DATA PROCESSING OF LABORATORY TEST RESULTS WITH MICROCOMPUTER

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1 INTRODUCTION

For routine laboratory testing work and also for academic research and instruction, the use of personal computers and standard software offers an economical, fast and reliable method of data processing. This paper presents the results of an undergraduate research study on the processing of data for several soil laboratory tests with the use of microcomputer.

2 DATA PROCESSING WITH SPREADSHEETS

In this study, data processing was done using worksheets made using the Lotus 123 software. Worksheets can contain a maximum of 8,192 rows and 256 columns of data, with each data cell able to contain either numbers, labels, or the results of calculations which were carried out with the use of equations, special functions or commands. This way, standard worksheets can be written with built-in equations and commands, and then used repeatedly for similar tests; the particular results depending only on the newly input data. Data input is made directly while the data calculations are done automatically, with the results presented in uniform formats, and more importantly, calculation errors are virtually eliminated. Output from the worksheets may be in the form of data printouts and graphs. It is also possible to make automatic execution of data input and processing with the use of specially written sets of macro commands, i.e. pre-written commands which automatically execute by pressing a specific key.

3 DISCUSSIONS

Nine laboratory tests for soils which are commonly included in the curricula of universities were chosen for this study. These tests are listed in Table 1, together with the results which can be obtained from the data processing program. Reference was made to the Laboratory Manual for Soil Testing of the JSSMFE (JSSMFE, 1991) for test procedures, raw input data, and the format of the presentation of test results in the form of data sheets and graphs. In addition, worksheets were written for the prediction of the stress-strain behavior of soils using the Cam Clay and the Modified Cam Clay theories (Roscoe and Burland, 1968).

A flow chart for the use of the worksheets is shown in Fig. 1. With the Lotus 123 system disk loaded in the microcomputer, the desired worksheet for a particular test can be retrieved from among the files which have been written. All worksheets contain an auto-executable macro program which initially asks the user to choose from a menu of desired operations. The choice of operations include data input or correction (press the [I] key), printout of data (press [P]), printout graphs (press [G]) or exit (press [Q]). Data input is automated as the cursor will move automatically to the appropriate cell after pressing the [RETURN] key. An advantage in using worksheets is the fact that scales of graphs may be changed easily and quickly. For the case of the prediction of soil behavior, the equations for the soil models are already in the worksheets such that the data input consists only of the soil parameters, e.g. M, λ and k and the test variables p_0 (pre-shear consolidation pressure) and e_0 (void ratio).

Table 1 Laboratory tests and results of data processing

TEST NAME	REFERENCE	RESULTS OF DATA PROCESSING
Particle size test	JIS A 1204·JSF T 131	Grain size distribution curve , D_{max} , U_c , U'_c
Atterberg limits test	JIS A 1205·JSF T 141	I_c , ω_L , I_r , ω_c , I_c
Compaction test	JIS A 1210·JSF T 711	Compaction curve , ρ_{dmax} , ω_{opt}
CBR test	JIS A 1211·JSF T 721	CBR of compacted soil , CBR of undisturbed soil
Consolidation test	JIS A 1217 JSF T 411	Consolidation volume-time curve e-logσ curve , σ_c , C_c , m_v , γ , c_v
Permeability tests	JIS A 1218·JSF T 311	Coefficient of permeability
Unconfined comp. test	JIS A 1216·JSF T 511	q-ε_a curve , q_u , $E_{s\theta}$
$\overline{CU}$ Triaxial test	JSF T 523	ε_a , q , p , η , u , stress-strain curves
CD Triaxial test	JSF T 524	ε_a , ε_v , q , p , η , e , stress-strain curves

4 SUMMARY

With the use of worksheets which were written for this study, the time spent in processing data of laboratory test results may be drastically minimized, and more importantly calculation errors are eliminated. It was also possible to pattern the format of the worksheets and the graphs to be similar to standard data sheets used for soil testing work, thereby simplifying the data input and analysis of results. While these worksheets may be no match to the highly sophisticated data acquisition systems available, they offer an economical, more flexible and equally reliable alternative to facilitate the data processing of routine laboratory test results.

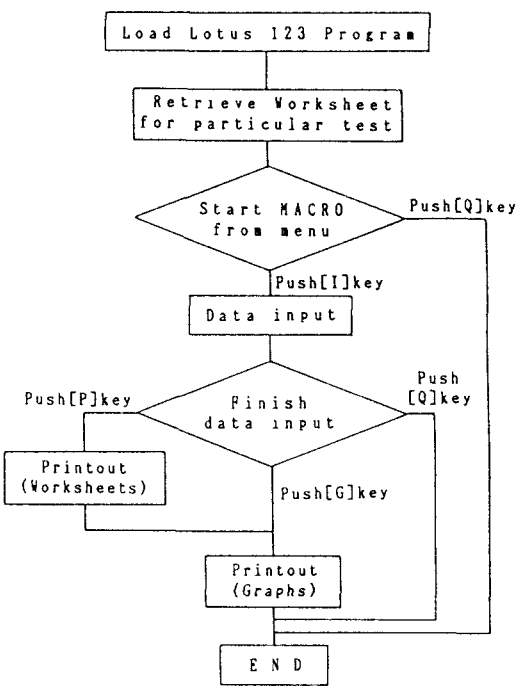

Fig. 1 Flowchart for use of worksheets

5 REFERENCES

JSSMFE (1991). Laboratory manual for soil testing. Second edition. The Japanese Society of Soil Mechanics and Foundation Engineering. Tokyo.

Roscoe, K.H. and Burland, J.B. (1968). "On the generalized stress-strain behaviour of wet clay". Engineering Plasticity. Cambridge Univ. Press, U.K. pp. 535-609.