 any dam which has been so designed. The suggestion has been
19 made that houses constructed upon top of the ground may be con-
20 structed so as to resist earthquakes, but a house does not have
21 a pressure upon both sides and I don't know as you would design
22 a dam of such magnitude. That the dam may have failed as a
23 nutcracker it is more likely that the schist on the west side
24 probably failed first, but it might have been the conglomerate
25 on the other end, on the east end.

26 Q You said the schist on the west side?

27 A Pardon me, on the east side.

28 Q BY A JUROR: Do you think that somebody blew up the
29 dam and there was an earthquake at the same time?

30 A No sir, I think it was a major earth movement that
31 did the trick.

32 Q Was the dam well built?

1 A The concrete was excellent as far as I could judge
2 from the concrete there. A section of the dam was what would be
3 called a standard gravity section and the arch was there only as
4 an additional precaution. Let me point out that the arch instead
5 of helping actually weakened the dam.

6 THE CORONER: What would have been the effect of this pres-
7 sure which you have described on a straight dam?

8 A I think it would have been safer because we have got that
9 bow there.

10 Q BY A JUROR: Would you have founded a dam of that type
11 on that location?

12 A I made no thorough examination but from the two days I
13 spent there I would have said it would be safe, yes. I go hunt-
14 ing up there every fall when I am here and viewed the work several
15 times, and have it never occurred to me that it was not a safe
16 location.

17 Q You would hesitate to build a dam there?

18 A I know I would, knowing of that ground movement. If I
19 had known of that I don't believe I would, but I would have put
20 a rock-filled dam there instead of a gravity dam.

21 Q Up to that height?

22 A Not to that height.

23 Q From your knowledge of the formation and all the in-
24 formation you have gained since then, do you believe that a dam
25 can be built there?
26

27 A I have not the slightest doubt but that a rock-filled
28 dam can be built. I will not say what type, and it would be
29 safe. There has been a great deal said about the material on
30 the west side. To me it looks like good material for a puddle
31 in the earth core of a dam. Anybody can take such a piece out
32 after it has been in a dam and put it in a glass of water and it

1 will come apart. You can walk around on the upstream side
2 where it has not gone out and I did, and I would not call it a
3 mush by any means. It had been under water for two years and
4 I would say it was pretty sound stuff.

5 Q BY A JUROR: Can you give us the names of some dams
6 of about the same size on similar material?

7 A I cannot. I have examined a lot of dams on clay and
8 various kinds of rock, but never found anything quite like this.

9 Q Were these on clay or a harder formation than this?

10 A No, part of that is pretty soft stuff.

11 Q Do you think that the gradual leaking from that foun-
12 dation material on the west side did carry away a considerable
13 part of the fines and limonites and calcites?

14 A I would not expect it to. I may add as to this dis-
15 integration test. I saw a similar test made years ago on the
16 Erie Canal and the engineer was accused of standing in with the
17 contractor because he called some earth hardpan, and the inves-
18 tigating committee was appointed and put it in a glass of water
19 and showed that it disintegrated, and I happened to be on that
20 job and seen pick-pointed plows drawn by six or eight horses
21 unable to excavate it economically. I knew of my own knowledge
22 that that hardpan was hardpan under the specifications.

23 Q Are you satisfied that the first line of levels
24 correctly established the height of this dyke?

25 A I don't know. The suggestion has been made bearing
26 on that dyke that this whole dyke to the west of conglomerate
27 became saturated and heaved or expanded. What does it matter
28 whether it was that method of slippage or some other so long as
29 it squeezed the dam as in a vise.

30 Q How would you expect such a squeeze to cause a rup-
31 ture of the dam.

32 A I would expect that the most yielding place on the dam

1 would be in this schist. The butts might even force a piece
2 of it uphill instead of it sliding down and then the water would
3 do the rest.

4 Q Do you think that this movement of one inch caused a
5 greater stress in the dam than the ordinary expansion of the
6 dam on account of temperature?

7 A You certainly have contraction and expansion working.
8 You have the south side of the dam exposed to the full sun and
9 the north side exposed to the coldness of the water. You have
10 two entirely different temperatures in that dam between the
11 north and south faces, and I am of the belief that the shearing
12 off of those places was due to ^{just} such a stress, supplemented by
13 this pushing of the west end, moving towards the east. That is
14 why I mentioned that shear line running clear up to the top.

15 Q Would you expect swelling of this conglomerate due to
16 the progressive infiltration of the water?

17 A I think that swelling has been in it for many years.
18 There might have been local swelling that would have produced
19 this thrust.

20 Q BY MR. DENNISON: You are interested in this dam
21 purely as an engineer?

22 A Absolutely.

23 Q And you have made some considerable inspection of it
24 and are able to pass an opinion upon it?

25 A I would do just as I have said.

26 Q Will you answer this question, after what you have
27 seen of it, the testimony you have heard a good deal of it here,
28 do you consider that a first class piece of engineering?

29 A Yes sir.

30 Q Do you consider a dam without a cutoff wall in soil
31 of that kind, a good piece of engineering?

32 A It seems so to me.

1 Q Do you consider a dam of that kind and character with-
2 out an inspection gallery, a good piece of engineering?

3 A Yes sir, there are plenty of them standing that have
4 none.

5 Q Do you consider a dam of that kind built in the manner
6 as that was built, without reinforcing, a good piece of engineer-
7 ing?

8 A Yes sir, it is a very unusual thing to reinforce a dam
9 of that magnitude.

10 Q Do you think that dam was a proper dam to place in
11 that place?

12 A Hindsight shows that it was not, but I never thought
13 it was not when I saw it going up.

14 Q It is what is known as a gravity dam. If there had
15 been such a preliminary investigation as has been made here, and
16 the conditions of the soil had been determined with its faults
17 and with the possibilities that might arise in the construction
18 of the dam, it might not have been constructed?

19 A I don't know. Hindsight is constantly influencing
20 me as it does everybody. My impression of it when I first saw
21 it going up---- it never once entered my head that the dam would
22 possibly fail. I now see it failed and it is a different matter.

23 Q Do you know Mr. Nathan Bowers?

24 A I don't know him.

25 Q You know of him in the engineering world?

26 A His name appears among seven or eight or ten associate
27 editors of Engineering News.

28 Q What is his reputation in the engineering world?

29 A I don't know anything about him. I don't know the man.

30 Q Now, this triangulation was an approximate triangula-
31 tion---- one of the points was lost?

32 A You do not triangulate the lost point, and there was

1 no such point about it. You are triangulating what did remain.

2 Q What did remain?

3 A All but one.

4 Q Which one?

5 A Closest to the west side.

6 Q Did you examine the notes of the men who made that?

7 A Yes sir.

8 Q Do you know whether it was correctly accurately located?

9 A Only as he describes his work.

10 Q You were not present when they ran the levels?

11 A Oh, no.

12 Q You know that it is quite a difficult thing, the matter
13 of surveying, it requires a lot of time and patience to do it?

14 A It all depends on how much you are referring to.

15 Q And that original triangulation might have been in
16 error?

17 A Not the way they did it. There is always a possibility
18 of error in any engineering work but the limits are very narrow,
19 within four seconds of arc.

20 Q How would you establish to me that the original triangu-
21 lation is accurate?

22 A I don't think I could to you, because you are not a
23 surveyor.

24 Q Tell these men.

25 A Taking the method under which it was done and examine
26 the notes and see whether that method was followed out. The
27 method I would insist upon would be repetition angles and limit-
28 ing of errors and reading from different parts of the arc, at
29 zero, ninety and two hundred and seventy and having that work
30 done more than once and reading the a and b verniers, and when
31 when that was done I would see that the men had pursued standard
32 methods.

1 Q BY A JUROR: TO quiet all this controversy in Mr.
2 Dennison's mind I suggest that Mr. Mayberry have a party go out
3 there and make a run of these and see how they come out.

4 MR. DENNISON: That would not determine the original, would
5 it? How could that determine the accuracy of the original.

6 A JUROR: Run it off of the U.S.G.S.

7 MR. MAYBERRY: The accuracy of the U.S.G.S. is not always
8 accurate itself.

9 MR. DENNISON: I am trying to get at the reasonable propos-
10 ition that the hill did not move.

11 A JUROR: Is not the tie that you get on the triangulation
12 one of the simplest ties you can get on work of that kind?

13 A Absolutely.

14 Q If you are off more than two seconds plus or minus it
15 would be an indication of very poor work?

16 A Yes. The sum of the three interior angles of a tri-
17 angle is one hundred and eighty degrees and when the angles don't
18 go to a hundred and eighty degrees they fail to check.

19 Q Would not the movement along this fault show striations?

20 A I doubt if they would find any evidence of the movement
21 unless they knew how to look for it. I don't think they made
22 a thorough investigation.

23 Q BY MR. ROBINSON: I am informed that this triangula-
24 tion is part of the whole and complete survey of the aqueduct,
25 and unless it is done in cooperation with someone who is familiar
26 with it it would result in a great loss of time.

27 (At this point an adjournment was taken until Tuesday,
28 April 10th, 1928, at 9:30 A.M.)
29
30
31
32

1 ALLEN E. SEDGWICK, having been
2 previously duly sworn, was recalled and testified as follows:

3 BY THE CORONER:

4 Q You were present and heard the testimony of Mr. Rieber,
5 relative to this model he prepared and brought here?

6 A I heard the greater portion of it.

7 Q From what you heard, would you understand the theory
8 he advanced as to the destruction of the dam?

9 A Not very clearly.

10 Q I would like very much personally to be enlightened
11 as to what his explanation means, if you can explain to me as
12 you get it what it means, what you derived from the explanation.

13 A Might I ask at what point he thinks the depth bomb was
14 dropped?

15 MR. RIEBER: If there had been one, I believe it would
16 have occurred just at the base of the dam (indicating).

17 MR. SEDGWICK: The supposition is, if any, it took place at
18 this point (indicating)?

19 MR. RIEBER: Yes sir.

20 MR. SEDGWICK: May I ask the effect of such a bomb upon
21 the concrete itself?

22 MR. RIEBER: What I would expect at the point where the
23 impact took place. You have destruction of the concrete
24 material itself, that is a certain limited amount of it, extend-
25 ing into the concrete, would be reduced to sand and washed out
26 of there. I would not expect a violent expulsion of concrete,
27 a very high velocity powder, would expect a very intense
28 shattering of the schist.

29 MR. SEDGWICK: Then do I understand the shattering upon
30 the schist would permit the water course to go underneath the
31 dam, and go out at this side (indicating)?

32 MR. RIEBER: Surely.

1 MR. SEDGWICK: The shattering would be sufficient to drive
2 the schist out?

3 MR. RIEBER: The elastic wave would reach clear through
4 here (indicating).

5 MR. SEDGWICK: From the time the bomb was placed and
6 until the water came out or washed out would be only a few
7 minutes?

8 MR. RIEBER: Might be short, might be fairly long.

9 MR. SEDGWICK: Then this (indicating) would have formed
10 first?

11 MR. RIEBER: That portion of the arch would have moved
12 out very early in the game first, otherwise possibly this piece
13 (indicating) the fractured lines might have radiated in such a
14 way it couldn't be released, and if this schist was all
15 shattered, it might have been pushed out.

16 MR. SEDGWICK: Then what would have been the next piece to
17 go out?

18 MR. RIEBER: After this piece (indicating), I think this
19 piece (indicating) went out. I think I can demonstrate it.
20 After that ^{there} might have been a fracture, a cleavage down here (in-
21 dicating), in which case these pieces would have fallen out, and
22 this piece and this piece (indicating), as soon as this was out,
23 the velocity of the water was very high, and this was wedged.

24 MR. SEDGWICK: Just what effect in a mass of this kind do
25 you expect the arch action would take as to the increased
26 factor, do you think it would give an increased factor, or is the
27 arch action in a mass of this kind affected?

28 MR. RIEBER: I would feel after you fracture a mass of
29 this type, and after this thing particularly had been either
30 undermined or was on slippery material, ^{so} ~~it~~ it could move
31 downstream, then the arch would come into play.

32 MR. SEDGWICK: Do you think you would change the arch

1 action in a case of this kind?

2 MR. RIEBER: I think there would be considerable arch
3 action-- try to push one out and you can see yourself.

4 MR. SEDGWICK: That was the reference you had to the man
5 in the doorway with the roller skates?

6 MR. RIEBER: This one right here (indicating).

7 MR. SEDGWICK: Isn't it a fact this didn't move this way?

8 MR. RIEBER: It moved in this direction (indicating),
9 downhill and over, moved both eastward and downhill. From the
10 fact it moved east, I conclude there wasn't anything on the east
11 to stop it at the time.

12 MR. SEDGWICK: Wasn't it brought out that the movement was
13 down and rotating?

14 MR. RIEBER: Down and east. The whole thing moved this
15 way (indicating), it doesn't rotate out, if any, very slight.

16 MR. SEDGWICK: Of course, we have apparently two schools,
17 one is reasoning from the theory to take facts, and one trying
18 to take from the facts a theory. Upon that method, we have
19 here a block that has fallen down in front of the standing
20 section, it has fallen off a high slope, and has turned around
21 and fallen over and lies in this direction (indicating) behind
22 this slope. We have a comparatively small block here (in-
23 dicating) that is quite a ways downstream; we have a large block
24 here (indicating), which is broken in three parts. The front
25 part or bottom portion is tipped over, lying against the bank,
26 and has moved approximately eight feet upstream. We have
27 another portion here (indicating), which is lying over upon top
28 of that, the outer portion of which is about thirteen feet
29 above stream, and then we have another portion here (indicating),
30 whose relative position I do not now remember. It is
31 postulated that the cause was a tremendous amount of excavation
32 back of this portion of the dam (indicating), if one would look

1 to this side of the dam-- was that one of the reasons?

2 MR. RIEBER: No, that was considered secondary, and possi-
3 bly supporting evidence-- that amount of excavation could just
4 about as readily occur from undermining and fall down. We
5 notice it seems to extend further upstream. If this portion
6 had been guiding, the support would have been in this direction
7 (indicating)--- there was nothing detaining it, as far as the
8 falling off of that material that could have been occasioned by
9 things going underneath, and then the central block wouldn't
10 have moved in that direction if there had been any east wing to
11 stop it, and west wing to push it.

12 MR. SEDGWICK: We are quite conversant with the fact---
13 assume I have some books piled up here (indicating), standing
14 about in that direction overlapping each other, and water comes
15 through and catches this, would appear as if you had bricks laid
16 one over another, and, of course, there would be a tremendous
17 waste-- on the other hand, the fracture planes, right angles to
18 this, so that water coming down through here, would strike this
19 bank, and swirl back and undercut.

20 MR. RIEBER: If your planes are inclined that way (in-
21 dicating) as you have turned them, and water is turning around
22 here (indicating), it is going up your shingles.

23 MR. SEDGWICK: The main portion is, of course, excavation
24 from this side (indicating), also underneath--- would take out
25 the talus and support and now is lying almost at an angle of
26 repose, and it was a steep angle, and that undercutting would
27 allow this to fall (indicating). The erosion on this side is
28 more difficult to account for--- this schist is standing so that
29 it has presented an edge in that direction (indicating), and you
30 are rotating across the edge of your formations rather than along
31 the planes, filling them up, like shingles on a roof. Take a
32 hose, shoot it up on the roof, see the shingles go up.

1 MR. RIEBER: It is entirely a different type of erosion.
2 I don't regard that as an important point, I don't regard that
3 as inexplicable by any theory. I think all we can do is take
4 the most probable out of such things as we can see, and I think
5 there is plenty of probability of all these things.

6 MR. SEDGWICK: There is another thing seems to be difficult
7 to explain, unless we assume that the failure was over here (in-
8 dicating), and that is that this block (indicating), if the
9 failure were here (indicating), this block went out first, then
10 we have this block coming out (indicating), when it is under the
11 maximum head and beyond, then simply overturned and laid down in
12 front of us right here (indicating). Still we have another
13 block, a tremendous size, which came from here (indicating), and
14 is fifteen hundred feet downstream. That seems to me to be a
15 rather difficult thing to explain, how this block could land
16 immediately in front, and how this block not land immediately
17 in front, should be taken downstream when it weighs ten or
18 twelve thousand tons. Evidently, you can see there has been a
19 very high head, a very high velocity to take this so far and
20 a relatively less one which would allow this to overturn and lie
21 in front of the standing section without being carried any great
22 distance. Of course, we can postulate, but there was no remote
23 protection to this block when it first went out, because this
24 was in place and the full head here (indicating) if this went
25 out, turned it or slid it back, threw it down the slope with the
26 combined stress, which would drive it in that direction (in-
27 dicating) and not down the slope in this manner (indicating).
28 It couldn't have landed here (indicating) under this combined
29 stress, one shoving it in this direction and one shoving in this
30 direction (indicating), consequently if this went out first and
31 this section (indicating) went out soon after, I can't understand
32 how this section (indicating) is upstream. We have this block

1 (indicating) which seems to be the direction of force going to
2 land it over into the stream, which is falling down here (in-
3 dicating) and being carried down in that direction, I realize
4 there was testimony about its being caught in a swirl, or that
5 the shape of the block would have something to do with it, with
6 the distance it was carried, and there were a great many factors
7 entering into it--- I don't believe when that great tremendous
8 rush of water came out there was very much of a swirl at that
9 point.

10 BY A JUROR (Addressing Mr. Sedgwick): Wouldn't that apply
11 on the west side?

12 MR. SEDGWICK: Yes sir, that is exactly the point. This
13 went downstream and carried it downstream fifteen hundred feet.
14 Let's look at it from the other point of view--- here we have a
15 hypothesis set up--- on this side, we have an incompetent
16 formation, the roller skates and the man standing in the doorway,
17 gets hit from behind, and the roller skates go out, his feet go
18 up, and he comes down, and that is what happened here, the
19 pressure was from behind, slid on the roller skates and went
20 down. The material was taken out from under it, and, of course,
21 with the support left out from under it, the material broke and
22 fell.

23 Q In that case, why would there be a sheering action on
24 this piece standing?

25 A Yes sir, I am glad to say that the water is going
26 through here (indicating) in this direction and carries across,
27 this section (indicating) being the first one to go out, and
28 strike this bank, and we get some swirl action here (indicating),
29 but most of this we will allow came from the cutting from this
30 side (indicating), that would have contributed--- if you will
31 look into this graph upon this picture (indicating). This
32 corner (indicating), probably because the water was going

1 through in this direction (indicating) due to this bank here
2 (indicating), this portion of the dam wouldn't allow the water
3 at that time to erode at that point.

4 Q In other words, you don't feel that whole section
5 went out at one time?

6 A No, I think this section went out first (indicating).
7 Now, as this section went out (indicating), it is very plain
8 that we have here a cantilever, lift here and one here (in-
9 dicating), this lift having a tremendous pressure, that is the
10 end of it was large, and on this base of the standing section,
11 there is a water mark now of an old extension crack, so it was
12 the natural place for it to break off, and then cantilevered or
13 broke off, and in turning it would have tipped and rotated it
14 and turned it so we would get the effect that the survey shows,
15 furthermore that tipping of that due to this pressure on here
16 (indicating) would spall off the face of this (indicating), in
17 accordance with the diagram I showed you yesterday, which seems
18 to be quite conclusive evidence, and also at some moment would
19 have spalled off the corner in the front, broken it off on the
20 right hand side, leaving a crack here (indicating), so that a
21 ladder, fish, or anything else might hide in there, might be
22 jammed in and be still there. There wasn't only a ladder in
23 there, but a great deal of debris wedged in from water flowing
24 through this narrow canyon. Then later we had still this
25 cantilever here (indicating) with rather insufficient support,
26 which was broken after the water had gone down, so that the
27 water when this (indicating) went out down across here (in-
28 dicating), seems to me that with a knowledge of this material,
29 that the theory was self explanatory, that there is no reason
30 for us to go into some hypothetical reasoning to find a new
31 cause, when the whole thing seems to be absolutely simple, based
32 upon some simple rather than some theoretical thing.

1 Q Professor Sedgwick, let us presume this standing
2 section (indicating) is in place at the time of the fracture of
3 this cantilever, you say that there would be a tendency for this
4 to slip downstream?

5 A Tendency for it to rock in this direction (indicating).

6 Q Presuming this sector (indicating) collapsed through
7 a crack in the center, would there be any tendency for this
8 portion (indicating) to move downstream?

9 A There is a tendency for it to move downstream at all
10 times before it is resisted. There was a tip, as evidenced by
11 the spalling here (indicating), fracture of the foundation, and
12 by the tension fracture we have in the front, and that tipping
13 was rather rotary in that direction (indicating).

14 Q Of course, that might have occurred after the piece
15 went out?

16 A Certainly it occurred after the piece went out.

17 Q The taking out of this piece (indicating), as you
18 described it, this piece here (indicating), not necessarily
19 would have moved this downstream?

20 A If you had a cantilever here (indicating), the force
21 of the water is trying to rotate in this direction (indicating).
22 This did tip until it fractured along the whole line.

23 Q If this point (indicating) went down as this (in-
24 dicating) straightened up, it wouldn't release this (indicating)?

25 A No, the fracture was in here (indicating). This
26 broke some place in between here like that (indicating). This
27 cantilever pitched over and this gave a little here (indicating),
28 rotated slightly, and had it not been for the fracture along
29 that line, that might have gone out with it.

30 Q It wouldn't mean that that necessarily would move
31 downstream--- this point here (indicating)?

32 A Tendency to tip more than to slide it. The whole

1 thing did tip until it fractured--- this moving in this di-
2 rection, and it did actually rotate in this direction (in-
3 dicating).

4 Q The thrust would be in this member here (indicating)?

5 A Up to here (indicating) until the break came. The
6 holding point of the cantilever would be in this block (in-
7 dicating) until the break came.

8 Q But the pressure at the break would be on this lower
9 edge here (indicating)?

10 A After the break. The damage was done before that.

11 Q BY MR. ROBINSON: In your opinion, when that occurred,
12 was the east wing of the dam in place?

13 A In place.

14 Q How do you explain the rock of the central section in
15 an easterly direction?

16 A Would this tend to be turned in this direction?

17 Q There would be a compression on the eastern portion?

18 A Broke it and broke it out.

19 Q Your opinion is the easterly portion broke?

20 A Yes, broke from sliding down from here (indicating).

21 Q So that there had been some breaking on the east
22 side?

23 A How much I don't know.

24 Q BY A JUROR: I have a different theory-- my theory is
25 that west hill softening up, that made it a poor supporting
26 material, which through force of gravity being the first thing
27 to go, heavy water set on top of it, is going to settle-- you
28 add to that the fact this dam was undoubtedly cracked---

29 A Yes sir.

30 Q You take a soft foundation and a cracked section,
31 heavy weight, that cracked section looks like it would be
32 pretty apt to settle--- let that settle and loosen up a little

1 bit, the pressure of the water behind it would be pretty liable
2 to skid it out?

3 A That is exactly what we described in our report.

4 Q The part I can't reconcile is the chunk dropping out--
5 you can take wheat in a grain elevator, if it is wedged it
6 won't come out, you couldn't expect concrete to drop out of its
7 own weight?

8 A All we can say, this section (indicating) went out.
9 We have no record of where this portion of it is (indicating).

10 Q Was there a very extensive undercut of the dam?

11 A Only a few moments.

12 Q Extensive?

13 A Yes sir.

14 Q Do you conclude that the greater part of the reduction
15 of the grade of that west hill took place before the failure?

16 A No sir. Due to erosion after the blocks went out,
17 this undercut here (indicating) for a distance of I don't know
18 how wide, would undercut and leave not only a spongy mass, but
19 undercut--- that water cut both ways, up and down, and extended
20 that undercutting very rapidly, and it would only take a very
21 few minutes--- that happened sometime after eleven thirty, or
22 thereabouts, and that water probably would not have reached the
23 power house for from five, six or seven minutes after, so that
24 if it happened at eleven thirty-seven, it would have been
25 eleven forty-five before it got down to the power house.

26 Q There was an extensive undercut before that block
27 dropped out?

28 A Before this first block dropped out, yes sir.

29 Q The question of cutting across on the opposite bank,
30 due to swirl--- I am trying to harmonize two different
31 theories.

32 A You must remember this (indicating) was coming down

1 here (indicating) from undercut, was entirely different--- then
2 a mass rushed straight downstream.

3 Q Would the direction of flow of water through an arch
4 of this kind be more perpendicular to the base of that section--
5 your suggesting it came through this way (indicating)?

6 A The water was down here (indicating), running over
7 this shoulder--- of course, it would affect it somewhat.

8 Q Why shouldn't we presume that the flow of the water
9 would be perpendicular to that failure--- the pressure on that
10 point there (indicating) would be in the neighborhood of about
11 thirteen hundred pounds to the square foot?

12 A I would have to multiply that out.

13 Q Will you give your idea as to what occurred relative
14 to the height of water in the reservoir, as these various
15 breaks occurred?

16 A I think this block (indicating) went out first, due
17 to faulty foundation--- think this block (indicating) broke away
18 from this concrete.

19 Q How much water had passed out up to that point?

20 A I couldn't say. Then I think the amount of water
21 rushing through here (indicating) has undermined portion of this
22 (indicating), this began to slide and the pressure took place
23 at and dug that out. This piece (indicating) perhaps went out
24 just after the water had gone down quite a little, then turned,
25 went out, and later this section (indicating) fell when the
26 water was quite low.

27 Q How do you account for the great erosion on this piece
28 down here (indicating), just below the standing section?

29 A Water rushing down here (indicating), across here
30 (indicating), carrying this securing material which is still on
31 top of it.

32 Q At what height of water would you presume that to

1 have been at that time?

2 A I don't know exactly, I wouldn't presume to say.

3 Q After the water had passed out, I mean the level of
4 the water had fallen to half the height of the center section,
5 there wasn't much hydrostatic pressure on that piece?

6 A No.

7 Q Must have gone out rather early?

8 A I don't know just how early it went out, I think it
9 went out quite a little after this (indicating). There was
10 enough water to push it down and slide, roll it.

11 Q BY DISTRICT ATTORNEY: Have you told everything you
12 want to tell?

13 A Yes, I guess so.

14 THE CORONER: That is all, you may be excused.

15
16
17 J. G. CLARK, having been previously
18 duly sworn, was recalled and testified as follows:

19 MR. CLARK: When I was first called in, the rocks were
20 rolling on this side of the dam (indicating), so it was im-
21 possible to examine the bedrock. Some days later, after we
22 had gone over everything else, I made a trip to examine the bed-
23 rock on both sides. We discovered the matter of sharp angles
24 and edges on this side (indicating), and in order to get any
25 information available that it was caused by an explosion, I came
26 down and examined the schist on this side (indicating) to as-
27 certain whether or not there was evidence of shattering of the
28 schist. This was several days after the failure of the dam.
29 I could find no evidence in the schist of shattering that
30 wouldn't be the natural shattering due to the sliding of the
31 schist on this side (indicating). There was a great many
32 sharp edges--- we thought at the time it might have been sharp

1 edges, might have been left through the action of the ex-
2 plosion, so we examined them carefully, and found that the sharp
3 edges in there were the little planes of hard material, left
4 where the calcite had been eroded out. I am satisfied they
5 are due to the cutting out of the soft material, so that on
6 neither side were we able to find any evidence that the failure
7 of the dam has been caused by an explosion.

8 Q BY THE CORONER: Did you examine the piece of dam,
9 see any mark on the dam that showed these radial cracks?

10 A We found many cracks, but none we could trace with
11 any degree of conclusiveness. At the time I was on the stand
12 the other day, we were discussing the flow of water. The re-
13 port called attention to the fact that if the loss of water
14 from the dam was distributed over twenty-three and one half
15 hours, it would be at an average rate of 12.9 cubic feet per
16 hour for that period of time. Also called attention to the
17 fact that the increasing rate shown by the graph would account
18 for more than half of that. As a matter of fact, thirty-five
19 one thousandths, or a total of five one hundredths during the
20 last period of three and one half hours, and if this was spread
21 uniformly over three and one half hours, it would be at the rate
22 of twelve second feet. The report does not indicate there was
23 a flow of twelve second feet over a period of twenty-three and
24 one half hours, a flow of seventy-four second feet over three
25 and one half hours--- it was drawn off that way to call atten-
26 tion to the fact that the greater part could have accounted for
27 over the last period of three and one half hours. One of the
28 jurors referred to a stream--- if there was such a stream as
29 that, twelve second feet would be two feet wide, one foot deep,
30 flowing at the rate of six feet per second, five miles per
31 hour is 7.33 feet per second. Seventy-four second feet would
32 be five feet wide, two and one half feet, flowing six feet per

1 second--- I hardly think either one of them would be floating a
2 horse. We found evidence of what we called the scour pool
3 water described under the dam, at a very high velocity, where
4 that is evidence, that the greatest amount of erosion, if the
5 material was forced out there (indicating on diagram), it was
6 softened from the inside toward the outside until, as the report
7 states, there was a veneer on the outside. In the meantime,
8 there had been some cracks or crevices, some leaks through
9 there, we are not prepared to say how much, leaving an opening
10 for the water to go through under the dam--- that came through
11 at a very high velocity, probably came up at that time, going
12 further back, accounting for the flow of water. We find if
13 that happened, we have no means of knowing what that opening
14 was, if it were twenty feet long, one foot high, that the head
15 of water under that, if we are going to allow for unusual
16 friction, we might have a velocity somewhere around seventy-
17 eight feet a second--- cutting it down sixty feet a second, we
18 would then have a flow of water through there amounting to
19 seven thousand two hundred cubic feet per minute, discharging
20 it out of there in fourteen minutes. The crack probably was
21 one of the contraction cracks, but if any of you gentlemen will
22 carry your natural arch from your concrete, take into con-
23 sideration the possibility of contraction crack, you will find
24 as we constructed it, that this piece (indicating) near the
25 foundation would not last long enough, it failed or carried out
26 from there--- when it did it might have carried out clear at the
27 time, we haven't found that top piece (indicating), but we have
28 found that piece (indicating), and that is downstream about
29 fifteen hundred feet, a piece that weighs between from eight
30 thousand to twelve thousand tons. We all know that the
31 distance you will carry a piece of solid material, the gravity
32 heavier than water, depends upon the volume of water in which

1 it was traveling. Thus the biggest piece carried downstream,
2 and yet, gentlemen, that was carried down fifteen hundred feet.
3 The evidence is that that piece came out when the maximum
4 volume below was moving at the maximum velocity. Then, coupled
5 right up with the explanation that Professor Sedgwick just
6 gave, that the cantilever arm was being pulled down by gravity--
7 it cut through both ways, and cut through rapidly. It was
8 only a matter of a few minutes, and I can testify that that is
9 true. I have turned a giant under high velocity against a
10 bank of schist and it cut it very rapidly. The hardest
11 material down here was schist--- coupling right in with
12 Professor Sedgwick's explanation, and we agree with that theory--
13 now, as to the flow of water, would call attention to the fact
14 when the water started out of there (indicating on diagram) this
15 bank up here (indicating) set very much higher than it now
16 stands. The flow of water, as it passed out of there (in-
17 dicating) was up against this section of the dam (indicating),
18 which was standing. If we assume that it passed out over here
19 first (indicating), that this section went through, and it
20 passed out there (indicating), this water is going through here
21 (indicating), but it is against a solid piece here (indicating),
22 and the tendency is to turn it around here (indicating). When
23 this gives way, it is against this piece (indicating), which is
24 very heavy at the bottom. This current is going through at a
25 lesser angle--- first you turn this corner, you have your face
26 that direction across here (indicating), this would turn towards
27 the east bank, in addition to that you have a high bank still
28 standing here (indicating). This east side in turning the
29 water so that, as we saw it during the early part of the failure,
30 the water crossed over here (indicating), undermined the east
31 bank, possibly not right up against the dam, but down here (in-
32 dicating). This material, as soon as it was cut away, began

1 sliding to a new angle of repose, and the fact there is a greater
2 amount of cutting on that side than on this side (indicating) is
3 due to the fact you had ~~me~~ in between cutting of the water coming
4 on this side, also here (indicating).

5 Q BY A JUROR: The direction of water is all the same,
6 that is the body of water, just the minute it goes through
7 orifices--- what is your angle in here (indicating)?

8 A This angle is at right angles to your pressure.

9 Q The maximum amount of water is at this point (in-
10 dicating)?

11 A It is the same over all of it there.

12 Q BY DISTRICT ATTORNEY: Would that scour pool have any-
13 thing to do with deflecting the water?

14 A Yes sir, examination of the scour pool showed it did
15 have a tendency.

16 Q BY A JUROR: This is a theory only, you don't know it
17 was actually made at that time?

18 A Your opening was very much wider on this side (in-
19 dicating), so it is quite easy to reconstruct that--- you are
20 getting the full velocity head on the outstream edge, on this
21 side (indicating) you are getting more of the effect of the
22 pressure there.

23 Q Isn't it a fact they haven't found a greater portion
24 of that concrete on the west side?

25 A This piece up here?

26 Q It didn't stay long?

27 A None of it stayed very long. I think when this went
28 out (indicating), I am of the opinion it carried through along
29 this line (indicating), and when it went out it dropped and
30 broke off as it went out. Examination by a twelve power field
31 glass indicated that this was a tension break, can find no
32 evidence of any scouring.

THE CORONER: That is all, you may be excused.

1 R. R. PROCTOR, having been pre-
2 viously duly sworn, was recalled and testified as follows:

3 Q BY MR. ROBINSON: Will you state whether or not any
4 further check work has been done under your direction with
5 reference to this triangulation matter since the measurements on
6 Friday?

7 A On Saturday, I asked Mr. Imbertson to come from Santa
8 Paula where he is working, and duplicate the work which he had
9 done previous to the construction of the dam.

10 Q He had done the triangulation work testified to by
11 Mr. Hemborg as being what he found on the ground?

12 A Yes sir.

13 Q Will you explain to the jury somewhat more in detail
14 than has already been done, the method of doing the work and what
15 the effect of any possible error in any of the measurements would
16 be?

17 A Yes, I would like to use the large diagram (showing
18 diagram to the jury).

19 Q Will you explain this diagram, Mr. Procter, stating
20 first what marks, if any, were on the ground when Mr. Imbertson
21 began the work that you refer to, which preceded the construction
22 of the St. Francis Dam?

23 A Yes, the point designated as "Pete", and the point
24 designated as "St. Francis", the two points being connected on
25 this map with a black line.

26 Q What do these points represent?

27 A They were two points on the triangulation system used
28 in the construction of the Los Angeles Aqueduct, we being given
29 the course and distance between them as was used at that time.

30 Q As I understand it, there was a triangulation system
31 extending over the whole aqueduct system?

32 A Practically the entire aqueduct.

1 Q Established in connection with the construction of
2 that system some years ago?

3 A Yes.

4 Q And these two marks, "Pete" and "St. Francis" were
5 marks, monuments in that system?

6 A Yes.

7 Q BY A JUROR: Is "Pete" on the easterly side of the
8 canyon on top of that mountain with a flag on it?

9 A Yes.

10 Q And "St. Francis" is up on the hill?

11 A On the west side.

12 Q I saw a flag looked to be about here (indicating on
13 map)?

14 A There is a hill which is almost entirely submerged.

15 Q BY MR. ROBINSON: Will you point out the location of
16 the dam?

17 A The center line of the course of the dam is designated
18 by a blue line, long and short portions of the blue line.

19 Q That is necessarily the line extending westerly from
20 that (indicating) would be the inner wall?

21 A Yes.

22 Q Will you explain what the other markings on the map
23 are?

24 A The brown dotted line is the location of the junction
25 between the conglomerate and the schist.

26 Q How is it marked on the map?

27 A Brown line, marked "Fault".

28 Q Will you proceed to explain what work was done based
29 on these monuments which you found, namely, "Pete" and "St.
30 Francis"?

31 A Point "A" on this map was set in the ground, iron pipe,
32 and its position determined with respect to "St. Francis" and

1 "Pete" by means of triangulation measurement of the three angles
2 of the triangle, made by these three points which were then de-
3 sired to equal one hundred eighty degrees. Computation was
4 made of the various sides of this triangle, and the position of
5 point "A" determined.

6 Q That triangle is defined by points "St. Francis", "A"
7 and "B"?

8 A Yes. In a similar manner point "B" was established,
9 again point "C" was established in the same manner.

10 Q Your triangle for establishing "B", being triangle "A",
11 "B" and "Pete"?

12 A Yes.

13 Q And for point "C" triangle "A", "C" and "B"?

14 A Yes, and for point "D" triangle "D", "C" and "B".

15 That work was done by Mr. Imbertsen who is now here, and then at
16 the time of the construction of the dam, I assembled under the
17 leadership of Woods--- where he is I don't know--- we continued
18 this work, establishing a point marked radial point "C" and "D",
19 and point marked as two inch I.P. (iron pipe) radial point and
20 "D"--- at the same time that work was done we measured the
21 distance from radial point to two inch iron pipe, went through
22 that three times, using a strong ballast on the tape, taking the
23 temperature, the mean of the three readings was taken as the
24 other point, which I have. The measured distance which we de-
25 termined in the field was 690.284 feet.

26 Q That is the distance from radial point to the point
27 marked two inch I.P.?

28 A Yes. The measurements were then taken in the office,
29 and the distance from radial point to two inch iron pipe was
30 calculated, found to be 690.280 feet, checked between the
31 measured and calculated distance of four one thousandths of a
32 foot.

1 Q That is to say you first did this triangulation work
2 in the field, established these points, observed all your calcu-
3 lations, establishing each successive triangle from the one pre-
4 viously established, and also you measured three times the actual
5 distance on the ground between these two points, radial point and
6 point two inch iron pipe, and then in the office you computed all
7 the lengths resulting from these observed angles and each
8 successive length, and that the computed length showed a difference
9 of four one thousandths of a foot?

10 A Yes.

11 Q If there had been any error in the carrying forward of
12 the triangulation work, would there have been the agreement be-
13 tween the computed distance and the actual measured distance?

14 A No, we measured this distance for the purpose of de-
15 termining if the distance "Pete" to "St. Francis" as given to us
16 was accurate, accurate enough for our work in the construction
17 of the dam.

18 Q BY A JUROR: What tension in pounds did you put on
19 your tape?

20 A I believe twenty-four.

21 Q What was the basis of measurement from "Pete" to "St.
22 Francis"?

23 A That was portion of the triangulation system used in
24 the construction of the Los Angeles Aqueduct.

25 Q What do the records show, the method taken to get that
26 distance?

27 A Our records are not complete on that. I know it was
28 determined from the base line measured near Saugus, from north
29 of Saugus, and that work was extended up through San Francisquito
30 Canyon by triangulation methods used in connection with the con-
31 struction of the aqueduct. In its use, the check I have shows
32 we have made many surveys for the purpose of locating conduit,

1 one for locating a road around the reservoir, all of which were
2 tied with triangulation, and no error was detected. Our agree-
3 ment with the triangulation was approximately one foot in five
4 thousand, which we considered sufficiently accurate work for our
5 purposes.

6 Q You don't know how the distance between these two
7 points was actually determined?

8 A Simply part of the aqueduct triangulation system.

9 Q When was that done?

10 A That was done in 1908.

11 Q BY MR. ROBINSON: Is it possible that the old records
12 showing what individual did that particular portion of it can be
13 unearthed, if it is desired?

14 A I don't know whether we could produce that evidence or
15 not.

16 Q BY MR. ROBINSON: Do I understand it to be a fact the
17 same monuments, "St. Francis" and "Pete" were used by Mr.
18 Imbertson in his work, which preceded the construction of the
19 dam, and also by Mr. Hemberg in his recent work, in determining
20 whether or not there has been a shift at certain points, and by
21 Mr. Imbertson in his check made on Saturday?

22 A Yes sir.

23 Q This photostat (indicating) has been handed to me as
24 being the information you refer to. Before we go into that,
25 in connection with the laying out of the St. Francis reservoir
26 site, was a survey made of the water line, contemplated water
27 line?

28 A Yes.

29 Q That is required for the purpose of filing with the
30 United States Government?

31 A Yes.

32 Q Is it a fact a lot of the land in the state was United

1 States Government land?

2 A Yes.

3 Q In preparing these filing maps, as I understand, you
4 made a survey of the water line of the reservoir and tied that
5 into this aqueduct triangulation control?

6 A The triangulation was used as a basis of control for
7 preparation of that map.

8 Q Is the same true in connection with the establishment
9 of Power Plant No. 2, was that tied in with the aqueduct primary
10 triangulation control?

11 A I believe it was, that comes under the Power Bureau.

12 Q During the period of years since the aqueduct was
13 originally constructed, there has been considerable additional
14 work done in the San Francisquite Canyon?

15 A Yes.

16 Q In the course of all that work, have any errors or
17 discrepancies in the original triangulation been found?

18 A We haven't.

19 Q As I understand it, the subsequent surveys were just
20 for the most part the original field surveys, and not done with
21 the same degree of accuracy as the original triangulation, but
22 nevertheless served as a practical check on it?

23 A Yes.

24 Q Is it true, if you make a number of surveys by tying
25 into an original triangulation, that would tend to develop
26 errors, if there were any in the original triangulation?

27 A Certainly would.

28 Q As far as you know, no such errors have ever been
29 observed?

30 A No.

31 Q Will you proceed with the explanation you were re-
32 quested to make as to how the points were established?

1 A As regards to the pull on the tape, we standardized
2 this tape against the Los Angeles City Engineer's standard, one
3 hundred foot length, at twenty-four pounds pull, at sixty-two
4 degrees Fahrenheit.

5 Q Then, Mr. Proctor, will you explain what the effect of
6 any error which may have been made in the establishment of the
7 length of your base line would have been on the observations of
8 the two points "B" and "C"--- assume, if you will, that the line
9 "A" - "Pete" was actually ten feet longer than or shorter than
10 it was measured as being by Mr. Imbertson--- assume he made an
11 error of ten feet in his measurement of that base line--- will
12 you explain what difference that would make in the determination
13 of the shift of the point "B" and "C"?

14 A (Witness drawing diagram on blackboard) I have drawn
15 a triangle on the blackboard, labelling the various corners
16 "Pete", "A" and "B". Now, this would represent the original
17 determination of the position of point "B" (indicating). We
18 will assume that the points represented as "B-prime" connects
19 this point with points "A" and "Pete", will connect "B-prime"
20 with point "B"--- this distance (indicating) has been given as
21 twelve one hundredths of one foot. Now, the distance from
22 point "A-Pete" is for the purpose of this demonstration twenty-
23 one hundred and fifty feet. Now, we will assume that the
24 distance was actually twenty-one hundred and forty feet. Now,
25 this figure as we have it is composed of one large triangle
26 with three smaller triangles inside of it. Now, from the
27 fundamentals of geometry that all triangles having the same
28 angles are similar triangles, and if you vary one side of two
29 triangles which are similar, you vary the remaining sides in
30 proportion. Now, based on twenty-one hundred and fifty feet,
31 we determined the distance of twelve one hundredths foot.
32 Based on twenty-one hundred and forty feet, the distance of

1 twelve one hundredths of a foot will vary in proportion--- the
2 proportion will be ten twenty-one fiftieths of twelve one
3 hundredths of one foot, will be one half of one one thousandth.

4 Q AS I understand then, if you assume there was an
5 error of ten feet in the observation of the length of the line
6 "A-Pete", that would only make the difference which you have
7 indicated in the results of the work?

8 A Yes, a distance which is much less than you can de-
9 termine.

10 Q BY A JUROR: Isn't it true all the points taken here
11 (indicating)--- the black line--- are on the opposite side of
12 the valley?

13 A Yes.

14 Q If there has been a movement that would affect the
15 distance of these two points (indicating)?

16 A This dimension wasn't used in the determination of
17 point "B". Points "A" and "Pete" were used in the determina-
18 tion of point "B" before and after the failure--- they are on
19 the same side of the canyon.

20 Q In fact, the only base line you know is this six
21 hundred foot line?

22 A We measured the six hundred and ninety foot line, and
23 checked all lines ~~xxxxx~~ which appear on here, and now after
24 movement, I would say that we can't be as certain of any line
25 which crosses the fault as any line which stays on the same side
26 of it, hence the selection of points "A" and "Pete" for the
27 purpose.

28 Q Assuming your length in the course of the radial line
29 in tying it into this first triangle, you can check your
30 distance in all other triangles, check the courses and lengths
31 of the sides of all other triangles?

32 A Yes.

1 Q Was that checked--- how closely?

2 A Four one thousandths of a foot. In other words,
3 checked as close as we were able to measure it, and we could
4 find nothing wrong. The work I am testifying to now was done
5 by Mr. Hemberg. Speaking of the line from point "Pete" to
6 point "B", the original course given south fifteen degrees,
7 thirty minutes, 9.31 of a second west. The course now de-
8 termined as written in the opposite direction, north fifteen
9 degrees, thirty minutes, 21.71 of a second east. Of course, I
10 might explain the course of southwest can also be written north-
11 east, a difference of 12.4 seconds.

12 Q BY MR. ROBINSON: What was the difference of the ob-
13 servation of the other line, namely "A" - "B"?

14 A Line point "A" to point "B" was given originally as
15 south sixty-four degrees, forty-three minutes, 9.21 seconds
16 east. The new determination being south sixty-four degrees,
17 forty-three minutes, and 11.81 seconds east, a difference of
18 2.6 seconds.

19 Q BY A JUROR: At what point on this map did the
20 elevation appear to be changed from your calculations?

21 A We have a drawing of the elevations.

22 Q Was that taken on the masonry?

23 A Yes, we have elevations at point "B" on the entire
24 remaining structure.

25 Q It has been stated there is another fault crossing at
26 an angle--- assuming a movement on that fault, how would that
27 affect the determination?

28 A You will have to ask the geologists.

29 Q You can locate that fault?

30 A I don't know where it is myself.

31 Q Assuming it would pass between "A" and "Pete", what
32 would be the effect?

1 A The fault crossing point known, from point "A" to
2 "Pete" which resulted in a movement--- I will illustrate with
3 the map I have in my hand--- causing a twisting in this di-
4 rection (indicating), apparently producing point "B" at right
5 angles to that, which we have observed.

6 Q You are assuming a horizontal thrust?

7 A I am not assuming, I am merely trying to show what we
8 have, bringing out the movement between point "Pete" and point
9 "A".

10 Q Do you know when that movement took place?

11 A I don't.

12 Q Could anyone know when it took place?

13 A No sir.

14 Q BY MR. ROBINSON: Are you able to answer, Mr. Proctor,
15 as to the period?

16 A No, I couldn't.

17 Q Can you answer to the period?

18 A Seemed it happened sometime between the original
19 observations and the last one.

20 Q What were those dates?

21 A The original observation, I believe, was in 1923, and
22 the last one was shortly after the failure of the dam.

23 Q BY A JUROR: You might state the relation of point
24 "A" relative to landslides?

25 A I feel certain they were away from any slides.

26 Q How far away?

27 A Point "A" is about fifty feet in elevation above the
28 road, by which I understand the jury approached the dam, mean-
29 ing the road which passed Surge Chamber of Power House 2.

30 Q Point "Pete"?

31 A Is approximately twenty-five feet in elevation below
32 the same road, and about one hundred and fifty feet away from it.

1 Q They are both on the westerly slope of that east side?

2 A Yes. Point two inch iron pipe is gone out, radial
3 point is gone, point "D" fell on the slopes of the buttress wall
4 and wasn't reestablished, leaving point "B", which was carefully
5 replaced on the top of the dam after construction, and point "C",
6 which is the original point, being one inch iron pipe, as driven
7 in the ground by Mr. Imbertson in 1923.

8 Q These are the only two points on which you could find
9 any movement?

10 A These are the only two points we could check.

11 Q Didn't you check the elevation here (indicating)?

12 A Yes.

13 Q Did you have an elevation on that?

14 A Yes.

15 Q Did you find the elevation of "B" and "C"?

16 A As I stated, we were unable to take the elevation of
17 "C". I might mention now that our bench marks, with reference
18 to this dam, were all down immediately below the dam, and were
19 all swept away by the flood.

20 Q Could this movement have taken place before the dam
21 was built?

22 A Hardly, as this entire matter was checked over during
23 the construction of the dam, and this information was used in
24 its construction.

25 Q I thought you said the last check was 1923?

26 A Point "B" was established in 1923, and the information
27 determined at that time was used in the construction of the dam.

28 Q BY MR. ROBINSON: The witness stated point "B" was
29 reestablished on that concrete after the work was completed?

30 A Yes.

31 Q BY A JUROR: Now, do you think that point is moved?

32 A Apparently has.

1 Q It was on top of the dam?

2 A Yes.

3 Q As I understand, it is to the westerly end of the
4 dyke?

5 A Yes. Point "C" is on the natural ground.

6 Q How much has point "C" moved?

7 A Nine one hundredths of a foot, I believe.

8 Q How much did point "B" move?

9 A Twelve one hundredths.

10 Q BY MR. ROBINSON: You testified awhile ago as to the
11 reservoir surveys and power plant surveys, road surveys, which
12 were tied into this original aqueduct control--- whose surveys
13 were those?

14 A Part of them made under my supervision, and part
15 didn't come under my supervision, and I wouldn't know ^{what} checks they
16 were.

17 Q BY A JUROR: Was the direction of movement of "B" and
18 "C" the same?

19 A We have them here (showing map).

20 Q About that reestablishing of point "B", is that in
21 the position of the original steam shovel?

22 A Yes, the details with reference to that, I believe,
23 were the setting of point "B" on line, such as "B" to "Pete"
24 provides, and line "B" to "A" provides, making an intersection
25 approximately right angles. I would say it was done that way,
26 Mr. Hemberg will know.

27 Q Were the points of triangulation accepted as a fact
28 by the government?

29 A They make no check of those things. We prepare what
30 is known as plane table, field sheets, based on triangulation
31 from which the survey was made, by the method of plane table.

32 Q They accepted that as a fact?

1 A Yes, and we were required to produce a proportionate
2 distance transfer around the high water line--- that is not the
3 standard method of doing that thing.

4 Q BY MR. ROBINSON: We were asked the question as to
5 filing with the government, as implying that the government
6 checked the work.

7 A JUROR: Naturally the question would come up, will they
8 accept what you have done, or check it over?

9 MR. ROBINSON: No, any errors in the original triangula-
10 tion--- we didn't want the question to carry the inference that
11 the government checked up on it.

12 Q BY A JUROR: Due to temperature change, there would be
13 a shortening of the wall?

14 A Apparently so, a short distance from point "B" the
15 wall is cracked below the other.

16 Q You feel through that temperature change, it wouldn't
17 dislocate point "B"?

18 A Certainly not, more than a quarter of an inch.

19 Q BY MR. ROBINSON: The profile of the dyke has been
20 prepared--- can you explain that?

21 A I will explain that.

22 Q I am handing to the witness plan and profile of the
23 St. Francis dyke.

24 A The title is given as plan, profile and elevation of
25 St. Francis dyke, April, 1928. At the top, we have a plan
26 of the remaining dyke, as it now stands, showing the buttress
27 wall and point of break. At the bottom, we have a downstream
28 elevation of the standing portion of the dyke. At Station five
29 plus naught naught, near the middle of the drawing, we have a
30 profile at an exaggerated scale, giving the elevation of the
31 top of the dyke as we now find it, the scale being on the
32 original map twenty feet to ^{the inch} ~~one~~ horizontally, vertically one

1 inch equals one foot. The original has been photostated,
2 however, I believe, to half scale, and would now be one inch to
3 forty feet, and one half inch equals one foot vertically. This
4 map shows a rise in the structure of approximately twenty-eight
5 one hundredths, as previously testified, along the westerly
6 portion of the dyke until we come to a point about eighty-seven
7 feet, I believe, from the end, where it tapers down at a fairly
8 uniform rate to the break, at the point of break the top of the
9 standing structure approximately one tenth of a foot above the
10 point to which it was constructed, showing the buttress to be,
11 as a matter of fact, about two inches below the rest of the
12 structure. Made a very careful examination of the foundation
13 of the buttress, main dyke, in the entire vicinity between the
14 cracks and end, and was unable to find any evidence of that
15 portion of the dam being further into the ground in which it
16 was constructed than it was before the failure of the dam.

17 Q Has any check been made to determine whether or not
18 there has been any tipping of the dyke, as distinguished,
19 tipping across right angles ^{to the axis of the dyke,} as distinguished from the original?

20 A We haven't, other than there was a gap eleven and one
21 one hundredths of a foot between the buttress and standing dyke.
22 I might add that there has been a movement, as we have testified,
23 but it would be very difficult for us to do that, as our method
24 of determining that would depend upon line from point "B" to
25 point "A".

26 Q BY A JUROR: Was the top of that dyke structure level
27 originally?

28 A Surveyors set points in the forms every twelve and one
29 half feet, I believe, nails, with pin around them, and concrete
30 was carefully poured to the correct elevation. The reason for
31 that was to avoid puddles in top of the concrete after con-
32 struction was complete.

1 Q If the dyke had tipped, couldn't that slope be checked
2 at the present time?

3 A It could be. We have a profile giving the elevation
4 on both sides.

5 Q BY MR. ROBINSON: That was what my question was directed
6 to a few minutes ago.

7 A I thought it was the horizontal movement--- we have the
8 observation.

9 Q The rotation of that dyke could change things?

10 A Mr. Hemborg has this.

11 Q BY MR. ROBINSON: I introduce the book produced by
12 Mr. Hemborg.

13 A Indicating Station naught plus seventy-five, being
14 about this position (indicating), a difference of elevation of
15 thirteen one hundredths of a foot from one side of the structure
16 to the other. The differences which I give are corresponding
17 to twelve one hundredths of a foot, which is a difference
18 supposed to be at Station two, would be in the middle of this
19 curve (indicating), find it sixteen one hundredths of a foot,
20 Station three, find fifteen one hundredths of a foot, Station
21 four, find fifteen one hundredths of a foot, Station five, find
22 sixteen one hundredths of a foot, and at the end of the dyke,
23 broken end, we find thirteen one hundredths of a foot. In ad-
24 dition to that, we have these elevations every twelve and one
25 half feet, it would take sometime to read them.

26 Q BY A JUROR: In other words, it shows a possible lean-
27 ing there of a slight amount?

28 A It would have to be a very slight amount.

29 Q These discrepancies were all in the same direction?

30 A Appeared to be, yes.

31 Q BY DISTRICT ATTORNEY: In relation to that point on
32 the dyke wall, did that indicate the wall stretched or shrunk?

1 A Don't think it indicated either.

2 Q Is it further west than it is east?

3 A The point is now further east than it used to be.

4 Q Do you know what the shrinkage of six hundred feet
5 would be in that wall from the time that tack was driven in
6 until the time you measured it?

7 A No.

8 Q You didn't compute that in your triangulation?

9 A Don't think anyone can compute it with accuracy.

10 Q There would be some?

11 A I don't think so, because there were many cracks
12 along that structure.

13 Q Do you know what time of the day it was put in, the
14 measurement made, the original one, the first one, when they put
15 the tack in?

16 A The wall wasn't there at that time. Point "B" was
17 originally placed in the natural ground. At the time of the
18 construction of the dam, the surveyors took measurements, and
19 established points with a view to accurately replacing point "B"
20 after construction, which was done.

21 Q Did you, in measuring that, take into consideration
22 the time of year, time of day, for the purpose of taking in any
23 expansion?

24 A We didn't.

25 THE CORONER: That is all, you may be excused.

26

27

28 Z. CUSHING, having been previously
29 duly sworn, was recalled and testified as follows:

30 BY THE CORONER:

31 Q In your testimony Friday, you stated you were having
32 some excavation work done under a portion of the dam?

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A Yes sir.

Q Have you carried on that work?

A Been carried on but not completed.

Q You haven't reached any conclusion?

A No sir.

Q Haven't developed any fact that you care~~axx~~ to disclose at this time, that would be of interest to the jury?

A Disclosed there was an abrasion found.

Q You haven't come to any conclusion as to what caused that abrasion?

A No sir, because it would involve technical study of chemists.

Q How long a time?

A I don't know.

Q You have had considerable experience in this sort of thing?

A Not in examination of concrete, not the technical end of it.

Q Have you already submitted samples to a chemist?

A Samples are taken~~xx~~ but I don't know whether they have gone to the chemist or not.

Q BY MR. ROBINSON: I might say investigation is being very vigorously prosecuted, but our feeling is this is a matter that should not be gone into piecemeal, there ought to be a complete investigation, lay it all before the jury, not lay a few fragments. It isn't that we want to keep anything back.

Q BY THE CORONER: I think in line with Mr. Cushing's testimony, it would be proper for him to state what he found there.

A As I say, there was an abrasion found in the face of the block, upstream side of the block, that is about, appears would be about two feet from the bottom of the block.

1 Q How far would that be on the dam?
2 A Up right close to where the block sets into---
3 Q Illustrate on the model.
4 A That piece is in there (indicating on model)--- this
5 block is laying in that position, probably a depth of forty-five
6 degrees, right along the face, and the abrasion is more or less
7 right in there (indicating).
8 Q How many feet from the top of the dam would you
9 estimate that to be?
10 A I didn't estimate that yet.
11 Q Would it be near where the piece of concrete was
12 shouldered onto the side of the canyon?
13 A That is it. I say it is within about two feet where
14 the concrete set into the side.
15 Q What was the shape of that abrasion?
16 A It is an oblong abrasion, about ten feet long and two
17 and one half feet this way, vertically--- six or seven inches
18 deep.
19 Q Is this piece of concrete on any other piece of con-
20 crete?
21 A No sir, seems to be laying on the original stream bed,
22 laying on bed rock, I wouldn't say for certain.
23 Q You are excavating there?
24 A It is more or less muck or schist and small pieces of
25 concrete, which has been broken somewhere else.
26 Q BY A JUROR: Who is doing this work, on whose au-
27 thority?
28 A It was my suggestion that this investigation be made.
29 Q BY THE CORONER: The Bureau of Water and Supply?
30 A Yes sir.
31 BY A JUROR:
32 Q Has the department retained you, are you employed by
the department as expert in this?

1 A No, I came here voluntarily.

2 Q BY THE CORONER: How long, in your opinion, would it
3 take to bring all these facts out, if they are found?

4 A I wouldn't attempt to say, because there is further
5 examination of other blocks to be made, a lot of things, before
6 coming to a conclusion--- I wouldn't attempt to say now.

7 Q Will your report be based wholly on the chemical
8 analysis or some other things?

9 A If the chemical analysis doesn't show it was disinte-
10 grated by powder or dynamite, we are willing to give up that
11 point.

12 Q Is there a well established process through which you
13 can determine the effect of dynamite or powder upon concrete?

14 A As near as I understand the proposition, dynamite is
15 the only thing known that absolutely destroys the combining
16 qualities of concrete, I am sure about that, always understood
17 it, not only on account of the blow, but also the tremendous
18 heat, temperature.

19 Q Would this be a chemical reaction or physical change?

20 A I won't qualify as a chemist.

21 Q You have never seen such test made?

22 A I don't know what that was, no sir.

23 Q You can't testify to anything until you see the
24 chemist's report?

25 A No sir.

26 Q Have your suspicions become strengthened any since
27 you testified the other day as to what the indications are?

28 A Yes sir, they have.

29 Q To what extent?

30 A Yesterday, in the excavation there was another crack
31 developed, behind the abrasion that comes out to the side of the
32 block.

1 Q Radial crack, what kind of crack?

2 A Seems to start behind the abrasion and turn, parallel-
3 ing the large crack, I can't tell you yet though.

4 Q BY A JUROR: It would be helpful to our purpose if we
5 could tell how much time is going to be consumed in bringing out
6 such facts.

7 THE CORONER: The witness says he doesn't know how long it
8 is going to take, because he wants to experiment with some other
9 blocks.

10 A BY WITNESS: My suspicions on that block were so
11 strengthened that I feel everything should be examined thoroughly
12 on that block, as well as another block that was adjoining it,
13 that has to be dug out three thousand feet downstream.

14 Q BY A JUROR: How many crews of men are working on
15 that now?

16 A I couldn't say.

17 Q How many points of exploration are projected?

18 A Stopped work on one and started another under this
19 crack, which would be a better one to make observations from.

20 Q Are they going to start six or eight explorations?

21 A No, I finished that block.

22 Q That will bring forth what you are looking for as to--

23 A Absolutely.

24 Q The crew working, I saw yesterday, is that the whole
25 crew doing the excavating?

26 A I don't know.

27 Q BY MR. ROBINSON: Will you state again, as you gave
28 in your testimony on Friday, as to why excavation was begun at
29 that particular point, why digging was begun at that particular
30 place, as you did Friday?

31 A This crack, large crack down near the bottom where you
32 could see it above the gravel showed some disintegrated concrete,

1 and I reasoned that if an explosion occurred, it occurred close
2 to the face of that crack, and close to the crack on the face
3 of the dam.

4 Q As I understand it, this crack you speak of is the
5 one which created a suspicion in your mind, and the digging was
6 to get to the other end?

7 A Yes.

8 Q Where was this scar with reference to that?

9 A Appeared this way (indicating). I imagine you are
10 going to find where feather edges occur, I don't know.

11 Q Is it approximately in the direction of the prolonga-
12 tion of that crack?

13 A Yes.

14 Q Was that the purpose of the digging to get to the
15 other end of that crack?

16 A Yes sir, also looking for further radiation cracks
17 that might have occurred.

18 Q As to the length of time, I might say this, efforts
19 are being made now to get experts on several different lines,
20 to come here and make examinations, tests, chemically, physically
21 and so forth. Until they can reach here and make preliminary
22 examination, there will be no definite estimate as to how long
23 it will take to do their work, it may be a matter of ten days or
24 two weeks. If it is the desire of the jury that ^{the} ~~Inquest~~ ~~xxxxxxx~~
25 remain open until these investigations are made---

26 THE CORONER: We will submit that proposition to them and
27 they can reach a conclusion as to that.

28 Q BY DISTRICT ATTORNEY: Are you an expert on dynamite?

29 A Yes sir.

30 Q What experience have you had with blasting dynamite?

31 A Twenty-two years.

32 Q Where did you ever do any blasting?

1 A I couldn't enumerate the places.
2 Q Name one place?
3 A Start in on the aqueduct.
4 Q When you use dynamite for blasting purposes, you tamp
5 it?
6 A It should be tamped.
7 Q And the reason for tamping it is so it won't blow
8 away?
9 A Yes sir.
10 Q What kind of dynamite do you think was used here?
11 A I wouldn't say.
12 Q What is No. 1 dynamite?
13 A I don't know it by that.
14 Q What is cordite?
15 A I don't know cordite.
16 Q What is dynamite made of?
17 A I know but I won't answer the question of these
18 formulas.
19 Q It was discovered by Mr. Noble?
20 A I don't care who it was discovered by. If you wish
21 to know any of these formulas, look in the encyclopedia and get
22 it.
23 Q You came Friday and told us you had come out here
24 voluntarily at your own expense to conduct this investigation.
25 What time Friday were you employed by the Board of Power?
26 A I wasn't employed Friday.
27 Q What time Saturday?
28 A I told them Saturday I couldn't afford to stay any
29 longer at my own expense.
30 Q What day did you go up to make this excavation?
31 A I think it was Thursday, March 29, I was first up
32 there.

1 Q When did you start digging first?

2 A I started on Wednesday morning to make the excavation

3 behind the face of the block.

4 Q This block here (indicating)?

5 A Yes sir.

6 Q Did you know a newspaper three weeks ago said that

7 dynamite was found here where you found it when you went up

8 Friday?

9 A No sir.

10 Q Did you know an enterprising reporter published that

11 in the paper here as coming from El Paso, Texas?

12 A No sir.

13 Q How did you happen to get here?

14 A Just as I stated, I read in the El Paso Times Mr. Nance

15 found a piece of concrete that would crumble in his fingers,

16 and I knew the work Mr. Mulholland always did--- I came to see

17 what I could do.

18 Q I believe you found in the block indicated that there

19 had been a hole bored?

20 A Abrasion.

21 Q Before the explosion?

22 A No.

23 Q Or had been tamped in there?

24 A No, the water would tamp it.

25 Q Was there anything blown out of the piece?

26 A The whole abrasion is blown out.

27 Q From the inside out?

28 A Like you hit anything a blow.

29 Q Was it blown out from the piece?

30 A Yes sir.

31 Q About how much?

32 A It varied as to extreme depth, probably six inches out.

1 Q Out of the concrete block?

2 A Yes sir.

3 Q You think that the dynamite was placed in there, it
4 was tamped by the water?

5 A Yes sir.

6 Q How would you explode it there?

7 A Either by a fuse or electric tap.

8 Q A fuse in the water?

9 A Yes sir.

10 Q Have you ever seen dynamite exploded in the water with
11 a fuse?

12 A Yes sir.

13 Q Where?

14 A Any place nearly that they have water.

15 Q BY MR. ROBINSON: In the use of explosives, which is
16 the more effective, a water tamped, by using explosives under
17 water, or tamping such as is ordinarily done in the use of ex-
18 plosives in dry rock?

19 A The water, we always presume it gives one hundred per-
20 cent efficiency.

21 Q What is the efficiency of tamping by the ordinary
22 methods in dry material?

23 A We never assume over sixty percent efficiency.

24 Q Will you name a few places where you had experience
25 with the use of explosives under water?

26 A The large one was in dry docks at Pearl Harbor,
27 Hawaiian Islands. They had built a dry dock of concrete blocks,
28 nine feet long, five feet wide and seven feet thick. Hydro-
29 static head under the bay buckled these blocks and the structure
30 collapsed. I wanted to get these blocks out of the way--- the
31 first one I tried was forty sticks of forty percent dynamite
32 made into different packages--- placed another one the same way,

1 and then the structure settled, it was too fine, would rather
2 have it in larger pieces, eventually used ten sticks of forty
3 percent dynamite.

4 Q You have some idea of the extent of that work--- how
5 much concrete was placed there?

6 A Somewhere in the neighborhood of three hundred and
7 fifty or four hundred thousand yards.

8 Q Where else have you had experience with blasting
9 under water?

10 A The last one was cutting ships in two. There was a
11 large English freight vessel that went on the rocks at Delaware
12 Gates, was in the way of the channel, and I made a string of
13 eighty percent gelatin, put it in a string around under the hull
14 and cut the ship in two.

15 Q Going back to this Pearl Harbor work--- where were
16 these blocks of concrete?

17 A They were in the bottom of the dry dock.

18 Q Under water?

19 A Under about thirty-five feet of water.

20 Q When you first took the stand, you made some statement
21 of the nature of your experience, which states whether or not
22 you have been sent for to foreign countries in connection with
23 dynamite problems?

24 A Yes sir, I was sent down to Chile, not long ago, to
25 pull off a big explosion. We moved a million tons of copper
26 with one shot.

27 Q Hasn't that been your work, probably all your life,
28 to supervise large dynamite and explosive operations, as a
29 representative of the explosive companies?

30 A Yes sir.

31 Q Have you had any local experience here other than that
32 experience with the aqueduct work here?

1 A No sir, not personally.

2 Q Did you at any time make any investigation here?

3 A I was on the committee that investigated the Times
4 explosion.

5 Q At the time, when the question was asked to whether
6 it was gas or dynamite?

7 A Yes sir.

8 Q In connection with the investigation of that committee,
9 did you carry on any experiments or tests of any kind?

10 A Yes sir.

11 Q What was the conclusion of the committee?

12 A The conclusion of the committee was that the building
13 was dynamited.

14 Q That afterwards was generally accepted as the theory?

15 A Yes sir.

16 Q BY DISTRICT ATTORNEY: The fellow ~~was~~ plead guilty of
17 leaving dynamite in the alley?

18 A After we proved absolutely it was dynamite.

19 Q This job you blew up, did you use dynamite or blasting
20 gelatin?

21 A Eighty percent gelatin.

22 Q You explode gelatin in a different way than you do
23 dynamite?

24 A No sir.

25 Q How do you explode that?

26 A With a cap, if you want to boost it along.

27 Q Dynamite freezes, doesn't it?

28 A Yes, it will.

29 Q And whenever you sell dynamite, you wrap it up in
30 papers, keep it away from the water?

31 A Not necessarily.

32 Q Isn't that true?

1 A No.

2 Q This blasting gelatin is used for work around wet
3 places?

4 A Gelatin is supposed to be a water dynamite.

5 Q You don't know ~~xx~~ how they explode that?

6 A With a cap.

7 Q Right down in the water, with a fuse on it?

8 A Yes, if you want to.

9 Q That is the same way you explode dynamite?

10 A Fuse or electric battery either, it doesn't matter.

11 Q Put the dynamite down in the water and it will blow
12 the dam out?

13 A No, no.

14 Q BY THE CORONER: How do they get it down there, put it
15 in a case of some sort?

16 A The divers place it.

17 Q In dynamiting the ship, you had divers, but if you
18 wanted to dynamite a structure such as this dam was, how would
19 you place that dynamite?

20 A Drop it over where I wanted it to go, and the force of
21 the water would lay it against the face of the dam.

22 Q Would it take very much time to rig it up?

23 A Absolutely not, do it in a half minute, drop it over
24 with a fuse on or battery, and blew it off. There is a water
25 proof fuse.

26 Q Have you ever had any experience using T.N.T.?

27 A Yes.

28 Q What is T.N.T.?

29 A I think it is developed for the purpose of being so
30 safe.

31 Q That explodes under a certain amount of pressure?

32 A No, just using cap on it. T.N.T. only equals about

1 forty per cent dynamite for destructive purposes.

2 Q What noise is given if exploded under water?

3 A It might be a little blunt and a vacuum is created and
4 ~~gases~~ bubbles come to the surface.

5 Q There wouldn't be any loud explosion that would attract
6 attention?

7 A No sir.

8 Q BY A JUROR: Would that have to be such a charge that
9 it would be necessary to have that dynamite hauled up by a truck?

10 A Hard to say how much they would put in. As I ex-
11 plained to you the other day, it would take a very small quantity
12 to break the schist that the dam was sitting on, that material
13 cracks readily.

14 Q The quantity necessary could be conveyed in an ordinary
15 automobile, or would it have to be in a truck?

16 A Carry it in an automobile. Take a case of fifty
17 pounds, that would be sufficient to crack that schist.

18 Q What amount would you think it was necessary to make
19 this abrasion?

20 A I don't know.

21 Q What effect would the difference of richness for con-
22 crete of a barrel per yard---

23 A It would be less. The richer the concrete strength
24 I imagine the abrasion would be small.

25 Q You don't know whether the concrete was good concrete
26 at that point?

27 A I don't know, I have never gone into the concrete.

28 Q BY THE CORONER: What was the thickness of that wall
29 you blew out at Pearl Harbor?

30 A It was about nine feet long, width five feet, seven
31 feet thick.

32 Q Seven feet, the total thickness of the wall?

1 A Of the block.

2 Q In this case, you had one hundred and sixty-nine feet
3 on the base there, as against seven feet here.

4 A JUROR: As I understand, this was simply facing blocks
5 on Pearl Harbor?

6 A No sir, the bottom of the dry dock.

7 Q BY MR. ROBINSON: Are these blocks in Pearl Harbor
8 blocks that were standing, water on all sides?

9 A Yes sir.

10 Q It wasn't a condition where you had a dam with a high
11 head, and the pressure on one side only?

12 A It would be just the same, you get the same tamping.

13 Q Yes, but if you had an explosion creating cracks in
14 either the concrete or in the rock formation at the abutment of
15 the dam, what would the effect of the water pressure on one side
16 be with reference to the destructive effect?

17 A The destructive effect would be down on the bottom.

18 Q I am not speaking of the effect of the dynamite so
19 much as what would follow the explosion?

20 A I imagine a very small crack, with such a tremendous
21 weight of water, would soon undermine.

22 Q BY A JUROR: If this abrasion is two feet above the
23 dam, it didn't affect the schist?

24 A You can't tell yet how that is.

25 Q BY DISTRICT ATTORNEY: Did you examine the schist
26 before you started digging for the crack?

27 A There isn't any schist there.

28 Q Where, is it?

29 A Downstream, I suppose.

30 Q You can't examine it until---

31 A No, fifty feet of that hill washed away.

32 Q Didn't you make any excavation there?

1 A What is the use?

2 Q These blocks, how did you use the dynamite there?

3 A Laid it on top of them.

4 Q How many sticks?

5 A Started with forty sticks, finally got down to ten.

6 Ten was sufficient.

7 Q BY THE CORONER: You realize, of course, as everyone
8 does, that both sides of the dam are out. Is it your con-
9 tention that both ends must have been dynamited?

10 A My contention is it isn't dynamited at all yet.

11 Q You are not making a positive statement from your in-
12 vestigation, that it was dynamited?

13 A No sir.

14 Q BY A JUROR: Is any effort being made to determine
15 whether there was any such shock on the west side?

16 A Can only do one thing at a time.

17 Q Are men searching the floor of the valley there under
18 your direction?

19 A Not now, no sir, I do my own searching.

20 Q BY THE CORONER: Is it your opinion that if this jury
21 went up there to see what you have just described, it would be
22 of any value to them?

23 A It might, I don't know, they might see something that
24 is interesting. I will be glad to take them and describe it to
25 them.

26 THE CORONER: That is all, you may be excused.

27

28

29

30

WILLIAM J. BRIGHT, being first duly
sworn, testified as follows:

31

BY THE CORONER:

32

Q Please state your full name.

1 A William J. Bright.

2 Q You are chief of the Homicide Department, Sheriff's
3 office?

4 A Yes sir.

5 Q Have you visited the excavation just mentioned by Mr.
6 Cushing?

7 A I have.

8 Q Did you secure any photographs?

9 A I got some of the outside, none of the inside. Had
10 to shoot a flash, and they didn't want me to shoot it in there,
11 on account of the chemicals that is in it.

12 Q Would these photographs (indicating) show anything of
13 that abrasion?

14 A Shows a crack at the sides, shows a hole--- this (in-
15 dicating) is the hole--- they are digging under it.

16 Q Show that to the jury and describe it.

17 A Runs down like that (indicating), that is the hole.

18 Q BY A JUROR: What experience have you had with powder?

19 A Nothing, except I watched them make the test of the
20 Times.

21 Q You don't know whether or not this is the effect of
22 powder?

23 A No, I couldn't say.

24 Q BY THE CORONER: When did you take these photographs?

25 A Last night.

26 Q After dark?

27 A Yes sir, with a flashlight.

28 Q BY DISTRICT ATTORNEY: Did you get under this place
29 (indicating) where this gentleman has dug the hole?

30 A I did.

31 Q What did you see?

32 A I seen the first time, it appeared small. Last night

1 it was very large, it is an abrasion.

2 Q Go over on the board and show the jury what you saw---
3 when did you see it first?

4 A Last Friday night.

5 Q Who was present at that time?

6 A There was Mr. Van Norman, Mr. Biles, Clark Sellers,
7 Walter Hunter, Mr. Cushing and several laborers.

8 Q Who asked you to go up there?

9 A Walter Hunter called me.

10 Q All right, show us what you found there.

11 A There is a big slab of some kind here (indicating
12 diagram on blackboard), looks like concrete to me. This is up
13 underneath, about six or seven inches deep, one place six, one
14 place seven.

15 Q The hole in the concrete?

16 A Yes, it is thirty-six or thirty-seven inches wide,
17 measures approximately ten feet over here (indicating), and then
18 continues on. This (indicating) is the face of the dam, and
19 this is on the face.

20 A JUROR:

21 Q You would have to almost stand on your head to see
22 that?

23 A Oh, no.

24 Q I was looking down, I almost had to stand on my head.

25 A It is different now. Inside of this (indicating) is
26 very rugged, a great many rocks sticking up.

27 Q BY DISTRICT ATTORNEY: Make a picture of the face of
28 that wall, of this crack you saw.

29 A That is approximately it (indicating), ten feet long,
30 thirty-six inches wide, six or seven inches deep.

31 Q That is the hole made by the dynamite?

32 A I am not saying it was made by dynamite, I am saying
what is there.

1 Q BY THE CORONER: If you hadn't heard of the possibility
2 that might have been shot, seeing that, would you have thought of
3 an explosive being used, or it might have happened in the de-
4 struction?

5 A I wouldn't know. Something else I found, Mr.
6 Dennison, up here (indicating) is a crack, comes up and lays
7 right like that (indicating), then there is another crack.
8 This (indicating) is the top of the block, there is a small
9 crack about as big as a chalk line, running up for three or four
10 feet. I didn't see any others except this (indicating), and
11 this on this side (indicating), she appears to run into the big
12 crack that is shown in the picture.

13 THE CORONER: That is all, you may be excused.
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April 10th, 1928, 2:00 P.M.

1 MR. DENNISON: (Deputy District Attorney read a report into
2 the record, entitled, "Report of Commission to investigate the
3 causes leading to the failure of the St. Francis Dam near Saugus,
4 California.") A copy of this report is appended hereto.

5 (Mr. Robinson, of Counsel for the City of Los Angeles, read
6 a report into the record entitled, "Report of Committee appoint-
7 ed by the City Council of Los Angeles to investigate and report
8 the cause of the failure of the St. Francis Dam." A copy of
9 said report is appended hereto.)

10 THE CORONER: Gentlemen, inasmuch as you have elected not
11 to make another trip to the dam site and, on account of the un-
12 certainty of the time in which any further information may be-
13 come available covering several matters that have been under dis-
14 cussion here, it seems wise to submit this case to you at this
15 time. One of your number has a very important engagement in
16 San Francisco within the next day or two and he might not be
17 able to return here in the course of ten days or two weeks, and
18 it is highly desirable that the full jury, which has heard this
19 testimony should act upon it. I am, therefore, going to submit
20 it to you at this time. I will give you some brief instructions
21 and some advice as to what your verdict should consist of, and
22 how it should be reached (reading) " Gentlemen of the Jury:
23 All the evidence in this case, that is available, has been pre-
24 sented to you, and it now becomes your duty First to determine
25 how, when and where Julia Rising came to her death, as well as
26 all the others whose names have been read into the record of
27 this case, and Second to determine whether these deaths were due
28 to homicidal or accidental means or natural causes, and Third if
29 to homicidal means, who is responsible therefor, and Fourth if
30 to accidental means, whether the accident was due to negligence
31 on the part of any person or persons. Penal Code, Sec. 192,
32 provides as follows: "Manslaughter Defined. Voluntary and in-

1 voluntary manslaughter. Manslaughter is the unlawful killing
2 of a human being, without malice. It is of two kinds: 1. Vol-
3 untary - upon a sudden quarrel or heat of passion. 2. Involun-
4 tary - in the commission of an unlawful act, not amounting to a
5 felony; or in the commission of a lawful act which might produce
6 death, in an unlawful manner, or without due caution and circum-
7 spection." It is incumbent on you to determine whether or not
8 the St. Francis Dam was located, erected and maintained with due
9 caution and circumspection, and to render a verdict recommending
10 such action by the proper authorities as you may deem appropriate
11 after reviewing all the evidence. Your verdict may also include
12 such other recommendations as, in your opinion, would assist in
13 preventing a recurrence of such catastrophes. You are sworn
14 to render a verdict in accordance with the evidence submitted to
15 you, the testimony of witnesses and your own observations at the
16 site of St. Francis Dam. All collateral information, hearsay and
17 preconceived impressions shall be disregarded by you in arriving
18 at your verdict. You are instructed that testimony based upon
19 theory or suspicion only is not the best evidence and that you
20 are to give such testimony only such consideration as ordinary
21 prudence would dictate."

22 THE CORONER: Now, gentlemen, if you would like to have
23 some elaboration as to the law covering negligence, I will ask
24 Mr. Dennison, as representative of the District Attorney, to
25 enlighten you on that point.

26 MR. DENNISON: I think you have covered it, Mr. Coroner.
27 Of course, here is one thing: If, in the erection and in the
28 inspection and the tare of this dam, the men who were charged
29 with it exercised ordinary care and prudence and honestly en-
30 deavored to do that which they were charged with doing, there
31 could be no criminal action resulting from the misfortune or
32 accident of the dam failing. In other words, if, in the

1 selection of this dam site and the building of the dam itself,
2 Mr. Mulholland, who was frankly stated that he was responsible
3 for the makter, made an error of judgment, an honest mistake,
4 and a catastrophe resulted, of course, there could be no criminal
5 responsibility attached to it. It would be monstrous to place
6 a man upon trial for the crime of manslaughter or murder, who
7 just merely made an error of judgment, and I base that upon our
8 report of engineers, for which I vouched, of course, in intro-
9 ducing it to the Coroner. In this manner, if geologists were
10 employed by the City and the Board of Public Works, they might
11 have disclosed to those that built the dam the treacherous nature
12 of the foundation upon which the dam was put. They did not
13 employ such geologists or whoever may know these things, and it
14 was not the custom to do it, and they left it to the individual
15 judgment of one man and he undoubtedly exercised an honest
16 opinion, and, if you find that to be a fact, of course, I don't
17 want you to send me into Court with him or anybody else to
18 prosecute him for crime, because it would only come to disaster.
19 Criminal evidence that would warrant the prosecution of a person
20 for a death, must be of such a nature as would support a civil
21 suit. If a man went up there and knowing that, put a dam up
22 on that treacherous foundation and said, I don't know anything
23 about it, I will put it there anyway, of course, he would be
24 guilty of manslaughter, but if he used all the care and prudence
25 that he was capable of using and found afterwards that he had
26 made a mistake there could be no criminal negligence.

27
28 THE CORONER: All right. Gentlemen, this case has been
29 submitted to you and you will take as much time as you feel dis-
30 posed ^{to deliberate} to/upon all these matters and then draw your verdict as
31 may suit you. This is probably the most important matter that
32 has ever come before a Coroner's Jury upon the Pacific Coast and
I am sure this jury will make recommendations that will be of
value in the construction of such edifices in the future.