

CIVE 413 – ENVIRONMENTAL RIVER MECHANICS

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Sample Review Problems on River Engineering

1. Consider a large river during a flood. The main channel width is 250 m, the flow depth is 6.62 m and the flow velocity is 2.26 m/s. The channel slope is 10 cm/km and the grain diameter is uniform 0.25 mm sand. Determine the following:
 - a. the Froude number
 - b. Manning n
 - c. the bed shear stress
 - d. the Shields parameter
 - e. what particle diameter is at beginning of motion
 - f. what is the settling velocity of the bed material
 - g. what is the shear velocity of the flow
 - h. is most of the sediment transported as bed load or in suspension

 2. Bridge piers are built on the river discussed above. The type of bridge pier considered is a square concrete bridge pier 3.5 m wide. Determine the scour depth around the structure. Also estimate the angle of repose of the material and estimate the lateral extent of the scour hole.

 3. Repeat the calculations from (2) above for the case of replacing square bridge piers with a large round sheet pile caisson that is 15.2 m in diameter. Determine the scour depth and the lateral extent of the scour hole. \

 4. The engineers are also considering an abutment protruding into the river. Consider a 75 m long spill-through abutment that is normal to the main flow direction. Also consider a 50 m abutment with the same orientation angle with vertical sheet pile wall at the end of the abutment. Compare the abutment scour depths for both cases.

 5. The median particle size distribution of riprap is 500 mm. Determine the proper particle size distribution of the riprap if it is placed on the sand bed channel. Would a single filter be sufficient? Plot the particle size distributions and determine the particle size distribution of the filter(s).
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