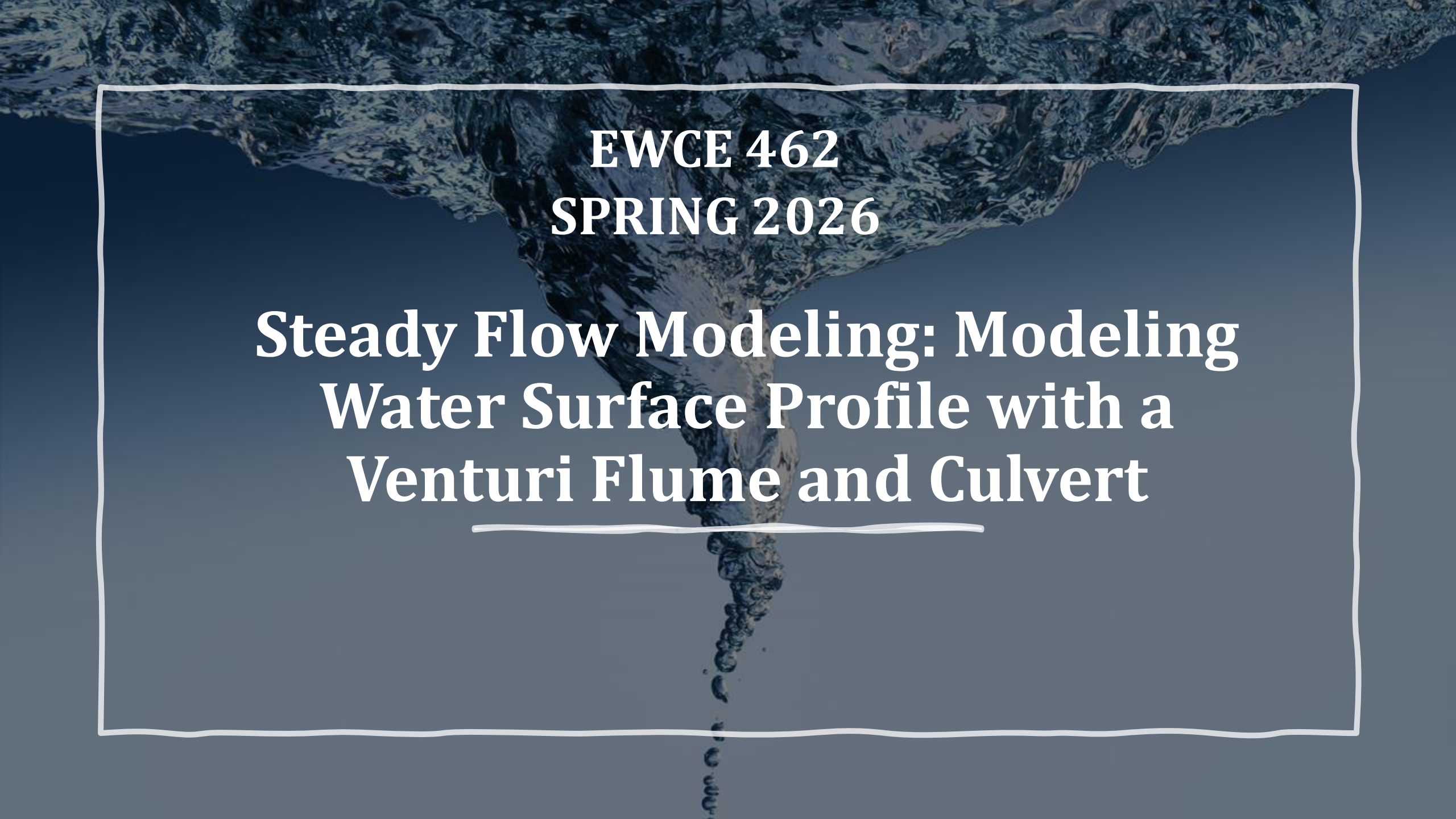


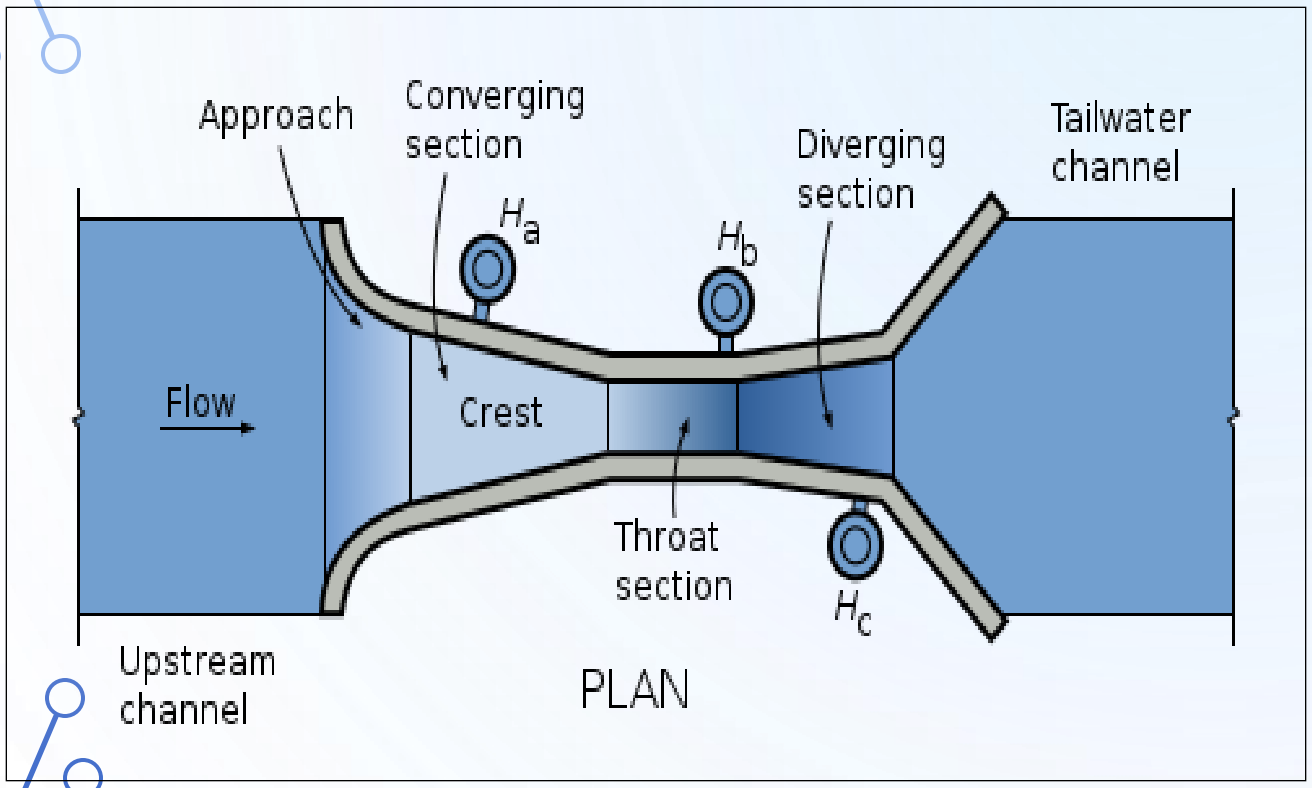
EWCE 462
SPRING 2026

Steady Flow Modeling: Modeling Water Surface Profile with a Venturi Flume and Culvert

Venturi Flume

- *Venturi flume*, a hydraulic structure, is also commonly used in open channel flow as a discharge measuring structure.
- In *venturi flume* width of the channel is reduced gradually and then width is increased gradually again.
- Flow is obstructed by the reduced width and critical depth is attained on the minimum width section.
- Based on the upstream depth, flow over a venture flume can be calculated based on the following formula:

$$Q = \left(\frac{2}{3}\right)^{3/2} B\sqrt{g}H^{3/2} \qquad (1)$$


Approach
Converging section
Diverging section
Tailwater channel
H_a
H_b
Flow
Crest
Throat section
H_c
Upstream channel
PLAN



Objective of this lab:

- In this lab, our main objectives are to understand the effect of transcritical flow and to be familiar with different components of HEC-RAS. Therefore, in this lab we will simulate water surface profile with a Venturi Flume

- ***Specific Objectives:***

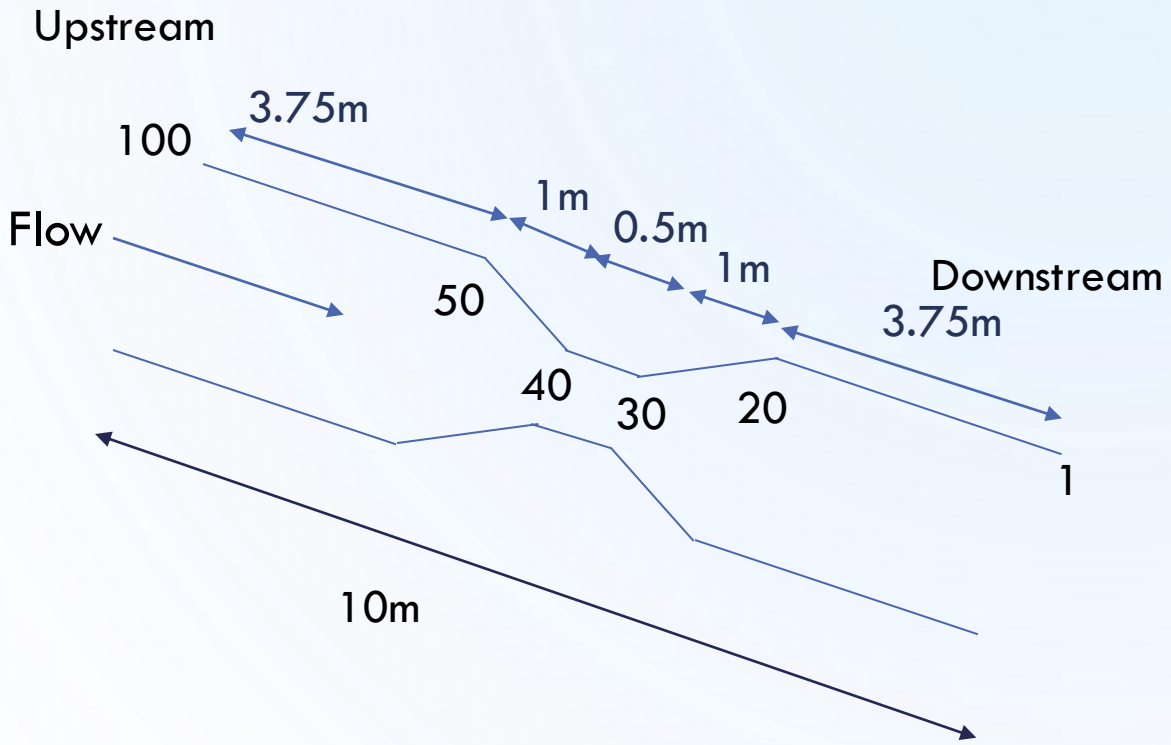
1. Generate a Venturi flume cross section profile in excel using the given information.
2. Create a new project.
3. Draw a schematic of a straight river.
4. Assign cross section data.
5. Assign boundary condition data.
6. Perform the analysis
7. View and present the results.

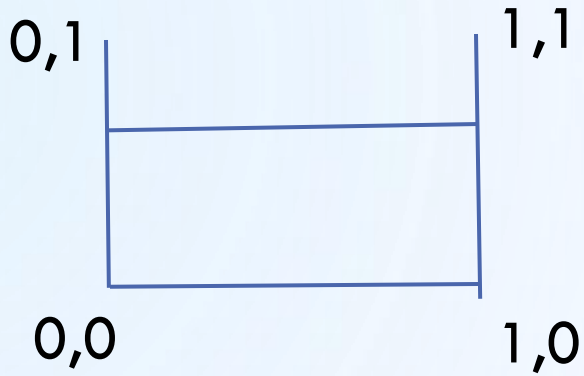
Problem 01

Given Information:

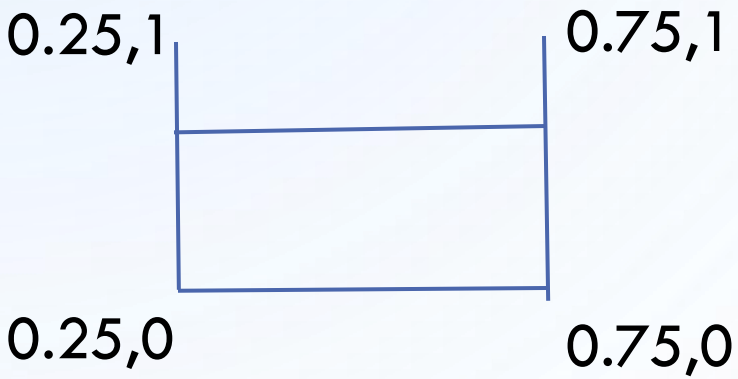
- The channel is rectangular.
- The channel width is 1 m except in the flume.
- The channel width is 0.5 in the constricted zone.
- The channel length is 10 m.
- The channel depth is 1m.
- Manning's n can be assumed as 0.01 s/m1/3.
- The discharge in the channel is 0.2 m3/s.
- Downstream boundary condition is = Last two digits of your student number /100 m
- Upstream boundary condition is = (Last two digits of your student number + 10)/100 m

VENTURI FLUME





Station 100,50,20 and 1



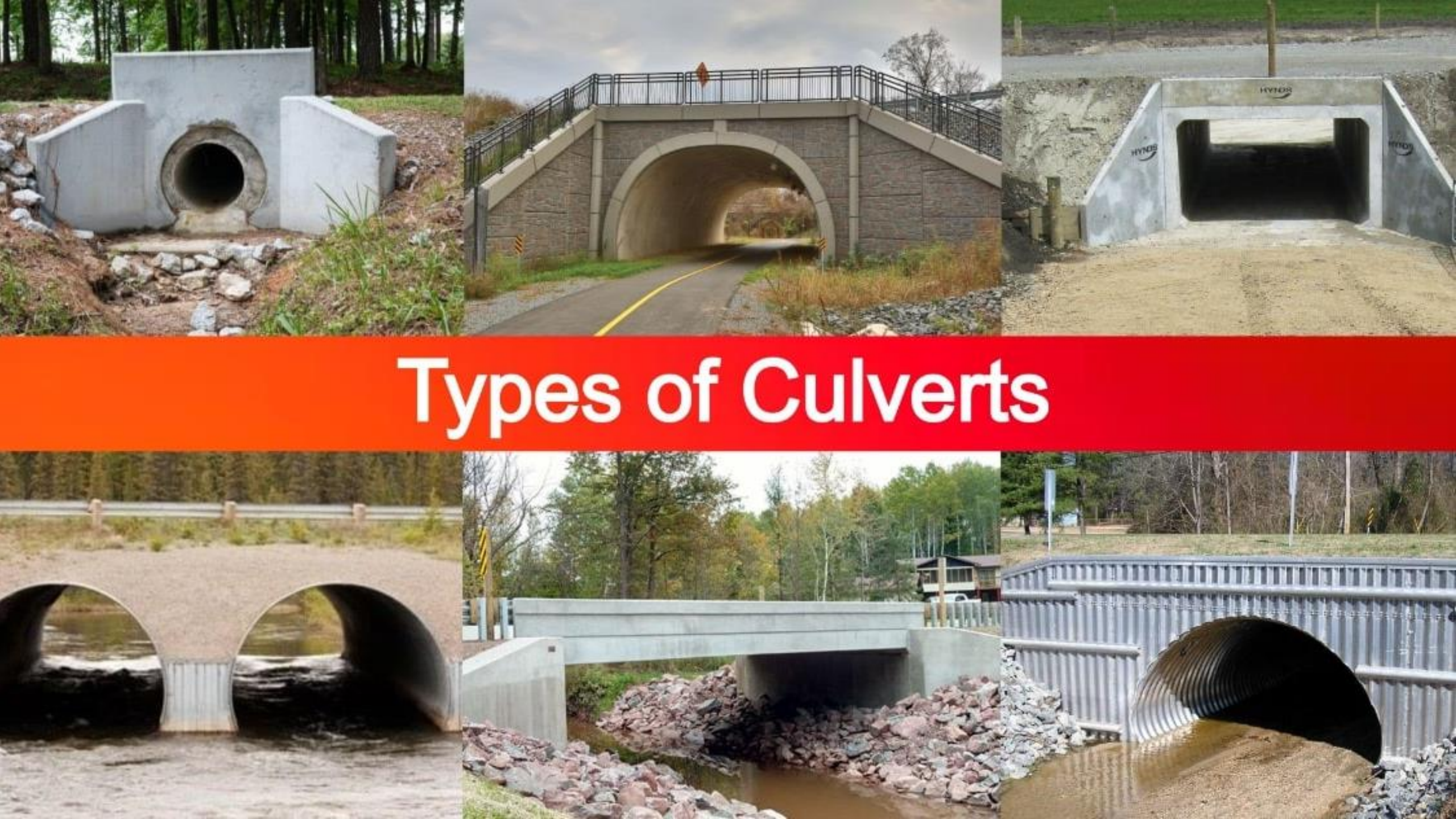
Station 40 and 30

Submissions:

- Calculate upstream depth using the equation 1 and compare it with your model result.
- Calculate the analytical critical depth for your case and compare it with your model result.
- Printing of longitudinal profile of water surface elevation.
- Printing of longitudinal profile of Froude number.
- What is a shock capturing scheme? Give examples of three shock capturing schemes.
- Why do we need shock capturing scheme to model Transcritical flow? Explain.
- Discussions.

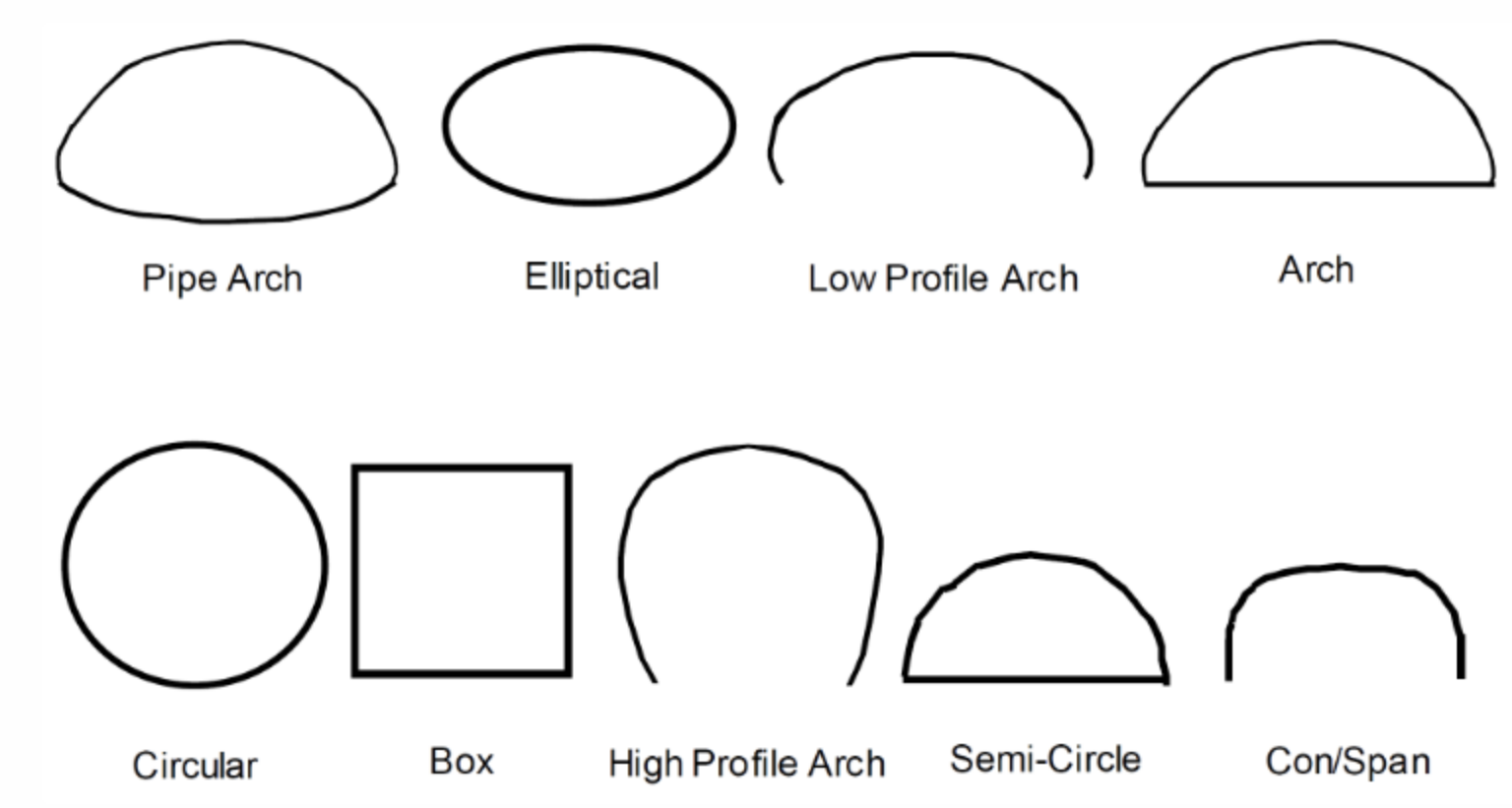
Culvert

- A culvert is a tunnel-like or conduit structure that channels water—such as storm runoff or streams—beneath roads, railways, or embankments, typically enclosed and embedded in soil.
- Culvert is commonly used to relieve drainage of ditches alongside of a road or to where a natural stream of water is flowing which cannot be blocked by passage of traffic.



Types of Culverts

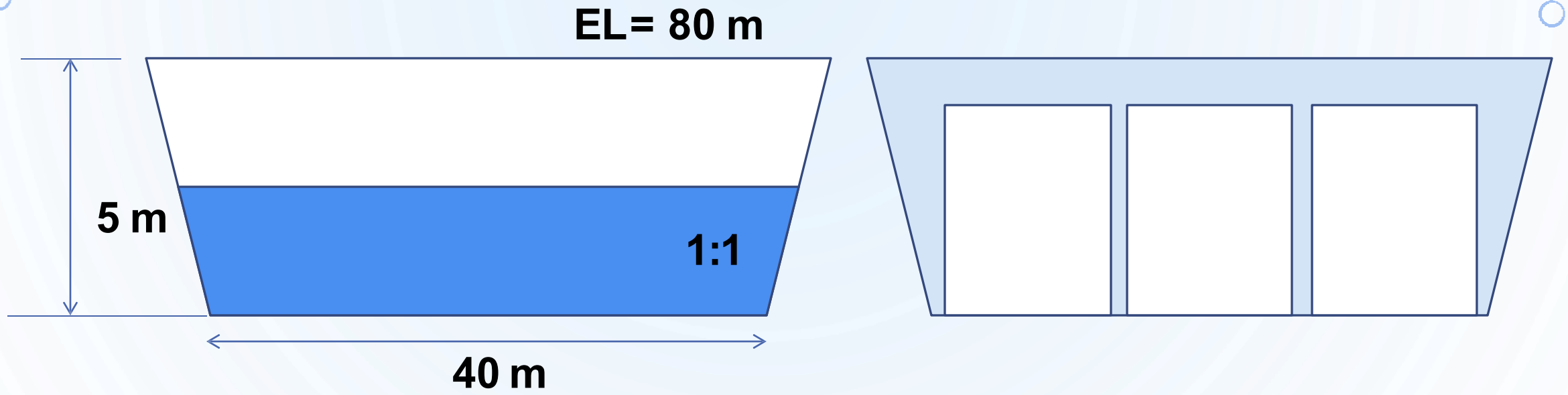
Types of Culverts



Box Culvert



Box Culvert in Trapezoidal Channel



Problem 02

Given Information:

- The channel is trapezoidal and the reach length is 100 m.
- The slope of the channel is 0.003 .
- The discharge in the channel is 200 m^3/s, 500 m^3/s and 750 m^3/s .
- The box culvert is located 50 m away from the downstream and has a length of 10 m in the direction of the channel's flow.
- Box culvert type: Chart# 58 and scale# 1
- Manning's n can be assumed as 0.013 $s/m^{1/3}$.
- Entrance loss coefficient = 0.013, Exit loss coefficient= 1
- Depth to use bottom n= 2+ ((Last two digits of your student number + 10)/100)m
- Number of barrels = more than 3
- Downstream boundary condition is = critical depth
- Upstream boundary condition is = normal depth = channel slope

Submissions:

- Printing of longitudinal profile of water surface elevation for each case.
- Printing of output table.
- Printing of culvert data editor window.
- Discussions.

THANK YOU