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Providing the effective methods to prevent from slide in the route of Chamestan-Lavij (suburb of Noor city) rural road

Masoud Kiapur
Masoud.kiapour@yahoo.com

Sina Etezadi Amoli
Sina.etezadi@yahoo.com

Jaber Naimi

Abstract
There is Various analytical method to investigating the stability of natural or artificial Slopes, regard to geological,ecological,topographic and seismic conditions of considered region experienced Landslide In this design , analysis of slide downhill stability has performed at both static and quasi-static conditions using limit-eqailibrium softwate SLPO/W Version 5/16. Research method Used in theis Paper is limit-equilibrium method and to analyse the stability of Slop plates , the method of plate fracture has been used. Regard to mentioned advantage and disaduantage,for each design,and also being Lower of administrative costs of option 2(establishing Gabioni Wall at Slide amplitude the Road deviation and broadening) than option1 (Establishing Gabioni Wall at slide amplitude and establishing L-shape concrete Wall by the side of road) and also having the least administrative problems,option(2) with the road deviation and broadening, is suggested as a superior choice for performance.

Keywords: slide trenches, software Slope/w, optimum stabilization, Gabioni wall

Introduction

Statistical study on landsildes show that Mazandaran province with 422 occurances and 12.5% frequency, has dedicated the most amount of all occurances of registered landslides. Due to these landslides, somebodies have been killed and more than 35 bilion Rials loss has been incurred to Mazandaran economical resoureces. This matter is so important, particulary at major constranction project including select the route of highways establishment, tunnel establishment, select the site of dams establishment and canal of water transfer. Understatnding this event and factor influencing of it result in essential planning to perform construction project, being distance from hazard sites or perform suitable endeavour to its stabilization.

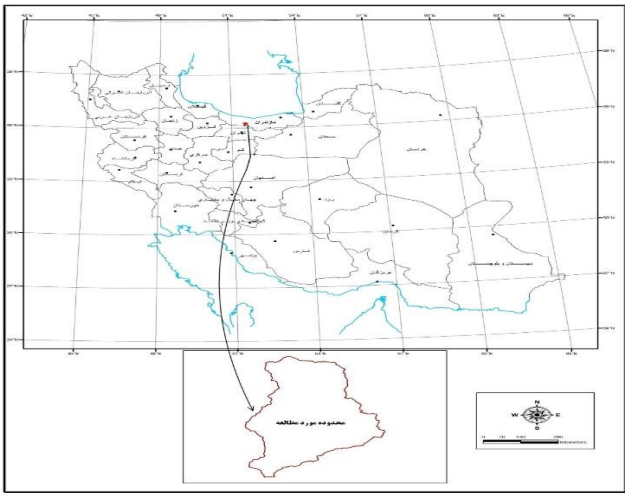
Bravely it can be said that the most sensitive and important issues in major construction projects including the site of establishing giant buildings, dams, selecting the route of highways establishment, transportation tunnels and any mine development require basic study on region natural slopes. Results of landslide, often is direct and it makes direct and disastrous results at residential regions. Various factors influence on slope base including geology conditions, hydrology and hydrogeology condition, topography and morphology situation, weather and wearing out and result in slide. A single factor, solely can be the reason of landslide. (Yang, 1998)

Limit equilibrium is the most widespread methods used in this field. These methods can be used to determine confidence coefficient of various type of unstability burden on dusty and stony slopes. (Mohammadi and Sedagh, 2012)

The aim of collecting this paper is investigate guidelines to prevent from road damages and security of ways in modern methods including establishing a Gabioni wall in silde slopes – deviation and widening of road and also establish Gabioni wall in slide slope – establish L – shape concrete wall by the side of road for this reason. First the information of various soil layers have obtained by drilling boreholes, then slide level determined using Slop/W software and following it, we planed the preventing methods to control the occurance of events and damages sustained on road and consumers.

Geographical situation and weather condition in region

Region understudied is located on north of Iran, at Mazandaran province, south of Chamestan town and nearly 20Km of southern part of Noor town in eastern 52°01' longitude and northern 36°23' latitude. At figure 1 the geographical situation of understudied region is shown. This region has cold winters and temperature summers. Regard to being elevated the region, raining in winter, generally is as snow. At most of year seasons, the region is raining.



Picture1: Geographical situation of understudied region

Engineering geology and seismic of slide site

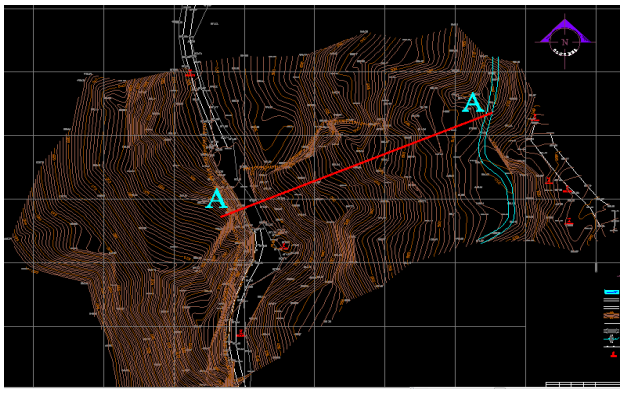
Considering conducted local researches and field visits, at investigation of area slide histories, it is diagnosed that this slide is old, in the term of age and is of transitional type.

Layer is stretching on eastern-western and has 15' slope. The drainage potential of slide is weak and drainage of slide slope is toward inside of slide region. Underground water level is low and weather moisture is high, influencing on wearing out erosion. In term of morphology, slide site is a mountainous region with V-shape and concave valleys. Materials involved in soch slide include stone and soil and slide type is of fast type. Length of slide is approximately 190m and its width is 65m. Elevation of slide crest is nearly 574m and differnce of elevation between crest and toe of interruption level is nearly 60m. picture 2 show the situation of this slide.

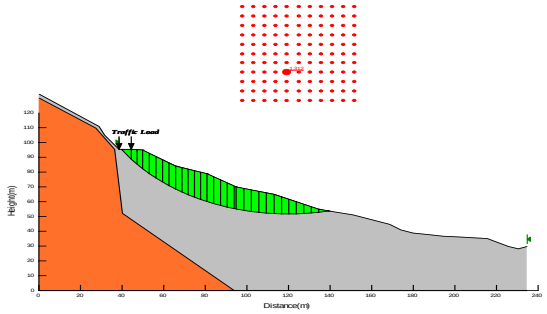
Picture 2: Landslide situation of understudied region

Analysis of stability

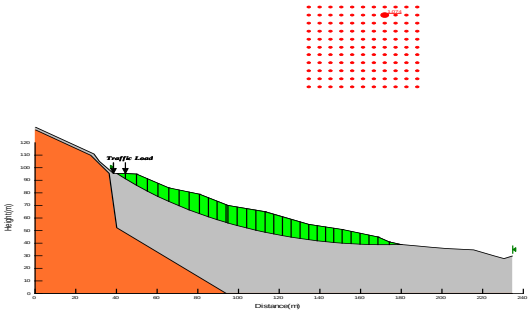
There is various analytical methods to evaluate the stability of artificial or natural slopes. Analysis result is originally expressed as confidence (that is the ratio of available resistance to planed resistance). At present, the most widespread using methods of analyze the slope stability are limit equilibrium methods. In this design, analysis of slide downhill stability has been performed at both static and quasi-static conditions using limit equilibrium Slope/W software version 5/16. For supposed interruption level, a pile of soil over the interruption level is divided into small parts. Then amount of stimulus or resistant forces is defined per part, lastly, the confidence coefficient is optained which is the ratio of sum of resistant forces to stimulus forces. The least obtained confidence coefficient is considered as confidence ceofficient of understudied slope stability. To investigate the slide downhill stability, a critical section by name "A-A" has been regarded. The situation of this section provided in map 1. Results show in picture 3.(Porkhosravani, A. and Kalantari, B, 2011)



Map 1: Topography map of lavij slide region



Picture 3: A) slope stability at A-A section at effective Stress (condition static)



B) slope stability at A-A section at effective (condition squasi – static)

Result of stability analysis show that the minimum confidence coefficient in the static and squasi – static state is 1.312 and 1.074, respectively. It should be noted that the base confidence coefficient, for static and quasi-static states has been regarded 1.4 and 1.1, respectively.

Suggested methods to prevent and watch the slide

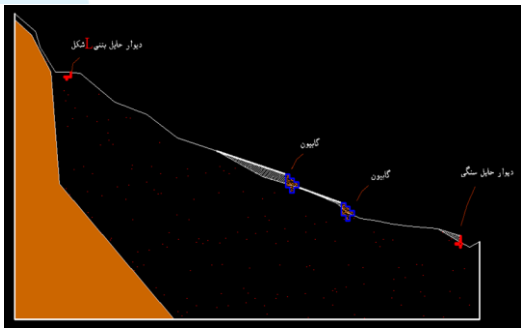
To stable and fix the landslide in rural route of Chamestan road toward Lavij, two different options have been considered, and details of design are explained following as:

a) Design number 1

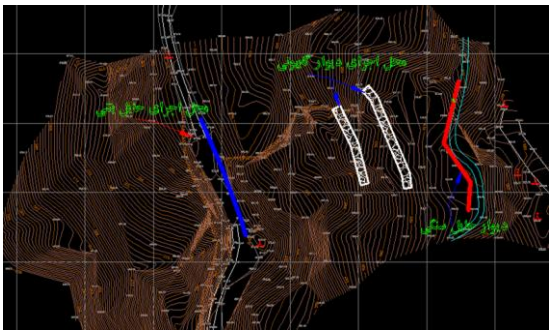
Option 1 includes following parts:

- Establishing a L-shape conceret support wall at outer margin of road with width of 3m and height of 2m in slide area and also with length of 90m and establishing a conceret drainage canal at inner margin of road.
- Construct a stony support wall by the rirer margin to prevent wearing out of slide toe in maximum height of 3.6m from base and lenght of 100m.
- Construct two Gabioni wall with 20m distance in area of slide toe and in balances of nearly 520 and 530m.

Various components of design are provided in maps 2 and 3.



Map 2: Vertical profile of design number1


Map 3: Situation of stabilization plan of number1

- a-1) Design of Gabioni wall

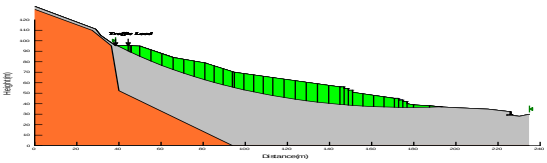
Regard to conducted stability analysis, two Gabioni walls with 3 stairs have been considered to enhance resistant forces and confidence coefficient againts slide at downstream of road and at balances nearly 520 and 530m. Considering that wall height is more than 3.5m, regard to recommendations, this Gabioni wall is considered as stairs appearance. Also, it is recommended that the wall during building being inclined toward back of wall. Although, constructing this wall with mentioned dimensions is necessery to increase confidence coefficient againts downhill slide of road downstream, then the stability of wall itself, should be independently, considered. Filter grading has been designed, regard to results of soil grading test in the region using measures of filter design.

- a-2) Design a L-shape support wall at outer margin of road and drainage canal

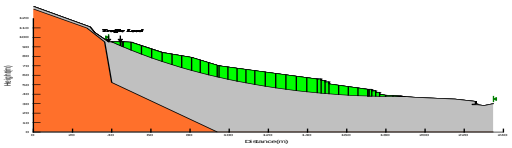
To prevent the lateral slide and movement of soil under the road toward downstream in slide location, left hand margin of road (slide crag) is protected. Also, in right hand margin of road, a conceret drainage canal is considered. This system includes a wall with 0.5m tickness, height 2m and width 3.5m. To design this system, in addition to force result of soil back of wall, influence of traffic load has been exerted. To determine lateral stress on support wall, due to 50Kn concentrated load which influence at 1m distance from wall, Bosinsek solution is used. So, a lateral force, due to erect traffic load 29.5Kn obtained, influencing its resultant at 0.96m distance from wall base.

- a-3) Design a stone wall at river margin

Considering that one of the most important cause of Lavij slide is the river flowing on slide toe, thus to prevent slide toe from bleaching through water current, a stone support wall was considered at slide base and at river margine. Necessery stability analysis has been performed in both static and quasi-static states to slide doqnhill at A-A critical section, and analysis results provide in picture 4. As it is observed, confidence coefficient over slide, after stabilization for such critical section and at both static and quasi-static state, was obtained 1.432 and 1.106, respectively, that is more than minimum necessery confidence coefficient.



Picture 4: A) slope stability at A-A section in option1 after slide stabilization (static states)



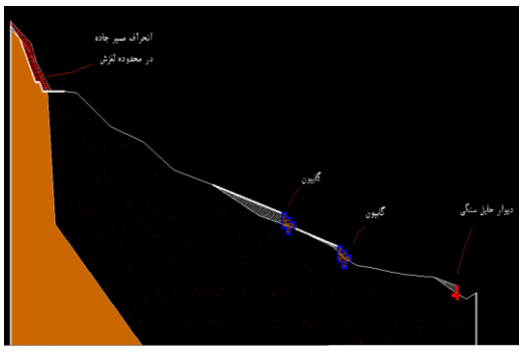
B) slope stability at A-A section in option1 after slide stabilization (squi-static states)

a) Design number 2

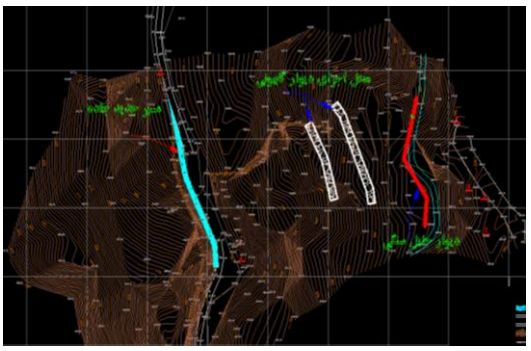
Option 2 includes following segment:

- Road deviation, nearly 4m toward right hand elevation at slide area and with 130m height, and also establish a conceret drainage canal at inner margine of road.
- Build a stone support wall at river margine to prevent from bleaching slide toe at 3.4m height from base and nearly 100m henght.
- Construct two Gabioni wall with 20m distance from eachother at slide toe area and with balance nearly 520 and 530m.

Various components of design provided in this option at maps 4 and 5. Difference of option 1 with 2 is that in this option instead of L-shape conceret support wall, a new route has been constructed.

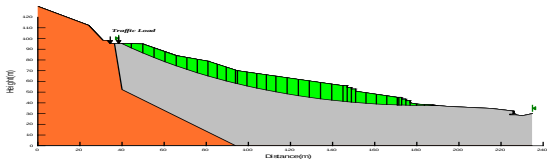


Map 4: Vertical profile of design number1

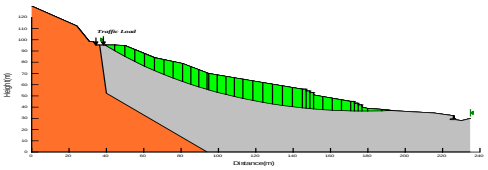


Map 5: Situation of stabilization plan of number1

After providing necessery designings and design details in this option, necessery stability analysis has performed in both static and quasi-static states to slide downhill at A-A critical section and result of analysis provided in table 5. At it is seen, confidence coefficient againts slide, after stabilization for such critical section and at both static and quasi-static state, was obtained 1.437 and 1.109, respectively, that is more than minimum necessery confidence coefficient.



Picture 5: A) slope stability at A-A section in option2 after slide stabilization (static states)



B) slope stability at A-A section in option2 after slide stabilization (squi-static states)

conclusion

Regard to performed designs, establish a Gabioni wall at slide amplitude establish a L-shape conceret wall, by the slide of road 1 has advantages including using materal available in the side, easy to performance and non-effectiveness from region weather condition, but its disadvantages include this cases that build a L-shape conceret wall result in blocking road at some part of design time or heavily slowing in traffic vehicles. Building Gabioni wall at slide slope deviation and widening the road 2 has the same advantage and disadvantage, but design 1 has the most administrative cost regard to expressed points, and also availability of the least administrative problems, option 2 with the road deviation and widening, is suggested as a superior choice for perfomance.

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