CHAPTER - I

INTRODUCTION

In geotechnics, the topic 'stability of slopes' is dealt with from two engineering points of view - namely (i) the design of man-made slopes of cuts and fills in advance of new earthwork construction with prescribed safety requirements against failure and (ii) the study of stability of existing slopes of rocks, and earth, slopes which are potentially unstable. The slope stability evaluation is often an inter-disciplinary endeavour requiring concepts and expertise from engineering geology, soil mechanics and rock mechanics. Natural slopes which have been stable for many years may fail due to external disturbance in the form of excessive foundation load.

Civil engineering structures are generally constructed on plane ground surface but construction of such structures on top of a slope or on the slope is not uncommon and is more frequent in hilly regions. The investigation of bearing capacity of loaded slopes is one of the very important aspects in design of such structures because they are more liable to fail than other types of earth structures. The design of such structures includes considerations pertaining to bearing capacity of the soil formation, settlement and stability of structure interrelated with the stability of the slope itself.

The selection of the method of analysis depends on the type of design ; i.e., whether it is a new design or it is a corrective design. It also depends on the anticipated or actual shape of the failure surface, reliability of information, regarding the strength parameters and ground water conditions within and around the zone of failure mass.

Generally, a significant amount of information on soils, ground water conditions and soil properties is available for new slopes but the locations and shape of the failure surface are unknown under the foundation load. As such, model analysis of footings on top to slope has become necessary. Model analysis of foundations has become a sufficiently reliable method of foundation design and investigation. Due to development of the theory of models, techniques of measurements and working out of new model materials, the method of model studies became highly powerful and reliable approach to investigate both local and overall foundation behaviour. The models also can be used as design tools providing comparatively rapid designing of complex foundation problems which cannot be only designed by means of theoretical methods.

The model studies being an experimental method has an additional advantage over experimental investigation of full-scale foundations because they are simple, economical and at the same time equally reliable. It does not, however, mean that model studies can altogether replace investigation of full-scale foundations in all cases. It is therefore possible to conclude, that the model study is a versatile useful method to solve some particular foundation problems.

At present (1986) many types of slope stability analyses are available in the literature but only a few methods have gained popularity among the designers. Generally, for design of slopes two types of analysis based on the shape of the failure surfaces - namely (i) circular slip surface analysis and (ii) general slip surface analysis are available. Circular failure analysis is the most popular in design work and is one of the earliest methods of slope stability analysis appearing in some of the early works of Fellenius (1927). The classic 'Charts of Stability Numbers' by Taylor (1948), is still used to-day for simple cases of homogeneous slopes. Bishop's (1955) method, which considers circular failure of nonhomogeneous slopes, has been used in computer programs which allows a search for the most critical failure surface. This method is particularly used for design work where failure surfaces cannot be readily determined.

Some of the slope stability analyses using general shape of failure surface has been studied by Janbu (1954), Morgenstern and Price (1965), Nonveiller (1965) and Bell (1968). Morgenstern and Price method has been used as a tool for research work.

It is well known that various investigators went on refining the analyses of slope stability while incorporating the possible variations like slope of failure surface, interslice forces and their relations, pore pressure, inhomogeneity of soil but mostly under the self weight of the soil mass alone. While some others developed the theories relating to the load carrying capacity of the slopes, no one seems to have considered simultaneously both load carrying capacity and stability of the slopes particularly under external load acting away from the edge of the slope.

In this investigation it is intended to study both the aspects of bearing capacity and stability under the arbitrary external load of the footing acting away from the edge of slope and at the same time model experimentation is thought to be the most useful tool for the investigation to study the various aspects of footing size, edge distance and slope angle of the soil formation.