THE DESIGN OF CANAL DIVERSION WEIRS ON A SAND FOUNDATION.

W. C. Bligh, M. Inst. C.E.

(Continued from last week.)

Before leaving the subject of the particular type of weir under discussion, viz., the direct overfall (which will subsequently be designated as type B), we will give the section of the Narora weir (Fig. 5), which is a most instructive example of how a weir should not be designed.

As originally built the rear apron extended for only 30 feet behind the drop wall, and the impervious apron continued for 42 feet beyond the very deep fore curtain which terminated the masonry floor. The length of l, or of the effective base line, is the total horizontal length plus the contour of the vertical depressions. In this case the horizontal length of impervious base is 123 feet, to this must be added 10 feet vertical depth at the weir wall, 17 feet down one side of the fore curtain and 18 feet up the other, total 168 feet. This is the distance measured along the line of the floor surface to the point B, from a vertical drawn through A at the termination of the impervious rear apron. The line AB drawn from the summit level at A is then the actual hydraulic gradient of the water pressure and has an inclination of 168÷13=1 in 13. Now from B, the vertical lengths, which, as we have seen are 10, 17, and 18 feet, respectively, are measured back in reverse order, and lines drawn from the points thus obtained parallel to BA, up to their several positions on the section, will give the outline of the trapezium of pressures. Thus the line AB runs from A as far as C where the vertical depressions aggregating 10 feet are situated. A vertical step there occurs which is equal to the loss of head occasioned by the length 10 feet, i.e., 10÷13 feet. The second slope is intercepted at D, where another step takes place at the commencement of the vertical curtain. This last is formed by the intersection of a gradient line drawn from the end of the 17 feet measured back from B. Similarly at the further side of the curtain wall another step takes place down to the interception of a third gradient line. This point must correspond with the termination of the impervious floor. The space enclosed between the horizontal floor surface and the stepped slope will now correctly represent the hydrostatic pressure area on the floor of the work.

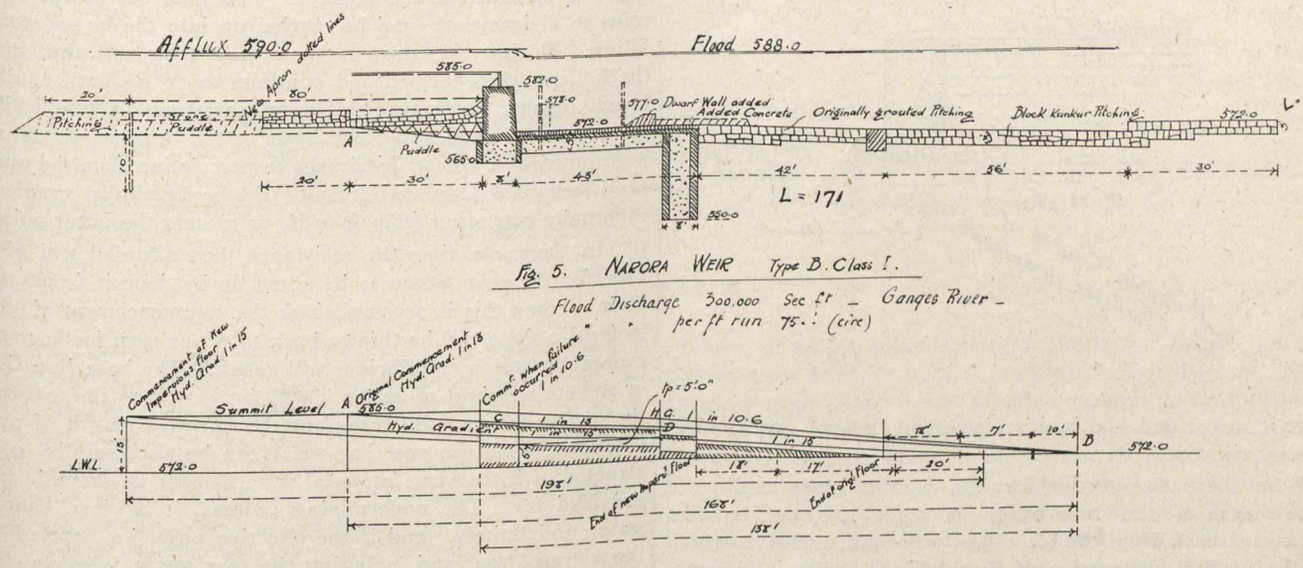

Fig. 5. NARORA WEIR Type B. Class I.

Flood Discharge 300.000 Sec ft — Ganges River — per ft run 75.: (circ)

Inspection of the diagram, Fig. 5A, on which the depth of t p is marked (t being thickness of floor) shows that the area of the trapezium of pressure over the first part of the floor is nearly double that of A p or of the area of the section multplied by its effective S.G., which is unity. The floor at its commencement should, therefore, be twice as thick than actually constructed. When failure took place, the rear apron was non-existent, having been washed away. The effective base length would then be reduced to 168–30=138 feet=10.6 H, and this fact, added to the further increased deficiency in the value of A p (i.e., the weight), is quite sufficient to account for the failure. With a gradient of 1 in 13 the work stood for several years in spite of the deficiency in weight, although hollow actually existed below the floor, which was practically supported by the hydrostatic pressure.

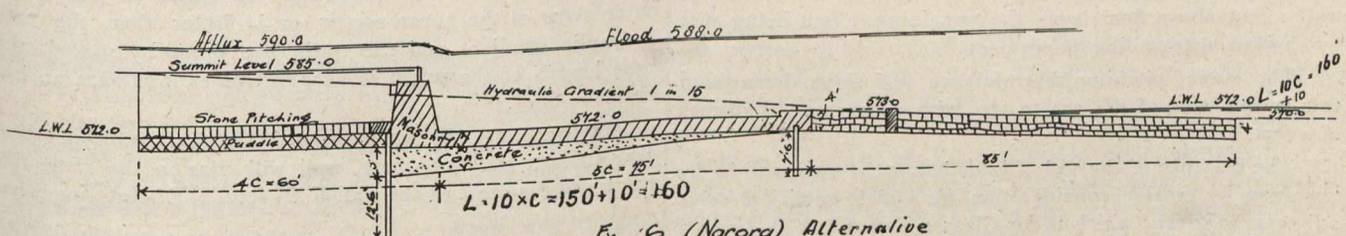

Fig. 6 (Narora) Alternative

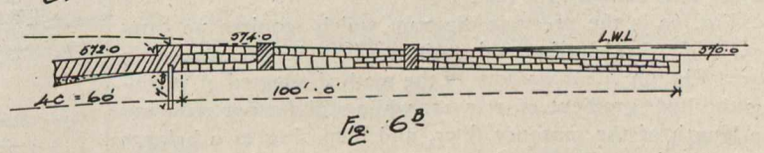

Fig. 6B

C=15 f=2 p=1=1

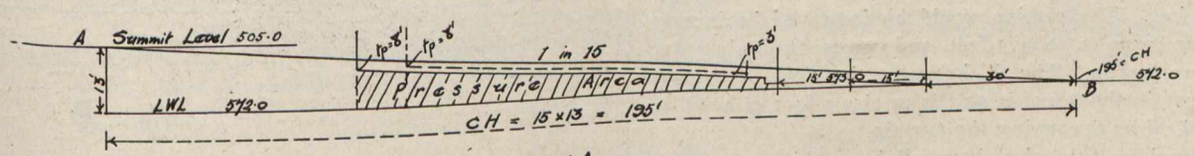

Fig. 6A

Mr. Bligh, while in Canada, addressed the Engineers' Club, Toronto, and the Engineering Society of Toronto University on this subject.