

## Design of Rubber Dam

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**Abstract**— Rubber dam is a relatively new type of hydraulic structure compared with steel sluice gate, weir, causeways, etc. which is made of high strength fabric adhering with rubber forming a rubber bag. The barrage, made of rubber, will be filled with air, so that it can be inflated or deflated as per requirement. The concept of rubber dam and its application in India has yet to develop to gain from its advantages, though the system has been used in great extent in countries like China, Australia and in Scandinavia. It is used in site specific cases where it may prove to be a very good alternative to costlier permanent structures. A rubber dam has many advantages, such as simple hydraulic structure, short construction time, perfect seismic performance, and low resistance to water flow in flood season etc. General description of system, various configuration and types, working principle and comparative analysis has been presented in this paper.

**Key words:** Rubber Dam, Flood Control, Irrigation

### I. INTRODUCTION

Rubber Dam is a different type of hydraulic structure compared to a conventional water retaining structure with gated or un-gated spillways and weirs to release the surplus water, such as dams and barrages. Strictly speaking these are not dams, but structures made of high strength fabric adhering with rubber, which forms a ballooned rubber bag when filled with water or air and anchored to the basement concrete floor, and are used for water retention. Such type of a water retaining structures (Rubber dam) themselves could also serve the purpose of releasing the surplus water over the body of the dam by emptying filled water or air from the dam bag, which are mostly used for flood release.

Why Rubber Dam:

- Better control of flood.
- Increase of per capita storage capacity and water use efficiency.
- Easy installation.
- Lower investment cost.(about 40%)than the conventional gated structure.
- Ground recharging.
- Other purposes irrigation water supply. Power generation environment improvement.

#### A. The Use of Rubber Dam:

With regard to the mentioned importance nowadays the rubber dams are used in various water projects that some of them are mentioned below:

- divert water to open channels for irrigation
- Construction of rubber dams in order to increase the water level in reservoirs of constructed dams
- Use rubber dams as wide river dam

#### B. Classification of Rubber Dam

##### 1) Air Filled Rubber Dam:

In these types of rubber dams, the inflating medium used is air. This type of rubber dam is particularly useful in cold countries where freezing of water is the main problem with which is mainly infested. The standard inflating air pressure given by any manufacturer is 30 Kpa. At this pressure dam is fully inflated & it gains circular shape.



Fig. 1: Air filled rubber dam

##### 2) Water Filled Rubber Dams:

In these types of rubber dams, the inflating medium used is water. This has special advantage over the air filled rubber dams that this has easy deflating process. But in case of cold region water may get freezes & to avoid it continuous circulation is required & thus maintenance cost gets increased.



Fig. 1.2: water filled rubber dam

#### C. Selection of Dam Site:

Rubber dam site should be selected on the following considerations:

- 1) The site should be such that the dam at that location can command the maximum cultivated land.

- 2) The beneficiaries have to be consulted and the site of proposed dam will provide them the desired benefits of irrigation of the neighboring lands.
- 3) The site should be easily approached by road
- 4) The channel reach should be relatively straight and smooth water flow
- 5) Bank of the river/channel should be stable one
- 6) Land should have uniform slope.
- 7) Optimum utilization of scarce water to derive maximum benefits.

#### D. Components of a Rubber Dam:

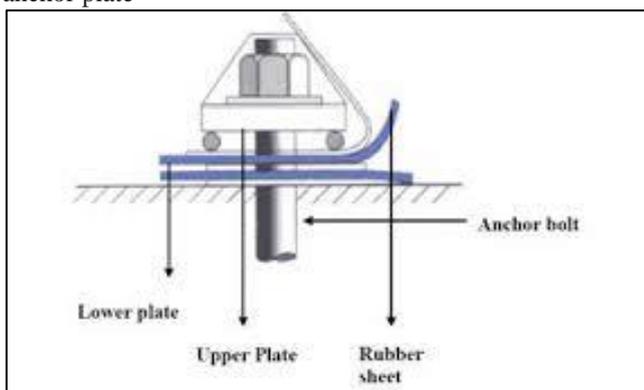
Rubber dam is mainly divided into four parts-

- Dam body or dam bag
- Anchorage system
- Control system (including water or air filling and emptying system, monitoring system and safety control system)
- Foundation (including base floor, abutment and side walls etc.).

##### 1) Anchorage of Dam Bag with Concrete Base:

###### a) Steel Clamps with Anchor Bolts:

Fixing of rubber sheet on the concrete slab, steel clamp elements and stainless steel anchor bolts and nuts are used. Fixing of rubber sheet is not as simple as like as other construction work of the rubber dam project. At first, the anchoring slot is kept open for second stage concrete for positioning and fitting and fixing the anchor bolt with dowel bar of the slot. Then lower anchoring plate is fixed with the help of anchor bolt and the anchor bolt is fixed with dowel bar with welding work. The design level of lower plate is done with the help of machine and this level is adjusted with the help of bottom nut of anchor bolt. Then second stage concrete is cast up to bottom level of lower plate. The thickness of lower and upper plate is designed with the height of rubber dam. The works are done very carefully with maintaining proper alignment of the anchor bolt, because any deviation of anchor bolts will create problems in fitting of anchor plate



##### 2) Data Collection

A rubber dam basic data shall be collected, processed, analysed and studied on

- 1) Hydrology
- 2) Engineering geology
- 3) Topography
- 4) Meteorology

##### 3) Hydraulic Design

The design data/parameters required for hydraulic design of rubber dam data/parameters are as follows:

- 1) Design discharge (20 years discharge record of river).
- 2) Design water levels.
- 3) Water retention level of the project.
- 4) Average lowest bed level of the river.
- 5) Soil information.
- 6) Embankment crests Level.
- 7) Cross section of the river up to 7-10 Km U/S and up to 2 Km D/S.
- 8) Long section of the river.

##### 4) Construction Procedure of Rubber Dam:

Rubber dam construction will be done in three stages.

- The design stage
- Construction stage
- The operation stage
- The maintenance stage

In the construction stage the rubber bag of the dam is attached with the concrete floor. At the beginning of the construction sheet pile wall or cut off wall is constructed at both the upstream and downstream side for controlling soil corrosion due to seepage. After that, the upstream, downstream, and the rubber bag is cast with concrete. At last, abutment wall, block, pump house, valve chamber etc. are constructed. But the main attached concrete structure of rubber bag is constructed very carefully. By using M.S. pipe, pad and platen; rubber bag is anchored with the floor bed.

## II. SAFETY CONSIDERATIONS

When the Rubber dam is inflated/deflated, water levels change suddenly and may create a hazard to adjacent people or their properties.

### A. Preventive Maintenance

Innovative materials and designs have been applied to rubber dams to increase their life span and enhance their performance. It is included that rubber dams are vulnerable two types of damages,

- 1) Vandalism
- 2) Flood borne debris, especially sharp objects

### B. Periodic Inspection and Maintenance:

These includes mainly

- 1) Inspecting the dam body and surrounding environment to identify if there any presence of unidentified object that may cause to rubber cut or puncture.
- 2) Removing silt and debris from both upstream and downstream of dam.
- 3) Keeping the chamber clean that contains the level sensor and associated piping system

### C. Sediment Removal:

Rivers have scouring effect on the dam body. Since rubber is less susceptible to scour than concrete so this doesn't pose a major problem to dam body.

## III. CONCLUSION

Rubber dam gives a major advantage in the flexibility of its operation. It can also be used as a temporary dam for the

construction of conventional dams because of its transportation convenience. As we know that the overall cost and maintenance of Rubber Dam is low compare to other dam, so we can use this types of dam. Compared with steel gates, the rubber dam becomes more cost-effective with the increase of the length of its spans. The rubber dam has been put into a wide scope of application (irrigation, water supply, power generation, flood control, environmental improvement, and recreation) due to its structural simplicity, being inflatable and deflatable, and proven reliability.

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