

The Impact of Geomorphological Factors on Physical Development of Quchan City

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Abstract. The physical development of the cities is directly related to the natural context and geomorphological effects. Development of the city in mountainous regions is highly sensitive due to geomorphological limitations and instability of the ranges. The study area in this research is Quchan City which is in the margins of Atrak River in Khorasan Razavi Province. In this study, it is attempted to investigate the physical development limitations of Quchan City in light of its natural context with a focus on geomorphology. The data in this study are topographic, geological, land use and soils maps, the map of Quchan City and field visit, and the given results of this study show that development of Quchan City is influenced by many limiting factors. Among these, the factors of flooding, subsidence and the seismic risk have the most important effects on urban development. Development areas are limited and with geomorphological risks.

Keywords: Physical development, city, natural contacts, proposed scope of urban development projects

1. INTRODUCTION

Study of the approaches related to the physical development of the cities and emphasis on the importance of the issue of urbanism and prevention from the uncontrolled expansion of the cities and the more appropriate development of these facilities to the next generation have caused this issue to draw more attention and it can be said that this issue is considered as one of the most essential aspects of sustainable development (Asgari, 32, 2006). In Suez and the country of Egypt, based on the records of the existing test wells, geomorphological maps and nature and distribution of earth, the forms of the area were specified and the features of the earth for urban planning were evaluated (Ario, Kuk et al., 89: 1998).

The researchers in the field of physical development of the cities have less emphasized the role of natural factors such as geological, geomorphological and other effects. In this study, it is intended to investigate the role of natural and geomorphological factors of Quchan City so that urban planners can, by predictions for future development of the city and achievement of sustainable development, provide the grounds for sustainable development of the city.

2. STATEMENT OF PROBLEM

Basically, establishment and formation of a city is more than everything else subject to environmental conditions and the geographical situation since natural effects and phenomena in localization, distribution, sphere of influence, physical development, urban morphology and the like have a firm impact on the camping site as a positive factor and for a time act as a negative factor and inhibitor. Topographical and geomorphological features of every geographical place,

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not only in distribution or accumulation, but are always considered as one of the effective factors in the physical growth of the city, in such a way that some geomorphological forms act as obstacles to the path of urban growth or development. Moreover, the reflection of geomorphological processes also appears as several problems and issues and geomorphological issues cause irreparable damage to the body of the city. Thus, the impacts of topographical and geomorphological conditions of every place have an undeniable role in issues such as urban constructions and its expansion. It is therefore necessary in urban planning in order to increase the safety of the citizens against the risks of geomorphic processes. Our ancestors in the past mostly relied on experience in localization of the cities, which was not often coordinated with the science of the day; but today, the simple life of those days has changed into the complex urban life and advanced cities have been familiarized with the sewage systems, subways, skyscrapers, etc. Today, buildings have large dimensions (size), cities have become considerably immense and in the margins of most cities industrial institutions have been developed. Thus, before constructing secure and resistant buildings, careful studies and research should be conducted on the localization of the cities and selection of the proper place for development of the buildings, since the subsequent plans are done based on these studies. In the physical study, geomorphological, weather or climactic, hydrological, geological and other conditions should be studied and the relationship and interaction of these phenomena should be further investigated. Somewhere, (1994: 276), the main question of this study is proposed as: how much have geomorphologic phenomena influenced the physical development of Quchan City?

3. IMPORTANCE AND NECESSITY

It might be said that one of the important issues in the field of city and urban management is the physical development of the city and the impact of environmental factors such as flooding bed of rivers, topography, climate, forests, etc. on them. Today, with the development of science, technology and development in the life of citizens have made changes to people's demands and inclinations. The increasing growth of population and increasing immigration from rural areas to the cities have caused special concerns about uneven urban growth and damage to the natural environment surrounding the city and laying the grounds for decrease of life security of the citizens. Accordingly, experts have over the recent years considered this issue high on their agendas and look for solutions to reduce these problems, specifically prevention from the construction of houses near the river and development of the cities on large rifts and other regions that are faced with limitations resulting from natural factors. As the success of this plan is closely related to identification of all the factors related to the issue of physical development, its success at the macro level can pave the way for sustainable development. Therefore, it can be said that comprehensive urban management and standard urban development can, by identifying the physical potentials and limitations, take an effective step in determining the direction of physical development of the cities. Based on these factors, Mr. Rahmat Nourizadeh has investigated the process of changes of physical development of Ilam City with a focus on rural immigration and considers the spatial structure of Ilam City to have been greatly influenced by the immigration of people from rural areas to this city over three decades from 1968 to 1996.

In 1986, Soltanzadeh, in a paper entitled "an introduction to the history of city and urbanization", has investigated the importance of the issue of land use and the impact of environmental factors on the expansion of the city.

In 1994, Professor Farid, in his book entitled "application of geography in the urban and rural research method", has studied the importance of the issue of physical development.

In 1996, Qarebaqian, in his book entitled "economy of growth and development", investigated the impact of regular physical development mechanism on urban economy.

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In 2009, Akbar Kamijani investigated the process of formation and physical development of Kamijan City.

In 2007, Nader Omidi looked into the role of geomorphological elements in formation and physical development of Kangavar City.

In 2009, Maryam Galedar investigated the process of development and physical expansion of Khorramabad City after the Islamic Revolution. She engaged in the study of urban development in the past and review of the urban development projects.

Rahnamayi in 1990 examined the undeniable role of natural factors in development of the cities.

Makhdoum in 1993 also in his book entitled "foundation of land preparation", examined the role of geomorphology and the impact of these factors on the land preparation projects.

Mahmoudian in 1998 also in evaluating the slop movement in an earthquake-stricken area, attributed the destruction and caused damages to the occurrence of slop movement in some areas in addition to the seismic wave.

Moqimi in 2006 in England, in Manchester Construction Projects of large slope and topography, the risk of flooding and subsidence, considered all the obstacles to urban development.

In 2004, Mohammadzadeh, in a paper entitled "modernity and urban planning", investigated the basic criteria in advancing urban goals and integrated urban development.

In 1830, Roge, in his book entitled "geomorphology", conducted his studies entitled "a look into the proper grounds of urban environment from a geomorphological perspective".

In 1841, Mr. Kamel studied the relationship between the city and its natural and cultural environment and in his study, he noted the impact of environmental factors on the regular urban growth.

In 1894, Couli, in a study entitled "shipping lines, railways and natural environment", showed that all the noted factors are highly effective in expansion of the cities.

In 1942, Harvey, in his study entitled "social justice and proper urban planning", studied the relations between the urban environment and proper living environment.

4. RESEARCH METHODOLOGY

This study is descriptive-analytical with an applied goal and for this purpose, the required data has been collected through library and field studies. Thus, the data collection methods in this study were library-documentary and field operations. In the first method, by means of books, journals, articles, research projects, newspapers and maps, the required research data was gathered.

In the second method, by directly visiting the area of research and method of physical development of the city and environmental factors of the city and speaking with the urban development officials of Department of Urban Development of Quchan, the data was collected.

5. GEOGRAPHICAL LOCATION

Quchan City is part of Khorasan Razavi Province. This city has been located between the geographical orbit of 36 degrees and 37 minutes to 37 degrees and 40 minutes, north latitude from the equator, and 58 degrees and 10 minutes to 58 degrees and 58 minutes, east longitude from the Greenwich meridian. In terms of location, it reaches Dergaz from the north-east and Neishabour and Esfarayn from the south and Farouj in North Khorasan Province from the west

and Chenaran from the east. Quchan within 75 km has common borders with Turkmenistan. The city area is 4.3713 square kilometers 3.2% and the altitude from the sea level is 1225 m. Quchan City is among the cities that were established at the level of Khorasan Province after the legislation of the first Law of Country Divisions in 1937. After the legislation of this Law, Quchan City, with the centrality of Quchan City, was established and included central parts and Bajgiran. Since then, with different extensions and abstractions, it has always been considered as one of the cities of Khorasan Province. Based on the country divisions approved by the Ministry of the Country in 2003, Quchan City, with the centrality of Quach City, included three sections and nine villages and in the latest country divisions in 2003, with the separation of Farouj section and its conversion into a separate city, Quchan was considered as one of the cities of Razavi Khorasan Province (Statistical Annual of Quchan City, 2007: 22).

Climate:

Quchan, due to the geographical latitude higher than the cities in the south of Khorasan Province and also expansion of two tall Kape Dagh and Aladagh mountains with the north-west and south-east directions that have had different effects on the air masses prevailing in the area and also micro-climactic factors, has a special local climate; in such a way that in summers the climate is moderate and the mountains are more moderate and have more favorable air. In winters, a severe and extreme cold prevails in this area and it can be said that the more we move from inside the plain to the ranges, the temperature decreases and the duration and severity of the cold increases. The cold season in the year starts earlier in this area and its duration is longer. Spring starts later and autumn has a short life. The rainfall is mostly in winter and in the form of snow and summer is the dry season of the year. In this area, the more we move from the north to the south, the rainfall decreases and the temperature increases.

Temperature

Temperature is studied due to its importance in terms of dryness and degree of evaporation and transpiration and also the role it plays in changing the quality of weather in summer and winter.

Table 1-3. The number of frost days and minimum temperature occurred at Quchan City from 1999 to 2011.

1390	1389	1388	1387	1386	1385	1384	1383	1382	1381	1380	1379	1378	
2	1	3	0	5	0	9	8	6	0	0	0	0	April
0	0	1	0	0	0	0	0	0	0	0	0	1	May
0	0	0	0	0	0	0	0	0	0	0	0	0	June
0	0	0	0	0	0	0	0	0	0	0	0	0	July
0	0	0	0	0	0	0	0	0	0	0	0	0	August
0	0	0	0	0	0	0	0	0	0	0	0	0	September
0	0	5	0	5	0	0	0	0	0	0	0	0	October
9	16	13	16	15	4	0	0	7	3	2	7	9	November
28	28	24	13	18	30	13	20	16	21	7	20	19	December
30	30	19	28	29	30	27	28	16	25	14	22	22	January
29	26	22	22	29	16	15	27	20	27	24	25	27	February
21	23	4	11	16	16	9	7	12	15	15	13	21	March
119	124	91	90	117	96	73	90	77	91	62	87	99	Sum
22/6	17/8	12/8	15/4	25/4	15/4	15/8	11/2	14/8	12/2	10/0	14/6	13/4	Lowest temperature

(Source: Quchan Aerology Station, 2011)

Rainfall

Average annual rainfall of Quchan station is 8.250 mm and the maximum rainfall is in March. In general, the rainfall in the cold months of the year is mostly in the form of snow.

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Table 3-2. Average monthly and annual rainfall collection (1999-2011).

Annual	September	August	July	June	May	April	March	February	January	December	November	October
316	3/2	1/9	5/8	11/8	31/7	38/3	55/5	49/5	37	33/1	29/4	11/2

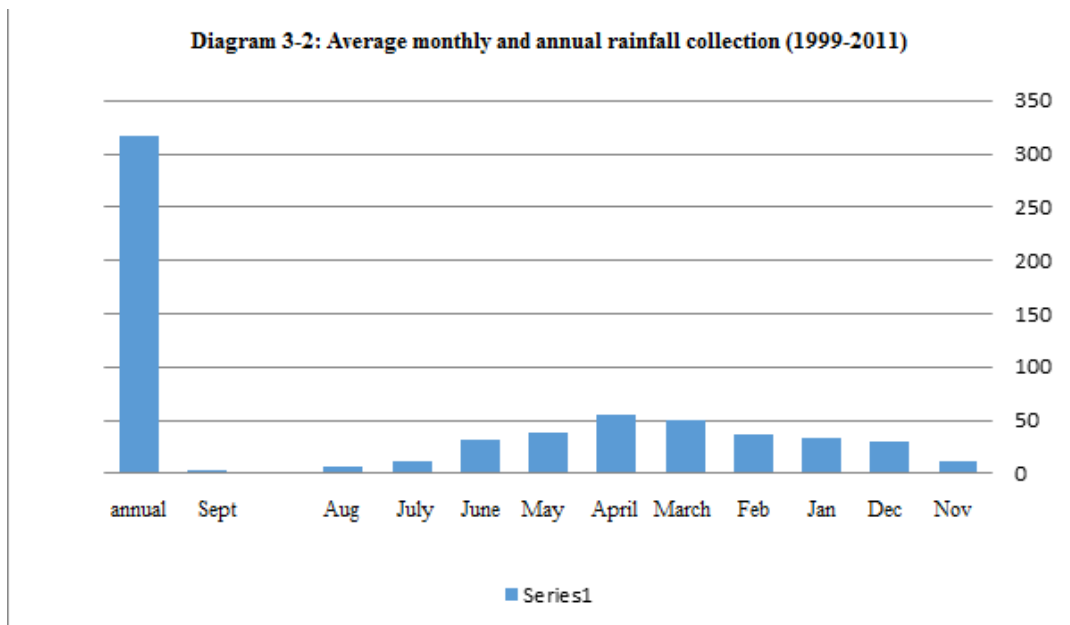


Diagram 3-2. Average monthly and annual rainfall collection (1999-2011).

The Role of Natural Factors in the Physical Development of Quchan City

In the physical development of the cities, natural factors have played an undeniable role. The most important of these factors include: the climate of geomorphological phenomena, topographic effects, rifts, flooding beds of river topography and other geomorphological forms such as limestone forms, forms related to volcanic areas, etc.; and it can be said that Quchan City is located on the plain. With regard to the role of natural factors in Quchan City, factors such as topographical conditions, the condition of flooding beds of the river and geological condition of the region can be mentioned.

The Role of Phenomenon of Geology in the Expansion of Quchan City

Based on the study and statistics, the region under study has been comprised of the formation of various periods such as Sanganeh, Sarcheshmeh, Tiregan, clastic sediments of Neogene, formation of Mozduran, formation of Atayer, loess cover, folded conglomerate, formation of Shourijeh, long terraces, Cretaceous flyschs, formation of Shemshak and alluvial fan plain.

Quaternary sediments have been formed by old and young alluvial fan terraces and alluvial plains. These sediments have covered a large area of Quchan plain. As the city has been made on the alluvial fan plain, in its physical development, the issues related to the areas with alluvial fan formations should be given special consideration (Technical Bureau of Soil Mechanics Studies of North Khorasan Province).

The Problems Arising from the Expansion of Quchan on Alluvial Fan Areas

One of the major problems that threaten the cities located on alluvial fan areas is the change of the riverbed in intermittent intervals and river flooding. In other words, when the water flow expands in width, its depth and speed decrease; therefore, sedimentation occurs. As the cities made on the alluvial fans are built on this kind of sediments, they do not have proper stability

and even the urban institutions that are built on these formations, despite the use of resistant building materials, lead to subsidence and creation of gaps between the walls of buildings. In Quchan City, in the marginal or peripheral areas of the city, housing has been done even inside the flooding bed of the river.

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Geomorphological factors such as rifts, flooding bed of the rivers, the type of formations, etc. can play a significant role in the physical development of the cities.

The Rifts

In Quchan City, many rifts can be seen and if their length and distribution is not heeded, expansion of Quchan City will lead to irreparable risks as in 1993 and 1994 a destructive earthquake caused the whole Quchan region to be destroyed (Detailed Project of Quchan)

5. DEVELOPMENT MODEL OF QUCHAN CITY

The urban movement in Quchan City is the movement from the center towards the surroundings; this means that the affluent classes in the city reside mostly around and outside the old context of the city and in the old context of the region, the highest level of instability can be seen.

The Physical Development Condition of Quchan City

After the destructive earthquake in 1993 and 1994 in old Quchan, Quchan in its current place was formed in Nazarabad lands and within 12 km from north-east of old Quchan.

The initial core of the city was the central square of the city and the expansion of the city until 1953 reaches Atrak River from the north, Sa'adi and Lachini Streets from the east and Taftazani and Dabaghi Streets from the west and Sanayi and Sadrabad Streets from the south, and in the period 1983-1997, the city has enjoyed sharp growth in the south and east.

Expansion of Quchan City, Removal of Building Materials and its Effects

Extensive housing constructions, implementation of infrastructure projects, etc. have caused humans to invade the nature to provide their required consumption materials and engage in the extraction of materials by means of various machines. The most important of these materials is sand which is provided from the context of the old river and the removal of these materials from the riverbed causes changes in their longitudinal profile and leads to the increase of the slope of the bed. This causes the raw power of the river to increase even without an increase in the water flow and leads to the emergence of the risks of flood and flooding. With the growth of urban development of Quchan City, we witness the aforementioned factors, in such a way that the most important economic activities that occur inside the catchment basins of the region, have been the removal of stone and sand from the bed of major waterways for use in urban constructions and infrastructure projects. The removal of these materials is to such an extent that it has completely disrupted the morphology of catchment basins and has changed the longitudinal profile of the waterways and uneven beds have led to slope breaks which on the one hand has increased the risk of flood and on the other hand, due to disruption of the sediments in the bed floor, it has helped to the transportation of more materials to the downstream areas. A considerable amount of sand removal has caused cavities in different sizes. This has disrupted the balance of slope of the ranges and has created several precipices.

6. CONCLUSION

What is inferred from the studies conducted is that expansion of Quchan City has directly and indirectly made changes in the hydrological and geomorphological conditions of the region. The

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development of this city has indirectly led to the occurrence of the phenomenon of subsidence in some areas of this city. This will in turn cause gaps in the lands and the vast destruction of agricultural lands and in case of inattention to these factors in the future, many problems will emerge. Moreover, the development of this city has transgressed the watercourses and their peripheral lands have engaged in ungrounded construction and unloading of a great volume of the dump into the watercourses has decreased their width and has led to their obstruction. Also, to provide raw materials, it has been tried to unload sand from the waterway, which has in turn disrupted the balance of the ranges and their morphology.

These factors caused the flooding rate of the catchment basin to increase and to cause the problems of flood and surface flooding in the region. Also, Atrak River has become the collection place for urban waste and garbage of the citizens and in some parts of it constructions have been started, which has disrupted the latitudinal and longitudinal profile of Atrak River and has caused flood in the region at the time of heavy rain. Based on the above factors, as a result of uncontrolled development, Quchan City is subject and vulnerable to the risks of flood, subsidence, fracture and environmental pollution.

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