A Review on Rubber Dam

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Abstract- *Rubber dams are inflatable and deflatable hydraulic structures. Thousands of rubber dams have been installed worldwide for various purposes: irrigation, water supply, power generation, tidal barrier, flood control, environmental improvement, and recreation. Furthermore, rubber dams have been used in cold areas where the temperature is as low as –40°C. The simplicity and flexibility of the rubber dam structure and its proven reliability are key considerations in its wide scope of applications.*

Keywords- construction, hydraulic structure, maintenance, operation, repair, rubber dam.…

I. INTRODUCTION

Rubber dams are long tubular-shaped fabrics placed across channels, streams and medium sized rivers to raise the upstream water level when inflated and thus play a vital role in enhancement of irrigation capacity. In Rajasthan, there is very low rainfall in winter. So, the requirement of water in winter for irrigation must be met from groundwater source and by conserving a part of monsoon surface water in suitable storage. To use the river water in winter, Rubber Dams were introduced. It is a new type of hydraulic structure compare to conventional dams with un-gated spillways.

Rubber dam is a structure made up of high strength fabric (EPDM-ethylene propylene dienemonomer) adhering to the rubber. Rubber dams are the cheaper water conservation structures compared to conventional gated structures like barrages especially in small and medium rivers. Conventional dam may not install or construct for small project because cost and time consumption are more in conventional dams. Rubber dam are the modern type of completely automatic structure used to store the water and to increase water level of a watercourse. Rubber dam is a cost effective technology for retention and conservation of surface water. It is an ideal solution to fulfill the shortage of water in dry season. A unique characteristic of the rubber dam is its ability to function as a reliable crestadjustable water gate. When inflated by a medium (air water or combination of both), it rises to retain water. When deflated by releasing the medium, it collapses flatly down to the foundation and allows water to free flow through the channel. Rubber dam can also be adjusted to operate at intermediate height to meet the needs for the different upstream and downstream water levels at different times. Rubber Dams have certain definite advantages, within their applicability range; over conventional gated regulating structures.

Replacement of heavy gates, hoisting gears and piers of conventional structures by light rubber-nylon shell body saves huge amount of steel, cement, timber and other construction materials. This brings the economy. The dam body can be fully deflated to lower it to flat level on base floor so that flood flow passes without any obstruction. This provides rubber dams a dominant position over conventional gated regulating structures. Rubber dams can have spans as long as, 100 meters without dividing piers. This provides full width of active cross section of the river channel to release flood flow.

The rubber dam is relatively recent technology break-through. Rubber dams are placed across channel stream and weir crest to increase the upstream water level when inflated and because of that rubber dams.

Inflatable dams are flexible cylindrical structures attached to rigid base. The dams are tubes made of rubberized material. The material is a multilayer fabric made of synthetic fiber which may be rubberized on one or both sides and coated with plastic film.

The fabric is quite flexible and yet exhibits very large resistance characteristic and inflated by air, water or combination of air and water. Their height ranges up to 6m and their length may reach up to 150m.

The thickness of the material ranges from 25mm to35mm and present dams have 30 to 40 year life span according to manufacturer.

Inflatable rubber dams are cylindrical rubber fabrics placed across channels, streams and weir or dam crests to raise the upstream water level when inflated. The membrane is a multi-layer fabric made of synthetic fibre (usually nylon) and rubberised on one or both sides. The fabric is quite flexible and yet exhibits good wear-resistance characteristics. A layer

of stainless steel mesh or ceramic chips can be embedded in the surface layer to reduce or prevent vandal damage.

The inflatable flexible membrane dams (IFMD, or rubber dams) were developed in the early 1950s - Flexidam - Imbertson. They are installed in stream and river beds, generally being bolted into a concrete foundation. They are used to divert water for irrigation, temporarily raising existing dams, flood control, water retention for aquifer recharge, reducing or preventing salt water intrusion into fresh water areas, protect low-lying coastal areas from tidal flooding, enabling fish passage past diversion works, by deflation, and for sewage retention/separation during flood events.

Inflatable dams can be filled with water, air or both. They are low pressure - typically 4 to 10 psi. The present trend suggests an increased use of air-filled membranes because they can be deflated or inflated more rapidly, and they are little affected by freezing conditions. Characteristic dimensions cover typically lengths of about 100 m with specially-made membranes up to 200-m wide, dam heights usually less than 5-m but some special designs might be up to 10-m high. The membrane is usually deflated for large overflows.

It is however common practice to allow small spillages over the inflated dam. During overflows greater than 20% over-topping, vibrations might result from fluid-structure interactions,[1] and the instabilities might damage or destroy the rubber membrane. Several failures were experienced (e.g. CHANSON 1996). In practice, a deflector (i.e. fin) is installed on the downstream face of the rubber dam to project the nappe away from the membrane, hence preventing rubber membrane vibrations.

There are more than 2000 inflatable rubber dams around the world. Durability can be excellent: recently, a 35-year-old dam in eastern Ontario, Canada was replaced, and while still functional in both freezing winter conditions when it was air filled, and water filled in summer, it was deemed to have served its useful life, and was replaced.

The balgstuw near Ramspol is an inflatable rubber dam. It is situated between the Ketelmeerand the Zwarte Water in the Netherlands. This dam is built to protect the villages against the rising water of the Ketelmeer. It is the biggest inflatable rubber dam of Europe.

With the development of polymer composites, there is a new type of hydraulic structures, which is the inflatable rubber dambelongs to the flexible wall structure. In 1957, the world's first inflatable rubber dam appeared in Los Angeles, the United States, since then widely used all over the world.

China also built the first inflatable rubber dam in 1966 and that is the right-door inflatable rubber dam in Beijing. Although the dam bag has been replaced twice in the meantime, it has been operating well so far. Since the 1990s, the technology of inflatable rubber dam has made unprecedented development in our country.

At present, there are thousands of giant inflatable rubber dam built in our country, and the construction speed is even at an average speed of 300 inflatable rubber dams per year. Among them, the inflatable rubber dam of Donglan River in Xiaowu Village, linyi City, Shandong Province is the longest inflatable rubber dam in the world, which fully shows that the construction technology of inflatable rubber dam in our country has reached the world advanced level.

a) The Classification and Usage of Inflatable Rubber Dam

Water filled inflatable rubber dam and air filled inflatable rubber dam are the two basic forms, the water filled inflatable rubber dam has a significantly higher water filling and water discharging time because of its unique characteristics. However, both types of inflatable rubber dam are similar in terms of cost. From the composition of the inflatable rubber dam structure, the inflatable rubber dam is mainly composed of the civil part, dam bag and anchors, filling and discharging water (air) facilities and control systems and other components. In operation, we must strictly follow the established program and operational rules and regulations. In particular, attention should be paid to the blasting of inflatable rubber dam, which is often due to the fact that the pressure of filling water or filling air of the inflatable rubber dam is significantly higher than the design pressure.

Among many water conservancy projects, inflatable rubber dam is more suitable for sluice projects with low head and long span. For example, it can be used for the diversion of water from the head of a river, which facilitates the flooding during the flood season and facilitates the water diversion of the canal. It can also be used for landscaping in the center of the city, where inflatable rubber dams can be used to intercept river savings and create artificial lakes. In short, the application of inflatable rubber dam is very wide range.

b) The Advantages of Inflatable Rubber Dam

The reason why the inflatable rubber dam can be developed rapidly in our country is inseparable from a series

of advantages of its construction. The construction cost of the inflatable rubber dam is low. According to the statistics, the average investment can be reduced by 30% to 70%. The construction period is not very long, and most of the inflatable rubber dams can be completed in the year of construction. As the inflatable rubber dam has a flexible structure, it can effectively buffer the impact of water, resist earthquakes and so on. It can also be applied to garden projects in urban areas, and has a wide range of applications.

II. LITERATURE SURVEY

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The Adam T. Bower Memorial Dam (formerly known as the Sunbury Fabridam) is the world's longest inflatable dam.[2] The dam is located just below the confluence of the Western and Main Branches of the Susquehanna, between the towns of Shamokin Dam and Sunbury, Pennsylvania.

The dam is 2,100 feet (640 m) long. When it is raised in the summer time, it creates the 3,000 acre (12 km²) Lake Augusta, which is used for recreation.[3] The dam and lake are part of Shikellamy State Park.

In 2001, the dam was renamed for Adam T. Bower, Chief Clerk of the Pennsylvania House of Representatives from 1967–68 and Director of Services during the Pennsylvania Constitutional Convention of 1967-68, by Act 2001-5 of the Pennsylvania General Assembly.[4]

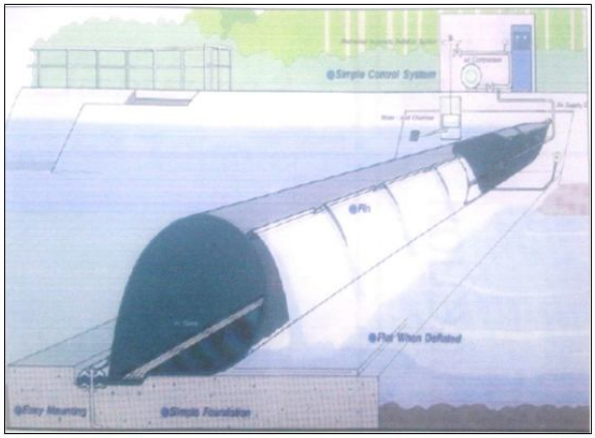

Fig-1 Structure of rubber dam

The longest single span (190m) rubber dam is located in Molino de Suso, Spain. Qingdao Hua Chen Industrial Science and Technology Company Limited has built the longest rubber dam with 3.7m high and 1,110m long in Asia.[citation needed] As the largest manufacture of rubber dam in China, Qingdao Hua Chen has built more than three thousand rubber dams all over the world.

III. CONCLUSIONS

Water filled rubber dam is a tear-shaped rubber dam filled with stabilizing water. Normally, it is considered to be expensive and slow to fill but more stable to provide optimal

control over upstream water levels compared with air filled rubber dam.

- Stabilizing water-filling with heavier weight to minimize vibrations.
- Ideal for applications with tail water elevation or broad watercourses.
- Capable to withstand a higher overtopping up to 50% of the dam height.
- More evenly during the inflating and deflating procedure.
- Can be operated without electric power.
- Lower maintenance cost.
- Optional water circulation system to eliminate the possibility of freezing in winter.

Rubber dam is an innovative technology; which can be used profitably for various purposes such as

- Waterparks
- Floodcontrol
- Diversion for building maindam
- Repairs of dams
- Small powerplants

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