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Engineering Geomorphology Investigation of Top-Branch Ladiz River

Mohammadali Enayat, Jafar Rahnamarad, Kazem Shabanigorji

Department of Geology, College of Science, Zahedan Branch, Islamic Azad University, Zahedan, Iran

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ABSTRACT

Ladiz River in the South East of the country and the province Tuesday busted a major watercourse of Saeed Abad, Miyanrood and siyahjangal. The aim of this study was to investigate the geomorphology of river engineering branches Ladiz (the waterfall to the Ladiz dam) and set a redirection, longitudinal and transverse profiles and determine the stable and unstable parts of the river is. After data collection, field visits sampled in the river bend area, examining aerial photos of the area, the river is 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, and Figure channels etc. were calculated in GIS environment. Braded with gravelly. The study of geometrical parameters, 5.43 to 5.56 percent of bends and folds are stable unstable. The Kornais model, 5.56% of the central angle of the arc is located in Horseshoe category. Maximum and minimum width of the river respectively 2 and 94 meters. Classify the morphological component is Gradients rivers. In Rosgen classification, G3 and G4 are placed in the river. Comparing the 1971 and 2014 aerial photographs, River redirection is only 7 Bends.

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INTRODUCTION

Rivers, as a Hungarian gathering and transmission of natural precipitation from the distant past has always been of interest to human societies. Throughout the history of civilization, large and small, 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. Rivers and streams, are fully functional system, the location, shape and other morphological characteristics, it has been changing steadily over time [17,7,22]. River as a natural resource contexts, has elements that are in dynamic equilibrium with each other, and changes in any of the components will lead to changes in other components [30]. Rivers affected by 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. River Ladiz in the South East of the country and the province Tuesday busted a major watercourse of Saeed Abad, Mesopotamia and the Black Forest there. In this study, the river branches Jghrafyayy'00 Ladiz the opportunity to '20 ° 61 ° 61 'east longitude and '85 ° 28 to '00 ° 29' north latitude (the waterfall to the Ladiz dam) has been studied. Road access to the area via Zahedan-Myrjaveh asphalt road and then to the Ladiz village (Figure 1). The aim of this study was to determine the geomorphology of the Ladiz river branches of engineering, based on river morphology, determine the route changes, the engineering properties of soil textures Privacy river, involvement in agriculture, river erosion mechanisms and reaction channels is investigated in terms of length and pattern Vnymrkh transverse and ultimately determine the stable and unstable parts of the river is.

In this study, between 1971 and 2014 using aerial photographs, satellite images, to investigate the stability and redirection branches River Ladiz (upstream from the Ladiz waterfall) in the two periods studied. Engineering geomorphological studies to identify such changes for the purposes of organizing and securing the river in front of the results is very important.

Corresponding Author: Jafar Rahnamarad, Department of Geology, College of Science, Zahedan Branch, Islamic Azad University, Zahedan, Iran.
E-mail: Jrahnama@appliedgeology.ir

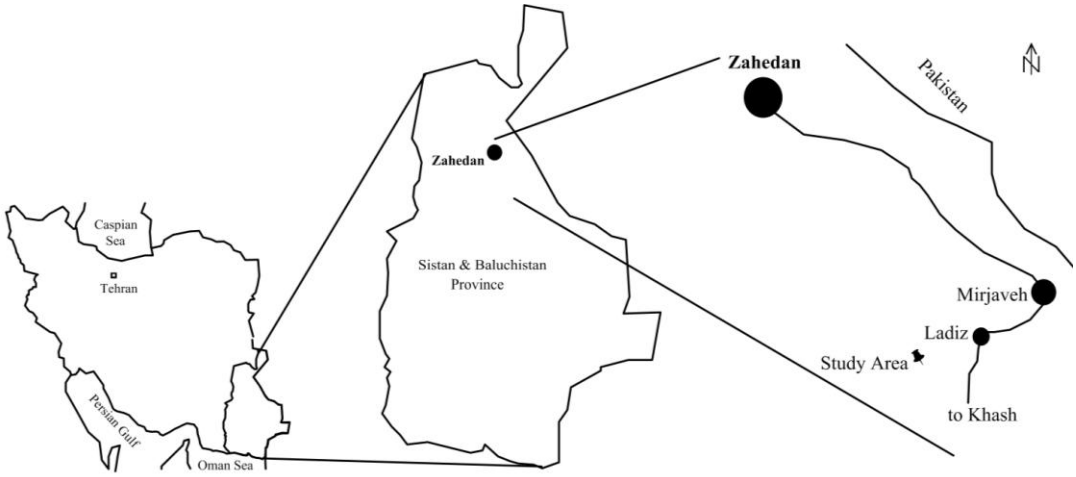

Fig. 1: Geographical location.

2- Ladiz River Classification:

2-1- Classification of River of age:

In this category, due to the erosion of the bed and is the successor to the ablation process has steep sides are. Section of the river is able to transport sediment, the slope shoots more, engages in the gravelly bed of the river is young.

2-2- Classification of the River:

In general, both the fork of the Cascade Range to the upstream is braded. 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 [8] and [11] placed in the artery.

2-3- Classification of river morphology:

Given the longitudinal profile (Figure 3), the morphology of the river Gradients placed. Also by Category I [25], is an irregular pattern of vasodilatation.

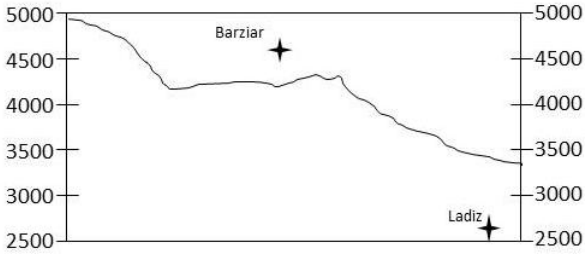

Fig. 3: longitudinal profile of the Ladiz River (above the waterfall).

2-4- Classification of river classification system Rosgen:

Rosgen classification, characteristics such as the shape of the plan, the slope, the average particle size of the substrate, the ratio of W / D, 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 classify.

The River Plan	Particle size	The average slope	Than **W/D**	Than **En**	Coefficient of curvature (sinusitis)		
Braded	Gravel	0.02-0.39	<12	<1.4	2.43	0.76	1.5

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

3- River engineering polymorphic method:

The best way to identify these parameters in various ranges of morphological 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).

Range	No.	(m)λ	L	AM	Si	$R/_W$	w	R	D (Degree)
1	1	200	130	55	0.76	1.46	23	33.6	221
	2	301.7	352.2	150.8	1.4	1.65	50.5	83.65	241
	3	941	937	145	1.04	6	25.6	155	346
	4	356	347	268	1.60	6.58	14.5	95.5	208
	5	318	331	271	2.43	1.70	34	58	327
	6	253	338	271.5	1.88	2.82	34	96	201
2	7	482	477	151	1.4	1.04	75	78	350
	8	495	547	149	1.17	1.27	69	88	356
	9	532	430	193	1.08	1.14	69	79	312
	10	524	381	191	1.24	1.08	70	76	287
	11	528	457	89	1.006	1.52	72	74	354
	12	754	495	161	1.87	1	83	83	341
	13	950	1047	163	1.61	1.82	92	168	357
	14	500	433	143	1.6	0.8	90	72	344
	15	637	374	145	1.6	0.83	91	76	282
	16	500	297	110	1.26	0.56	89	50	216
	17	511	351	111	1.33	0.66	94	62	324
	18	445	339	108	1.56	0.73	92	68	285
	19	445	339	108	1.56	0.73	92	68	285
	20	546	398	1012	1.77	0.75	93	70	325
	21	615	570	237	2.43	47	2	94	347
	22	608	534	248	1.44	61.33	1.5	92	332
	23	375	426	256	1.61	50.5	2	101	241

According to the results of Table 3, thirteen of the bend (4, 5, 6, 12, 13, 14, 15, 18, 19, 20, 21, 22 and 23) due to greater than 4.1 ° unsteady sinuosity have been less sediment transport capacity of the river is. Tsvyr4-7 graph shows the frequency factor sinuosity. According to this chart, 5/56 5/43 percent of bends and folds are stable unstable.

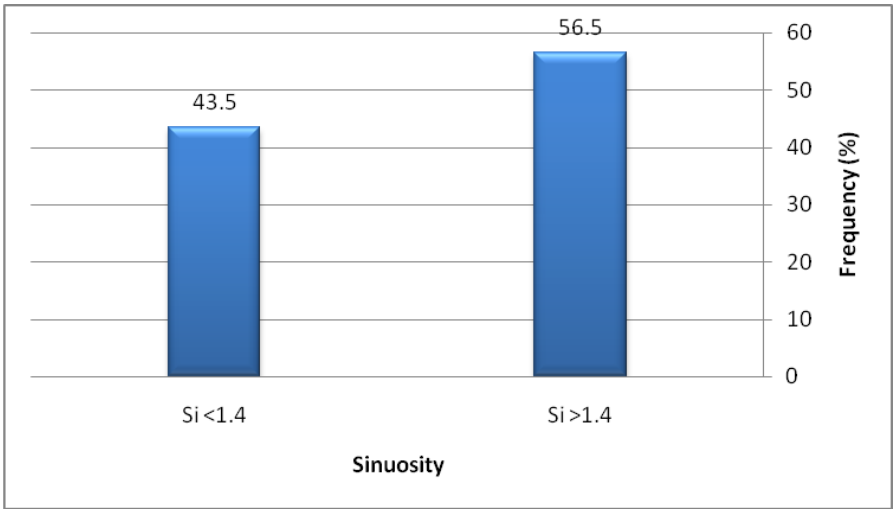

Fig. 5: Diagram of the frequency sinuosity of Ladiz River (above the waterfall).

Table 4 Characteristics of curvature of the bend in the river coefficient is expressed in percentage terms. According to Table 4.4, it is observed that the mean coefficient of curvature of the arc of the river is 5.1.

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

River	The mean coefficient of curvature	Maximum curvature coefficient	The minimum coefficient of curvature
Ladiz	1.5	2.43	0.76

The central angle of the arc of the river and out of the model Kornais, was calculated in Table 5, it is observed that the central angle of the arc in the range of 13 (more than 296), 10 River Bend in the range between (296 -185) are located. The most central point in the river, about 56.5 percent of those placed over 296 degrees, which is the horseshoe pattern (Table 5).

Table 5: Growth rate of the twisted river bend in the river, based on the Central Angle.

The shape River	Frequency of the Ladiz river	Central Angle (degrees)
Twisted goes too extended	43.5	185.1-296
Horseshoe shaped	56.5	More of 296.1

Figure 7 shows a graph of frequency, within a radius of bend of the river. The ratio of the radius of curvature of less than 5.1 on the river, which is 56.5% state cut by a shot from the show. In some bending and lateral spreading is observed. The results of the field survey has been implemented.

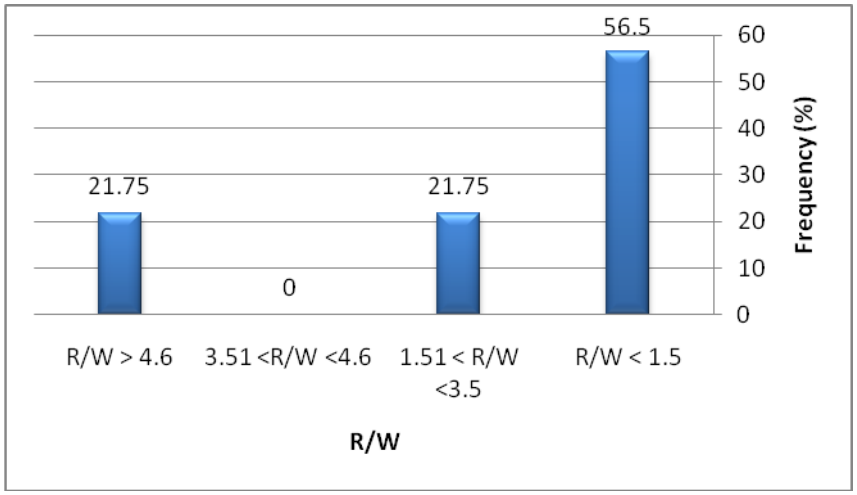

Fig. 7: Diagram of the frequency range spanning the Ladiz River (above the waterfall).

Results Table 6 shows that both rivers interval according to the parameters obtained for each interval mode is unstable.

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

No.	Av. Si	Av. R/W	Av. D(degree)	Based on the range of Si	Based on the range of R/W	Based on the range of Central Angle
1	2.6	3.4	257.3	Unstable	rotatory	Horseshoe shaped
2	1.5	10.2	214	Unstable	Stable	

In general, based on the results of the two range of, the river (upstream of the waterfall) mean curvature coefficient of 5.1, which represents the magnitude of the maze, which is the boundary between river meanders directly. The model also Kornais, 5.56% of the central angle of the bend of the river among the twisted Horseshoe shaped are to be developed. Coefficients obtained from these models, the need for stabilization through management practices, biological and engineering structures requires.

4- Ladiz River Changes:

4-1- Changes in Cross River:

Transverse sections of the river due to erosion and sedimentation in the outer arc of the inner arc, compared to range of local increases have experienced directly. 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.

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

River	Min W (m)	Av. W (m)	Max W (m)
Ladiz	2	59	94

Figure 8 shows the displacement cross the river.

4-2- 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. Meandri -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.

Fig. 8: Displacement Lateral River.

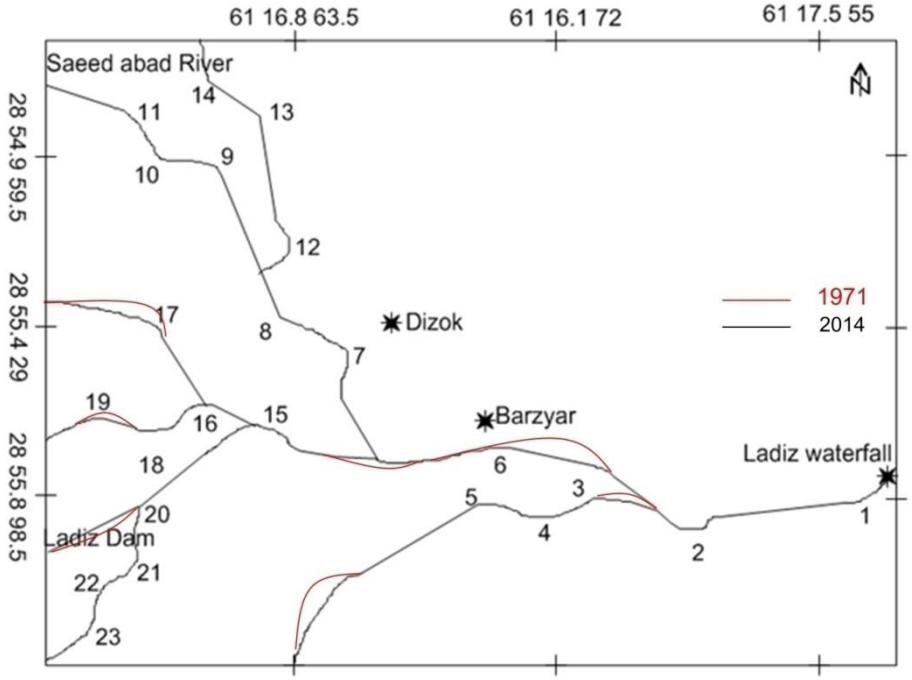

Fig. 9: Change in River Plan period (1971 to 2014).

Conclusions:

Classifying the shape of Braded pattern. According to the geometric parameters, the bend 23 polymorphic method, in two periods, suggesting that 8-bending, according to sinuosity greater than 4.1 are unstable and low sediment transport capacity of the river. A total of 5.56 percent and 5.43 percent, bends, folds unstable stable Bashnd.ba Kornais model, 5.56 percent of the central angle of the arc in the category of Horseshoe shaped Bend Darnd.dm associated with the radius ratio of the width the river is less than 5.1, the probability of the formation, by shooting at some folds, lateral spreading was observed. Maximum and minimum width of the river, respectively, 2 and 94 meters. Classify the morphological component is Gradients rivers. Rosgen classification, G3 and G4 in the river undertook a comparison of aerial images of 1971 and 2014, River Bend redirect only 7 cases have resulted from human activities such as agriculture and erosion Ast.frsaysh damage to the lateral sides of the river water Ast.frsaysh Nir down huge rocks in the riverbed sand dams that caused compatibility, the bed is muddy.

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