Chapter 1

INTRODUCTION

1.1 Introduction

The determination of lateral earth pressure against the retaining walls is one of the oldest questions in civil engineering field. Rankine (1857) investigated the plastic state of stress, when the failure is imminent. Lots of theoretical and experimented works have been done in this field; many theories and hypothesis have been proposed.

This study is carried out mainly for improvisation of the ‘retaining structure’ as it is an indispensable feature of civil construction projects, especially all types of bridges, high walls in hilly terrain, etc with suitable type, proper design and reasonable estimation. These modifications help to save thousands of rupees in projects involving retaining structure. It is noticed that the losses occur to the tune of 20 to 35% in terms of time, energy and money. It is also observed that these losses of resources could be avoided if effective alternatives are considered and used in practice.

A retaining wall is a structure designed to sustain the lateral pressure of earth behind it. It retains a steep faced slope of an earth mass against rupture of slopes in cuts and fills and against sliding down. Earth retaining structures may be retaining walls, sheet piling, bulkheads, and basement walls, other permanent, temporary structures used in earth works and foundation engineering that retain vertical or almost vertical slopes of earth masses.

The lateral force acting between the retaining structure and the retained earth mass is termed as lateral earth pressure. The earth mass behind the retaining structure may be in its natural state or in a disturbed condition i. e. backfilled earth. Retaining
walls are encountered and constructed in various fields of engineering such as roads, harbors, dams, subways, railroads, tunnels, mines, and military fortifications.

One of the major disadvantages of all reinforced retaining walls is that they are susceptible to damage by impact, and are sensitive to volume changes caused by temperature oscillations, frost action and associated phenomena. A counter forted wall is a reinforced concrete retaining structure strengthened on the backfill side by a vertical slab of a wedge shape. Such walls are used for heights over seven meters, are suitable for heavy surcharge and they result a statically very stable structure. The buttress type retaining walls are sometimes built depending upon the configuration of the building site and limits of property line to save material. This results in reduction of weight of retaining wall. A crib wall is essentially a gravity earth retaining structure and can be quickly erected. Crib walls are made of timber or of pre-cast concrete or steel sections. Such walls resemble a rock filled log crib.

1.2 Retaining Wall with Pressure Relief Shelf

Retaining wall with pressure relief shelves is one of the special types of retaining wall. High R. C. C. retaining walls may be used economically by providing relief shelves on the back fill side of the wall. Such walls may be termed as the Retaining Wall with Pressure Relief Shelf. Providing one or more relief platforms or shelves, extending them to the rupture surface, can considerably increase the stability of retaining wall. The relief shelves have an advantage of decreasing the overall lateral earth pressure on the wall and increasing the overall stability of the structure. This results in an economical design because less material goes into the wall as compared to massive structure of cantilever or even counterfort retaining walls without the shelves.
Study of retaining wall with pressure relief shelf is somewhat an un-noticed area in the field of Geotechnical Engineering. Very few studies have been carried out so far on this topic. It is also observed that rarely such retaining wall structures are constructed. The study of this type of retaining wall is therefore important to see the performance of such wall. The analytical and practical solutions regarding reduction in earth pressure is interesting to observe.

1.3 Objectives

The basic objective of this study is to check the suitability of cantilever Reinforced Cement Concrete Retaining wall by providing relief shelves. Following are the objectives of this investigation;

1. To develop the laboratory scale model of cantilever retaining wall with and without relief shelves.

2. To observe experimentally the earth pressure distribution mechanism behind retaining wall with relief shelves of different widths factors and location factors.

3. To carry out the comparative study of analytical results with experimental results obtained from the model studies.

4. To use Rankine’s Method of Analysis for active earth pressure and to observe its suitability for analysis of retaining wall with pressure relief shelves.

5. To study the cost comparisons of cantilever retaining wall with and without relief shelves and also suggest the suitability of retaining wall with pressure relief shelves.

6. To develop a computer programme for the analysis and design of cantilever retaining wall without and with single relief shelf.
1.4 Thesis Layout

The thesis comprises six chapters. Chapter 1 highlights the importance of retaining wall in general and retaining wall with pressure relief shelves in particular. This chapter ends with objectives of this investigation. The previous studies of retaining wall and also retaining wall with pressure relief shelves are included in Chapter 2. Theoretical analysis of retaining wall with and without relief shelves by Rankine's theory is included in Chapter 3. Development of Instrumented model of retaining wall with relief shelf is discussed in Chapter 4. The results and discussions on theoretical and experimental results are added in Chapter 5. Conclusions are highlighted in chapter 6. Future scope of this investigation is quoted after conclusions.