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The Checkout and Separation of Environmental Hazards of the Range Overlooking the Meshkin City

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***Abstract*—**Natural environments have always been affected by one of the most important natural hazards, which is called, the mass movements that cause instability. Identifying the unstable regions and separating them so as to detect and determine the risk of environmental factors is one of the important issues in mountainous areas development. In this study, the northwest of Sabalan hillsides overlooking the Meshkin city and the surrounding area of that have been delimitated, in order to analyze the range processes such as landslides and debris flows based on structural and geomorphological conditions, by means of using GIS. This area due to the high slope of the hillsides and height of the region and the poor localization of roads and so because of them destabilizing the ranges own an inappropriate situation. This study is done with the purpose of identifying the effective factors in the range motion and determining the areas with high potential for zoning these movements by using GIS. The results showed that the most common range movements in the area, are debris flows, rocks falling and landslides. The effective factors in each one of the mass movements, considering a small amount of weight for each factor, the weight map of each factor and finally, the map of risk zoning for the range movements were provided. Based on the zoning map resulted in the study area, the risking level of damaging has specified into the four zones of very high risk, high risk, medium risk, low risk, in which areas with very high and high risk are settled near the road and along the Khyav river and in the mountainous district.

***Keywords*—**Debris flow, environmental hazards, GIS, landslide.

I. Introduction

THE slope motions encompass all the processes, which lead to a mass movement of materials such as rock, soil, or a combination of them to down the slopes [1], [7]. In our country also, according to the preliminary estimates, approximately 500 billion Rials, damages to properties through the mudslides occurrence is reported, also the analyses show until the beginning of year 1378, about 2590 landslide occurrence in the country caused the deaths of 162 people, ruined 176 houses and made granular sedimentation with the volume of 963,807 cubic meters [6], [9].

The Natural and human forces intervention has caused the collapse in the balance of ranges, and by reducing the stability, range motion is created [2].

The Meshkin city located in the northwest range of mount Sabalan as one of the areas in terms of the settlement, because of the hard and inappropriate topographical conditions and also the unsuitable location of roads [3], needs to study the prevailing conditions to it, due to the risk management of this track [11]. The geographical foundation role in which causes a lot of difficult obstacles in some areas owns a great importance in the network communicational construction of roads.

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A. Geographic Location and Topography of the Region

The Meshkin city area with geographic coordinates 47 degrees 39 minutes 20 seconds to 47 degrees 43 minutes 47 seconds of east longitude and 38 degrees 17 minutes 4 seconds to 38 degrees 23 minutes 10 seconds of north latitude in the west of Ardabil province and northwest of the volcanic mass of mount Sabalan is located.

The topographical condition of the Khiavchay basin in terms of topography situation can be seen as smooth and rough topography. Based on the topographic map (1: 50,000) of the region three units of topography can be identified. These three units are briefly introduced from south to north (Fig. 2) a) the Mountain unit b) the Foothills unit c) the plain unit.

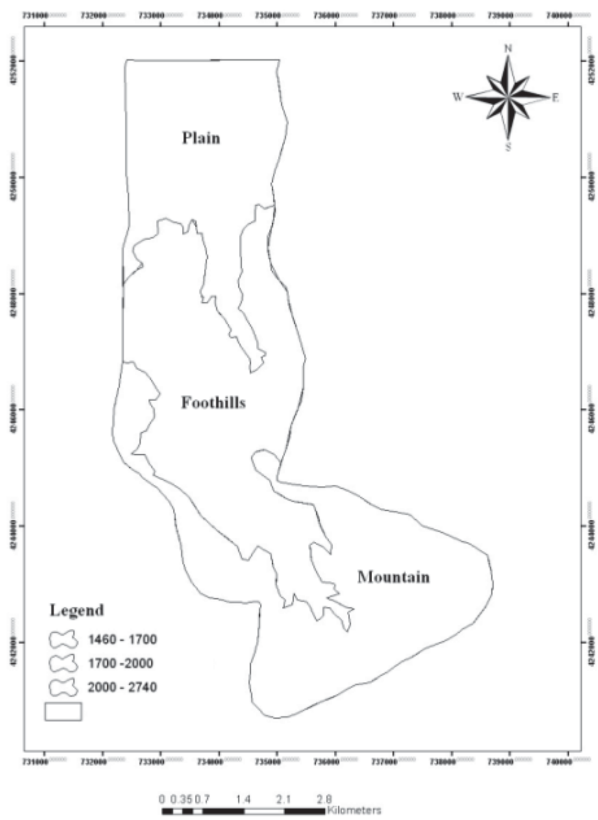

Fig. 1 Map of the topography

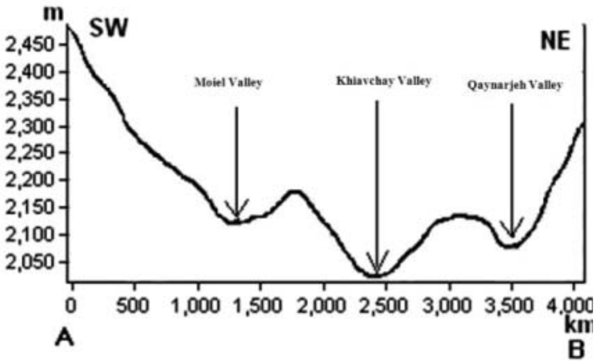

Fig. 2 Profile width of the topographical unit of the mountain

The Fig. 3 shows the topography map of the study area, in which the altitude process, waterways direction and how to draw the profiles of each unit of topography is displayed.

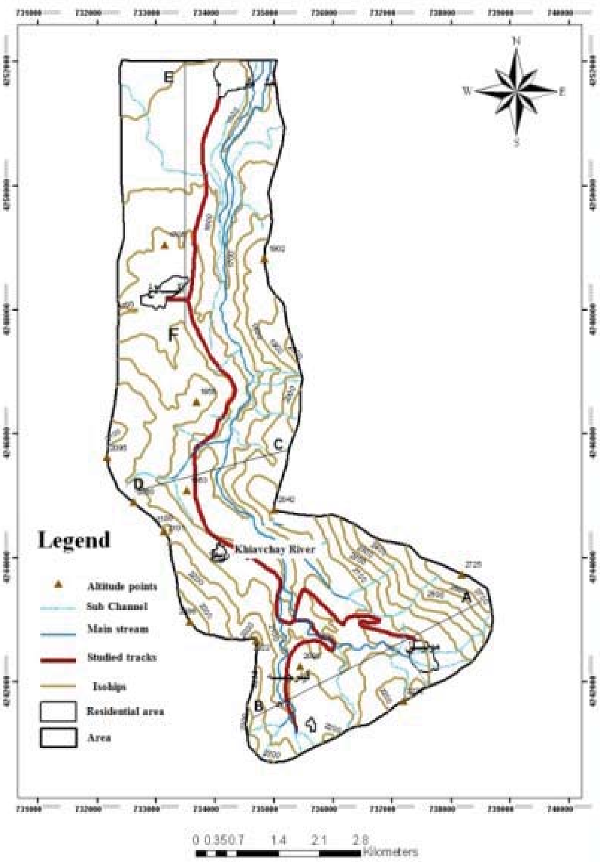

Fig. 3 Topographic map

In the northern and western slopes due to having the higher humidity, broad landslide can be seen [8], and in the eastern and southern slopes because of the maximum energy absorption and the minimum residual water in the soil, the minimum sliding movements, and the maximum collapse movements can be seen [4]. The geographical direction contribution in the study area is seen in Fig. 4.

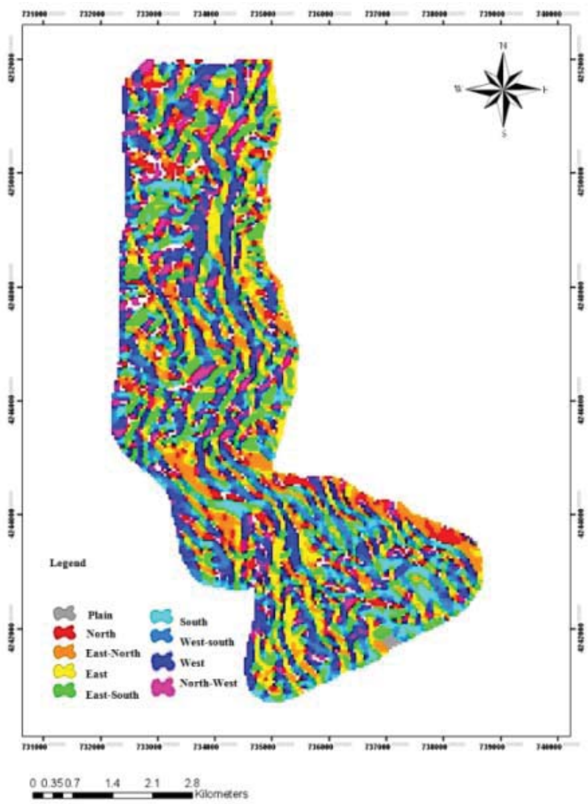

Fig. 4 Map of the slope area

II. Method

In order to incorporate the information layers resulted of the landslides in the area of Meshkin Shahr city, the data layers should be valued, for this reason, the layers after being digitalized in the GIS environment according to Table I divided into intended classes and as a result, were standardized to the resulting maps, so to be effective for the layers incorporation due to the zoning (Figs. 6-13). Table I, also shows the value of the criteria in which is valued into four categories: very high-risk to low-risk, in a way that, for the very high risk category (the class which is the most effective) value (1), and for the low-risk class (the class that has the least effect) value (4) has been allocated.

In order to incorporate the information layers resulted of the rock falling in the area of Meshkin Shahr city, the data layers should be valued [4], for this reason, the layers after being digitalized in the GIS environment according to Table II, divided into intended classes and as a result [10], were standardized to the resulting maps, so to be effective for the layers incorporation due to the zoning (Figs. 15-20). Table II, also shows the value of the criteria in which are valued into four categories: very high-risk to low-risk, in a way that, for the very high risk category (the class which is the most effective) value (1), and for the low-risk class (the class that has the least effect) value (4) has been allocated.

In order to incorporate the information layers resulted of the debris flows in the area of Meshkin Shahr city, the data layers should be valued, for this reason, the layers after being digitalized in the GIS environment according to Table III, divided into intended classes and as a result, were standardized to the resulting maps, so to be effective for the layers incorporation due to the zoning (Figs. 20-25). Table III, also shows the value of the criteria in which are valued into four categories: very high-risk to low-risk, in a way that, for the very high risk category (the class which is the most effective) value (1), and for the low-risk class (the class that has the least effect) value (4) has been allocated.

TABLE I
CRITERIA EVALUATION OF LANDSLIDE

Low risk (4)	Medium risk (3)	high risk (2)	Very high risk (1)	Criteria
300<	200-300	100-200	0-100	Distance from the road (m)
0-10	27-62	10-17	17-27	Slope (degrees)
-	Resistant	Moderately resistant	Unstable and weak	Lithology
Rangeland dense residential areas	Dry land Agriculture	Dense pastures	Irrigated agriculture and gardens	Land use
150 <	100-150	50-100	0-50	Distance from the fault (m)
150 <	100-150	50-100	0-50	Distance from the river (meters)
2400-2740	1440-1760	2100-2400	1760-2100	Elevation (m)
284-307	307-325	341-365	341-325	Rainfall (mm)

TABLE II
THE CRITERIA EVALUATION OF ROCK FALLING

Low risk (4)	Medium risk (3)	high risk (2)	Very high risk (1)	Criteria
300<	200-300	100-200	0-100	Distance from the road (m)
0-8	8-17	17-27	27-62	Slope (degrees)
-	Resistant	Moderately resistant	Unstable and weak	Lithology
> 150	100-150	0-50	50-100	Distance from the fault (m)
Rangeland dense residential areas	Irrigated agriculture and gardens	Dry land Agriculture	Dense pastures	Land use
2740-2316	1440-1740	2316-2050	1740-2050	Elevation (m)
North, Northeast	West, Southwest	Southeast, Northeast	East, South	Slope

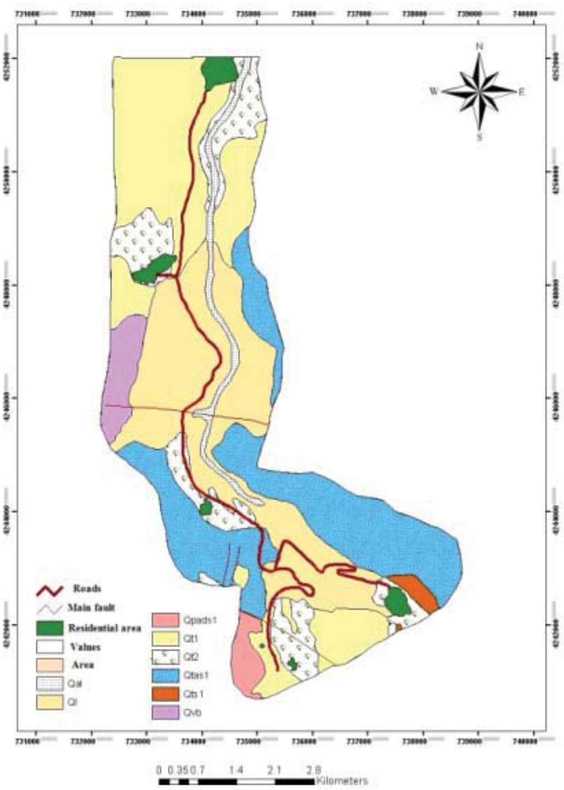

Fig. 5 Geological map of the study area

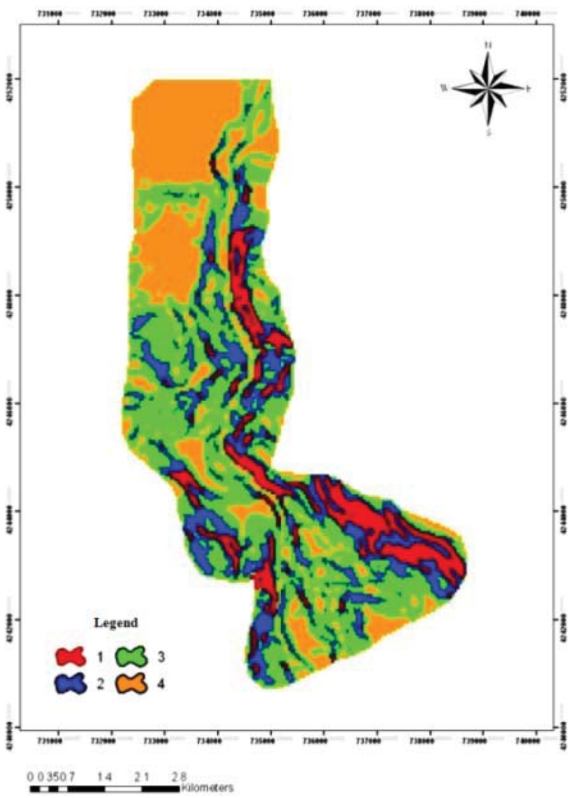

Fig. 6 The standardized map of slope

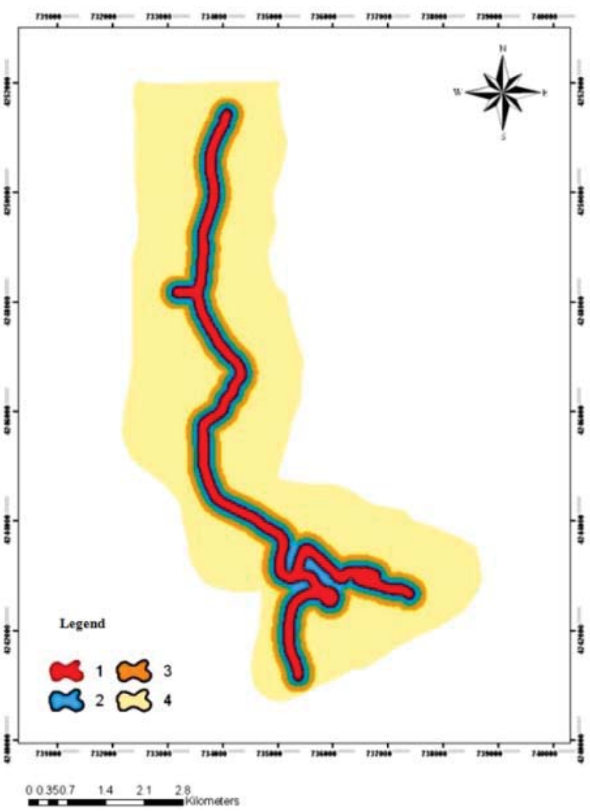

Fig. 7 The standardized map distance from the road

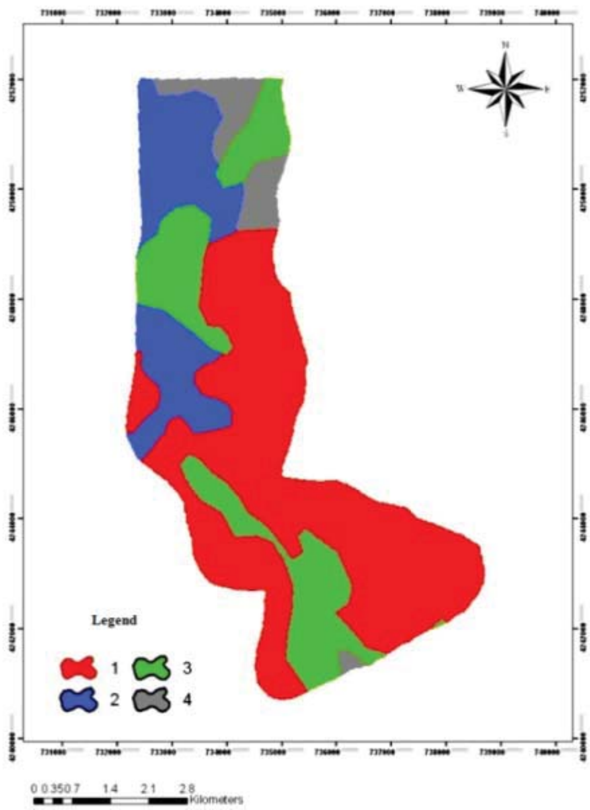

Fig. 9 The standardized map of lithology

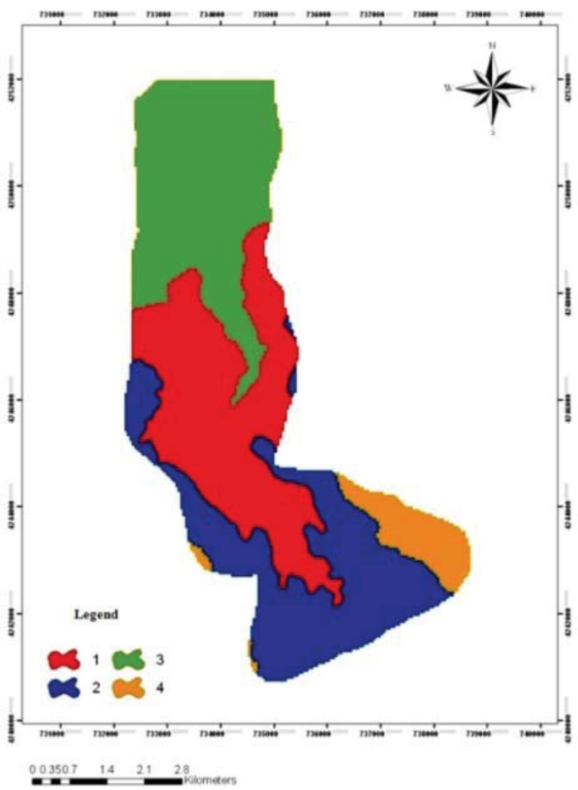

Fig. 8 The standardized land use map

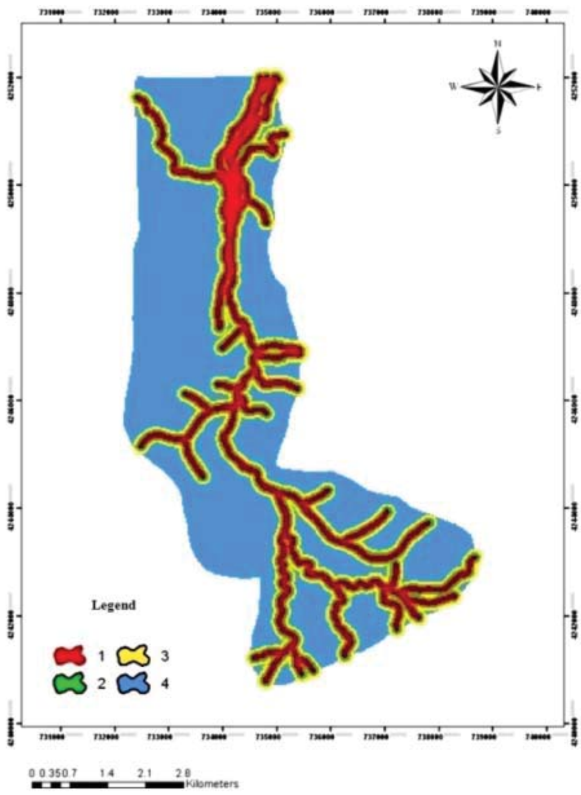

Fig. 10 The Standardized Map distance from stream

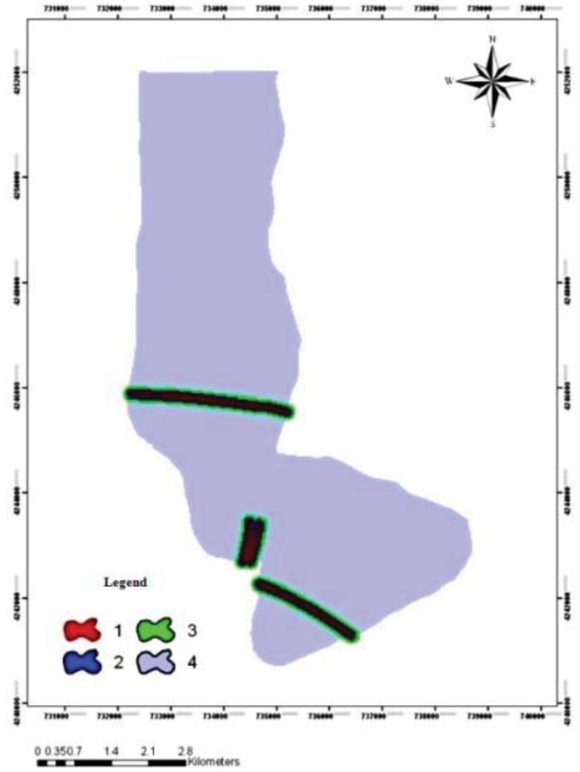

Fig. 11 The Standardized Map distance from fault

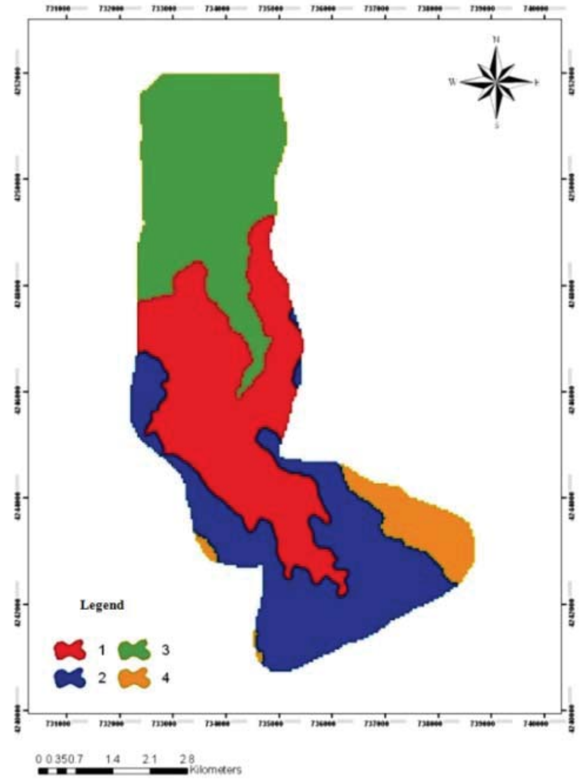

Fig. 13 The standardized Map of height

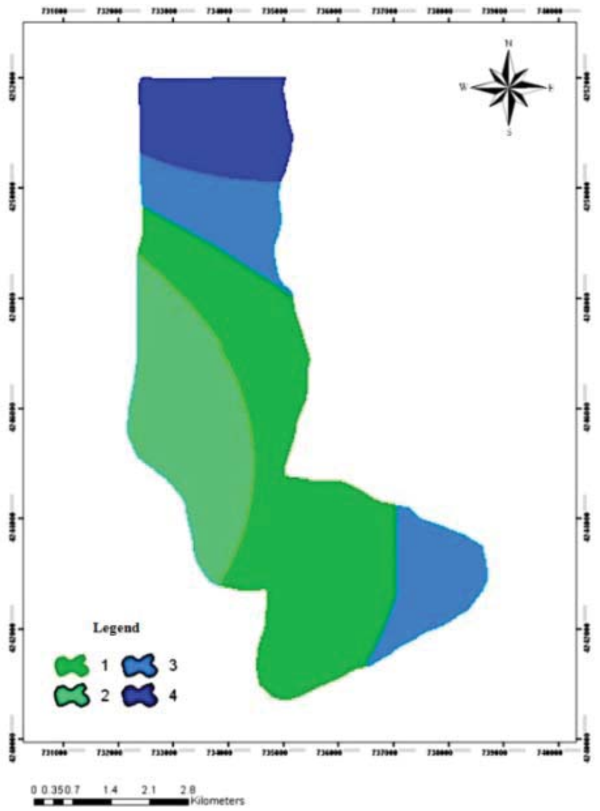

Fig. 12 The standardized Map of precipitation

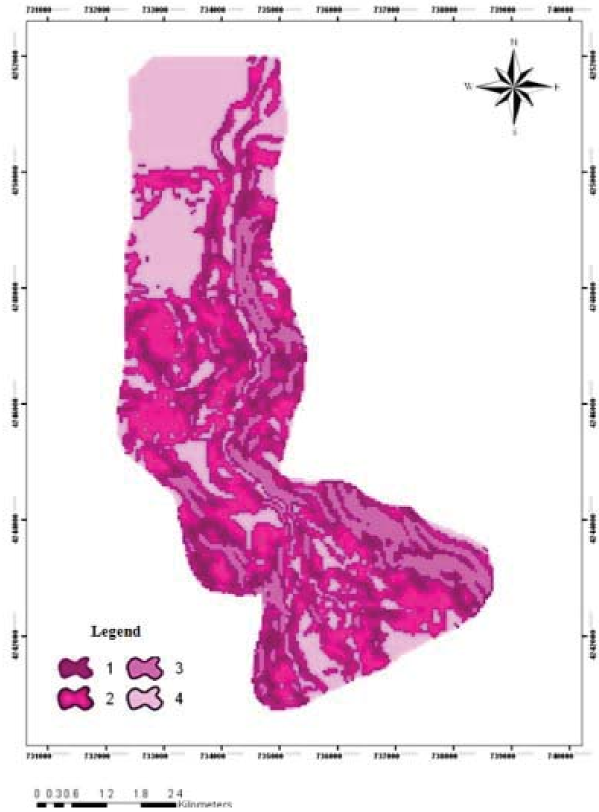

Fig. 14 The standardized map of the slope

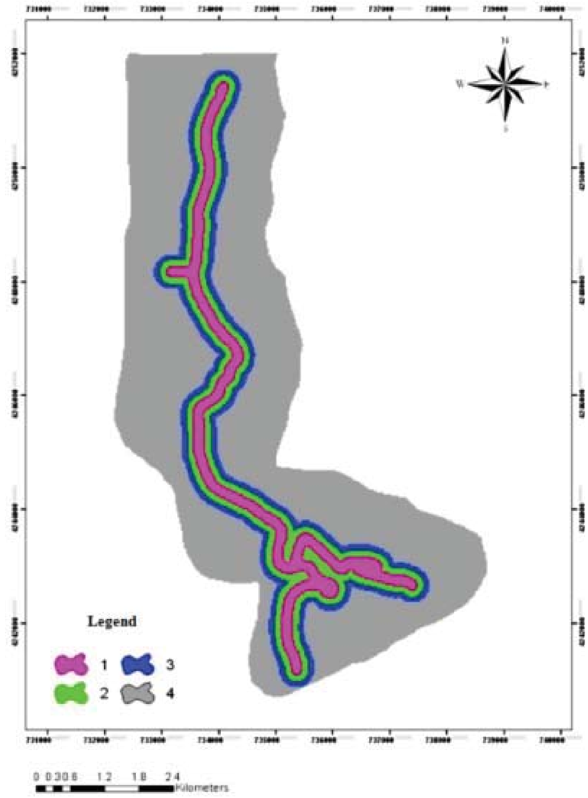

Fig. 15 The standardized map distance from the road

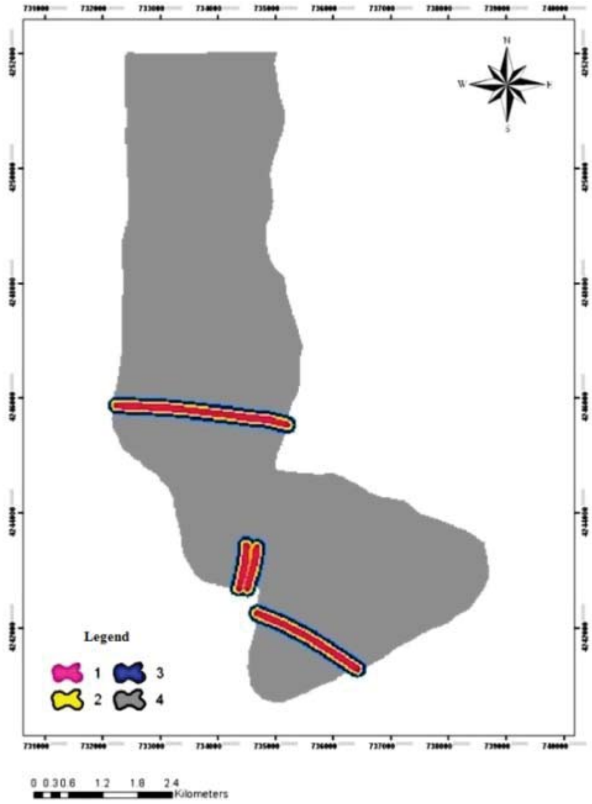

Fig. 17 The Standardized map of lithology

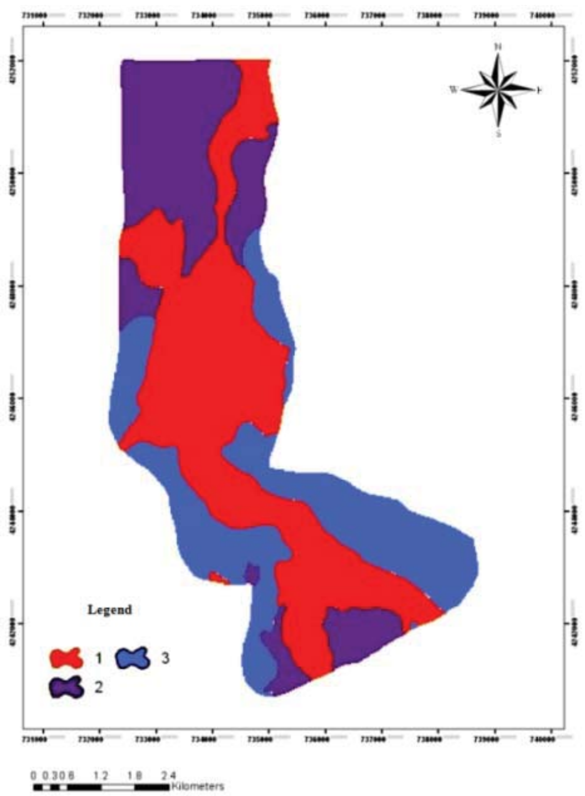

Fig. 16 The standardized map distance from the fault

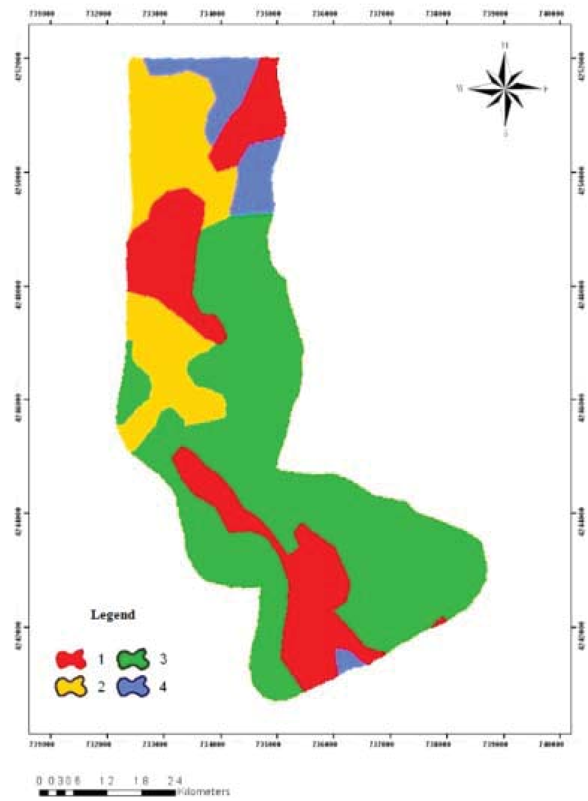

Fig. 18 The standardized map of height

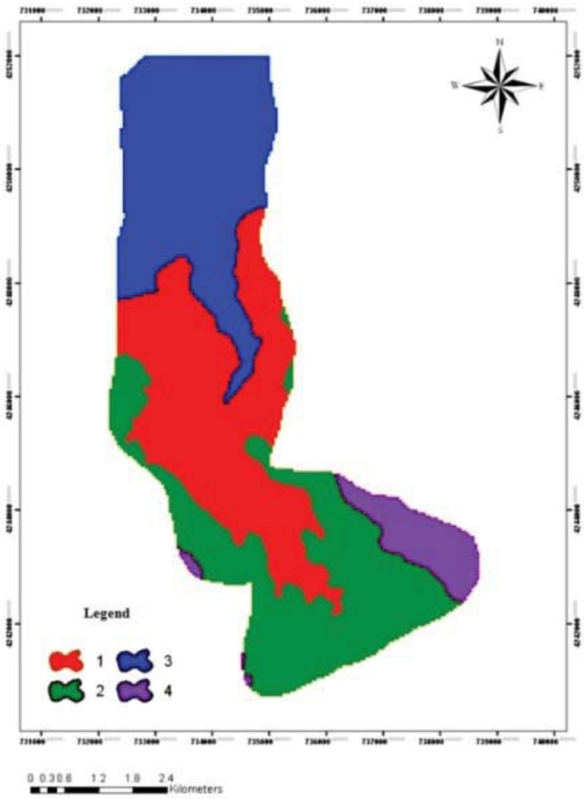

Fig. 19 The standardized land use map

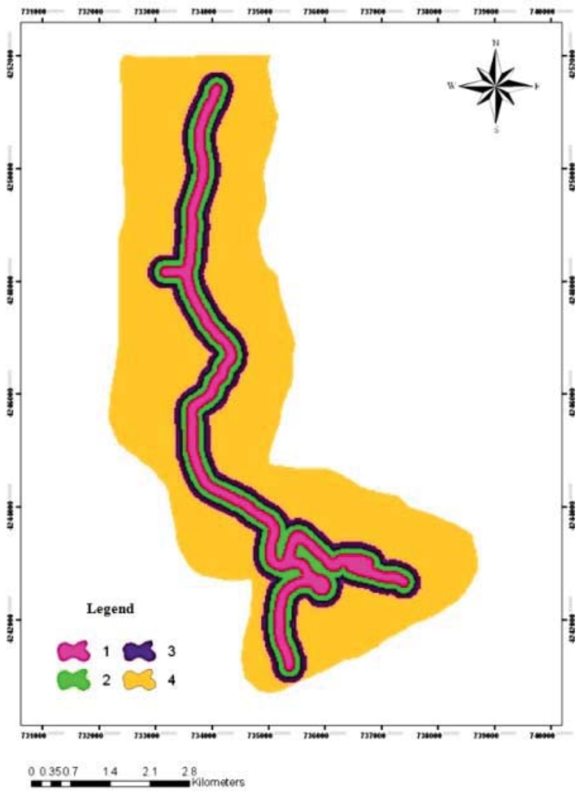

Fig. 21 The standardized map distance from the road

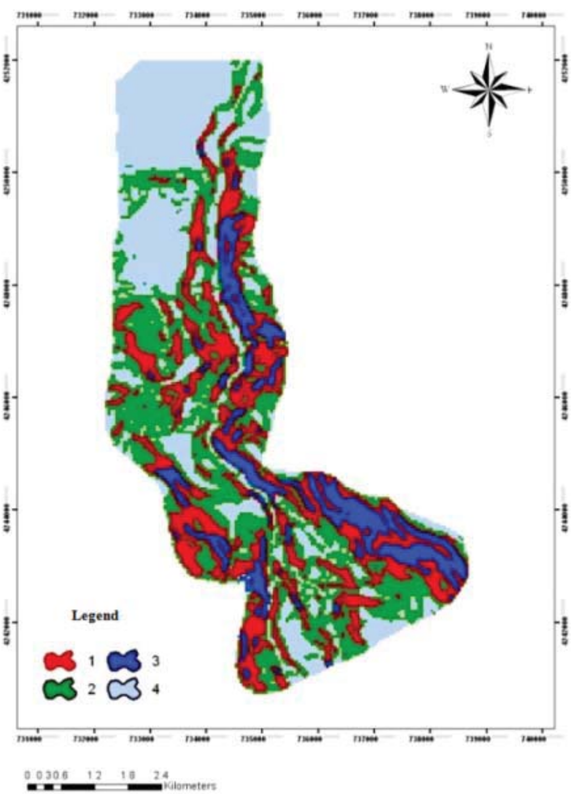

Fig. 20 The standardized map of slope

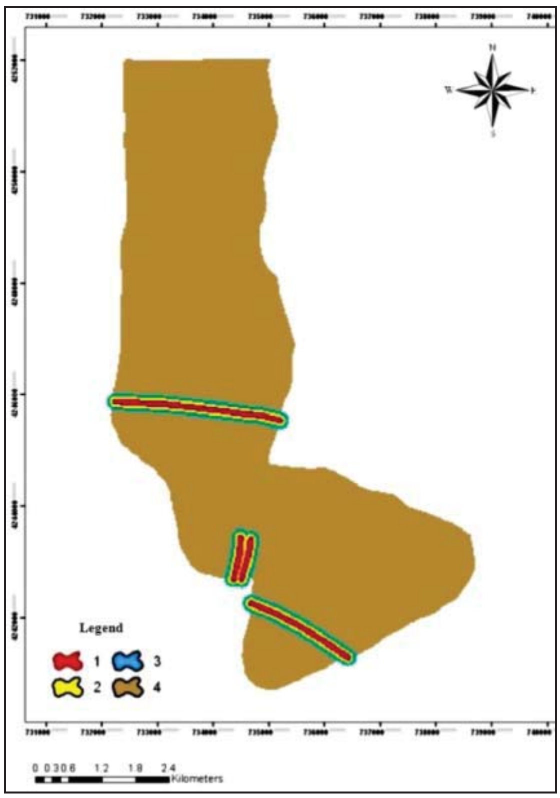

Fig. 22 The standardized map distance from the fault

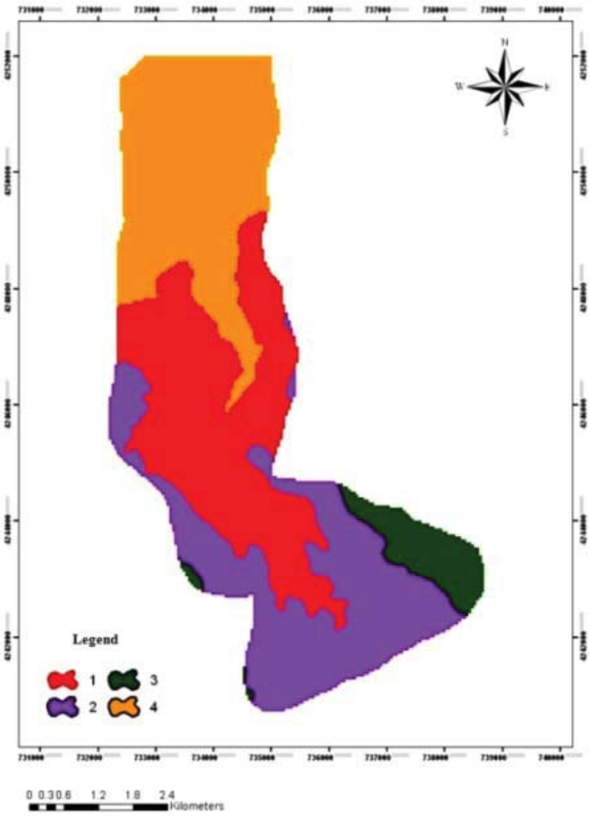

Fig. 23 The standardized map of the high levels

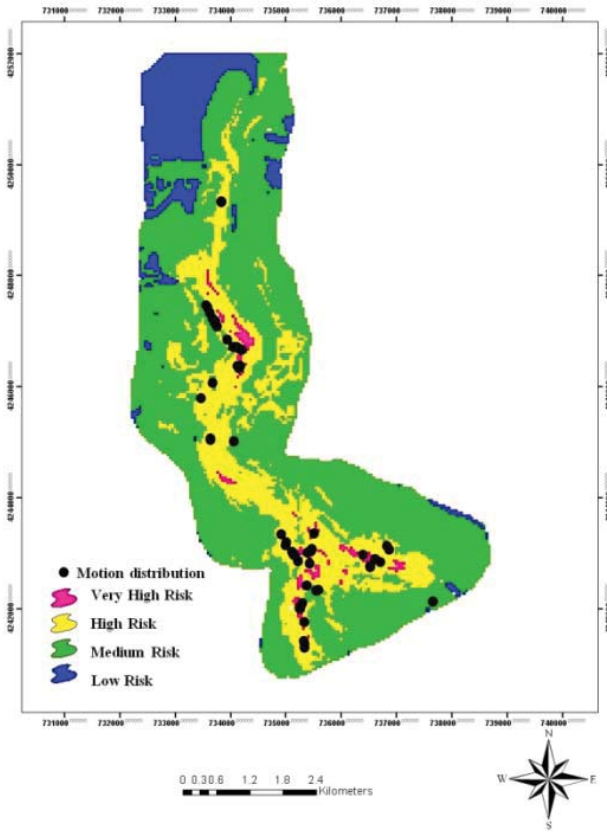

Fig. 24 The zoning risk map of the motion range in MeshkinShahr

TABLE III
THE CRITERIA EVALUATION OF DEBRIS FLOWS

Low risk (4)	Medium risk (3)	high risk (2)	Very high risk (1)	Criteria
300 <	200-300	100-200	0-100	Distance from the road (m)
0-8	27-62	8-17	17-28	Slope (degrees)
-	Resistant	Moderately resistant	Unstable and weak	Lithology
150<	100-150	50-100	0-50	Distance from the fault (m)
1440-1470	2740-2300	2005-2300	2005-1740	Elevation (m)
284-307	307-325	341-364	325-341	Rainfall (mm)
Rangeland dense residential areas	Dense pastures	Dryland Agriculture	Irrigated agriculture and gardens	Land use

With overlapping the three-layer zoning of the landslide, rocks falling, and debris flows in the GIS environment, the zoning map of the range movements was provided as a result of this study (Fig. 24).

III. CONCLUSIONS

Due to specific conditions of the study region in terms of the geological structures, elevation, topography and geology slope, lithology and tectonics and vegetation, generally, the slope movement threatening the road has a lot of variety. The strengths and weaknesses of each of these factors to each other can have a prominent role in the determination of these movements. The debris flows, landslides, and etc., are the crucial range procedures that threaten the asphalt on the road of MeshkinShahr to Moeil, and from these movements, the rock falling has been widespread and, its risk in all ranges as the essential parameter of instability of the rock slopes has effective role in the region morphology and owns a high potential in comparison with other range processes. Factors affecting the range motion to be showed up in the study district are the distance from the road [5], slope, lithology, distance from fault, land use, distance from drainage, elevation, rainfall, slope direction [12]. After overlaying the three-layer zoning of landslide, rocks falling, and debris flows in the GIS environment, the zoning map of the range movements was achieved, and the rate of risk level of risk was extracted and identified into four zoning risk of very high risk, high risk, medium risk and low risk, in which the regions with very high risk and high risk are settled around and nearby the roads, mountainous ranges and along the Khiavchay river. Within the efficient factors causing the range motion, distance from the road, as the most important human factor has had the most influence on slope instability, so that even affected the natural factors such as slope and geology. Creating trenches, the weight changing which is resulted of excavation and embankment, getting rid of the vegetation of the ranges, and etc., are the interactions attributed to the road construction engineering that within the period of road construction has been considering the region. Among the natural parameters also, the slope and lithology elements have had the most influence.

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