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Study of Flood Protection Work on Men River at Tilakwad Village of Narmada District, Gujarat

KEYWORDS

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ABSTRACT *Flood events are a part of nature. Flood, caused by overflow from a river, wind induced surges, tides, or other many factors are normal events of the earth's hydrosphere. Some of them occur regularly, like floods arising from spring melting of snow accumulated during winter, while others are occasional.*
The Aim of this paper is to reducing the flood effect through flood protection work at Tilakwada village. Tilakwada village is located on Men river bank in Narmada. In the Men River flood are occurred frequently and adverse effect of flood are bank erosion reduction in crops yield, loss of human life, level erosion. The mechanism of flood protection work first the design flood then selecting the flood protection measure and the design & analysis of flood protection measure and find the benefit cost ratio & find the which flood protection measure are Economical and better flood protection by Tilakwada village in Narmada.

Introduction
Flood protection is a method or a set of measures to prevent damage and eliminate loss of life in future floods. Flood protection is a complex social and economic problem that can be effectively solved only by countries with high economic potential.

During monsoon, Men River is flooded almost every year and the level of extremity has been increasing. The river banks are formed of alluvium strata, of alternative layer of sand and clay or sand and Gravel, not capable to resist the effects of waves and current forces of flood water, which ultimately results in erosion of banks. Due to heavy rain, Men River was highly flooded. The lower bank which acts as foundation for upper bank is generally susceptible to erosion due to flowing water and recession of bank occurs particularly at toe. The recession is fast, because lower bank consist of sandy soil which gets washed away by strong current and the overhanging bank portion collapses or erodes gradually every year. The villages situated on the banks of Men River were vulnerable to such floods and hence need to be protected from the likely damage by flood protection schemes. Men River is tributary of Narmada River, which is small west flowing river flows in Narmada district of Gujarat, near the Tilakwada village which mingles with river Narmada. It is 62km Long River and it has a catchment area of 47sq km. This river lies between longitudes 73°35'E to 74°01' E and latitudes 21°56'N to 21°59'N.

During the site visit it was observe that existing bank about 20m to 25m high. Due to higher height when high flood comes the bottom portion of bank gets eroded and resulting of upper portion of bank in sudden collapsed. Due to the steeper bed gradient, flood generates high velocity in the river hence the right bank of the river gets eroded gradually every year. It is highly necessary to protect the bank from further erosion. Bank protection works may be classified as direct and indirect. Direct protection includes works done on the bank itself such as providing vegetation cover, pavement, revetment, grading of slope etc. Indirect protection includes works constructed not directly on the banks, but in front of them for reducing the erosive forces of the current, either by deflecting the current away from the bank by inducing silt deposition against them. There are different such as embankment, retaining wall, flexible structure. From the entire alternative structure flexible structure suitable for particular site.

Flood Forecasting Method
All hydrologic analysis shall consider the flood history of the area and the effect of these historical floods on existing and proposed structure. The following methods are considered for calculating the design flood:

[1] Gumble Distribution Method
[2] Observed HFL Method
[3] Ingli's Formula.

[1] Gumble distribution method:
From the River flood data of some year, calculate:

$X, X^2, e^{-a*x}, X * e^{-ak*x}, X^2 * e^{-ak*x}$

n =No. of Observation

Standard Deviation S, $S^2 = \frac{\Sigma x^2 - (\Sigma x)^2}{n}$

$n - 1$

Computation of value= $a = \frac{\prod x k}{\sqrt{6} \times S}$

$u = \log e10 \times (1 / ak) \times [\log10 (n) - \log10 (e^{-ak * xi})]$

Magnitude of Peak Flow of a given Return Period T

Calculate: $T / T (T - 1)$

$XT = u - [1 / a \times [\log e \log e (T/ (T-1))]]$

[2] Observed HFL method:
Observed HFL method can be carried out from different

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chainage on the river section and from the flood history of the river carried out the high flood level at Particular chainage at Particular River. Carried out the ground level from the site . Evaluate the chainage difference, sectional area and perimeter at particular chainage.

[3] Ingli's Formula:
This formula is based on flood data. The Flood peak Q p in cusecs is expressed as

$$Q_P = \frac{125\ A}{\sqrt{A+10}}$$

As per the IS 12094-2000Guidelines for planning and design of river embankment ,design flood 1 in 25 years return period flood should be considered for works pertaining to protection of agricultural areas. From above which method give more discharge consider for design flood of river for flood protection on Men River. Then calculate scour depth from lacy's formula. Lacy's scour depth: $D_L = 1.35\ (q^2 / f)^{1/3}$

Maximum scour depth below bed level:
$D_{max} = H_{bed} - D_{sl}$

Effective Length of Apron assumed 1.5 times of Maximum Scour Depth below Bed level:
$L = 1.5 \times D_{max}$

Select the Flood Protection Measures:
Narmada & Men River passes from village Tilakwada. During the site visit it was observe that existing bank about 20m to 25m high. Due to higher height when high flood comes the bottom portion of bank gets eroded and resulting of upper portion of bank in sudden collapsed and hence village boundary is now near about the right bank of Narmada & Men and resulting in damage of properties.

Due to the steeper bed gradient, flood generates high velocity in the river hence the right bank of the river gets eroded gradually every year. In view of the above, the below mentioned alternatives can be considered for the protection of the bank of the rivers.

[1] Retaining wall:
A retaining wall is a structure designed and constructed to resist the lateral pressure of soil when there is a desired change in ground elevation that exceeds the angle of repose of the soil. The walls must resist the lateral pressures generated by loose soils. The existing bank is about 20m to 25m high. Providing retaining wall for such a large height will be expensive as compared to revetment of the side slope by mattress or other alternatives and moreover retaining wall will be a rigid structure which is not suitable for 20m to 25m height.

[2] Spurs:
Spurs are constructed transverse to the river flow and are projection from the banks of the river to divert the flow. The spacing and length of spurs is usually decided by model experiments and it can affect on other bank also. Looking to the site situation and topography at the proposed structure the proposal of spur is to create adverse effect on other banks.

[3] Flexible structure:
River side slope is flatter and river flow currents are strong; hence protection of the bank has to be provided by pitching with stone revetment or mattresses. Pitching bank shall be protected at toe by launching apron with toe wall. Launching apron has to be designed for the maximum scour depth. This Structure has permits to tolerate differential settlement without fracture. The property of the flexible structure is especially important when a structure is on unstable ground or in an area where scour from currents can undermine it. It is also utilized to with stand absorb the forces generated by retained earth or flowing water. It is a heavy monolithic gravity unit able to with stand earth trust. Its efficiency increases instead of decreasing with age since further consolidation takes place as silt and soil collect in the void and vegetation establishes itself.

Keeping in view all the above and the height of existing bank, Flexible structure such as Gabion structure are the ideal solution on account of their flexibility, natural drainage capacity, and high structural resistance.

Conclusion:
From the above introduction and site condition flexible structure suitable for particular site condition on tilakwada village. Design flood can be evaluated as per forecasting method in which more discharge give it is consider for flood protection work. Flexible structure suitable at tilakwada village.

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