ROLE OF MARGINAL BUNDS IN FLOOD FIGHTING; A CASE STUDY OF CUTTING OF MARGINAL BUNDS DURING FLOODS OF 1992 AT TRIMMU AND PANJNAD HEADWORKS

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ABSTRACT

Late floods of 1992 in Pakistan caused an unprecedented loss of life and property costing billions of rupees. The government agencies responsible for safe passing of floods through dams and barrages attracted some criticism on their actions during and after floods of 1992.

Both Trimmu and Panjnad Headworks are located at the confluence of two Rivers, with different hydrologic controls. During all super floods these barrages have suffered heavy damages. The objective of this case study is to analyze the situation under which the marginal bunds were cut and the justification to do so. The results of this study indicate that proper management of the flood plains in an integrated manner is required. The agencies responsible for the control of floods in Pakistan need to take these events seriously.

I INTRODUCTION

Floods have common features all over the world. Most of the civilizations have developed on the banks of rivers, therefore, destructive floods have been taking a heavy toll of life and property. Since the birth of Pakistan the menace of floods has been growing both in intensity and frequency, thus having adverse effects on the economic and social conditions. Recent floods in Pakistan have caused an unprecedented loss of life land property. During these floods, both the irrigation and communication systems of the country were disrupted, thousands of houses were collapsed rendering millions of people homeless and crops worth billion of rupees were destroyed. This was in addition to loss of thousands of precious lives(Table.1). The battle against floods is in fact the battle of survival specially for the rural community.

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Flood problems differ greatly from one area to another depending upon the physiographic and hydrologic conditions. Floods in Pakistan result from heavy rainfall in the upper catchments of rivers often augmented by snow melt.
The Indus River system has four main tributaries namely Sutlej, Ravi, Chenab and Jhelum. The Indus plains have been extensively developed for irrigated agriculture. Protection of valuable irrigation facilities, agricultural lands and major population centers against floods inundation and bank erosion has been accomplished through the construction of embankments and river channel control structures like spurs.

The intensity of damages occurring in recent and previous floods requires improved systems of flood management. The purpose of this study is to review the existing facilities for flood fighting and the techniques used for management of floods. This analysis highlights the weaknesses in the existing flood control and the flood management systems and provides a way forward for the improvement of the system. It requires effective strategies for better flood management in future.

II DESCRIPTION OF TRIMMU AND PANJNAD HEADWORKS

Both the headworks are located on the River Chenab which originates in Kulu and Kangra districts of Himachal Pardesh province of India. The river flows through alluvial plains of the Punjab province for a distance of 3398 miles. It is joined by Jhelum River at Trimmu and further 40 miles downstream the Ravi joins it. The Sutlej joins it upstream of Panjnad and finally about 30 miles below Panjnad it meets Indus at Mithankot (Nazir, 1988).

The discharge of the Chenab starts increasing in the later part of May and passes about 50,000 cfs mark in June. High flows above 50,000 cfs continue till the middle of September, the peak months being July and August. This River is a life line for the Punjab agriculture. The following barrages were constructed in series on River Chenab.

* Marala Barrage
* Khanki Headworks
* Qadirabad Barrage
* Trimmu Headworks
* Panjnad Headworks

Hilly catchment area above Marala Barrage is 12610 sq. miles. The river has 12 major tributaries and among these the famous one are Jammu Tawi and Munawar Tawi.

Here is a brief description of Trimmu and Panjnad Headworks:

Trimmu Headworks

Trimmu Headworks is located at the confluence of rivers Jhelum and Chenab. It has a designed discharge capacity of 6.45 Lacs cfs. Three systems of canals off take from this barrage, namely Haveli, T.S. Link and the Rangpur Canal. Its Right Marginal Bund (RMB) is 54000 feet long and is tied with high sand dunes. The breaching section is specified at RD 16-18 of RMB. The left Marginal Bund (LMB) is 46000 ft. long with wetting channel, There is another flood protection bund, called Jhang Bund, as an extension of LMB to save the Jhang City area. The critical gauge for operating the breaching section is installed at RD 15 of LMB. The braking level of this gauge is 501 ft. This barrage receives flood water from Rasul and Qadirabad Barrages on River Jhelum and Chenab respectively. These above two barrages have capacity to pass around 10 lacs cfs each and were constructed under the Indus Basin Project of 1962. Trimmu Headworks existing capacity to pass floods is in the order of 6.80 Lacs cfs in spite of the oblique approach of the main river upstream of the barrage and the growth of belas (National Flood Protection Plan, 1974).

Panjnad Headworks

This Headworks is located about 62 miles downstream of Sher Shah Railway Bridge near Multan and about 163 miles below Trimmu Headworks. It has main and annexe weirs, with aggregate capacity of 7 Lacs cfs. Three important canals namely Punjnad, Abbasia and Punjnad Abbasia Link, off-take from this Headworks. Its RMB is 62,000 feet long and is tied with retired flood embankments. The breaching section is specified at RD 19-20 of RMB. The LMB is 65,000 ft long with wetting channel. The critical gauge for operating the breaching sections is installed at RD 15 of LMB with RL value of 345. Its flood embankments were redesigned and constructed after floods of 1973 and are safe to bear the hydraulic pressure upto design limits and the free board provided is 5 ft. above HFL of 1973.

III. FLOOD FIGHTING DURING FLOODS OF 1992

During the year 1992, Pakistan has been subjected to two major flood events; first in July and August and the second in September. In the month of September there were exceptionally high floods in the Rivers Jhelum and Chenab caused as a result of heavy and

sudden rainfall in the catchments of these two Rivers (Table 2). The flood fighting details for these two rivers are discussed below:

Trimmu Headworks during floods of September 1992

The flood of exceptionally high magnitude was received at Trimmu at 0900 Hours of 13.9.92 and persisted upto 13.00 Hours of 15.9.92 (Irrigation Department Flood Report, 1992). The peak discharge passed through barrage was 6,83,117 cfs with addition of 2,05,000 cfs escaped through relief cuts made in the RMB, totalling 888117 cfs (Table 3). These relief cuts were made about 3 to 4 days in advance of the receipt of the peak flow which in the first instance was estimated as 19 Lacs cfs (The Daily Jang, 12 September 1992) and the flood warnings issued accordingly.

The water passed through relief cuts breached Rangpur Canal over 350 locations and 738 breaches were reported in the distributaries and minors. In addition to this many masonry structures and bridges collapsed. It was reported that the relief cuts were made through machinery as the blasting through explosives did not work like Rasul Barrage. The detail of flood damages at Trimmu is given in Table 4.

Punjnad Headworks during floods of September 1992

On 16.9.92 at 23.00 Hours, the river started rising at comparatively higher rate and reached the peak limiting capacity of Punjnad Headworks by 12.00 Hours on 17.9.92. The magnitude of discharge was 713662 cfs. It remained steady for 12 hours. During this stage the maximum water level was found ranging from RL 341.80 at Right Flank to RL 340.70 at Left Flank against ever recorded upstream flood level of RL 341.50. The maximum downstream water level was at RL 339.90 against ever maximum value of RL 340.30 ft. At 24.00 Hours on 17.9.92, the upstream water level at barrage rose to RL 342 in bay No. 33 and down stream water level rose to RL 340.50 ft. The gauge at RD 15 of LMB was recorded as 344.45 ft tending to rise.

The breaching section was operated at 4.00 Hours on 18.9.92. The discharge at that time passing through the barrage was 744152 cfs and through breaches at the rate of 68,000 cfs,totalling 812152 cfs. The River started falling at 24.00 Hours on 18.9.92 and the structures were saved (Irrigation Department Flood Report, 1992).

IV. DISCUSSIONS AND RESULTS

The relief cuts made at Trimmu were in anticipation of the receipt of peak discharge and attainment of the critical water level upstream of the barrage. The estimation for probable maximum discharge to be expected at Trimmu barrage appears to be incorrect. The discharge actually received was 888,117 cfs against estimated value of 19 Lacs cfs. The magnitude of discharge stated to be passing through the relief cuts seems to be over estimated.

In the river flood plains, the discharge in the range of 80-90 % is always passing through the deep channel. The remaining 10-20 % flows through over flowing sections. The flood plain close to the marginal bunds contains only sheet flow at a very less momentum of flow as compared to the central sections. The calculated figures of downstream discharges at Rasul and Qadirabad barrages do not indicate discharge in excess of the barrage capacity at Trimmu. So the cutting of the Right Marginal Bunds appears to be questionable under the existing operational guide lines approved by the Federal Flood Commission (FCC). Similarly for the Punjnad Headworks after the breach of Sher Shah flood bund there is absolutely, no necessity left to breach the RMB of Panjnad and is questionable. The gauge recorded at the RD 15 of LMB was still low as of critical value of 345 ft. It seems the cutting of marginal bund at Punjnad has not been given careful consideration.

V. CONCLUSIONS AND RECOMMENDATIONS.

The following main conclusions can be drawn from this study:

- Cutting of marginal bunds at specified locations was a solution based on flood levels of 1973. Even after 20 years no serious thinking was given either by the operating agencies or by the consultants appointed for this very purpose, to increase the capacity of these two barrages commensurate with the requirements.

- It is recommended that at all the barrages the provision of permanent overflow type weir structures are introduced in preference to the cutting of marginal bunds.

- Although large sums of public money are continuously being spent on flood protection works, yet the flood damages are on the increase. All river reaches be hydraulically modelled so that different regulation scenarious can be quickly tested before their actual implementation.

- Blasting of marginal bunds through explosives has not been efficient and is costly and difficult to operate. There is also wastage of time in the storage process and then transferring the same to the marginal bunds. The deployment of stand by machinery option be studied as an alternative alone.

- A standing high powered committee at the departmental level be formed of competent and experienced field engineers who shall supervise the passing of peak flows at all headworks.

- Diversions of excessive flows at suitable locations other than upstream of barrages be investigated like River Chenab at Chiniot District Jhang.

- The Executive Engineers incharge should devote more time for the flood preparedness. For the District level meetings a liaison officer at the zonal level may take up such duties to provide relief to the Executive Engineers incharge of floods management.

- Executive Engineers and Sub Divisional Officers incharge of headworks be trained in stream flow mechanics, river dynamics and river morphology.

- Posting and transfer of headworks engineers be assigned to a committee of senior engineers and only their recommendations be accepted.

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