Engineers' Club.

The opening meeting of the Engineers' Club was held on October 1st at the club rooms, King Street West. President Sing presided, and a large number of members were present.

The main item of the evening's proceedings was a paper read by Mr. W. G. Bligh, M. Inst. C.E., formerly in the Public Works Department of India, on the design of river weirs founded on sand. The lecture was accompanied by numerous lantern slides representing drawings illustrative of the subject.

A short resumé of this paper may be of interest to our readers, as it deals with a subject quite new to most members of the profession interested in irrigation works. Firstly, it was shown that the conditions governing the flow of water through the sand substratum of a dam or weir are identical with those well known to exist in the case of pipes, viz., that the velocity of the current is a constant throughout, its value being dependent on the fineness of the particles of sand through which it is compelled to percolate, as well as the length of the base of the superimposed structure. The hydrostatic upward pressure on the base of the weir wall and its protective horizontal apron are similar to the case of a pipe line measured by the ordinates drawn from the level of the tail water to the hydraulic grade line, which latter is the hypothenuse of a right angle triangle whose base is the length of the floor and whose perpendicular the head or difference of levels between the head and tail water.

The problem, therefore, resolves itself into the following, that the stability of a weir on a sand foundation from a statical point of view can be definitely assured by providing a length of base of the structure sufficient to effect the neutralization of the velocity of the percolating stream to a negligible quantity. The required thickness at any point is also definitely determinable from the area of hydrostatic pressure.

As the pressure head diminishes with the length given to the base, the latter must clearly be a multiple or coefficient of the head, or symbolically $l = cH$, in which expression l is the effective base length of the impervious superstructure, i.e., including all vertical depressions and sinuosities. The design, therefore, hinges entirely on the values adopted for the coefficient c. These values are obtained from existing examples of successful and unsuccessful weirs, the failures proving as usual the most valuable object lessons, and the values adopted vary from 18 for Nile quicksand, to 9 for boulders and sand, 15 and 12 being respectively the coefficients for ordinary light and coarse river sands. Thus, with a given height of weir of 12 feet the length of the base would be (from the formula $l = cH$) for a fine sand of Class I. $12 \times 15 = 180$ feet.

The value of the projection of the horizontal floor to the rear of the drop wall, where the conditions differ from those existing with the fore apron in its freedom from hydrostatic pressure, as well as from the erosive effect of falling water, was then treated at some length, as well as the value of vertical curtains of steel or concrete steel sheet piling. The method of design of parts of an overfall weir under given conditions of head and sand coefficient were then illustrated on the graphical system now first introduced by the author. Several such examples illustrating this method of design were given in the paper.

Next, examples of critical analysis of the section of the Narora overfall weir were given, illustrating the hydraulic grade lines and effective base lengths of this section under three conditions: Firstly, as originally constructed; secondly, as it was when failure took place, and thirdly, as repaired by extension of its rear apron. At this stage it was shown that the principles already enumerated applied equally well to weirs which had no impervious apron, but were built of masses of loose rock, pitched to a slope; in fact, the Indian anicut or loose-rock weir, of which one example exists in America, viz., the Laguna weir on the Colorado River.

The efficiency of the vertical party walls in the fore apron in compelling percolation through the sand base was touched on, and two examples were illustrated, one, the section of the celebrated Okhla weir, which has no vertical curtains whatever, and the other the Dehri weir, over the Son River, which is 2½ miles long, and carries a discharge of 730,000 second feet. The improvement which could have been effected in this section by removing the two rows in five miles of curtain blocks, substituting one row of concrete sheet piles at the rear of the work, was brought to notice, as well as the immense saving such an alteration in the design of the section would effect, while assuring equal or greater stability.

After this a large number of graphically analysed sections of Indian weirs of several distinct types were exhibited on the sheet and commented on. Alternative sections were also given illustrative of suggested change in type or design, among the most notable being the section of the Damietta and Rosetta subsidiary weirs, recently constructed over the Nile in Egypt. A short description was given of the novel method of subaqueous construction first adopted in this great work, which, when better known, will revolutionize older systems. Objectionable points in the design were brought to notice and remedy suggested in an alternative section.

The last section was that of the Sidnai needle weir on the Ravi River, a valuable object lesson in the successful application of clay, surfaced with shallow brick blocks, lime grouted, as a material for the fore as well as the rear apron of a weir, a system which the lecturer considered could be applied in many cases with great advantage as regards cost.

ORDERS OF THE RAILWAY COMMISSIONERS OF CANADA.

Copies of these orders may be secured from the Canadian Engineer for a small fee.

5246—Sept. 23—Authorizing A. A. Granger, Montreal, P.Q., to lay a 9-inch water pipe under the track of the C.P.R. at L'Epiphanie, P.Q.

5247—Sept. 23—Authorizing the muncipal Township of Maidstone to erect, place, and maintain its wires across the tracks of the M.C.R.R. at one mile east of Essex Station, Ont.

5248—Sept. 28—Authorizing the city of Hamilton to lay a 6-inch water pipe under the tracks of the G.T.R. where Liberty Street crosses same, between Hunter and Yonge Streets, Hamilton.

5249 to 5251—Sept. 22—Authorizing the municipal Township of Maidstone to erect, place, and maintain its wires across the tracks of the MC.R.R. at 300 feet west of Woodslee Station, one mile west of Woodslee Station, two miles west of Woodslee Station, Ont.

5352—Sept. 25—Authorizing the Burford Electric Light Co. to erect, place, and maintain its wires across the tracks of the G.T.R. at Maple Avenue, Burford, Ont.

Delayed Order, No. 5310, dated Sept. 17th, authorizing the Consumers' Gas Co., of Toronto, to lay a 20-inch gas main under the tracks of the C.N.R. where the same crosses Eastern Avenue, Toronto, Ont.

5352—Sept. 25—Authorizing the Burford Electric Light, Heat and Power Co. to place its electric wires across the track of the G.T.R. at Maple Avenue, Burford, Ont.

5353—Sept. 14—Authorizing the C.N.R. Co. to fence its right-of-way between Canora and Tiny, in the Province of Saskatchewan, and that the work be completed before the 1st December, 1908.

5354—Sept. 29—Authorizing the C.P.R. Co. to construct an additional track across public highway at Rolling Dam, New Brunswick, on its St. Andrew's Branch.

5355—Sept. 29—Authorizing the Noisy River Telephone Co. to place its wires across the track of the G.T.R. at Collingwood Street, village of Creemore, Ont.