$S_1 = [b(b^2+20h_1^2)^{1/2}-b^2]/220h_1^{1/2}$ .....(14)
$S_2 = 4$ .....(15)
$t = 0.004h_1^{3/2}b^{1/2}1.5$ .....(16)
$t_1 = 0.3t$ .....(9)
$t_2 = h_1/15$ .....(10)
$t_3 = h_1/4.5$ .....(17)

Counterfort Walls without earth backing. Fig. 4: —
C = same as Equation 2.
S_1 = same as Equations 3, 4 and 5.
$t_3 = bh_1^{1/2}/40$ .....(18)
$t_4 = (h_1+60)/90$ .....(19)

Counterfort Walls with earth backing. Fig. 4:—
C = same as Equation 2.
S_1 = same as Equations 12, 13 and 14.
t_3 = same as Equation 18.
t_4 = same as Equation 19.

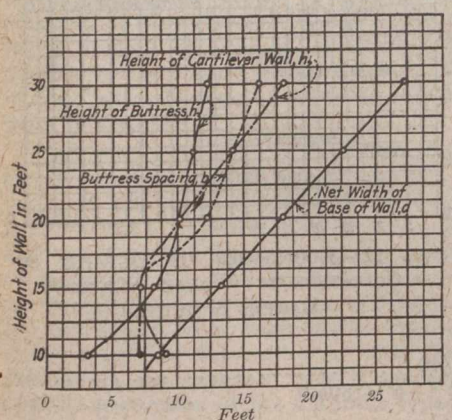

FIG. 15—ECONOMIES OF DETAILS OF SPECIAL TYPE OF WALL WITHOUT EARTH BACKING

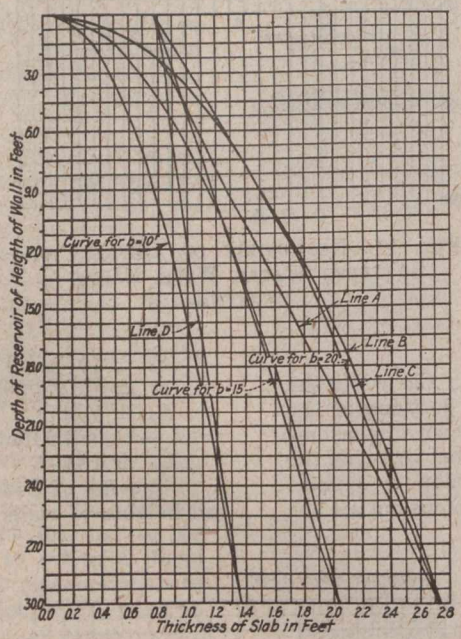

FIG. 16—GRAPHICAL SOLUTION OF SLAB THICKNESS FOR SPECIAL TYPE OF WALL*

Buttress and Counterfort Walls without earth backing. Fig. 5:—
$C = [b(b^2+8h_1^2)^{1/2}-b^2]/40h_1$ .....(20)
$S_1 = ch_1^{1/2}/18$ .....(21)
$S_1 = b(h_1-c)^{1/2}/80$ .....(22)
$S_1 = [b(b^2+80h_1^2)^{1/2}-b^2]/720h_1^{1/2}$ .....(23)
t_1 = same as Equation 9.
t_2 = same as Equation 10.
t_3 = same as Equation 18.
$t_4 = (h_1+6)/24$ .....(24)

Special Type of wall without earth backing. Fig. 6:—
$S_1 = h_2^{3/2}/31$ .....(25)
$t = 1.5$ .....(26)
$t_2 = h_3/15$ .....(27)
$t_1 = 0.67$ .....(28)
t_2, t_4 and t_5 determined graphically from Fig. 16.

The analytical expressions taken together with the graphical representations show the economical dimensions of every portion of the types of wall studied. The results show that for a wall with earth backing a buttress type is the cheapest unless the gain of the floor by the use of the "special" type is taken into account. For walls without earth backing the "special" type is the most economical, regardless of consideration of the saving in the floor area.

*The curves of Fig. 16 represent correct thickness of slab in accordance with the expression $t = bh^{1/2}/40$. Straight lines represent approximate solutions as used.

G. T. Milne, of Montreal, H.M. Senior Trade Commissioner for Canada and Newfoundland, is being transferred to Cuba as commercial secretary to the British legation in Havana.

RECOMMENDED PRACTICE OF MISSISSIPPI VALLEY STATE HIGHWAY DEPARTMENTS FOR CONCRETE ROAD CONSTRUCTION

AT a conference of the Mississippi Valley Association of State Highway Departments, held to consider questions relating to rural concrete road construction, the following "recommended practice" was adopted:—

Proportions.—One-course road: The concrete for a one-course pavement that is to be machine finished should be mixed in the following proportions: 1 sack of cement, 2 cu. ft. of sand and 4 cu. ft. of coarse aggregate. For work that is to be hand finished the proportions should be 1 sack of cement, 2 cu. ft. of fine aggregate and 3½ cu. ft. of coarse aggregate.

Two-course road: The proportions of the concrete for a two-course pavement should be as follows: For the lower course, 1 sack of cement, 2 cu. ft. of fine aggregate and 4 cu. ft. of coarse aggregate.

The proportions for the wearing course should be 1 sack of cement, 2 cu. ft. of fine aggregate and 3½ cu. ft. of the coarse aggregate prescribed for the wearing course of the two-course pavements.

Quantity of Water: It is recommended that extreme care be employed in proportioning the mixture as regards water content, and that this fact be checked by the slump test as follows: For the test, 6 by 12 in. cylinders should be tamped full of the concrete as mixed and the cylinder immediately removed. For work that is to be finished by hand, the slump of the concrete upon removing the cylinder should not exceed 6 in. and for work that is to be machine finished the slump should not exceed 2 in.

Thickness.—The thickness should be not less than 7 in. at the sides nor 8 in. at the centre for two-track roads up to 20 ft. in width. The thickness for single-track roads should be not less than 7 in. at any point.

Widths.—It is inadvisable to build concrete roads less than 18 ft. in width. Where a single-track road must be built it should be made 9 ft. in width and the 9 ft. should be centred on the centre line. Pavements with widths between 10 ft. and 16 ft. should not be built.

The width of grade to be traveled should be not less than 24 ft. for any width of pavement and the minimum over-all width of shoulders should be at least 8 ft. more than the pavement width.

Crown.—The crown should be a total of 1 in. for two-track roads not exceeding 20 ft. in width. If on centre line the crown for single-track roads should be ½ in. If placed with one edge on the centre line the surface should be sloped all one way with a total slope of 1 in.

Alignment.—No radius should be less than 200 ft. on centre line of turns.

Whitening Turns.—On all turns the centre line of the road should be marked by a white strip 8 in. wide.

Superelevation of Curves.—Except when drainage condition may prevent, the grade of the original centre line before widening is to be maintained where pavement is superelevated. The crown of the surface is to be flat where pavement is superelevated.

Grades.—Concrete pavements can be successfully constructed on any maximum grade likely to prove best from general economic consideration. In the middle west maximum grades exceeding 6 to 8% should not be adopted under ordinary circumstances.

Considering the permanency of concrete surfacing a greater expenditure of money is justified in eliminating frequent and minor breaks or changes in grade than is the case with a less permanent type of road.

Vertical curves on steep grades should be sufficiently long to give an unobstructed view of at least 250 ft.