

Applied Hydraulics – Week 8 – Gradually Varied Flow (#1)

Reading Assignment: Chin, Ch. 3, section 3, pages 127-145.

Homework Problems: 3.37, 3.38 (due in class, November 12)

Hands-on Assignment

In this experiment you will create several different gradually varied flow profiles in the flume. Water depths at several locations along the flume will be measured in order to create a water surface profile plot.

Procedure

1. Download the spreadsheet gvf1.xls from the class web page. In this spreadsheet are several tables where you can enter your water surface profile data. Even though numbers are currently in this spreadsheet, highlighted areas will need to be filled in by members of your group as you do the experiment.
2. Cover the bottom of the flume with a single layer of marbles over the entire flume length.
3. Set the flume bed slope to 2.5%.
4. Measure the uniform water depths in the flume for flows of 0.5, 1.0, 1.5 and 2.0 L/s. Estimate the bed roughness and marble bed height so that the calculated flows are close to the observed flows.
5. Set the flume flow rate to something between 0.5 and 1.5 L/s.
6. Measure the water depth at 11 locations along the channel using the point gauges. Enter the water depths into the spreadsheet. Enter “yes” or “no” in column I of the spreadsheet.
7. Add one large stop block at the downstream end of the channel.
8. Repeat step 6.
9. Add a second large stop block.
10. Repeat step 6.
11. Remove both stop blocks. Now change the bed slope to 0.5%. Set the flume flow rate to something between 0.5 and 1.5 L/s, and repeat step 6. Be sure that the Froude numbers calculated in column F are less than 1.0.
12. Add one medium stop block at the downstream end of the channel and repeat step 6.
13. Remove the medium block. Place the underflow gate in the flume at location 4.00 m. Set the gate height so that an undular jump (standing waves present) exists downstream of the gate. Be careful not to restrict the gate opening too much, as the marbles will begin to erode downstream. If they do, turn off the flume, fetch the marbles from behind the downstream weir, and set them back into the flume. When ready, repeat step 6.
14. Add once again the medium block. Repeat step 6.

To Be Done Later (Bring to class October 29)

1. Check all calculations done by your spreadsheet.
2. Determine if the use of the Manning's equation is acceptable. Modify calculations if necessary
3. Make water surface profile plots for each case that you measured. Classify the water surface profile.
4. Make a list of any results that seem not to follow the expected pattern.