Evaluating the erosion hazard of the stream banks of Karoun, south of Ahvaz,Iran

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Abstract: The Karoun River with about 900 km length and 84000-km2 catchment's area is the longest and greatest river of Iran. Intense erodability of riverbank makes vastly economical damages and numerous legal difficulties for the owner of the lands. In this study, on the basis of several criteria such as soil texture, presence and absence of retaining structures and vegetation coverage around the river, the areas exposed to the erosion have been evaluated. Moreover, using aerial photographs of different years the rate of erosion in the different portions of the river has been assessed.

Key words: Karoun river, stream bank erosion, erosion and soil texture

1 INTRODUCTION

The Karoun River with about 900 km length is the longest and greatest river of Iran and its catchments area is about 84000 square kilometers. The annual average discharge of river is about 93 billion cubic meters, which about 26 billion cubic meters of this volume has been stored by dams constructed over that in upper stream and the remaining pours to the Persian Golf. The elevation difference between the water level in the river and adjacent grounds ranges from about 7m in Ahvaz to about 0.5 m in Abadan. The Karoun River is vitally important for Khozestan province in the south of Iran. Most of cities and villages of Khozestan have been established around this river and the agriculture of Khozestan plain depends mostly upon this river. There are 69 villages around the river from Ahvaz to Khoramshahr and 126 pumping stations, which transmit the water to agricultural and industrial consumers.

2 GEOMORPHOLOGY OF RIVER

This river in the vicinity of Ahvaz has a meander shape. The main reasons for formation of meanders in this river are:
-Decreasing the slope of the plain
-Uplifting of the land surface
-Existing non-cohesive material in river banks

-Deviation of flow direction due to obstacles (such as important structures and residential areas)
-The collision of Arabian and Iranian plate results in uplifting of Zagrous range and Khozestan plain, which, in turn, decreases the ground slope. The general direction of flow in Karoun river is north to east and direction of large meanders is east to west. It is seen that the

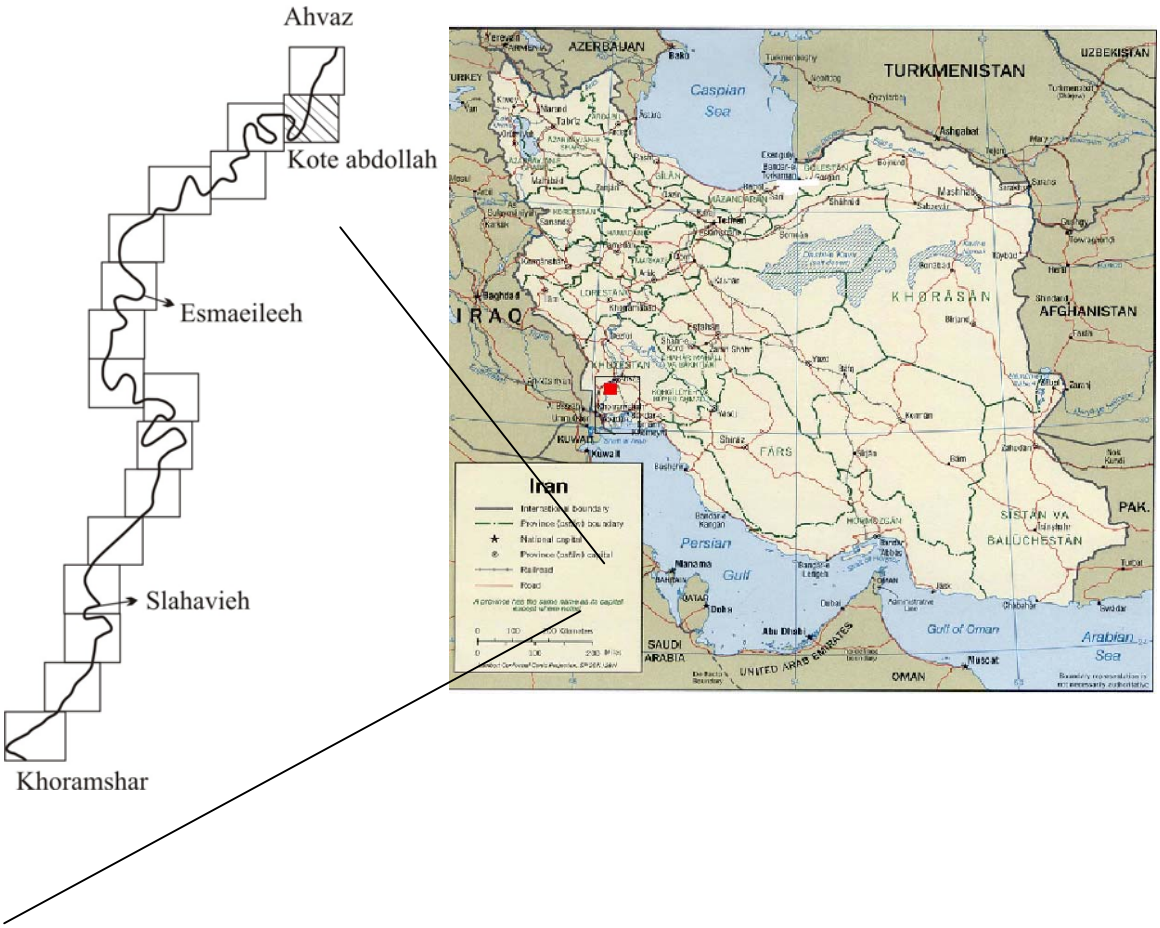

Fig 1 Location map of study area

earth rotational movement in the large river such as Karoun have rolled in east-west erosion and formation of east-west alignment of curvature.
The compression and intensity of meanders in section of study is not the same, in the first part of river channel from Ahvaz to Salahavieh river exhibits a more compressed meandering morphology.

3 SOIL TEXTURE IN STREAM BANK

The soil textures in banks of meander rivers are function of the location of points related to meanders. For example inside the curvature, the soil type in ground surface is fine-grained material, which becomes coarser with depth and vice versa for the channel (Fig 2). In addition, the size of material becomes smaller from upstream to downstream. The change of environmental conditions such as change of precipitation, sediments load and tectonic activities results in more heterogeneity of soil texture in longitudinal, transversal and depth directions.

To evaluate the texture and engineering properties of soils in the stream bank of section under study, geotechnical study including 48 boreholes and 92 cone penetration tests (CPT) were performed.

In exploration boreholes, the investigation tests of SPT and shear wave were applied. Also the disturbed and undisturbed samples were taken from each meter. Then the different laboratory tests of grading, hydrometer, atterberg limits uniaxial compression strength test, direct shear test and odometers were performed.
Based on geotechnical studies three following horizon of soils are recognized in marginal of Karoun river:
-Horizon A: low plasticity sandy silty clay (CL).
-Horizon B: Non cohesive clayey sandy silt (ML-CL)
-Horizon C: Clayey silty sand (SC-SM)
The two former horizons could be seen in inside of meanders and flood plain. The later one is indicator of channel deposit.

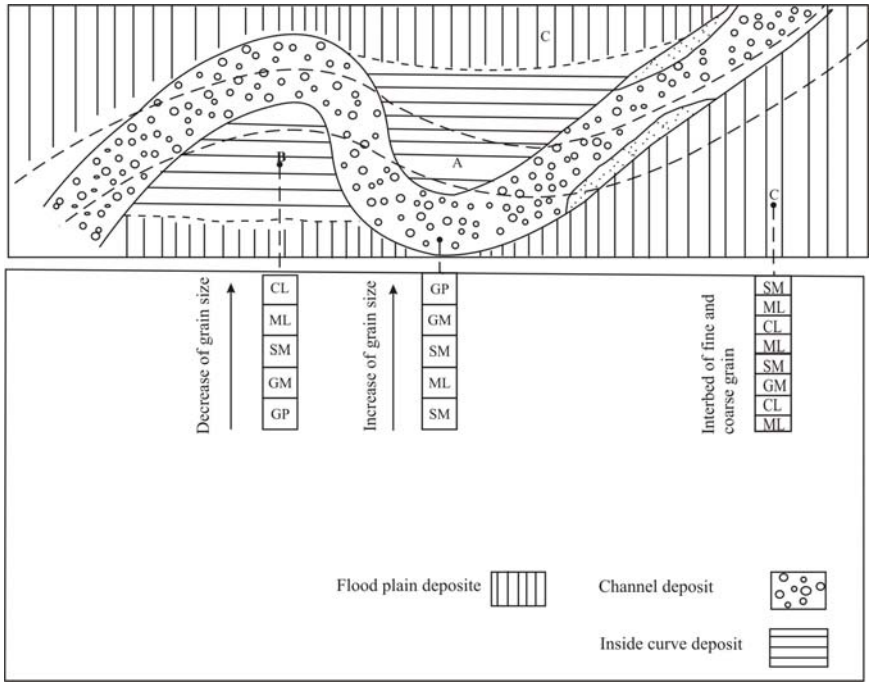

Figure 2 Soil texture around the meandering river

4 EVALUATION OF EROSION

The cross section of meandering river is asymmetric. It is because of erosion in outer curvature. The rate of erosion depends upon some parameters such as the angle of flow, strength of river, soil type formation of bank river, vegetation cover and stream gradient.

In upper parts of the river from Ahvaz to Salahavieh village where the non-cohesive soil exists, the rate of stream bank erosion is very high. The erosion of the toe of slope results in fall of stream banks. The comparison of ancient and new aerial photographs shows that the rate of erosion reaches up to 0.5 meter per year in some parts. A slightly slope of deposional

bar and absence of vegetation cover in inner curvature of meanders and vertical slope of stream bank in outside curvature are some evidences of rapid rate of erosion.

Intense erodability of riverbank in the external meander makes economical damages such as replacement of pumping stations (which transfer water from the river to adjacent lands), damaging of roads and buildings, increasing of sediment load of the river, making problem for shrimp nourishment and fish farms etc. In addition, formation and loss of land in the internal and external meanders, respectively, have produced numerous legal difficulties for the owner of the lands. The investigation showed that extensive erosion has occurred in area in which sandy or sandy silty non-cohesive soils exist or where extensive meandering occurred. In upper part of study area, there is a fine sand layer with thickness more than 6 m in depth of 7 to 8 meters, which is the present water level of river in Ahvaz region, there is a thick layer of sand, indicating the bed deposits in the last periods. Therefore, the sandy layer is easily eroded and failure occurred in the bank of river. Such conditions are observed in Ganjeh and south of Soeichi villages(Fig 3). In the later location the movement of river have been damaged the Ahvaz-Khoramshahr road. Finally, on the basis of several criteria such as soil texture, presence and absence of retaining structures and vegetation cover around the river, the areas exposed to the erosion have been evaluated.

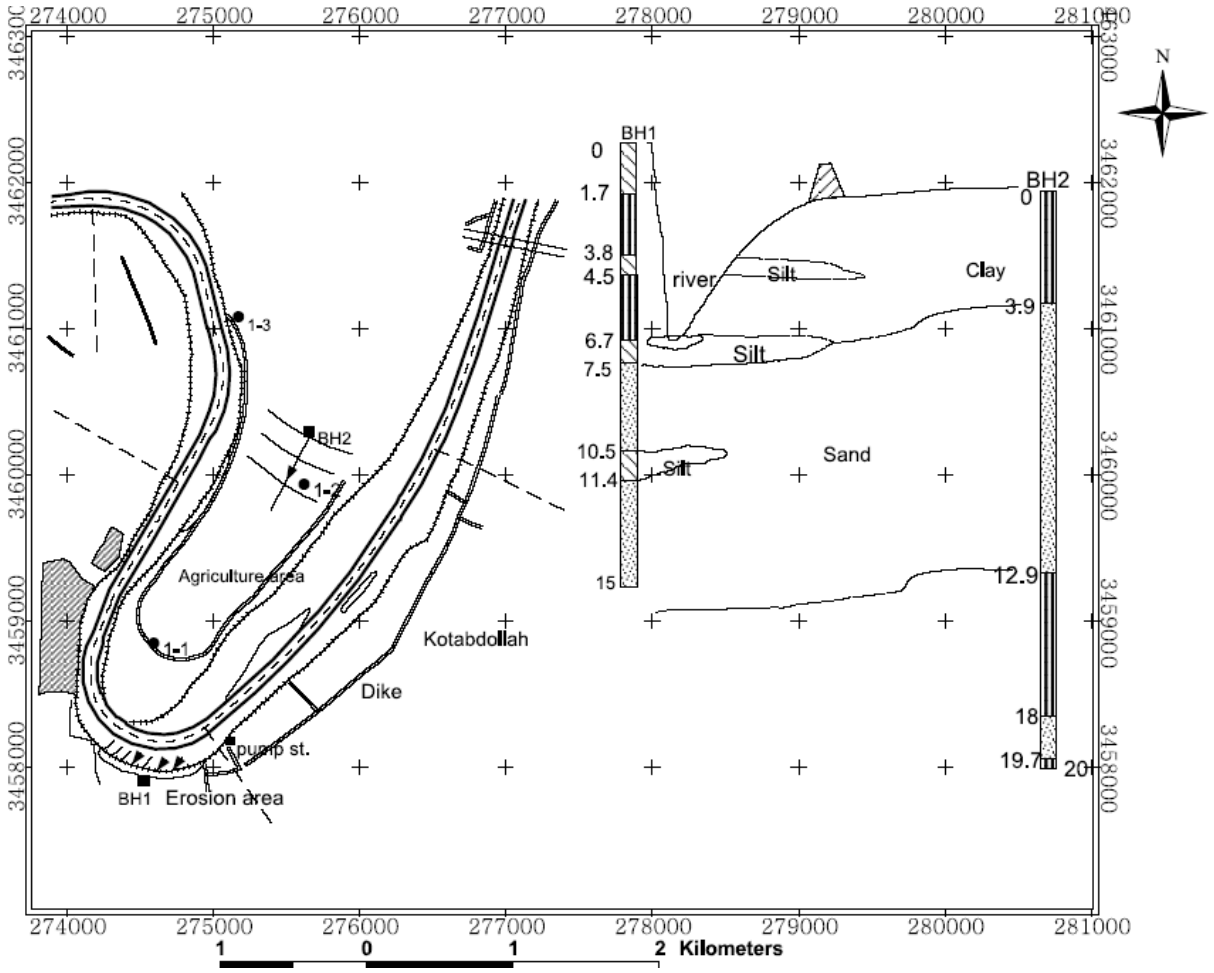

Figure 3 : The cross section of river in erosion area of Kotabdollah

5 CONCLUSION

The stream bank erosion was naturally occurred in big Karoun meandering river. This study reveals that the stream bank erosion depends upon the soil texture and intensity of meanders. The maximum rate of erosion is about 0.5 meter per year. It may be argued that the susceptibility to erosion increases as soil texture becomes coarser and cohesiveness decreases.

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