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DESIGN AND CONSTRUCTION OF WORKING MODEL FOR CANAL SYPHON

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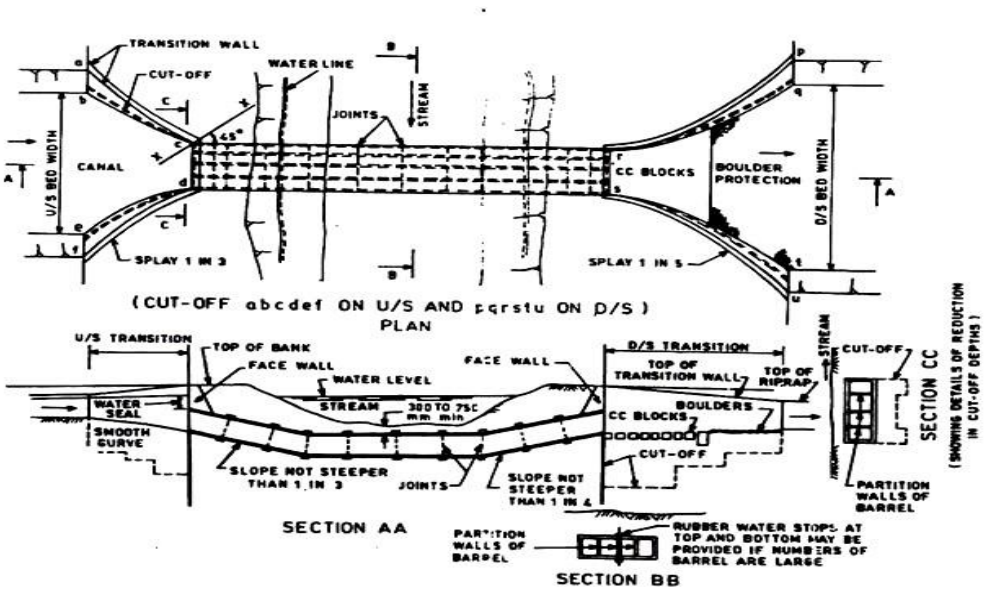
ABSTRACT: *It is very difficult to study the actual behaviour of structure at site and is also a lengthy process so for study of the behaviour of structure we require a model of structure which has a same factor but reduced in scale factor so it is easy to study the behaviour of the structure on model and it relates the real structure by multiplying the scale factor. Model are mainly of two types distorted model or undistorted model.*

KEYWORDS: *cross drainage works, canal syphon, model of canal syphon, design of canal syphon, barrel, slope etc.*

INTRODUCTION: canal syphon is a structure at a site where river or drainage crossing the canal at the same bed level. As the bed level is at same level so the canal should pass below the river or drainage for the easy flow of water and the structure constructed in that case is called canal syphon. In canal syphon HFL of the canal is below the bed level of the river or drainage. The water is pass through barrels under symphonic action with easy flow. The section of the canal is reduced at the barrel to increase the velocity of the water. The structure is constructed in such a way that the drainage water will not get contaminate the canal water as the canal water is used for irrigation purpose it may affect the crop.



TYPICAL SECTION OF CANAL SYPHON

LITRATURE REVIEW: we have studied the design example of canal syphon form the online websites scribe and designed the example by using a text book named as ‘’ irrigation engineering “by S.K GARG.

DATA COLLECTED:
CANAL:

1. FULLY SUPPLY DISCHARGE =42 CUMECS
2. BED WIDTH =16 M
3. FULL SUPPLY DEPTH =2.3 M
4. BED LEVEL AT D/ S =250 M
5. SIDE SLOPE = 1.5 : 1
6. FREE BOARD = 0.75

DRAIN:

1. MAXIMUM OBSERVED FLOOD DISCHARGE =102 CUMECS
2. BANK LEVEL =255 M
3. BED LEVEL =252 M
4. HIGHEST FLOOD LEVEL =253.30 M
5. SLOPE =1 / 600

SECTION OF DRAINAGE CHANNEL:

According to lacey's formula
P = 4.83 * Q^ (1/2)
P = 4.82 * 42^ (1/2)
=48.78 m.
Therefore provide bed width of the drain at the crossing as 45 m.

CANAL WATERWAY:

Area of canal section = BD + SD^2
= (16 * 2.3) + (1.5 * 23 ^2)
= 44.74 sq.mt.
Velocity = Q/A
= 0.94 m/s

Adopt size of barrel as

Width = 3 m
Height = 2.5 m
Wall thickness = 0.3 m
Number of barrels = 2 m
Velocity through the barrel should be less than 6 m/s.
Velocity through barrel = Q/15
= 42/15
= 2.8 m/s < 6m/s

MODEL MAKING OF CANAL SYPHON

Section view of canal

This is the section of barrel. As per design its width is 3m and height is 2.5 in actual data, and it is reduced while making model through scale factor, it is separated by one intermediate wall to make two barrels .the top slab of barrel is design to withstand against the load of drain water, it is subjected to invert pressure in barrel therefore velocity of water is high so it is designed to withstand the abrasion and scouring forces.

Top view of barrel

Canal waterway

HEAD LOSS THROUGH BARRELS:

Head loss through barrel is given by

= (1+ f1 + f2 * L/R) * v^2 / 2g

= 0.4218 m

DESIGN FEATURES:

Following consideration have been made in the design of barrels :

- Bottom slab: this design is for uplift pressure and reaction from soil resulting from the load of the foundations.

Theoretically, the soil reaction is not uniform but for simplification it is assumed uniform.

- Side walls : side walls would be tested in following two conditions

(a) High flood in the drain while barrel is empty

(b) No water in the drain while barrel is full

- Partition walls :the partition walls are subjected to equal pressure on either side and therefore no reinforcement is required, nominal reinforcement is however provided to take care of contingency arising due to unequal pressure resulting from chocking up of any barrels
- Top slab : the load consider for design of top slab are :

(a) Earth load

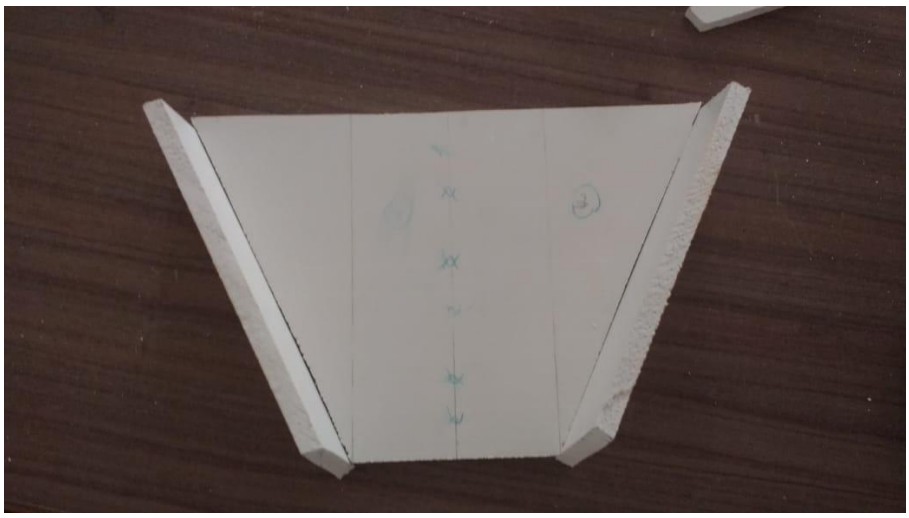
(b) Weight of water below saturation line

TRANSITION:

The general method of hinds shall be applied for designing the transition ,as the water depth in the transition vary from 2.1 m to 3 m

Front view of component of transition

This is the section of the contraction transition .this is made up as per the design example ,it is reducing gradually towards the barrel and is placed in gentle slope to pass water through gravity and it is designed as per mitra^s transition method,due to reduce in cross section from upstream to downstream it increase the velocity of flow and passing of water easy and speedy .



Top view of component of transition

Placing in position of transition bed

After cutting all the components as per our design ,all parts are fixed together and made our whole model workable. Some photos of model are as below.

Tank and gate for testing of model

Thus tank is also added in this model , it is an additional component which is made for checking the canal syphon and make it workable , it has the capacity of 10000 m^3 it is fixed on upstream side of canal syphon .

Canal without river

Completed model of canal syphon

Conclusion: By making model of any structure it becomes very easy to understand the various components we precisely understood all components like barrels, transition, guide walls, fluming, pitching, river protection works etc. Design and construction become very clear with the procedure of same.

