CHAPTER II

REVIEW OF THE LITERATURE

2.1 Shear Strength:-

HOGENTOGLER and WILLIS (1) found that the stability or strength of a compacted cohesive soil decreases with increasing temperature.

LAMBE (2) believed that an increase in temperature should result in an increase in shear strength.

LEONARD (3) believed that an increase in temperature should cause a reduction in shear strength and supported his point of view by citing the work of Hogentogler and Willis. Rosengvist, Trask and Close, which shows that an increase in temperature tends to cause reductions in shear strength.

SEED, MITCHELL, and CHAN (4) found that pore pressure in undrained triaxial samples vary with temperature and that an increase in temperature causes an increase in pore pressure. This result was verified by Ladd and others.

LADD (5) conducted cone-penetration tests on Buckshot Clay at various temperatures (5, 22 and 50°C) and found that hot samples gave slightly higher strength at a given moisture content and cold samples gave a higher strength at a given consolidation pressure.

SEMCHUK (6) performed undrained triaxial tests on two soil (both consolidated and sheared at test temperature of 1.7 and 25°C) and found practically no temperature influence on shear strength of both soils.

MITCHELL (7). From undrained triaxial tests conducted on compacted San Francisco Bay mud, he found that the higher temperatures produce lower shear strength and higher pore pressure buildup during the shear.

DUNCAN and CAMPANELLA (8) The data obtained on soils consolidated at 20°C and sheared in undrained triaxial tests (at 20, 35.5 and 48.8°C) indicated that an increase in temperature causes a reduction in strength, an increase in initial pore pressure, and a decrease in pore-pressure buildup during the shear testing.

CALVIN A. NOBLE and TURGUT DEMTREL (9) The study was run on remolded, statically compacted specimens of a highly plastic clay and a low-plasticity silt using a direct shear machine, and it was found that:-

1. Creeptests showed a linear relationship between the logarithm of deformation rate and shear stress.

2. Activation energy values obtained from creep tests were approximately equal to those obtained from direct shear tests.

3. The coefficients relating deformation rate and shear strength to water content were also found to agree quite well. The values for silt were about three times larger than the values for clay.

4. At the same shear temperature for clay, the peak shear strength increased with the consolidation temperature. At the same consolidation temperature and shear stress for silt, the deformation rate increased with the shear temperature.

MEHMET A. SHERIF and CHESTER M. BURROUS (10). ran an undrained and unconfined compression test of reconstituted clay. The reconstituted clay studied, was one-half Champion and one-half Challenger (known by its trade name as C & C). The samples were consolidated at room temperature and were failed in undrained, unconfined compression at 23.9, 37.8 51.7 and 65.6°C, and it was found that:-

1. An increase in temperature caused a decrease in compression strength.

2. A linear relationship existed between the logarithm of compressive strength and the moisture content at all test temperature levels.

3. Soil samples of lower moisture contents underwent a greater absolute reduction in strength with rising temperatures than those of higher moisture content levels.

J. G. LAGUROS (11) performed a test by changing temperatures between 1.7, 21.1 and 40.6°C and using four clay soils - a kaolinitic (N. Carolina clay), an illitic (Illinois clay), a montmorillonitic (Texas clay), and a montmorillonitic -illitic (Oklahoma clay), and found that the unconfined compressive strength of the soils increased with increases in temperature. Illitic soil contitutes an exception in that it showed a parabolic tendency which the highest strength being observed at 70°F. From the test data of these clay soils, Laguros was forced to accept that at high temperatures the soils displayed higher shearing strength.

2.2 Consolidation:-

A. R. JUMIKIS (14) wrote that the higher the temperature of the soil under a consolidation test, the greater its drainage, the higher the compressibility, and the higher the rate of consolidation.

WU ET AL (12) believed that the effects of temperature on consolidation was related to an increase in thermal energy, which permitted more rapid passage of flow units over the energy barrier and allowed deformation to progress more rapidly.

PAASWELL, R. E. (13) has reported that an increase in temperature effected an increase in the rate of consolidation, and the increase in the rate of consolidation was also related to the decreased viscosity of the water, which permitted more rapid drainage.

JOAKIM G. LAGUROS (11) tested four clay soils samples at temperatures of 1.7, 21.1 and 40.6°C. Tests were run on remolded specimens of soils compacted at their maximum density and optimum moisture content, and it was found that, first at high temperatures low pressure was sufficient to cause the same amount of consolidation, as high pressures did at low temperatures; second, at low temperatures consolidation was more rapid than at higher temperatures.

FINN (15) using remolded clay and temperatures ranging from 26.7°C to 4.4°C showed that the consolidation - void ratio curves were of the same general shape and were not particularly affected by temperature the conclusion drawn by Finn on the basis of his test results was that the compression of a clay stratum is independent of temperature.

LAMBE (2) using the results of consolidation tests on Boston blue clay, found that under constant load the test samples expanded with a decrease in temperature and contracted with an increase in temperature.

GRAY (16) reported after his study that temperature changes produced a shift in the void ratio - log pressure curve. The conclusions drawn indicate that if the temperature was lowered one would expect to obtain higher void ratios for the same consolidation pressures.

TAYLOR (17) and YONG ET AL (18) wrote that on valume change of sodium montmorillomite showed that swelling pressure decreased as the temperature was decreased.