CHAPTER 1

INTRODUCTION

1.1 GENERAL

In routine foundation design, it is assumed that the foundation is rigid compare to the soil and that the soil pressure distribution is linear. This assumption is approximately true only if the soil is homogeneous and the footing is rigid but may not be true in all the cases. In actual practice, it is very difficult to make a rigid footing. The pressure will be uniform only if the location of the resultant load coincides with the centre of the footing.

Other method of designing foundation is the elastic method and in this approach the soil is assumed to behave as an elastic material. When analyzing the foundation using these two methods separately, bending moment, shear force and soil pressure underneath the footing and with the sub grade reaction and the bearing capacity of the soil.

Foundations for buildings, retaining walls, piles and many other structures and structural elements are analyzed and designed as Elastic Foundation method and Rigid Foundation analysis method. Beams on Elastic Foundation are not limited to the area of Civil-Structural Engineering. These methods are used in various areas of Mechanical and Geotechnical Engineering as well.

Currently analysis of beams on elastic foundation is performed by using structural engineering software and most of the computer programs are developed for Winkler's soil model leaving no other options for the practicing engineer.

Analysis of both rigid and elastic method can be performed using structural analysis software SAP 2000 [6]. In the event of analyzing elastic case of strip foundation winkle model would be used and for rigid case it is designed as uniformly distributed system. By varying the spans of the columns, identical high rise building models are analyzed for two cases completely.

It is intended to compare the results of two cases, especially to study how the soil pressure bending moment & shear force vary.

1.2 MAIN OBJECTIVES

When strip foundations are designed, study on variation of soil pressure, bending moment and shear force acting along the beam underneath the foundation is an important aspect and cannot be ignored. This research is thus intended to study the behavior of soil pressure variation, bending moment and shear force of a strip foundation with different types of soil properties, especially, bearing capacity and sub grade reaction of the soil by varying the types of the foundation structures.

The research is mainly conducted 3D modeling of building structures with the foundation of inverted T type strip. Another objective would be to identify the soil pressure variation not in a practical case but using a theoretical approach, the structural analysis software of SAP 2000. [6]

1.3 METHODOLOGY

In order to achieve the above objectives, the following methodology is adopted.

1. Several building models are considered for the proposed project as listed below:

    a. Six storeyed building of 3 m column spacing

    b. Six storeyed building of 4 m column spacing

    c. Six storeyed building of 5 m column spacing

    d. Six storeyed building of 8 m column spacing

2. 3 D models were prepared for each building using SAP 2000 structural design software [6].

3. For each building, foundation is selected as inverted T type strip which is provided in the X direction of the model. In Y direction, all columns were connected rectangular in shape ground beams over the inverted T beams.

4. In idealized rigid foundation and elastic foundation, two types of soil behavior are applied. Uniformly distributed soil pressure is selected for rigid case and an idealized model of soil media proposed by Winkler (1867) is considered for elastic analysis. Physically Winkler's idealization of the soil medium consists of mutually independent spring elements.

5. Only vertically downward loading conditions of the building such as dead and imposed load were considered.

1.4 MAIN FINDINGS

1.4.1 Soil Pressure

In this research four six storied buildings and one four storied building are analysed with identical parameters for each span. Observations are made how the soil pressures under the foundation varied with the spans of the inverted tee type beams and all soil pressure details are shown in the graphs.

It is observed that when analyzing the soil pressure variation, especially in rigid case, pressure directly under the column is assumes relatively higher values and at some instances it had exceeded even the safe bearing pressure.

Soil pressures in the edges of the strip foundation significantly vary for both rigid and elastic analysis. In rigid analysis pressure is much lower than the allowable bearing pressure but in elastic analysis pressure developed in edge sections were higher than the allowable bearing pressure.

In elastic analysis, pressures under the middle sections of the strip beams do not vary much even if the spring constants are varied. It follows the spring constant related to minimum allowable bearing pressure.

1.4.2 Bending Moment

If cantilever section is available beyond the outer column in the strip beam and when considering the bending moment variation along the beam it is seen that the bending moment in cantilevered sections are higher in elastic case irrespective of the span

variation of the beam. Bending moment in joints of columns & beam and adjacent areas shows a comparatively higher bending moment in rigid case of analysis for all spans variations.

It is observed that bending moments vary with both span of the beam and the behaviour of the soil condition underneath of the beam. It shows that if cantilevered sections are not available in the strip beam, bending moment would be higher for rigid analysis case rather than elastic analysis case at all joints of the beams.

4.2.1 Shear Force

Analysis shows that shear forces along the beam varies for both rigid cases and elastic cases. Values of shear force at the joints for all the spans of the beam are higher than that in the elastic case. Shear forces along the beam in elastic analysis varies in a continual manner but not in a continuous manner at the places where springs were fixed.

1.5 ARRANGEMENT OF THE REPORT

This thesis consist of five chapters in order to give better clarification of the research project and to get enhanced knowledge on foundation engineering designs mainly encountered in the field of structural engineering design.

The chapter 1 describes the introduction including background, main objective and main findings.

The chapter 2 is focused on literature review. It describes the various types of foundations used in many areas of structural engineering design and the design procedure etc.

The chapter 3 is described about the procedure that was adopted in this research project.

The chapter 4 explains the results obtained after the analysis and discussion about the results.

Chapter 5 describes conclusion and future work, any researcher or interested parties will benefit for designing of high degree of safe and greatly concern economical strip foundation design.