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IMPACT OF 1987 FLOOD ON FCD PROJECTS

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SYNOPSIS

The flood of 1987 was a very remakable one in respect of its magnitude and the damage it has done to the national economy of Bangladesh. The said flood has exceeded the flood of 1974. In order to control and mitigate flood problems Bangladesh has implemented a good number of small, medium and large scale flood control and drainage projects (FCD). The impact of 1987 flood on different types of FCD project was studied. A good number of the FCD projects were affected by the flood. Most of the projects suffered due to breaching, over topping and human interference on the flood embankments. In many cases it was observed that some medium and small scale projects had suffered due inadequate design criteria and some of the large, medium and small scale projects were affected due to lack of proper maintenance facilities. Further more, there is a need for mass awareness and participation by all for protecting the embankments.

1.0.0 INTRODUCTION

1.1.0 Bangladesh is ravaged by floods almost every year. In an average year about 136 Mham of run off crosses the boarder from catchment out side the country and about 12.34 Mham is generated by rainfall inside. They carry about 2.4 billion tons of sediment annually. The peak discharge of the three mighty rivers system the Ganges,the Bramhaputra and the Meghna may exceed 0.142 million cumec. Since most of this large volume is concentrated in the short period June through September,flood comes every year. More over,the flat topography of the country formed by the deposits of the rivers though ideal for agriculture is prone to drainage congestion and flood problems under prevailing rainfall pattern and the alluvial river regimes. About fifty percent of

the country lies less than 7 m above mean sea level. The over all gradient of the rivers in the flood plains is less than 0.0002 except in the north-west portion where it increases to about 0.0006.

1.2 The recorded history of the floods in this part of the world is available from 1787. From this record it is observed that the flood has occured almost evrey year. Although no written history on earlier period is available but it may be well presumed that the frequency of flood was not much different from present days, the magnitude and losses might have varied.

1.3 In a normal year more than 18 percent of the country (26,000 sq.km) is flooded. In an abnormally high flood condition about 36 percent of the land (50,500 sq.km) is submerged causing heavy damage to agricultural products, livestocks, industries, roads, homesteads, structures and numerous human and animal lives. The assessment of flood damage in monetory terms for the period between 1960 to 1986 indicates an amount of TK. 600 millions (USD 30 m) on an average annually. The preliminary report on the devastatting flood of 1987 for the period between July to September shows the colossal damage. The total tangiable loss has been estimated as Tk. 30 billion (USD 1 billion).The catastropic flood of August to September 1988 will incur a loss more than 100 billions to the national economy .

2.0 SALIENT FEATURES OF 1987 FLOOD

2.1.0 RAINFALL:

2.1.1 The average yearly rainfall of Bangladesh is about 2000 mm . Most of this rainfall is limited to the four months June through September . The rainfall pattern in 1987 presents a systematic incresing trend . All the three major river basins inside the country experienced unusally heavy rainfall in 1987 . A picture of basinwise rainfall from June to September is given in table 2.1.1 .

Table 2.1.1 **Basin wise Monthly Rainfall,mm (1)**

	June		July		August		Sept.	
	Normal	1987	Normal	1987	Normal	1987	Normal	1987
1.Ganges basin	330	330	415	445	332	707	251	304
2.Brahma-putra basin	434	332	423	845	327	565	267	368
3.Meghna basin	717	641	599	811	515	561	362	616

4.South Eastern Hill basin	596	392	650	1077	494	797	293	457

2.1.2 The northern part of the country received rainfall exceeding the normal level. In most cases the cumulatative 10-day rainfall in the stations in the northern part of the country recorded volume which corresponds close to the 100 year return period.A picture of 10-day rainfall with the frequency level is given in table 2.1.2 .

Table 2.1.2 **10-day Cumulatative Rainfall of 1987 mm (1)**

Month	Station	Normal Rainfall	Rainfall of 1987 Amount	Return Period
July	Phulbari	335	788	94
	Nawabganj	332	804	100
	Dinajpur	318	652	73
	Badarganj	350	866	100
	Mithapukur	427	1029	100
	Rangpur	354	933	100
	Saidpur	350	819	100
	Gaibandha	349	726	82
	Lalmonirhat	422	791	72

2.1.3 Another picture regarding the rainfall all over the country where the rainfall of 1987 exceeded recorded maximum level is presented in table 2.1.3 . This shows the severity of the occurence of the rain fall in 1987 .

Table 2.1.3 **Stations where rainfall of 1987 exceeded the recorded maximum rainfall (1)**

Month	Stations	Normal Rainfall mm	Recorded Maxm. Rainfall (1950-80) mm	1987 Rainfall mm
July	Kaunia	504	1162	1554
	Rangpur	443	862	1378
	Jamalpur	440	744	867
	Noakhali	629	1020	1294
August	Bogra	321	722	734
	jamalpur	363	683	702
	Dinajpur	318	627	843

	Kushtia	292	590	775
	Jessore	309	510	753
	Khulna	301	540	666
Sept.	Jamalpur	253	509	604
	Panchagarh	276	536	736
	Sylhet	439	741	854
	Sunamganj	596	1130	1685
	Sheola	413	671	682

2.2.0 **River Stages**

2.2.1 A review of the high flood level in 35 flood monitoring stations for 1987 was made in all the four hydrologic basins of the country and it was found that 69 percent of the stations the showed flood peak higher than 1974 and 54 percent of the stations showed longer duration above the danger level compared to 1974. It is pertinent to note that the three major rivers almost simultanously registered their respective peak levels in 1987 . Usually, two of these rivers e.g. Ganges and Bramhaputra register their respective peak with a time lag of about a month. The synchronous peak in the major river systems has created a very alarming situation .

2.2.2 The river stage of the major rivers in the fourhydrologic basins are presented in table 2.2.1 .

Table 2.2.1 **Major river stages above Danger Level (D.L.) (1)**

Sl.	River	Station	D.L.	HFL	Date	Days above D.L.		
						Jly.	Aug.	Sept.
BRAMHAPUTRA BASIN								
1.	Dharla	Kurigram	26.06	27.50	12.8.87	-	9	-
2.	Teesta	Dalia	52.25	52.77	13.8.87	2	8	2
3.	Teesta	Kaunia	29.41	30.47	14.8.87	18	14	10
4.	Bramhaputra	Chilmari	23.62	24.56	12.8.87	6	18	-
5.	Bramhaputra	Bahdurabad	19.35	19.68	15.8.87	4	9	-
6.	Bramhaputra	Sirajganj	13.56	14.47	17.8.87	5	24	12
7.	Old Bramhaputra	Jamalpur	17.22	17.21	17.8.87	-	-	-
8.	Old Bramhaputra	Mymenshing	12.80	12.72	21.8.87	-	-	-
9.	Buriganga	Dhaka	6.10	6.64	22.8.87	-	15	-
10.	Lakhaya	Narayanganj	5.49	6.04	22.8.87	-	29	-

GANGES BASIN

11.Karatoya	Panchagarh	71.93	71.41	14.8.87	-	-	-
12.Punarbhava	Dinajpur	33.53	34.31	14.8.87	-	5	-
13.Mahananda	CNawabganj	20.80	22.25	19.9.87	-	21	30
14.Ganges	Rajshahi	18.29	19.46	19.9.87	-	8	21
15.Ganges	Hardinge Bridge	13.56	14.80	19.8.87	-	28	27
16.Ganges	Gualnando	8.38	9.52	20.8.87	2	29	23
17.Ganges	Bhagyakul	6.10	6.99	20.8.87	2	29	25
18.Gorai	Gorai Rly. Bridge	12.34	13.43	19.9.87	-	19	24
19.Kumar	Faridpur	7.47	8.28	21.8.87	-	16	18

MEGHNA BASIN

20.Surma	Sylhet	11.28	11.60	1.8.87	-	3	2
21.Surma	Sunamganj	8.23	9.13	1.7.87	15	15	6
22.Khusiyara	Shola	13.11	14.00	2.8.87	-	11	13
23.Manu	Moulavibazar	11.58	12.12	2.8.87	-	3	-
24.Khowai	Habiganj	9.62	10.80	31.7.87	-	-	-
25.Someswari	Durgapur	12.50	13.71	1.8.87	11	4	2
26.Meghna	Bhairab Bazar	6.55	6.91	16.8.87	-	30	-
27.Gumti	Comilla	11.33	12.51	29.8.87	-	7	-
28.Meghna	Chandpur(HWL)	3.96	4.70	22.8.87	-	7	-
29.Meghna	Chandpur(LWL)	3.96	4.32	21.8.87	-	18	2

SOUTH EASTERN HILL BASIN

30.Muhuri	Parshuram	11.58	11.60	01.08.87	8	9	8
31.Halda	Panchpukuria	9.30	14.48	27.08.87	-	3	2
32.Sangu	Bandraban	14.63	17.66	27.08.87	-	5	
33.Sangu	Dohazari	7.32	7.82	27.08.87	-	3	-
34.Matamuhuri	Lama	12.19	15.16	26.08.87	-	4	-
35.Matamuhuri	Chiringa	4.88	6.78	26.08.87	-	5	6

2.3.0 DISCHARGE

2.3.1 The recorded maximum peak flow in the Ganges at Hardinge Bridge was 73200 cumec in 1961. This peak has been exceeded in 1987 and the flow recorded was 76000 cumec. In the Bramhaputra at Bahdurabad the maximum recorded flows were 91000 and 74800 cumec in 1974 and 1987 respectively. The peak flow of Ganges at Hardinge Bridge and in Brahmaputra at Bahdurabad were registered on August 19 and August 12, 1987 respectively. In the Meghna at Bhairab Bazar the peak flow of 16000 cumec occured on August 8, 1987 . The peak of the combined flow of the Bramhapura and the

Ganges at Gualnando was 113000 cumec on August 20, 1987 which was equal to the peak of 1974. The discharges of the three river system are presented in table 2.3.1.

Table 2.3.1 **Discharge data of three major river system in 1987 (in cumec) (1)**

Sl. no.	River	Station	Peak flow	Year	Flow of 1987
1.	Ganges	Hardinge Bridge	73200	1961	76000
2.	Brahmaputra	Bahdurabad	91100	1974	74800
3.	Ganges and Brahmaputra	Gualnando	113000	1974	113000
4.	Meghna	Bhairab Bazar	19500	1974	16000

3.0.0 PAST EFFORTS ON FLOOD CONTROL

3.1.0 No systematic study on the floods was undertaken prior to the report of the Krugg Mission in 1956. After the major floods of 1954 and 1955 the then Pakistan Government approached the United Nations to send a technical mission to study the flood problems of the country and to recommend remedial measures . The United Nations sent a technical assistence team headed by Mr. Krugg in 1956. The Krugg Mission report is the first step towards the systematic study and planning of the flood control in this country. The Krugg Mission recommended sevaral measures for the flood control in the country. The salient points in their recommendations were channel improvement and building of dykes along the major river banks. As a result of the Krugg Mission report erstwhile East Pakistan Water And Power Developement Authority (EPWAPDA) was created in 1959 with the objective of flood control in the country. Since then erstwhileEPWAPDA,presently,Bangladesh Water Developement Board(BWDB) is primarily responsible for planning and implementation of the Irrigation, Flood Control and Drainage projects in the country.

3.1.2 General John R. Hardin, an ex-chairman of Mississipi River Commission visited the country in January , 1963 and submitted a report in February 1963. The findings of the General Hardin were almost similar to those of Krugg Mission. He proposed for channel improvements and embankments to confine the flows . Sluices and fuse plugs in the embankments were recommended to release water into the protected areas to avoid load and avoid over topping of the dykes when flood level exceeds the design limit .

3.1.3 Prof . J . Thijsse of the Netherlands also studied the problems of flood in Bangladesh and submitted a report in 1964 . Prof.J.Thijsse suggested to maintain the existing river systems as long as possible and he ruled out the possibility of construction of storage reservoir to tackle the flood . He further advised for channel improvement and flood embankments along the river banks .

3.1.4 All the above mentioned reports were fairly in agreement with the highly complex and unusually difficult nature of flood problems in the deltaic region of Bangladesh . Channel improvements and embankments were suggested by them as means of flood protection . They were also not very much sure of the success of implementation of river training works on major rivers and suggested for testing and observing each phase of work for a long period of time . The reports not only highlighted the instability of alluvial rivers in the deltaic region , but also the uncertainities related to siltation and erosion proces togather with the economic aspects of the river training works.

3.1.5 In early sixties erstwhile EPWADA appointed M/S International Engineering Company(IECO), an American consultants,to frame a Master Plan for the Irrigation,Flood control & Drainage projects for the country. M/S IECO submitted a comprehensive Master Plan in 1964. Since then the BWDB started implementing the Irrigation, Flood control and Drainage projects on the basis of the IECO Master Plan. Subsequently, further studies on the concepts of the flood control and drainage were conducted and from time to time and from the mid-seventies large number of small scale Flood control and Drainage projects were undertaken. It may be mention-ed here that some major flood protection embankments were constructed in the sixties on the basis of IECO master plan.

3.1.6 During the period between 1945 and 1987 the BWDB (erstwhile Irrigation Deptt. and erstwhile EPWAPDA) have completed about 415 nos of small , medium & large Flood control,Drainage & Irrigation projects . Out of 415 projects about 300 projects fall in the catagory of the FCD projects . By 1987 about 272 FCD rojects were completed and about 2.265 million ha were benefitted through flood protection and drainage .

4.0.0 PERFORMANCE OF FCD PROJECTS

4.1.0 It has already been mentioned that Banladesh is a flood prone country . Seventy percent of its agricultural lands are susceptible to seasonal flooding. In table 4.1.1 a picture on the flooding condition of the agricultural land is given which has been prepared Master Plan Organisation .

Table 4.1.1 **Flooding condition of the Agricultural land (2)**

Flood Depth in cm	Area in Mha	Percent	Nature of flooding
< 30 cm	2.35	27	Intermittent
30 - 90 cm	3.68	39	Seasonal
90 -180 cm	1.66	18	Seasonal
> 180 cm	1.46	16	Seasonal / Perrenial
	9.35	100	

4.2.0 It has alredy been mentioned that about 272 FCD projects had so far been completed in different catagories. Three catagories of the projects has been decided on the basis of the command area of each of the project and criteria of the division is as follows :

1) Small Scale Project less than 4000 ha

2) Medium Scale Projects 4000 to 20000 ha

3) Large Scale Projects more than 20000 ha

4.3.0 Out of total area of 2.65 million hectres under FCD projects small, medium and large projects cover 29,26 and 45 percent respectively . The total area of FCD projects is about 25 percent of the total agicultural land . This is presented in table 4.3.1 .

Table 4.3.1 **FCD Projects**

Catagory	No.	Command Area in million ha	% Area
Large Scale	20	1.035	45
Medium Scale	65	0.59	26
Small Scale	187	0.64	29
	272	2.265	100

4.4.0 The reasons of failure of 24 small , medium and large scale projects were investigated(of which 5 are small scale , 11 are medium scale and 8 are large scale FCD projects). Due to the failure of flood embankments and drainage sluices the percent of area affected under small , medium and large scale projects are

74 , 75 and 39 . The common reasons for damage of these FCD projects are noted below :

i) Breaching of the embankments due to seepage and piping ,
ii) Over topping of the embankments ,
iii) Erosion of the embankments by river ,
iv) Human interference on embankments ,
v) Failure of the drainage sluices due to over loading ,

4.5.0 A picture deleneating the reasons of failure of 24 FCD projects is given in table 4.5.1

Table 4.5.1 **Failure of Embankments in 24 FCD Projects**

Project Description	Nos .	Total area '000 ha	% Area Affected	Causes of failure: Breaching	Over-topping	Erosion	Human interference
1. Large	8	591.00	39	7	2	2	8
2. Medium	11	123.35	75	7	2	-	4
3. Small	5	1.82	74	5	4	-	2

4.6.0 It is observed from the above table that the two main reasons of failure of the different types of FCD projects are breaching and human interference. In case of small scale projects breaching and over-topping of the embankments have taken place simultanously . The breaching and over-topping of the embakments in large scale projects mostly were taken place at the retired embankments constructed latter on while the orginal one was subjected to river erosion. The reasons of human interference may be attrbuted to the drainage congestion within and outside the poldered area due to unplanned road construction after the embankment changing the surface drainge pattern which was not considered during the planning stage. In some cases the people outside poldered area cut the embankments considering themselves of being relieved from inundation . For the medium scale projects the said reasons are valid and in addition inadequate planning and design criteria contributed to the failures. In all the small scale projects the design criteria were found to be inadequate to face such a severe flood . The following points will indicate the drawbacks of the design and planning criterion :

a) Most of the medium and small scale projects were designed with a flood of 10/20 year return period

b) The embankments of the medium and small scale FCD projects were mostly constructed uncompacted. Proper design sections were not maintained during costruction due to the problems of right of way and land acquistion. In some cases,even if,the design sections were maintained during construction,the sections could not be maintained properly during operation and maintenance of the projects.

c) Within the poldered area the drainage channels were found to be silted up and created drainage congestion which could not be anticipated during the planning stage of the project.

d) Building up of unplanned road communication within the poldered areas without keeping adequate drainage provision created drainage congestion as well as change in the drainage basin of the outfall drainage sluices .

e) Some of the FCD projects were undertaken in an isolated manner specially the smaller ones without taking into consideration the adverse effects of the project on the surroundings . Consequently , it was seen that in many cases the public outside poldered area cut the embankment to get relieved of the drainage congestion in their own locality .

f) Inspite of the relatively lower stage in the adjacent rivers some poldered areas suffered from inundation due to drainage congestion within the poldered area themselves .

g) In some cases it was found that the low lying areas adjacent to river which are usually acted as detention reservior during river floods were poldered without taking into cosideration the confinement effects of the river on the surroundings . In small scale projects the confinement effects are not at all considered . Due to confinement effects the river stages became high , the drainage from the poldered area is severely obstructed and in several occasion it was observed that the concept of gravity drainage did not work , jeopardising the entire project.

h) A number of the small scale/medium scale projects were planned and implemented within the same hydrological unit without taking into consideration the interlinkage of the projects during the post project condition .More over,most of the riverbeds are found to be raised due to accretion and thus adversely affecting the conveyance capacity of the channels as well as the river showed higher stages even at relatively lower discharges.

i) Above all the people within the flood protected areas usually

have a sense of security and thus the forms of habitat , cropping practices etc. have been changed and when abreach occurs in the flood embankments , the losses are much higher than the pre-project condition .

5.0.0 CONCLUSION

5.1.0 The catastropic flood of 1987 clearly shows that the present planning and design criteria of the FCD projects need updating with proper quality control of the earthen embankments and stuctures. There is also need for peoples' awareness and participation not only during flood fighting but also in the planning and implementation of the projects. Study on the adverse effects of the projects on the surroundings during planning stage should not be neglected. Smaller and medium scale projects should be implemented as adivisible part of the intregrated project concept in the same hydrological unit. The inter linkage between the projects should be studied during post project condition at the planning stage.

5.2.0 Though the normal floods of Bangldesh can be controlled through stuctural and corrective measures, but the catastropic floods such as the 1987 & 1988 cannot be controlled by taking measures inside the country. The flood protection,river training works, river diversion works in the upstream portion of the co-riperian countries of the Bramhaputra and the Ganges contribute to the flood problems of Bangladesh as lower riperian country. Possibilities of utilizing flood water by construction of detention reservoir, kharif channel and intregrated water shed and flood plain management should be taken up on the basis of regional concept. Research efforts and data base of the region on water resources should be pooled togather for the developement of appropriate methodology for optimal utilization of excess water including study of echology and water resurces management.

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