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Investigation of the Initial Condition of Motion for Non-Uniform Sediments

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Abstract

Experiments on the beginning motion condition and bed capacity transport of different components for non-uniform sediment are presented in this paper. According to studies done for this study and by other researchers, the known relation for the critical tractive stress (CTS) of sediment mixture has certain upper and lower bounds. The best knowledge of hydraulic restrictions comes from experimental research into factors including flow rate, sediment transport capacity, bed depth, and critical shear stress. In this context, we investigate hydraulic limitations. At the APCOER Hydraulic Lab in Pune, experiments were carried out in the 10 meter long, 0.35 meter wide, and 0.50 meter deep inclined flume.

Keywords: Incipient Motion, Critical Tractive Stress, Geometric Standard Deviation

1. Introduction

Hydraulic engineers need to know the range of hydraulic parameters at which sediment particles of a certain size start to migrate. This data might be referred to as the "movement threshold." The maximum allowable slope (or depth) for channels that are stable, convey clear water, and flow through coarse granular material is established by the condition that the material on the channel bed and sides does not change. This requirement applies to stable water-transporting channels. This is the criteria used to identify the steepest slope (or greatest profundity). When estimating the sediment load transported by the bed, it is also important to take into account the initial hydraulic conditions. They can also be used to learn about erosion and the ebb and flow of river beds, as well as the deposition of sediment in reservoirs. From a theoretical perspective, these criteria are extremely useful since they are linked to the balance of different forces acting on different particles. This is due to the fact that the initial circumstances for motion are crucial.

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1.1. Utilization of Critical Tractive Stress

The Critical Tractive Stress calculation is helpful in

- Design for a Robust Channel
- Different building constructions' hydraulic layouts
- Comprehensive research
- The study of weathering, weathering, and weathering

2. Tables and figures

Table 1. Water velocity, average speed, and gradient

Mixture Designation	mm of Flow Depth	Average Speed (m/s)	Slope value
1St Sample	100.00	0.05	0.0016
2nd Sample	120.00	0.09	0.0022
3rd Sample	150.00	0.13	

Table 2. Sedimentary Features

Mixture Designation	Da in (mm)	d50 in (mm)	σg	dσ in (mm)	References
A Sample	2.725	0.68	2.4	3.02	Autho-
B Sample	2.568	0.99	2.6	3.25	Author-
C Sample	2.892	0.92	3.2	4.85	Author-
S1 Sample	3.25	2.40	1.8	8.59	Patel, Ranga Raju
S2 Sample	3.36	2.21	1.6	7.59	Patel, Ranga Raju
S3 Sample	3.38	2.51	2.2	8.84	Patel, Ranga Raju

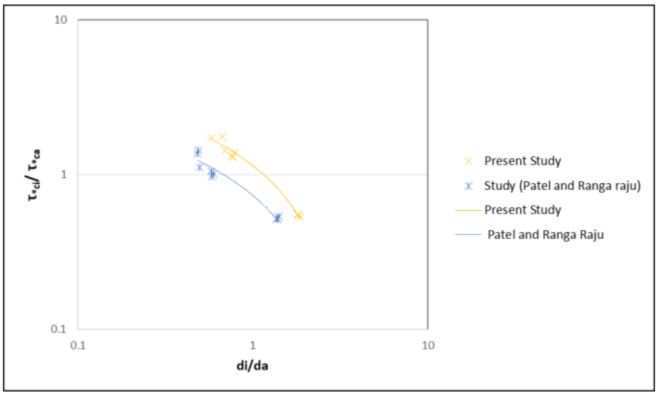

Figure 1: This research is compared to Patel and Ranga Raju.

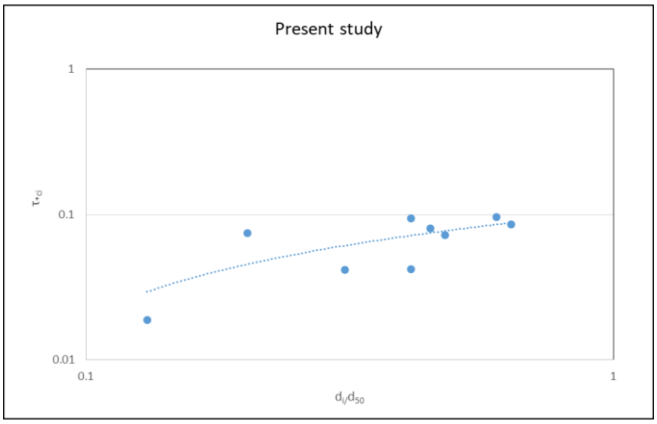

Figure 2: Graph of di/d50 vs *ci

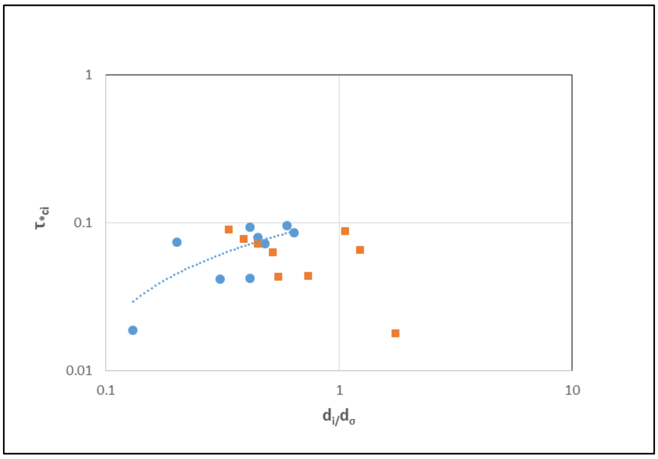

Figure 3: Graph of τ*ci & di/dσ

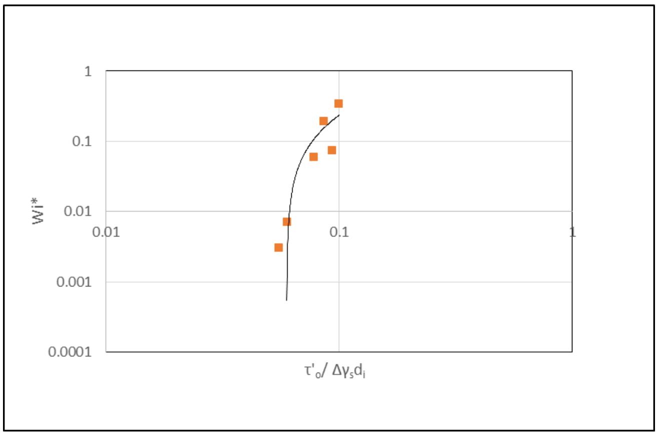

Figure 4: Variation between τ'o/ Δγsdi & Wi*

3. Equations

3.1. Critical Tractive Stress-

Egiazaroff claims that the critical shear stress, independent of di, is ci. =

$$\tau^*ci = \frac{0.10}{(\log 19di/da)2}$$

Hayashi gives the following formula for determining *ca's significance:

$\frac{\tau * ci}{\tau * ca} = \left(\frac{da}{di}\right)$, for di/da<1.0

$\frac{\tau * ci}{\tau * ca} = \left(\frac{\log(8)}{\log(8di/da)}\right)$2, for di/da> 1.0

Conclusions.

1. Experiments were performed on soil that was not consistent in texture. A critical shear stress (CST) was determined for the heterogeneous sediment. We drew these conclusions by comparing our findings to those of Patel and Ranga Raju and other writers whose di and da values are comparable to ours.
2. For both the current and the previous studies, a graph depicting the relationship between the dimensionless parameters di/da and ci/ca was drawn. The graph displays parallel trends.
3. The findings show that the critical shear stress for non-uniform sediment may be accurately calculated using the approach proposed by Egiazaroff and Hayashi et al.
4. From Figure 2, we may deduce that as particle sizes grow, so does the value of *ci.
5. When comparing di/da to di/d50 and di/d, with a root mean square value of 0.2525, di/da produces much better results for both *ci and *ca.
6. Figure 2 shows that the value of the dimensionless critical shear stress is greater for the same values of di/da than it was in a prior research by Patel Ranga Ragu. Possible explanation: more extreme standard deviation numbers.

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