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write on whom
to whom
see note sent
Xm

FELLOW AM. INST. ELEC. ENGINEERS
MEMBER AM. SOC. CIVIL ENGINEERS

RUDOLPH W. VAN NORDEN
CONSULTING ENGINEER
MILLS BUILDING
SAN FRANCISCO, CALIFORNIA
TELEPHONE BUTTER 1448

July Tenth
1 9 2 8

Copies sent to:
W. B. Fisher
L. B. Rippenworth
H. W. Savage
C. Harditt
A. G. Wiley
C. R. Oldberg
Frank Seifert
Basil Bruschi
Louis C. Mairs
Stewart P. McMullen
Edward H. Howell
Major H. C. Clark
C. E. Hodges
S. R. Nelson

Col. Ed. Fletcher,
San Diego Cal.

Dear Col. Fletcher,

A number of clippings from the San Diego papers have been received relative to new developments in the city's water system, but particularly I note references to the cracks in the buttresses of the Hodges dam, upon which a committee of engineers consisting of Messrs. A. J. Wiley, G. F. Tolman and C. R. Oldberg, has made a report, from which the following is quoted:

"The cracks in the buttresses are much larger than those in buttresses of dams of this type with which this board is familiar. The concrete along the cracks shows signs of distress. No such condition exists in any of the other dams we have inspected."

620
Idaho C.
Boyer
Idaho

At various times within the last five years engineers and others have commented on the presence of these cracks. These comments always carry the inference that the cracks might be evidence of some weakness in the arch supports, but without giving any specific reason as to why the cracks should be evidence of weakness, or yet, what might be the cause.

Apparently there has been a steady sowing of the seeds of unrest in the public mind by these innuendoes, but there has never been a specific instance, within the writers knowledge, of any opinion backed by a proper line of reasoning that would justify the slightest cause for fear as to the safety of the structure.

The St. Francis dam, which was a totally different structure, being a gravity type, showed no evidence by cracks, or otherwise, of impending failure. But knowledge of the nature of the foundation and of the design of the structure itself should have furnished sufficient proof that the dam might fail. There is no such prospect confronting the Hodges dam.

The cracks in the Hodges dam do not represent any weakness, or danger to the structure, for the simple reason that these cracks were not caused, nor are they maintained, by any pressure stresses, or strains having a tendency to weaken the dam.

The Hodges dam will not fail. The design was accurately computed with proper care for all stresses involved. The writer

RUDOLPH W. VAN NORDEN

Col. Ed. Fletcher, #2:

is familiar with the design and calculations of stresses and has visited the dam and observed the cracks.

The explanation of the cause and maintenance of these cracks is simple:

In any high mass of concrete, such as the buttresses in the Hodges dam, which are substantially triangular in shape with base as long as their height, if there were no imposed stresses, there would be cracks running from the bottom to the top due entirely to the shrinkage of the concrete. These cracks would be vertical because the weight of the mass would prevent cracks from shrinking opening in any other direction.

Were this concrete mass reinforced, these shrinkage cracks would still be present, the effect of reinforcing being, however, to create more and smaller cracks.

Water pressure from the arches, plus the weight of the arches themselves bears against the sloping edge of the buttress. And, all of this pressure must be carried through the buttress into the ground. While passing through the buttress the weight of the buttress itself is added.

Approximately one-half of the pressure against the edge of the buttress occurs within one-third of the height of this sloping edge. The other half of the applied pressure is taken by the upper two-thirds.

On the other hand, the lower half of the pressure after passing through the buttress is carried into the ground over one-half of the buttress base while the upper half of the pressure is distributed, approximately, over the other half.

These lines of pressure, with the weight of the buttress added, curve downward from the edge of the buttress to the ground.

The zone within which the cracks occur is neutral in respect to these stresses, i.e., it is parallel to the stress lines.

Hence, there is nothing to prevent cracks from shrinkage. Or, in other words; There are no cross stresses which would close a crack, or tensile stresses crossing this zone which would tend to open a crack wider.

It is noteworthy that these cracks are of the same width, (in each specific case), whether the dam be full, or empty.

Were the cracks caused by dangerous stresses they would close at times and open wider at other times.

That the concrete along the cracks shows distress is natural, the slight movement from heat and cold causing expansion and contraction in idle concrete would account for this appearance.

If a slot six inches wide were cut through the buttress from the ground, following the crack line to the spring line of the arches, the dam would still stand and be just as strong as it now is. It would not be perceptibly weakened by cutting such a slot notwithstanding that by so doing the buttress would be divided into two separate segments.

In other words: Instead of buttresses, which are merely

RUDOLPH W. VAN NORDEN

Col. Ed Fletcher, #3:

mechanical supports for the arches and their loads, we might substitute shores, or sloping columns, which should be within themselves properly arched to carry their own weight without bending. The spaces between these sloping columns would not be cause for criticism of the dam's strength in the minds of either engineers, or laymen, notwithstanding that such spaces would be taking the place of the cracks.

To substitute a gravity dam, or even a partial gravity dam, for the present structure would be an economic error and a reflection against good engineering practice, for the gravity dam in spite of its appearance of great mass which carries with it the impression of safety has a factor of safety against overturning much less than is true of the Hodges dam and if it should be curved in plan, still again less.

Finally: The Hodges dam was well and properly designed. It has a good rock foundation. It is well built and of good concrete. Its factors of safety are higher than would be possible in any other type of dam suitable to this site.

The Hodges dam is absolutely safe.

I am writing this letter to you as I know that you have a sympathetic interest in the Hodges dam and as a citizen will give some weight to my statements.

With kindest regards, I am,

Yours very truly,

Rudolph W. Van Norden

RVN/W.

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MEMBER AM. SOC. CIVIL ENGINEERS

RUDOLPH W. VAN NORDEN
CONSULTING ENGINEER
HILLS BUILDING
SAN FRANCISCO, CALIFORNIA
TELEPHONE BUTTER 1448

July Twenty-Eighth
1 9 2 8

Col. Ed. Fletcher,
908 Eighth St.,
San Diego Cal.

Dear Col. Fletcher,

Your letter of the 25th., inst., enclosing a copy of a letter from Mr. Wiley has been received:

I have not seen the Hodges dam since the last time I visited San Diego which was in November 1925. At that time I spent an hour, or so examining several of the buttresses. At various times I have talked with a number of engineers and others who have seen the cracks so that I have felt justified in my stand.

Mr. Wiley's letter is exactly what I would expect. He is, naturally, guarded in what he says and bears out my point that nothing has been done that would definitely indicate a dangerous condition.

One half of the pressure is carried normally below the cracks, the lower part of the dam, therefore, is stable and could not be questioned.

The upper half of the pressure is carried by that part of the buttress above the cracks and acts as a strut, or shore. Its weight offsets the line of arch thrust which is not parallel to the curve of the cracks and is in equilibrium. If there was a tendency to distress in this upper half of the buttress there would be cracks perpendicular to the existing cracks. So far as I know such a condition does not exist.

I appreciate your very kind invitation. But I have nothing in view to take me to Los Angeles. I am pretty busy, incidentally, getting out some preliminary plans for the U.S. Reclamation service. Naturally I want to vindicate multiple arched dams in general and particularly my dear old friend Eastwood. An acceptable report covering the stresses in the Hodges dam would mean quite a little time and work together with the expense of a trip down there. If, however, the matter becomes sufficiently acute I will try and arrange to take it up.

Very sincerely yours,

Rudolph W. Van Norden

*1 a Nelson
1 Hodges
1 Savage
1 King*
RVN/W:

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MEMBER AM. SOC. CIVIL ENGINEERS

RUDOLPH W. VAN NORDEN
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TELEPHONE BUTTER 1448

August Thirteenth
1 9 2 8

Col. Ed. Fletcher,
920 Eighth Street,
San Diego Cal.

Dear Col. Fletcher,

Your letter of the 1st., inst., enclosing copy of letter from Mr. Lippincott to Mr. W. E. Hodges, was received and I appreciate your sending it to me.

Mr. Lippincott's letter is a pleasant surprise to me as I had understood that it was he who proposed to replace the Hodges dam with a gravity dam, or at least, to fill in the buttresses, making a solid mass. It was this report which I had in mind when I said in my first communication to you on this subject, that it would be an economic and engineering error to do such a thing. I think I might have used stronger language with justification.

It is quite natural, being an engineer and therefor always working on the side of safety, while he knows of no reason why the dam should be in any danger, he would wish to see a stress analysis.

The details of the design, which he mentions are easy enough for anyone to obtain, if by no other means, by simple measurment. Apart from this, I am quite sure that the water company possesses the plans and drawings used in construction.

Eastwoods calculations of stresses, while complete in themselves and quite accurate followed methods of his own and would require elucidation and possibly some elaboration in order to present the subject in an acceptable manner. He always said that as he held no patents, in order to protect himself, he would guard his methods of design. He discussed these matters with me very freely, but refused to discuss publically the technical features of his dams, or to write analytical articles from which the engineering confraternity might profit.

I think that both the letters from Mr. Wiley and from Mr. Lippincott are fortunate and oppertune at this time and will help to steady an uncertain situation.

Yours very truly,

Rudolph W. Van Norden

Handwritten notes:
1-50-28
H. W. Savage - 6-1-28
RVN/W.
8-25-28
2-10-28
652

RECEIVED BY THE DIRECTOR

1942

San Diego Cal.
Dear Sir:

Your letter of the 1st of this month...
I am glad to hear that you are...
I am glad to hear that you are...
I am glad to hear that you are...
I am glad to hear that you are...

It is quite natural, being an engineer and inventor...
working on the side of a factory, while he moves...
why he should be in any danger, he would want to see a...
stress-analysis.

The details of the design, which he mentions are...
enough for me to obtain, if I can get them, by...
measurement. I am sure that you will be...
company possesses the plans and drawings...
in connection.

Method of calculations of stresses, which you...
give and different methods of design of...
parts and details and possibly some...
present the subject in an accessible manner...
that he has no doubts, in order to protect himself...
would want his method of design. He...
with me very freely, but wanted to know...
what features of his design, or to write...
that which the engineering community...
rightly.

I think that both the letters from Mr. W...
and the letter from Mr. W...
are interesting and...
very...
I am glad to hear that you are...
I am glad to hear that you are...

Very truly,
Yours very truly,
W. L. ...

W. L. ...

Ed Fletcher Papers

1870-1955

MSS.81

Box: 31 Folder: 38

General Correspondence - Van Norden, Rudolph W.



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