Volume : 1 | Issue : 4 | April 2012 ISSN - 2250-1991

Research Paper Engineering

Use of Rubber Dam In Tapi River Front Development At Surat City

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ABSTRACT

River Front Development on River Tapi though lucrative is a specific issue in the is non perennial sense that Tapi river and in the river the discharge carrying capacity of the existing cross section is about 3 lac cusecs (8495 cumecs) to 4 lac cusecs (11327 cumecs).This discharge is regulated by el is to make the reservoir full at the end of the monsoon and henUkai Dam Authority by rule level. The principle of rule levce this rule level is modified from time to time depending upon the experience gained by the previous years.

When efficient regulation is provided by Ukai Dam Authority, experience shows that discharge in the river is remaining almost not more than 2 lac cusecs (5664 cumecs) for reasonable time during the monsoon and the discharge beyond 2 lac cusecs (5664 cumecs) is practically experienced only during very few days of monsoon. Sometimes this discharge never exceeds even in monsoon also. Therefore River Front Development is proposed for 2 lac cusecs (5664 cumecs).Once monsoon is over the discharge in the river is decided depending upon the availability of water in the reservoir and water required for hydropower generation, irrigation and riparian rights of the downstream people. Thus during post monsoon period, the discharge released many times reduces to 300cusecs (8.49 cumecs).This discharge is not sufficient for River Front Development and hence it is period when the Rubber dam is fully inflated and the sluice gates are closed. During the monsoon period, when the discharge is comparatively more, the combination of the operation of deflation of the Rubber Dam and opening of the sluice gates will provide safe passage of discharge proposed to construct a concrete weir and Rubber Dam at Rundh with sluice gates. This will provide a storage space for water on upstream side during the post monsoon through and above the sluice gates. An attempt is made in this dissertation to calculate the discharge through the sluice gates, height of the concrete dam and height of the Rubber discharge taken care of at this particular section. Dam with maximum and minimum discharge taken care of at this particular section.

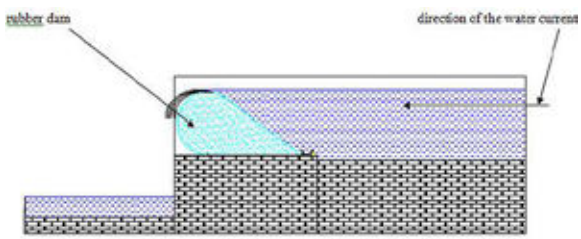
Keywords : Needful storage, recreation, rubber dam, Tapi riverfront

I. Introduction

- Surat is situated at the mouth of River Tapi where it meets the Arabian Sea. It is one of the most dynamic cities of India with fastest growth rate due to immigration from various parts of Gujarat and other states of India. The Area of Surat City is
- 326.515 km². The Population of Surat city is 45,05,000. The location of the Surat City is 21°10′N 72°50′E/ 21.17°N 72.83°E. The Temperature during the different season are
- Summer : Max 42 °C, Min 22 °C
- Winter : Max 31 °C, Min 12 °C
- STD Code 0261
- State Gujarat

The River Tapi, ancient original name River Tapti is a river in central India, in Gujarat passing from Songadh and Surat. It is one of the major rivers of peninsular India with a length of around 724 km. It is one of only three rivers - the others being the Narmada River and the Mahi River that run from east to west.The River Tapi rises in the eastern Satpura Range of southern Madhya Pradesh state, and flows westward, draining Madhya Pradesh's Nimar region, Maharashtra's Khandesh and East Vidarbha regions in the northwest corner of the Deccan Plateau and south Gujarat, before emptying into the Gulf of Cambay of the Arabian Sea, approximately 11 Km. west of the city of Surat. The length of River Tapi from its source to sea is about 724 Kms. Out of which it flows through Madhya Pradesh for a length of about 332 kms. and 217 Kms. in Maharashtra and for about 175 Kms, in Gujarat before joining the Arabian Sea near Surat.Ukai dam controls the flow of water and water level in the river Tapi, which is 100 km. away from Surat city. The dam is constructed at Ukai, Tal: Songadh, Dist: Tapi. It is constructed mainly for irrigation purpose and also serves the purpose of flood control, generation of hydropower and supply of industrial and drinking water.

TAPI RIVER



- Rubber dams are made of long tubular-shaped fabrics placed across channels, streams and weir crest to raise the upstream water level when inflated. The membrane is a multi-layer fabric made of synthetic fibre which may be rubberized on one or both sides, and possibly coated with plastic film. The fabric is quite flexible and yet exhibits very large resistance characteristics. They are installed in stream and river beds and generally being bolted into a concrete foundation.

- Inflatable dams can be filled with water, air or both. They are low pressure – typically 0.281 to 0.703 Kg/cm2 .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 and the instabilities might damage or destroy the rubber membrane. 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 vibration

NEED OF THE PRESENT STUDY

1. Conservation and storage of river water post monsoon flow before it is merged into tidal water.

2. Development of water body in Rundh Singanpur stretch of river passing through city.

3. Create raw water source for Athwa, Dumas, Adajan, Hajira and villages having no source of water (113 Nos or so) in Khar land and 88 village water ponds.

4. Stabilize river regime and prevent sloughing and sliding of banks under tidal cyclical changes from weir-cum-causeway to Rundh.

5. Provide designed flood spill for rare releases from Ukai on right bank to minimize random uncontrolled damages on right bank, and cost of maintenance of communication etc.

OBJECTIVES OF THE STUDY

- A proposal of Rubber Dam downstream of Singanpur weir is conceived with following objectives:

- The discharge from Ukai Dam is reduced to very negligible which is up to 300 Cusecs (8.49 Cumecs) during pre monsoon and post monsoon period and as increase in population of surat city and its adjacent areas, it is necessary to maintain discharge up to 700 Cusecs (19.82 Cumecs) to fulfil the water demand.Hence, The aim is to maintain sufficient quantity of water through Tapi River front Development in between singanpur weir and Rundh during post monsoon period especially summer.

SCOPE OF THE STUDY

City of Surat (SMC and Citizens).

- SUDA areas- satellite townships.

- No source village where water supply is to be ensured by government of Gujarat including water works at Gaviyar.

- Department of Sports youth and athletics for water sports, swimming, boating etc.

- Architect Engineers and Builders for riverfront development.

- Department of Horticulture.

- Campus starved of water, even at price, like South Gujarat University, Sardar

Vallabhbhai National Institute of Technology, ONGC, Reliance Colony,

Patilnagar, Enclaves on Magdalla Road.

· Jilla and Taluka Panchayat for activating village ponds (Government of Gujrat)schemes

SMC for planning water works to cater needs west of Athwa in future.

- Industry by providing social activity canters to employees living far away from city and home towns.
- The tourism department for organizing religious Ghats, gardens, tapobhumi, along right bank from Rander to Hazira. There will be some scope along left bank as well say at Ambaji etc. this Ghats will be entry for boating andwater sports.
- Developers of picnic spots on island. Children games like Disney land, inland transporters. Rope way etc.
- Chamber of Commerce and Industry striving for creating better air, water and environment.

3 STUDY AREA

- The Study area for proposed Rubber Dam is from Weir-Cum-Causeway near Singanpur village to Rundh. The approximate length of the reach is 10 Km.

DATA COLLECTION

Cross section data
rainfall data
soil data
Bed level data
Weir cum cause way data
tide water data

METHODOLOGY:

.To find out Head over the Rubber Dam and Back water Length

Head over the rubber dam can be calculated by following Equation

$$Q = \frac{2}{3} C_d \sqrt{2g} H^{3/2}$$

Where,
Q = Design Discharge = 2 Lac Cusecs (5664 Cumecs)
Cd = Coefficient of discharge =0.62
g = acceleration due to gravity=9.81m2/sec
L = Length of effective cross section 40 = 552 m
H = Head over the Rubber Dam in m

2.Back Water Length can be calculated from the following Equation

$$L = \frac{E_2 - E_2}{i_b - i_e}$$

Where,
L = Back Water Length in Km
E1 = Specific Energy on downstream at Section 40 in m
E2 = Specific Energy on upstream at Section 40 in m
ib = Bed Slope =0.0000619
ie = Energy Line Slope

3.Specific Energy E can be calculated from following Equation

$$E = h + \frac{V^2}{2g}.$$

Head over the Rubber Dam can also be calculated from the following equation:-

$$H = h_1 - h_2$$

Where,
Link 1: Where,
h1 = Depth of Flow on downstream at section 40 in m
h2 = Depth of Flow on upstream at Section 40

4.Velocity can be calculated from the following equation

$$V = \frac{1}{N} R^{2/3} i_b^{1/2}$$

Where,
V1 = Velocity of Flow on downstream at section 40 in m/sec
V2 = Velocity of Flow on upstream at section 40 in m/sec
N = Manning's Coefficient = 0.012
R = Hydraulic mean Depth

$$R = \frac{A}{P}$$

A= Area of particular section = b x h
P= Wetted Perimeter = b+2h
Also To Find the value of ie use Manning's formula

$$V_{avg} = \frac{1}{N} R_{avg}^{2/3} i_e^{1/2}$$

Same Calculations of Head over the Rubber Dam and Back water Length for different Design Discharges Say 1 Lac Cusecs (2850 Cumecs), 1.25 Lac Cusecs (3600Cumecs), 1.50 Lac Cusecs (4300 Cumecs), 1.75 Lac Cusecs (5000 Cumecs), 2.25 Lac Cusecs (6400 Cumecs) and 2.50 Lac Cusecs (7100 Cumecs) are taken.

To find out Discharges over the Rubber Dam and through the sluice gates:-

Discharge from one sluice gate is

$$Q_1 = C_d \sqrt{2gH}\, A$$

Where,
Q1=discharge from one sluice gate
Cd = Coefficient of discharge =0.62
g = acceleration due to gravity=9.81m2/sec

$$H = h_1 - h_2$$

H= head at sluice gate
h1 = Depth of flow on upstream of sluice gate
h2 = Depth of flow on downstream of sluice gate

There are two possibilities that affect the discharge from upstream:-

(1) When tide level on downstream is minimum, tide water flow from d/s towards u/s affects the discharge a little bit.

2) When tide level on upstream is maximum, tide water flow from d/s towards u/s affects the discharge considerably.

A= Area of one sluice gate

Case:-I When Rubber Dam is inflated fully:-

Design discharge over the Rubber Dam

$$Q = \frac{2}{3} C_d \sqrt{2g} H^{3/2}$$

Total discharge Q = Q + Q1

Total discharge Q= Q + Q2

Case:-II When Rubber Dam is deflated fully:-

Discharge over the Rubber Dam

$$Q = \frac{2}{3} C_d \sqrt{2g} H^{3/2}$$

Total discharge Q= Q + Q1

Total discharge Q= Q + Q2

Conclusion

For the River Front Development on River Tapi, a Rubber Dam on the concrete weir at Rundh is proposed which is 10Km away from Singanpur weir. A Rubber Dam is required for storage of water when the discharge in the river is reduced to 300 Cusecs (8.49 Cumecs) during the post monsoon period especially during summer months. Thus Rubber Dam will provide a temporary structure over the solid concrete weir which forms a barrier for storage of water on the upstream side. At the same time, it will reduce the effective cross section area of river at Rundh and thus to take care of the discharge 22 numbers of sluice gates are proposed in concrete Dam. Thus it is aimed to provide beautification of the River Front and the area of the river cross section itself between Rundh and Singanpur where the slums are prone to develop and hence otherwise not used properly, can be used for recreational purpose. For this recreation purpose, it is important that we have not to procure land from out side. Thus this will add one more feather to the crown of Surat city after proposed cable stayed bridge.

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