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# The Stream Correction in Meandering Rivers

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***Abstract* - As initial river reconnaissance was restored at each of a number of potential study sites in the fluvial system in order to identify dominant processes and characteristic channel forms, assess the general stability conditions of the streams. A variety of restoration techniques and objectives exist which include a-asymmetrical cross-section construction**
**b- point bar development**
**c- two-stage channel design**
**d- floodplain approaches**
**e- pools and riffles recreation**
**f- sinuosity and meander restoration.**
**Modifications of the longsection geometry can define new morphological and ecological consequences and channel planform adjustment which depends on the energy of the river that also result in failure of the restoration design through either erosion or sedimentation. In this research we give an analysis of the accuracy of empirical relations of different meander parameters for use in meander restoration procedures.It is also demonstrated the analysis by river meandering data.**

***Keywords:* Stream, connection, meanders, parameter**

## I. INTRODUCTION

Many meamder parameters are generally given for larger streams while restoration projects are given for small streams. That's why the objective is also to provide an analysis of the accuracy of empirical equations of meander parameters for evaluation in meander restoration projects. These parameters are given as [1]:

1) Determining the comparability of currently used empirical equations regarding meander data
2) Evaluation of meander characteristics such as wavelength, amplitude, and radius of curvature

There are academical approach about river management in recent works like [2, 3, 4, 5 ],

Data Collection

An initial stream reconstruction was taken by using different data at potential study sites of the meandering river systems to access the dominant processes and characteristic channel stability conditions and planform changes [6, 7]. Meander migration is a significant river engineering problem, which interferes with many human activities on and around the rivers, such as navigation, highway construction, flood control, and farming.

The geometry of a meandering channel can be described by the following:

1. A characteristic depth of the channel, h;
2. A characteristic width of the channel, b;
3. The wavelength of the meandering channel, L;
4. The height of the bed deformation;
5. The amplitude of the concurrent surface oscillations;
6. The slope of the channel, S;
7. The ordinate of the meander pitch.

The slope of the channel is defined as the slope of the axis of the meander oscillation which remains essentially constant during the evolution of the channel.

The parameters of transport on which the geometry of a channel in a given gravitational system with the acceleration of gravity, g, and with steady flow conditions is assumed to depend, are the following:

1. The discharge, Q,
2. The viscosity of the fluid, $\mu$,
3. The density of the fluid, $\rho$,
4. The transport rate of bedlod, $q_b$,
5. The density of the bed materil, $\rho_s$,
6. The angle of repose of the bed material, $\phi$, which is a measure of the size, size distribution, and form of the sediment; and,
7. A characteristic diameter of the bed material, d, which accounts for the grain roughness of the bed.

Measurements of Sediment Transportation

Bed load particles move through an alluvial channel under the action of gravity, fluid drag, lift, and friction associated with the loss of momentum to the bed via collisions. In a straight channel, fluid drag and friction are generally in the direction of the channel axis. In a curved channel, the centrifugally induced secondary current causes both fluid drag and friction to be in directions different from that of the channel axis. In the experimental set-up, sediments collected at the downstream reservoirs provided the only way to calculate thye sediment transport rate. Sediment washed down from the flume was collected with a sieve in the downstream reservoir. Then, dividing the total dry weight of the collected sediment by the sediment-collection-time gives the average sediment transport rate in weight per unit time. Since the sediment transportation rate was not uniformly distributed with time, this method could only give a rough estimate rather than a precise measurement of the transport rate.

Empirical Studies for Alternate Bars

The alternate bars have formation in the boundary layer of fluvial flows where their specific extremes are given by the different parameters of flow and sediment transport.

Using the Shields stress which is given as [1],

$$\tau s = \frac{\tau o}{(\gamma s - \gamma) d} \qquad (1)$$

Here $\tau s$ is given as the Shields stress where $\tau o$ is given as stress at the fluvial boundary layer and d is the mean size of the fluvial bed armour. The alternate bars as the moving boundary layer formations can easily develop over the values of the boundary layer Shield's critical shear stress at the bottom. The smallest bars are defined as [2]

$$\frac{\tau s}{\tau scr} = 1 \qquad (2)$$

For boundary layer of alluvial rivers which have nonuniform bed materials alternate bar development is observed at the stable boundary layers. For the development of alternate bars they need greater stresses in coarser alluvial bottoms. It is developed another relationship for smaller limits of alternate bar observations as [3]

$$\frac{\tau s}{\tau scr} = \left(\frac{d90}{d}\right) ** 0{,}67 \qquad (3)$$

Here, $d_{90}$ is the armour boundary layer sedimentation size which exceeds 90% of boundary layer materials as weight. This defines the formations for graded materials developing bars in maximum evaluations of $\tau_s/\tau_{s,cr.}$

For the higher limit evaluation of bar developings many attempts have been made [1-3]

## II. METHOD

By determining the empirical relationships the researchers applied the Buckingham Theorem for finding dimensionless values from different parameters like Froude Number, like Reynolds Number. Their constant values are channel flows on alluvium with and without meanderalternate bars. Each relationship is given by collecting of experimentation parameters in the laboratory alluvium channels. It is given different laws for alternate bars on alluvium as [1]

$$\frac{B}{R} > \frac{1}{125}\left(\frac{\tau s}{\tau scr.}\right) ** 2.\left(\frac{1}{S}\right) \qquad (4)$$

Here, B is the boundary layer width, R is given as hydraulic radius in the Velocity law and S is given for channel slope. In the Buckingham Theorem to obtain the empirical relationships, several parameters are given as stream width and the ratio of width – depth ratio where silt – clay content in the alluvium has higher values [4]. A threshold in the river boundary layer formation is given in the silt-clay content.

Meander Planform Occurrence

A regular meander boundary layer is observed for determining the important parameters which easily effect this natural phenomena. They are applied by the below given relationships as [1],

$$\Lambda = 10{,}9\ B^{1{,}01} \qquad (5)$$

$$a = 2{,}7\ B^{1{,}1} \qquad (6)$$

$$\Lambda = 4{,}7\ r_c^{0{,}98} \qquad (7)$$

where Λ is the wavelength, a is the amplitude and $r_c$ is the curvature of meande r's radius. All of them are measured in meters. If the exponents are approximated as unity, it gives

$$r_c = 2{,}4\ B \qquad (8)$$

Such an application indicates the approximate maximum curvature for meander migration which is the same formation in the natural prototypes. However, migrations described with the Equations (5-6 and 7-8) must be given for natural channel migrations [5]. There are observed many sinuous boundary layers where its relative migration , $r_c/B$ is greater than 2,5 or 3.1, that have a curvature of smaller than 1,6.

## III. RESULTS

For mean value of sediment particles in transition zone, which is dependent to the mean diameter of particle D gr is given in theory. The parameter is the immersed weight of sediment particles and the viscous boundary layer forces. There is also a sensitivity ana 6lysis for different flow data for Dgr > 6 mm. and Dgr < 1 , for different kind of coarse and fine particles, respectively. The transition zone for different particles can take place between above different zones. By sediment transport process there is stream power definition in the research area.
The formulation of different variables are:

1) The continuity equation,
2) Formulas for sediment transport,
3) Formulas for sediment flow resistance,
4) Formulation of sediment power condition, that if the stream power should be decreased, where maximum sediment discharge takes place in the channel boundary layer.

Method
The Particle Degradation relationship is emphasized as

$$F\varphi = \frac{(V*)**2}{\sqrt{gD(s-1)}}\left[\frac{\mathrm{V}}{\sqrt{32\log\left(\frac{10d}{D}\right)}}\right]**1-n \qquad (1)$$

where n is defined as fine sediment as n=1, while for grain , n = 0. The traditional approaches are between 0 and 1 [1]. Dgr is defined for different properties of suspended load in boundary layer of a channel as,

$$\mathrm{Dgr} = \mathrm{D}\left[\frac{\mathrm{g}\,(s-1)}{\upsilon}\right]**1/3 \qquad (2)$$

where g is the gravitational constant,
υ = kinematic viscosity of the continuum medium,
s = density of coarser sediment
Dgr > 60 gives the condition of the meandering discharge data for coarse sediments [2, 5]. For fine sediments the result for computation Dgr <1 is given in detailed expressions [3,4]. Between these given research characteristics there are borders between transition zones from fine to coarse sediment properties. It is observed that the gravel river sediment discharge with existing empirical regime relationships are measured by prototypes at natural meandering rivers [6]. The aim of theresearch is to give a mathematical relationship about the stable cross-section geometric observation of model boundary layer. It is proposed the determination of a stable slope in alluvial channels which is in nature not stable. According to the observations an alluvial channel need reaching an equilibrium condition where it changes its plan geometry until a stable condition can be defined in plan configuration. Width,Depth and channel slope are three different properties of channel boundary layer in bird's view configuration.

Sediment Properties Definition
The intention about mathematical model is investigation the conditions for possible meandering properties. The evidence of laboratory studies and data information are collected to investigate the new relationship. As 2nd step, the meandering boundary layer conditions are reviewed which have effective reliable performance also in the laboratory sand-bed channel [2]. The observations from the experimental set-up is good reference and similar physical events are distributed on the natural gravel-bed discharge of a flume [7]. In the river boundary layer it is given that the light sediment particles continue to flow in the tributary direction. The parameters V, d, X and B given for determination of meandering discharge and boundary slope of the channel where it is obtained that the flume has a steady characteristic in the uniform flow at noncohesive boundary layer material. The mobility at these conditions takes place with different kind of parameters of three variables without any dimensions (8,9,10):

1) Particle size Dgr without dimension
2) Content of Sediment Ggr
3) Unstabil particle property.

Different particle property is defined as the ratio of immersed weight and the ratio of shear forces which is a river boundary condition while the water flowing as a function of bed resistance.

Frictional Characteristics
The new theories pointed out that the solutions about different parameters which have sedimentation discharge under the maximum rates and width under the extreme values. There are another constrains with parameters of bank and bed erosion. It gives a solution about erosion parameter where the banks have more erosion property than the bed boundary layer, observed as a new bed deformation on alluvium with more larger curvature. This researh

about sediment particles at meandering rivers in uniform flow properties are occupied the characteristics which subjected the development of river plan behaviour.

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