

Experimental Analysis of Minimization of Trap Efficiency of Dam Using Different Techniques: A Review

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Abstract — Trapping of sediments in rivers is done by various methods as it is a tedious job; But still many researchers have shown different techniques. By using artificial obstacles for collection of trap we can minimize transfer and deposition of trap in our reservoir. Along with obstacles some river training works found to be useful for collection and deposition of trap at particular location so that it will not get transferred close to the dam site. This research suggests the experimental analysis of trap collection in the river channel prior to dam site. Perennial rivers in which there is no chance to collect or remove the trap in dry period. It is quite possible for seasonal rivers therefore collection of trap in wet season and removal of it in dry season is quite possible in most of the states of India. Reservoir sedimentation has become one of the major problems facing water resources development projects in many countries around the world. However, only a limited number of studies has been reported in this field, particularly addressing the trap efficiency of reservoirs. The most important practical and critical problem related to the performance of reservoirs is the estimation of storage capacity loss due to sedimentation process. A small-scaled laboratory model was set-up in representing a reservoir and a series of tests were conducted by varying inflow rate, inflow sediment concentration, reservoir capacity and outflow rate. The experimental results were compared with the available theories

Keywords— Trap Efficiency (TE), Reservoir Sedimentation, Inflow Rate.

I. INTRODUCTION

Any river has changes in its cross section at different locations due to different soil conditions and topography. As a result of which some of the zones in river way required to provide river training works which will not allow to widen the channel. Such training works include groynes and marginal bunds; but this will only for prevention of river banks, however one can also make the use of this as a trap collection zones by making some possible changes in it. In India mountainous rivers will have water in all 12 months but this is not possible in southern and western region specifically in Maharashtra. Our study relates to the collection of trap which will only possible in dry period so that this method is quite useful in western and Southern region of India. According to literatures the research happens only in western countries where seasonal changes in environment are not affecting much on river conditions and so there is no any frequent change in soil condition. However it is not possible in India specifically in Maharashtra where seasonal changes are frequent. Our study approaches to the collection of trap by some methods and removing it before it enters in the reservoir. According to the seasonal changes we have also made difference in Northern and western part of India so that proper training works is to be given to particular site. The experimental setup consists of a storage tank for varying discharge artificial

channel for sediment transport and a collection of tank in which trap and water gets collected separately.

II. PROBLEM STATEMENT

The life of reservoir and water retaining structure is generally considered as 100 years or over the world. Since from last few decades due to urbanization there are rapid changes in the environment. Due to impact of these changes the assessed life of structures like dams and reservoirs becomes less than 100 years. The major factor responsible for minimizing storage capacity of dam is increase in trap and the reason behind it is soil erosion and these eroded material gets trapped in catchment area.

Our study approaches to methods that allow water without conveying trap through channels, rivers, streams

III. LITERATURE REVIEW

Sultana and Naik (2016) : A) have applied the artificial neural network technique to Forecast the annual trap efficiency of a reservoir and observed that the developed ANN model captured the trend of trap efficiency percentages well when compared to the traditional regression approach.

B) estimation of trap efficiency of the sriramsagar reservoir. With the help of methodology like Heinemann's method, Brown's method, Churchill's curve (sediment index method) and Brune's curve (capacity inflow method).

Morteza Marosi, Mehdi Ghomeshi and Hamed Sarkardeh et al (2015): studied about the sedimentation control in the reservoir by using an obstacle. Variations in the shape, size and depth of the obstacle. obstacles used in this study were trapezoid.

Mulu and Dwarakish (2015): have taken up the problem of nonavailability of data of reservoirs, with no stream gauge stations on the upper side of the reservoirs, considering the factors like seepage of water into the ground and loss of water due to evaporation. The authors have utilized trap efficiency in terms of storage capacity and outflow parameters. They found that there is a large difference in the results of the assessment of reservoir siltation using Brune's curves with and without consideration of the seepage and evaporation losses.

G. Mathias Kondolf, Yongxuan Gao and George W. Annandale et al (2014):
 N.M.T.K. Revel, L.P.G.R. Ranasiri, R.M.C.R.K. Rathnayake and K.P.P. Pathirana et al (2014): Carry out the experimental investigation of sediment trap efficiency in reservoirs. And give new formulae incorporates the reservoir capacity, sediment inflow rate and spillway length which is directly correlated to out flow from the reservoir.

M.A. Eizel-Din, M.D. Bui, P. Rutschmann and A.S. Hussein et al (2010): studied the trap efficiency of reservoir on the Nile river. Trap efficiency is influenced by many factors, of which primarily factors are the sediment fall velocity, the flow rate through the reservoir and the reservoir operation rules. Observations and hydromorphological numerical simulations showed that the equation proposed by Siyam (2000) with definition of the sedimentation parameter β can better describe the relationship between trap efficiency of the reservoir and the average annual inflow as well as the reservoir capacity.

Siddha Kumar Burman, Dr. P. K. Gupta and Dr. A.K. Garg: estimating the trap efficiency of Kodar reservoir. with the help of three methods Gill method, Brown method and Brune method. It is found that the trend of results follow the Brune's method curve which shows that the sediment in the reservoir.
 D. L. Rausch and H. G. Heinemann: studied about controlling the reservoir trap efficiency. to control the trap efficiency they consider some parameters like reducing detention time, changing the particle size of sediment. And found that trap efficiency changes with the change in detention time of the

storm runoff, change in the particle size of incoming sediment and eliminating the dead storage in a reservoir

IV. RESEARCH GAP

Among all the researches it is clear that the collection and removal of trap from reservoir is a difficult task till now the research is limited to changes in trap collection according to height of obstacle but there is clear investigation on comparative analysis of position changes as well as orientation changes in obstacle in river channel.

V. METHODOLOGY

1. Experimental Set Up

The experimental analysis consists of a storage tank acting as a reservoir, open channel acting as a river through which sediment gets transported, obstacles made up of concrete (Rectangular, small blocks), collection tank which will collect trap and water separately.

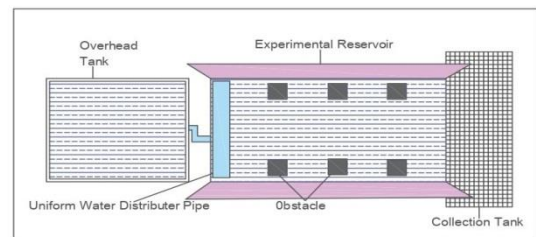


Fig 1 :Top View of Model

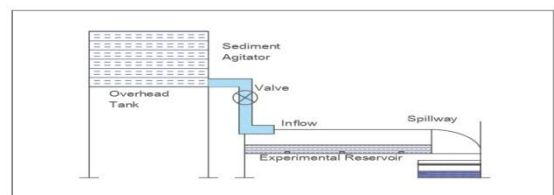
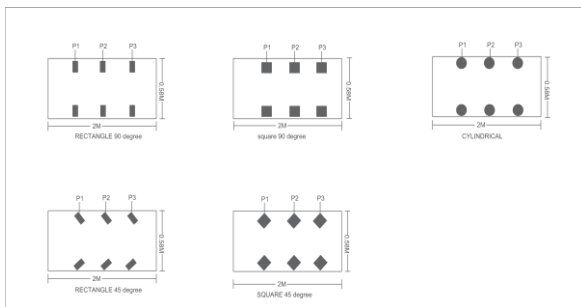


Fig 2: Side View of Model

The Experimental Setup Consists of an overhead tank which has Dimensions of 0.55 x 0.5 m x 0.4 m, to feed sediment laden water into the reservoir, a sediment. Figure 2 shows a schematic diagram of the experimental set up. The Reservoir bed was made linearly sloping towards the Dam to represent the model much closer to a real reservoir. A river sand is used for the Proposed tests.

The Experiment was carried out for a duration of one hour for the multiple times as we have different shape of obstacles and we also change their positions and angles. During the Experiment, two type of sand variation we have given and also, we have given variations in discharge After the experiment was over, the sediments deposited on the mesh were collected and weigh. This Procedure was Repeated for 15 times and values are recorded in observation Table.

VI. RESULTS AND DISCUSSION



For 45-degree Trap Collected at P2 is Maximum so the Preferable Position is P2.

From Graph at Position P3 Trap Collected is Minimum for both 90 degree and 45 degrees

From all three-position maximum trap will be collected when obstacles at P2. So, most preferable position is P2

Trap collected from P1 and P3 are same.

Variation is trap collection for 90-degree obstacles is more at respective position as compared to 45 degrees.

VII. CONCLUSIONS

- From experimental result we can calculate that obstacle in the form of river training work found to be effective in trap minimization.
- By adopting proper shapes and positions we can collect maximum trap accordingly.
- Experimental set up to quite effective in small scale project such as weirs and barrages.
- The retaining rate of large size sediments are more than fine sand

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