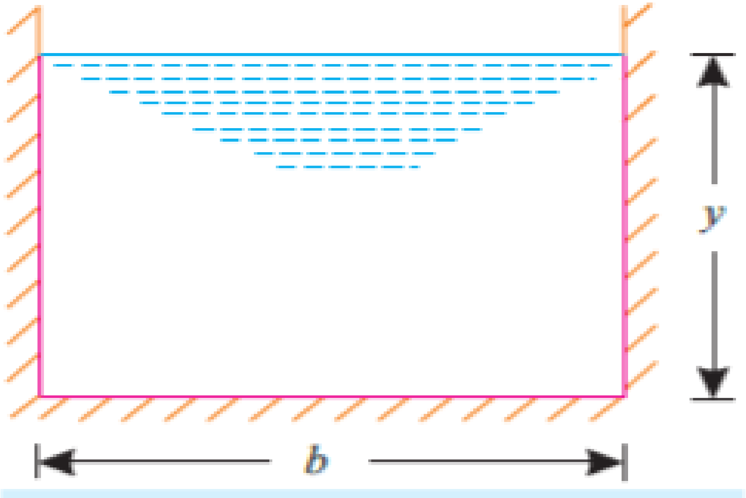
MOST ECONOMICAL SECTION OF A CHANNEL

The most economical section also called the best section is one which gives the maximum discharge for a given amount of excavation. From continuity equation it is evident that discharge is maximum when velocity is maximum, the area of cross section of channel remaining constant. From Chezy's formula and Manning's formula it can be seen that for a given value of slope and surface roughness the velocity of flow will be maximum if hydraulic radius R = [A= A/P] is maximum.

Further the area being constant hydraulic radius is maximum if the wetted perimeter is minimum; this condition is used to determine the dimensions of economical sections of different forms of channels.

Rectangular channel.



MOST ECONOMICAL RECTANGULAR CHANNEL SECTION

Figure shows the cross section of rectangular channel. Let b and y be the base and width and depth of flow respectively.

Area of flow,A = bxy,

Wetted perimeter, P = b +2y

Substituting the value of b(=A/y from equation (i) and (ii), we get

P= A/y +2y

For the section to be most Economical / efficient , the wetted perimeter P must be a minimum.

i.e, dp/dy = 0

d/dy [A/y +2y] = 0

or $A/y^2+2 = 0$

or $A = 2y^2$

or b $xy = 2y^2$

because A = b x y

or b = 2y

and $y = b/2$Hydraulics Radius, R

Hydraulics Radius, $R = A/P = b\,xy/\,b+2y$

$$= 2y \text{ x } y/\,2y + 2y = 2y^2/\,4y$$

$$= y/2$$

$$R = y/2$$

(i) Thus the rectangular channel to half the base width ($y = b/2$), or

(ii) Hydraulic radius is equal to half the depth of flow ($R = y/2$)