A STUDY ON SOIL STABILITY AND SLOPE ANALYSIS OF LANDSLIDES ALONG RAILWAY LINE BETWEEN SAKLESHPUR AND SUBRAMANYA

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INTRODUCTION:
The movement of mass of a soil in a downward direction of a slope is called a slide or a slope failure. The failure of a natural slope is a common geological phenomenon occurring whenever an imbalance takes place between shear strength and shear stress in the ground. The first sign of an imminent landslide is the appearance of surface cracks in the upper part of the slope, perpendicular to the direction of the movement. The instability is either due to increase in seepage pressure, due to excavation of slope toe material, due to increase of shear stress from surface loading as a result of construction or train traffic. The slip may occur through the fill, through the base or through foundation. A number of design approaches are available. Design methods of analysis for determining the stability of gabion walls are based on The Code of Practice BS 8002. The two methods considered are:
1. Serviceability Limit State Design

However, in this study the most commonly used analysis was based on Ultimate Limit State, where the structure had to meet certain factors of safety on sliding (1.5) and overturning (2.0). The soil forces being determined on the peak soil conditions. Traditionally retaining walls of masonry, concrete or RCC are used to hold back earth along cut or fill where safe side slopes cannot be provided due to inadequacy of space. However, gabion walls are finding increasing use in modern construction due to their flexibility in design, flexibility of construction over poor subsoil condition and capacity to withstand differential settlement. These gabions are manufactured from a square mesh, where the longitudinal wires are welded to the cross wires at their intersection points. This type of fabric manufacture, produces a dimensionally stable mesh. They are utilized in a range of applications in many areas of Civil Engineering like geotechnical, transportation, water resources, environmental, coastal and erosion control engineering for achieving technical or economic benefits.

OBJECTIVE:
Landslides are the most common hazards which modify the surface morphology of the orogenic belts. Structural conditions and nature of slope forming material play vital role in the development of surface morphology. The project work highlights the influence of structure on slope morphology and consequent instability pattern in between Subramanya and Sakleshpur of south western Railway line. The area is punctuated by many landslides of various
dimensions affecting all the lithological units present. However, study is based on three major landslides occurring adjacent to the railway line between Sakleshpur and Subramanya namely, railway tunnel no 50, 22 and near Arebetta. Structural data shows that thrust environment has crushing and shearing of rocks, which play an important role in landslides proneness along with the rainfall intensity. This study includes the precautionary measures to overcome all the problems faced. The main objective of the study consists,
1. Characteristic study of soil.
2. Topography of the area.
3. Remedial measure to stabilize soil and slope.
4. Earth embankment structures.
5. Design of economic structures.

**METHODOLOGY:**
1. **Geology of the area:**
   Rocks of Peninsular Gneiss and Western ghat scarp, Red loamy soil and laterite soil occurs in the area. The area is punctuated by many landslides of various dimensions affecting all the lithological units present.
2. **Rainfall details collection:**
   The rainfall of the area is uneven that is not uniform throughout the area. The average rainfall of the area is 2500 mm.
3. **Study of vegetation:**
   The types of plants, trees, crops present there should be study. It’s a tropical rain forest.
4. **Reconnaissance survey of the area:**
   The site visit has been done and the reconnaissance survey has been carried out.
5. **Study of pre-existing failure surface:**
   The pre-existing area that has been undergone failure and the causes for the failure and type of failure has be carefully analysed.
6. **Finding tension cracks:**
   The tension cracks that are already present in the land has be clearly found out, analysed and studied about them.
7. **Test on soil:**
   The soil sample was collected from the area and test has be carried out to find the basic properties of the soil.
8. **Permeability test on soils:**
   To know the permeable conditions of the soil the soil sample collected are tested in permeability test apparatus.
9. **Erosion control measures:**
   Water is the main cause of slope failure. Therefore, we should provide proper drainage in the study area.
10. **Design of Gabion walls:**
    Based on BS 8002 code book the design of the gabion wall has been carried out. The structure is checked against sliding, overturning and load-bearing capacity.

**CONCLUSION:**
It may be concluded that the slope failure along railway line between Sakleshpur and Subramanya occurred due to a number of causes. The primary causes being infiltration of rain water due to non- homogenous and soil erosion. Improper drainage of water and steep slope compounded the failure. The remedial measures adopted consisting of concrete retaining wall
have not been successful. The inclined Gabion wall have been proposed in this study to prevent any further slope failure. However, it is recommending that a MSE Gabion wall may be constructed taking into consideration of local site conditions and topography. The gabions are provided up to a certain height which will avoid the collapse of the slope on the track. If the entry of the soil is retained in to the track the trains movement is safe. Gabions are highly permeable and prevent the build-up of water pressure. They are flexible and conform to difficult site geometry and can adjust to differential settlement and lateral movement. They are also cost effective as the rock fill available at the site may be used and can be constructed in small time frame. It is also an eco-friendly structure and permits the growth of vegetation.

**FUTUREWORK:**
1. The same study can be carried out for the geosynthetics. The most common types are - Geotextiles, Geogrids, Geonets, Geomembranes, and Geo-Composites which are used in contact with soil, rock and/or any other Civil Engineering related material, as an integral part of manmade structures.
2. The soil nailing technique can be applied for the same.
3. Proper maintenance of slopes and drainage studies by proper techniques can be studied.
4. The new techniques of benching to avoid soil erosion can be studied.
5. The retaining wall techniques for suitable and required areas of slope which causes destruction to the movement of trains can be analysed and proposed.
6. The studies can be carried out to cover the area by turfing method.