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Techniques used to protect embankment slopes at Rajiv Gandhi Education City (Sonepat)

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ABSTRACT: Highways, railways, dams, canals, stockpiles do have embankments as per geometric design and topographical requirement. Slopes of embankment need to be stable for the safety of the structure. In the present study various techniques used for stability of embankment slope of in Rajiv Gandhi Education City (Sonepat) are discussed. In order to meet geometric design requirement considering, terrain condition and to minimize the cost of construction, roads and rails are built in cut and fill sections, resulting in natural or artificial embankment slopes. Stability of these embankment slopes always remains a worry to highway and geotechnical engineers. A number of failure causing forces acting on embankment slopes include gravitational force, flowing water, pore water pressure, wind force and loads the structure is subjected to. Depending upon the height of embankment and other factors such as type of material used, financial status, availability of space etc. various slope protection techniques are used. These techniques include RCC retaining wall, RE walls, drainage chutes, use of geosynthetics, providing vegetative cover on the slopes, stone pitching etc.

INTRODUCTION

Slopes either occur naturally or are constructed by humans. Slopes stability has been faced throughout history when men or nature has disrupted the delicate balance of natural soil slopes. There exists an inherent tendency in the slopes to assume a more stable a more stable configuration. If there is only tendency to move, it can be considered as instability but if actual movement of soil mass occurs it is termed as slope failure. The most important of forces which cause instability are gravitational forces and seepage forces. Landslides, slips, slumps, mudflows, rock falls – these are just some of the terms which are used to describe the movement of soils and rocks under the influence of gravity. Man-made structures such as highways, dams, levees, canals and stockpiles are constructed by sloping the lateral faces of soil because slopes are generally less costly than constructing a wall. Engineers have to pay attention to geology, surface drainage, ground water and the shear strength of soils in assessing slope stability. Slope failure, in general are caused by natural forces, human misjudgement and activities of burrowing animals. In road constructions, a flow slide occurs when internal and external conditions force soil to behave like a viscous fluid and flow to even shallow slopes, spreading out in several directions. Flow slides can occur in dry or wet soils.

Engineers generally use concrete, rock wall or framework to fix the excavated slopes or road embankments. Now bio-engineering methods are also been used to protect the roads and slopes along the road. Slope is considered stable if shearing resistance within the soil mass is larger than the shearing stress. Stresses are induced due to soil mass itself and the imposed loads such as loading due to structures above slope. Saturation and pore water pressure building up can cause slope failure. Drainage chutes are provided to drain off water which prevents slope failure. Mostly we use geometrical method to stabilize slope where land is available for widening and we use retaining structures like RCC wall, RE wall etc. where area is constrained, however it proves to be costly but provides flexibility during construction.

I. OBJECTIVE

The objectives of the study are to define the various measurable configurations of slopes and classify various slope failures, to study prevailing and new remedial techniques and also method and design elements for slope protection at newly constructing slopes. Study of typical slope failures were carried out by visiting and inspecting the site. The various remedial techniques were seen at the site and identify the most widely used method. In this case we use vegetation yo protect the erosion of soil.

II. LITERATURE REVIEW

In every slope there are forces which tend to promote down slope movement and opposing forces which tend to resist movement. A general definition of the factor of safety, F, of a slope results from comparing the down slope shear stress with the shear strength of the soil, along an assumed or known rupture surface. Starting from this general definition, Terzaghi divided landslide causes into external causes which result in an increase of the shearing stress (e.g. geometrical changes, unloading the slope toe, loading the slope crest, shocks and vibrations, drawdown, changes in water regime) and internal causes which result in a decrease of the shearing resistance (e.g. progressive failure, weathering, seepage erosion).

There are ground conditions such as weak strength, degree of weathering, fracturing, internal structure which are influential criteria not causes. These conditions lead to development of unstable slopes. There is also role of the other factors such as extent of stress, pore water pressure, temperature etc. So if the ground is weak it is not necessary that it will lead to a failure, there is an effective process that results in a failure. This process can be natural or by human action.

Factors inducing slope failure:

i. Gravitational force

Gravity is the force acting everywhere on the Earth's surface and it pulls everything towards centre of Earth. It is mainly responsible for the mass movement.

ii. Water

Addition of water from rainfall or snow melt adds weight to the slope which causes instability. Water may enter into existing cracks and may weaken underlying soil layers leading to failure.

iii. Earthquakes

Earthquakes induce dynamic shear forces that reduce the shear strength and stiffness of soil. Structures founded on these soils would collapse.

iv. Erosion

Forces such as water and wind continuously erode the natural and manmade slopes. Erosion changes the geometry of slopes and causing failure of slope ultimately.

v. Geological features

Many failures occur due to unidentified geological features. There are soil that contain a high proportion of certain type of clay mineral called montmorillinites. Such clay minerals expand when they become wet.

vi. Loading

Loads placed at top of the slope add to gravitational load acting on it, which may cause slope failure. While the load placed at the toe will increase stability of slope.

vii. Human activities

Construction activities near the toe of an existing slope can cause failure because lateral resistance is removed. In case of excavation the total stress is reduced and negative pore water pressure is generated in the soil.

Viii Liquefaction

Liquefaction occurs when loose sediment becomes oversaturated with water and individual grains loose grain to grain contact with one another as water gets between them

III. FINDINGS

There are many methods for stabilisation of slopes. Based on the observation that have been made on few stretches in Rajiv Gandhi Education City (Sonepat) methods employed are of following types: This erosion is caused mainly by water and wind. As the soil is mainly silty sand, it get easily blown away with wind. Lack of permanent vegetation increase the effect of wind. The impact of rain drops on the soil surface can break down the loose soil lumps and disperse the soil. Runoff occur whenever there is excess water on slope. The effect of runoff becomes more pronounced with greater slope length. This sort of problem is very common in case of newly constructed embankments as the slopes are left uncovered after construction. The measures for protection of embankment slope are mainly as follows:

- Laying a layer of top soil which is more resistant to erosion (clay in nature).
- Mulch
- Vegetation.
- Gravel protection.
- Providing drainage chutes.
- Geosynthetics.

Considering all the factors responsible, results of laboratory analysis, stability analysis and the various measures available, the following measures after repair of slopes are suggested for protection:

i. Drainage chutes for runoff water.

- These measure are suggested because the main problem is due to runoff water and rain drops.
- Drainage chutes will provide passage for runoff water.
- This will prevent the formation of gullies.

ii. Vegetative cover of slope surface.

- Vegetation will protect the slope surface from direct impact of rain drops, thus soil does not get dispersed.
- Vegetation roots binds the top soil and the resistance against erosion is increased.
- Vegetation protect the soil against wind force.

Figure - Slope with drainage chutes and vegetation

CONCLUSION

a) The study can be conducted using different materials such as by adding lime, fly ash and using cement of different grades.
b) This study can be conducted on different type of soils with different characteristics.
c) The analysis of slope stability can be done using advanced software which will give more accurate factor of safety.
d) In this study the Direct Shear test is used to find the shear strength parameters. It can be extended with test such as Triaxial test which is more accurate and various condition of drainage and consolidation can be simulated.
e) The effect of vegetation on slope stability can be studied.
f) In case of residential areas or where enough area is not available for workability retaining walls and reinforced earth wall are mostly used in case of our observation on the national highway.
g) Vegetative cover is provided on the slope usually in combination of other methods such as geometrical method, drainage etc.

REFERENCES

[1]. Gopal Ranjan, A.S.R. Rao,"Basic and applied Soil Mechanics," New Age International 2004 edition.
[2]. http://www.tulane.edu/~sanelson/Natural_Disasters/slopestability.htm.
[3]. N. Mizal-Azzmi, N. Mohd-Noor, N. Jamaludin, Geotechnical Approaches for Slope Stabilization in Residential Area, 1877-7058 © 2011 Published by Elsevier Ltd. doi:10.1016/j.proeng.2011.11.190.
[4]. Terzaghi K "Mechanisms of landslides," Geological Society of America, Berkley Vol, pp 83–123, 1950.