



# Geomorphic systems affecting the Kerman

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## ABSTRACT

According to geomorphic systems affecting the settlement of areas, including in the planning and urban management. Due to the geographical location and structural the Kerman and performance of various systems of agents, such systems are alluvial, Aeolian and morphotectonic Implementation and management of all development plans need to be obsessively this space very carefully done. The incidence of serious risks such as ground subsidence, loss of water resources, tectonic activity and Aeolian processes in the atmosphere is solid evidence of this claim. Kerman is located at a point that many factors can affect its normal study of factors influencing the reduction of environmental hazards can be effective. The purpose of this study demonstrates the effect of natural factors and the impact of Kerman urban development on the intensity of negative factors affecting external. This research is trying to use GIS techniques to evaluate geomorphic systems the Kerman range of factors influencing the mapping of processes to check. The results show that morphotectonic systems, including Fluvial and Aeolian systems are effective the Kerman. The maps show that the levels of native lands, and large parts of the Kerman planar surfaces with low slope and covered with alluvial deposits and clay zones form. This can have a considerable impact on the intensity of risks.

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## 1- Introduction

According to geomorphic systems affecting the settlement of areas, including the planning and urban management ,the ultimate settlement will lead to prosperity and security in the region. Geomorphic and topographic features in a location not only affect the distribution and concentration of human activities, but eventually one of the factors in the form and physical features of the spatial structure is considered. Cities are allocated to the vast land. These lands are formed by combining various units' topography and geomorphology. The size of the development and spread of cities, dealing with various subjects and topics related to topography and geomorphology is higher. Geomorphologic units have always been associated with vitality and dynamism of the natural environment, any act in a manner consistent with the dynamics of urban development and the dynamics will converge, resulting in the phenomenon of geomorphology (Rajaei, 2008). As urbanization and urban development Urban Affairs has provided grounds for intervention in geomorphology. The importance of geomorphology in urban areas when becomes clear that the damages are excessive and beyond human tolerance. Flooding in the past, simple house, to be destroyed, Very brief and simple furnishings, your life, it would ruin and their uses, But in terms of breadth and complexity of modern life in cities and urban infrastructure

Development, Losses would be enormous and catastrophic (Rajaei, 1994).

Implies essentially the deployment and the creation of a city is above all a function of environmental conditions and geographical location, The effects of natural phenomena on the location, distribution, hinterland, physical development, urban morphology,

and the like are decisive effect and sometimes as long as a positive factor and a negative factor and a deterrent act (Negaresh, 2003).

Overall urban area, which gives an account of the composition, is made up of several units of geomorphology. Space associated with the development of the city as more varied geomorphic units will be the dynamism inherent characteristic of them. So regardless of any activity in urban space and the passage of the features of thresholds will have irreparable consequences? Due to the geographical location and structural Kerman city and performance of the various systems, such as systems causing alluvial, Aeolian and morph tectonic implementation of all development programs and space management must be taken very seriously obsessed. The incidence of serious risks such as ground subsidence, loss of water resources, tectonic activity and Aeolian processes in the atmosphere is solid evidence of this claim. What are the geomorphic processes affecting Kerman city, the basic question of this research. In this regard, this study has tried using GIS techniques to evaluate geomorphic factors affecting Kerman city, using a range of different processes map to check.

## 2. Theoretical Foundations

Geomorphic impact on the establishment of human settlements, both urban and rural areas and the impact of human settlements on Earth is a two-way communication with each other geomorphology and cities. The city itself can cause major changes in the context, impact on the climate, soil, vegetation, wildlife, water resources, environment, landscape, environment, energy cycle that is much, Study this interaction could help in solving the problems is generated in cities. "Jean Bastieh in locating the town gives more importance to natural factors place and believes that the future of cities and special places of natural selection are correlated (Farid, 1992).

So here is formative in direct contact with the geomorphology is important, Morphology can be positive or negative effect on urban location, have, Morphological proper position can cause the development of cities. And improper positions can create a serious limitation in the development of high altitude for example, holes, narrow valleys, karst formations, madly, flood plains, Non beaches, deltas and wetlands, inappropriate exposure strong winds, sand storms could all be urban spatial constraints. Geomorphologists are seeking to identify the causes and complexities of the Earth's surface shape and the forces they represent in terms of temporal and spatial on the other hand, are trying to understand how these changes can be and human, what is involved in changing the natural environment (Moatamed and Moghimi, 1999).

Cities are allocated to land, vast and wide .This land, are formed from the combination of different units, topography and geomorphology. However, those cities develop, they encounter a variety of topographic and geomorphic units are higher. Any such action in line with the dynamics of urban development and the dynamics of geomorphologic phenomena and thus overlapped with that (Rajaei, 2003).

Essentially born out of urban morphology, geographical environment, culture and technology of countries, The urban morphology of natural and cultural factors combined form (Rajaei, 2008). Wherever natural factors and geomorphology, especially in urban centers with the focus of the association have emerged. "The roughness factor for the development of urban centers, there is a close relationship. In places where the terrain as a barrier or limit permanent settlements and confirms act, naturally, has not been created urban centers . (Rahnamaei,1992)

This paper deals with the interaction of geomorphologic these interactions have been studied in Kerman city the results show that there is a direct correlation between morphological parameters and the City.

### 3. The study area

Kerman province is located in the South East of Iran, as the northern province of Yazd province of South Khorasan, Hormozgan Province in the south of the East and the West of Fars province is bordered (Zangi Abadi,1991). Kerman city province in the North East and in the range of 14,000 hectares (Governor of Kerman, Department of Planning, 2013)

The city's population in 2011 was equal to 534,441 people (Population and Housing Census 2011). The city's geographic location, 56 degrees, 55 minutes, 57 degrees, 15 minutes east longitude and 30 degrees 10 minutes North latitude is 30 degrees 20 minutes. (Aftabi,2006)

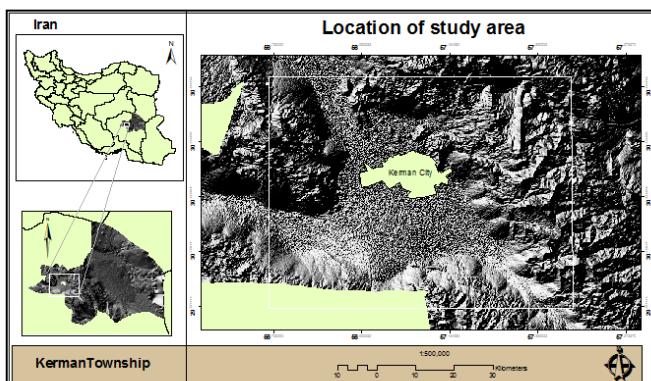


Figure 1. Location of the study area

### 4. Research Methods

Methods In this paper cross - sectional study, using field data and libraries (documents, maps, aerial photos, etc.) to understand

geomorphologic processes and phenomena affecting the city of Kerman. The first step in using topographic maps and digital elevation map of the study area, and then proceed to prepare the land surface layer. Then, using geological maps, topographical and satellite imagery layers of parent material was prepared. After using a digital elevation model, topographic maps and images of geoforms in the study area were extracted. Finally, by combining different layers of geomorphology map of the region along its timeline was provided. To achieve the above steps GIS techniques are used.

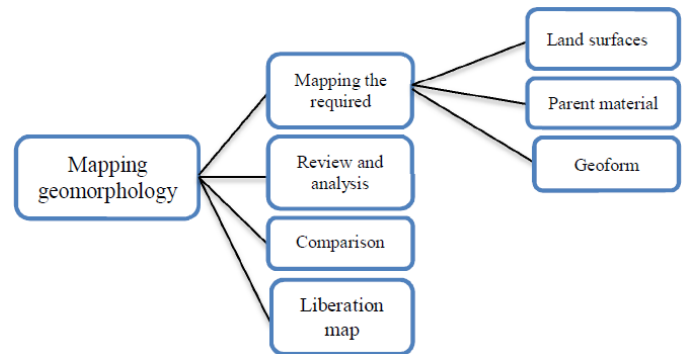


Figure 2. Conceptual model proposed mapping using GIS

### 5. Research findings

General system of the building geomorphic processes and forms of interaction separately or common ground that acted and set the pattern units are created. In this view balance geomorphic explain a certain relationship between input and output forms or in a form of creation (Moatamed and Moghimi,2005).

Due to the geographical location of Kerman city and environmental conditions on the systems of various pathogenic agents on the impact of these systems include:

#### A - Process morphotectonic

Morph tectonic term was first applied to the roughness of the major forms. This term emphasizes the underlying structural geomorphology. So a unit morph tectonic the large morphological units of construction geomorphology. Land forms the tectonic significance of the morphology of the Kerman region is created. "Land of tectonic form is the result of internal factors on the ground floor provides a variety of shapes (Jahanbakhsh and Rajabi, 2009).

Multiple faults in the Kerman province of Kerman city is the impact of the Earth's interior, so that relatively high activity of the Kerman region of Iran has turned into one of the most volatile areas. Main faults that may affect the study area include:

**1-Kuhbanan faults:** As one of the major faults of a set of fundamental faults in southeastern Central Iran is known, the oblique-slip movement (direction along the right-lateral strike-slip component, reverse) caused many seismic events in the northern part of the South East of Kerman to Yazd. During the morphological evidence of tectonic faults is observed, indicating the activity of this fault is present. In general, the most important structural elements which are discussed in the deformed the shell, Strike-slip faults that are more than 100 km in length, have the ability to generate large earthquakes. Devastating earthquake, Kerman Saturday, January 18, 1964 - Chatrud magnitude 6 on the Richter scale, the earthquake September 28, 1834chatrud, Earthquakes with magnitude of 6 on the Richter scale Kuhbanan, June 30,1838, September 29, 1859earthquake in Kerman - Chatrud magnitude 7.5 on the Richter scale, an earthquake with a magnitude of December 3, 1937 Gyskarand 7.5 on the Richter scale, which has killed more than 665 cases of faults activity (Abasnejad and Dastanpour, 1999).

2- Lakarkooh faults line in the northern province of North - South and parallel with Naiband faults. Depending on the type of structure, it divides into three sections: North, Central, South and North and South it is divided in two parts. Ponytail structures are observed. Steep topography on the northern end of the South West and South terminals, is the North East and the middle section is mostly mountainous with steep sides, Western. March 30, 1873 RAVAR devastating earthquake that killed about 700 people had been attributed to the activity of these faults (Shahpasandzadeh and Heidari, 1996).

3-Gook fault for the first time in 1972 by geologists Yugoslavia was introduced to Sarvestan fault. The fault length of about 100 kilometers northwest - southeast, south of West Barn, the West Shahdad continues and in this place Lakarkooh fault joins YAGHMAEI, its length is about 200 kilometers stated (Yaghmaei and Noroozian, 1993).

4-Gook strike-slip fault system coincides with the sharp central Iran and Afghanistan due to plate collision Arabic - came into existence in Eurasia. Figure 3 and 4 shows major faults and types of faults affecting the study area.

Fault Golbaf: Golbaf fault due to exposure of more than 12 historical earthquakes in the twentieth century (with drastically greater than 5 on the Richter scale) on the, One of the most active and the most seismically active faults in Kerman province. June 11, 1981 Golbaf devastating earthquake that killed 1,100 people and injured 4,000 in withdrawals and August 27, 1991 Sirch Earthquake, 1,300 killed and thousands were injured. Both have been associated with this fault, 1876 quake Sirch - Hassan Abad with 6.5 Richter and 6 Richter scale earthquakes Gok October 27, 1909 and September 3, 2005 earthquake with a 3.5 on the Richter scale have been caused by the fault movement (Abasnejad and Dastanpour, 1999).

What was stated that Kerman province, especially in the northern regions, especially the city of Kerman, several earthquakes that caused major fault the region has experienced. Therefore, the Earth Land forms are the result of internal factors, the specific form given to this area certainly in the future to be effective.

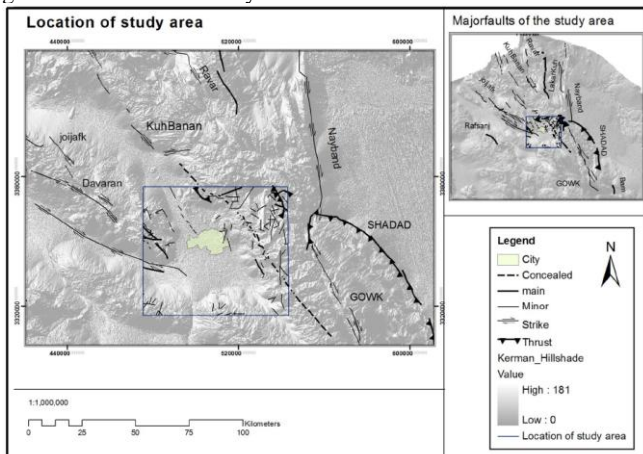


Figure 3. Major faults affecting the study area

## B - Performance current water (Fluvial system)

Except for the glaciated areas at high latitude and high altitude mountain territory, this nearly all surface waters of the effects of drought can be seen. Apart from the non-native rivers (rivers that rise in the passage of the climate outside, they are formed) the wilderness pass (Nile, Tigris, Euphrates, Amu Darya, Syr Darya, Caron and ...) Net effect of water even in the most arid regions of

the world, there are different forms. Current water or linear, focused on a table or surface flow. In terms of water volume, length and timing of their work, are seen as permanent, seasonal or casual (Mahmoudi, 2007).

Urban growth, which increases the risk of flooding. As compared to normal levels, the streets and roofs of buildings which constitute an important part of the city impermeable and may cause minor flooding is increased several times (Omidvar, 2011).

The water flow on the surface creates different forms; these forms indicate that they are causing the behavior and performance of the water. Development of urban areas increases impermeable surfaces and runoff volume increases. For example, in 1967 the total area of the city of Kerman, about 5.4 square kilometers and in 2001 to 2.101 sq. km is reached. Can be used to reduce the influence of the permeability coefficient is the ratio of the total surface impermeable surfaces can be calculated.

$$SS = C/A$$

SS: Permeability index

A: catchment area in terms of square kilometers

C: area of impermeable surface

Accordingly, in 1967 the city was 5.4 square kilometers, permeability index 8.30, respectively. But in 2002, the city area is about 101.2 square kilometers at the index of about 0.086 are dropped. The reduction index is meant to increase the amount of runoff in the city. Surface runoff is directed in Kerman, in the old part of town, by absorbing well as underground aquifers and due to the low permeability shallow alluvial bulk of it will evaporate (Hasanzadeh, 2006).

Since Kerman is located in arid and semiarid the region, mainly in the region rainfall, runoff and rainfall-runoff event that a lot of this type are created. On the other hand due to the reduction of the level of penetration and lack of sewage systems, if these trends are associated with erosion, brings many risks. Figure 5 shows the drainage network of the study area.

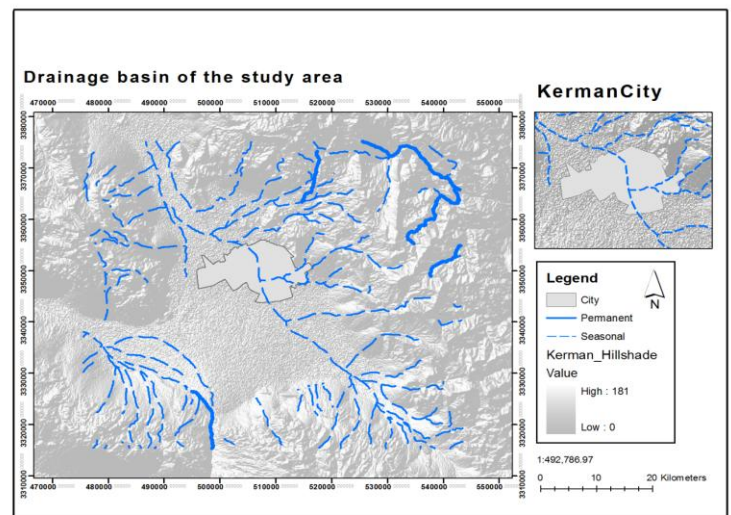


Figure 4. drainage network of the study area

As mentioned, depending on the current water Performance over time can be caused by many different forms the flowing water is treated forms of expression So that the identification and resolution of these problems can be anticipated and treated waters, on each of them contributed to the planning of urban spaces. Figure 6, the shapes of Performance current groundwater in the study area shows.



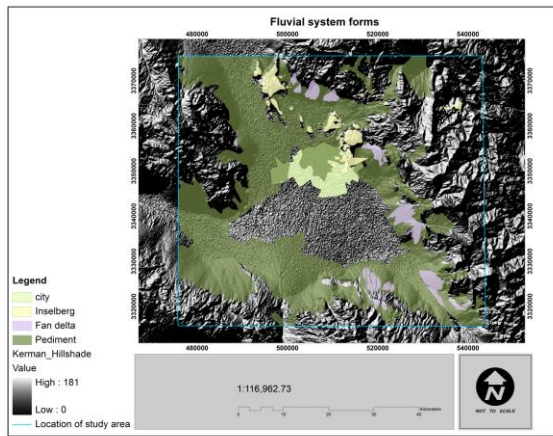


Figure 5. Failure of Performance Fluvial

#### C - System Performance Aeolian

Winds will take dominion over the earth and erosion, as well as other important processes, such as running water, refrigerators, work activities widely seen to be different. When the wind as an agent of erosion is important, first, the natural environment is appropriate for its function and second, its strength is that it can remove obstacles from their path (Mahmoudi, 2007).

Moving sand and dust environments usually occur by wind, but this effect was more dramatic in arid areas creates serious problems. Rapid urbanization in arid areas to move past barriers against natural patterns and Aeolian material buildup and their nucleus is mainly based on the use of ground water and soil pressure is built up, a way that may harm the surrounding desert ecosystems. As a result, vegetation degradation and soil structure may be damaged and subsequently moving sand and dust rises and increase the intensity and scope of the problem. Thus the problem of sand and dust often associated with desertification problems that are getting more attention recently that (Roostaei, 2007).

Wind erosion is not a factor in itself, but when the dust is associated with loss of power, it increases, Erosion much more power to the ground, and the height of its power reduced so that the maximum power is 20 cm in height (De Bij and Muller, 1998). Explore the Land of forms and densities in arid regions act together geomorphic forms and can cause various forms that these cities will greatly affected. Figure 7, the shapes in the study area indicates Aeolian system performance. According to this figure, the error Performance of the system consists of mainly Barkhan, Saif, and expanse of sand which threaten city of Kerman.

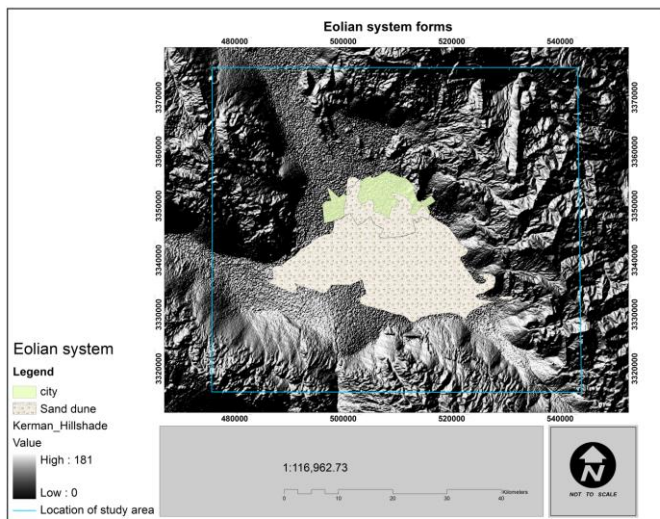


Figure 6. Shapes away from the wind system performance

#### 6. Geomorphic units in Kerman

Geomorphology is the most important task in the development of urban areas as data entry geomorphologic map. The primary purpose of such maps, showing the distribution of irregularities in shapes, materials and processes, the surface and near the surface, causing deformation of shapes and materials represent an appropriate scale and understandable. The importance of maps in developing regions, mainly related to data needed for planning land from which they are extracted (Roostaei, 2007).

Mapping to identify geomorphologic forms and processes faces terrain, land surface separation, showing occurrence and Symbolize they are based. Three tools to perform reconnaissance operations and processes of the form are as follows: Topographic maps, aerial photos, and process images, check and direct field observations (Taghizadeh and Mousavi, 2009).

Topographic maps based on the three pillars of the iconic elements of the geomorphologic map of land forms, processes, gender, and native place. In general geomorphologic map of determining the scope, scale and purpose of its preparation, five spectra recorded and symbolic terrain data is displayed. In other words, the pillars of the elements in a map the geomorphology must firstly identify and then it will be shown symbolically as follows: Land surfaces, Geoforms (the phenomenon of land), parent material, creating new processes and forms.

#### 7. Land surfaces

Considering that the effects of surface roughness are nothing but a combination, Thus it can be seen that the surface features of the topography of a region combines together the overall outlook of the region has created. In other words, a natural landscape is nothing but a combination of levels. These surfaces can have certain characteristics that generally define and measure indicators point to it. Such features can be used to level surfaces, slope, convexity and concavity and how steep they noted changes.

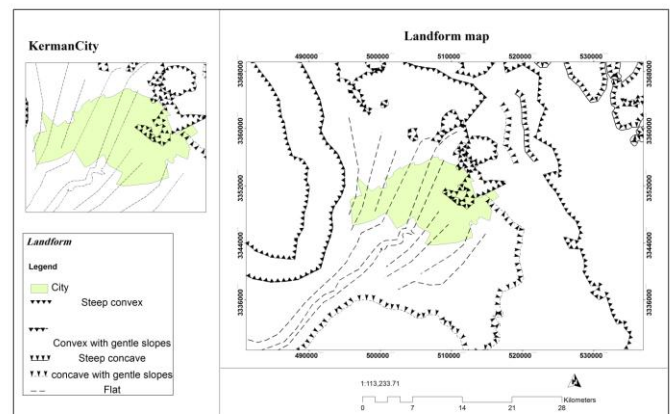


Figure 7. land surface map of the study area

#### 8. Geoforms

Geoforms order forms that are specific geomorphologic processes and systems Figure by a specific pathogen, relative to the event in a derived class. Geoforms to identify the most important factors in a particular form of topographic maps is much curved lines (Taghizadeh and Mousavi, 2009). Land forms are a reflection of the balance between Performance forces and the material properties, Figure creation of them occurred in the past, not only on geomorphologic process is explained, But also depict processes in the future. Geoforms the features of that analysis are important spatial distribution and deploy them. The spatial distribution of phenomena, not only the concept of space and time to reflect but in our understanding of the features that occur along a transverse profile, Helps, Thus, the spatial distribution and spatial patterns sometimes as much as the scope and scale of geomorphic

phenomena can be important, For a scholar is worth it because the ultimate goal, knowledge management and environmental issues to depict relationships and appropriateness of land forms, parent material and the current process environment.

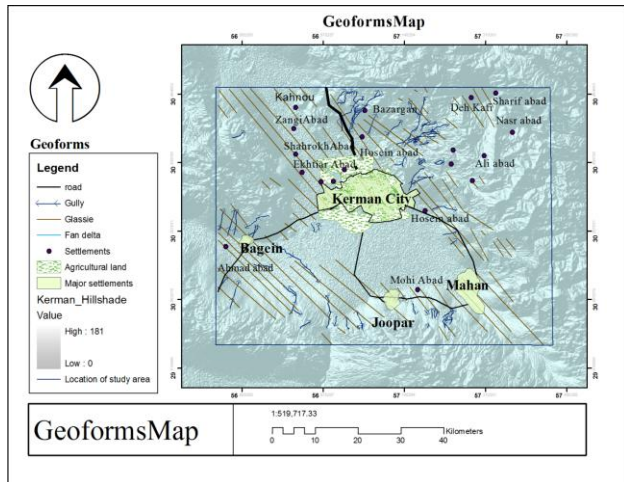


Figure 8. Geoforms map of the study area

## 9. Parent materials

How to interpret the origin and development of perspectives about gender and the nature of the sediments, geomorphology, geology, parent material, and the extent of the differences is essential. As you can see parts of the north, northeast and northwest of Kerman city area consists of clay, East of the city of limestone and calcareous highlands created and southeastern parts of the area consists of sandy and at longer distances, formation of igneous parent materials were useful in forming the composition. Area of impervious clay and sandy north or south of the area both can be a serious threat to the city.

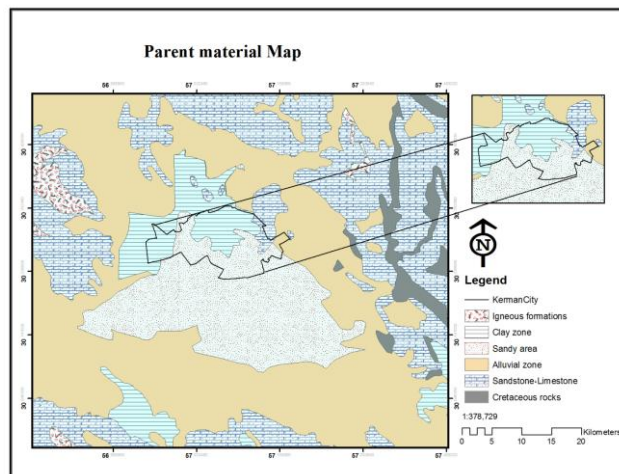


Figure 9. parent material map of the study area

## 10. Process and Time

In practice rarely attempted to process displaying maps of geomorphology phenomenon is the result and the result shows the Performance of processes and process governance are considered. The origin and genesis of geomorphologic shapes and forms more of a personal knowledge and any interpretation should be done about it, based on individual capabilities, knowledge and experience of the interpreter. The information age phenomena latest collection of information is reflected in the geomorphologic map Recorded as relative age phenomenon in geomorphology map and an event occurs. The time element maps a symbolic image is

not displayed, but this factor as written, the table is ready to map Guide and contrary to map geological phenomena cannot be arranged in time, Age but usually attributes geomorphology phenomenon is reflected in separate tables. Age determination in Geomorphologic phenomena, especially phenomena related to the Pleistocene, is facing many problems, but the aristocracy to realize the development process, and this mechanism could help him in the category of relative phenomena. However, due to the special meaning when considered in geomorphology is not expected to be done at compile time, either relative or absolute, as it is common in the geological maps (Ramesht, 2006).

Table (1): the process and Time in the study area

symbol	landform	Creation Era	process
→→	Gully	Kata Glacial	Concentrated runoff
	pediment	Kata Glacial	Decentralized Flow
	Alluvial Fan	Kata Glacial	Concentrated runoff
	settlement	Kata Glacial	Human
	Sand Dunes	Kata Glacial	Wind
	Inselberg	Kata Glacial	Decentralized Flow

Geomorphological map of the study area was prepared by combining different layers of information.

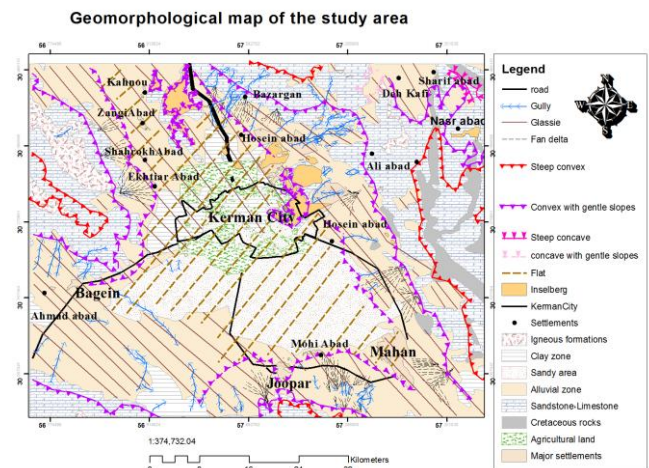


Figure 10. Geomorphological map of the study area

## 11. Conclusions

Mainstream geomorphic units constitute the formation and development of human settlements for this reason, understanding the geomorphic processes affecting settlement areas have a large impact on the planning, management and welfare and security of this region will be. The classic view of changing the system, the geomorphology makes analysis more desirable to achieve remarkable results in the constituent systems is the geographical landscape. This attitude leads to a change in view of the concentration of components and connections between components of the whole test, so understanding, utilization and management system based on existing relationships between elements. Understanding the cognitive components of attitude, increasing

accuracy and reducing costs are the result. Each element of the system can be a unique and inherent characteristic of the element is considered as a matter of personal characteristics play an important role in the formation of collective identity or group play So based knowledge discovery system in view of the existing communication system. Among these is the geomorphic system, consisting of the construction processes and the interaction between surface forms and processes so as to form a set of common Performance units and land forms are created. The other side of the city as an example of a geographic area that is the result of human interaction with nature is part of a geomorphic system that is formed on the substrate forms this Land Forms the identification and distribution Landforms and the processes that create urban management is essential. The results show that:

1 - Tectonic structures, systems and Aeolian geomorphic systems Fluvial of the most effective systems are in Kerman.

2 - The bulk of the area south of the city of Kerman, especially large parts of the system affected by Aeolian and problems arising from Performance the system as Barkhan, and Saif is a sandy zone. The lack of attention to the performance of the system can cause many problems such as dust storms.

3 - Structure and Distribution of Kerman tectonic faults that indicate tectonic activity in this region the lack of attention to this issue in the context of the appropriate distribution of urban infrastructure, compared to the tectonic structure and reinforcement principles of irreversible consequences will follow.

4 - Land of Kerman map shows that much of the city is situated on surfaces with low slope, which caused many problems in the field of wastewater discharge surface runoff and the pollution of underground water resources lack of sewers will be.

5 - Although based on the principles of building and residential buildings should be established on the oldest geological formations. But Kerman parent material map shows that a large part of the area's young Quaternary formations, such as the area of alluvial and clay form. That's why this case should also be considered in construction.

6 - Threats faults, steeply dipping and lack of proper disposal of runoff, soil permeability of the current location of Kerman city, vast areas of sand south of the city, the construction of urban poor management, and lack of proper management of waste city of Kerman are the most important threats it is necessary to note that all these factors should be appropriate to the clear vision of life lived in the city for citizens to be created.

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