CHAPTER III

EXPERIMENTAL INVESTIGATION

3.1 Soil Sampling and Field Vane Testing

Auger boring method was employed for one 4 in. diameter bore hole. Undisturbed samples were taken by 4 in. diameter, 0.60 m. long thin walled sampling tubes at every interval of 1.5 m depth or at every changing of soil layer. After sampling each sample the vane shear test was done at the speed of 10 degrees per minute. Then the vane was rotated 5 revolutions.

3.2 Laboratory Testing

In the laboratory, the general properties of natural moisture content, Atterberg Limits, and unit weight were measured.

Undrained shear strength were measured in the laboratory using unconfined compression tests on 1.4 in. diameter, 3 in. length specimens.

All the subsoil properties are summarized in Fig. 7.

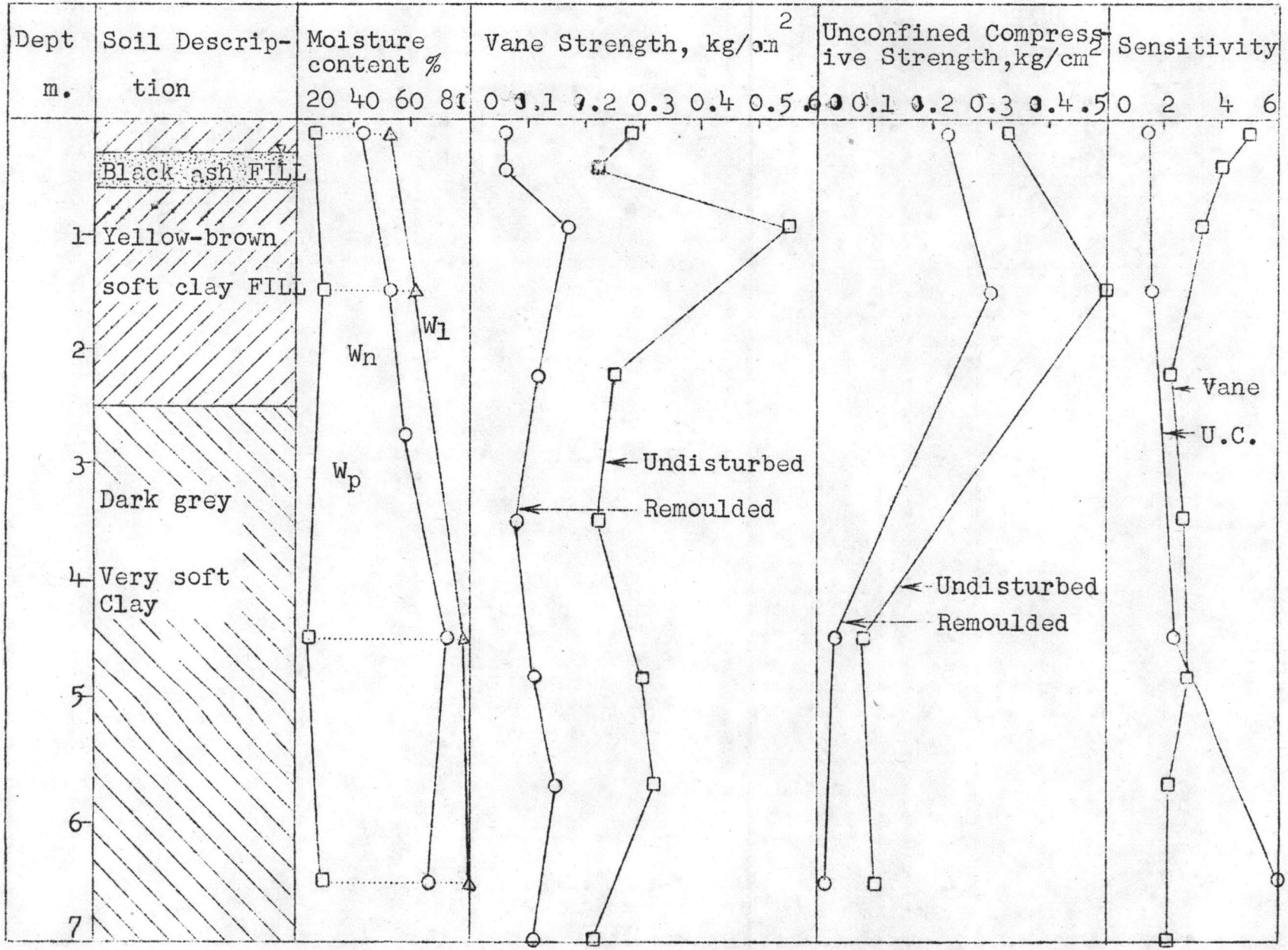


Fig. 7 - Soil Properties at Test Site

3.3 Description of the Piles

3.3.1 Details of Piles

(a) Short piles - Four rectangular short piles are precast prestressed concrete piles. The piles are 18 x 35 cm, 3.50 m. long, embedded 2.90 m. in the clay and loaded at the top at an eccentricity of 46 cm. The details of short pile are shown in Fig. 8.

(b) Long piles - Two 18 cm. square long piles are precast prestressed concrete piles which are 7 m. long. The details of long pile are shown in Fig. 9.

3.3.2 Pile Location and Layout Plan All piles were driven with drop hammer. The test site is near the hydraulic laboratory, the Faculty of Engineering, Chulalongkorn University. Three supporting piles of 0.20 x 0.20 cm. were also driven. The general plan is shown in Fig. 10.

3.3.3 Procedure of Testings

(a) Maintained load test - The procedure adopted was to apply static loads in increments of the anticipated working load. Increment of 0, 25, 50, 75, 100, 0, 100, 125, 150, 175 and 200 % of the working load were employed except for the special repetitive load tests on piles. The lateral loads were applied and released at a rate of 2 tons per min, and held constant for a minimum period of 1 hour or until the pile head movement was less than 0.01 in. per hour. Deflection readings should be made immediately before and after the addition of each load increment and at elasped time 2, 4, 8, 15, 30 minutes, every 1 hour and at not less than three specified times between load increments until application of the next load increment.

During the unloading of the pile, the deflection should be measured when the load remaining on the pile amounts to 75, 50, 25,10 and 0 percent of the full test load, with decrements of load released at not less than half-hour intervals, and with measurements of the rebound being made immediately before and after each decrement. If the load was increased to failure, this was done by reducing the increments where failure was imminent so that ultimate load capacity could be accurately measured. Tests were carried to failure or the lateral deflections approaching 2 in. except for piles scheduled for subsequent tensile tests and

special repetitive load tests; in these instances the lateral deflections at the ground surface were limited to 0.50 in.

(b) Constant rate of deflection test (CRD) - The rate of deflection selected is usually used in shearing soil samples in the unconfined compression test (0.0012 in./min). CRD test was run after the ML test was finished.

(c) Quick test - The laterally test loads were applied in about 10 equal increments except for the increments nearly failure loads; in these instances the increments were reduced. The lateral loads were applied and released at the rate of 2 tons/min, and held constant for 5 minutes, gross deflection readings, loads and other data were recorded immediately after pumping had ceased and again after intervals of 2½ minutes and 5 minutes. Net deflection readings were made immediately after all load had been removed and at intervals of 2½ minutes for a total period of 5 minutes.

(d) Repeated load test - The short piles No. 2 and No. 3 were subjected to 30 repetitions of loads. These loads were applied at the rate of 2 tons/min as single increments except for the tenth, twentieth and thirtieth applications in which the loads were applied in three increments.

3.3.4 Pile Material Properties

(a) Concrete properties:

f'_c = 448 ksc,

Unit weight (W) = 2.40 ton/m^3,

Modulus of elasticity (E_c) = $W^{1.5} 4270 \sqrt{f'_c}$ ksc.

= $2.40^{1.5} \times 4270 \sqrt{448}$ ksc.

= 336,029 ksc.

(b) Steel properties:

Diameter (D) = 4 mm,

Cross-section area (A_s) = 0.13 cm^2,

Young's modulus of elasticity (E_r) = 1.95×10^6 ksc,

Tensile stress of steel (f_s) = 17,500 ksc.

(c) Modulus of elasticity of precast prestressed concrete (E_p)

$$E_p = E_c + (E_r - E_c) \frac{A_s}{A},$$

where A = total cross-section area of pile (cm^2).

i) Short piles:

Number of prestressed steels = 60 items

A_s = 0.13 x 60 = 7.8 cm^2.

A = 35 x 18 = 630 cm^2.

E_p = 336,029 + (1,950,000 - 336,029)$\frac{7.8}{630}$ = 356,012 ksc.

$I_p = \frac{1}{12} \times 35 \times 18^3$ = 17,010 cm^4.

$E_p I_p$ = 6.06×10^9 kg-cm^2.

ii) Long piles:

Number of prestressed steels = 8 items

A_s = 0.13 x 8 = 1.04 cm^2.

A = 18 x 18 = 324 cm^2.

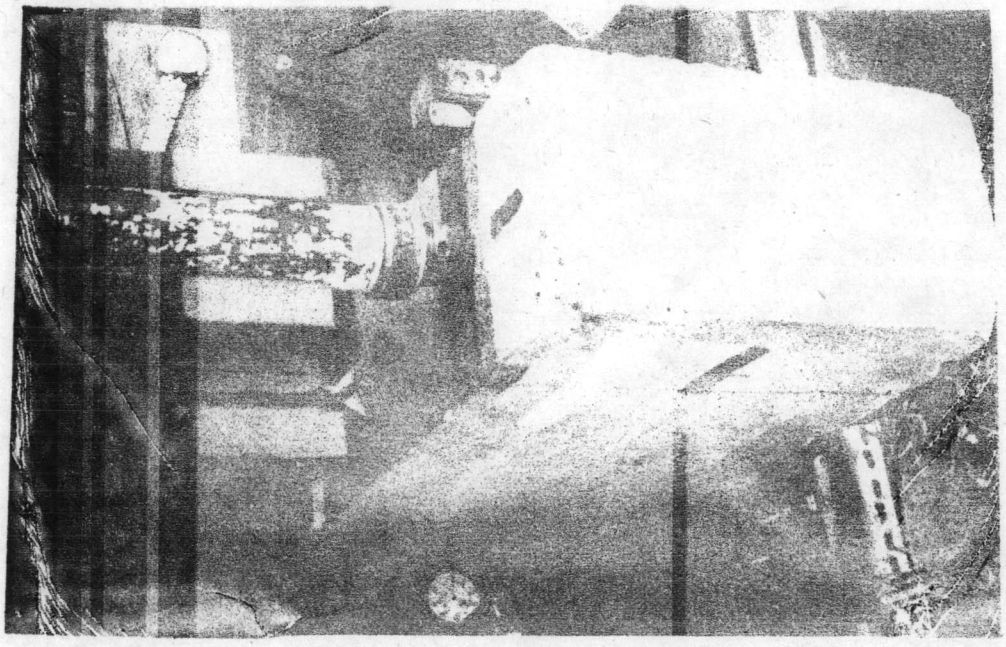
E_p = 336,029 + (1,950,000 - 336,029) $\frac{1.04}{324}$

= 341,210 kg/cm^2

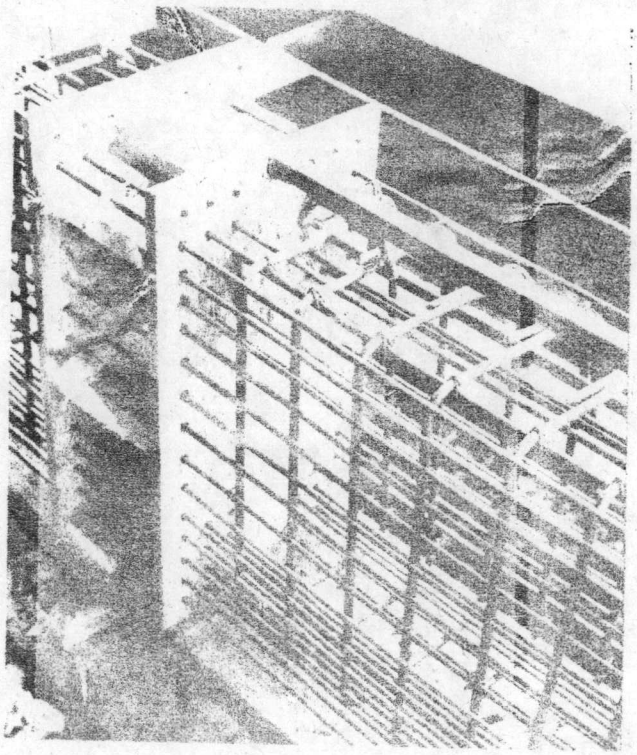
$$I_p = \frac{1}{12} \times 18^4 = 8748 \text{ cm}^4.$$

$$E_p I_p = 2.98 \times 10^9 \text{ kg-cm}^2.$$

3.3.5 Programme of Pile Tests The programme of pile tests is shown in Table 4.

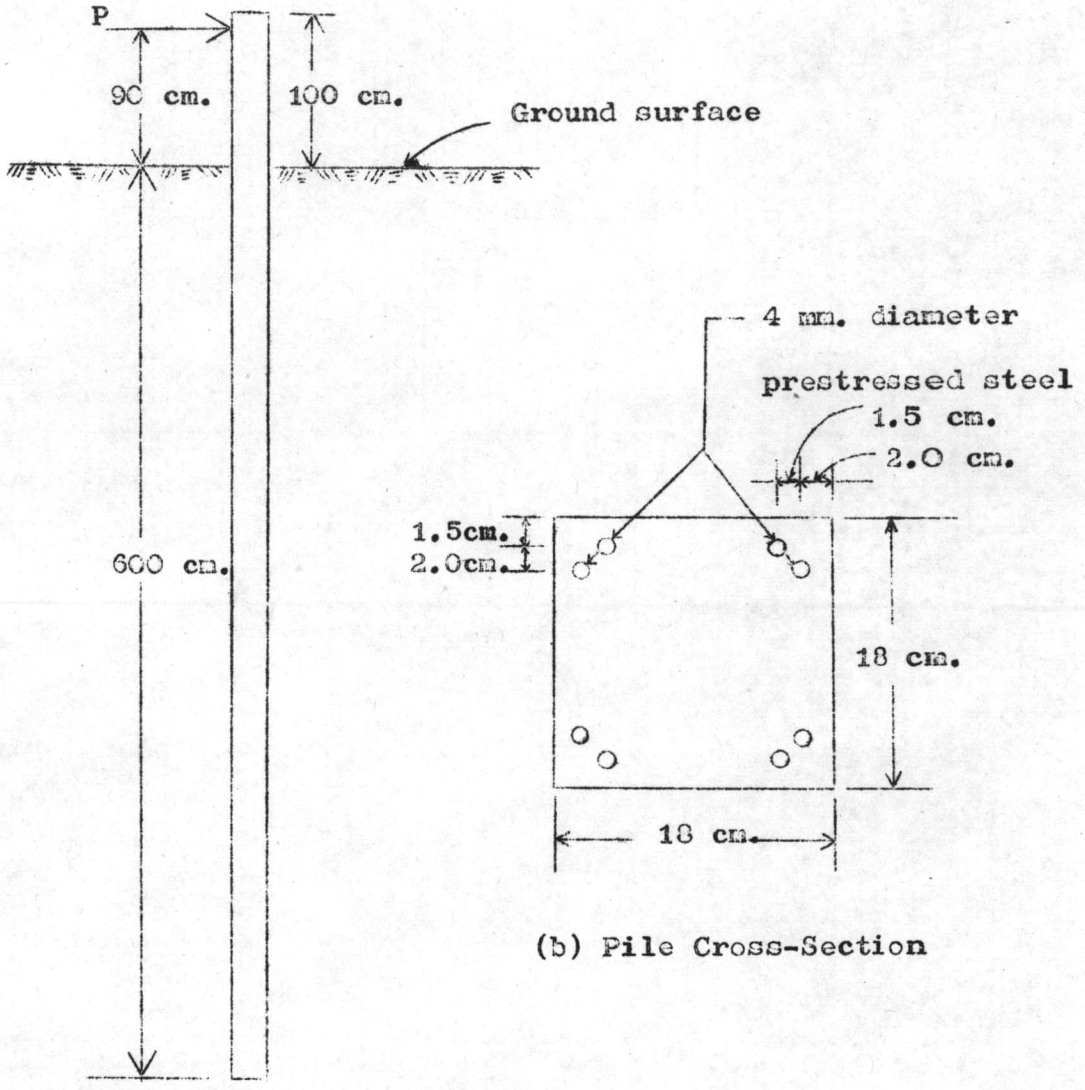


(a) Pile Testing Preparation



(b) Prestressed Steel Detail

Fig. 8 - The Details of a Short Pile



(a) Pile Position

(b) Pile Cross-Section

Fig. 9 - The Details of a Long Pile

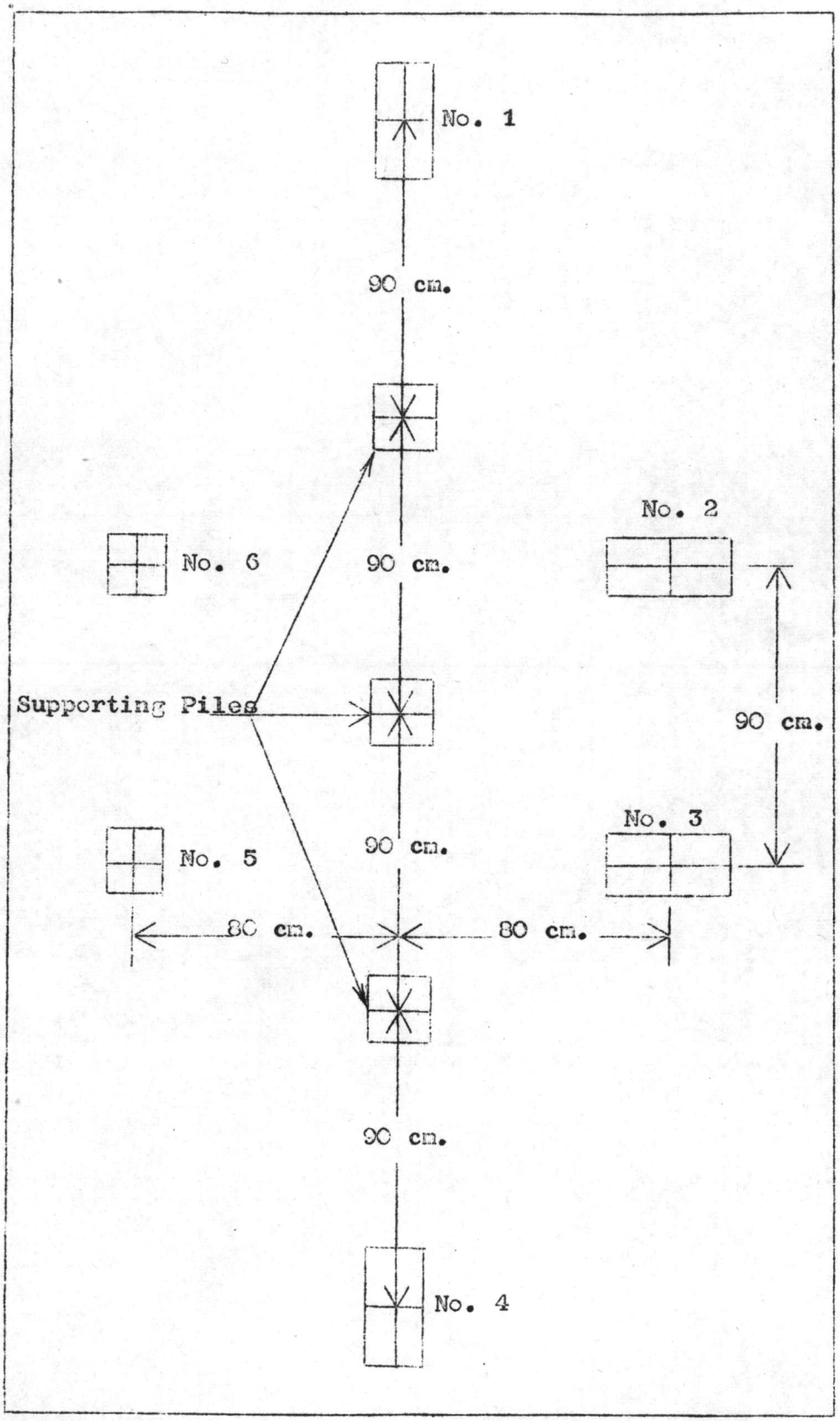


Fig. 10 - Layout of Test Piles.

Table 4 - Programme of Pile Tests

Pile No.	Test No.	Testing Methods	Date Driven	Date Tested
1	1	ML	4/4/75	31/5/75
	2	CRD		11/6/75
	3	Quick		11/6/75
2	1	ML	4/4/75	6/6/75
	2	CRD		7/6/75
	3	Quick		7/6/75
3	1	ML	4/4/75	4/6/75
	2	CRD		5/6/75
	3	Quick		11/6/75
4	1	ML	4/4/75	1/6/75
	2	CRD		2/6/75
	3	Quick		12/6/75
5	1	ML	4/4/75	10/6/75
6	1	ML	4/4/75	8/6/75