River Training: A Brief Overview

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Abstract— River is considered as mother of civilization. Almost all of the world's major civilizations have flourished on the bank of River. The main source of water on earth is rain which precipitates on earth surface and later on takes the form of the river, ponds, reservoir, etc. River runs on its natural course and hence it makes its own way what we call uncontrolled path. This causes damage to the banks as well as surrounding. We hear in the news every year that river Ganga, Yamuna … has caused damage to the civil structure or 'so many villages are evacuated' because of rise in the water level… etc. This happens because of river changing its course or overflowing from the bank It happens only because of lack of river training work. Yearly we are wasting billions of rupees and thousands of man-hour because of uncontrolled flow of river. This causes downfall of GDP of the nation. Basically India has agriculture based economy. If wasted water can be saved by use of proper engineering, India can never feel shortage of water, even in the years of drought. In this paper we shall see the importance of river training and methods of river training in brief.

Key words: River Training, GDP, Damage to public utilities

I. INTRODUCTION

It is true that more of the water is wasted than what we use.

Fig. 1: Untrained River (Google Image)

Untrained rivers can cause damage costing billions of rupees by flood.

Sr no	Item	Unit	Average Annual Damage	Maximum Damage	
				Extent	Year
1	Area affected	M ha	7.06	17.50	1978
2	Population affected	million	36.86	70.45	1978
3	Human lives lost	nos.	1611	11316	1977
4	Cattle lost	nos.	93202	618248	1979
5	Cropped area affected	M ha.	3.46	10.15	1988
6	Damage to crops	Rs crore	703	4247	2000
7	Houses damaged	nos.	1193877	3507542	1978
8	Damage to houses	Rs crore	276	1308	1995
9	Damage to public utilities	Rs crore	828	5605	2001

Table 1: Untrained Rivers can cause damage costing

The above figures show the extent to which untrained river can cause damage. Hence importance of river training has been felt. River Training envisages training and stabilizing a river within a suitable waterway and along a certain alignment for a variety of purpose. In other words River Engineering deals with behavior, control, and training of rivers.

A. (google nptel):

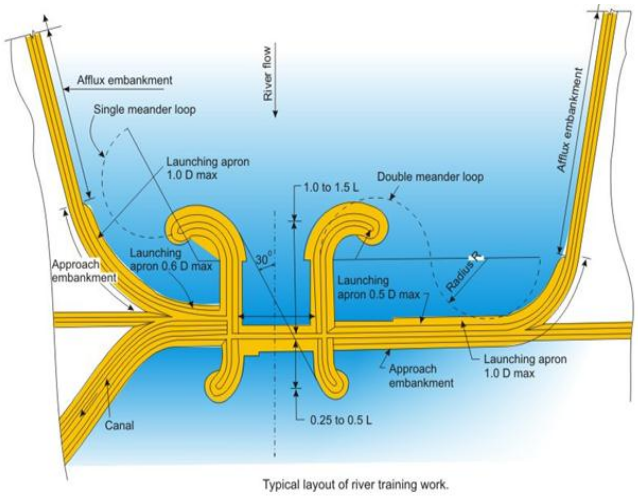

Fig. 2: (google nptel)

II. OBJECTIVES OF RIVER TRAINING WORK

- To guide the axis of the flow and safe passage of flood without over topping the bank.
- To prevent the bank from erosion and generally improve their alignment
- To train the flow in such direction so as to avoid flood and over topping
- To prevent from changing the course.
- To confine the width of the river and to reclaim valuable land.
- To trap bed load in areas of superfluous flow.
- To transport efficiently the suspended load and sediment.
- To provide sufficient depth for navigation purpose.
- To establish channel boundaries where braiding has created too wide a section
- To correct disorderly banks and flow conditions.

III. CLASSIFICATION OF RIVER TRAINING WORKS:

A. Based on Purpose:

- High water training: It is aimed at flood protection.
- Low water training: It mainly depends on increasing depth of the bed.
- Mean water training: It is also termed as training for sediment.

B. Based on Structure Alignment:

- Longitudinal structure: This is mainly aimed at guiding the axis of flow

IV. PROJECT TRAINING WORKS

It is aimed to protect the bank from which they project into the river so that the current is defected.

- Two approximate theories are available for river training design i.e Tractive force for bed load and Regime theory for suspended load

V. METHODS OF RIVER TRAINING

Training of river mainly depends on the type of river and the sediments it carry. Stable River, grading rivers, and degrading rivers. Model studies of the river training must be carried out and are very useful.

Planning for river training measures mainly depends on type of river. The steps involved are fixing Alignment and cross section. Alignment generally depends on the layout and numbers of curves it has and Cross section is the one built by river itself. i.e when the channel is uniform and does not show the sign of accretion and retrogression.

VI. TYPES OF RIVER TRAINING WORKS:

River training works are of following types:

- Guide banks
- Afflux bund
- Embankments
- Spurs
- Artificial cutoffs
- Pitched islands
- River training without embankments.
- Bandalling
- River diversion
- Bank protection

A. Guide Banks:

It is also called Bell's bund. It is defined as protective or training embankment constructed at the site of barrage, weir, bridge etc. to guide the river flow through the confined waterway without causing damage to the structure and its approaches.

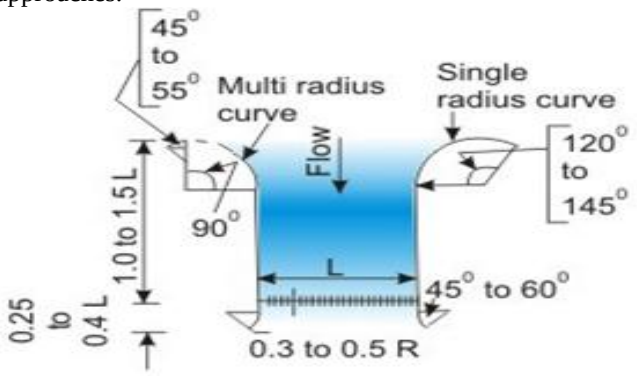

Fig. 3: Straight Guide Bank

Function of a Guide banks: The function of the guide bank are Economical spanning, Safe and expeditious passage of floods, Protect adjacent land, Control and direct the flow axially, Prevent occurrence of cross flow Protect the approach embankment. The effect of the guide banks are, increase in the rate at which flood wave passes down the river, increase in the maximum discharge, rise in the water level of the river during the flood

B. Afflux Bund:

Afflux bunds extend from the abutments of guide bunds (usually) or approach bunds as the case may be. Afflux bunds are provided on upstream and downstream to afford flood protection to low lying areas as a result of floods due to afflux created by the construction of bridge/structure and to check outflanking the structure.

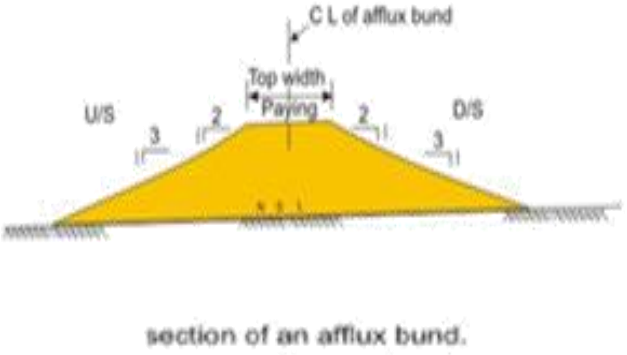

Fig. 4: Section of an afflux Bund

C. Embankments:

They may be defined as earthen banks extending generally parallel to the river channel and designed to protect the area behind them from overflow by flood water. The choice, the location the alignment, the type, the shape, and the size of the embankment depend upon the flood, the protected area, the economics, and the after effect of such protective

structure. The embankment may be classified as: Marginal Embankment, Approach Embankment, Retired Embankment, Flood Embankment

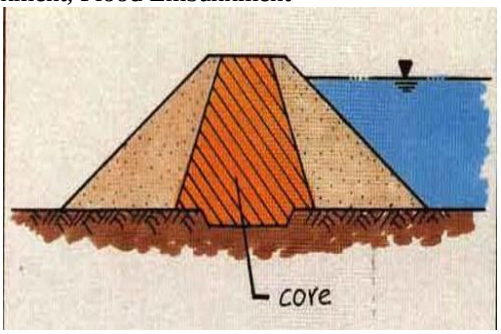

Fig. 5: Embankments

- Marginal Embankment: They are constructed along both sides of a river upstream of a barrage or weir at a short distance from the margin. (google nptel)
- Approach Embankment: It is the embankment that is provided to approach the barrage or weir from the high river edges on the both sides.
- Retired Embankment: Retired embankment are constructed at a distance from the river edge behind the existing embankment as a second line of defense.
- Flood Embankment: Flood embankment are constructed along both sides on high ground, sufficiently away from the river bank, more or less straight and little away from river channel to minimize the risk.

D. Groynes or Spurs:

Groynes or spurs are constructed transverse to the river flow extending from the bank into the river. This form of river training works perform one or more functions such as training the river along the desired course to reduce the concentration of flow at the point of attack, creating a slack flow for silting up the area in the vicinity and protecting the bank by keeping the flow away from it

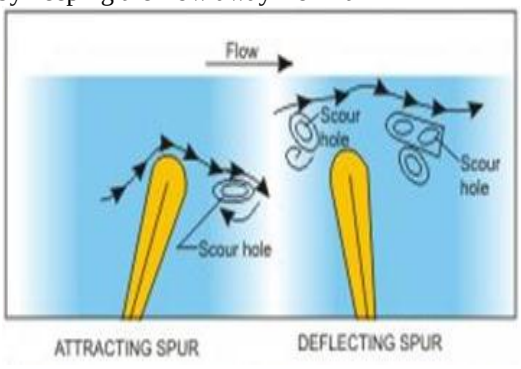

Fig. 6: Groynes

Classification of Groynes or spurs: Groynes or spurs are classified according to (i) the method and materials of construction (ii) the height of spur with respect to water level (iii) function to be performed and (iv) special types which include the following: These are Permeable or impermeable, Submerged or non-submerged, attracting, deflecting repelling and sedimenting and T-shaped (Denehey), hockey (or Burma) type, kinked type, etc.
The different types of spurs are shown in Figure.
(google nptel)

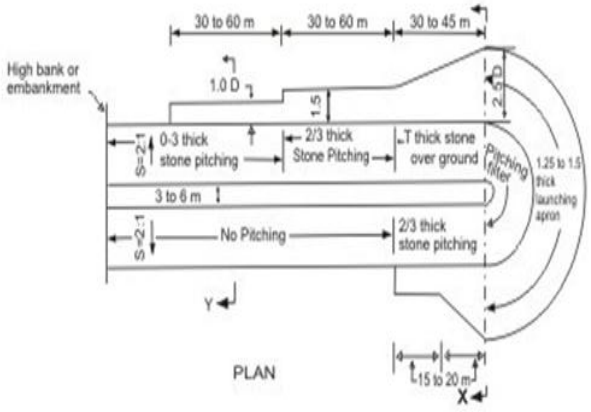

Fig. 7: spurs

E. Cut-offs:

Cut-offs as river training works are to be carefully planned and executed in meandering rivers. The cut-off is artificially induced with a pilot channel to divert the river from a curved flow which may be endangering valuable land or property or to straighten its approach to a work or for any other purpose. As the cut-off shortens the length of the river, it is likely to cause disturbance of regime upstream and downstream till readjustment is made

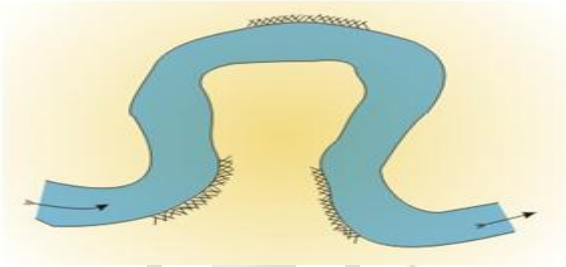

Fig. 8: Cut-offs

VII. Few Derivations and Suggestions:

It is seen from the above studies action in provision of various river training works not only mitigates serious threat to the safety of bridges and embankment at later stages but also prevents many fold escalation of cost.

It is desirable to go for detailed physical model studies before undertaking any major river training works.

The River Training works after model study should be implemented expeditiously i.e. without delay.

Trees planted on and along guide bunds/ spurs serve as natural protection measures.

For more effective results spacing of solid spurs should be kept between 2 to 3 times of their lengths & permeable spurs used for bank protection be spaced at 5 to 6 times their length.

Execution of river training works requires special attention.

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