

# Cross Drainage Works

## Definition:

A cross drainage work is a structure carrying the discharge from a natural stream across a canal intercepting the stream.

Canal comes across obstructions like rivers, natural drains and other canals.

The various types of structures that are built to carry the canal water across the above mentioned obstructions or vice versa are called cross drainage works.

It is generally a very costly item and should be avoided by

- Diverting one stream into another.
- Changing the alignment of the canal so that it crosses below the junction of two streams.

## Types of cross drainage works

Depending upon levels and discharge, it may be of the following types:

### Cross drainage works carrying canal across the drainage:

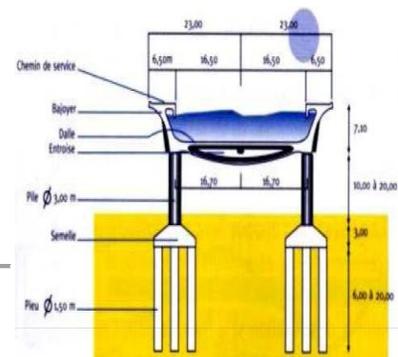
the structures that fall under this type are:

1. An Aqueduct
2. Siphon Aqueduct

### Aqueduct:

When the HFL of the drain is sufficiently below the bottom of the canal such that the drainage water flows freely under gravity, the structure is known as Aqueduct.

- In this, canal water is carried across the drainage in a trough supported on piers.
- Bridge carrying water
- Provided when sufficient level difference is available between the canal and natural and canal bed is sufficiently higher than HFL.



# Crossing works: (aqueducts)



## Siphon Aqueduct:

In case of the siphon Aqueduct, the HFL of the drain is much higher above the canal bed, and water runs under siphonic action through the Aqueduct barrels.

The drain bed is generally depressed and provided with pucca floors, on the upstream side, the drainage bed may be joined to the pucca floor either by a vertical drop or by glacis of 3:1. The downstream rising slope should not be steeper than 5:1. When the canal is passed over the drain, the canal remains open for inspection throughout and the damage caused by flood is rare. However during heavy floods, the foundations are susceptible to scour or the waterway of drain may get choked due to debris, tress etc.



## Cross Drainage Works

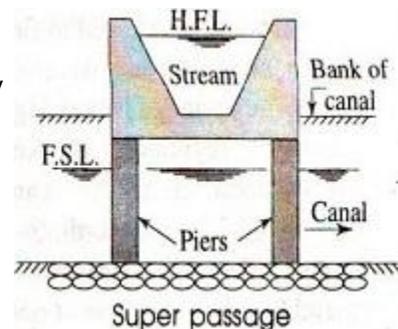
*Cross drainage works carrying drainage over canal.*

The structures that fall under this type are:

- Super passage
- Canal siphon or called syphon only

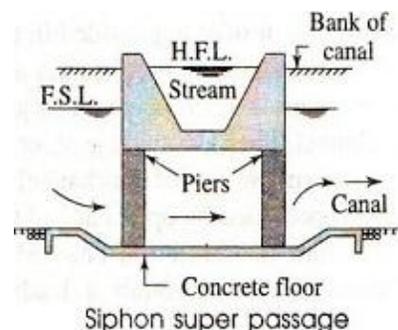
### Super passage:

- The hydraulic structure in which the drainage is passing over the irrigation canal is known as super passage. This structure is suitable when the bed level of drainage is above the flood surface level of the canal. The water of the canal passes clearly below the drainage.
- A super passage is similar to an aqueduct, except in this case the drain is over the canal.
- The F.S.L. of the canal is lower than the underside of the trough carrying drainage water. Thus, the canal water runs under the gravity.
- Reverse of an aqueduct



### Canal Syphon:

- If two canals cross each other and one of the canals is siphoned under the other, then the hydraulic structure at crossing is called "canal siphon". For example, lower Jhelum canal is siphoned under the Rasul-Qadirabad (Punjab, Pakistan) link canal and the crossing structure is called "L.J.C siphon".
- In case of siphon the F.S.L. of the canal is much above the bed level of the drainage trough, so that the canal runs under the siphonic action.
- The canal bed is lowered and a ramp is provided at the exit so that the trouble of silting is minimized.
- Reverse of an aqueduct siphon
- In the above two types, the inspection road cannot be provided along the canal and a separate bridge is required for roadway.



For economy, the canal may be flumed but the drainage trough is never flumed.

### **Selection of suitable site for cross drainage works**

- The factors which affect the selection of suitable type of cross drainage works are:
- Relative bed levels and water levels of canal and drainage
- Size of the canal and drainage.
- The following considerations are important
- When the bed level of the canal is much above the HFL of the drainage, an aqueduct is the obvious choice.
- When the bed level of the drain is well above FSL of canal, super passage is provided.
- The necessary headway between the canal bed level and the drainage HFL can be increased by shifting the crossing to the downstream of drainage. If, however, it is not possible to change the canal alignment, a siphon aqueduct may be provided.
- When canal bed level is much lower, but the FSL of canal is higher than the bed level of drainage, a canal siphon is preferred.
- When the drainage and canal cross each other practically at same level, a level crossing may be preferred. This type of work is avoided as far as possible.

### **Factors which influence the choice / Selection of Cross Drainage Works**

1. The considerations which govern the choice between aqueduct and siphon aqueduct are:
2. Suitable canal alignment
3. Suitable soil available for bank connections
4. Nature of available foundations
5. Permissible head loss in canal
6. Availability of funds

Compared to an aqueduct a super passage is inferior and should be avoided whenever possible. Siphon aqueduct is preferred over siphon unless large drop in drainage bed is required.

### **Classification of aqueduct and siphon aqueduct**

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Depending upon the nature of the sides of the aqueduct or siphon aqueduct it may be classified under three headings:

#### ***Type I:***

Sides of the aqueduct in earthen banks with complete earthen slopes. The length of culvert should be sufficient to accommodate both, water section of canal, as well as earthen banks of canal with aqueduct slope.

Sides of the aqueduct in earthen banks, with other slopes supported by masonry wall. In this case, canal continues in its earthen section over the drainage but the outer slopes of the canal banks are replaced by retaining wall, reducing the length of drainage culvert.

***Type II:***

Sides of the aqueduct made of concrete or masonry. Its earthen section of the canal is discontinued and canal water is carried in masonry or concrete trough, canal is generally flumed in this section.

Source:

<http://www.aboutcivil.org/cross-drainage-works.html>