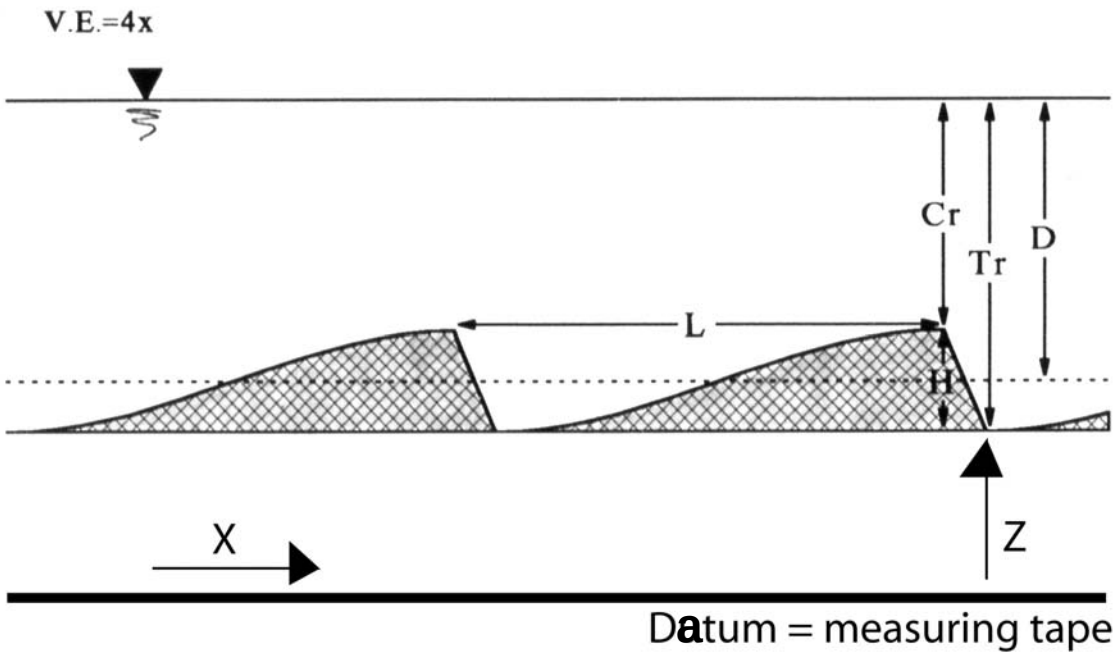
12.110/12.465 Lab #1: Sediment Transport & Development of Bed Topography

This lab provides an opportunity to directly measure sediment transport and bedform kinematics, and to relate these kinematics to bulk properties of the flow field.

Measurements to be collected:
1. Grain size and sorting of particles moving as bed load and suspended load.
2. Bedform height, length and migration rate as a function of current velocity.
3. Brief description of bedform shape/geometry as a function of water depth and velocity.
4. Brief description of processes sorting particles with different sizes and shapes and how these processes produce stratification within the sediment bed.

--Measurements should be made about every 2 minutes.
--Measurements will be made for 3 different flow stages (i.e., 3 discrete steps in average flow velocity)



Cr = crest of bedform [elevation relative to some datum (e.g., the water surface)]
Tr = trough of bedform [elevation relative to some datum (e.g., the water surface)]
H = bedform height (Tr –Cr)
L = Wavelength (λ) of bedform (measured from crest to crest or trough to trough)
D = average flow depth [≅ **(Cr+Tr)/2]**
Stoss face or side of bedform = the surface running from an upstream trough to a downstream crest
Lee face or side of bedform = the surface running from an upstream crest to a downstream trough
X = streamwise position of trough as measured on datum tape
Z = distance of bedform trough above datum measuring tape

What to Record

One data sheet for each bedform at each stage of flow.

Data sheet should include:

1) Bedform Number and Flow Stage
2) Time, X, Z, H, and L; D at current meter, U at current meter.

Observations to Make

1) Pull out a sample of the sand bed from the flume and examine for grain size and sorting. You will then compare this with suspended sediment collected from siphons.

Data Analysis

1) Email all data collected to the TA so that he can share this data with all measuring groups.
2) The TA will email all students grain size statistics of bedload and suspended load samples collected during lab.
3) Calculate bedform migration rates for all cases.
4) Calculate average sediment discharges using expression below

$$q_{s_{average}} = \varepsilon_{bed} C \frac{H}{2}$$

1)Calculate the Froude numbers at the site of the current meter.
2)Plot histograms of H, L, migration rate, sediment discharge, Z, and U for each flow stage.
3)Plot mean, median and minimum and maximum values for H, L, migration rate, sediment discharge as a function of the average value for U for each of the three stages of flow.
4)Compare grain size and sorting of sediment transported as bedload to sediment transported as suspended load.
5)Write a brief summary (not more than 2 pages) summarizing both key laboratory observations and interpretations from the analyzed data. Be sure to comment on the accuracy of values for sediment discharge calculated using the equation above.