The reason for the differences in the Bay Muds in the Davidson Avenue and Custer-Rankin areas may, in part, be due to soil composition, since the Davidson soils have a higher liquid limit and sensitivity. However, there are also significant differences in preconsolidation pressures. The preconsolidation pressures, p_c, determined for the New Bay Muds along Davidson Avenue are, in all cases, lower than those along Custer Avenue and Rankin Street. In fact, the p_c values from Davidson Avenue are even less than the effective overburden pressures calculated using a hydrostatic water pressure distribution. There are a number of possible reasons for the low consolidation levels: (1) Minimal exposure to desiccation effects due to the presence of a stream channel in the area (see Fig. 4); (2) incomplete consolidation under the rubble fill load; or (3) the effects of artesian pressures from the lower sand layer.

The latter two suggestions would require that water pressures above hydrostatic levels would have to exist in the clay, which is actually the case. Two piezometers, placed in the clay for this investigation along Davidson Avenue (see Fig. 3) at depths of 30 ft and 40 ft (9.2 m and 12.2 m), gave initial readings which were some 500 psf (23,950 Pa) above the hydrostatic pressure. This amount of pressure is equal to the difference between the p_c values in the normally consolidated part of the Bay Mud below 30 ft (9 m), and the effective pressures calculated assuming hydrostatic water pressures.

Whether these excess pore pressures are due to on-going consolidation or artesian pressure is a matter of speculation, although previous drilling in the basin has verified the presence of artesian pressures. The actual reason for the observed differences in preconsolidation pressures is likely to be some combination of the three proposed. In any case, the low preconsolidation pressures of the New Bay Muds along Davidson Avenue are probably the primary reason they are weaker than those along Rankin Street and Custer Avenue.

The undrained shear strengths below about 25 ft (7.6 m) increase approximately linearly with depth in all areas. Using average values from the different test results in Figs. 5 and 6, the ratio of undrained strength, s_u, to effective overburden, is 0.42 for Custer-Rankin samples and 0.33 for Davidson samples. The difference is consistent with the fact that the Davidson soils are normally consolidated while those for the Custer-Rankin are modestly overconsolidated.

As a check on the conventional laboratory strength test results for the Bay Muds along Davidson Avenue, a series of isotropically consolidated undrained (CU) triaxial compression tests were performed on samples from 58 ft–65 ft (17.7 m–19.8 m). The samples were consolidated to pressures above the overburden values to minimize disturbance effects (6). The normalized undrained shear strengths derived from these tests is 0.33, a value in general agreement with the other results shown in Fig. 6. Excess pore pressures developed during shear were high, with the $\bar{A}$ pore pressure parameter at failure ranging from 0.7–1.15. The average drained friction angle was 26°.

TABLE 1.—Comparison of Properties of Bay Mud from Custer Avenue and Rankin Street and Davidson Avenue

Depth, in feet (meters) (1)	Average Water Content, as a Percentage		Average Unit Weight, in Pounds per Cubic Foot (Kilograms per Cubic Meter)		Average Shear Strength, in Pounds per Square Foot (Pascals)		OCR[c]		Sensitivity		*PI*, as a Percentage		LL, as a Percentage	
	D[a] (2)	C[b] (3)	D (4)	C (5)	D (6)	C (7)	D[d] (8)	C (9)	D (10)	C (11)	D (12)	C (13)	D (14)	C (15)
0–30 (0–9)	95	92	91 (1,460)	92 (1,470)	350 (16,770)	500 (24,000)	1.4	1.5	15	10	59	59	105	95
30–55 (9–17)	75	65	96 (1,540)	104 (1,670)	450 (21,600)	800 (38,300)	1.0	1.5	10	10	45	38	85	68

[a]D = Davidson Avenue.
[b]C = Custer Avenue and Rankin Street.
[c]OCR = overconsolidation ratio.
[d]Based on effective pressures with allowances for artesian pressure.
Note: 1 psf = 47.9 N/m²; 1 pcf = 0.157 kN/m³.

Excavation Supports and Construction Sequence

The excavation support system used for most of Davidson Avenue and all of Rankin Street consists of a 45 ft interlocking sheet-pile wall braced at four levels (see Fig. 7). The uppermost and lowest struts are wooden, 12 in. (304.8 mm) square and 12 in. (304.8 mm) in diameter, respectively; the intermediate struts are steel wide flange members, designation HP 12 × 74. The sheet piles were manufactured in Belgium with characteristics essentially the same as those of the U.S. Steel section PZ-

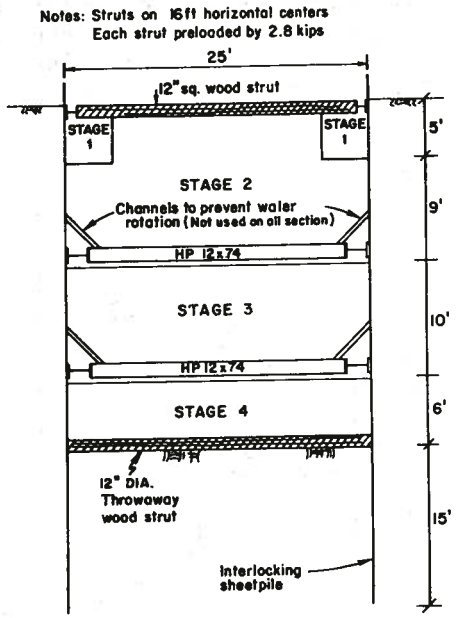

FIG. 7.—Structural Support System and Excavation Sequence (1 ft = 0.305 m)