CHAPTER V

SCOPE, PROGRAMME AND SCHEME OF THE INVESTIGATION

Ever since the classical work of Terzaghi on consolidation process, number of workers pursued the research and focussed the attention on various influencing factors. Appendix B of Volume II supplies a general bibliography on the subject. A list of references directly used in this work is given at the end of this volume I. The object of the present investigation is to examine the influence of various physico-chemical and mechanical factors on the consolidation characteristics of clays from fundamental considerations and aims to propose a unified treatment of the phenomenon. An abstract of the work is presented in volume II as Appendix A and as synopsis in Volume I.

5.1. Scope

5.1.1. Theoretical Work

Classical and modern theories for one dimensional consolidation of clays are critically appraised in Chapter III, to find out their sensitiveness in reflecting the physico-chemical and mechanical factors. The deficiencies arise due to neglecting deformability of individual constituent phases and non-consideratiòn of overall larger deformations in the clay mass. During this work a generalized theory based upon the fundamental considerations is developed in the department which is described in Chapter IV. In order to utilize the new theory for the analysis of experimental data the analytical solution of the partial differential equation assuming the parameter P as a constant is evaluated using Fortran II programme on IBM 1402 computer. Ishochrones and various theoretical relationships between degree of consolidation and time factors are obtained for range of P value. The details of the theoretical evaluation are presented in Volume II appendices E, F and G.

5.1.2. Experimental Work

Experimental data of variety of tests from number of important research studies are reviewed in Chapter II to determine the chief factors that influence the consolidation characteristics. In the present work experimental investigations are planned to examine the influence of mineral type, degree of saturation, fabric structure, stress history and drainage path on the consolidation characteristics of clays. A series of one dimensional consolidation tests for each of the factors are scheduled. Appendix H in Volume II presents experimental data so obtained.

5.2. Programme

5.2.1. Objectives

It is proposed to keep in view the following specific points while analysing the experimental data obtained during this investigation :

(i) Expanding and non-expanding nature of lattice structure.

(ii) Interaction of individual and group of clay colloids with intra and intermecellar water.

(iii) Interparticle spacing in clay skeleton.

(iv) Edge to face and face to face configuration in clay skeleton.

(v) Extent of water and air phases in clay skeleton.

(vi) Hystersis losses during loading and unloading cycles.

(vii) Bond resistance to applied stresses.

(viii) Orientation and length of drainage path.

5.2.2. Experimental Schedule

Experimental investigations use Kaolinite (LL = 67.8 PI = 36.6, Activity = 0.85), Bentonite (LL = 365, PI = 301, Activity = 4.18 and Illite (LL = 46.4 ; PI = 21.4 ; Activity = 0.437) clays. The details of the physical properties of these clays used are given in Volume II under Appendix C. Consolidation Tests are conducted on Conventional Casagrande and hydraulically pressurised Rowe type Oedometers as described in Chapter VI. Appendix D in Volume II supplies the specifications of various equipments employed during this investigation. Table 5.1 presents the experimental schedule followed for the investigation of various factors.

5.3. Scheme

Data collected from the experimental investigations as detailed in Table 5.1 are analysed employing standard parameters and plots. In order to bring out specific points, necessary plots and parameters are chosen as will be discussed in coming Chapter VII.

5.3.1. Parameters

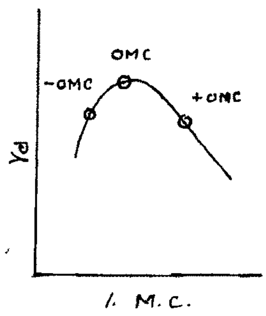
Parameters as defined in the classical theory and which have become conventional are adopted in the present work. These standard parameters are (i) co-efficient of consolidation, cm^2/sec; (ii) time factor, non dimensional and (iii) coefficient of volume change, cm^2/kg. In the context of the present scheme wherein the full sample is represented by a depth dimension which is half in relation to that of Terzaghi, the time factor will be a quarter of that of Terzaghi. While analysing the data various specialised parameters are introduced qualifying at the relevant places in the discussion.

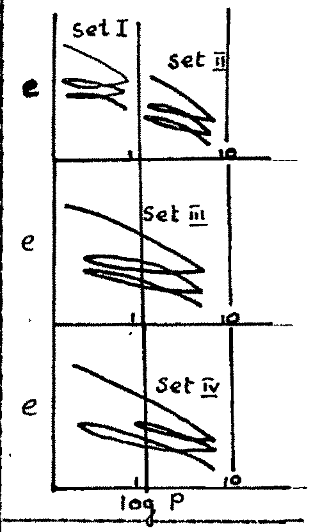
5.3.2. Plots

The observations of the experimental investigations are plotted in a conventional manner as shown in Appendix H of

Volume II. These plots are (i) dial gauge reading in 10^{-4} inches and time in minutes (ii) ratio of mid plane pore water pressure to initial value of pore pressure and time in minutes, (iii) void ratio and effective pressure in kg/cm^2 on log scale. From these basic data various plots are derived in order to obtain exposition of the specific points of investigations.

TABLE 5.1

Group Name	Index No.	Details	Remarks
CM CLAY MINERAL	1 CM.1	Kal - Sat - Casa	Kaolinite of Bhavnagar origin Guj. India. Bentonite from M/S Bharat Pulverising Mill, B'ay. Illite Fithian origin Illinois U.S.A.
	2 CM.2	Bent -Sat - Casa	
	3 CM.3	Ill - Sat - Casa	
	4 CM.4	Kal - Sat - Rowe	
	5 CM.5	Bent- Sat - Rowe	
	6 CM.6	Ill - Sat - Rowe	
DS DEGREE OF SATURATION	7 DS.1	Kal - o.m.c. Casa	
	8 DS.2	Kal - (+)o.m.c.-Casa	
	9 DS.3	Kal - (-)o.m.c.-Casa	
	10 DS.4	Bent- o.m.c. - Casa	
	11 DS.5	Bent- (+)o.m.c.-Casa	
	12 DS.6	Bent- (-)o.m.c.-Casa	
FS FABRIC STRUCTURES	13 FS.1	Kal - Flocc - Casa	Sodium Polyacrylate as flocculating agent. Sodium Tetra Phosphate as dispersing Agent.
	14 FS.2	Kal - Flocc - Casa	
	15 FS.3	Bent- Flocc - Casa	
	16 FS.4	Bent- Dispr - Casa	
	17 FS.5	Kal - Flocc - Rowe	
	18 FS.6	Kal - Dispr - Rowe	
	19 FS.7	Bent- Flocc - Rowe	
	20 FS.8	Bent- Dispr - Rowe	

Group Name	Index No.	Details	Remarks
SH STRESS HISTORY	21 SH. 1	Kal - Set I - Casa	
	22 SH. 2	Kal - Set II- Casa	
	23 SH. 3	Kal - Set III-Casa	
	24 SH. 4	Kal - Set IV -Casa	
	25 SH. 5	Kal - ΔP/P =1-Casa	
	26 SH. 6	Kal - ΔP/P =2-Casa	
	27 SH. 7	Kal - ΔP/P =4-Casa	
	28 SH. 8	Kal - ΔP/P =1-Rowe	
	29 SH. 9	Kal - ΔP/P =2-Rowe	
	30 SH.10	Bent- ΔP/P =1-Rowe	
	31 SH.11	Bent- ΔP/P =2-Rowe	
DP DRAINAGE PATH	32 DP. 9	Kal - Vert - Casa	Samples taken at (90)° vertical horizontal and (45°) inclined orientation
	33 DP.10	Kal - Incl - Casa	
	34 DP.11	Kal - Horz - Casa	
	35 DP. 1	Kal - H =.25"-Casa	Samples of different thickness in Casagrande oedometer with one way drainage
	36 DP. 2	Kal - H =.5" -Casa	
	37 DP. 3	Kal - H= 1" - Casa	
	38 DP. 4	Kal - H =2" - Casa	

Legend

Kal - Kaolinite
Bent - Bentonite
Ill - Illite
Sat - Saturated
+ Omc - Wet of omc
- Omc - Dry of omc

Flocc - Flocculated
Dispr - Dispersed
Vert - Vertical
Incl - Inclined (45%)
Horz - Horizontal

Set - Mode of stress
ΔP/P - Stress incremen Ratio
H - Thickness of samp
Casa-Casagrande Oedometer
Rowe - Rowe Oedometer

Index No. 1 CM 1 indicates serial Number (1), group name (clay mineral) and sample number (1).