

UNIVERSITI TEKNOLOGI MARA

**A COMPARISON OF GROUND
SETTLEMENT RESULTS WITH
THOSE PREDICTED USING
TERZAGHI AND ASAOKA
METHODS**

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ABSTRACT

Constructions on soft ground have often given rise to a number of critical geotechnical issues especially those related to ground settlements. Excessive post-construction settlements, which may be of total or differential nature, have always posed a serious problem to all parties concerned in the project. Insufficient knowledge of existing ground conditions due to, say, lacking a proper site investigation coupled with inadequate design; particularly in foundation are among the likely causes for the problem. For those critical cases settlement problem may lead to eventual failure of the structures constructed over it. The main objective of this study is to correlate and compare settlement results observed in the field with those theoretically predicted by Terzaghi's (1996) one-dimensional consolidation theory method and Asaoka's (1978) graphical plot approximate method which nevertheless relies on an "observational procedure" for settlement prediction. In addition, possible factors that can lead to the yielding of excessive settlement beneath housing property in Shah Alam of Selangor will also receive attention. Through appropriate tests conducted both in the laboratory and in the field the relevant properties of soils at site to facilitate subsequent research analysis were established and from these tests conducted the type of soil in the subgrade is identified to consist mainly of soft clay. To name a few of laboratory tests carried out are Particle Size Distribution, Atterberg Limits, Specific gravity Test and One-Dimensional Consolidation. For field tests conducted they are the Standard Penetration and Ground Water Level monitoring. Subsequently, based on soil properties obtained ground settlements were produced, one theoretically using Terzaghi's method and the other assessed empirically via Asoka's graphical solution. From the results obtained comparison among them were made where it revealed that settlements derived from Asaoka method is at least three times higher than that from Terzaghi's. Perhaps it is worth mentioning that observations made during the course of study had shown clearly that the settlements occurred at site is considerable and after some careful consideration, it was thought that in the presence of very soft clay at site the exclusion of any suitable ground treatment method prior to construction is the main contributory factor for critical situation experienced at the site today. Furthermore, serious disturbance in the form of vibration imparted by major constructional activities in the vicinity of development site is thought would accentuate the already severe settlement problem there. In the current investigation, among one of the main objectives is to examine the usefulness of two potential methods, one being theoretical as in Terzaghi's and the other semi-empirical of Asoka in arriving at a good estimation and thus prediction of ground settlement that might occur in the soft compressible subgrade layer especially during post-construction time. Subsequently, should such a settlement prediction tool be established then it will allow future engineer to have better chance of designing safer structures over soft ground through the adoption of preventive measures prior to construction and thus avoiding the development of excessive settlements during the post-construction years.

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CHAPTER ONE

INTRODUCTION

1.1 Research Background

Construction of embankment over soft compressible soils has often resulted in the development of significant settlements in subgrade and in the newly constructed structures above it such as embankment and building platform. This situation often occurs in soft subgrade which may comprise of silty, clayey soils or a combination thereof. In the case of clay, there are two definitions based on their stress histories. According to Braja & Khalid (2010) normal consolidated clay refers to a case where overburdened pressure presently applied on the building platform is less than what the foundation soil has ever experienced in the past.

In addition, based on Braja & Khalid (2010), consolidation of compressible soil is a process that occurs in saturated soil whose volume is reduced through expulsion of pore water via loading applied upon it. In the case of normal consolidated and/or marginally over-consolidated clayey foundation soils, consolidation settlement is often the major contributor of vertical deformation of embankment that is built upon it. In general, apart from immediate settlement that takes place during construction, the total consolidated settlement of the ground is contributed chiefly by primary consolidation and to a much lesser extent the secondary compression settlements (Arulrajah & Bo, 2010).

The current study is based mainly on a roadway along Jalan Plumbum (or Plumbum Road) at Seksyen 7, Shah Alam where according to the site investigation report produced by G&P Professional Sdn Bhd., and historical account of the site, the soft ground in existence at the site has not been subjected to proper treatment of any kind prior to the commencement of construction. As a result, problems related to settlements began to appear during post-construction period and in rectifying the various problems surfaced, the client of the project Perbadanan Kemajuan Negeri Selangor (hereinafter referred to as "PKNS") suffered significant financial losses.

In the current study, theoretical settlements of soft clay underlying roadway (Jalan Plumbum) embankment are determined using Terzaghi and Asaoka methods