

## 4.1 Velocity Measurement and distribution

One of the basic components in Hydraulics is the understanding of velocity in the flow field. Generally the average velocity or the mean velocity is computed using the continuity equation namely  $\bar{v} = \frac{Q}{A}$ . The velocity varies locally and spatially depending on the type of channel (straight, steep, bends, meandering, etc.,) and the flow (uniform, non-uniform, laminar, turbulent etc.,). Therefore it is essential to measure the velocity vectors in the flow field. There are different approaches for measurement of velocities.

a. [Velocity measurements using Hydrogen bubble technique](#): This technique is used basically for flow visualisation purposes in the laboratories.

b. [Velocity measurement using Laser Doppler Velocimeter](#):

This is yet another technique to measure the flow field very precisely in the laboratory using Laser Doppler Velocimeter. This can also give us the turbulence level. The fundamental requirement for this is the transparent sides of the channel.

c. [Velocity measurement in free surface flows in laboratories](#):

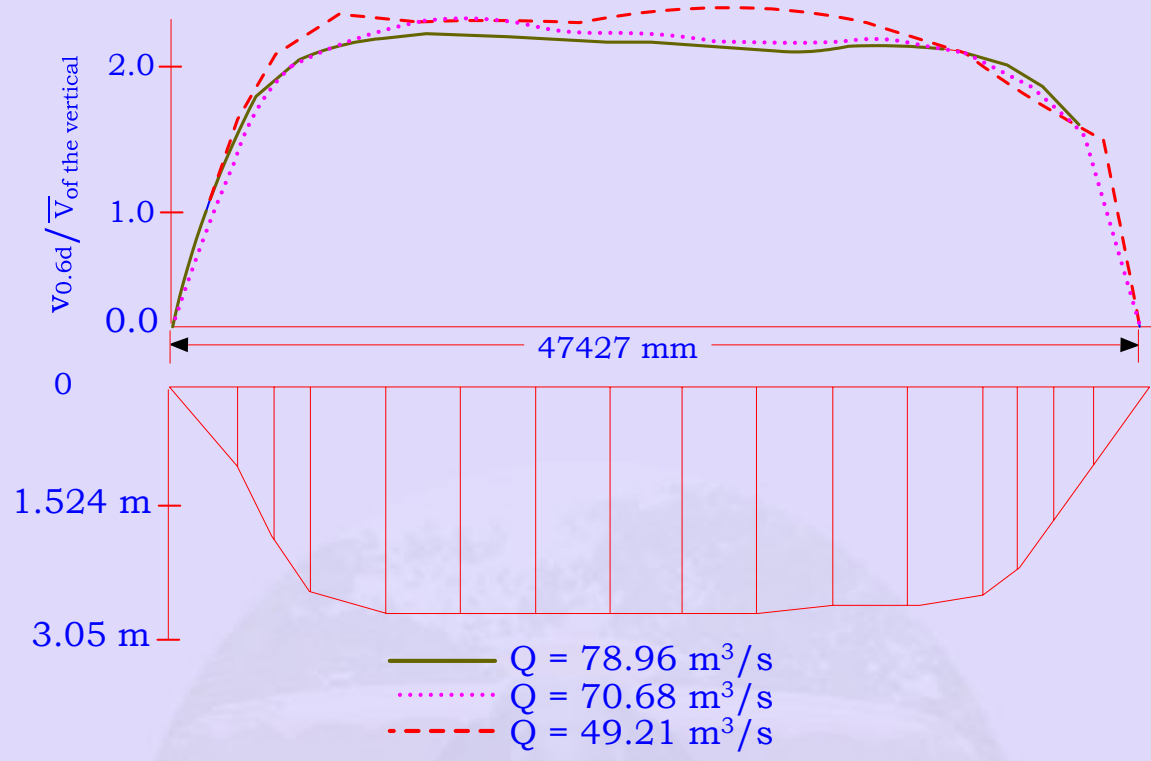
In general, in the laboratories and to an extent in the field, velocities can be measured using different devices such as Pitot tube (One dimensional), Pitot cylinder (Two dimensional) and Pitot Sphere (Three dimensional). However, these devices have their limitations and are restricted to low velocity fields.

d. [Stream Gauging](#):

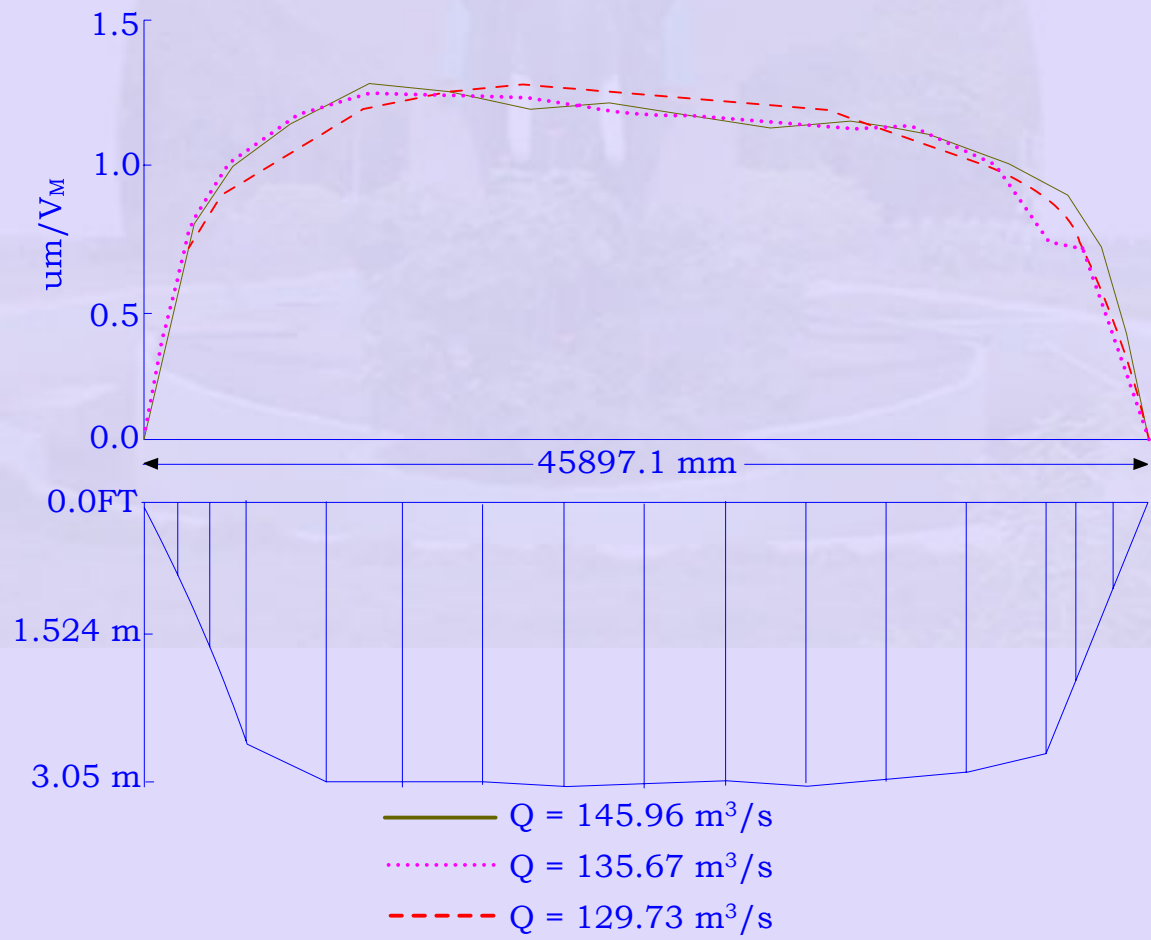
In case of flow measurements in channels and in rivers different approaches are adopted. Current meter is used in measuring the flow in canals and in rivers. While using current meter it is necessary to calibrate. For this purpose the towing tank is used.

The details are given in different links. One of the very popular methods is the velocity area method. Also float rods are used for estimating the surface velocity. In order to understand the accuracy of measurements the error analysis is to be carried out.

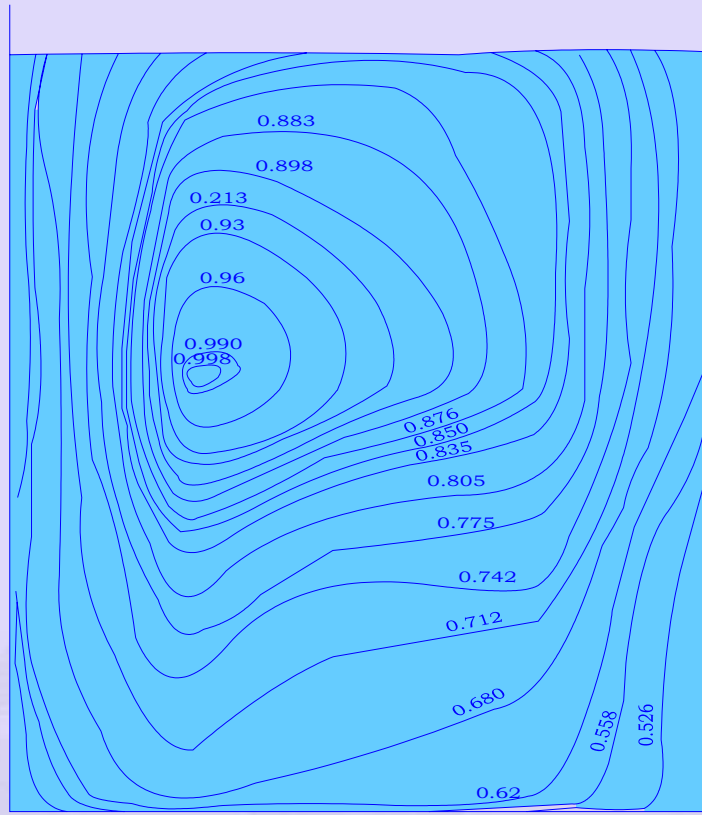
Some typical Velocity distributions in a river are shown below:



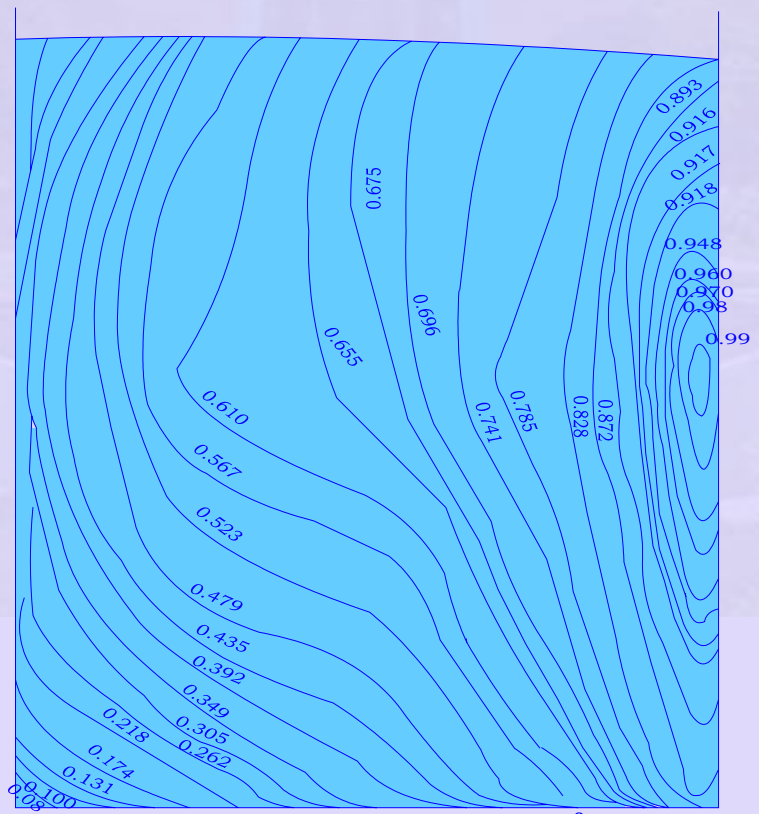
Godavari Western Main Canal - Mile 5/2



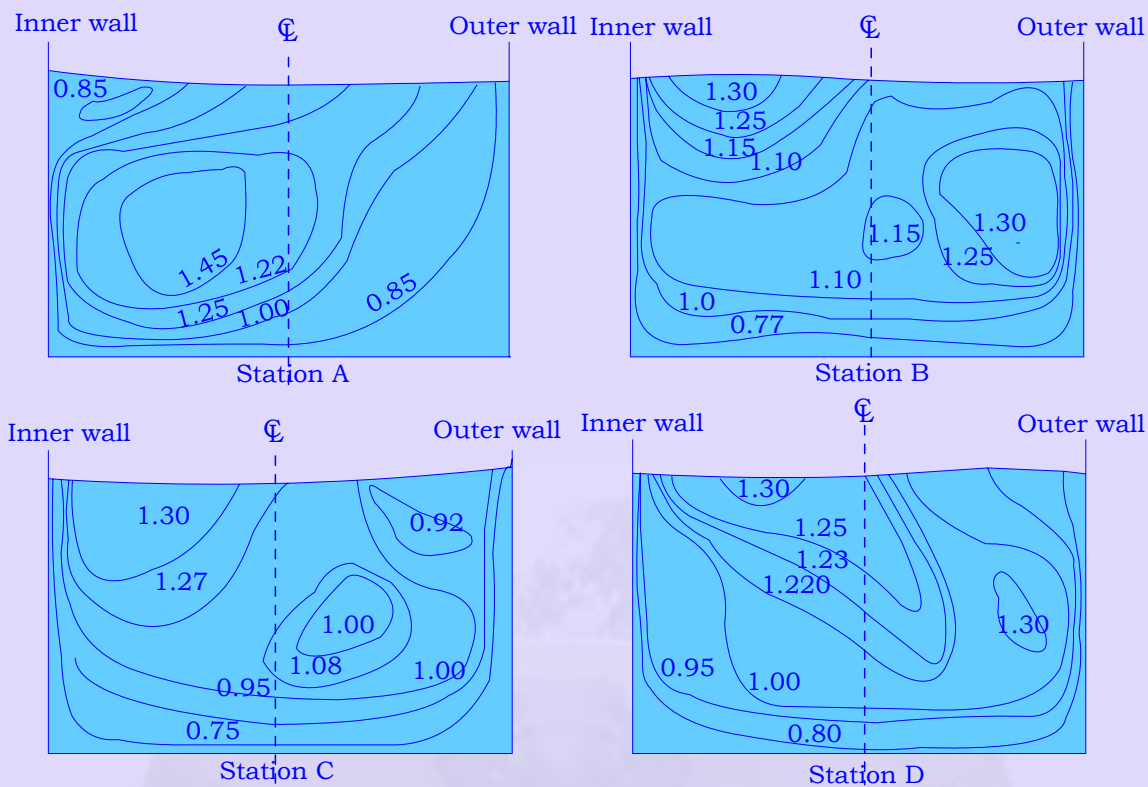
Godavari Western Main Canal - Mile 5/2



SECTION 7

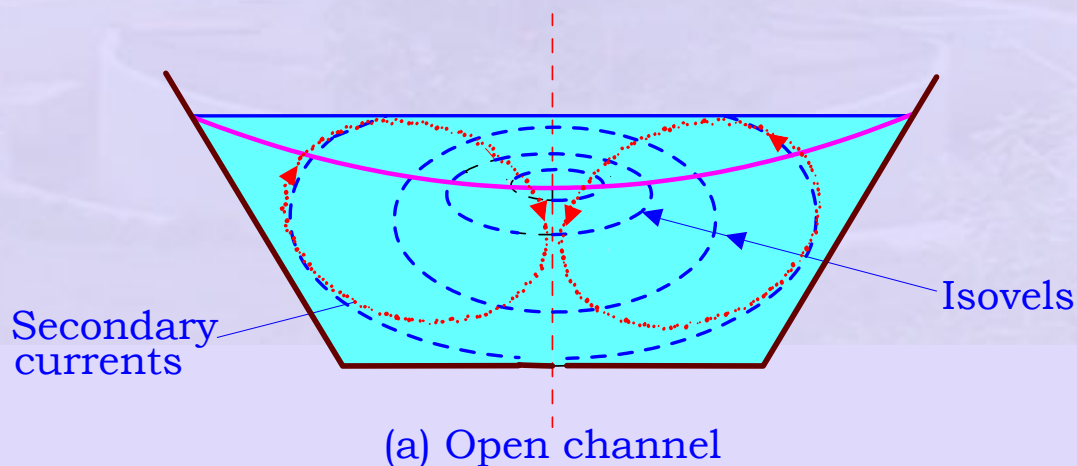


SET III SECTION 0°  
Q = 1.187 CFS, F = 0.2457, Re = 179574  
NON-DIMENSIONALISED ISOVELS ( $v/v_{max}$ )



Isovels [Normalised with  $V_{\max}$ ]  $Q = 71.9$  lps,  $F = 0.44$ ,  $Re = 95420$

Further the maximum velocity does not occur always at the free surface. It occurs below the free surface due to presence of differential shear distribution on the boundary. Hence secondary currents play an important role. The isovels reveal the presence of secondary currents when there are more than one location of the maximum velocities.



The moving boat method, ultra violet measuring technique are the modern measurements of measuring the flow. In order to access the water resources and to have proper management it is essential to measure the discharges at various gauging stations in rivers. This aspect is dealt in detail under river flow measurements.

[Moving boat technique](#)

[Acoustic Doppler Current Meter](#)

[River Flow Measurements](#)

[Calibration characteristics of Current Meter:](#) Rating of current meter is to be completed before it is used in the field.

[Towing Tank:](#) Towing tank is used for calibrating (rating) the current meter.

