CHAPTER 1

INTRODUCTION

The use of soil as an engineering material involves many problems but none are more complicating than the relationship of the properties and the behavior of the finegrained types. Eventhough many progress have been made toward reasonably rationalized solution for these problems by the concepts of comtemporary soil mechanics. However, there are reasons to believe that some of the most difficult problems must be approached from a difference direction. It seems quite logical to belived that any physical or chemical characteristic of a material which affects its properties must be of interest whatever use will be made of the material. Therefore, finegrained soil problems involve the concepts of soil physics, soil chemistry and mineralogy as well as soil mechanics.

With the growth of population and business in Bangkok area the constructions of apartment, dwelling houses, buildings, roads and highways to serve the society are increasing. Unfortunately, Bangkok soil is considered to be soft clay which creates many engineering problems and leads to unneccessary excessive high cost of construction. It is engineering responsibility to minimize this high cost of construction. One of the solutions is to work on less estimation in calculation which requires more comprehensive knowledge of the soil properties. Many researches were made on Hydraulic and Mechanical properties, yet, it is very essential to have more details in chemical and mineralogical properties which will lead to the best solution for such engineering problems.

The application of the principles of soil chemistry and mineralogy to engineering problems is quite outside the limits set of soil mechanics. Many local engineers do not have occasion to keep up and easy familiarity with the chemical and mineralogical properties of Bangkok clay. It is quite understandable, therefore, why some of the pertinents developments have been overlooked or have been considered foreign to engineering interests. Hence, to improve the situation for a better understanding, it is vital that these properties should be studied and reported. Therefore, this research will have the following objectives:

1.1 Research Objectives

1. To make possible identification of the mineralogical composition.
2. To analyse the chemical composition, and
3. To determine the cations exchange capacity of the representative samples of Bangkok clay.

In order to achieve the objectives of this research, samples were collected from many locations around Bangkok and some from the center. Ten locations were selected and collection of samples were drawn up from elev. -1.50 to -17.00 m. These samples were used as the representative samples of Bangkok clay for the determination of mineralogical and chemical composition.

Bangkok situates on the central plain, about 20 km. north of the Gulf of Thailand, which consists of multiple soil layers. The Bangkok soil layers are the result of marine & terrestrial depositions. Terrestrial deposit starts from elevation 0.0 m to about 4.0-5.0 m.(13) above M.S.L. and the

other soil layers are Marine Deposition which is the result of changes in sea-levels during Quaternary Period. The soil profile may be divided into four layers as shown in Fig I.

1. Weathered crust layer about elev. 0.0 m. to -2.0 m. composed of brown clay in the middle and southern part of the plain and dark gray clay in the northern, dark clay having crack due to climate.

2. Soft layer, about elev. -2.0 m to -12.0 m. composed of soft to medium dark gray clay.

3. Stiff to hard layer, about elev. -12.0 m. to -20.0 m. composed of light gray and yellow-brown clay.

4. Dense sand and gravel with some sandy clay layer are usually found alternatively to the depth of more than -300 m.

The term "Bangkok Clay" represents the clay layers 1, 2 and 3. The index properties are: natural water content 50-100%, liquid limit 55-95%, plasticity index 23-33%, specific gravity 2.65-2.75, total unit weight 1.65-1.80 t/m^3 at elev. 0.0 m to -2.0 m. and 1.45-1.75 t/m^3 below elev. -2.0 m. The clay has low strength and high compressibility.

1.2 Hypotheses

Since Bangkok clay has been derived from the soil which was deposited by terrestrial & marine depositions (13). Bangkok clay may considered to be composed of mixed clay minerals. In order to arrive at the mineral compositions and predominant mineral of Bangkok clay, possible cause based

on original minerals and environmental condition would be considered as follows:

In 1962, Sorasith Vacharotayan have shown that the clay mineralogical compositions of the surface soils covering a wide area of Thailand consist of kaolinite, illite and montmorillonite.

Kawaguchi and Kyuma, in 1969, study the soil in the central valley, in the Korat and Chieng Mai basins and conclude that the clay mineralogical compositions to be consisted of kaolinite, illite, montmorillonite, vermiculite and small amount of chlorite from which the predominant mineral is kaolinite.

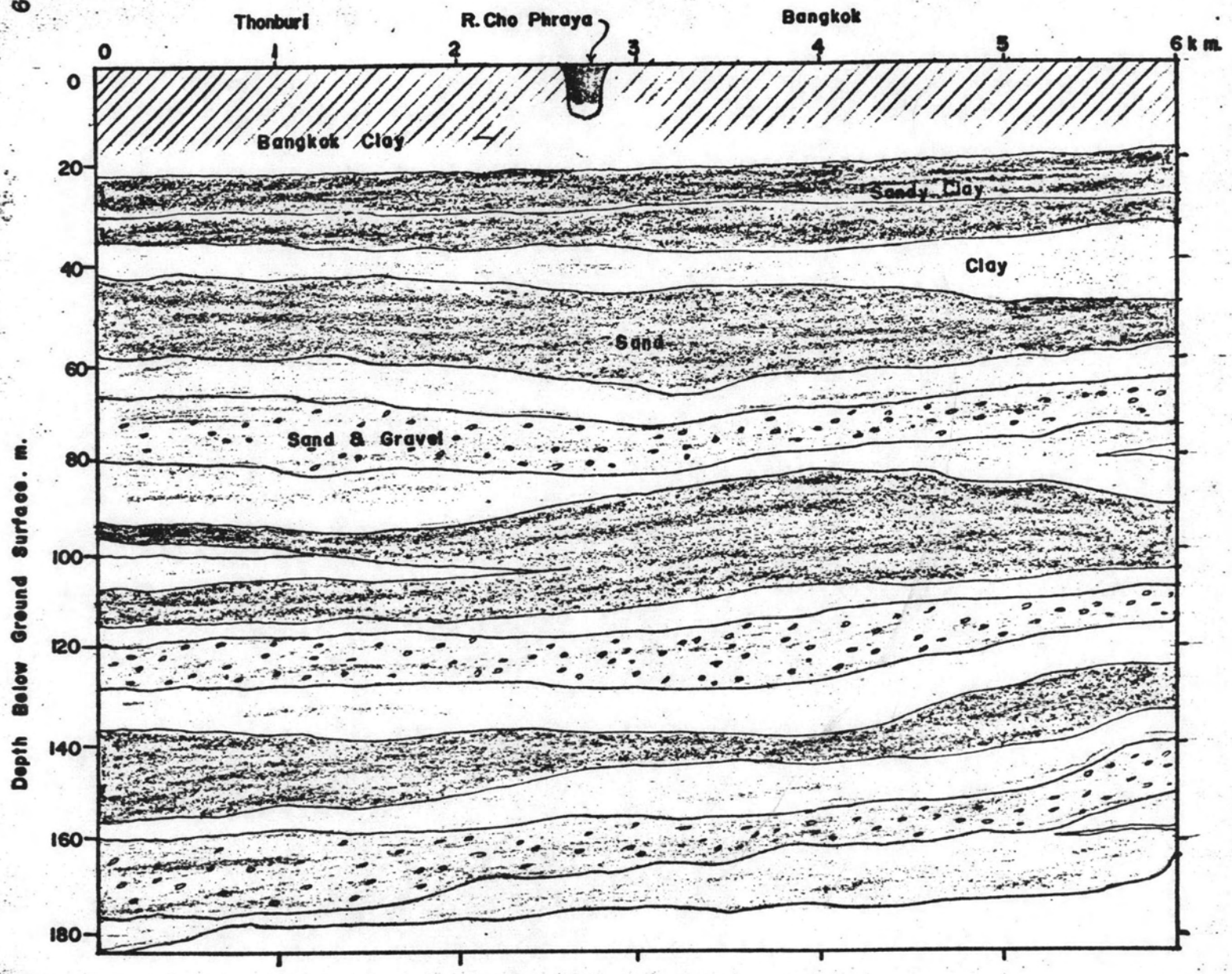
Owing to the fact that Thailand is situated in the tropical zone, high precipitation created the leaching effects to the primary minerals which leads to the process of rapid removal of bases. This was explained in Buchman and Brady's theory of weathering processes. From the theory, Alumino-Silicates when it was subjected the process of rapid removal of bases, this primary mineral would be derived to kaolinite except Muscovite, Micas and Biotite whose potassium content was leached out and during which H_2O was absorbed by these primary minerals. In such cases, the derivation was resulted in Hydrous Micas, (Illite)

Therefore, clay mineralogical compositions of the surface soils in the North and the North-East are composing of kaolinite, illite, and montmorillonite. These zones provide the original sources of minerals for terrestrial & marine deposition of the Bangkok clay layers.

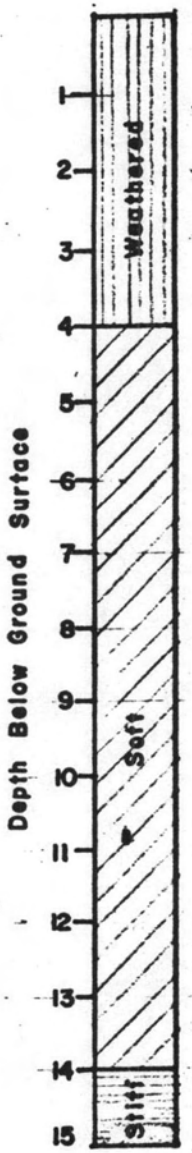
Moreover, from the study made by Moum and Rosenqvist (1957), illite which was deposited by marine depositions

would be derived to montmorillonite by oxidation processes.

Hence, it may be hypothesized that Bangkok clay should compose of the mixed minerals namely Kaolinite, Illite, Montmorillonite and very small amount of Chlorite and Vermiculite and the predominant mineral should be Kaolinite.



Geological Section Through Greater Bangkok (after MUKTABHANT. 1963)



Typical Profile Of Bangkok Clay (Moh et al. 1969)

Fig 1