

PRESSURE UNDER A FLUSH FLOOR WITH INCLINED SHEET PILES

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Introduction

IN a series of investigations carried out in connection with the design of weirs on permeable foundations, the authors have studied the problem of the uplift pressure by the electrical analogy method developed by them.¹ The results of these investigations have already been published.^{2,3}

The earlier studies were concerned only with sheet piles at right angles to the floor. In the construction of the Kalabagh Weir in the Punjab, certain difficulties might be experienced in driving the sheet piles vertically downwards. An investigation of the problem of the distribution of uplift pressure under a floor with inclined sheet piles was, therefore, made. This problem was investigated by the electrical analogy method referred to above.

Experimental

In the present investigation five different inclinations (105° , 120° , 135° , 150° and 165°) of the sheet pile to the floor were studied. The length of the impervious flush floor was kept constant at 12 inches for all the cases but for every inclination of the sheet pile to the flush floor six different lengths (1", 2", 3", 4", 5" and 6") of sheet piles were examined. Equi-pressure lines were plotted for only three inclinations, *viz.*, 120° , 135° and 150° . For inclinations of 105° and 165° only the pressures at the points corresponding to B and C in Fig. 1 were observed. The position of the sheet piles inclined to the flush floor at the various angles investigated is shown in Fig. 1.

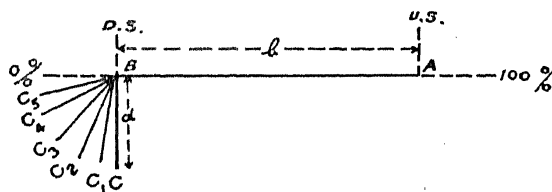


FIG. 1

The results of these investigations are represented by Figs. 2-7 and Table I, which give the pressures at B and C for the various cases.

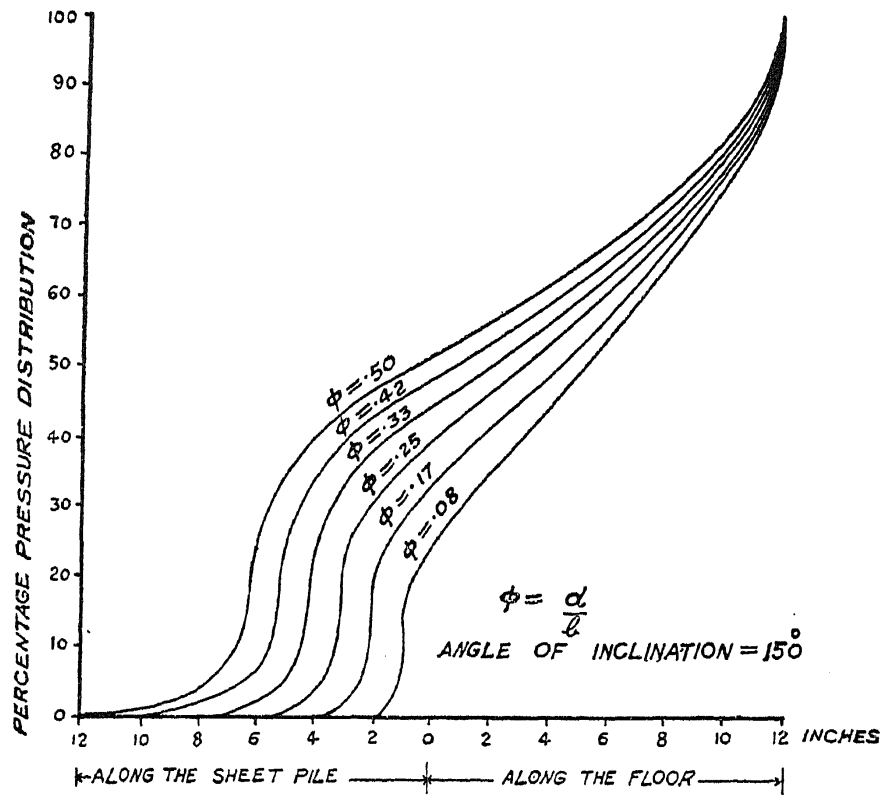
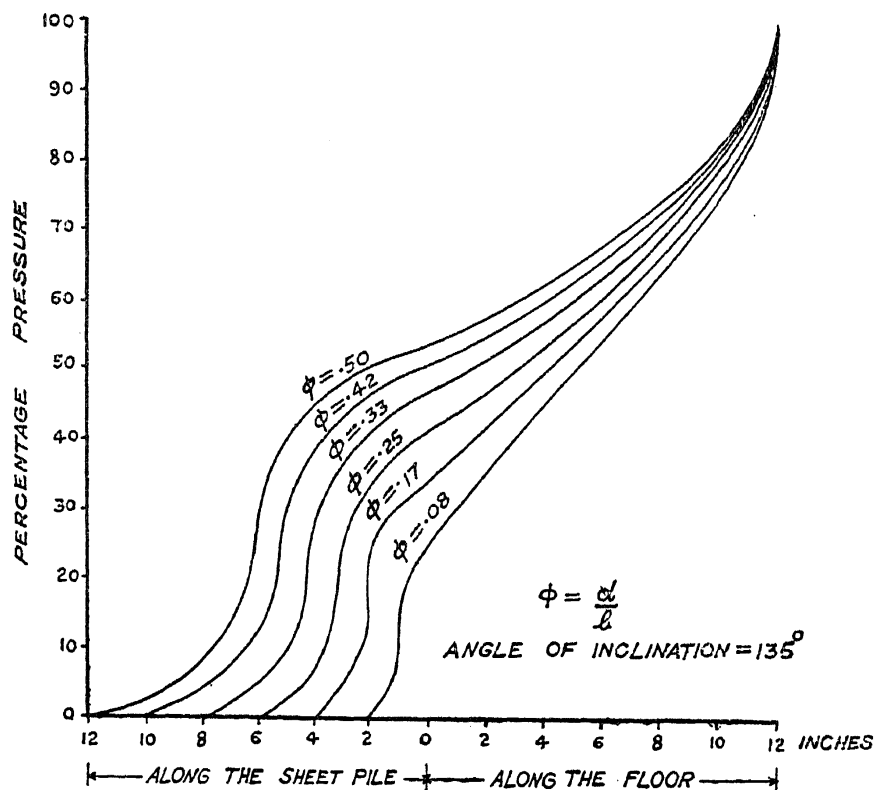


FIG. 2



Pressure under a Flush Floor with Inclined Sheet Piles

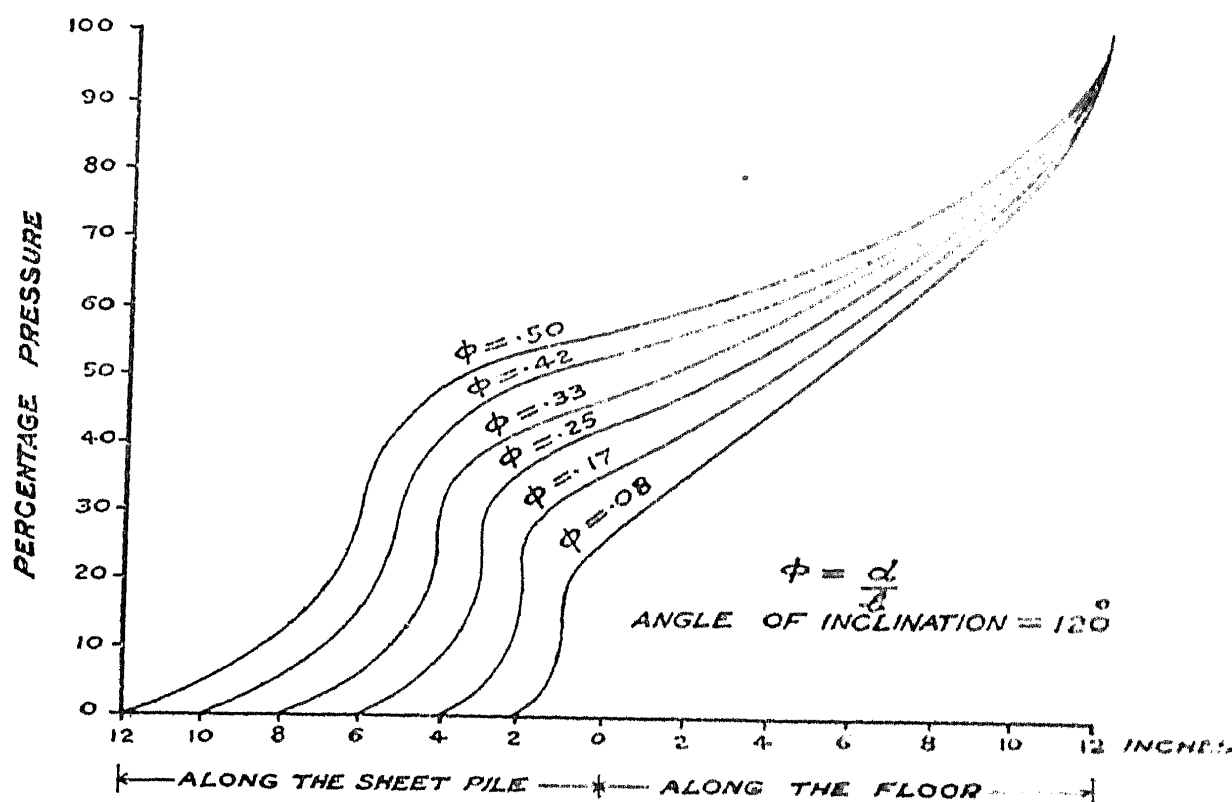
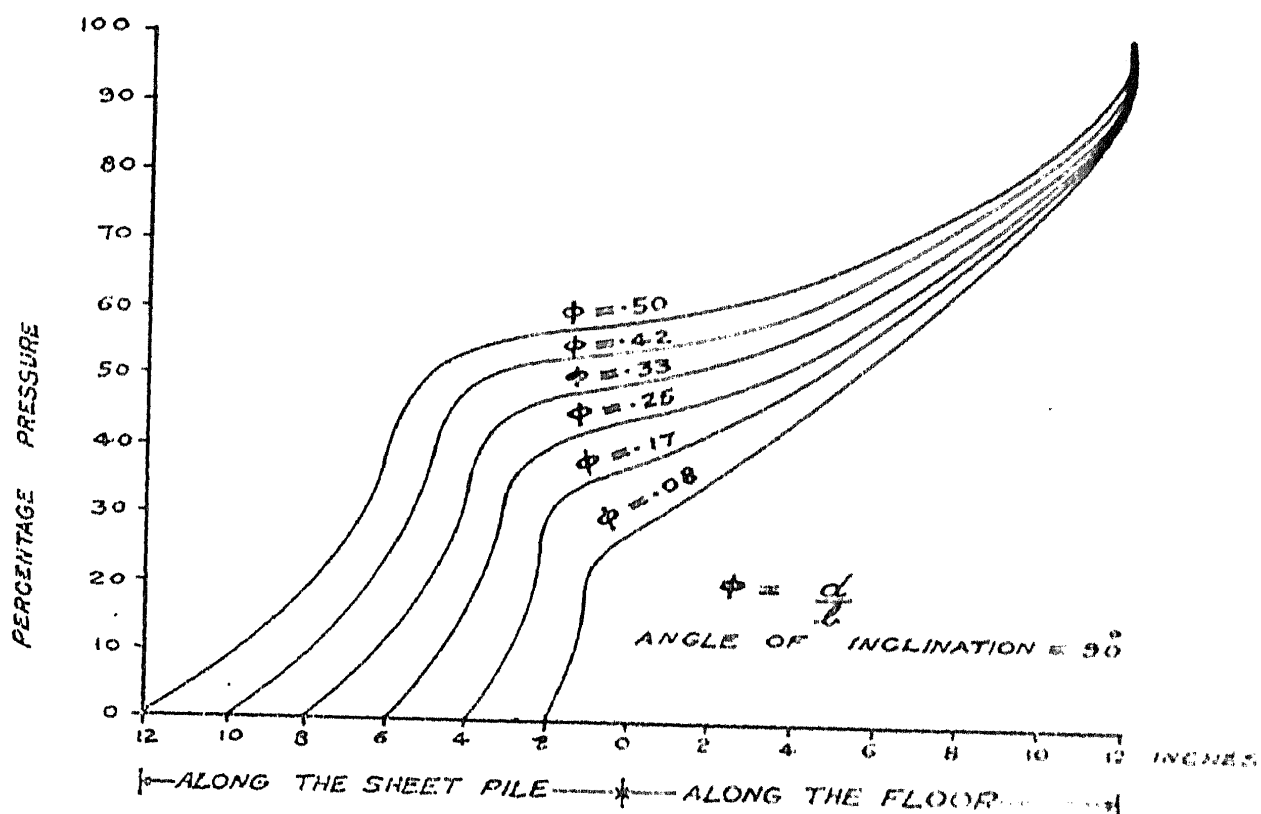


FIG. 4



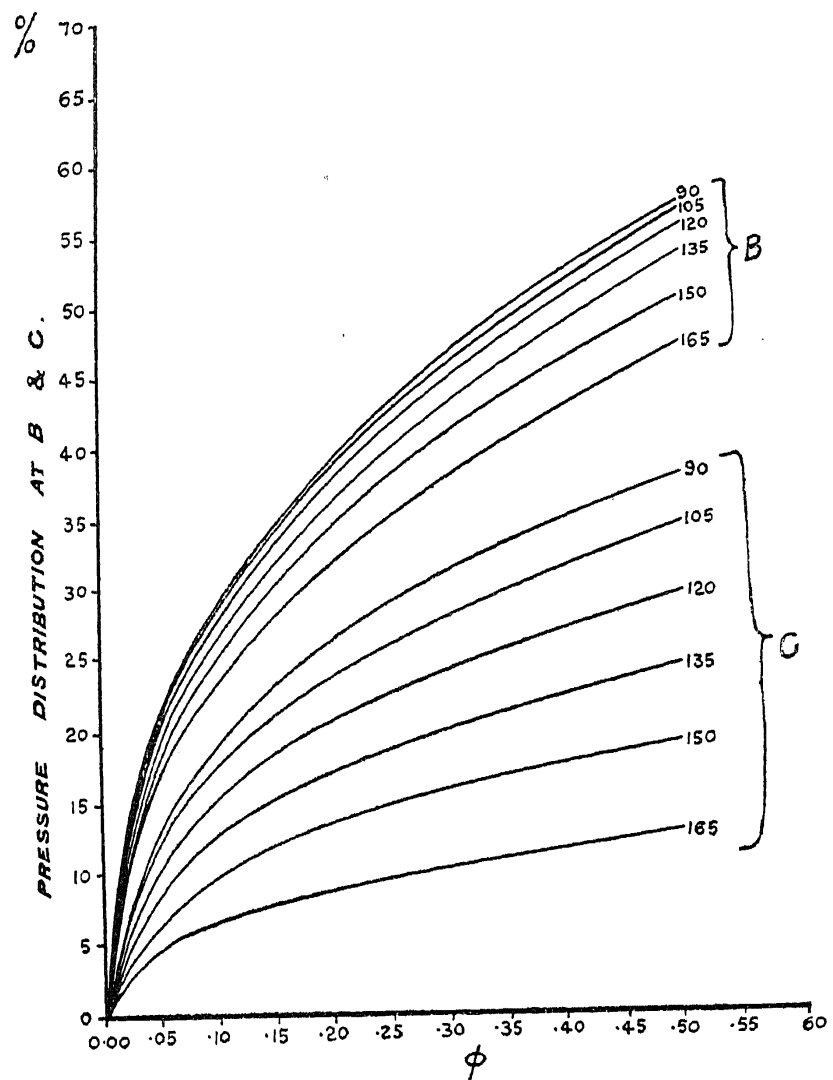


FIG. 6

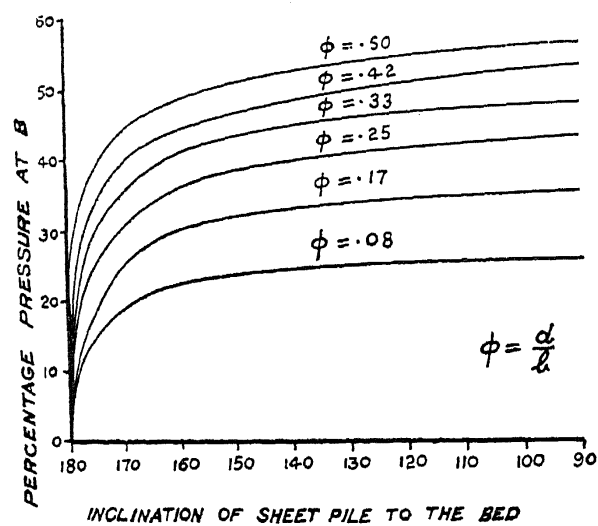


TABLE I

Depth of Sheet Pile	Percentage pressures at B and C											
	165°		150°		135°		120°		105°		90°	
	C	B	C	B	C	B	C	B	C	B	C	B
1"	6.3	21.6	9.1	23.4	11.6	24.6	14.0	25.4	16.3	25.7	17.2	26.1
2"	8.1	29.4	12.0	31.8	16.0	33.7	18.9	35.1	22.1	35.7	25.0	36.2
3"	9.7	35.0	14.8	38.2	18.8	40.0	22.7	41.8	26.4	42.7	28.5	43.2
4"	11.0	39.8	16.5	43.0	21.1	45.2	25.5	47.4	29.6	48.3	32.5	48.8
5"	12.0	43.8	18.1	47.3	23.5	50.1	28.0	52.1	32.5	53.2	35.8	53.7
6"	13.0	47.5	19.5	51.0	25.0	54.0	30.0	56.1	34.8	57.2	38.5	57.6

Fig. 2 represents the results of experiments carried out with a floor of length 12 inches and sheet piles of length 1 inch to 6 inches. The ratio d/b where d is the length of sheet piles and b is breadth of the floor is denoted by ϕ . The position of the sheet piles is at an angle of 150° to the floor. In this figure the abscissa represents the length along the floor and sheet pile and the ordinate represents the distribution of percentage pressure.

Figs. 3, 4 and 5 are plotted similarly as Fig. 2 but with angles 135° , 120° and 90° respectively between the sheet pile and the floor.

Fig. 6 represents the pressures at the points B and C (the positions of B and C are shown in Fig. 1) for various inclinations, shown in the figure, plotted against $\phi = d/b$.

Figs. 7 and 8 show the relation between the inclination of the sheet pile to the floor and the percentage pressure at B and C (the positions of B and C

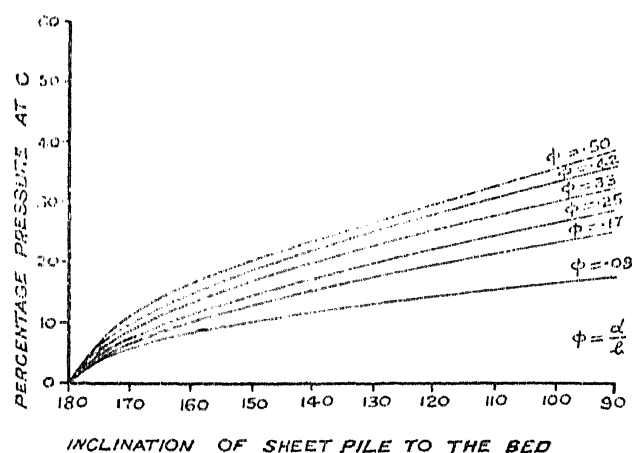


FIG. 8

are shown in Fig. 1) for various values of ϕ shown in the figure. Thus, if in a particular weir the length of the floor is 120 feet and that of the sheet pile 10 feet, ϕ will be $= .08$. If the angle of inclination is equal to 130° , then the percentage pressure at $B = 25.2$ as can be read from curve $\phi = .08$ in Fig. 7. The pressure at C is equal to 12.8 as can be seen from curve marked $\phi = .08$ in Fig. 8.

A comparison of Figs. 2 to 5 shows that the pressure distribution along the floor does not show any marked change with change of inclination of sheet pile to floor. But as the angle of inclination increases, the percentage pressure at the point C, *i.e.*, the end of the sheet pile, shows a considerable decrease which means that the exit gradient decreases with the increase in inclination.

Summary

In this investigation, the distribution of uplift pressure under weirs with a single sheet pile inclined to the floor has been determined.

Five sets of experiments have been carried out, with angles of inclination of the sheet pile to the floor at 165° , 150° , 135° , 120° and 105° . In each of the sets, the pressure distribution was determined for six values of ϕ , *i.e.*, the length of sheet pile/the breadth of the floor.

In conclusion we have great pleasure in thanking Dr. E. McKenzie Taylor, the Director of Institute, for his keen interest in the problem. We have also to thank Dr. R. R. Bajpai of the Institute for his valuable assistance during the course of the investigation.

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