having only two or three significant figures in the final result. If the planes originally had been taken 0.1 ft. apart vertically, a ten-place table would have been required.

Checks.—The value of p′, for x = 0, p′ = 80.012896, is the same as that given by Appendix (a), 80 + 0.6448 × 0.02. When x = 134, the formula gives p′ = 75.81, whereas the exact theory, Appendix (b), gives $p' = m^2 p = (0.65)^2 \times 178.39 = 75.37$. The difference is 0.44 at the outer face. For any other point, it might be assumed to vary with x, so that it could be corrected by subtracting $\frac{0.44}{134} x = 0.0033\ x$ from the value of p′ above. For ease of computation, the formula will be written,

$$p' = 80.01 - 0.02\ x + 0.00034\ x^2 - 0.00001\ \frac{x^3}{3} \quad \ldots\ldots (8)$$

The first coefficient of x^3 cannot be counted on to the last two figures, hence we are permitted to change 323 to 333 in that coefficient. When x = 134, Equation 8 gives p′ = 75.41, nearly the exact value.

The three formulae for p, q and p′, at the level h = 200, are thus as follows:—

$$p = 32.24 + 1.09063\ x.$$

$$q = -0.64 + 0.962\ x - 0.000686\ x^2.$$

$$p' = 80.01 - 0.02\ x + 0.00034\ x^2 - 0.00001\ \frac{x^3}{3}.$$

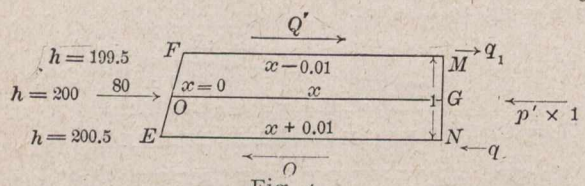

Fig. 4.

Since the weight per cubic foot of masonry was assumed as two and one-half times that of water, we must multiply the stresses given in Table 1 by $\frac{5}{2}(62.5) = 156.25$, to reduce to pounds per square foot; or by 1.085, to reduce to pounds per square inch.

TABLE 1.

x	0	10	25	50	75	100	134
p′	32.24	43.15	59.50	86.77	114.04	141.30	178.39
q	−0.64	8.91	22.98	45.75	67.65	88.70	115.95
p′	80.01	80.02	79.66	79.11	79.01	78.08	75.37
max f	80.02	82.06	94.67	128.85	166.40	203.85	253.71
min. f	32.23	41.11	44.48	37.03	26.64	15.52	0
θ for max. f.	90°46′	76°06′	56°50′	42°36′	37°44′	35°12′	33°01′

In Table 1 the stresses are those experienced at the level, h = 20.

p = vertical unit stress on a horizontal plane,

q = shearing unit stress on horizontal or vertical planes,

p′ = horizontal unit stress on vertical planes,

Max. f = maximum normal stress acting on a plane inclined to the horizontal at the angle θ, given on the last line,

Min. f = minimum normal stress acting on a plane perpendicular to the last.

From max. f and min.f, with θ, the ellipse of stress can be drawn, and the stress in any direction, with the plane on which it acts, can be ascertained.

It will be observed that there is no tension exerted anywhere, and that the maximum compression is 253.71, or 275 lb. per sq. in., which is exerted at the outer face, upon a plane at right angles to the face.

In Appendix (e), the important formula, for the maximum normal intensity at the outer face, acting parallel to that face,

$$f = \frac{p}{\cos.^2 \phi}$$

is proved. In this instance, p = 178.39, tan. φ = 0.65, therefore φ = 33°01′, whence f = 253.71.

This stress is unaccompanied with any conjugate stress, perpendicular to the face. In the interior of the dam, where conjugate stresses prevail, the masonry is perhaps better able to withstand a certain compressive stress than at the face. The distribution of stresses, at the level h = 200, is shown in Fig. 5, on the supposition that the base of the dam is a little below that level. The connection with the foundation materially modifies this distribution; but Fig. 5

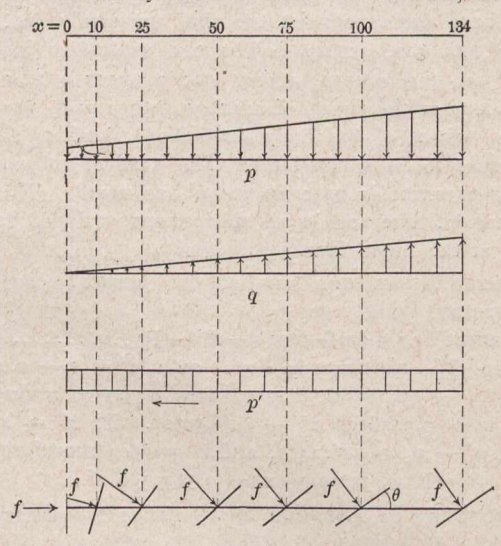

Fig. 5.

shows the distribution for sections, say, from 10 to 20 ft. above the base, up to the level h = 50, fairly well, on the basis of the trapezoid law. As has been mentioned before, this law gives a pressure greater than the actual at the outer face.

Since the batter of the inner face is very small, the results of Table 1 should agree approximately, except near the inner face, with those found by Mr. Hill in the paper referred to in the foot-note. Substituting numerical values, Mr. Hill's formulae, for h = 200, reduce to,

$$q = 0.9426\ x - 0.0005768\ x^2,$$

$$p' = 80 - 0.0001289\ x^2 - 0.0000009615\ x^3;$$

giving,

x	0	10	25	50	75	100	134
q	0	9.36	23.20	45.69	67.45	88.49	115.95
p′	80	79.99	79.90	79.56	78.87	77.75	75.38

To be concluded in next issue.

EDMONTON STREET RAILWAY.

The total number of passengers carried by the Edmonton Street Railway since the commencement of operations on the 9th November, 1908, to August 31st, 1909, was 1,347,600. For the month of August the number was 193,704. The net earnings in August were $8,161.87.

The Halifax Electric Company's gross earnings for the week of September 7th, 1909, were $4,719.70, a decrease of $2,315.23, and from January 1st, $122,512.95, an increase of $565,976.

The earnings of the Toronto Street Railway for the week ended September 11th, 1909, show an increase of $7,542.61 as compared with the figures for the same week in 1908. 1909, $114,488.66; 1908, $106,946.05.

Mr. W. H. Jones, acting superintendent of the Idaho division of the Oregon Short Line Railway, accompanied by four minor officials of the same railway, were in Montreal recently. They are looking over the Canadian roads for pointers and will make a full report of their observations to Mr. Julius Kruttchnitt, director of maintenance and operation of all Harriman roads in America and Mexico, who will decide as to the advisability of adopting Canadian methods.

N. T. RAILWAY.

The steel has been put down for 40 miles west of Cochrane on the Transcontinental Railway, and will be extended twenty miles further within the next thirty days.

Two temporary bridges had to be built, the permanent steel structure will be put in place during the winter. The grade is practically completed for 100 miles west of Cochrane.