Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231– 6345 (Online)
An Open Access, Online International Journal Available at www.cibtech.org/sp.ed/jls/2015/01/jls.htm
2015 Vol.5 (S1), pp. 3805-3812/Mohammadreza et al.
Research Article

ENGINEERING GEOMORPHOLOGY ASSESSMENT OF LADIZ RIVER

Mohammadreza Yaghubifeyzabadi, *Jafar Rahnamarad and Kazem Shabanigorji
Department of Geology, Islamic Azad University, Zahedan Branch, Zahedan, Iran
**Author for Correspondence*

ABSTRACT
Ladiz River located in the South East and Iran's and Sistan and Baluchistan province. The aim of this study was to determine changes in direction, longitudinal and transverse profiles and determine the stable and unstable parts of the river. In this research, library studies, field visits and samples from the bend of the river, explore the aerial photographs of the area, the river was divided into two intervals and morphological characteristics such as length and radius of curvature of each interval, the general trend of movement and erosion width of the channel was calculated in GIS. The results showed that the pattern of rivers, Gravelly the arterial bed. The study of geometrical parameters, 38% and 62% bend folds are stable and unstable. The minimum and maximum width of the river respectively, 13 and 253 meters. Classify the morphological component is Shybza rivers. Rusgen classification, G3 and G4 are placed in the river. Comparing the 1971 and 2014 aerial photographs, river diversions have 3 bends.

Keywords: *Ladiz River, Geomorphology, Engineering, Rusgen Classification, Geology, GIS*

INTRODUCTION
Rivers, in the past, the focus of attention of mankind and civilization, large and small, throughout history, along with the natural phenomena of life, and continued to rise. In many cases, flood, inundation and erosion of the river bed sides hurt many farms, homes, put people marginalized in natural waterways. It is therefore important to understand the factors contributing to the erosion of the river tried to change the normal process (Refahi, 2003).

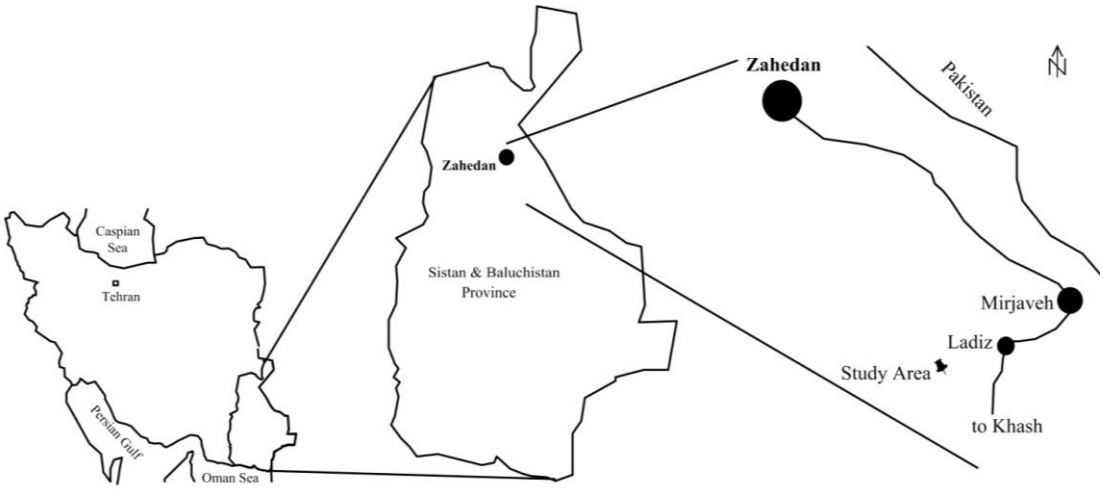

Figure 1: Geographic location map of the study area

Rivers and streams, the system is entirely dynamic. Position, shape, and other morphological features which are continuously changing over time (Rangzan *et al.*, 2006; Khanlary *et al.*, 2013; Roostaee *et al.*, 2013). River as natural resource contexts has elements that are in dynamic equilibrium with each other and a change in any component will cause changes in other components (Shirdeli *et al.*, 2006; Talebi and Bayazid, 2008). Rivers, under influence of erosion and sedimentation, are subject to various changes. Including a change of direction, the longitudinal and transverse displacements, taking shortcuts, change of river bed elevation change, modify or alter aggregation path pointed geometric features (Hey, 1986).

Ladiz River in the South East and Iran's Sistan-Baluchistan province Tuesday busted a major watercourse of Saeed Abad, Mesopotamia and the Black Forest there. In this study Jghrafyayy'00 river Ladiz the opportunity to '20 ° 61 ° 61 'east longitude and '85 ° 28 to '00 ° 29' north latitude (the cascade downstream) has been studied. Road access to the area, via Zahedan- Mirjaveh- Ladiz asphalt road (Figure 1). The aim of this study was to determine changes in direction, involvement in agriculture, river erosion mechanisms and reaction channels is investigated in terms of longitudinal and transverse pattern ultimately determine the stable and unstable parts of the river is.

In this study, using aerial photographs and satellite images for the years 1971 to investigate the stability and change Ladiz River downstream from Niagara Ladiz discussed.

Classification of River of Age

In this classification, the successor bed erosion is the erosion process. Cross rivers carry sediment by branches of the slope is more to it. Ladiz River with gravelly bed of a river is young.

Classification of the River

In general, both the Cascade Range to the branching points downstream, the arterial pattern. Based on the average slope of 2.0 to 6.0 per thousand and the average annual rate of 4/69 cubic meters per second, according to the criteria (Lane, 1957; Leopold and Wolman, 1960) placed in the artery.

Classification of River Morphology

Given the longitudinal profile (Figure 3), the morphology of the slant river placed. Also by Category I (Schumm, 1963), is an irregular pattern of vasodilatation.

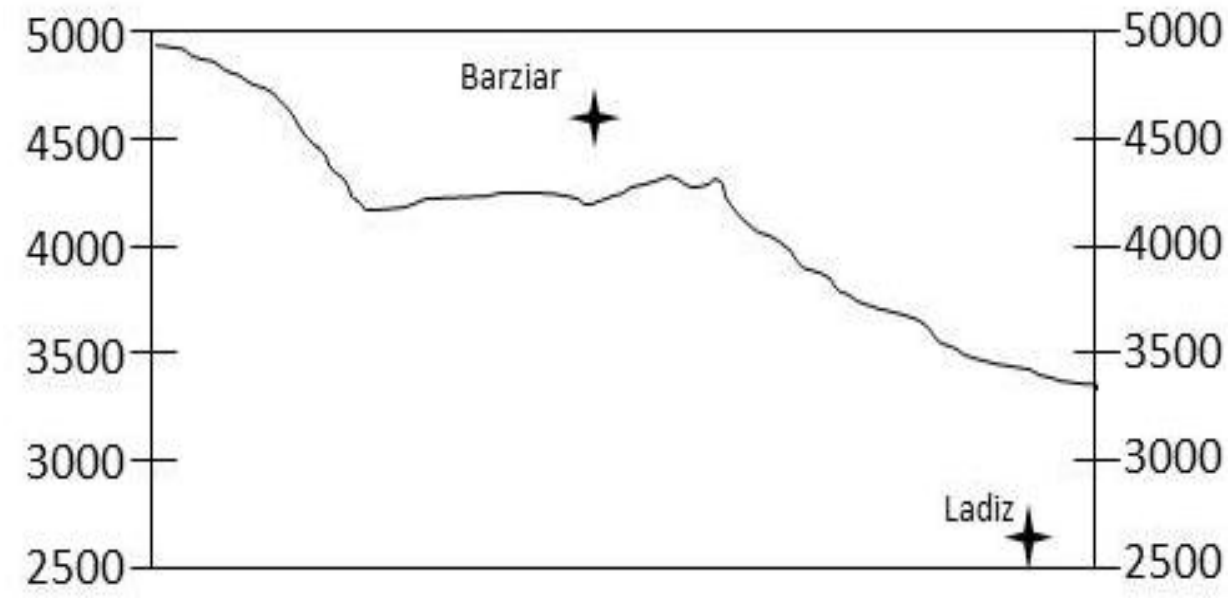

Figure 3: Longitudinal profiles of Ladiz River (downstream from the waterfall)

Classification of River Classification System Rusgen

Rusgen classification, characteristics such as the shape of the plan, the slope, and the average particle size of the substrate, the W/D ratio, En, and sinusitis than calculated and listed in Table 2. The average width of 41 m river width to depth ratio is less than 12 degrees.

Table 2: Characteristics of the study to River classify

The River Plan	Grain Size	Dip Av.	W/D	En	Si		
					Max	Av.	Min
Braded	Gravel	0.02-0.39	12>	1.4 >	2.05	1.46	1.25

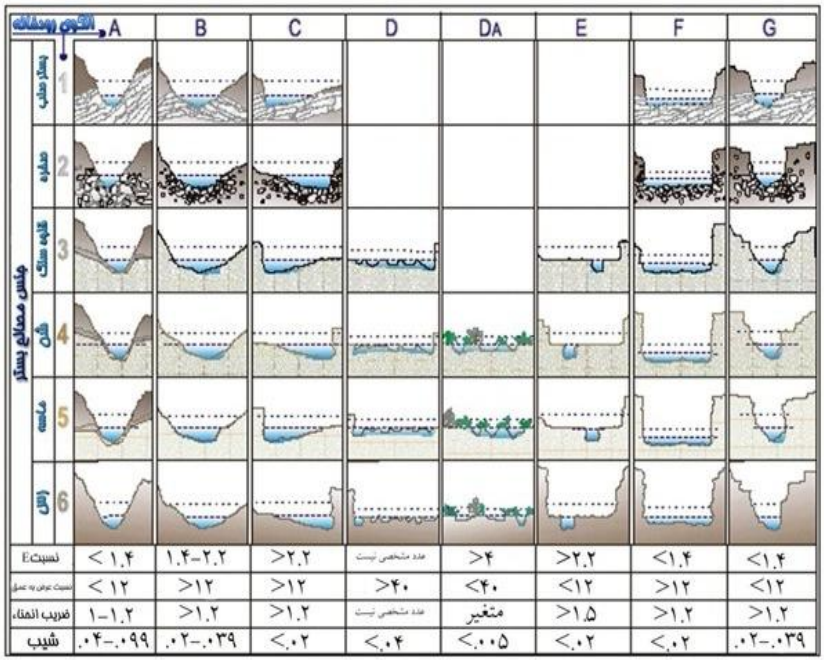

Figure 4: Classifications in the Rivers II (Rusgen, 1994)

According to the specifications listed in Table 2 and Figure 4, the river in groups G3 and G4 (classified according to the Rusgen level II) the arterial form is placed.

River Engineering Polymorphic Method

The best way to identify these parameters from Morphology studies and their use in the regularization scheme. Estimate Morphological Rivers, River Bank Stability of Three hydraulically, experiential and qualitative done.

Table 3: Characteristics of the studied bending Ladiz River (above the waterfall)

No.	λ	L	AM	Si	R/B	B	R	D (Degree)
1	920	562	97	1.3	2.9	32	95	339
2	1083	930	86	1.2	12.16	13	156	341
3	1139	1014	84	1.3	12.14	14	170	342
4	1395	973	135	1.2	8.04	24	193	289
5	1853	1746	127	1.6	2.8	110	309	323
6	1489	767	136	1.3	1.45	151	220	199
7	754	519	107	1.4	1.2	102	122	243
8	590	562	77	1.4	1.34	78	105	306
9	412	391	196	1.8	3.48	39	136	164
10	337	478	156	2.05	2	55	110	249
11	390	547	242	1.9	0.95	192	182	172
12	1184	1377	239	1.44	0.94	253	238	331
13	1207	864	334	1.15	1.14	227	259	191

According to the results of Table 3, five of bending (5, 9, 10, 11 and 12) is unstable with respect to the degree of Sinuosity greater than 4.1 and low sediment transport capacity of the river. Figure 4-6 shows a diagram Sinuosity frequency coefficients, according to the chart, 38 percent and 62 percent of bends, bends are stable and unstable.

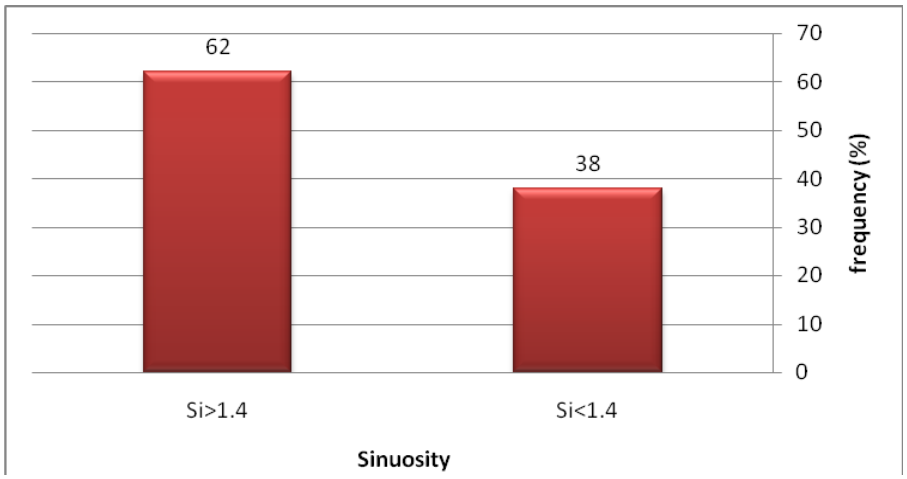

Figure 5: Diagram of the frequency Sinuosity Ladiz River (above the waterfall)

Table 4-4 Characteristics of curvature of the bend in the river Ladiz coefficient expressed in percentage terms. According to the results of Table 4-3 can be seen that the average curvature of the arc of the river coefficient is 1.46.

Table 4: Characteristics of the coefficient of curvature bend in the river

Av. Si	Max Si	Min Si
1.46	2.05	1.15

The central angle of the arc of the river and out of the Kornis model (Kornis, 1980), a central angle of 6 arc in the range (more than 296), 5 River Bend in the range (296-185) and the second arc in the range (185-85) are given. Most central angle of approximately 46.15% of those placed over 296 degrees, which corresponds to a twisted pattern is developed (Fig. 6).

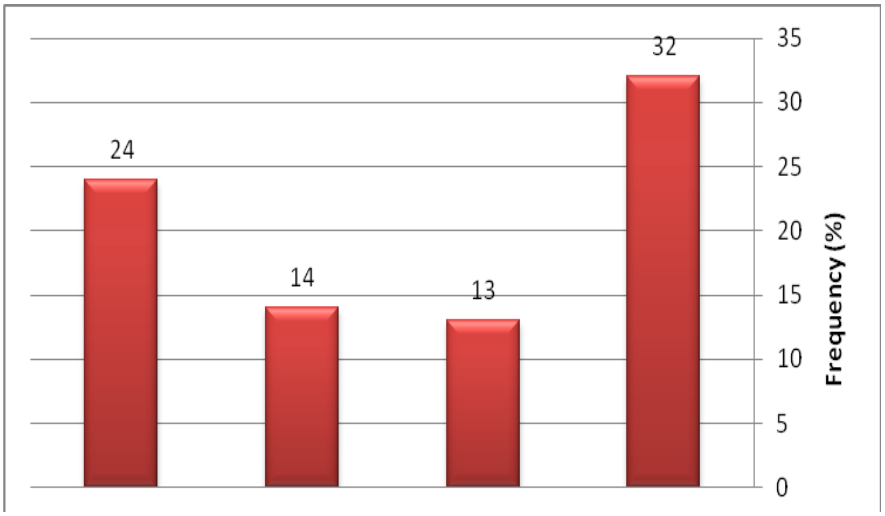

Figure 6: Graphs the distribution of the central angle of the bend of the river Ladiz

Figure 7 graphs the frequency range spanning the river bends to show. The ratio of the radius of curvature of less than 1.5 on the river, which is about 35% cut by shooting mode shows in some of the bends, lateral spreading is observed. The field survey results have been implemented.

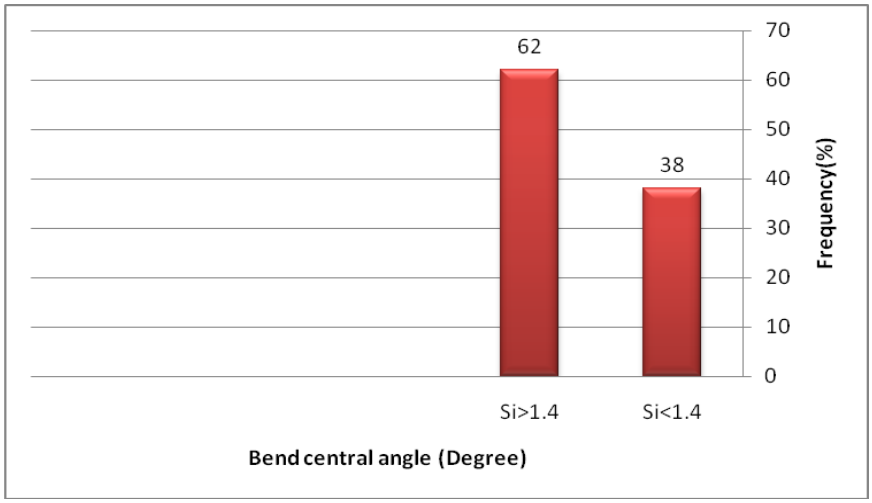

Figure 7: Diagram of the frequency range spanning the River Bend Ladiz

Results Table 6 shows that both the average interval streams according to the parameters obtained from the unsteady state.

Table 6: To determine the range of stable and unstable streams based on the geometric parameters in each interval

Av. Si	Av. R/W	Av. D	Si type	R/W type	D type
1.46	3.88	268	Unstable	Unstable	Horseshoe shaped

The mean coefficient of 1.5 indicates high curvature of the maze that is the boundary between the straight and the river meanders. Also Kvrnays model, 56.5% of the central angle of the bend of the river among the twisted horseshoe is to be developed. Coefficients obtained from these models, the need for stabilization through management practices, biological and engineering structures requires.

Changes in Cross River

Transverse sections of the river due to erosion and sedimentation in the outer arc of the inner arc straight over intervals have experienced localized increases. Farmers also play a role in reducing the width of the river is the river. In Table 7, changes in minimum, medium and Maximum River is presented.

Figure 8: Handling Cross River

Table 7: The minimum, average and maximum width of the river

Min Width	Av. Width	Max Width
13	99	253

Changes in River Morphology over Time

River morphology is such that Erosion and twisted phenomenon is, when the annual flooding occurs frequently in its path. Meanders-moving rivers and the longitudinal and lateral movements caused by changes in river plan. River plain of low slope and low-speed stream, river occupied by villagers and bank erosion, major morphological changes over time has experienced. Figure 9 Plan of the river in the period 1971 to the present show. As it becomes clear picture of the seven bends of the river, have been rerouted.

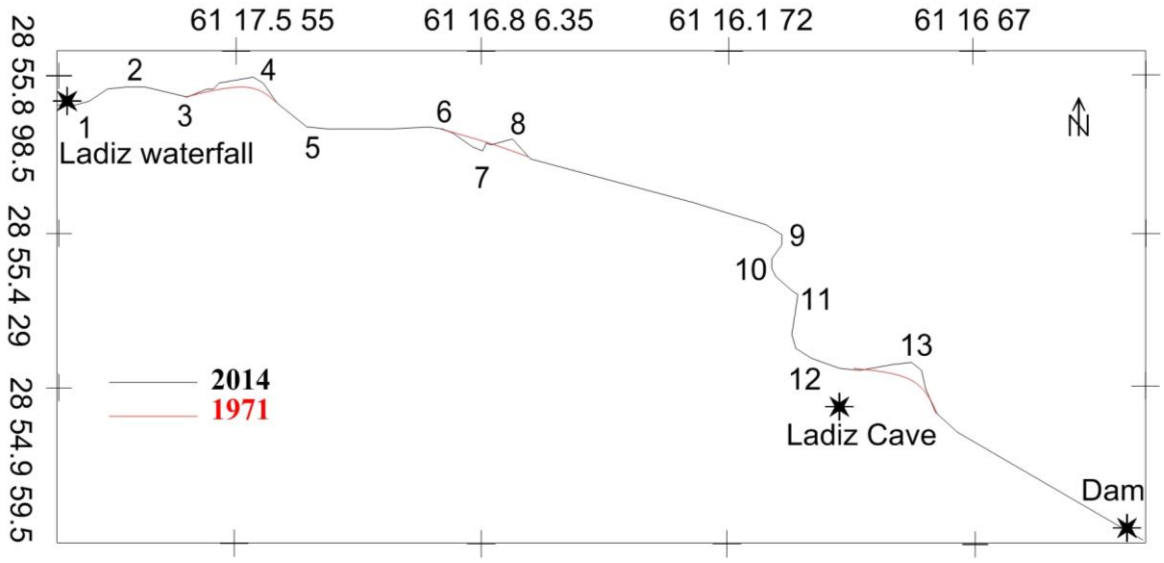

Figure 9: Change in the River Plan (1971 and 2014)

CONCLUSION

Classifying the shape of the arterial pattern of the river. According to the geometric parameters of the 13 bends, polymorphic methods show that 5 from bending due to Sinuosity greater than 4.1 are unstable and low sediment transport capacity of the river. A total of 38 percent and 62 percent, bends, folds unstable stable. Considering the Kornis model, No. 6 Bent over 296, No. 5 and No. 2 for bending bending between 296-185 185-85 and Rudy twisted pattern has developed. Maximum and minimum width of the river respectively 13 and 253 meters. Classify the morphological component is slope rivers. Rusgen classification, G3 and G4 are placed in the river. According to the 1971 and 2014 aerial photographs, river diversions have been studied in 3-Bend.

REFERENCES

Aghanabati S (2004). Geology of Iran. Geological and Mineral Survey 586.
Alai Taleghani M (2005). *Geomorphology of Iran* (Ghomes publication).
Alizadeh A (2012). Principles of Applied Hydrology", Sixth Edition, Thirty-Fourth Edition, University of Imam Reza in Mashhad.
Barjasteh A (2006). Evaluation of geomorphic features of river engineering (Ala) northeast of the city Ramhormoz. Tenth Symposium of Geological Society of Iran, Tarbiat Modarres University.
Bodaqpur S and Ebrahimi M (2010). The morphology of rivers and swamps Gorgan River, the fourth had a scholarly conference and Exhibition on Environmental Engineering, Tehran University.

Kangi A, Rahnamarad J, Saadatkhah N and Rohani A (2009). The variation in amplitude of the seismic loading influenced Rjdvn River (North Gonaveh). *Journal of Applied Geology*, Islamic Azad University, Zahedan (III).

Khanlary Gh, Heydari M, Mohebbi Y, Abdi Lar Y and Babazdeh R (2013). Engineering geomorphological characteristics of the river bottom Gamasyab located in East of Kermanshah. *Journal of Engineering Geology* **VII**(2) Autumn and winter, 92 1832-1811.

Lane EW (1957). A study of the shape of channels formed by natural streams flowing in erodible material, MRD Sediment Series No. 9, U.S. Army Corps of Engineers, Missouri River Div., Omaha, Nebraska.

Lawlor Sean M (2004). Determination of Channel-Morphology Characteristics, Bankfull Discharge, and Various Design-Peak Discharges in Western Montana, *Scientific Investigations Report* 2004-5263 1-19.

Lee EM and Fookes PG et Milligan G (2005). *Geomorphology for Engineers* (Whittles Publishing, CRC Press) (Scotland, U.K.) 851.

Leopold LB and Wolman MG (1960). River meanders. *Geological Society of American Bulletin* **71** 769- 794.

Leopold Luna B, Wolman MG and Miller JP (1964). *Fluvial Processes in Geomorphology* (W. H. Freeman and Co.) San Francisco.

Mehrparto J (1983). Geological Map of Taftan (1: 100,000). Department of Geology and Mineral Exploration.

Nohehgar A, Hosseinzadeh M and Afshar T (2010). Longitudinal and transverse profiles geomorphologic changes Minab upper river (from the dam to the bridge Minab). *Geographic Society's Journal* **VIII**(24).

Pasban A, Mahbubi A, Mahmoodi Gh M, Khanehbad M and Taghdisi NS (2009). Evaluation of processes affecting the particle size changes during Srghayh River south of Mashhad. Twenty-Seventh Symposium of Geosciences - The Thirteenth Meeting of the Geological Society.

Pourkermani M (1986). *Brief on Geomorphic Province*. Geographical Research, Mashhad **1**.

Rangzan K, Salehi B and Salahshoori P (2008). Changes in the region downstream of Karkheh dam before and after images using multi-temporal Landsat, Geomatics, National Cartographic Center, Tehran.

Ramesht MH and Tavangar M (1999). The concept of equilibrium in geomorphology philosophical perspective. *Journal of Geographical Research*, Faculty of Humanities, University of Isfahan, 542 articles.

Ramesht MH (2000). Environment Impact and Sustainability of Navigation Improvements to the Karon River, Geography, Bulten, New Castle University.

Rosgen DL (1994). *A Classification of Natural Rivers*, Catena **22** 169-199.

Rosgen DL (1985). A stream classification system. In: *Riparian Ecosystem and their Management, First North American Riparian Conference*, Rocky Mountain Forest and Rosgen Experiment station, RM-120 91-95.

Roostaee Sh, Khorshiddoost MA and Khaleqi S (2013). Assessment of river channel morphology Lighvan Rasgn classification methods. *Quantitative Geomorphology Research* **4** 16-1.

Sabzivand R, Hashemi AS, Majdzaheh TMR and Shafahi M (2007). *Classification of River Morphology Perspective* (published in Yazd verandah).

Samani B and Ashtari N (1992). Geological development of Sistan-Baluchistan region. *Journal of Earth Sciences* **1**(4) 25-14.

Schumm SA (1963). Sinuosity of alluvial rivers on the Great Plains. *Bulletin of Geological Society of America* **74** 1089 – 1100.

Schumm SA (1969). River metamorphosis. *Proceedings of ASCE Journal of Hydraulic Division*, HY1 6352 255 – 273.

Schumm SA (1977). *The Fluvial System* (John Wiley & Sons) New York 338.

Schumm SA (1989). Anastomosing Streams or Anastomosing patterns. *Geological Society of America Abstracts with Program* **12** 153.

Schumm SA (1993). River response to base-level change: implications for sequence stratigraphy. *Journal of Geology* **101** 279-294.
Talebi L and Bayazidi Sh (2008). Evaluation of morphological changes using classified rivers Rosgen (The Case of the Green River Mountains), *the Seventh Conference of Iranian Hydraulic, Power and Water University of Technology (Martyr Technology), 21 to 23 November*.
Tirrul R, Bell LR, Griffis RJ and Camp VE (1983). The Sistan Suture Zone of eastern Iran. *Geological Society of American Bulletin* **94** 134-150.