same value as E when h = unity and $\gamma = 100$. E for any value of h equals h^2C. (C is termed a constant for the reason that when once computed for any set of conditions the corresponding value of E is derived for any height h by squaring h and multiplying into C.)

In Figs. 2 and 3 the angle of repose ϕ is platted as abscissa and the constant C in pounds as ordinates. The back of wall batter angle α is constant for a given curve or group of curves. In Figs. 4, 5 and 6 the back of wall batter angle is platted as abscissa. Positive values of α are given on the right of zero, and negative on the left. C is platted as ordinates as before. All values of C and E are for a portion of earth or wall one foot or unity in length.

Characteristics of Curves for Back of Wall Batter Constant.

By referring to the figures the following will be noted:

In Fig. 2 the curve for back of wall batter α = O, and surcharge $\epsilon = 0$, Rankine and Rebhann both give values for C that agree. For α = O, and $\epsilon = \phi$ (angle of repose) Rankine gives increasingly higher values for C than Rebhann, as the angle ϕ increases from zero or hydrostatic pressure.

In Fig. 3 curves are shown for $\alpha = -4^\circ 46'$, ϵ = O and $\epsilon = \phi$. Also for $\alpha = -22^\circ 37'$, ϵ = O and $\epsilon = \phi$. The apparent disagreement between the two theories is not so great, with one exception, as in the previous cases shown, and there appears to be no complete break-downs except in Rankine $\alpha = -22^\circ 37'$ and ϵ = O. The exceptional disagreement is also for $\alpha = -22^\circ 37'$ ϵ = O. For example, for $\phi = 45^\circ$ Rankine gives the value of C equal 22.5 lb., while Rebhann gives only 3.1 lb. The result from Rankine is over seven times as great as that obtained from Rebhann. As shown later, however, Rankine's theory breaks down for all negative back of wall batter angles, α.

Characteristics of Curves for Angle of Repose ϕ Constant.

In Figs. 4, 5 and 6, as previously stated, the back of wall batter angles, α, are platted as abscissa, with ϕ and ϵ constants for a given curve, and C as ordinates. Fig. 4 shows curves for $\phi = 45^\circ$ and $\epsilon = 0^\circ$ and 45°. For comparison, the curve for $\phi = 0^\circ$ or hydrostatic pressure is platted in the dotted line.

For $\phi = 45^\circ$ and ϵ = O, Rankine and Rebhann give the same result when α = O. With $\alpha = 45^\circ$, Rankine gives a much higher value than Rebhann. For negative values of α, Rankine gives rapidly increasing values of C, while they should manifestly be decreasing. Rebhann gives decreasing values with the curve convex downward. Of course a negative back of wall batter angle 45° is outside of any probability, and the values were only calculated to show the character of the curves in reaching that limit. With the angle of repose $\phi = 45^\circ$, and a negative back of wall batter of $\alpha = -45^\circ$, C must reduce to zero. For $\phi = 45^\circ$ and $\epsilon = 45^\circ$, Rankine gives excessively high values for α positive. For α negative they run down to a fairly consistent termination. Rebhann gives much lower values with ϵ positive, while for α negative the results coincide with those from Rankine from $-14^\circ 02'$ to $-22^\circ 37'$. After passing $-22^\circ 37'$ they again diverge, Rankine giving the greater values until the limit of -45° is reached.

EARTH PRESSURE CONSTANTS (C) AND ANGLES OF RESULTANT (δ) WITH HORIZONTAL; FOR DIFFERENT ANGLES OF SLOPE (Φ), INCLINATIONS OF SURFACE (ε), AND BACK OF WALL BATTERS (α). SLIDING PRISM THEORY. COULOMB AND REBHANN. FROM PRELINI.

BATTERS AND ANGLES OF INCLINATION OF BACK OF WALL WITH THE VERTICAL, α. VALUES OF EARTH PRESSURE CONSTANTS (C) AND ANGLES OF RESULTANT WITH THE HORIZONTAL (δ).

EARTH SLOPES AND ANGLES OF REPOSE (Φ)	SURFACE SLOPE BACK OF WALL (ε)	VERTICAL 0° 00'		1" IN 12" (1 IN 12) 4° 46'		2" IN 12" (1 IN 6) 9° 28'		3" IN 12" (1 IN 4) 14° 02'		4" IN 12" (1 IN 3) 18° 26'		5" IN 12" (1 IN 2.4) 22° 37'		6" IN 12" (1 IN 2) 26° 34'		8" IN 12" (1 IN 1.5) 33° 42'		1" IN 12" (1 IN 12) −4° 46'		2" IN 12" (1 IN 6) −9° 28'		3" IN 12" (1 IN 4) −14° 02'		4" IN 12" (1 IN 3) −18° 26'		5" IN 12" (1 IN 2.4) −22° 37'		12" IN 12" (1 IN 1) 45° 00'		SURFACE SLOPE BACK OF WALL (ε)	EARTH SLOPES AND ANGLES OF REPOSE (Φ)
		C	δ	C	δ	C	δ	C	δ	C	δ	C	δ	C	δ	C	δ	C	δ	C	δ	C	δ	C	δ	C	δ	C	δ		
1 TO 1	0° 00'	8.7		10.0		11.7		13.3		15.3		17.3		19.7		24.3		7.3		6.1		5.0		3.8		3.1		35.4		0° 00'	1 TO 1
	29° 45'	14.7		17.6		20.9		25.1		29.3		33.9		39.9		53.0		12.4		9.9		7.9		6.1		4.7				29° 45'	
45° 00'	45° 00'	25.1		29.3		34.6		40.6		46.8		54.5		63.0		83.7		20.7		17.2		14.3		11.3		8.3				45° 00'	45° 00'
1¼ TO 1	0° 00'	11.5		13.1		14.8		16.6		18.7		20.6		23.1		28.0		10.0		8.6		7.4		6.3		5.0				0° 00'	1¼ TO 1
	29° 45'	29.5		33.2		37.3		42.0		47.3		53.1		60.0		75.8		26.2		23.3		20.5		17.8		15.6				29° 45'	
38° 40'	38° 40'	30.4		34.8		39.5		44.8		51.1		58.3		66.5		84.8		26.1		22.9		19.8		17.0		14.3				38° 40'	38° 40'
1½ TO 1	0° 00'	14.2		15.9		17.7		19.5		21.6		23.8		26.0		30.5		12.8		11.3		10.2		8.9		7.8				0° 00'	1½ TO 1
	29° 45'	29.5		33.2		37.3		42.0		47.3		53.1		60.0		75.8		26.2		23.3		20.6		17.8		15.6				29° 45'	
	33° 42'	34.5		38.2		42.9		48.4		54.4		61.2		68.7		84.5		30.3		26.9		24.2		21.5		19.4				33° 42'	
33° 42'	45° 00'	65.6		69.6		75.5		81.5		89.3		98.7		109.6		135.6		62.7		61.1		62.2		64.2		79.3				45° 00'	33° 42'
1¾ TO 1	0° 00'	16.8		18.5		20.6		22.5		24.6		26.7		29.2		34.8		15.5		14.2		12.8		11.5		10.4				0° 00'	1¾ TO 1
	29° 45'	37.2		41.3		45.7		50.5		56.1		62.4		69.8		85.7		33.9		30.9		28.1		25.6		23.2				29° 45'	
29° 45'	45° 00'																													45° 00'	29° 45'
2 TO 1	0° 00'	19.1		21.1		22.8		24.6		26.7		29.1		31.3		36.3		17.7		16.3		15.1		13.7		12.3				0° 00'	2 TO 1
	26° 34'	39.3		43.0		46.8		51.4		56.7		62.4		69.2		84.9		36.0		33.1		30.8		28.5		26.3				26° 34'	
26° 34'	45° 00'																													45° 00'	26° 34'
2½ TO 1	0° 00'	22.9		24.6		26.4		28.1		30.1		32.5		34.7		40.1		21.1		20.3		19.2		17.6		16.6				0° 00'	2½ TO 1
	21° 48'	42.9		46.2		49.4		53.6		58.4		63.2		68.9		82.9		40.2		37.8		35.7		33.9		32.2				21° 48'	
21° 48'	45° 00'																													45° 00'	21° 48'
3 TO 1	0° 00'	25.9		27.4		29.1		31.0		32.5		35.1		37.5		42.2		24.6		23.1		22.2		21.0		19.9				0° 00'	3 TO 1
	18° 26'	44.9		47.6		50.8		54.4		58.7		63.5		68.9		81.3		42.3		40.4		38.9		37.3		36.1		113.3		18° 26'	
18° 26'	45° 00'																													45° 00'	18° 26'
4 TO 1	0° 00'	30.5		31.9		33.2		35.3		36.8		39.1		41.8		45.9		29.4		28.3		27.2		26.3		25.6				0° 00'	4 TO 1
	14° 02'	47.0		48.9		51.3		54.2		57.5		61.4		65.7		76.6		44.6		43.1		41.9		41.1		40.6				14° 02'	
	29° 45'																													29° 45'	
14° 02'	45° 00'																													45° 00'	14° 02'
6 TO 1	0° 00'	35.9		37.0		38.3		39.9		41.6		43.0		46.1		50.5		34.9		34.3		33.9		33.6		33.1		61.7		0° 00'	6 TO 1
	9° 28'	48.4		50.1		51.6		54.1		56.8		58.8		63.8		72.3		47.1		46.1		45.6		45.2		45.1		93.7		9° 28'	
9° 28'	33° 42'	188.2		178.0		169.6		169.8		172.5		177.2		188.0		208.6		208.5		244.8						676.7		276.0		45° 00'	9° 28'
LEVEL (HYDROSTATIC)	0° 00'	50.0	0° 00'	50.2	4° 46'	50.7	9° 28'	51.5	14° 02'	52.7	18° 26'	54.2	22° 37'	55.9	26° 34'	60.1	33° 42'	50.2	−4° 46'	50.7	−9° 28'	51.5	−14° 02'	52.7	−18° 26'	54.2	−22° 37'	70.7	45° 00'	0° 00'	LEVEL (HYDROSTATIC)

ASSUMED WEIGHT OF FILL OR BACKING γ = 100 LBS. PER CU. FT. TO OBTAIN THE EARTH PRESSURE E MULTIPLY THE CONSTANT C BY THE SQUARE OF THE HEIGHT h IN FEET. $E = Ch^2$ = EARTH PRESSURE IN POUNDS.

Table No. 2.—Constants C from Sliding Prism Theory, Rebhann's Graphics. (Courtesy of Engineering News.)

For the positive back of wall batter $\alpha = 33^\circ 42'$ and angle of surcharge $\epsilon = \phi$, Rankine gives what would appear to be excessively high values for C. Rebhann gives a relatively rapid increase from ϕ = O (hydrostatic pressure) up to a slope 3 to 1 ($\phi = 18^\circ 26'$), and but moderate increase up to 1¼ to 1 ($\phi = 38^\circ 40'$). At a slope of 1¼ to 1 there is a break-down and the values of C rapidly decrease. That is from the graphical determination in which friction against the back of the wall is not considered. On the other hand, when friction against the back of the wall is considered and taken at $\phi' = \phi$, the same graphics, see curve "Rebhann $\alpha = 33^\circ 42'$, $\epsilon = \phi$ (directrix angle $= \phi + \phi' = 2\phi$)" gives values for C that are high beyond any reason. For this particular case we get what may be termed a double break-down in the sliding prism theory, while as above stated Rankine gives very high values.