THE DESIGN OF CANAL DIVERSION WEIRS ON A SAND FOUNDATION.

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(Continued from last week.)

Fig. 18 is the section of the Jamrao weir built across a branch of the Indus River. The value of the coefficient c will thus be 15, which is common to all Himalayan rivers.

The head, or difference of level between the crest of the weir shutters and LWL is 8 ft. The correct contour base length should therefore be 8 × 15 = 125 ft. As will be seen from Fig. 18a, the actual contour, including the tail curtain,

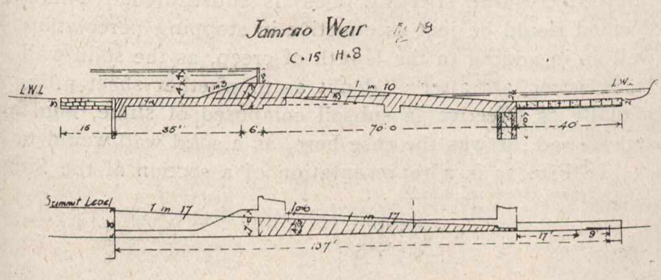


Fig 18.

is 137 ft. long, which quantity when divided by the head 8 ft., the quotient or the coefficient c will be 17.

The outline of tp in Fig. 18a shows that the effective depth of the floor or tp is just sufficient. The design must be pronounced to be good and economical. The height of the weir being so low, (only 4 ft. above LWL), renders the construction of a solid apron a necessity, in order that the necessary weight be afforded without having to greatly increase the depth below LWL. Material for loose stone filling was also not available near the site of the work.

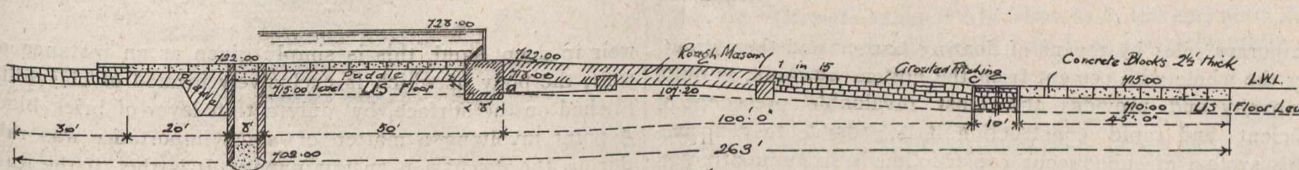
The diagram of pressure in Fig. 19a shows the hydraulic gradient of the work as originally built and as restored. In the latter case the addition of the rear apron and rear curtain reduced the hydraulic slope from 1 in 8.3 to 1 in 16.

The pressure at a, the commencement of the sloping apron is only 3 feet, the base line of the trapezium of pressure being raised in part above LWL. This reduction in pressure is due to the head of water being diminished owing to the base of the floor being raised above LWL, as explained previously. The value of t p is everywhere considerably in excess of requirements, being 4×2=8 feet at the point a, and continuing at that value up to b, where the floor base intersects the LWL. From b onwards the value decreases owing to partial submergence up to the termination of the impervious floor at c, where it is 4×1=4 feet.

From the above it is evident that the profile would be much improved, without increasing cost, by lowering the floor below LWL, thus converting the section from one of type A_2 to B_2. This has been done in Fig. 4 in which the quantities of material are less than in Fig. 19, while the waterway at the weir wall is increased in depth by 7 feet. This increase will effect a material diminution of the velocity of the current and thus enable the length of the talus to be diminished, and in addition effect a substantial reduction in the annual cost of renewal and repairs during the first few years of the weir's existence.

In Fig. 4 the fore-apron is designed of concrete slabs laid at an angle similar to the construction adopted in the Colombo breakwater, the joints will subsequently be grouted with cement mortar, the whole operation being effected in water. The profile of the fore and rear apron will be dredged out of the sand and in the pool, thus formed, the material will be deposited.

Fig. 4a is the pressure diagram, which requires no comment.



Chenab Weir. Fig 19.

The section of the Chenab weir is given in Fig. 19. Having originally hardly any rear apron whatever, the effective length of base up to the end of the grouted pitching was but about 108 or 116 feet. As the head is 13 feet this would give a hydraulic gradient of 1 in 108÷13 or 116÷13, i.e., 1 in 8 or 9. This proved insufficient and the floor, as already mentioned, failed by piping, except beneath the partition walls or groins

A further example of Type A_2 is given in Fig. 20 of the Jhelum weir over the river of that name. The class of sand is the same as in the last example with coefficient 15. The head being 10 feet, a base length of 15×10=150 feet is all that is required. The actual horizontal base length is 133 feet, to which, if the vertical depression be included, a further length of 87 has to be added, making a total value of 220 feet.

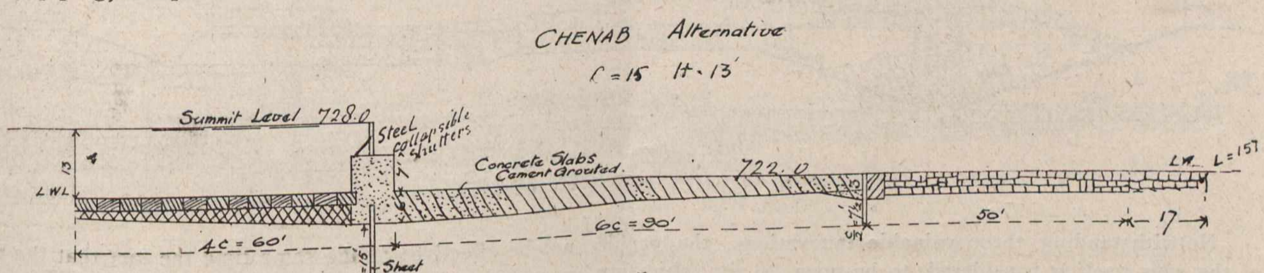


Fig 4

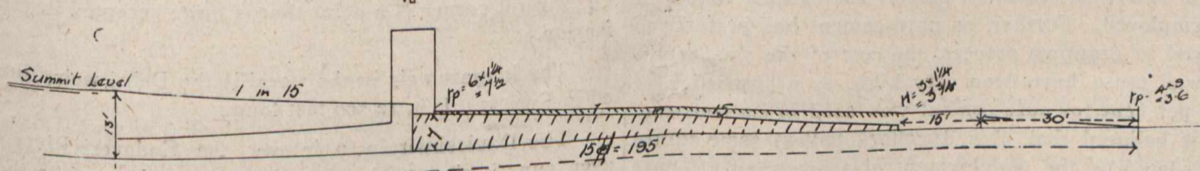


Fig 4A

500 feet apart with which this weir was provided. The extra weight of these walls prevented disintegration of the sand in their immediate vicinity. The extensive horizontal rear apron shown in the figure was constructed subsequently.

N.B.—The letter p is used for the Greek letter roe in formulae.

The hydraulic gradient will then be 220÷10=1 in 22. This is clearly excessive. If all the lines of curtain walls were abolished and one line of rear sheet piling 15 feet deep substituted, the gradient would be reduced to the more reasonable ratio of 1 in 16. At the same time it is considered that if the apron were depressed to form a horizontal floor at