Evaluation of Geosynthetic for Increasing the Slope Resistance Using Plaxis Software

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Abstract: The increasing world population and necessity of optimum using the shore lands have brought about more researches on designing and performing shore dikes and rebirth of shore lands. Different computer models have been improved for designing the dikes. In last de code, Netherland as one of the first countries in performing shore dikes has improved two developed models of Diana and Plaxis. For applying this thesis, here is the equipment of Hendijan shore dike in khouzestan province which is 40 KM length and has been equipped using two general methods. The first is equipping the dike frame using synthetic thread (Silk) in parallel layers in the slopes of both sides of dike frame; the second is by using layers of synthetic Silks in dike bed. The presented analysis is limited to part methods which carried out by PLAXIS software. And the parameters have been used according to accessible materials in south shore and the site of Hendijan. The more important in this research is decreasing of the sides slopes of shore dike according to maintenance of its resistance; this decrease is by synthetic silk materials and growing of resistance factor. The purpose of this design is land retrieval, improving agriculture and fishery in Hendijan delta and optimizing the performance of shore dike.

Key words: Geosynthetics %Slope resistance %Plaxis %Optimum Length

INTRODUCTION

Today using polymers for equipping weirs, especially in building the barriers of armed soils and shore walls, have been very significant. Arming soil method is mainly based on mutual friction between soil and arming elements. By creating reliable synthetic materials in last fifty years using these materials in engineering have increased. Gradually, with accepting their applying roles, especially in these 15 years, designing and making soil synthetic materials or Geosynthetics in architecture operations have had an important technological development. Main usages of geosynthetics are in inappropriate slopes or beds and for building special. Buildings, as well as performing landscape and arming soil, Geosynthetics are textiles wade of silks of oil derivatives which their main feature is that they aren’t decayed against soil internal factors. The more important of these are geotextiles, geograds, geomembranes, geodrains, geocells and etc. and each one is, according to its features, is used in road and band, water and barrier, Hydraulic, soil, geotechnic, oil and gas and petrochemical, or architecture [1]. The purpose of this research is to study the using of geosynthetics as an arming and utilizing the materials of oil derivations in proofing the barrier house tops and dike beds by using PLAXIS software. In this study, by selecting the suitable Hendijan shore dike and using PLAXIS model, the length of armaments and their distance from dike slope as well as its effect on reliability factor have been appreciated.

A Review on References: In 1981, by remaking a casting chip in England with using georade a more developed applying of these materials have been found [2] and after that this technical was used in Germany an US. Using cane straw in Italy and canvas in Netherland, US and England for enrichment of river and road weirs created. Consuming first generation of polymeric geotextiles from 1950s began when their using was as new filters; and this period of it started from 1960s and grew with utilizing fabric geotextiles as filter cover ages and armament of roads, airports, barriers and soon. Today's in making different constructions and specially Hydraulic ones the geotextiles are used most; so that in 1960 the first utilizing of geomembrane synthetic layer was used in barriers by with using 10000 m of P.V.C plate as layer in some barrier...
Parts in Canada [2]. In 1970, in walcerass barrier of France, the geotextile was used as a filter in two different parts of the barrier-in the below part of the slope for covering and keeping the sandy sewer materials and in top slope of it, between the weir layers. [4,5]. Until 1990, in south of America, there were used about 500 million meters of geotextiles and until 1989, 90 million meters of P.V.C were sold for producing silk which its selling is about 0.1 of geotextile, because it is more expensive comparing to geomembraines. Today, synthetic materials are made by 75 productions throughout the world and relate basic developments in materials with simulteneous improvement in managing technology [5].

Theory: Generally, it can be said that the main factor in breaking sloped surfaces is the ten city of cutting resistance in the breaking level; so the calculation of sloped surface resistance is, in fact, the comparing of forces that cause the detachment and forces preventing this detachment. Forces which are considered in calculation of slope surfaces resistance are:

**Destructive Forces:** These forces which cause trembling in sloped surface are destructive forces. One of these important forces is the mass soil weight on top of the breaking level. It may occur that a combination of some factors causes the trembling, which are:

- C Increasing the external load on the sloped surface such as building, water, etc.
- C Increasing of soil weight because of increasing of humidity percentage.
- C Excavation in a part of the sloped surface.
- C Constructing a tunnel by the water string.
- C A blow such as explosion or earthquake.

**Resistant Forces:** The sum of forces which prevent the trembling of sloped surface more significant than the resistance of cutting resistance in the level of breaking. The decrease in the cutting resistance in this surface causes trembling of the sloped surface. Some of the causes of this decrease are:

- C Clay distension caused by increasing of humidity percentage.
- C Pressure of outlet water.
- C Cracks caused by repeatedly wet and dry soil
- C Transition and growing of detachment in case of sensitive soils.
- C Dissolving of the attaching ingredients of soil particles.
- C Dissolving of the outlet negative pressure [10,13,14].

Finding the real trembling level is one of basic problems in calculation of sloped surface resistance, soil mechanic researches haven’t been successful in defiant determining of the form of trembling surfaces and the kind of internal tensions distribution. For a sloped surface it is usual to select several trembling levels and calculating the sure factor for all of them. By accessing the impetus of forces, the sure factor is by the following. F= all resistant impetus / all destructive impetus

The least sure factor for soils without tack is 1.7 and for all soils is considered by 1.5 In case of soil housetop resistance, based on Flenius suggestion; the sure factor is present cutting ratio(s) to needed cutting consistency for the resistance:

$$FS = \frac{S}{t}$$

Here, S=on tan n+C and B = n tan n + Cr that C and n are parameters of consistency, Cr an nτ is the minimum of these measures for resistance. If FS<1 is reached, trembling will be % cured and for FS>1 it is resistant housetop [7].

Fig. 1: Circle detachment.
**Housetop Resistance:** As it is said before, the housetops are natural weirs or made by human beings which is the sloped soil and in a usual position it is balance. This detachment is assumed as circle. In figure, the housetop with H height makes an $\angle$ angle and the balance conditions are studied.

If the assumed cutting line is AMC, the mass resistance of ABCMA must be studied. Forces on the mass are:

- C W weight of mass soil
- C If there is any trembling in mass along the AMC, the cutting tensions are along this line.

**MATERIALS AND METHODS**

Spillway Ione-Zohre river is in the south of Zagros and it is in the sixth zone of the third studied area of country’s water plan divisions. The area of this zone is between 49°, 31' and 52°, 16' of eastern length and 30°, 00' to 30°, 57' of northern width. This weir is in the Persian Gulf weir as its Hydrology division in Iran. This region is the Delijan Delta and most of the area is in the Zeydoun and Hendijan in the Khouzestan plain. The weir of Zohre-Hendijan is settled in southern folds of mid zagros and mostly contain mountains which except zeydoun and Hendijan Plains, it includes the rest of its area. In the end part of river between Molla and Massab countries, around Hendijan, the bed is deep and wide and it forms a clear meander.

Table 1.

<table>
<thead>
<tr>
<th>Assembly distribution (percentage)</th>
<th>Percentage of distribution</th>
<th>Area (Km)</th>
<th>Altitudes (meter from sea level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100/-</td>
<td>42.24</td>
<td>7244</td>
<td>Less than 500</td>
</tr>
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</table>

According to the table, about 42 percent, of area is in less than 500 meter from sea level in which Zeydoun and Hendijan plains are settled. The slope of Zohreh river in its western part have estimated about 0.4 percent.

**PLAXIS Model:** The introduced program is a computer model with limited elements which its first edition was utilized for analyzing soil barriers in Netherland in 1987 by Geotechnical Department of Delft University. This program with edition 3 was introduced commercially in 2000 to the world and with development in this field, now the 8.2 edition of this program is available in Iran. This software has got the support of center for civil engineering research and codes (CUR). This program includes following four programs: 1. Input, 2. Calculations, 3. Output, 4. Curves. The contents of this chapter have been listed and classified according to these four sub-program. For instance, the Input program contains all abilities related to drawing and changing the engineering model, element drawing and causing the original conditions. The forming of the original conditions is carried out in a separate mode in the Input program. Main window in Input program includes the following items [8].

The program of calculations it includes abilities for defining the original element calculations. In the start of program of calculations, the user should select a project in which the calculations are defined. This selection is not needed when in original mode, but by clicking delta, the project in calculations, program is selected automatically. Then, the main window is with the following items (Figure 5).
RESULTS

Methods of analysis-for modeling the shore dike of Hendijan in the start of the analysis, the dike was modeled according to figure 4.

Firstly, by Input program the model environment and needed inputs were introduced to the program, as shown in Figure 5.

Considering materials of CL sort to the dike and its basis (according to the studies) and also materials of G-W-GP sort to the sewer, the modeling stage was started. In Figure 6, an instance of modeling has been shown.

After this stage, there is the time of original tensions and water pressures and that the calculations of original water pressure is carried out assuming the basis soak (Saturation). In the 7 and 8 the results of these calculations are shown.

Results of Ending Stage of Making: In this state, as shown in chart 9, with increasing of slope in shore the maximum of changing place has been carried out.

Also, about sure factors in this state and according to analysis which shown in charts 10, the sure factors are

Fig. 3: Main window of calculations programmer

Fig. 4: The modeled of dike pit in PLAXIS program

Fig. 5: An instance of modeling input of PLAXIS program
in their at most status. In this part, it is very significant that the decreasing of sure factor in both statuses 3:1 to on, especially in slopes 4:1 and 5:1.

As it is clear in figure 11 it is significant that in resistance stage, the changing status of sure factors is different. Also Results of original tensions and Results of original water pressure shows in figure 12, 13.

Charts 10: Comparing results of sure factors

Results of Dropping Stage: In chart 14, has been shown this changing of place with change of embankment reinforcement
Chart 11: Results of calculations of sure factors in resistant stage for different slopes.

Fig. 12: Results of original tensions

Fig. 13: Results of original water pressure

Fig. 14: Results of FOS with change of embankment reinforcement
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