The Atchison, Topeka and Santa Fe Railway Company.

COAST LINES

752

XIX Kerckhoff Building

G. C. MILLETT,
Assistant to Chief Engineer.

Los Angeles, Cal.,
April 20th, 1917.

Mr. W. S. Post,

Fletcher Building, San Diego.

Dear Sir:

Referring to your letter to Mr. Davenport of April 18th, regarding the rock fill type of dam, San Dieguito River:

I am enclosing comment by Mr. Davenport upon the points raised:

It would seem that the matter should be closed as far as this office is concerned, since other work is claiming all of our attention.

No analysis of the small dams was made since their acceptance depended on that of the large dam.

Yours truly,

G. C. Millett

[DAVENPORT]

Los Angeles, April 9th, 1917.

Mr. G. C. Millett,
Assistant to Chief Engineer,
Los Angeles.

Dear Sir:

Carroll Dam - Jorgensen Design.

Referring to my report of March 29th, 1917, on the Carroll Dam, constant angle arch type, as designed by Mr. L. Jorgensen. The numbering of the following paragraphs corresponds with that used in my previous report. At a conference held April 6th, with Mr. Jorgensen and Mr. Post, satisfactory explanation was given by the former for the discrepancies noted by me.

1. Axial stress in dam due to arch action.

It is admitted that the axial stresses due to arch action considered alone would be 382 pounds per square inch at elevation 260. The actual stress will be somewhat less than this.

Case "A" - Dam fully loaded but not grouted at contraction joints.

Reduction of stress will be approximately 10 per cent due to cantilever action plus 5% due to internal stress. 382 pounds less 15% (57 pounds), equals 325 pounds per square inch actual stress.

Case "B" - Dam fully loaded and contraction joints grouted.

Reduction of stress will be approximately 5% due to cantilever action plus 5% due to internal stress. 382 pounds less 10% (38 lbs.) equals 344 pounds per square inch, actual stress.

The thickness of the dam need not, therefore, be increased as I formerly recommended. Mr. Jorgensen's printed articles do not clearly cover this change, now proper to make in my figures.

2. Pressure at toe of dam, downstream side.

According to the theory presented by Mr. Jorgen sen to the American Society of Civil Engineers, some three years ago, my figures are admitted to be correct. Further, use of his revised coefficients given in the article reprinted from "The Canadian Engineer" of March 9th, 1916, does not lead to sufficiently low compressive stresses. However, Mr. Jorgensen has verbally advised me of two additional factors which when considered reduce the calculated stresses to below the 350 pounds per square inch.

(a) Recent experiments made at the University of Minnisota prove that when concrete is subjected to a compressive strain of more than about 300 pounds per square inch a slow deformation up to a maximum amount takes place in the course of several months. Therefore, in this dam as construction progresses, and the toe stresses due to cantilever action begin to exceed the 300 pound limit of normal elasticity the concrete at the toe will deform slightly and the stress instead of becoming larger than the allowable of 350 pounds, will be gradually transferred toward the upstream toe, allowing the arch to take a much larger proportion of the load than the original theory would indicate.

(b) If the contraction joints of the arch are grouted some time after completion of the dam, as recommended for water tightness, the cantilever action at the foundation can be reduced to a large extent so that the axial stresses which are much lower than the safety limit will predominate. It will be noted that this action is independent of the reduction of stress explained under "(a)" and is merely an additional safeguard as the first explanation is sufficient in itself.

3 and 4. Pressure at upstream toe and shear at base.

No further comments to be made, design satisfactory.

5. Sliding on base.

The plans have been changed to better show the tying into the foundation as suggested.

6. Shear where dam joins spillway.

Definite sizes of reinforcing rails have now been added to the plans. Some reduction has been made to the amount of steel I recommended, due to the fact that much of the stress will be carried by the concrete which is made purposely thicker at this point.

7. Initial axial st ress in arch.

Mr. Jorgensen admits that the initial stresses amount to only about 10% of the total, but explains that with a dam of this comparatively small height the economical results due to this cause as proven in the case of a higher dam, cannot be expected.

8. General Suggestions.

(a) Reinforcement for cornice has been shown on plans.
(b) Position of rails in section is now indicated.
(c) Stepping of side slopes has been indicated.
(d) Cutoff walls are now shown as suggested.
(e) Waterproofing with "gunnite" is not considered necessary by Mr. Jorgens n, though he feels that if money is available it would add much to the appearance and possibly some to the water tightness of the work.

9. Comparison with similar dams.

The explanation given under paragraph "(2)" covers also the criticism made by me in this connection.

Yours truly,

Geo. L. Davenport Jr.
Assistant Engineer.

L os Angeles, April 20,1917.

Mr. G. C. Millett,

Assistant to Chief Engineer.

Dear Sir:

Referring to Mr. Sellew's letter to Mr. Post regarding my criticism of his design for a rock fill dam, San Dieguito River:

In order to obtain the resisting horizontal force I multiplied the vertical load of 930 tons (my estimate) by a friction factor of 0.6, giving an effective horizontal resistance of 558 tons. This divided by 220 tons gives 2.5 factor of safety.

Preliminary drainage did not show the dry rubble backing which would be necessary.

My statement as to the failure of such dams from overtopping should have been qualified to read "probably will cause failure". I did not have data to analyze the various floods that might occur and merely made this suggestion as basis for further study by the engineers if desired.

The matter of spillway velocities is also one of experience which the writer has not had opportunity to investigate. It seemed that attention should be called to this feature as the scouring action on poor concrete is certainly apt to be great. With the exception of the Turlock Dam, it would appear that the instances cited by Mr. Sellew were of too short duration to give a safe basis of comparison.

The factor of safety of a structure is usually considered - the ratio of its breaking strength to its stress under the working load. At the moment of failure this ratio would have the same numerator and denominator, hence be equal to 1.

I was probably in error in assuming to make any criticism of the design since my instructions were to simply check the stresses in the various designs submitted. In this case no well defined stresses could be analyzed, hence a few general suggestions were made.

Yours truly,

Geo. L. Davenport Jr.
Assistant Engineer.

Ed Fletcher Papers

1870-1955

MSS.81

Box: 18 Folder: 19

General Correspondence - Millett, G.C.