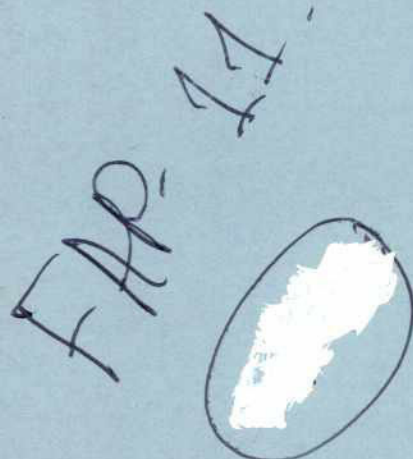
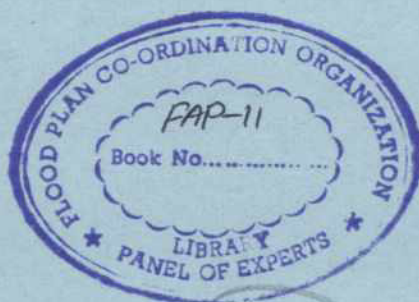


United Nations Development Programme
Government of the People's Republic of Bangladesh

Assistance to Ministry of Relief in Coordination of Cyclone Rehabilitation (BGD/91/021)



Final Report

Volume IV

ASSESSMENT OF DAMAGE CAUSED BY DISASTERS

- Part 1 : Agriculture
(including Livestock and Fisheries)
Part 2 : Forestry
Part 3 : Infrastructure

BN-360
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Mott MacDonald International Ltd.
in association with
Asian Disaster Preparedness Centre
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December 1993

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Government of the People's Republic of Bangladesh
United Nations Development Programme

**ASSISTANCE TO MINISTRY OF RELIEF
IN COORDINATION OF CYCLONE REHABILITATION
(BGD/91/021)**

The Final Report for the Project comprises the following volumes:

- Volume I : Main Report
- Volume II : Natural Disasters affecting Bangladesh
- Volume III : Organisation and Systems for Disaster Management in Bangladesh
- Volume IV : Damage Caused by Disasters (Agriculture [including Livestock and Fisheries], Forestry and Infrastructure)
- Volume V : Disaster Management Training Strategy
- Volume VI : Concept Plan for Integrated Coastal Protection

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**ASSISTANCE TO MINISTRY OF RELIEF
IN COORDINATION OF CYCLONE REHABILITATION
(BGD/91/021)**

FINAL REPORT

VOLUME IV

ASSESSMENT OF DAMAGE CAUSED BY DISASTERS

Part 1 - Agriculture (including Livestock and Fisheries)

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FINAL REPORT

VOLUME IV

ASSESSMENT OF DAMAGE CAUSED BY DISASTERS

PART 1 : AGRICULTURE

CHAPTER 1

INTRODUCTION

Bangladesh is often visited by natural disasters, cyclones, hailstorms, floods and droughts. The immediate problem is the provision of food, shelter, clothing and health facilities for the affected people. However, in the longer term a rehabilitation programme is needed to repair the damage and losses suffered by the agricultural sector including crops, livestock and fisheries.

Cyclones strike the southern coastal areas of the country, Cox's Bazar, Chittagong, Feni, Noakhali, Laxmipur, Patuakhali, Bhola, Barisal and Khulna, while damaging floods affect northern, north-eastern and central areas. While the whole of the country sometimes suffers from drought, the most drought prone areas are the western and northern parts of the country.

Since 1981, there have been a number of cyclones and hailstorms which caused damage and losses to crops. There were hailstorms and heavy rains in 1981 in the boro and aus season, hailstorms and cyclones in 1982, boro and aus seasons; a cyclone in 1986; a cyclone and flood in 1988 which affected aus, aman and boro seasons; and cyclone in 1991 which affected the aus season.

This report discusses the processes by which the damage and the loss of production of crops, livestock and fisheries are assessed. It also highlights the precautions taken in 'normal' times, the measures taken during emergencies and the rehabilitation activities undertaken later.

In accordance with the Terms of Reference for the assignment, which are given in Annex A, visits were made to different national and local offices of government, UN agencies and NGOs.

Field visits were made to Noakhali, Companiganj Thana (Noakhali), Char Jabbar and Char Bata Unions of Noakhali Sadar Thana, Sariakandi Thana (Bogra), Bogra Sadar Thana, Singra Thana (Natore), Natore, Lalpur Thana (Natore), Jamalpur District, Sarishabari Thana (Jamalpur) and Bhuapur Thana (Tangail) to discuss the relevant issues with Government and NGO personnel.

At each location, the procedures for damage assessment were ascertained. Information was gathered on the immediate rehabilitation requirements of crops, livestock and fisheries of farmers affected by disaster and the possibilities for reducing disaster damage in future.

CHAPTER 2

'NORMAL' PHASE ACTIVITIES

2.1 Codes, Standing Orders and Guidelines

Various Codes, Standing Orders and Guidelines have been found. The most important were:-

Ministry of Relief	:	Emergency Standing Orders for Flood 1984 (Bengali and English)
	:	Standing Orders for Cyclone 1985 (Bengali and English)
	:	Cyclone Code 1970 (English)
Ministry of Agriculture and Forests	:	Standing Orders for Drought, 1980
	:	Drought Code, 1980 (English)
	:	Flood and Drought Code, 1980 (English)
PACT/PRIP	:	Training Manual for Flood in pictures, 1990.

These Codes were reviewed. They were found to contain much useful information for both farmers and officials. They, of course, needed some updating to mirror the latest administrative changes etc.

However, the main problems were that :-

- they were in very limited circulation;
- no copies being found during the visits to any field offices; and
- no training had been given in their utilisation.

2.2 Disaster Preparedness

Few steps appear to be taken to prepare for disasters. The BMD Storm Warning Centre at Agergaon, Dhaka analyses weather charts aided by weather radar. Weather radars located at Cox's Bazar and Khepupara and satellite pictures supplied by the SPARRSO, Dhaka help to locate the positions of the cyclones and heavy rainfalls. BMD advises the radio and television authorities to issue warnings to the people and the district administrations about the probable occurrence of cyclone strikes and the resultant sea-surges and for them to take appropriate measures to combat the impending danger.

BWDB operates a national flood forecasting and warning system between April and October. Daily bulletins give the current water levels for the three major rivers and 21 minor rivers relative to their danger levels, above which crops or property on adjoining

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floodplain land may be damaged. On the basis of this information, the concerned officials should take appropriate action in order to avoid or reduce losses.

Warnings of cyclones are passed to different administrative levels from Division down to thana level through the telephone system. However, the union level Block Supervisors (BSs) of Department of Agricultural Extension (DAE) and the farmers at village level are the ones left uninformed. They come to know of impending disasters like cyclones and floods through transistors and in local meeting places like mosques, schools, madrashas, hats and bazars if the disaster is of a serious nature. In the coastal area, the Thana Agricultural Officer sometimes receives information from the MoR/BDRCS Cyclone Preparedness Programme (CPP). He then transmits the news to his other officers and BSs to alert them to the disaster.

In the coastal areas, preparedness involves forecasting and warning of cyclones and tidal bores, the preparation of operational plans and procedures and the stockpiling of necessary resources to enable timely action at all levels by farmers, communities, government and aid organisations, when a warning is issued and following a disaster impact. This plan should include for evacuation of people, the transportation of seeds, food stuff, fertilizers and other agricultural inputs and implements to a safe place where they would not be damaged or destroyed. BADC should instruct their local officers to advise the farmers to hold a small stock of seeds and fertilizers in case of such emergencies. If cattle, goats and poultry are likely to be affected then they should also be transferred to safer places.

A most significant advance in disaster preparedness occurred before the 1988 flood. A strategic stockpile of more than 1.3 million tons of food was prepositioned throughout the country with the help of NGOs and voluntary organisations. An effective disaster preparedness programme can significantly reduce losses of crops, livestock, seeds, tools and equipment that are essential for implementing the subsequent rehabilitation programme.

Farmers have their own ways of coping with natural disasters, born of their own experience and that of their forefathers. They are largely conversant with techniques of reducing the damage and losses caused by the disaster. They do not easily change their attitude or adjust to new cropping patterns or techniques that might help them to avoid the effects of the disaster.

The farmers and their advisors, the BSs who are often recruited from the same locality, are usually aware of the time, nature and extent of damage likely to be caused by disasters. Farmers do not seem to need so much advice on flood 'proofing' their farming systems. It is therefore likely that the farmers do reduce the damage and losses brought about by disasters to quite an extent.

They know that cyclones are most likely to strike at two times in a year, in April - May, and October - November. Similarly, they know that the major monsoon floods occur in August and September depending on the topographical nature of the area, and that drought affects crop production during the period April to July. They have generations of experience behind them in adapting their crops, varieties, cropping patterns and cultivation practices to the flood characteristics in their local area. This experience has made them masters of hazard 'mapping' and associated risk assessment at the micro level.

As to warning systems for floods, the farmers and the BSs of the locality are aware of the daily flood situation. They have usually lived in their area all their lives, are aware of the topography and of the nature of the flood in their area and the extent of likely damage to crops. They are aware of the type of warning that they have received from officials, and these have not been found to be very useful. BSs feel that they only receive instructions when the flood has already inundated a significant area and has already done much damage to crops.

On hearing cyclone and flood warnings, people should take seeds, fertilizers, insecticides, agricultural equipment and cattle to killas or other high land. The seeds and fertilizers should be placed in waterproof polythene bags. The construction of shelters and killas should be encouraged as should 'green belt' afforestation in the coastal areas. Country boats with shallow tubewell engines may help in the movement of people and agricultural goods during floods.

CHAPTER 3

EMERGENCY PHASE ACTIVITIES

3.1 Type of Damage

Both cyclones and floods damage crops of all sorts, including paddy, vegetables, fruit trees, jute and sugarcane. Cyclones destroy crops completely, whereas high floods either carry the plants away or kill them due to prolonged submergence. Seedlings are particularly vulnerable to flood damage. Among seed stocks, wheat, mustard, mung, jute, kaon, potato, chili and onion may sprout in their containers if they are moistened and, hence, they may be damaged. Disasters may create problems for the movement of fertilizers and other inputs. Urea, phosphate and insecticides may be spoiled by floodwater and agricultural equipment may also be damaged.

3.2 Cyclones

The cyclone of 1991 caused extensive damage to crops and resulted in production losses. The loss of standing crops was estimated at 115,000 tons of foodgrains equivalent. Some 700 000 acres crop land was affected by the intrusion of saline water, wind, tidal surge, excessive rain and waterlogging. Yields were also apparently lower than normal in the following season due to the lingering effects of salinity. The major crops damaged were paddy, pulses, spices, oilseeds, sweet potatoes and fruits.

The cyclone resulted in the death of many domestic animals, some 60% of cattle were reported to have died. The figures were even higher for goats, ducks and poultry. The cyclone also caused extensive damage to shrimp production. The growth of Common Carp in ponds was stunted due to intrusion of saline water.

3.3 Floods

Damaging floods occur in some part of the country each year and major floods have occurred twelve times in the last 40 years. The severe floods, which attracted international attention, in 1987 and 1988 were preceded by significant floods in 1984, 1983, 1980, 1977, 1974 and in many earlier years. The areas flooded in 1987 and 1988 were 57,000 km² and 82,000 km² respectively. The loss of rice was 3.5 Mmt, cattle, goats and sheep 64,700 and poultry 206,000 in 1987 and that of rice 2 Mmt, cattle, goats and sheep 172,000 and poultry 410,000 in 1988.

The cumulative experience gained from previous disasters resulted in a very low number of deaths during and immediately after 1988 floods, which in their severity and intensity surpassed all previous flood events.

During September 1991, more than 500,000 acres in northern Bangladesh were flooded. The duration of the floods varied but some areas were under water for more than two weeks. As a result, considerable damage occurred especially to T Aman, B Aman, aus, jute, mashkalai and summer vegetable crops. It was reported however that the T Aman that was not affected

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grew remarkably well due to siltation and abundant rain water and that its production more than compensated for the losses elsewhere.

Cattle cannot be properly looked after during major floods. Their health deteriorates quickly due to lack of feed and they fall victim to disease. Many hundreds of cattle, goats and poultry died during 1974, 1984, 1987, 1988 floods and in some areas during the 1991 floods.

The Department of Fisheries (DoF) consider that nationally there are no significant losses of fish production due to floods, however, the Department does not seem to have any statistics to back up this view. Innumerable ponds, owned and managed by individuals, are flooded and the fishes escape to beels, haors, canals and rivers. This situation results in heavy losses to such owners.

3.4 Droughts

Drought reduces the quantity and quality of water in ponds, beels, haors and canals. Droughts seriously reduced crop production, and also affected animal health in 1972, 1978-79, 1982 and 1989. Egg production is also affected by drought. The drought of 1986 reduced the fish population by making it very easy for people to catch the fish.

CHAPTER 4

RECOVERY PHASE

4.1 Damage Assessment Procedures in Crop, Livestock and Fisheries Sub-Sectors

Damage assessments are carried out to determine the relative needs of different areas and thanas for assistance immediately after a disaster, be it a cyclone, flood and drought. In order to review the procedures for damage assessment and the subsequent rehabilitation programmes, visits were made to different national and local level offices of government, UN Agencies and NGOs. Damage assessments should be made on a standard form which should be as far as possible similar for all types of disaster. Similar forms should be used for rehabilitation programmes.

4.2 Damage Reporting

4.2.1 Reporting Channels

There are several parallel reporting channels for agricultural damage data (See Figure 4.1). These include those of the Union Parishad via the civil administration, Department of Agricultural Extension (DAE), Department of Livestock, Department of Fisheries, Bangladesh Bureau of Statistics (BBS), and Red Crescent Society. The damage due to severe disasters is sometimes assessed by concerned NGOs and by outside teams from UNDP, FAO, World Bank and the like which are engaged for specific purposes.

The three widely used channels are :-

- Union Parishad to Thana Nirbahi Officer (TNO)/Thana Parishad Chairman, thence to Deputy Commissioner (DC) and finally to MoR and perhaps Prime Minister's Office/Cabinet;
- Field Assistant to Thana Statistical Officer, thence to Regional Statistical Officer and finally to the national level of BBS; and
- Block Supervisor (BSs) to Thana Agricultural Officer (TAO), thence to Deputy Director (DD) and finally to Director General (DG of DAE) and similar arrangements for the DoL and DoF using their own staff..

At present, the reports prepared by the different agencies are each prepared according to different formats.

4.2.2 General Damage Reporting

a) Civil Administration

Data and other information reported through the civil administration channel in the first days following a disaster are used to determine the relative priorities of different areas and provide a basis for the allocation of relief resources. In other words, the damage assessments reported

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through the civil administration to the Ministry of Relief and to the Cabinet/Prime Minister appear to provide the basis for the allocation of relief assistance by the government.

The civil administration reports estimated damage on a "D" Form (Table 4.1) which covers all sectors and is prepared and submitted by the Union Parishad Chairman to the Thana. A detailed diary form is also completed and submitted by Union Parishad Chairman. (Table 4.2) The Thana Parishad submits a consolidated report covering all aspects of damage including crops, livestock, fisheries, houses, roads, railways, bridges, culverts and educational institutions (Table 4.3).

Disaster damage assessment procedures of Sariakandi Sadar Union in Bogra District and Chardarbesh Union in Feni District were reviewed. In neither of the Unions was the 'D' Form used. The data on damage compiled by the Thana Parishad Chairman of Companiganj were found to be significantly higher than those of the TAO in the same thana.

DC, Feni District, wondered if the discrepancy in damage figures prepared by different departments for the same sectors, especially for crops, might arise as the reports were prepared at different times. Damage figures in the preliminary assessments might vary from those prepared three weeks later. Upon receipt of urgent instructions, the Union Chairman prepare and send the preliminary assessments to the TNO, who after compilation transmits them to the DC. The damage reports which are made after a period of three weeks might be considered more reliable. The DC stated that the reports of DAE were discussed in a district meeting before the 'final' report was sent to MoR [other officers did not confirm this point outside the meeting].

In most cases inflated figures of damage/loss appear to be shown. There could be several reasons for this like exaggerating the importance of the disaster to obtain relief materials quickly and earning a good reputation with the concerned agencies and organisations.

b) Bangladesh Bureau of Statistics

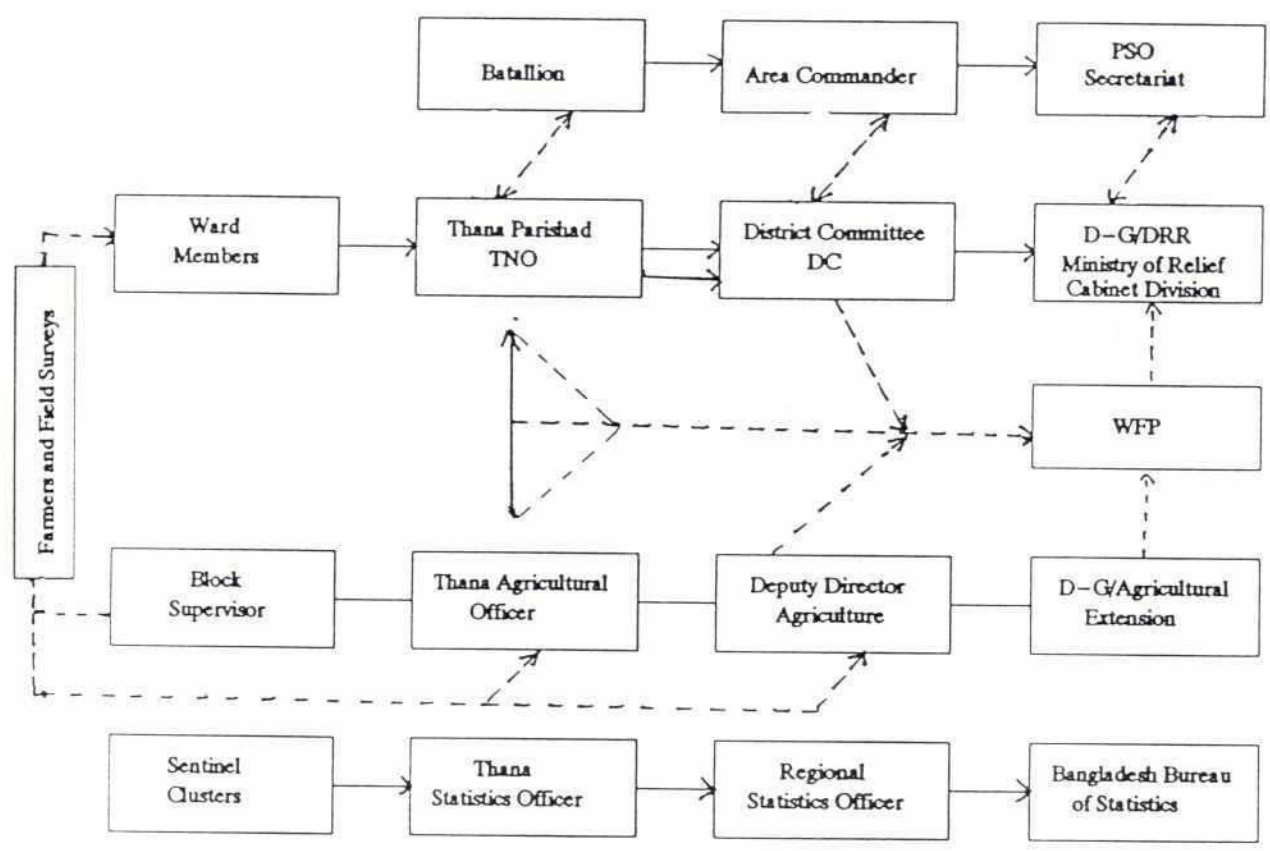
The BBS crop sub-sector data are collected for their own long term statistical use only. However, the figures when published by BBS in their official publications are accepted by the GOB as a correct record of the effects of the disaster.

4.2.3 Crop Sub Sector Damage Reporting

The damage assessed by DAE forms the basis for the allocation of resources for agricultural rehabilitation, progress of replanting and the like.

The Block Supervisors (previously UAAs/VEAs) at the block level below the union level, collect damage data within one or two days of a disaster by moving either on foot or by bicycle in their respective areas of jurisdiction. They have some basic idea of damage assessment, although they are not fully trained. It is difficult to complete the assessment in the adverse conditions, unusable roads with fallen trees, damaged roads and culverts and, perhaps, being in a mentally disturbed condition having their own family difficulties after a disaster like 1991 cyclone. However, they collect the damage data as quickly as possible.

Figure 4.1
Channels Reporting Crop Damage Assessment Data



REPORT CHANNEL WCI



TABLE 4.2
Form of Emergency Diary to be Maintained by Union Parishad Chairman

[illegible]

N.B: Union Parishad Chairman will sign the Proforma

Source : Standing Orders for Cyclone, MoRR, 1985

A: 11k-10VForm-5 Fr. Wk. 1

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Upazila Project Implementation Officer	Upazila Nirbahi Officer	Chairman Upazila Parishad
..... Upazila, District	 Upazila, District	 Upazila, District

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It is known that DAE in the Feni area makes two reports, the first within 2/3 days of the disaster and the second about 25/30 days after. The later one provides more or less correct figures. Two damage reports were prepared by TAO, Sonagazi. The first report was based on assumptions, with only limited field visiting, while the second was based upon the knowledge and experience of the BSs backed up by farmer interviews and field visiting. The thana has nine unions, each divided into eight sub-blocks. There are two BSs in each Union. The BSs know the area of each sub-block, how much of the area is under which particular crop and how much might have been damaged having practical experience of the crop conditions.

Different types of format were found to be used by different TAOs. For example, the formats used by TAO, Companiganj, was different to those of TAO, Bhuapur (Tangail District) and TAO, Sariakandi (Bogra District). The formats found in Bhuapur and Sariakandi dealt only with floods. The TAOs of Sariakandi (Bogra) and Lalpur (Natore) provided the standard damage format for drought. The TAO, Singra used a format with 13 columns, not the original one supplied by headquarters. The formats found in the Noakhali region appeared to be the best.

The damage in Sariakandi following the 1988 flood was assessed only once, and the report was not prepared in the prescribed format supplied by the DAE Headquarters. Following the 1991 flood, the damage was assessed three times, one assessment was made on the standard format, the other two were not. Seedings were apparently raised as a preparedness measure in advance of the flood season.

It was gathered from Deputy Director, DAE, Bogra that they also assessed crop damage twice, once immediately after the flood disaster and again about three or four weeks after almost in a proper format.

DAE headquarters receive the compiled damage and loss of production data from the different unions via thana and districts. However, the data are often not compiled properly or in a timely manner. Sometimes, records are not maintained in systematic way.

4.2.4 Damage Assessment Procedures in the Livestock Sector

Thana Livestock Officers (TLOs) collect data from the field after a disaster with the help of various categories of field staff who move on foot and sometimes by bicycle. These staff collect information from different sources, including by observation and by interviewing farmers. At thana and below, Department of Livestock (DoL) has the following staff: Thana Livestock Officer, Assistant Veterinary Surgeon, three Field Assistants in Animal Husbandry, Field Assistant in Artificial Insemination, Compounder, Thana Animal Husbandry Assistant and Dresser. However, posts are often vacant due to recruitment problems.

DoL do not prepare disaster damage reports to any common format rather the individual officers devise their own format each time. This was confirmed by the DoL officers in Noakhali, Feni, Jamalpur, Tangail and Bogra. TLO, Sariakandi, prepared damage assessments following the 1988 flood according to a particular format, which he varied in the following year according to perceived needs. Brief damage assessment reports following the 1988 and 1991 floods were prepared by the TLO, Singra, (Natore District) both in

different formats. TLOs were not aware of any damage reports for droughts. DoL, Sonagazi, prepared short damage reports following the cyclone and storm surge of 1991 and forwarded these to the District Livestock Officer, with a copy to Thana Parishad. The TLO prepared two reports, the first on 9 May 1991 and the second on 13th May 1991, the formats used were different to those used in other areas.

TLOs stated that it was quite difficult to obtain a true picture of the number of affected cattle and poultry within 24 hours of a disaster like a cyclone. There should be proper Action Plans for each area for the procurement of livestock feed. Necessary vaccines and medicines are not usually available in stock, hence epidemics break out after disasters.

4.2.5 Damage Assessment Procedure in Fisheries Sub-Sector

The assessment of damage in the fisheries sector immediately after a cyclone or flood is carried out by the Thana Fisheries Officers (TFOs) in association with their subordinates, the Assistant Fisheries Officer and the Field Assistant in each Thana, by observation and interviewing the fish rearers. It is very difficult for them to collect data. They travel mostly on foot after a disaster. However, as with DoL, there is a shortage of staff and many posts are vacant.

District Fisheries Officers (DFOs) of Jamalpur, Bogra and Feni all stated that although individuals might suffer losses of fish due to disasters like cyclones or floods, nationally few fish were lost. However, droughts reduce fish production by affecting breeding capacity. Although they did prepare damage reports following cyclones and floods, they did not following droughts. Cyclone or flood damage reports were not prepared to any specified format. TFOs in Sariakandi and Singra prepared their damage assessments following the 1988 and 1991 floods to formats designed by themselves.

DoF, Feni District, prepared a brief report on the damage caused by the 1991 cyclone. DoF in Sonagazi Thana prepared two damage reports, the first was rather detailed covering loss of fishermen's lives, missing and damage to craft, trawlers, boats, nets, that would hamper the catching of fishes and damages of house the second was more general. The formats used by DoF seemed to vary from year to year according to individual perceptions.

4.3 Rehabilitation Programmes

4.3.1 Objectives and Organisation

The immediate rehabilitation activity in the agricultural sector should aim:-

- to minimize losses in the post disaster period and to maximize food production in the existing as well as in the following seasons;
- to provide financial assistance to small and marginal farmers to enable them to regain the momentum of agricultural activities that has been lost due to the disaster; and

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- to rehabilitate the damaged equipment, sprayers and the like required immediately to maximize production.

In each District, there is a District Agricultural Rehabilitation Committee (DARC), of which the DC is Chairman and the DD, DAE, Member-Secretary. Rehabilitation requirements are decided by this Committee. However, the Committees should have accurate damage assessments before making their decisions. Due to differences in the damage assessments for the same area from different organisations, the relevance of reports to actual rehabilitation needs arises. The supply of seeds for aus, T. Aman and vegetables was stated to be the most immediate requirement following the 1991 cyclone in the affected areas.

4.3.2 Criteria for Distribution of Rehabilitation Inputs to Crop Sub-Sector

The criteria for distribution of inputs for crop sub-sector rehabilitation are based on the extent of damage and an assessment of needs. To determine input requirements, the damaged areas are firstly identified. The crops in some areas are destroyed while in others they are only partially damaged. The partially damaged areas are converted into a destroyed area by applying an appropriate percentage of damage. The seed rate for particular crops per acre is known, hence the total requirement for seeds can be calculated. Similarly, the requirements for rice seedlings in the damaged area can be determined. There is a rule of thumb that seedlings of one acre can be transplanted to cover 20 acres. In some cases, money is given to farmers to enable them to procure seeds and seedlings. Agricultural personnel in the field are trained and experienced in assessing the needs for fertilizer, insecticides, water and credit.

After assessing total seed requirements, the BADC seed stock position is ascertained and, if there is a shortfall, the DC distributes money to the farmers by drawing from MoA. BARC also assists by providing some of their seeds and seedlings to DD, DAE for him to distribute among the needy farmers.

TAO, Sariakandi, prepared three rehabilitation programmes, but not one was implemented as proposed. TAO, Singra did not prepare any rehabilitation programme following the 1987, 1988 and 1991 floods. TAO, Sonagazi, stated that he had prepared a rehabilitation programme for the next season covering aus and vegetables, amounting to Tk. 571,849 and submitted it to DD, Feni. This amount was less than the actual losses suffered by agriculture. In addition, he should have prepared a rehabilitation programme for the aman season to compensate for the losses incurred. He was newly posted man and it could not be ascertained whether the rehabilitation programme was really prepared or not.

TAOs and Subject Matter Specialists (SMOs) mentioned that while cropping seasons were somewhat fixed in time, rehabilitation materials, either in kind or in cash, were never available in due time and rarely in the required amounts.

During floods, crop input prices rise making them less available to small and marginal farmers. When deciding relief amounts, consideration should be given to the number of family members, rather than categorizing farmers simply as landless, small, medium and big farmers.

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Credit for agricultural inputs, seeds, fertilizers, pesticides, irrigation pumps and draught animals should be provided either in kind or cash on easy terms and conditions.

4.3.3 Rehabilitation Programme in Livestock Sub-sector

It was reported that the Department of Livestock (DoL) does not undertake any rehabilitation programme following disasters. TLOs of Companiganj, Sariakandi, Singra and Sonagazi confirmed that they did not prepare such programmes, as GOB had never provided any funds to this sector for rehabilitation. This was also confirmed by the DLOs of Noakhali, Jamalpur, Bogra and Feni.

DoF did report having provided vaccines to affected cattle and poultry following the 1991 cyclone.

4.3.4 Rehabilitation Programme in Fisheries Sub-Sector

TFOs generally confirmed that no rehabilitation programme was devised following any disaster as no funds were allocated. DFOs in Bogra, Natore and Feni Districts confirmed this.

However TFO, Singra did prepare a fisheries rehabilitation programme in 1988 but it could not be implemented for lack of resources.

After cyclone disasters oxygen depletion occurred in some ponds and disease epidemics were reported. People became cautious about rearing fish. A small quantity of fingerlings were distributed from the DoF fish farms in same without payment.

CHAPTER 5

ROLE OF BADC

5.1 Previous Role

The Bangladesh Agricultural Development Corporation (BADC) was established in 1961 to promote the use of modern agricultural inputs. Section 13 of its Ordinance gives the functions of the Corporation as to :-

- make suitable arrangements on a commercial basis for the procurement, transport storage and distribution to agriculturalists of essential supplies such as seeds, fertilizers, pesticides, and agricultural machinery and implements;
- promote the setting up of co-operative societies with a view to handing over the supply function;
- encourage the development of co-operatives in other spheres.

The corporation may (inter alia):

- organise the supply, maintenance and operation of low-lift pumps and set up workshops for repairs;
- encourage the expansion and improvement of industries for the manufacture of diesel engines used in agriculture;
- make arrangements for servicing machinery; and
- provide and maintain transport facilities and assist other public or private agencies to provide such facilities for the use of the corporation.

The use of good quality seeds of appropriate variety helps to ensure good production. At present BADC grows and supplies rice, wheat, potato, mustard, fruit and vegetable seeds. In the past the work of BADC had two aspects, one was seed procurement and multiplication, and the other was distribution throughout the country. BADC imported quality seed from abroad, received quality seed from its registered and contract growers and obtained seed from its own Seed Multiplication Farms. It also procured a small amount of seed from traders. However only about 7-10% of the total requirements for seed were satisfied by BADC. It is likely that in future its 22 Seed Multiplication Farms will be handed over to private entrepreneurs.

DAE also produces foundation seed. Seed testing is also carried out for quality, purity, germination, foreign grains and inert materials and certified by the Seed Certifying Agency. Seeds are then bagged and sealed for distribution and use. The distribution is undertaken through private wholesale and retail traders.

Chemical fertiliser was introduced to Bangladesh in 1951 by DAE. Procurement and distribution was later handed to BADC. In the initial years, farmers response to the use of chemical fertilizers was not encouraging. Consumption of fertilizers increased from the mid 1960s with the introduction of HYV crops. Consumption of fertilizers in the country during the Second Five Year Plan (1975/80) was around 1.0 Mmt per year and the upward trend has continued. BADC used to procure fertilizers from local manufacturers and from abroad, arrange transport to godowns and Primary Distribution Points (PDP) for delivery to the dealers, who sold to the farmers. Fertilizer production and distribution is now fully privatised. Many of the fertilizer godowns have been handed over to Department of Food.

The rapid expansion in the use of small-scale irrigation equipment is in part a response to natural disasters, mainly floods. This equipment has enabled farmers to switch their main production period from the flood-prone monsoon (aman) season to the safer dry (boro) season. Floods now represent much less of a serious hazard to their livelihood in floodplain areas where irrigation is widespread.

BADC established a 'Unit Office' in each thana to supply, initially on loan, irrigation equipment, fuel and lubricants. In every thana, there was a BADC godown to store the equipment and a team of mechanics to provide a maintenance service for farmers. BADC no longer has a monopoly on the sale and servicing of low lift pumps (LLP) and shallow tubewells (STW) and has sold virtually all of the previously rented LLP and STW. Its main function now is the installation, operation and maintenance of deep tubewells (DTW) but this again may be privatised in the future. There are approximately 24,000 DTWs installed throughout Bangladesh and the process of turning these over to the private sector has already commenced. BADC officers stated that irrigation equipment like STWs and LLPs were handed over to private owners in 1990-91 and only DTWs were fielded after the disaster season. In future, BADC will probably exist, but will mainly be providing support to private irrigation equipment owners.

BADC used to procure and distribute different kinds of insecticides. It maintained a storage godown at each thana for this purpose. However, this activity was privatised some time ago.

5.2 Future Role

In the past BADC distributed HYV seeds and seedlings, fertilizers, insecticides and irrigation pumps to the disaster affected areas as part of the rehabilitation programmes. Their role in the future with the gradual privatisation of these services is not clear and such programmes may suffer as a result. This is an issue that must be addressed by Government.

CHAPTER 6

RECOMMENDATIONS

6.1 Updating and Refinement of Guidelines and Procedures for Precautionary Measures

The Codes, Standing Orders and various guidelines for cyclones, floods and droughts were first prepared many years ago. They were developed by both the Ministry of Relief and Ministry of Agriculture. There have been many changes and the procedures to combat natural disasters have become more organised. The Cyclone Code, 1970, in English and Drought Code, 1980, also in English need to be updated. The Standing Orders for Drought, 1980, should be revised and be translated into Bengali to be better understood by the common man.

The multiplicity of Codes and Orders needs to be integrated into a broadly based Disaster Code for cyclone, flood and drought. Booklets, leaflets and bulletins should be prepared in Bengali for distribution among the people so that they have better understanding and are able to follow the instructions as and when given. Documentary films should be prepared to help the common man have a good idea of preparedness issues. The correct assessment of rehabilitation needs should be the subject of special training for officials.

6.2 'When', 'How' and 'Whom' of Damage Assessment

The BSs go out to their villages on foot, collect data on the damage, prepare and submit a report to the TAO within 2/3 days of a disaster. The TAO passes the reports to DD, DAE (with a copy to TNO) who compile them and send them on to DAE Headquarters at Dhaka.

There need to be more BSs in an area after a disaster and they should be drafted in from areas which have not been affected. They should make assessments two weeks after cyclones, three weeks after floods and four weeks after droughts. This is because it cannot be certain if a part of the crop will recover after being damaged by cyclone, submerged by flood, or dried by drought until such a time has passed. BSs should consult with their Contact Farmers (CFs) to prepare a more accurate assessment of damage. They should make actual field observations and interview the affected farmers.

One broadly based assessment form should be used by Union/Thana level DAE (Table 6.1) a similar form should be used by the DoL and DoF officers. (Tables 6.2 and 6.3).

In the crop sub-sector, only DAE staff should assess damage and losses. They should do this **two times**, once within 2/3 days of the disaster and the other after 2/3 weeks. The Union Parishad should be kept informed of the damage assessments prepared by the BSs. Similarly, the Thana Livestock and Fisheries offices should assess the damage and losses twice using their own field staff and again the Union Parishad should be kept informed.

It is suggested that while preparing and compiling the damage reports more coordination between the personnel of the different agencies engaged in the assessment is required. They should sit together, discuss assessments and make a single integrated damage report. They

Reason for crop loss A		Name of Assessee :
Date of event		Signature :
Action taken (if any)		Designation :
Remarks		Date :

TABLE 6.2
Fish Damage Assessment Report

Sl. No.	Name of Damaged Union	Number of Villages	Number Ponds/Ditches	Category of Fishes	Area Under Fishes (Acre)	Damaged/Flooded Area (Acre)	Total Damaged Area (Acre)	Partially Damaged Area (Acre)	Extent of Partial Damage (%)	Partially Damaged Area Converted to Fully Damaged Area (Acre)	Total Area Damaged (Acre)	Damage of Fish Rearing are Compared to Total Fish Rearing Area (%)	Expected Yield per Acre (Maund)	Loss in Production (Maund)	Value (Tk)	Category of Fishing Equipment	Cost of Damaged Equipment (Tk)	Value (Tk)	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
* Common Carp, Cat fish, Zool fish, Fingerlings, Eggs Reason for fish loss Date of event Action taken (if any) Remarks																			
** Nets, Boats, Trainers & other equipments Name of Assessee Signature Designation Date																			

TABLE 6.3

Sl. No.	Name of Damaged Union	Number of Villages	Category of Livestock (Cow/Bullock/Goat/Poultry/duck/etc)	Number of Livestock Under Damaged Area	No of Livestock		Expected Yield per 100 No. (Maund)	Loss in Production (Maund)	Value (Tk)	Fully Damaged Fodder Area (Acre)	Partially Damaged Fodder Area (Acre)	Extent of Partially Damaged Fodder Area (%)	Partially Damaged Area Converted to Fully damaged Fodder Area (Acre)	Total Damaged Fodder Area (Acre)	Damage of Fodder area Compared to Total Fodder Area (%)	Expected Yield of Fodder per Acre (Maund)	Loss in Production (Maund)	Value (Tk)	Remarks
					Dead	Deseased													
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Thana :

District :

Name of Assessee :

Signature :

Designation :

Date :

Reason for Livestock loss :

Date of event :

Action taken (if any) :

Remarks :

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should do this within the framework of the proposed Disaster Management Committees which are proposed at the Union, Thana and District level (See Volume III).

Many posts at the field level are vacant and this affects both the normal time activities and emergency operations immediately after the disaster. All steps should be taken to fill up these posts.

6.3 Training to Personnel in the Agriculture Sector

Thana and union personnel of DAE, DoL and DoF are given some orientation on disaster prevention, precautions, damage assessment and rehabilitation, however the necessary detailed training for preparedness for cyclones, floods and droughts is missing.

All personnel concerned with agricultural activities in disaster-prone areas should be trained separately in their particular discipline and as a group to encourage an integrated approach. Staff in the coastal areas and off-shore islands should be provided with detailed knowledge of cyclones (timing, probable paths etc) staff in flood prone areas with information on floods (timing, measures to reduce damage, measures during flood, cropping pattern to avoid flood loss etc) and staff in drought prone areas about droughts (timing, measures to save crops, cropping pattern). They should be shown how to make and implement plans for rehabilitation after specific disasters. Detailed syllabi should be prepared by the training institutes. The two rural development academies at Comilla and Bogra should be employed for the purpose.

Farmers and fish rearers have proved themselves adaptable to the new technologies which have become available in the last three decades, especially the high yielding varieties of rice, irrigation equipment, improved breeds of cattle and poultry, and high yielding fish. To avoid the hazards, they may be able to sow or transplant seeds or seedlings either earlier or later to avoid the usual period of occurrence of a particular type of disaster. This idea should be applicable to all areas in Bangladesh. Field staff should be given proper training in such aspects so that they can advise the farmers and fish rearers of the best things to do.

Personnel who are responsible for damage assessments and implementation of rehabilitation programmes should be given more specific training. They should be fully conversant with the causes of losses and be given ideas about how to minimise them in future and also how rehabilitation plans could be implemented.

The Education Department should consider including such topics in the Secondary School Certificate (SSC) syllabus. The Red Crescent Society of Bangladesh, BRAC, Rotarians and some NGOs can be mobilised and play a vital role in educating adults about these subjects.

6.4 Specific Activities

6.4.1 Before Emergency : Preparedness

To increase crop yields through more extensive and effective use of inputs, five aspects should be considered: better seeds, fertilizer, irrigation, pesticides and agricultural

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techniques and management. These need to be applied in the correct quantity, in time and in a proper manner. All major inputs, except DTWs, can now be obtained from the open market. Credit is obtained from different sources as mentioned below.

A National Contingency Plan should be prepared and up-dated each year, taking into account changes in agricultural technology and infrastructure. The Plan should include the following:

- i) provision of reserve seed stock by DAE, BARI and BRRI (see below);
 - reserve seedbeds (BARI, BRRI and at union level);
 - pre-planning for import of seeds;
- ii) stocking of fertiliser at union levels;
- iii) arrangements for mobilizing pumps (BADC?);
- iv) storing of insecticides at union level;
- v) arrangements with BKB, BRDB and commercial banks to provide additional credit promptly to disaster affected farmers;
- vi) recommended agricultural techniques and management.

Reserve stocks of rice, wheat, potato, mustard, fruit and vegetable seeds should be held throughout the country. If necessary quality seeds should be imported. Quality seed from registered growers and from the BADC's 22 Seed Multiplication Farms spread over the country should be obtained. DAE should contribute in the form of foundation seed. The seeds should be bagged and sealed for distribution and use in the affected area.

Actions which might be taken up as normal preparedness measures by farmers include :-

- i) for the protection of seeds, polythene bags, suitable containers, motka etc. should be procured, seeds should be kept in the portable containers and be transferred to safe places out of reach of water;
- ii) arrangements for the transfer of the foodgrains and other things to highland during floods should be made in advance;
- iii) stocks of short growing period varieties of aman seed should be held in reserve;
- iv) seedlings and vegetables should be grown on highlands;
- v) agricultural equipment like ploughs, smoothing 'ladders', spades, tillers and pumps should be transferred to safe places in due time;
- vi) a check to see that the embankments of the ponds are in good condition. These should be repaired, if necessary. Dhaincha seeds should be sown on

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the embankments so that after the flood recedes it may be used as fodder or fuel.

6.4.2 During Flood Emergencies

During flood emergencies, the following actions should be taken :-

- i) seeds should be transferred to dry, safe places;
- ii) efforts should be made to ensure that crop loans and credit are available from banks in due time just after the floods recede;
- iii) country boats should be designed to use irrigation engines to ply during floods;
- iv) DAE should operate a control room to keep in touch with the Emergency Operations Centre of the proposed MoR Disaster Management Bureau;

6.4.3 Recovery Phase

The GOB post flood agricultural rehabilitation programme needs to be expanded and greater flexibility given for implementation through district and thana agricultural rehabilitation committees.

The post flood depressed economic situation and food shortage will be quickly overcome as the harvest of T aman begins and planting and sowing of winter crops shortly resumes. There is a need to intensify the Food for Work Programme, Vulnerable Group Feeding and Test Relief works in the severely affected regions and to continue such programmes until the following wheat and boro crops are harvested.

In the recovery phase, the following should be considered :-

- i) Flood prone areas are generally low lying depressions and lands adjacent to rivers. The date of planting is a crucial factor in determining the crops' susceptibility to flood damage. Crops should be sown earlier to avoid risk;
- ii) Arrangements should be made to dry out wet seeds, if possible;
- iii) If T aman cannot grow as the proper time of planting has passed, emphasis should be given to rabi crops and all necessary support should be provided by DAE. Short growing period vegetables, mung, lentil, mustard, kheshari, and fodder should be grown;
- iv) An adequate supply of inputs (seed, fertilizer, fuel and pesticides) should be ensured as far as possible.

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- v) There should be close monitoring of prices of inputs, particularly in the seriously affected areas and the availability of sufficient critical inputs should be ensured as far as possible;
 - vi) Farmers should be cautious in applying pesticides;
 - vii) Necessary arrangements for the repair of breached embankments and other physical damage, including removal of sand deposits from crop lands should be made through Food for Works to provide immediate employment, particularly for agricultural labourers who will need alternative employment until the next season;
 - viii) Free seeds and fertilizers should be supplied to those whose crops have been destroyed, on a flat rate basis. Sufficient inputs should be provided for 1.5 acres of land. Farmers whose crops have been destroyed but who do not receive free seeds and fertilizers should be given interest free credit. Based upon a rehabilitation programme, equivalent to 50% of the adjusted 'destroyed' area, an allowance of Tk. 1,500 may be required for each household;
 - ix) Adequate credit should be available for 'larger' farmers who have lost larger areas of crops, that is those with more than 7.5 acres of crop affected;
 - x) The main crops to be supported in a rehabilitation programme should be boro, wheat, mustard and vegetables. Farmers should be encouraged to grow other crops, such as pulses, and some rehabilitation funds may be earmarked for the supply of manually operated irrigation pumps for small and marginal farmers;
 - xi) Funds for rehabilitation should be provided to the DDs not later than 15 November;
 - xii) Wholesalers should be given preferential tariffs to ensure that adequate supplies of inputs are available at reasonable prices;
 - xiii) Sources of credit in Bangladesh are:
 - relatives;
 - merchants or landlords;
 - money lenders;
 - Cooperative societies;
 - banks; and
 - Government institutions.

Borrowing from the first three sources involves distressed farmers in the payment of high rates of interest. The last three institutions are usually cheaper, but the time needed to obtain the money and the security required are problems. Procedures should be simplified to encourage the farmers to obtain credit from institutional sources.

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It is interesting to note that the yield and production of foodgrains in disaster year has been observed to be higher than in 'normal' years. Much damage was caused by the 1987 and 1988 floods, inspite of this, production was higher in 1988 than in 1987. This might have happened as :

- i) a well planned and implemented rehabilitation programme was carried out (this seems rather unlikely);
- ii) based on their experience in the 1987 floods, farmers might have changed their cropping patterns to reduce the effects of floods. Hence, although damage may have been high, it might have been compensated for by higher production;
- iii) the farmers might have planted more crops with resulting higher production to compensate for the loss and damage that they had incurred earlier;
- iv) due to flooding of the land, siltation might have made it more fertile, as a result, the following 'boro' crop might have been higher; and
- v) inputs like improved HYV crop seeds and late planting variety seedlings, recommended fertilizers and insecticides might have been used more widely to make up shortfalls.

6.5 Longer Term Measures

6.5.1 Focus of DAE Activities

The role of DAE is to increase the production of farm commodities by extending knowledge, skills and habits to the farmers and farming community, providing them with advice on the use of appropriate technology and improved management of their farming systems.

Training and advice should be strengthened at Block level, the closet point of institutional services to the affected farmers, through the BSs and TAOs. Crop calenders should be prepared and crops be selected on the basis of land types and locations. While encouraging food production, consideration should be given to crop diversification. All extension workers should be fully aware of their role.

In most cases, farmers lack a strong organization. The farmers should be trained in relation to improved crop production technique such as land preparation, HYV crop selection, seed rate and seeding methods, planting methods, use of balanced doses of fertilizers, use of organic and green manures, insecticides, weed control and harvesting operations. T. Aus should be given due importance. The DAE - BRDB linkage programme should be made more effective. Active feedback from farmers to DAE and agricultural research institutes should be encouraged. BSs visits to farmers should be increased. 'Method and Result Demonstrations' through demonstration plots in farmers own fields to propagate ideas should be activated in each thana.

6.5.2 Crop Research

Current rice breeding research strategy is to develop faster maturing varieties of boro paddy which would reduce farmers' risk of crop loss due to early floods. For aman paddy, the strategy is to produce varieties suitable for later transplanting with longer seedlings, to reduce exposure to damage by late floods. Work is also in progress to provide improved varieties of deepwater aman.

6.5.3 Flood Control Projects

Flood control projects also help to reduce disaster exposure. In general, farmers adapt their cropping practices quickly to the changed environment of polders and flood embankments.

6.5.4 Forestry Department

A forest belt should be developed outside the coastal embankment to lessen the impact of surges. Mangroves should be developed outside the polders. A long term programme of afforestation in the coastal and off-shore islands should be considered. A green belt of a considerable width would not only protect the coastal embankment but also reduce the devastation by diminishing the wind speed and lowering the height and intensity of surges.



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ANNEXES

ANNEX A
Terms of Reference for Agricultural Studies

Terms of Reference for Agricultural Studies

The consultants will:

- (i) Obtain copies of all Standing Orders Codes etc. that have been issued to or developed by the Ministry of Agriculture in connection with disaster management etc.
- (ii) Collect and review available technical reports and evaluations concerning cyclone, flood and drought damage to crops during recent years, and agricultural rehabilitation programmes, with special reference to the floods and cyclones of 1988 and 1991, and the Land Resources Appraisal of Bangladesh for Agricultural Development series of reports (FAO/UNDP 1988);
- (iii) Meet with relevant agricultural officers at national level (in DAE, BARC, BARI and BADC), and make field trips to meet and hold discussions with civil administration and agricultural officers at divisional, district, and upazila levels, and with Block Supervisors and farmers at union and village levels;
- (iv) Meet with relevant personnel of selected NGOs (BRAC, CARE, CARITAS, RDRS,....), FAO, and other technical advisory groups (e.g. USAID, World Bank, EEC, WFP....);
- (v) Review a sample of the damage reports submitted through the civil administration and agricultural directorate channels following the 1991 cyclone and the 1988 floods and the extent to which recommendations in these reports were implemented;
- (vi) Evaluate the overall coordination of relief and rehabilitation efforts by various agencies and NGOs and assess the degree of duplication (if any);
- (vii) Prepare standard damage assessment proformas for the use of district and upazila staff and for missions;
- (viii) Prepare a concise summary report on the key findings in relation to:
 - the status of the codes and standing orders and any other official guidelines that may be found, and the extent to which they are available and used (in field operations or training);
 - the nature of the contingency plans for agricultural rehabilitation prepared at national and local levels (the extent to which the guidelines provided in the 1980/81 code are followed, and the specific reasons for any departures);
 - the training received by agricultural officers at all levels specifically relating to disasters (prevention, precautions, damage assessment, and rehabilitation);
 - the extent to which block supervisors and other personnel are informed about and pass on warnings of floods or cyclones (in theory and in practice);
 - the apparent accuracy of initial crop damage reports from the various sources, the consistency of the reports submitted through the different reporting channels, and the relevance of those reports as indications of the need for relief and/or rehabilitation assistance;
 - the extent of losses of crops, draught animals, and other essential agricultural inputs in different areas;
 - the extent to which crop losses were able to be recuperated by replanting or the planting of substitute crops, and the factors which determined the scope and rapidity recovery for different groups of farmers;
 - the criteria applied to the distribution of (i) relief to farmers and landless agricultural labourers, and (ii) inputs for agricultural rehabilitation;
 - the extent to which different groups had access to credit to finance the acquisition of inputs;
 - the likely effects on post-disaster agricultural rehabilitation operations of the changed role of BADC.

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(ix) Prepare recommendations in relation to:

- the most relevant, feasible indicators of the short- and medium-term effects on agriculture and the various population groups who depend on agriculture for their livelihoods (including the possibilities for agricultural rehabilitation/recovery);
- when, how, and by whom, valid estimates of the above can be made;
- the up-dating and refinement of guidelines and procedures for initiating precautionary measures and assessing agriculture-related damage and needs following a cyclone or flood;
- the training requirements of agricultural personnel at all levels in relation to preventive measures, assessment and rehabilitation;
- the possible involvement of the UAOs and block supervisors in the dissemination of flood warnings;

(x) Collaborate with the specialist engaged to prepare hazard maps of Bangladesh, particularly in relation to droughts leading to crop shortfalls.

ANNEX B

Organisations and Personnel Contacted

ASSISTANCE TO MINISTRY OF RELIEF
Organisations and Personnel Contacted

The following list gives details of the organisations visited, the personnel met and the date of the meeting.

<u>Date '92</u>	<u>Organizations Visited</u>	<u>Personnel Contacted</u>
1 June	North West Regional Study New Eskaton Road	Mr M A Aziz Agricultural Economist
1 June	South East Regional Study Gulshan	Md Mohsinuddin Co-Team Leader
1 June	BADC, Krishi Bhaban	Mr Abul Kalam Chief Engineer
3 June	North West Regional Study New Eskaton Road	Mr M A Aziz Agricultural Economist
3 June	BARC, Farmgate	Mr Mosharraf Hossain Director, BIRTAN
7 June	DAE, Khamarbari	Mr Rafique Ahmed Deputy Director
8 June	SER Study Gulshan	Dr Malorie Agricultural Economist
9 June	SER Study Gulshan	Dr Malorie Agricultural Economist
13 June	DAE, Khamarbari	Mr Mosharraf Hossain Project Director
15 June	BIDS, Agargaon	Biswas Dhillon Librarian
27 June	DAE, Khamarbari	Md Siddiqur Rahman Deputy Director
27 June	SER Study Gulshan	Dr Malorie Agricultural Economist
27 June	Fisheries Department Fisheries Bhaban	Mr Mamudul Haq, A.D. Mr Wahidun Nabi Chowhdury, A.D.

28 June BARC, Farmgate Dil Afroz
Sr Scientific Editor &
Asgaruddoula, Librarian

29 June DAE, Khamarbari Mr M R Sharif, Director (FS)
Mr Siddiqur Rahman
Deputy Director (FS)
Mr Syed Majed Ali
Project Director(CDP)

29 June BARC, Farmgate Asgaruddoula, Librarian

4-6 July Field Trip to Noakhali
Area Officers and
representatives of
Govt. and NGOs

8 July DAE, Khamarbari Md Siddiqur Rahman
Deputy Director

8 July DAE-FAO David Giles
Irrigation Agronomist

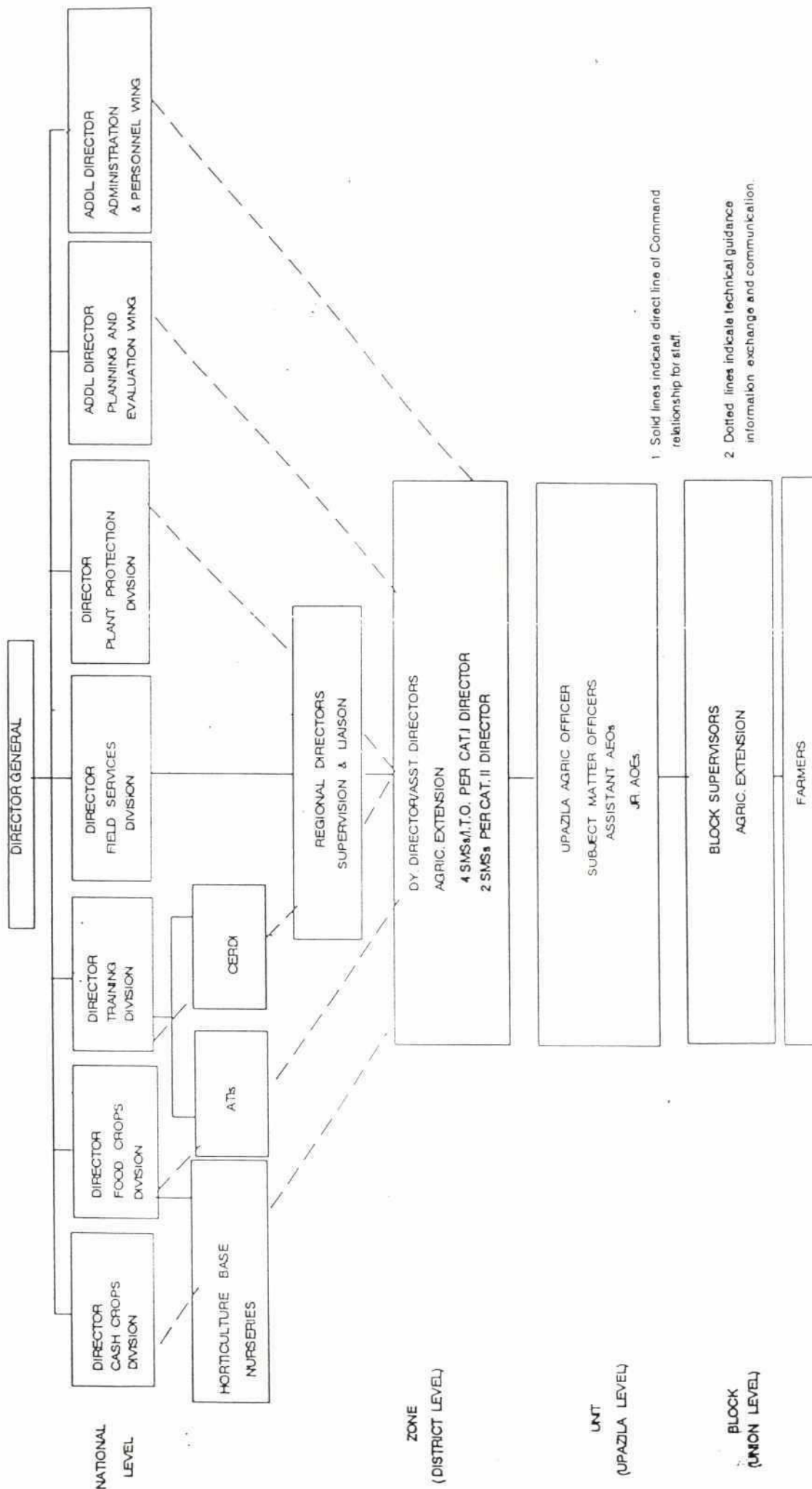
9 July BADC, Krishi Bhaban Md. Ansar-ul-Haq
Chief (Monitoring &
Evaluation)

20 July BARC, Farmgate Dr. Jahurul Karim
M-D, Soils & Irrigation

ANNEX C

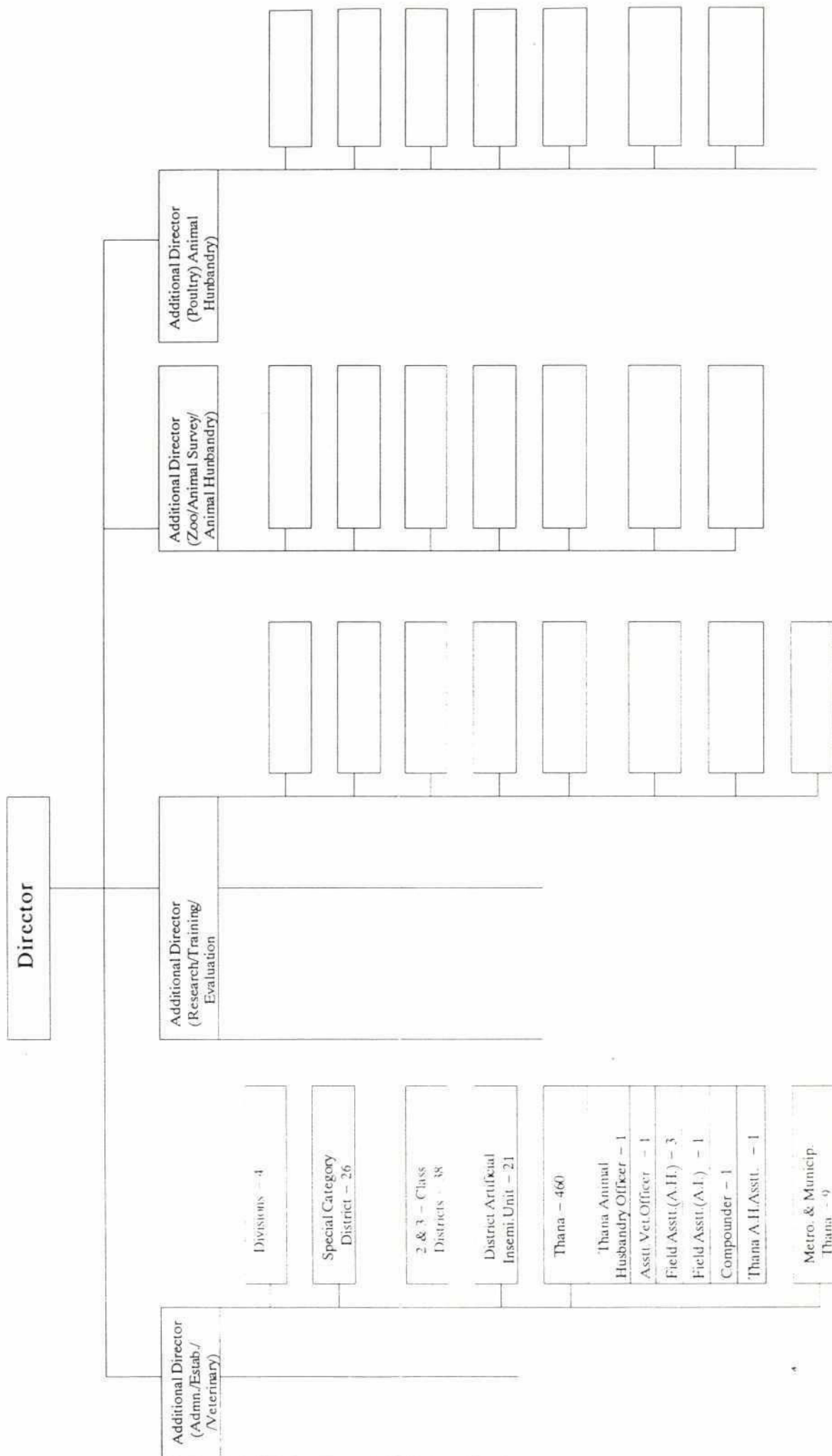
Organisational Set up of DAE, DoL and DoF

DEPARTMENT OF AGRICULTURAL EXTENSION ORGANIZATIONAL CHART



MINISTRY OF DEPARTMENT OF LIVESTOCK

Organizational Chart



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**ASSISTANCE TO MINISTRY OF RELIEF
IN COORDINATION OF CYCLONE REHABILITATION
(BGD/91/021)**

FINAL REPORT

VOLUME IV

ASSESSMENT OF DAMAGE CAUSED BY DISASTERS

PART 2 - FORESTRY

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ASSESSMENT OF DAMAGE CAUSED BY DISASTERS

PART 2 - FORESTRY

CHAPTER 1

INTRODUCTION

It is well known that Bangladesh is a disaster prone country. Disasters may come as discrete events at almost any time of the year and in following forms :

- Cyclone
- Flood
- Earthquake
- Erosion

This project has attempted to establish the nature and intensity of disasters and damage over the whole country and develop a Hazard Index for each thana and district. Major floods in Bangladesh are caused by excessive water in the rivers Ganges, Brahmaputra and Meghna. The head-waters of these rivers all lie outside Bangladesh. It has been estimated that 94% of the water comes through these three rivers, although in some years, the amount of water is not high enough to cover the flood plains. Every year torrential rains occur between May and October. During this period, the discharge from snow melt through the Ganges alone is 370,000 cusecs, this discharge drops to less than 70,000 cusecs during the dry period. In some years, very high discharges not only submerge the flood plain, but overflow nearly half of the country. This situation occurred in 1954-55, 1965 and 1988.

Flooding causes little damage to forests, except to the Sal forests of Gazipur, Tangail and Mymensingh. Due to the development of stagnant (anerobic) conditions in the root system, Sal trees die and have to be removed before root rot and unauthorized extraction sets in. (Note: This information is not published but is based on the personal experience and observation of the author over the last 40 years).

The occurrence of cyclones is unpredictable. They originate in the Bay of Bengal between the Andaman Islands and the Port Blair Island System. Initially, they are depressions of minor intensity, gradually they increase to hurricane intensity, with the air pressure falling and wind speed increasing, up to 150 to 250 kph. During the last few hundred years, many cyclones have battered the country, however the most devastating were in the years 1584, 1673, 1960, 1963, 1970 and 1991.

The earliest record of cyclone damage appears to have been recorded by Abul Fazal, the Chief Executive of Emperor Akbar the Great. Abul Fazal reports that during 1584 Bakla Pargana (now Barisal Division) and Chittagong were battered by a storm which resulted in heavy loss of life and property.

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The damage to life and property during the 1970 cyclone was very high in part because the cyclone signals were altered. The Cyclone Preparedness Programme was not yet operational. Few people heard the warnings through radio broadcasts and those that did not believe them or pay heed. The number of human lives lost was anything between 0.5 million and 1.4 million. The maximum air speed was reported to be 240/250 mph.

The 1991 cyclone hit the coast in a broad arc with a wind speed of 210-220 kph. The loss of life was estimated at 139,000. Some organisations, however, estimated the loss at 300,000. In any event, a large number of people died and millions lost their belongings and were rendered destitute.

CHAPTER 2

DAMAGE TO FORESTS

2.1 Damage Assessments

After an event like the 1991 cyclone concerned forestry agencies make reconnaissance level assessments of the damage. The Department of Forests (DoF) has a standard format on which its officer should report damage (Figure 2.1).

DoF, the Forest Industries Development Corporation (FIDC) and the Department of Environment (DoE) made quick assessments of the extent of damage and prepared a rehabilitation programme for the Environment and Forestry Sector. It was stated that the assessments were made very hastily mainly as the location of the damaged forests was so remote that a complete assessment of damage or loss in such a short time could not be made.

However, it has been found that no exhaustive and complete report was subsequently prepared. Sub-sector damage according to the initial report prepared by the MoEF is given in Table 2.1.

Although young coastal plantations were seriously damaged, the plantations themselves played an important role in lessening the ferocity of the cyclone. It was found that damage was much less in places protected by coastal forests on the foreshore.

Various degrees of damage to trees, both in forests and associated with homesteads occurred all along the coast from Teknaf to the Sundarbans. The loss to homestead tree resources was very high but it is extremely difficult to assess due to the large area affected. The damage assessed by DoF is given in Table 2.2.

Rehabilitation grants, wherever they have been allocated, have yet to be released. Some funds were provided but these have largely been utilised to repair and reconstruct infrastructure.

Damage appraisals were made by both MoEF and DoF and estimates of rehabilitation and reconstruction costs were also made by both organisations. However, the details do not tally with each other. This is probably as each estimate was made for a different purpose and different methods were followed by each organisation. In future, standard forms should be used so that information is comparable.

Physical damage to forests and plantations and rehabilitation costs as provided by DoEF are presented in Table 2.3. The geographic distribution of damage according to DoF is shown in Tables 2.4 and 2.5 while the estimated cost of a three year rehabilitation programme is given in Table 2.6.

TABLE 2.1

Damage to Coastal Forestry due to Cyclone 1991

Name of the Project	Location (District)	Damage to	Destroyed		Partial Damage		Total
			Physical (acre/nr)	Financial (Tk. lac)	Physical (acre/nr)	Financial (Tk. lac)	Financial (Tk. lac)
2nd Forestry Project (IDA funded)	Greater Ctg. Noakhali, Patuakhali, Bhola	Trees, infrastructure	60 000	789.56	5 000	21.00	810.56
Mangroves	Greater Ctg. Noakhali, Patuakhali, Bhola	Trees, infrastructure	0	0.00	60 000 (45%)	3 138.00	3 138.00
Coastal Afforestation Project	Greater Ctg. Noakhali, Patuakhali, Bhola	Trees, infrastructure	0	0.00	9 000 (20%)	420.00	420.00
Total :			60 000	789.56	74 000	3 579.00	4 368.56

Source : MoEF

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Figure 2.1

Standard Damage Assessment Proforma for Field Staff (Forestry)

District	Thana	Union	Mouza			
<table border="1" style="width: 100%; border-collapse: collapse; margin: 10px auto;"> <tr> <td style="width: 33%; text-align: center;">Compartment</td> <td style="width: 33%; text-align: center;">Block</td> <td style="width: 33%; text-align: center;">Forest Range</td> </tr> </table>				Compartment	Block	Forest Range
Compartment	Block	Forest Range				
1. Date						
2. Name and Designation of the Staff/Officer-in-Charge						
3. Total Area of Compartment Block and Forest Range						
4. Planted area	ha					
5. Unplanted area	ha					
6. a) Area damaged by disaster	ha	Tk. Tk.				
b) Trees	nr					
c) Volume of biomass damaged	Cu.m					
d) Cost of formation						
e) Approximate cost of rehabilitation						
7. Infrastructural damage	nr	Cost of Construction	Cost of Reconstruction			
a) Building						
b) Road						
c) Bridges/Culverts						
d) Water supply						
e) Miscellaneous						
8. Vehicles and stores	nr	Cost of Procurement	Cost of Replacement			
a) Vehicles (Cars etc)						
b) Launches						
c) Speed boats						
d) Boats						
e) Miscellaneous stores						
9. Consumable stores	nr/qty	Cost of Procurement	Cost of Replacement			

Total of administration unit (Range)
Total of Forest Division

AK-10(Fig-First.Wk1

Signature of Range Officer
Signature of Divisional Forest Officer

TABLE 2.2

Forest Sector Damage due to Cyclone 1991

Description	Destroyed		Partial Damage		Total Damage
	(acre/nr.)	(Tk.lac)	(acre/nr.)	(Tk.lac)	(Tk.lac)
Plantations (age 1-5 years)	70 000	2 800.00	25 000	500.00	3 300.00
Plantations (age 6-30 years)	66 000	3 000.00			3 000.00
Large trees	24 000	1 200.00	100 000	500.00	1 700.00
Nursery	40	160.00	50	50.00	210.00
Buildings	258	1 170.78	407	134.54	1 305.32
Launches	0	0.00	3	20.00	20.00
Trawlers	12	120.00	5	10.00	130.00
Speedboats	8	32.00	5	5.00	37.00
Country boats	20	4.00	25	1.25	5.25
Wireless set	12	30.00	15	10.05	40.05
Communication Equipment					
Total	—	8 516.78	—	1 230.84	9 747.62

Source : Department of Forestry

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TABLE 2.3

Forest and Environment Sector Damage and
Rehabilitation Costs following 1991 Cyclone

Sub-Sector	Damage		Rehabilitation	
	(Tk. Lac)	(US\$ Million)	(Tk. Lac)	(US\$ Million)
Forestry				
- On-going project	1 585.02	4.40	2 139.09	5.94
- Completed project	4 689.04	13.03	3 069.61	8.53
- Natural forest	3 483.71	9.68	5 733.00	15.93
Sub-Total :	9 757.77	27.11	10 941.70	30.40
Forestry Research			114.41	0.32
BFIDC				
- Industry	401.91	1.12	320.83	0.89
- Rubber Plantation	1640.71	4.56	1 360.71	3.78
Sub-Total :	2 042.62	5.68	1 681.54	4.67
Homestead Sub-Sector	23 558.80	65.44	21 325.62	59.24
Private : Rubber	383.73	1.07	1 230.00	3.42
Total:	35 742.92	99.30	35 293.27	98.05

Source : MoEF

a:\M8\TabF-3.Wk1

TABLE 2.4

Rehabilitation of Damaged Forests and Plantations following 1991 Cyclone

Forest Division Description	Chittagong		Cox's Bazar		Forest Utilisation		Pulp wood		Lama		Bandarban		Total (acre/hr)	(Tk. Lac)
	(acre/hr)	(Tk. Lac)	(acre/hr)	(Tk. Lac)	(acre/hr)	(Tk. Lac)	Bandarban		Forest		Forest			
Rehabilitation of damaged high forest	5 000	400.00	5 000	360.00									10 000	760.00
Casuarina plantation			600	36.00									600	36.00
Nursery		1.00											0	1.00
Reconstruction of destroyed buildings	46	184.00	30	120.00	12	6.00							88	304.00
Reconstruction/repair of partially damaged buildings		113.00	89	43.50									89	156.50
Miscellaneous		3.00		3.00									0	6.00
Sub-Total		701.00		562.50		6.00	0	0	0	0	0	0		1 263.50
Price escalation		29.10		24.80									0	53.90
		31.60		13.30									0	44.90
Management and development														7 984.01
Communication and buildings														2 028.00
Vehicles and tools														193.86
														33.80
Sub-Total														10 239.67
Salary														1 764.99
Miscellaneous														94.70
Price escalation														1 055.06
Sub-Total														2 914.75
Total		761.70		600.60		6.00	0	0	0	0	0	0		14 516.72

TABLE 2.5

Damage to Coastal Plantation due to Cyclone 1991

Circle Forest	Coastal Afforestation Division	Destroyed Plantation (acre)	Amount (Tk. lac)
Khulna	- Bhola (Barisal)	8 198	107.80
	- Patuakhali	3 352	94.87
	- Noakhali	30 748	404.33
	- Chittagong	17 702	233.00
	Sub-Total	60 000	840.00
Chittagong	- Chittagong	3 000	660.00
	- Cox's Bazar	3 000	1 500.00
	Sub-Total	6 000	2 160.00
Total		66 000	3 000.00

Source: DoF

TABLE 2.6

Forestry Rehabilitation in Coastal Afforestation Areas (3 Year Programme)

Description	Year 1		Year 2		Year 3		Total	
	(acre/hr)	(Tk. Lac)	(acre/hr)	(Tk. Lac)	(acre/hr)	(Tk. Lac)	(acre/hr)	(Tk. Lac)
Union Nursery	273	136.00	275	137.50	128	68.00	676	341.50
Coconut plantation @ 14 plants/home and 285 homes/village 85,500 for each village	3 000	2 565.00	3 000	2 565.00	1 884	1 610.82	7 884	6 740.82
Home-stead plantation 30,000,285 Households Tk. 5,700/-per village	3 000	171.00	3 000	171.00	1 884	107.39	7 884	449.39
Plantation on embankments 3 lines on both sides @ Tk. 32,000/-per mile	350 miles	112.00	350	112.00	300	96.00	1 000	320.00
Coconut plantation inside embankment Tk. 6,650/-per mile	350	23.27	350	23.28	300	19.95	1 000	66.50
Vacaney filling and needing 3 times in 1st year plantation	0	0.00	350	18.90	350	18.90	700	37.80
Vacaney filling in 1 year plantation incl. weeding					350	18.90	350	18.90
Vacaney filling in 3 years plantation incl. 2 weeding					350	12.60	350	12.60
Sub-Total	6 973	3 007.27	7 235	3 027.68	5 546	1 952.56	19 844	7 987.51
Price escalation 10%		300.73		300.77		195.26		798.75
Total	6 973	3 308.00	7 235	3 330.45	5 546	2 147.82	19 844	8 786.26

Source : Department of Forestry

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**ASSISTANCE TO MINISTRY OF RELIEF
IN CO-ORDINATION OF CYCLONE REHABILITATION
(BGD/91/021)**

FINAL REPORT

VOLUME IV

ASSESSMENT OF DAMAGE CAUSED BY DISASTERS

PART 3 : INFRASTRUCTURE

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- B Correspondence regarding the Estimate, Programme and Progress of 1991 Cyclone damage to different Departments on 13.07.92
- C Correspondence to Superintending Engineers of Bangladesh Power Development Board and C.E/RHD, C.E/BWDB & C.E./BPDB on 03.11.92.

ASSESSMENT OF DAMAGE CAUSED BY DISASTER

PART 3 - INFRASTRUCTURE

CHAPTER 1

INTRODUCTION

1.1 Background

Almost every year Bangladesh, due to its geographical location and topography, suffers disasters either due to flood, cyclone, tornado, river/sea erosion or drought. On 29-30 April, 1991, a most devastating cyclone hit the coastal area and offshore islands of Bangladesh. It caused disaster not only to the affected area, but also to the whole nation. Windspeeds reached 225 km/hour and caused storm surges of between 5.5m and 6.1m at the coast, which affected 16 southern districts of Bangladesh, 11 of which were badly affected. The cyclone created havoc and caused the deaths of 1,40,000 people and one million livestock, massive damage and destruction to crops and other national economic assets.

1.2 The Assignment

Within the overall Terms of Reference of the assessment the Rural Infrastructure Specialist is required to :

- review procedures for undertaking emergency and short term repair works including funding, especially the relationship to ADP allocations, design, construction and monitoring;
- assess GOB contributions to 1991 cyclone emergency and short term repair and rehabilitation works;
- assess the extent to which the first priority works identified following the 1991 cyclone damage assessments were completed by 31 May 1992 and, if appropriate, determine when the works will be completed;
- assess the current status of the second priority works identified following the 1991 cyclone damage assessments;
- assess the extent to which the emergency works have been coordinated by ERD following the WBRM meeting of 4 September 1992;
- determine the accuracy of damage assessments made by SMEC and others on the basis of the actual works carried out; and
- review Design Codes presently used in Bangladesh in the light of wind speeds experienced during cyclones and the associated risk of flooding from storm surges and, if required, propose changes to the Codes.

1.3 Methodology

1.3.1 Study work undertaken by the Disaster Co-ordination & Monitoring Unit (DCMU)

In order to undertake the study on cyclone damage and status of their rehabilitation as per TOR for the RIS, officials of all Directorates/ Departments concerned with infrastructure were contacted to obtain information/data/account of damage and their rehabilitation. Officials of Ministries were also contacted for the purpose and some have still being contacted. For facilitating the work the Project Director BGD/91/021 and Joint Secretary MOR issued a letter to all the heads of Departments and Organisations to give all sorts co-operation to the RIS of the project in providing with necessary information regarding the damage occurred because of the cyclone 1991 and the status of rehabilitation. A specific format (**Annex A**) was also supplied/handed/sent to the heads of the offices with a request to send those duly filled in to the Project Office (Disaster Co-ordination and Monitoring Unit). The RIS contacted many of the heads of the offices over telephone as well as attending their officers and concerned officials of different levels and personnel to obtain for the purpose of having the information as per the format. Information obtained only from a few departments after several meetings with the officials.

The RIS made a field visit to contact the officials of the worst affected Chittagong, Cox's Bazar, Feni and Bandarban districts in mid of August. The officials of BWDB, LGED, BPDB and Forest Department of Feni, Chittagong, Cox's Bazar and Bandarban who were available were contacted and meetings with them. Format regarding the information of 1991 cyclone damage was made available to them. The RIS visited the damaged Karnafuly bridge and embankment protection work at Patenga.

A request letter written on 20.10.92 to the Departments and Ministries which did not responded (even with personal contact) with a modified format by the Project Director to response and to send the informations (**Annex B**).

The superintending Engineers of Bangladesh Power Development Board were requested on 3.11.92 to send informations as per the formats attached within letter (**Annex C**)

The Superintending Engineer, PDB Chittagong responded without lapse of them. The RIS contacting personally on over telephone the officials from where information have not received.

No information received from the Chittagong City Corporation and Ministry of Commerce and Industries.

The RIS contacted and still continuing to contact and had several meetings with the officers of ERD & IMED, Ministry of Finance concerned with different Department/Ministries regarding the rehabilitation and reconstruction of damage occurred due to cyclone of 1991.

Enquired about the financial assistance obtained and being obtained by different Donor Countries agencies.

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Works under FFW (Food For Work) schedule were carried out by the Water Development Board and Local Govt. Engineering Department.

The information on the account of rehabilitation of works which were executed under FFW scheme were collected by the RIS from the respective departments.

a) Damage Assessment

The assessment of damage carried out by the Snowy Mountains Engineering Corporation (SMEC) in association with the Bangladesh Consultants Limited (BCL) was reviewed and the data field information used in the study.

Summary of the assessment of damage is prepared from the detail damage assessment made by hte SMEC. The consultant recommended for some special projects. Those special projects are found essential and the cost of those special projects are provided here also.

The percentage of contingency and consultancy which is considered (geneally 15% to 20% by the consultant is found reasonable and provided here also in the summary. The rehabilitation cost is determined by adding the of contingency cost and the cost of consultancy with base cost.

b) Rehabilitation of Damages

The consultant SMEC made the provision of rehabilitation of the damage in three phases with name as work priority-1, 2, & 3. For work of special project work priority-4 has been added.

The works of Priority-1 were of emergency nature and were programmed completed by end June 1992. Thus the work of priority-2 to be completed by June 1993 and those of priority-3 not before 1994. Works of special projects proposed to be cotacted by June 1995. The works of priority 2,3 & 4 mostly needs study and design.

The executing agencies or Department are not always following order of priority for the works. The cause of the little deviation of the programme is the non-availability of required fund and necessity of taking up work as per demand.

In order to have the information of the rehabilitation of cyclone damaged works Table (Annex D) was sent to each agency Each of the department with a desire to sent back the team duly filled by them. Many of the departments failed to send the format to the team duly filled in). Most of the departments do not have their own estimate, either preliminary or final. Revised estimates are taken as the same is done by SMEC. It is very difficult to show the contract value. Because as in any department there are many working contrators woking with different rates of work.

Regarding achievement of progress of works the value of the completed works have been considered irrespective of the financial progress. For getting the achievement for some departments IMED of the Ministry of Finance was contacted by the RIS of the team.

Estimates and work programme of different agencies or departments in rehabilitation/reconstruction work is presented in Table 1.1 and then progress of rehabilitation/reconstruction work of different agencies are presented in Table 1.2. Only 23% of the total work of rehabilitation/reconstruction have been executed till end of September 1992.

c) **Financial Assistnace/Funding**

In order to assess the extent of financial assistance (contribution) given to the department by the GOB or any foreign donor agency the officials of the department as well as the officials of ERD of the Ministry of Finance were contacted and being contacted by the RIS of the team.

1.3.2 **Cyclone Damage**

The cyclone occurred on 29-30 April 1991, caused damage to all the sectors of the national infrastructure. The total estimated cost of the damage so far obtained from different departments and taken from the SMEC's damage assessment report stands at Tk.1,67,025.95 Lac. The damage to the industrial sector shown in Table 2.1 (US\$ 0.55 million) seems at a very low side. The damage estimate figure as obtained from the Ministry stands at US\$ 356.32 Million.

On the other hand, the estimated cost of damage to Chittagong port Authority is shown seems at very high side (by UNCRD). The figure of damage of this sector also yet to be received from the authority.

1.3.3 **Definition of Cyclone Damage**

For the purpose of this assessment and subject to possible amendment once the extent and type of damage is known, cyclone damage will be defined as follows for each agency and category:

a) **Roads and Highways Department**

This includes all roads under the control of the Department

- i) Damage to road embankment and pavement structure caused by water passing over the road surface;
- ii) Breaches in the road embankments caused by wave action or scour
- iii) Damage to road bridge and culvert structures due to displacement or collapse of abutment or piers;
- iv) Loss of wingwalls, protection works, retaining walls or mattresses;
- v) Loss or displacement of box or pipe culverts;

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TABLE 1.1
Reconstruction Cost of Damage due to Cyclone 1991
(Summary of All Departments)

Agency/ Department	Works Priority	Preliminary Estimate by Agency	Revised Estimate by SMEC	Final Estimate by Agency/ Consultants	(Tk. million)	
					Contract Value (work programme)	
BWDB	1	72.70	72.70	72.70	72.70	
	2	561.00	561	561.00	470.00	
	3	1,762.13	1,762.13	1,762.13	1,762.13	
	Sub-Total	2,395.83	2,395.83	2,395.83	2,304.83	
RHD	1			219.25	219.25	
	2	2,125.72	1,442.10	1,498.75	300.00	
	3					
	Sub-Total	2,125.72	1,442.10	1,718.00	519.25	
BPDB	1				(**)	
	2	868.33	920.61	794.79		
	3					
	Sub-Total	868.33	920.61	794.79	0.00	
B.Railway	1		111.00			(100.00)
	2	446.45	26.30	276.62		(120)
	3					(5.20)
	Sub-Total	446.45	137.30	276.62		
DPHE	1	228.00	183.56	183.36	212	(212.00)
	2	38.00	82.70	82.70		(68.77)
	3					(22.23)
	Sub-Total	266.00	266.26	266.06	212.00	
LGED	1	1,800.00	454.93	454.93	5.50	(135.00)
	2		388.07	388.07	595.60	(668.90)
	3		578.42	578.42		
	Sub-Total	1,800.00	1,421.43	1,421.43	601.10	
Education Facilities	1	915.00	1,588.91	1,588.91	915.40	(915.00)
	2	615.00	1383.71	1383.71	1389.29	(1392.75)
	3		672.96	672.96		
	Sub-Total	1,530.00	3,645.58	3,645.57	2,304.69	
BIWTA	1	300.00	114.56	114.56		(10.00)
	2					
	3					
	Sub-Total	300.00	114.56	114.56		
BIWTC	1	209.80	113.15	108.60		(108.60)
	2	68.80	81.14	52.70		(52.70)
	3		72.20	7.60		
	Sub-Total	278.60	266.49	168.90		
T&T	1	219.91	219.99	219.99	60.00	(60)
	2	200.00	200.00	200.00	180.00	(180)
	3					(180)
	Sub-Total	419.91	419.99	419.99	240.00	
Post Office	1	20.00	20.00	20.00	1.00	(1)
	2					(5)
	3					
	Sub-Total	20.00	20.00	20.00	1.00	
MoH	1		85.06	85.06	218.58	(218.57)
	2	99.24	86.98	86.98		(170)
	3		64.86	64.86		
	Sub-Total	99.24	236.90	236.90	218.58	
Ctg. WASA	1	24.46	9.46	2.70	2.703	(2.70)
	2					(9.57)
	3					
	Sub-Total	24.46	9.46	2.70	2.70	
CCC	1	399.10	214.42	214.42		(125)
	2	389.43	122.29	122.29		
	3					(2.22)
	Sub-Total	788.53	336.70	336.70		
Mol	1	2,127.20	1,224.50	1,211.90		(52)
	2					
	3					
	Sub-Total		1,224.50	1,211.90	0.00	
Total :	Tk.in Million	11,363.07	12,857.71	13,029.95	6,404.15	
	US\$ Million	299.03	338.36	342.89	168.53	

US \$ 1 = Tk. 38.00

Dg 1 (Dutch Guikder) = Tk. 22.44

Source : Relevant Agency/Department/SMEC's damage assessment report

(**) Contract not yet finalised

Contract Value for reconstruction of Karnafully Bridge = 14.40 million Dutch Guikers

CCC : Chittagong City Corporation

B:JK24.123 SUMMIT WKL

TABLE 1.2
Progress of Reconstruction Works

Agency	Works Priority	Total	Value of Works (Tk. Million)			
			Completed by 30th June 1992 (percent total)		Completed by 30th Sept 1992 (percent total)	
BWDB	1	72.70	72.70	(100)	—	—
	2	561.00	120.00	(21)	144.00	(26)
	3	1,762.10	—	—	352.46	(20)
	Sub-Total	2,395.80	192.70	(8)	496.46	(21)
RHD	1	219.25	101.73	(47)	105.09	(48)
	2	1,498.75	84.76	(16)	97.69	(18)
	3	—	—	—	—	—
	Sub-Total	1,718.00	186.49	(10)	202.78	(11)
BPDB	1	135.20	135.20	(100)	—	—
	2	400.00	—	—	—	—
	3	385.41	—	—	—	—
	Sub-Total	920.61 (**)	135.20	(15)	—	—
B.Railway	1	—	101.42	(37)	—	—
	2	276.62	—	—	2.81	(1)
	3	—	—	—	—	—
	Sub-Total	276.62	101.42	(37)	2.81	(1)
DPHE	1	183.36	175.00	(96)	—	—
	2	82.70	—	—	—	—
	3	—	—	—	—	—
	Sub-Total	266.06	175.00	(66)	0.00	—
LGED	1	454.93	56.20	(12)	—	—
	2	388.07	4.80	—	392.70	(101)
	3	578.42	—	—	—	—
	Sub-Total	1,421.43	61.00	(4)	392.70	(28)
Education Facilities (MoE)	1	1,588.91	137.30	(9)	—	—
	2	1,383.71	—	—	192.15	(14)
	3	672.96	—	—	—	—
	Sub-Total	3,645.57	137.30	(4)	192.15	(5)
BIWTA	1	114.56	10.10	(9)	—	—
	2	—	—	—	—	—
	3	—	—	—	—	—
	Sub-Total	114.56	10.10	(9)	—	—
BIWTC	1	108.60	3.94	(4)	—	—
	2	52.70	—	—	0.25	(0.5)
	3	7.60	—	—	—	—
	Sub-Total	168.90	3.94	(2)	0.25	(0.15)
T&T	1	219.99	29.30	(49%)	—	—
	2	200.00	—	—	1.57	(0.86%)
	3	—	—	—	—	—
	Sub-Total	419.99	29.30	—	1.57	—
Post Office	1	20.00	1.00	(5%)	—	—
	2	—	—	—	—	—
	3	—	—	—	—	—
	Sub-Total	20.00	1.00	(5%)	—	—
MoH	1	85.06	11.08	(5%)	—	—
	2	86.98	—	—	125.00	(74%)
	3	64.86	—	—	—	—
	Sub-Total	236.90	11.08	(5%)	125.00	(74%)
Ctg. WASA	1	2.70	2.13	(79%)	—	—
	2	—	—	—	—	—
	3	—	—	—	—	—
	Sub-Total	2.70	2.13	(37)	0.00	(1)
CCC	1	214.42	100.00	(80%)	—	—
	2	122.29	—	—	120.00	(98%)
	3	—	—	—	—	—
	Sub-Total	336.70	100.00	(80%)	120.00	(98%)
Mol	1	1,211.90	130.80	(11%)	131.50	(6%)
	2	—	—	—	—	—
	3	—	—	—	—	—
	Sub-Total	1,211.90	130.80	(11%)	131.50	(6%)
Total :	Tk.in Million	13,155.74	1,277.45	—	1,665.22	—
	US\$ Million	346.20	33.62	—	43.82	—

US \$ 1 = Tk.38.00

1 Dg (Dutch guilder) = Tk. 22.44

Source : Relevant Agency/Department/SMEC's damage assessment report

(**) P.P. approved for Tk. 920.61 Million

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- vi) Loss or damage due to action of cyclonic winds, including the collapsing of trees, buildings or equipment;
- vii) Damage to department equipment due to flooding;
- viii) Damage to ferry ghats and ferries.

b) Local Government Engineering Department

Feeder Roads

- i) Damage to road embankment and pavement structure caused by water passing over the road surface;
- ii) Breaches in the road embankments caused by wave action or scour.
- iii) Damage to road bridge and culvert structures due to displacement or collapse of abutments or piers;
- iv) Loss of wingwalls, protection works, retaining walls or mattresses;
- v) Loss or displacement of box or pipe culverts;
- vi) Loss or damage due to action of cyclonic winds, including the collapsing of trees, buildings or equipment.

c) Rural Infrastructure - Other than Roads

- i) Damage to growth centre structures due to cyclonic winds and associated flooding;
- ii) Damage to Upazila buildings and existing cyclone shelters, ponds and landing jetties due to cyclonic winds, flying debris and flooding.

d) Pourashavas

- i) Damage to road embankments and pavement structure caused by water passing over the road surface;
- ii) Breaches in the road embankments caused by wave action or scour;
- iii) Damage to road bridge and culvert due to displacement or collapse of abutment of piers;
- iv) Loss of wingwalls, protection works, retaining walls or mattresses;
- v) Loss or displacement of box or pipe culverts;

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- vi) Loss or damage to action of cyclonic winds including the collapse of buildings and related equipment damage and damage caused by falling trees on buildings and equipment;
 - vii) Damage to street lighting, solid waste disposal canals, tubewells, drainage and other municipal services due to cyclonic wind and flooding.
- e) **Chittagong City Corporation**
- i) Damage to Corporation roads, streets, footpaths, bridges, culverts, ferries, drainage systems, well traps, street drainage, embankments and protection works due to water passing over the structures and also prolonged flooding;
 - ii) Damage to Corporation street lighting, solid waste disposal, tree planting, recreation facilities, markets, community centres and other municipal buildings due to cyclonic winds, floodings, flying debris and collapse of adjacent buildings or equipment;
 - iii) Damage or total loss of Corporation trucks, lorries and all other maintenance vehicles and equipment due to cyclonic winds and flood water.
- f) **Chittagong Water Supply and Sewerage Authority**
- i) Damage to water distribution system due to flooding, building collapse and erosion by flooding;
 - ii) Damage to water supply treatment facilities due to cyclonic winds and flooding;
 - iii) Damage to pumping stations, tubewells and elevated storage tanks due to cyclonic winds, equipment failure and flooding;
 - iv) Damage to sewerage reticulation and treatment facilities, including outfalls.
- g) **Inland Water Transport Authority (IWTA)**
- i) Damage to building and civil works of ferry docks and related structures, cargo jetties, passenger jetties, port facilities and pontoons;
 - ii) Loss and damage to navigational aids, hydrographic survey and water gauging equipment;
 - iii) Acquisition of vessels spares to replace the flood damaged equipment;
 - iv) Acquisition of damaged steel lantern buoys, mooring gear, dredger pipe, shore beacons, markers, gauges and recorders;

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- v) Damage to the fleet of vessels owned and operated by the Inland water Transport Authority including damage incurred during subsequent removal of beached vessels;
 - vi) Additional works or equipment required to meet increased demands resulting from the cyclone.
- h) Inland Water Transport Corporation (IWTC)**
- i) Sunk and damaged vessels lying along the bed and banks of Karnafuly river.
 - ii) Damaged or dislocated landing jetty of Karnafuly river.
 - iii) Damaged baily bridge of jetty approach of Karnafuly river.
- i) Ministry of Education**
- i) Damage to primary and secondary school buildings and facilities, resulting from cyclonic winds and flooding;
 - ii) Damage or loss of school equipment due to flooding and building collapses;
 - iii) Damage to playground facilities and fences.
- j) Ministry of Health**
- i) Damage to hospital buildings, accommodation and administration offices including fencing;
 - ii) Damage to hospital services due to building collapses, flooding and flying debris;
 - iii) Damage and loss of hospital equipment and facilities due to building collapse.
- k) Power Development Board/Rural Electrification Board**
- i) Damage to power generation and distribution system including generator installations, transmissions lines, distributions lines and substations, resulting from flooding, the collapse of lines and buildings during the cyclones or as a result of the cyclone;
 - ii) Damage to Power Development Board buildings and other facilities resulting from cyclonic winds and flooding.
- l) Bangladesh Railways**
- i) Damage to Chittagong workshop and store building including roofing and

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stores due to cyclonic winds and flooding;

- ii) Damage to housing due to flooding and cyclonic winds;
- iii) Damage to track between Chittagong Port and main railway line;
- iv) Damage to railway signalling equipment.
- v) Damage to fencing of the workshops & stores.

m) Exclusions

- i) Roads, structures, building and facilities whose condition, even though it may be poor, has not altered significantly because of the cyclone;
- ii) Providing higher standard of infrastructure than existed pre-cyclone, unless it is required as a part of other necessary repairs or rehabilitation;
- iii) Replacing unserviceable roads, structures, building or equipment where their condition is a result of age, lack of maintenance or other non-cyclone related causes.

n) Special Inclusions

- i) Where a length of road is cyclone damaged, and the rest of the road is in poor condition because of non-cyclone related causes, and further where the full economic value of the road will not be realised if only the cyclone damaged portion is rehabilitated, then the full length of damage may be included as cyclone related damage. This will be done on a case by case basis, and not taken as a blanket approval to upgrade long lengths of road where only a small portion is cyclone damaged.
- ii) Where the existing building or facility was in poor condition prior to the cyclone and major repairs are now necessary, the cost of reconstruction or rehabilitation to an adequate standard may be included as damage. This will be done on a case by case basis;
- iii) Where roads, buildings or structures have been damaged after the cyclone, but as a direct result of the cyclone, including subsequent building collapse.

1.3.4 Assessment

Following notification by the World Bank for the Consultant (SMEC) to proceed with the cyclone damage assessment the Consultant obtained all relevant information from Government Agencies relating to the affected area, divisions concerned and responsible officers who would assist with compiling cyclone damaged works.

Questionnaires were prepared by the Consultant and were sent to each of the Government

Agencies requesting details of damage by type, structure, location, order of priority approximate rehabilitation cost. Where appropriate maps showing the location of damaged sites were to be provided.

The questionnaires that formed the basis for discussion and field inspection of the claimed damaged works by the Consultant's assessment teams.

The Consultant fielded assessment teams for each of the functional groups.

Infrastructure	- Roads and Highways Department
	- Local Government Engineering Deptt.
	- Bangladesh Railway
Health and Education	- Ministry of Health
	- Ministry of Education
Energy	- Rural Electrification Board
Chittagong	- Chittagong City Corporation
	- Chittagong Water Supply & Sewerage Authority
Inland Water	- Inland Water Transport Corporation/ Authority



Each assessment team consisted of one expatriate engineer and one local engineer.

The Executive Engineer or equivalent from each of the agencies was invited to join the assessment team to inspect the damage claimed in the questionnaire.

The data from the questionnaire amended as necessary by detailed field inspection was entered into micro-computer based spreadsheets and edited for correctness. The spreadsheet record in separate field, agency, division, damage location, damage type, suggested rehabilitation, priority and estimated cost.

Completed questionnaires for each agency are included in the separate reports for each agency.

a) Water Development Board (BWDB)

The damage assessment for the works of Bangladesh Water Development Board (BWDB) was done by the field officers and personnel. The Executive Engineers of the department compiled the damage and sent to the Chief Engineer, Monitoring & Evaluation of the Board directly with a copy to the respective Superintending Engineer and Chief Engineer. Each of the Executive Engineer of BWDB field Division collected the damage report from the Sub-Division Engineers.

Damage caused by the cyclone 1991 to the infrastructure of the Water Development Board was of very high. Damage occurred for the following:

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- i) Embankments
 - ii) Sluices at the outfall of drainage channel of coastal embankment project, Chittagong, same to Khulna and Barisal.
- Regulators at the intake of irrigation canals Muhuri Irrigation Project, Chandpur Irrigation Project and Bhola Irrigation Project.
- iii) Bridges and Culverts of the Inspection roads of BWDB and over the irrigation canals.
 - iv) Protective works of the embankments, where those are exposed to the sea or faces the wave action and bank erosion. Protective works of the hydraulic structure also were damaged.
 - v) Spurs were damaged due to surge pressure & tremendous wave thrust.
 - vi) Source of the River closures were affected by surge pressure.
 - vii) Some of the drainage channel were silted up as a result of inundation due to cyclone surge and deposition of silt.
 - viii) Flap gates of sluice.
 - ix) Boundary walls sluice gasrd shets, Tinsheet etc.

b) Department of Public Health Engineering

The Executive Engineer, Programme and Co-ordination Division, Dhaka collected the damage report from the field divisions of cyclone affected area of the department in specified forms and compiled. The compiled report the Executive Engineer was transmitted to Chief Engineer, DPHE. The field divisions of the department have their own field staff who assessed damage after field inspection and proper survey.

1.3.5 Rehabilitation Programme

The rehabilitation programmes for each agency are divided into categories by the consultant with discussions of the departments.

- | | |
|--------------|---|
| Priority - 1 | Work of an immediate nature and economic and social priority which should be carried out immediately and be completed before the end of June 1992. |
| Priority - 2 | Works of an urgent nature which should be carried out within the next two years and for which a shortened technical preparation and procurement process is necessary for the works to be completed in time. |

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Priority - 3

Other works for which completion may not be expected before June 1993.

Following comments were made by different departments on the assessment made by SMEC

a) Chittagong City Corporation

The Chief Executive Officer CCC (Chittagong City Corporation) expressing some concern at the prioritising of some of the road projects. It is the Consultants view that any expansion of the Priority-1 works will over stretch the capacity of contractors to carry out the work programme by the end of June 1992.

b) Roads & Highways Department

Correspondence from the Additional Chief Engineer, RHD, Planning and Development, to the Chief Engineer, RHD, was issued to clarify to the CE that some projects had not been assessed as damage as they are included for rehabilitation under existing or planned projects and secondly that the Consultant was still awaiting reports from the filed before any assessment could be made on the RHD ferry circle. These reports have since been received, assessed and included in the final report.

c) Local Government & Engineering Department

- i) The assessment of LGED and CCC be combined into a common report with sub-section for each sector since both LGED and CCC fall under the same ministry with respect to funding. The sectors are presented in separate reports as per the TOR.
- ii) LGED have expressed concern that the assessment has not allowed a sum of money for full reconstruction of some roads connecting growth centres. The Consultant has used his discretion under the assessment guidelines to arrive at the damage assessment amount.
- iii) LGED feel that the amount allowed for reconstruction of growth centres is insufficient. The Consultant has stated in the report that the pre-cyclone condition of many of the centres contributed to the degree of damage and has made the assessment accordingly.
- iv) The Consultant has made some suggestions in the report regarding the construction of earth mounds or "killas" as possible cyclone shelter sites and focal points for community development. LGED have rightly stated that there is an allowance in the assessment for construction of these mounds and has suggested that these "killas" might be constructed under bilateral food aid (i.e., Australian, EEC).

The Consultant has purposely omitted any costing for the construction of the mounds (Killas) as they will only be useful if they form part of the overall cyclone shelter initiatives which are part of the Cyclone Shelter Task Force

Terms of Reference and which allowance for construction ought to be included in that report if adopted.

- v) LGED have queried the Consultants recommendation for smaller 2-3 tonne vibrating drum roller and have requested larger 5-7 tonne rollers. The Consultant has chosen smaller units as more units can be purchased for the same amount, and they can be readily transported on small relatively inexpensive tilt bed trailers or trucks to the various islands and around the districts where it is proposed they will be used. Larger units will require expensive low loaders for transporting and load limitations on many of the bridges may restrict their movement.

1.3.6 Multi Purpose Cyclone Shelters

The government formed a task force to investigate the feasibility of using cyclone shelters as multipurpose structures incorporating schools and medical facilities and constructing more cyclone shelters in the cyclone prone area. The consultant has studied in detail and recommended for constructing 2,500 nos. new shelters with a capacity of 1,750 persons by year 2,000 under Multipurpose Cyclone Shelter Project (MCSP) in the southern coastal part of Bangladesh (High Risk Area - 8,093 sq. km in 44 thanas with a population 5.2 million).

Presently there are 132 coastal community Centre, construction in sixties, 238 three stories PWD type constructed in seventies need repair of doors and windows.

1.4 Persons/Officials Involved in Damage Assessment and Reconstruction Works

During collection of information/data/accounts regarding 1991 cyclone, the following persons/officials were contacted :

a) Bangladesh Water Development Board

- Chief Engr., Monitoring & Evaluation, BWDB, WAPDA Bhaban, Dhaka
- Chief Engineer, FFW schemes, Elite House WDB, Dhaka,
- Superintending Engineer, Food for Work, BWDB, Dhaka,
- Superintending Engineer, Monitoring-I, BWDB, Dhaka,
- Superintending Enr, Design & Planning Schemes-I(DPS-I),BWDB, Dhaka,
- Superintending Engineer, Planning General, BWDB, Dhaka,
- Superintending Engineer, Food for Work, BWDB, Dhaka,
- Executive Engineer, Monitoring & Evaluation Division-I,BWDB, Dhaka,
- Executive Engineer, Food for Work Scheme, BWDB, Dhaka
- Executive Engineer, DPS-I, BWDB, Dhaka,
- Executive Engineer, Monitoring-I, BWDB, Dhaka,
- XEN, Planning General, BWDB, Dhaka,
- Executive Engineer, Chittagong O&M Division-II,BWDB,Dhaka, and
- Executive Engineer, Cox's Bazar Cyclone rehabilitation Division
- Dy.Director, Technical,Cox's O&M Division,BWDB,Cox's Bazar.
- Exec.Engr.,Office of the CE.,Monitoring-I, WAPDA Bldg.BWDB,Dhaka.

b) Roads and Highways Department

- Chief Engineer, RHD, Dhaka,
- Additional Chief Engineer, RHD, Dhaka;
- Additional Chief Engineer, Planning, RHD, Dhaka,
- Superintending Engr., ODA-Bridge Project and Authorised Officer;
- Executive Engineer, Progress Division, Dhaka,
- Executive Engineer, Planning, RHD, Dhaka, and
- Assistant Engineer, Progress Division, RHD, Dhaka.

c) Local Government Engineering Department

- Superintending Engr., Plan. (Engr. Monwar H. Chowdhury), LGED, Dhaka;
- Habibur Rahman Akond, Senior Consultant, LGED, Dhaka;
- Executive Engineer, Planning, (Engr. Shoroj Kumar), LGED, Dhaka;
- Shailender Nath, Project Director, Project-10, LGED, Dhaka;
- Assistant Engineer, Project-10, LGED, Dhaka;
- Executive Engineer, Training Programme, LGED, Dhaka
- Executive Engineer, LGED, Cox's Bazar District; and
- Executive Engineer, LGED, Bandarban District.
- Asstt. Engineer, (Mr. Morfique), Progress Cell, LGED, Dhaka,

d) Education and Facilities Department

- Director General, Primary Schools, Directorate of Education, Dhaka,
- Director, Facilities Department, Dhaka;
- Joint Secretary, MOE (Sheikh Motiur Rahman)
- Deputy Secretary, MOE, (Resina Akhter)
- Executive Engineer, Facilities Department, Dhaka; and
- Assistant Engineer, Facilities Department, Dhaka.

e) Department of Public Health Engineering (Health Facilities)

- Superintending Engineer, Planning, Department of Public Health Engineering, Dhaka; and
- Executive Engineer, Planning & Co-ordination Division, Department of Public Health Engineering,

f) Power Development Board and Rural Electrification Board

- Superintending Engineer, Directorate of Project Planning, PDB, Dhaka;
- Superintending Engineer, Metropolitan Circle, PDB, Chittagong
- Project Director, Greater Chittagong, PDB, Chittagong
- Superintending Engineer, Barisal Circle, PDB, Barisal
- Superintending Engineer, Khulna Circle, PDB, Khulna
- Director General Diesel Powerstation, Ramna Bhaban, Dhaka
- Deputy Director, Diesel Power Generation.
- Director Electrical Equipment and Project Co-ordinator, BPDB; and

- Executive Engineer, Directorate of Programme, BPDB, Dhaka;
- Director Finance, REB, Dhaka
- Deputy Director, Finance, REB, Dhaka

g) Public Works Department, PWD

- Superintending Engineer, Co-ordination Circle, PWD, Dhaka;
- Superintending Engineer, Development Circle, PWD, Dhaka; and
- Assistant Engineer, Coordination Circle, PWD, Dhaka.

h) Ministry of Health/Directorate of Health

- Chief Planning Officer, MOH
- Deputy Chief Planning Officer, Ministry of Health;
- Project Director, MM Roy
- Deputy Secretary, Hospitals
- Assistant Chief Planning Officer, Ministry of Health;
- Assistant Secretary, Ministry of Health;
- Research Officer, Ministry of Health;
- Deputy Director, Directorate of Health, Mohakhali, Dhaka; and
- Officer-in-Charge of Control Room, Directorate of Health Mohakhali, Dhaka.

i) Ministry of Finance

Implementation and Monitoring and Evaluation Division

- Director, (Mr. M.A. Bashar) IMED, Dhaka
- Deputy Director (BWDB works), Dhaka
- Deputy Director, Education, Dhaka
- Asstt. Director (BWDB Works), Dhaka
- Asstt. Director, co-ordination, Dhaka

j) Ministry of Industry

Mr. Aminul Islam, Dy. Chief, Ministry of Industries.

Export Processing Zone

- Deputy General Manager, Investment Promotion
- Chief Engineer, BEPZA
- Joint Chief, Planning Commissions Industry Wing, Dhaka.

k) Telephone and Telegraph Department

- General Manager, Planning
- Director Maintenance and Operation
- Project Director, Directorate of Building and Construction
- Divisional Engineer

to

l) Chittagong Water Supply and Sanitary Engineering Authority

- Chairman, Chittagong WASA
- Chief Engineer

m) Chittagong City Corporation

- Mayor Chittagong City Corporation
- Chief Engineer, CCC
- Project Director, CCC
- Chief Accounts Officer, CCC



p) Other Persons Contacted

i) ADB:

- Engineer Taluker, Asian Development Bank;
- Engineer Nurul Huda, Asian Development Bank; and
- Mr. Parvez, Mission Secretary

ii) Consulting Firm:

- Engr. Jafar, Snowy Mountainous Engineering Corporation (SMEC)
- Engr. Md. Abdul Aziz, Director, Bangladesh Consultants Ltd. (BCL)

q) Workshop/Meeting attended

- Disaster Management in Bangladesh - arranged by Bangladesh Development Partnership Co-operation (BDPC); and
- "Flood Action Plan - Team Leaders Months Review Meeting" - arranged by the Chief Engineer, Flood Plan Co-ordination Organisation (FPCO).
- One day Workshop on "Compartmentalisation Pilot Project" (FAP-20) arranged by the Project Director, CPP, Tangail
- Two days' workshop on Flood Modelling Management (FMM), a component of FAP:25 at FAP:25's Office, Gulshan, Dhaka on 9.2.93 and 11.2.93.

CHAPTER 2

2. EXTENT OF DAMAGE TO INFRASTRUCTURE

The extent of damage due to Cyclone 1991 was extremely high. Besides the loss of human life and death of cattle and livestock, there were losses/damage to other sectors of the national economy:

- Physical Infrastructure
- Socio-economic Infrastructure
- Crop Agriculture
- Industry

An overall assessment of the cost of repairing the damage to infrastructure has been made and is shown for Tk. 167,025.95 Lac on Table 2.1 using estimates prepared by the different Departments, SMEC, UNCRD, BWDB & DPHE.

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TABLE 2.1
Cyclone Damage to Infrastructure

Sl. No.	Sector	Estimated Cost of Damage Repair (Tk. Lac)	Estimated Cost of Damage Repair (US \$ Million)	Remarks
01.	Embankment (BWDB)	36,343.60	99.57	
02.	General Infrastructure:			
a)	Major Roads (RHD)	13,806.29	37.83	
b)	LGED	14,214.32 *	38.94	
c)	Chittagong City	3,367.03	9.22	
d)	Chittagong Water Supply	94.58	0.26	
e)	Inland Water Transport:			
i)	BIWTC	2,310.48	6.33	
ii)	BIWTA	991.00	2.72	
f)	Education	25,067.19	68.68	
g)	Health Facilities	1,320.84 *	3.62	
h)	Electricity (PDB+REB)	7,712.10	21.13	
i)	Railway	997.30	2.73	
03.	Other Infrastructure:			
a)	Rural Drinking Water (DPHE)	981.19	2.69	
b)	Ministry of Civil Aviation			
c)	Post and Telecommunication	44,950.00	123.15	UNCRD (estimate) seems to be very high)
04.	Chittagong Port Authority	14,670.03	40.19	UNCRD (estimate seems to be very high)
05.	Others (Industry)	200.00	0.55	
	Total	167,025.95 *	457.61	

Source : BWDB, DPHE, SMEC and Cyclone Damage in Bangladesh (UNCRD, 1991).

* Since corrected

US \$ 1 = Tk. 36.50

A:\UK24\123\Tab2-1.Wk1

CHAPTER 3

DAMAGE ASSESSMENT AND RECONSTRUCTION

3.1 General

The donor response to 1991 Cyclone damage was co-ordinated initially by the World Bank Resident Mission (WBRM). Many donor countries came forward to help Bangladesh with the reconstruction of the infrastructure, which was divided into the following sectors :

- Embankments
- General Infrastructure
- Other Infrastructure
- Chittagong Port
- Industry

The donors directly concerned with sector a), c), d) and e) works arranged with their Consultants to verify GOB assessments. The damage assessment of the b) sector works was undertaken by Snowy Mountains Engineering Corporation Ltd. (SMEC) on behalf of many donors. SMEC divided the works to be undertaken into three categories considering the urgency of the works:

- Works to be undertaken by 31st May/92 (Priority - 1)
- Works to be undertaken by 31st May/93 (Priority - 2)
- Works to be undertaken as part of normal rehabilitation programme and extension on buffer stock, if there be any requirement (Priority - 3)

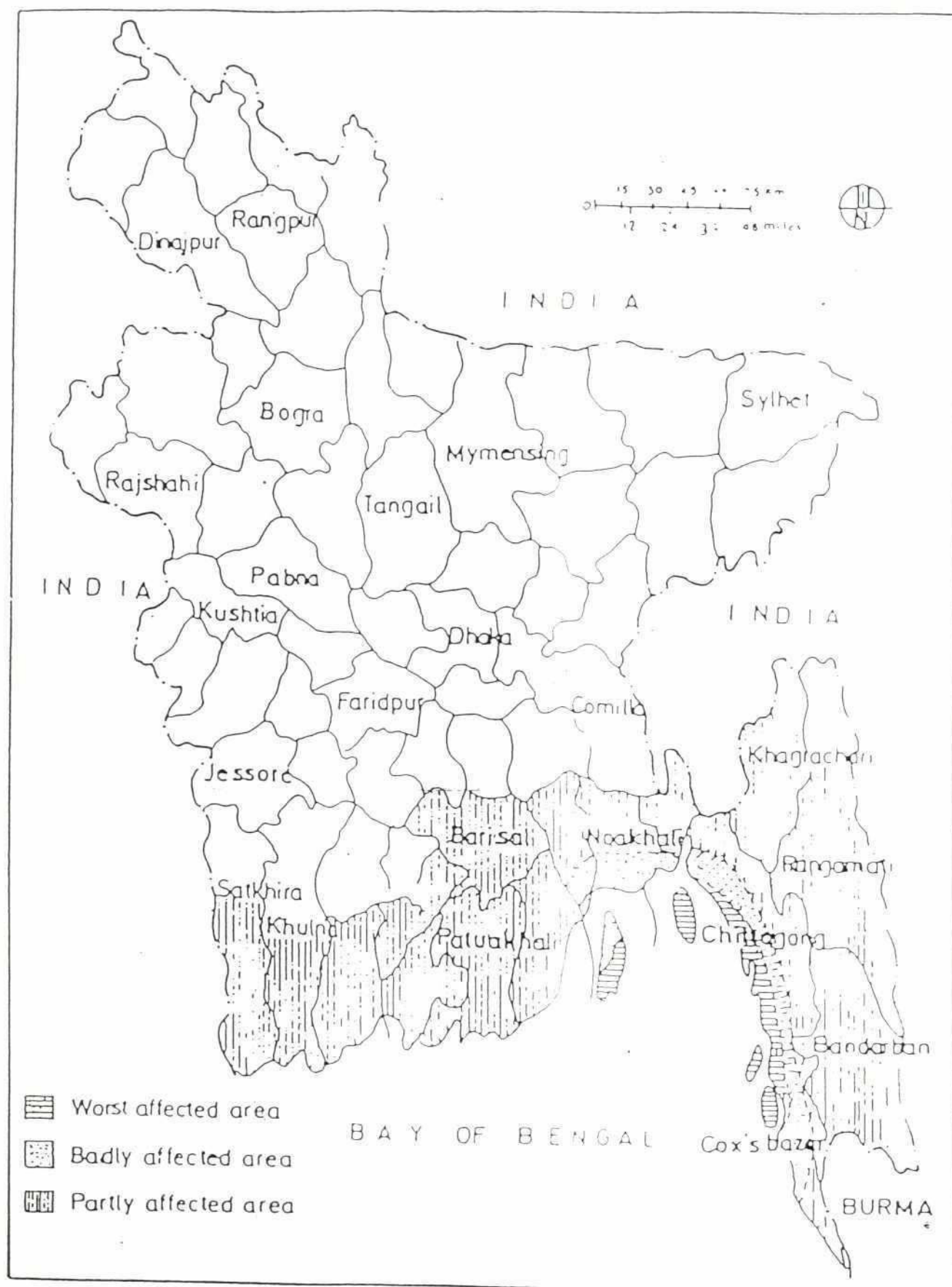
3.2 Departmental Responsibilities

The Departments which are to undertake reconstruction of their infrastructure are follows:

- a) Embankment Works
 - Bangladesh Water Development Board (BWDB)
 - Priority Repair
 - Long Term Rehabilitation and Strengthening.
- b) General Infrastructure
 - Roads and Highways Department
 - Major Roads
 - Bridges and Culvert
 - Equipment.
 - Local Govt. and Engineering Department (LGED)
 - Feeder Roads
 - Rural Infrastructure
 - Paurashavas

Figure: 2.1

29-30 April 1991 Cyclone Affected Areas



- 18
- Chittagong City Corporation
 - Pavement
 - Bridges
 - Equipment
 - Local Govt. Facilities
 - Chittagong Water Supply (Chittagong WASA)
 - Inland Water Transport Corporation
 - Ministry of Education/Directorate of Education
 - Building
 - Facilities
 - Ministry of Health/Directorate of Health and Family Planning
 - Electricity Department (PDB+REB)
 - Bangladesh Railway
 - Public Works Department
- c) Other Infrastructure
- Department of Public Health Engineering
 - Rural Drinking Water Supply and Sanitation
 - Shallow Tubewells
 - Deep Tubewells
 - Sanitation
 - Facilities
 - Department of Civil Aviation
 - Air Traffic Control System
 - Ground Facilities
 - Telecommunication Department (T&T Deptt)
 - Replacement of Microwave Tower etc.
- d) Chittagong Port:
- Chittagong Port Authority
 - Salvage Operation
 - Navigation Aids
 - Rehabilitation of Fenders Berths etc
 - Cargo handling Equipment
 - Engineering Services.
- e) Industries
- Various industries in Chittagong Export Processing Zone.

3.3

BWDB Embankments and Related Structures

In 1958, the Government of East Pakistan initiated a programme of embankment construction through the Irrigation Department in an effort to increase rice production. Initially, the embankments were constructed along river banks or around beels or low lying cultivable areas so that during floods, water would not inundate the crops. Early successes lead the East Pakistan Water and Power Development Authority (EPWAPDA) to employ International Engineering Company (IECO) to undertake engineering feasibility studies. IECO reported in favour of constructing 4,500 km of perimeter dykes and 5,200 nr. pipe sluices to provide protection from saline intrusion for the coastal area (IECO, 1960). In 1962, EPWAPDA engaged Leedshill-De-Leuw Engineers (LDL) to prepare detailed designs for the project. The majority of the present embankments in the coastal areas were constructed between 1962 to 1971 under the Coastal Embankment Project (CEP) which was engineered by LDL.

The primary purpose of the project was to increase agricultural protection by protecting some 14,000 km² (3.5 million acres) from saline intrusion by constructing earth embankments, together with appurtenant structures (drainage sluices, surface sluices). The embankments, however, were not designed to prevent overtopping or to resist storm surges in the main path of a cyclone.

There are three different types of embankments, sea dykes, interior dykes and marginal dykes. Their dimensions are shown in Table 3.1. The sea dykes are provided where the embankments are exposed to the Bay of Bengal or major rivers. The interior dykes are provided where embankments are exposed to rivers and the marginal dykes are provided along the river banks in interior areas to prevent the intrusion of saline water in the polder areas. The height of the embankments was fixed with respect to the highest spring tide level to which a freeboard was added. There were no considerations of degree of exposure to wave action. In recent years, sea dykes at some vulnerable areas have been protected by placing concrete blocks on the sea/river side.

TABLE 3.1
Geometric Dimensions of Coastal Embankments

Type of Embankment	Slope		Crest width (m)	Minimum freeboard (m)	Set back (m)
	Country side	River side			
Sea	2:1	7:1	4.5	1.9	85
Interior	2:1	3:1	4.5	1.2	60
Marginal	2:1	2:1	2.8	1.0	40

a) **Coastal Areas affected by the Cyclone of 1991.**

The CEP extends from Satkhira, the Raymongal estuary at the border of India, to Cox's Bazar. In all, 92 polders are enclosed by a total of 4,000 km (2,500 miles) of embankment. An area of about 14,000 km² is protected. The cyclone of 1991 affected the coastal districts of Chittagong, Cox's Bazar, Bandarban, Rangamati, Noakhali, Laxmipur, Patuakhali, Barisal, Barguna, Bagerhat, Khulna and Satkhira. There are about 2,500 km of embankments within these districts protecting 8,440 km² in some 59 polders, with 650 sluices. Figure 3.1 shows the location of these polders and the affected areas.

b) **Damage to Embankments and Structures**

CEP embankments were designed to prevent flooding of land at high tide. Their crest were set to provide three to five feet freeboard above maximum spring tide level. The cyclone had a devastating effect on the embankments and associated structures, especially those facing the sea. During the cyclone, the surge overtopped the embankments of Chittagong and Cox's Bazar districts and thereby caused breaches and washing out at some places. Some appurtenant structures were washed out or badly damaged. The damage was highest in the districts of Chittagong and Cox's Bazar. The intensity of damage in different districts in decreasing order was:

Highest : Chittagong (Banskhali, Sandwip and Anawara), Cox's Bazar (Kutubdia, Sonadia, Moheshkhali, Chokoria) Noakhali, Bhola.

Lowest : Patuakhali, Laxmipur, Barguna, Feni, Bandarban, Rangamati, Barisal, Bagerhat, Khulna and Satkhira.

Preliminary damage assessments by BWDB are presented in Table 3.2 where the cost of reconstruction is shown as Tk. 36,343.60 Lac. Full or part damage indicates portions of embankments that have completely or partially washed away. For that structures, full damage indicates those will have to be replaced, while part damage indicates they may be reconstructed.

Division-wise damage to BWDB infrastructure is presented in Table 3.3. Damage in Chandpur district (Chandpur O&M Division) appears very high, this may due to the addition of the cost of the town protection work resulting from the 1988 flood to the cyclone damage reconstruction costs.

c) **Nature and Causes of Damage**

In general, damage was caused by overtopping of the surge water at the time of impact and the suction force at the time of backflow. The other observed causes of failure or breach were :

- i) overtopping by surge water resulting in erosion of country-sideslope leading to breach in embankment;
- ii) poor quality of earthwork construction without proper compaction;

TABLE 3.2

BWDB : Damage to Infrastructure following 1991 Cyclone

Sl. No.	Description of Main Infrastructure	Unit	Quantity Built (1)	Damage		Damage (Tk. Lac)	Percentage of damage to total cost (2)
				Full	Part		
01.	Embankment	km	2500	436.00	990.00	13,900.20	38.20
02.	Sluice	nr.	650	83.00	376.00	4,276.18	11.80
03.	Bridge/Culvert	nr.	--	17.00	32.00	269.00	0.70
04.	Protective Work	km	--	45.07	31.05	14,379.63	39.60
05.	Spur	nr.	--	114.00	--	84.00	0.20
06.	River Closure	nr.	--	6.00	--	21.50	0.10
07.	Drainage Channel	km	--	--	973.58	1,086.50	3.00
08.	Flap gate	nr.	--	519.00	--	161.60	0.40
09.	Building	nr.	--	427.00	--	451.00	6.00
10.	Tin shed	nr.	--	337.00	--	557.75	
11.	Boundary Wall	m	--	6,784.00	--	165.60	
12.	Others	L.S.	--	--	--	990.64	
Total Cost :						36,343.60	

Source : Bangladesh Water Development Board (May 1992)

(1) Quantity built : Report of LDL (1968)

(2) Report of Task Force of IEB

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BWDB : Divisionwise Assessment of 1991 Cyclone Damage

Source: Bangladesh Water Development Board.
 Durrat-Durra 1970

- iii) use of inappropriate fill material and poor turfing;
- iv) lack of proper maintenance;
- v) tree plantation on the slope of embankment resulting in the formation of cavities in the embankment due to the spreading of the trees roots;
- vi) sea erosion due to wave action at normal spring tides ; and
- vii) inadequate embankment section due to erosion from rain due to the lac of maintenance.

d) Reconstruction

From BWDB assessments, the cost of repair was calculated at Tk. 36,343.60 Lacs. It is observed that the maximum damage was caused to embankments, protection works and to embankment being 39.60% and 38.20% respectively, in comparison to other items. Immediately after the cyclone, the reconstruction of the embankments started under Food For Works (FFW) schemes as emergency repairs. With the commencement of the works under FFW, people of the locality who had lost everything, could find a source of income.

The major reconstruction programme was phased as part A, B and C and is presented in Table 3.4. The works which were programmed to be undertaken immediately, as being of an emergency nature, were grouped in 'A.' The execution of the 'A' works was to be completed by June, 1992 at a cost of Tk. 727.00 Lac. Details are presented in Tables 3.5 and 3.6.

The 'B' works, valued at Tk. 5,610.00 Lac, have commenced and may be considered 'middle term' and are scheduled to be completed by end June 1993. The works are in Cox's Bazar district and were 24% complete by the end of August 1992.

The 'C' works are long term reconstruction and comprise eight ICB contract packages. Work orders for all have been issued. The works are located at Sandwip, Patenga North, Patenga South, Naval Academy, Anwara, Banshkhali, Chokoria and Sitakunda in Chittagong district. The total cost is Tk. 22,217.65 Lac and it will be financed by IDA, EEC and Japan. (¥ 2,700 Million). Details are presented in Table 3.7.

The total reconstruction work taken up is valued at Tk. 28,491.74 Lac which is about 78% of the total cost of the damage. Work completed by June, 1992 was valued at Tk. 1,927.00 which is only 5% of the total.

Part of the works were carried out under FFW and account of these will be furnished after collection of the information.

e) General Comments and Recommendations

- i) The embankments were constructed without any compaction and the fill materials were not selected. Although the embankments were not designed to resist storm surges, for their safety especially that of the sea-facing embankments, they should be constructed using machine compaction.

BWDB : Status of Reconstruction Works following Cyclone 1991
 (as programmed)

Cost : Tk.in Lac						
Category of work	Cost of Rehab. of the work	Cost of completed work till July/92	Donor		Cost of remaining work	Remarks
			GOB	FC Compt		
PART - A						
Cyclone damage work taken up on emergency basis	727	727	72,720	0		Work completed
PART - B						
Cyclone damage work of Cox's Bazar area only .	5,610	1,200		Saudi grant (50 Million Saudi Rial)	4,800	Embankment 66.70 km Prot.work 0.80 km Sluice const 10 Nos. Sluice repair 3 Nos.
Polder no.64/xc, 66/3, 69 and 71.						Bldg.repair & tree plant Total estimated cost is 5610 lac Schedule to be completed by 1993
PART - C						
Construction of Embankment, embankment protection work and construction of hydraulic structure at Sandwip, Potenga North, Potenga South, Naval Academy, Anwara, Banshkhali, Chokoria and Sitakunda in Chittagong district	22,155	--		¥ 2,700 Mil. IDA, EEC & Japan	22,155	IDA, EEC & Japan Govt. ¥ 2,700 Million Yen
Total	28,492	1,927			4,800	Rehab. work complete 5.30% of the total damage & 6.75% of the programme

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TABLE 3.5

BWDR : Componentwise Status of Reconstruction Works (Part-A) executed during 1990-1991 & 1991-1992

Sl. No.	Items	Unit	According to P.P.			Progress up to June 1991			Progress during 1991-1992			Cumulative Progress upto June 1992		
			Phy. Qty.	Estimate Cost	Weight	Financial	Physical % of Compt.Qty.	Physical % of Weight	Financial	Physical % of Compt.Qty.	Physical % of Weight	Financial	Physical % of Compt.Qty.	Physical % of Weight
01.	Breach/Cut/Repair	No.	53.00	138.58	0.190	41.12	51.00 (96.23%)	18.28	108.56	2.00 (3.77%)	0.71	149.68	53.00	18.99
02.	Repair/Reconst. of Embk.	Km	29.95	84.73	0.116	0.00	0.00	0.00	84.73	29.95 (100%)	11.60	84.73	0.00	11.60
03.	Supply/Repair of Flap Gate	No.	468.00	87.68	0.120	62.90	157.00 (33.55%)	4.02	39.28	307.00 (65.60%)	7.87	102.18	464.00	11.89
04.	Repair of Building	No.	230.00	165.23	0.227	19.01	15.00 (6.52%)	1.48	107.90	139.00 (60.43%)	13.71	126.91	154.00	15.19
05.	Regulator/Sluice	No.	9.00	60.44	0.087	0.00	0.00	0.00	70.44	11.00 (122%)	10.61	70.44	11.00	10.61
06.	Protection Work	km	2.50	42.85	0.058	0.00	0.00	0.00	42.85	2.54 (100%)	5.80	42.85	2.54	5.80
07.	Construction of Spur	No.	31.00	33.00	0.045	0.00	0.00	0.00	33.00	30.00 (96.77%)	4.35	33.00	30.00	4.35
08.	Jetty Repairing	No.	1.00	14.00	0.019	0.00	0.00	0.00	16.00	1.00 (100%)	1.90	16.00	1.00	1.90
09.	Dredger Equip. Repairing	No.	2.00	28.00	0.038	8.00	2.00 (100%)	3.80	20.00	0.00	0.00	26.00	2.00	5.80
10.	Wireless Set & Antingauge	No.	11.00	5.00	0.009	0.00	11.00 (100%)	0.90	4.42	0.00	0.00	4.42	11.00	0.90
11.	Boundary Wall Reconst.	Metre	3,000.00	21.69	0.029	0.00	0.00	0.00	21.69	1,770.00 (59.00%)	1.71	21.69	1,770.00	1.71
12.	Others	No.	L.S.	45.80	0.062	10.78	L.S.	0.00	36.32	L.S. (102%)	6.32	47.10	0.00	6.32
Total				727.00		141.81			585.19			727.00		

TABLE 3.6

BWDB : Division-wise Reconstruction Works executed during 1990-91 & 1991-1992 FY

Name of BWDB Division with Polder	Embankment Qty. (Km)	Protective		Structure		Branch/Cut		Spur		Building		M.S. Cms		Jetty		Dred. Equipmt		Gauge		B. Wall		Cost Tk. in Lac					
		Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Others		Total			
		(Km)	(Tk)	(Km)	(Tk)	(No)	(Tk)	(No)	(Tk)	(No)	(Tk)	(No)	(Tk)	(No)	(Tk)	(No)	(Tk)	(No)	(Tk)	(No)	(Tk)	Qty.	Cost	Qty.	Cost	(Tk)	(Tk)
Chittagong O&M-1																											
Polder No.62		0.24	2.26			5.00	39.18					18.00	4.00									L.S.	0.50			45.94	
BWDB Colony										1.00	1.00															1.00	
Chittagong O&M-2																											
Pol No. 61/1, 61/2, 63/1A, 64/1A, 64/2A, 72, 64/1B, 64/1C.				3.00	30.00	6.00	5.91			17.00	40.02	87.00	26.30													115.81	
Cox's Bazar O&M																											
Pol No. 66/3, 66/4, 66/1, 66/2, 68, 64/2B, 65, 70, 65/A, 71, 69/B1, 69/C1, 64/2A.		L.S.	25.73	39.00	91.49	31.00	33.00			39.00	39.65	204.00	11.96	1.00	14.00											236.18	
Kapali O&M		0.05	0.20																								
RCC, Kumarichar										79.00	42.86																55.44
KDP/Mednaghat/Marudpur/Chandnighat/Rangunia/Rangmat Colony																											
Mahuri O&M																											
Charipur/Somgaol/Char Khonz Colony										2.00	2.00																3.24
Mahuri MB																											
Feni Raguhior										1.00	2.30																2.30
Laxmipur O&M																											
Older No.59/2, Tombgaj, Dalabazar										6.00	1.20	24.00	4.42														7.50
Nakhal O&M																											
Pol No. 73/2, 59/1A, 1B, 3B, 63/1A, 64/173/1A, 1B, 73/2, 60		0.64	19.19	1.25	5.20	2.00	0.14			4.00	12.86	135.00	41.00														78.39
Bhola WD-1																											
WDB Colony										7.00	1.78																2.00
Bhola WD-2																											
WDB Colony										10.00	1.06																2.00
Barisal WD-2																											
Gourmadi Colony										3.00	0.60																1.00
Jhalakati WD																											
WDB Colony										16.00	1.43																2.00
Barisal O&M																											
Sagardi Colony										1.00	0.18																6.00
Patukhali O&M																											
Colony Patukhali/Gulchips										13.00	6.00																7.00

Name of BWDB Division	Embankment		Protective		Structure		Breach/Cut		Spur		Building		M.S. Cms		Jetty		Dred. Equip		Gauge		B. Wall		Others		Total
	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	
with Polder	(Km)	(Tk)	(Km)	(Tk)	(No)	(Tk)	(No)	(Tk)	(No)	(Tk)	(No)	(Tk)	(No)	(Tk)	(No)	(Tk)	(No)	(Tk)	(No)	(Tk)	(No)	(Tk)	(No)	(Tk)	(Tk)
Barguna O&M																									
Colony/Barguna/Pathargama																									
Amraol																									
Dredger Directorate																									
Madan ghat, Chitra gong																									
CAI(Hydrology), Dhaka																									
Chirga, Lama, Sandwip																									
Hatia, etc																									
MB Division																									
Kapal																									
Amra Research																									
Amra																									
Khulna O&M-1																									
Polder No.27/1, 28/2,	6.00	9.81			1.00	3.00																			
Bankpur-Dighulia																									
Proj. Barnal-Salimpur																									
KBK project																									
Khulna O&M-2																									
Polder No.32,10/12	9.00	22.23			1.00	5.00																			
Satkhira O&M-1																									
Poder No.3,5,15	8.04	19.71																							
Satkhira O&M-2																									
Polder No.4,7/1,7/2,14/1	6.22	13.59	1.05	9.66																					
Ba gharihat O&M																									
Poder No.35/1,34/3,35/1,35/3					1.00	20.00	3.00	2.00																	
Total Civil Works	29.95	84.73	2.54	42.85	9.00	60.44	53.00	136.58	31.00	33.00	230.00	165.23	468.00	87.68	1.00	14.00	2.00	28.00	11.00	5.00	0.00	21.69	45.80	727.00	

Source: P.P. for rehabilitation and reconstruction of Coastal Embankment Project : Part-A

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TABLE 3.7
BWDB : Long Term Reconstruction Works (Part 'C')

Contract No.	Location	Description of Works	Contract Value (Tk. Lac)	Local/ GOB/RPA (Tk. Lac)	F.C. Component (Tk. Lac)	Exchange Rate 1 US \$ = Tk.
a. Civil Works						
1	Sandwip	Embankment	1,639.80			
		Hyd.Struct.	603.44			
		Preliminaries	221.46			
		Prov.Sums	178.82			
		Sub-Total	2,643.52	2,260.19	383.33	38.85
2	Potenga North	Embankment	1,846.02			
		Hyd.Struct.	1,017.47			
		Preliminaries	133.20			
		Prov.Sums	148.84			
		Sub-Total	3,145.53	2,520.97	624.56	38.93
3	Potenga South	Embankment	1,613.97			
		Hyd.Struct.	198.88			
		Prot.Works	1,406.94			
		Preliminaries	101.89			
		Prov.Sums	31.85			
Sub-Total	3,353.53	1,712.64	1,640.90	38.93		
4	Anwara	Embankment	1,422.15			
		Hyd.Struct.	4.00			
		Prot.Works	719.32			
		Preliminaries	136.70			
		Prov.Sums	19.44			
Sub-Total	2,301.61	1,882.26	419.35	39.06		
5	Banskhali	Embankment	2,285.25			
		Hyd.Struct.	113.49			
		Preliminaries	372.00			
		Prov.Sums	47.30			
		Sub-Total	2,818.04	2,397.00	421.00	39.06
6	Chokoria	Embankment	1,201.30			
		Preliminaries	230.80			
		Prov.Sums	14.39			
		Sub-Total	1,446.49	1,263.49	183.00	38.85
		7	Sitakunda	Embankment	484.34	
Hyd.Struct.	150.23					
Preliminaries	89.59					
Prov.Sums	46.20					
Sub-Total	770.36			655.57	114.79	N.A.
8	Naval Academy	Embankment	1,082.58			
		Hyd.Struct.	39.53			
		Preliminaries	70.00			
		Prov.Sums	13.01			
		Sub-Total	1,205.12	1,205.15	0.00	
Sub-Total "a"			17,684.20	13,897.27	3,786.93	
b. Land Acquisition			1,490.00	1,490.00	0.00	
c. Transport Vehicle			36.00	36.00	0.00	
d. Consultancy			1,100.00	0.00	1,100.00	
e. Manpower			711.10	711.10	0.00	
f. Project Over Head			386.43	386.43	0.00	
g. Head Quarter Over Head			425.76	425.76	0.00	
h. Allowances for unacc cost			384.16	384.16	0.00	
Total (a - h)			22,217.65	17,330.72	4,886.93	

BWDB/1/JAN/2008-C/002



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- ii) A programme should be taken up to plant trees on the berm of the sea/river side of the embankments. Tree plantation on the slope of the embankment should be stopped. If possible, the existing trees should be removed and a re-construction programme for those portions taken up.
 - iii)) Turfing of embankments, both the slope and crest should be done properly.
 - iv) Embankments should be maintained every year after the monsoon. They should be brought to design section and be properly turfed.
 - v) A programme should be taken for proper protection of embankments where this is exposed to sea waves and trees should be planted densely on the berms.

3.4 Roads and Highways Department

a) Major Roads (Department of RHD)

The newly constructed bridge over the river Karnafuly was struck and damaged by the floating crane 'Shaktiman', which broke lose from its mooring during the cyclone. The 920 metre long, 6 span bridge, had been completed in January, 1990. The crane hit the span between piers P3 and P4. The trusses of the suspended span, approximately 100m long, together with the decking were dislodged from their bearings. The truss has been removed and now lies on the southern bank of the Karnafuly.

The repair of the bridge will include:

- the placing of the detached span in position including decking
- repair of the railing of the unaffected spans
- repair of the 3rd and 4th pier and
- repair of deck of the unaffected spans

b) Damage Assessment

The cost of reconstruction work to RHD infrastructure on the basis of surveys and assessments made by SMEC, was Tk. 10,621.17 lac excluding the cost of Karnafuly bridge repair. The total costs increase to Tk. 13,807.52 lac allowing for 25% price contingency and 5% consultancy fees (Table 3.8).

Costs for the repair of Karnafuly bridge, including replacement of the detached span is shown separately in the table. The contract value for repair of the bridge is Tk.3,372.48 lac including contingencies and consultancy fees, against an RHD estimate of Tk.3,865.17 Lac.

c) Reconstruction of RHD Works

The cost for RHD reconstruction works was estimated Tk. 17,180.00 Lac. By June 1992, Tk.911.92 Lac had been paid to the Contractors for work completed, that is only 5.3% of

TABLE 3.8
RHD : Assessment of 1991 Cyclone Damage and Reconstruction

Tk. in Lac										
	Road Work Cost (1)	Bridge work Rev.Cost (1)	Structure Rev.Cost(1)	Total Cost of Reconst.	Contingency (25%)	Consultancy (5%)	Total Cost of Reconst.	Payment made June 1992	Remarks	
A. Chittagong Zone										
Chittagong Road Division	670.25	498.72	23.50	1192.47	298.12	59.62	1,550.21	162.39		
Cox's Bazar Division	2,487.25	739.00	27.60	3253.85	813.46	162.69	4,230.01	220.53		
Noakhali Road Division	2,520.00	220.00	0.00	2740	685.00	137.00	3,562.00	206.77		
Khagrachari Road Division - I	14.35	153.50	6.60	174.45	43.61	8.72	226.79	8.29		
Khagrachari Road Division - II	132.80	3.00	6.00	141.8	35.45	7.09	184.34			
Rangamati Road Division	88.00	102.80	30.40	221.2	55.30	11.06	287.56	34.07		
Bandarban Road Division	18.00	33.00	24.75	75.75	18.94	3.79	98.48	122.93		
Sub - Total of 'A'	5,930.65	1,750.02	118.85	7,799.52	1,949.88	389.98	10,139.38	754.98		
B. Khulna Zone										
Khulna Road Division	300.00	110.00	0.00	410	102.50	20.50	533.00			
Barishal Road Division	93.00	0.00	0.00	93	23.25	4.65	120.90			
Patuakhali Road Division	1,300.00	238.00	2.90	1540.9	385.23	77.05	2,003.17	38.98		
Bhola Road Division	620.00	80.00	11.50	711.5	177.88	35.58	924.95	117.96		
Workshop Division	-	-	66.25	66.25	16.56	3.31	86.13			
Sub - Total of 'B'	2,313.00	428.00	80.65	2,821.65	705.41	141.08	3,668.15	156.94		
Total of ('A' + 'B')	8243.65	2178.02	199.5	10,621.17	2,655.29	531.06	13,807.52	911.92		
Karnafuly Bridge				3,185.12	46.84	140.52	3,372.48		Contingency 0.20m Guilder GOB contribution will be utilised for painting work	
				(DG 13.60m)	(DG 0.20m)	(DG 0.60m)	(DG 14.40m)			
Total				13,806.29	2,702.13	671.58	17,180.00			

Notes : SMEC Revised Costs
1 Dutch Guilder (DG) = Tk. 23.42

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the total. Repairs to the Karnafuly bridge were awarded to a Dutch Company on 1st August, 1992 and are scheduled to be completed by 1993.

Reconstruction works were placed in three categories:-

- **Priority - 1** : The works which are of an immediate nature, of economic and of social priority, are to be carried out immediately and be completed before the end of June, 1992.
- **Priority - 2** : The works of an urgent nature which should be carried out within the next 2 years i.e. before June, 1993, and
- **Priority - 3** : The works which are not expected to be completed before June, 1993.

Works of **Priority 1** are still being carried out.

d) **Conclusions**

- The pre-cyclone condition of the RHD infrastructure contributed to its vulnerability during the cyclone; and
- a modest investment in maintenance would have resulted in a significantly reduced amount of damage.

e) **Recommendations**

- Implementation of the immediate (**Priority 1**) repair works should be completed as soon as possible as the works were scheduled to be completed by June, 1992.

3.5 **Bangladesh Power Development Board**

The electricity supply systems of BPDB sustained severe damage and disruptions due to the 1991 cyclone and related surge. Chittagong was cut off from the national grid and the power supply in the affected area was disrupted in the early hours of April 29, 1991.

Due to the cyclone, the following BPDB infrastructure was damaged:

- Grid sub-stations
- 132 kV transmission line
- 33/11 kV sub-stations
- Distribution lines
- SCADA system
- Diesel generating station on the off-shore islands
- Miscellaneous installations (godowns, security walls, complaint center, ansar barrack, storeyard etc.)

Immediately after the disaster, PDB undertook the following:

- preliminary assessment of damage
- taking up repair work on an emergency basis.

a) **Power Development Board Systems**

Generation : Major power generating stations are located at Ashuganj, Ghorasal, Siddirganj, Khulna and Kaptai (hydro). Power stations of varying (smaller) plant capacities are sited at other locations throughout the country and are generally used for the provision of energy during times of peak demand. Each of the offshore islands has a small diesel generating station.

Power Transmission System : A 230 kV transmission system has been established to provide interconnection between the major generating stations in the Dhaka (eastern) Region and to transfer power to the western part of Bangladesh via an East-West Interconnector.

The remainder, and backbone, of the transmission system comprises 132 kV double and single circuit lines. The system has in excess of 2200 km of overhead lines in operation.

Electricity Supply Distribution System : Power for the reticulation network is supplied through the 132/33 kV grid substations to the 33kV network where it is again stepped down to 11kV distribution voltages at zone substations for reticulation within local areas via 11kV/415-230 volt substations.

The 33kV, 11kV and 415-230 volt distribution system is largely overhead and employs steel towers or concrete, steel or wooden poles. In the Chittagong Metropolitan areas some 11kV underground cable circuits exist, mainly connecting 33/11kV zone substations to the 11kV overhead distribution system or high voltage consumers.

The overall system supplies electrical energy through 37,000 km of overhead lines to over 1,155,000 consumers, with a peak maximum demand of approximately 1400 MW.

Large industrial and commercial consumers may be directly supplied from 11kV and 33kV high voltage lines with revenue meters connected directly to the step down transformers.

Electricity is supplied to domestic consumers via a Low Tension (LT) 415-230 volt network.

Supervisory Control and Data Acquisition System (SCADA): A SCADA system control centre for the Chittagong Region has recently been established adjacent to the Kulshi Grid substation at Chittagong. This computerized system has been developed, designed and installed by CEGELEC of the United Kingdom, using GEC Telecontrol Technology.

The system provides for the remote operation of circuit breakers, transformer on load tap changers and automatic logging of operational data, alarms, bus bar voltages, and circuit clones for each 132 kV grid and 33kV zone sub-station in the Chittagong Metropolitan

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region. Communication to the remote sub-stations is by VHF microwave system. At each sub-station, a computer outstation interfaces with the sub-station secondary control circuits to carry out the control and data acquisition functions.

The SCADA system was still under contractual maintenance by CEGELEC at the time of the Cyclone.

b) Damage to PDB Infrastructure

Nine grid substations at Halishahar, Dohazari, Khulsi, Sikalbaha, Chandragona, Baraulia, Madanhat, Cox's Bazar and Hathazari were damaged. Control panels and battery chargers at Halishahar grid substation were under five feet of seawater for many hours. Six towers of the 132 kV Kaptai - Madanhat double circuit line were destroyed.

Several 33/11 kV substations, including Stadium, Patharghata, Bakulia, Halishahar, New-mooring, Patenga, Rangunia and Nazirhat in the Chittagong area, were flooded by the storm surge. Extensive damage was caused to circuit breakers, control and protection panels, batteries, and battery chargers.

33kV lines were also extensively damaged. In Chittagong, Barisal and Noakhali area, 659 nr. 33 kV pole/towers, 100 km 33 kV conductor, 1292 nr. 33kV insulators were damaged.

Extensive damage were caused to distribution lines. Within Chittagong Metro, Chittagong North, Chittagong South, O&M Circle Khulna, O&M Circle Barisal, Distribution Division Feni, Distribution Division Noakhali, P&D Circle Chittagong, Area under Project Director Greater Chittagong Power Distribution Project, 2412 nr. (12m & 11m) poles, 10631 nr. 9m poles, 1967 km conductors and 505,881 nr. insulators were damaged.

Many distribution transformers were damaged. In the Chittagong, Khulna, Barisal, Noakhali and Feni areas 133 nr. distribution transformers of various ratings were damaged. About 18284nr. energy supply meters were also damaged.

The newly installed SCADA system was damaged. 10 nr. VHF towers were destroyed and required replacement.

Although the power station equipment was saved, extensive damage was caused to the residential and non-residential buildings and godowns of the Karnafuly Hydro Power Station, 60 MW Shikalbaha power station, Chittagong TG-7 and Barisal Diesel power station.

Power supplies to all the off-shore islands, Hatyia, Sandwip, Kutubdia, Moheskhal, Saint Martin, Charfession, Manpura and Mehendiganj, were severely damaged. All diesel power stations on these islands are very old and most were damaged. They need to be replaced by new generating sets and related power distribution networks. The 33kV river crossing tower between the mainland and Moheskhal collapsed. In addition godowns, security sheds, complaint center, Ansar barracks, and storeyards of various electric supply units were damaged.

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c) **Damage Assessment for the Infrastructure of PDB and REB**

Damage assessment surveys were undertaken by SMEC. PDB division-wise summary of cost of reconstruction are presented in Table 3.9. Total costs of repair for PDB and REB are presented in Table 3.10.

The works have been phased in three groups:

Priority-1 : The works which are of an immediate nature, are of economic and of social priority and should be carried out immediately and be completed by June 1992.

Priority-2 : The works which are of urgent nature and to be carried out by June 1993, and for which a short technical preparation and procurement period is necessary.

Priority-3 : Works are those for which completion can not be expected before June, 1993. Most of these are the procurement of material either from the country or from outside for buffer stock (stock for future emergency).

d) **Rehabilitation of PDB and REB Works**

From the division-wise summary, the cost of Works comes to Tk.4,478.55 lac (Table 3.9). The cost of damage to REB facilities is Tk. 1,394.00 lac. Hence, the total cost is Tk. 5,872.55 lac. The rehabilitation cost includes the cost of consultancy, price contingency and escalation. Considering all these, the cost of rehabilitation of PDB and REB is Tk. 7,947.94 lac (Table 3.10).

ADB, Japan and France have agreed or are expected to agree to finance the total costs identified by BPDB and approved by National Economic Council equal to Tk.9,206.12 lac which includes:

- Foreign exchange amounting to Tk. 689.02 lac
 - Commodity aid
 - ¥ 9,45.00 Million (Japan)
 - Project aid - US\$ 7.707 Million (ADB)
- Local Currency amounting to Tk. 3,117.10 lac
 - Commodity loan
 - Tk. 1,569.60 lac (ADB)
 - Custom duty + VAT - Tk. 1,547.50 lac (GOB)

e) **Recommendations**

- i) Funding should be made available to enable PDB to proceed with the payment of rehabilitation work and thereby to complete the work in time.

TABLE 3.9
BPDB : 1991 Cyclone Damage (Divisionwise)

				Tk. in Lac
Sl. No.	Name of PDB Division	Type of Repair	Cost of Repair	Remarks
Chittagong Metropolitan O&M Circle				
1.	Ctg. Metropolitan O& M Division-1	Locally cable fault and repair	122.58	
2.	Ctg. Metropolitan O& M Division-2	Replacing Poles, fitting Conductors	208.17	
3.	Ctg. Metropolitan O& M Division-3	Repair of poles and replacement of Conductors	115.75	
4.	Ctg. Metropolitan O& M Division-4	Replacement/Repair of Circuit Pannel and Conductor etc.	510.92	
5.	Ctg. Metropolitan O& M Division-5	Repair of Building works	33.62	
Chittagong North O&M Circle				
6.	Chittagong North	Repair of vehicle & stationery.	2.29	
7.	Hathazari Distributioin Division	Repair/Replacement of Tower, Pole	159.10	
8.	Rangamati Distribution Division	Repair/Replacement of Tower, Pole	140.77	
9.	Fouzderhat Distribution Division	Replacement of Poles & Conductors	419.00	
Chittagong South Circle				
10.	Patiya Distribution Division	Repair of Distribution Line & Low Voltage System 0.4/0.23 Kv	93.88	
11.	Cox's Bazar Distribution Division	Repair of Distribution Line	247.86	
Planning & Development Circle				
12.	Chittagong Zonal Repairing Shop	Repair Zonal Shop	1.98	
13.	Ctg. Planning & Development Zonal Office	Repair of Transports	0.30	
14.	Ctg. Electrification Project	Repair of Distribution & Low Voltage System 0.4/0.23 Kv	4.46	
15.	G.C. Pop Extension Division-1	Repair of Distribution Line and Distribution Transformer	16.89	
16.	G.C. Pop Extension Division-2	Repair of Low Voltage System 0.4/0.23 Kv.	1.50	
17.	Sub-Station G.C. PoP	Repair of SCADA System	734.00	
18.	Cox's Bazar	Repair of Distribution Line and Low Voltage System 0.4/0.23 Kv	4.00	
19.	Construction Division, Cox's Bazar	Repair of poles and conductors	24.79	
20.	P.C. Pole Factory G.C. PoP	Manufacturing of Poles	7.50	

Contd...

Sl. No.	Name of PDB Division	Type of Repair	Cost of Repair	Remarks
Planning & Development Circle				
21.	Comilla Electric Supply	Repair of Damaged Poles	77.00	
22.	Comilla Distribution Division	Repair of Poles & Towers	230.65	
23.	Noakhali Distribution Division	Repair of Poles, Tower & Conductor	238.01	
24.	Chandpur Electricity Supply	Replacement of Conductor	39.35	
25.	Feni Distribution Division	Repair of Conductor & Insulation to HT & LT.	80.44	
26.	Diesel Generation Off Shore Island.		40.00	
	a) Hatia Island Power Station - 12	Overhauling replacement of Parts of Generator		
	b) Sandwip Island Power Station - 16			
	c) Kutubdia Island Power Station - 12			
Commercial Operations Chittagong:				
27.	Commercial Operation LT. Division - 1	Supplying Spares for Restoration of Electricity Supply	63.59	
28.	Commercial Operation LT. Division - 2	- Do -	99.01	
29.	Commercial Operation LT. Division - 3	- Do -	113.14	
30.	Ctg. Commercial Operation HT Division	Restoration HT Line	29.35	
Khulna O&M Circle				
31.	Khulna O&M Division-I	Repair/Replacement of Transformer, Poles, Conductors, Lightning arrester etc.	12.34	
32.	Khulna O&M Division-II	- Do -	13.24	
33.	Khulna O&M Division-III	- Do -	14.11	
34.	Bagerhat Electricity Supply	Replacement of Poles, Conductor, Transformers	134.61	
35.	Pirojpur Electrical System	Replacement of Poles, Conductors, Transformers etc.	99.51	
Barisal O&M Circle				
36.	Faridpur Electric Supply	Replacement of Conductors, Insulation Straintening Poles	55.84	
37.	Patuakhali Distribution Division	Replacement of Poles & Conductors	44.30	
38.	Barisal Distribution Division	Replacement of Conductor, Insulator, Transformer etc.	36.62	
39.	Barisal Electricity Supply Division	Replacement of Poles, wire and other Fittings	59.00	

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Tk. in Lac

Sl. No.	Name of PDB Division	Type of Repair	Cost of Repair	Remarks
40.	Barisal Diesel Power Station	Replacement of Power Station Building Roof	3.50	
41.	Bhola Electricity Supply Division	Erection of new Poles, Repair of Towers, replacing Conductors, Supplying insulators	53.42	
Jessore O&M Circle				
42.	Jessore Electricity Supply	Repair of Tower and Conductor	20.00	
43.	Satkhira Electricity Supply	- Do -	23.72	
44.	Kushtia Electricity Supply	Replacement of Steel Poles Conductors, Drop out fuse of diff. Kvs.	16.03	
45.	Kushtia Distribution Division	Replacement of Wooden Pole, Conductors, Shackle Insulators etc.	32.41	
Total			4,478.55	

Source : SMEC's report

R/23/PDB-DM/G.WK/

TABLE 3.10
BPDB/REB : Cyclone Damage and Reconstruction Costs

Sl. No.	Description	Cost of damage			FDB's Rehabilitation Cost			Rehabilitation done up to May, 1992	Cost of Remaining Work		Donor	Remarks
		Lac Tk	Millio US \$	P.P. Lac Tk	Estimate Lac Tk	Mill. US\$	Lac Tk		Lac Tk	Million US\$		
1.	Power Development Board											
	Repair/Replacement of Tower, Poles, Building, Conductors, Insulation, Material Stock etc.	4,478.55	12.27					500.00			ADB, Japan & Franco (expected) Total: Tk.9,206 Lac	Total allocation (project cost): Tk. 9,206.12 Lac
2.	Rural Electrification Board											
	Estimate of damage of REB works	1,394.00	3.82	N. A.								
	Total Damage Cost of FDB & REB	5,872.55	16.09		5,872.55	16.09		N. A.				
	Price Contingency 10% of FDB and REB works				587.26	1.61						1. Foreign exchange : Tk. 6,089.02 Lac a) Commodity aid : ¥ 945.00 mil.(Japan) b) Project aid : US\$ 7,707 mil.(ADB)
	Price Escalation 20% of FDB and REB				1,174.51	3.22						2. Local currency : Tk. 3,117.10 Lac a) Commodity loan : Tk. 1,569.60 Lac (ADB) b) Custom duty+VAT : Tk. 1,547.50 Lac (GOB)
	Consultancy fee 5% (Based on Sealed works where consultancy required) of FDB works				293.63	0.80						
	Island Generation L.S. (Special Project Consultancy fee)				20.00	0.05						
	Total Cost of Contingency & Consultancy				2,075.39	5.69						
	Total Cost for FDB & REB works			9,206.12	7,947.94	21.78		500.00	8,706.12	23.85		
								Exclude equipment loan from ADB				

Source : BPDB

BK/25/11/FDB-REB-WKI

(Tk.36.50 = 1 US\$)

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- ii) Funding for engaging consultants, where necessary, for the special type of works should have a provision.

3.6 Bangladesh Railways

a) General :

Bangladesh Railway (BR) sustained loss and damage due to the Cyclone of 29-30th April 1991 but the degree of damage in comparison to other sector is less. Bangladesh Railway moved rolling stock away from the high risk coastal region and as a consequence no damage incurred to the wagons. Some minor damage occurred to the rail lines in Chittagong civil yard.

Cyclone caused extensive damage to Bangladesh Railway workshops and staff quarters. Miscellaneous stores were damaged. The C.I. sheet roof on the leeward side of the stores, workshops and service buildings were damaged and some of the C.I. sheets were blown away. Most of the boundary walls of the store yard and of the workshop were collapsed.

b) Damage assessment

The total cost of damage primarily assessment by Bangladesh Railway was for Tk. 9,870 lac. Subsequently the department made an wide survey and revised the cost of rehabilitation/reconstruction for Tk. 4,464.54 lac and submitted to the Planning Commission. The Executive Committee of National Economic Council (ECNEC) approved the cost for Tk. 2,562.79 lac with the directions as :

- i) Tk. 1,034.16 lac will be expended including the grant of India (Tk. 600 lac).
- ii) Tk. 1,366.33 lac will be expended from the loan of ADB.
- iii) Tk. 162.30 lac will be expended from other available sources.

For the rehabilitation/reconstruction work which was expected to be financed by other agencies, SMEC was assigned by the World Bank to assess the cost of damage excluding the rehabilitation/reconstruction work programmed to be undertaken under Indian grant and ADB loan.

SMEC assessed the rehabilitation/reconstruction cost for Tk. 1,373 lac including the contingency and consultancy for Tk. 318 lac and Tk. 57 lac respectfully (Table 3.11). The work was programmed to be completed in two fiscal years (FY 1991-1992 and FY 1992-1993). Bangladesh Railway has shown the cost of rehabilitation for Tk. 918.30 lac in place of Tk. 1,373 lac omitting the repair of 3 nos. godowns at Pahartali (Table 3.11).

Bangladesh Railway submitted the revised Project Concept Paper (PCP) to the Planning Commission for Tk. 2,766.20 lac which is under consideration (Table 3.12 & Table 3.13 3.14).

TABLE 3.11
Bangladesh Railway
Prioritywise Cost for repair/reconstruction of Cyclone
affected infrastructure of Bangladesh Railway

Sl. No.	Description	Tk.in Lac						
		Total		Priority-1			Priority-2	
		Pri-1+Pri-2	Cost	Contingency	Consultant	Total	Cost	Contingency Consultant Total
01.	Semi-pucca Accommodation	444.00	321.00	102.00	21.00	444.00	0.00	0.00 0.00 0.00
02.	Service Building repair	455.00	249.00	79.00	16.00	344.00	80.00	26.00 5.00 111.00
03.	Katha accommodation	104.00	75.00	24.00	5.00	104.00	0.00	0.00 0.00 0.00
04.	Miscellaneous equipment	145.30	110.30	35.00	0.00	145.30	0.00	0.00 0.00 0.00
05.	Temporary Track repair	7.00	5.00	2.00	0.00	7.00	0.00	0.00 0.00 0.00
06.	Signalling & tele com.	217.00	47.00	15.00	3.00	65.00	110.00	35.00 7.00 152.00
Total : (Tk.in Lac)		1,372.30	807.30	257.00	45.00	1,109.30	190.00	61.00 12.00 263.00
(US \$ Million)		3.61	2.12	0.68	0.12	2.92	0.50	0.16 0.03 0.69

Grand total (Priority-1 + Priority-2) = 1,373.00 lac (including contingency and consultancy). Bangladesh Railway has considered the cost of rehabilitation/reconstruction for Tk. 918.30 lac omitting the repairing cost (Tk. 80 lac) for 3 Nos. Godown at Pahartali.

US \$ 1 = Tk. 38.00

Source : From Assessment of SMEC

BURZ/2/PRIOR/14.1.WKT

TABLE 3.12
Bangladesh Railway
Comparative Statement of Approved Cost and Revised Cost

Sl. No.	Items of works	Tk. in Lac					
		Approved Cost			Revised Cost		
		Local	FEC	Total	Local	FEC	Total
A.	Works to be executed under (Indina Grant)			66.95			
01.	Civil Engineering Works	174.00	300.00	474.00	30.00	300.00	330.00
02.	Signal & Telecom. equipment	20.95	46.10	67.05	0.00	46.10	46.10
03.	Electrical equipment	115.30	116.00	231.30	16.40	116.00	132.40
04.	Mechanical equipment	57.40	41.00	98.40	0.00	41.00	41.00
05.	Physical contingency	45.81	71.74	117.55	0.00	0.00	0.00
06.	Escalation	20.70	25.16	45.86	0.00	0.00	0.00
	Sub-Total "A"	434.16	600.00	1,034.16	46.40	503.10	549.50
B.	Works to be executed under (ADB Loan)						
01.	Civil Engineering Works	1,021.65	229.55	1,251.20	1,021.65	229.55	1,251.20
02.	Signal & Telecom. equipment	9.25	18.50	27.75	9.25	18.50	27.75
03.	Miscellaneous Cost	5.58	1.86	7.44	5.58	1.86	7.44
04.	Escalation	59.05	20.89	79.94	59.05	20.89	79.94
	Sub-Total "B"	1,095.53	270.80	1,366.33	1,095.53	270.80	1,366.33
C.	Works to be executed against Govt. Investment/Other Source						
01.	Civil Engineering Works	5.00	0.00	5.00	658.07	0.00	658.07
02.	Signal & Telecom. equipment	47.00	0.00	47.00	47.00	0.00	47.00
03.	Electrical installation	110.30	0.00	110.30	110.30	0.00	110.30
04.	Escalation	0.00	0.00	0.00	35.00	0.00	35.00
	Sub-Total "C"	162.30	0.00	162.30	850.37	0.00	850.37
Total (A+B+C):							
	(Tk. Lac)	1,691.99	870.80	2,562.79	1,992.30	773.90	2,766.20
	(US \$ Million)	4.45	2.29	6.74	5.24	2.04	7.28

US \$ 1 = Tk. 38.00

Source : Bangladesh Railway

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TABLE 3.13
Bangladesh Railway
Summary of Works (Donor wise)

Sl. No. Works covered under	Local		F.E.C.	Tk.in Lac Total
	Works	Duties & Taxes		
01. Indian Grant	46.40	0.00	503.10	549.50
02. ADB Loan	961.04	134.49	270.80	1,366.33
03. Other Sources	850.37	0.00	0.00	850.37
Total :	(Tk.Lac)	1,857.81	773.90	2,766.20
	(US \$ Million)	4.89	2.04	7.28

US \$ 1 = Tk. 38.00

Source : Bangladesh Railway

TABLE 3.14
Financial Assistance

Sl. No.	Description	Grant	Loan		Govt. Investment	Tk.in Lac
			P.A.	R.P.A.		Total
01.	Item under Indian Grant	503.10	0.00	0.00	46.40	549.50
02.	Utems under ADB Loan	0.00	270.80	807.27	288.26	1,366.33
03.	Other Sources	0.00	0.00	0.00	850.37	850.37
T	(Tk.Lac)	503.10	270.80	807.27	1,185.03	2,766.20
	(US \$ Million)	1.32	0.71	2.12	3.12	7.28

US \$ 1 = Tk. 38.00

Source : Bangladesh Railway

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The rehabilitation/reconstruction works were of the following four Engineering Departments of Bangladesh railway.

- Civil Engg. department including replacement of railway tracks,
- Signal & Telecommunication department,
- Electrical Engineering Department and
- Mechanical Engineering Department.

Each of the Engineering Department assessed the cost of damage repair/ reconstruction separately with the respective fields officer and personnel. Summary of the assessment made by different Engineering Department of Bangladesh Railway are shown in Table 3.15.

c) Methodology

i. Works of GOB & other Financing Agency

The World Bank assigned SMEC to assess the damage in association with BCL excluding the works which were decided to be executed under Indian grant and ADB loan. The consultants forwarded questionnaires to the Chief Engineer, Bangladesh Railway 2 weeks ahead of the field visit with a request to indicate the sites in a map where the effect of the cyclone were severe and the sites where the effect was little.

During the assessment by the consultant, the damage of the following were taken in to consideration.

- Chittagong workshop & store building including roofing
- Damage to housing caused by flooding & cyclonic winds
- Damage to track between Ctg. port to main railway line
- Damage to Railway signalling equipment.

Excluding the following:

- Roads, structures, building and facilities whose condition, even though the same may be poor was not altered significantly because of the cyclone.
- Providing higher standard of infrastructure than existed pre-cyclone, unless it was required as a part of other necessary repairs or rehabilitation;
- Replacing unserviceable roads, structures, buildings or equipment where their condition was a result of age, lack of maintenance or other non-cyclone related causes.

TABLE 3.15
Bangladesh Railway
Departmentwise Assessment of Damage

	Tk. in Lac
I) Civil Engineering Department	
(Indian Grant)	330.00
(ADB Loan)	1,251.20
(Govt/Donor Agency) *	658.07
Sub-Total	2,239.27
II) Signal & Telecommunication Department	
(Indian Grant)	46.10
(ADB Loan)	27.75
(Govt/Donor Agency) *	47.00
Sub-Total	120.85
III) Electrical Engineering Department	
(Indian Grant)	132.40
(Govt/Donor Agency) *	110.30
Sub-Total	242.70
IV) Mechanical Engineering Department	
(Indian Grant)	41.00
Sub-Total	41.00
V) Miscellaneous Cost	
(ADB Loan)	7.44
Sub-Total	7.44
VI) Escalation	
(ADB Loan)	79.94
(Govt/Donor Agency) *	35.00
Sub-Total	114.94
Total (1+2+3+4+5+6) : (Tk. Lac)	2,766.20
(US \$ Million)	7.28

* Donor Commitment not yet been available

US \$ 1 = Tk. 38.00

Source : Bangladesh Railway

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ii. **Works Financed by ADB**

It was agreed that the consultants for the CEAs, CPCS Ltd. and International Rail Consultants were in the field would make appropriate recommendations by 7th July, 1991 and reliant upon:

- Reviewing available BR documentation
- site visits where possible
- liaising with associated donor and BR personnel
- available expertise within the CEAs
- the CEAs knowledge of past, existing and future CIDA assistance, program intent, BR's capabilities and performance.

The CEA's personnel conducted site surveys and met with BR and donor personnel as follows:

- **May 4 - 5** : CPCS Ltd. site survey PHT workshop complex diesel workshop, stores, carriage and wagon shop, CGPY, Academy, Rail line to Airport and Fuel loading zone of port and PHT residential compounds.

Discussion with M/Diesel PHT, DSW PHT

- **June 10 - 11** : IRC site survey PHT workshop complex, diesel workshop, stores, carriage and wagon shop, CGPY, Academy, Rail line to Airport and Fuel loading zone of port and PHT residential compounds.
- **June 10 - 11** : CPCS Ltd. site survey PHT workshop complex, diesel workshop, stores, carriage and wagon shop.
- **June 16** : CPCS Ltd., IRC, CHC discussion
- **June 19** : CPCS Ltd. Meet with GM Projects to discuss rehabilitation requirements.
- **July 1 - 2** : CPCS Ltd. site survey PHT workshop complex, diesel workshop, stores, carriage and wagon shop, CGPY, Academy, rail line to Airport and Fuel loading zone of Port and PHT residential compounds.
- **July 4** : CPCS Ltd. IRC meet to discuss finding and recommendations.

The followings were the Special inclusions:

- Where a length of road was cyclone damaged and the rest of the road was in poor condition because of non-cyclone related causes, and further where the full economic value of the road could not be realised if only the cyclone damaged

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portion was rehabilitated, then the full length of damage might be included as cyclone related damage. This would be done on a case by case basis, and not taken as a blanket approval to upgrade long lengths of road where only a small portion was cyclone damaged.

- Where the existing building or facility was in poor condition prior to the cyclone and major repairs are now necessary, the cost of reconstruction or rehabilitation to an adequate standard may be included as damage. This would be done on a case by case basis;
- Where roads, buildings or structures were damaged after the cyclone, but as a direct result of the cyclone, including subsequent building collapse.

d) Progress of rehabilitation/reconstruction works

The approved cost for the works of the department is Tk. 2,562.79 lac, but the department submitted a revised PCP for Tk. 2,766.20 lac to the Planning Commission for reviewing on the ground of repair of some service buildings, residential buildings and boundary walls. Repair for those is badly needed. The revised PCP is now under active consideration by the Planning Commission.

The rehabilitation/reconstruction work was completed for Tk. 1,014.18 lac (37%) till 30th June 1992 (Table 3.16). Programme for 1992-1993 fiscal year has been fixed for Tk. 1,200 lac. Till 30th September only 2.34% physical work of the year's programme has been completed worth Tk. 28.10 lac only.

Balance of the revised cost of PCP i.e., Tk. 552.02 lac has been tentatively fixed as the financial target of 1993-1994 fiscal year (Table 3.16).

3.7 Department of Public Health Engineering

a) General

The strong wind and tidal surge made polluted and damaged rendered the majority of the tubewell (deep and shallow) in the cyclone affected upazilas(88) unutilisable immediate use after the cyclone. It is estimated that about 25 percent suffered physical damages remaining were contaminated with saline polluted water. A majority of the 130 latrine production centres and the materials were blown away. In addition, practically all the latrines in the households were destroyed.

The polluted tubewells were flushed out by the community member and the mechanics deployed by the Department of Public Health Engineering(DPHE). The damaged tubewells were attended very promptly and effectively by the tubewell mechanics using the spare parts from existing stocks (for normal DPHE - UNICEF programme). Actions were taken by DPHE to urgently repair the cracked platform which can contribute to tubewell water pollution as a result of leaking of polluted surface water.

TABLE 3.16
Assistance to Ministry of Relief
Estimate, Programme and Progress of 1991 Cyclone damage re-construction/rehabilitation (Financial)

Department/Agency : Bangladesh Railway								Tk.in lac	
Priority	Years	Preliminary estimate Prepared by Agency/Dept	Revised estimate	Final estimate Prepared by Agency/Consult.	Value of work Programme	Contract Value	Value of work completed by 30-06-92 (percent total)	30-09-92 (percent total)	Remarks
01.	1991-1992	--	1,110.00		1,000.00	--	1,014.18 (37)	--	
02.	1992-1993	4,464.54	263.00	2,766.20	1,200.00	--	--	28.10 (1)	
03.	1993-1994	--	--	--	552.02	--	--	--	
Total	(Tk. Lac) (US \$ Million)	4,464.54 11.75	1,373.00 3.61	2,766.20 7.28	2,752.02 7.24	0.00	1,014.18 2.67	28.10 0.07	

Source : Planning cell, Bangladesh Railway

Donor : India = Tk. 600.00 lac
ADB = US\$ 3 Million = Tk. 1,140.00 lac (US\$ 1 = Tk. 38.00)
GOB = Tk. 896.55 lac

US \$ 1 = Tk. 38.00

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Since many of the ponds used traditionally to supplement domestic water sources (excluding drinking water) are rendered saline, handpumps are becoming even more popular causing crowding at pump sites. This should be encouraging more to get people to use only tubewell water for their domestic needs. If it is practiced more tubewells are required, both of the shallow and deep well designs.

b) Extent of Damage

Storage and office facility suffered damages due to the cyclone. In addition, the mobility of DPHE was adversely affected as a result of damage to vehicles and disruption of communication.

As per report of the DPHE 3,000 deep tubewells and 6,500 shallow tubewells were damaged and taken under the programme of replacing and 20,000 tubewells (handpumps) were damaged partially and programmed for repairing through the use of the spare parts.

In the report of the Zonal Relief Co-ordinator, Chittagong "Operation Sheba" it is pointed out that total 9,317 nos tubewells have been damaged in the cyclone affected districts (specifically not classified how many of those are deep tubewells and how many are shallow tubewells Table 3.19).

Office buildings (40 Nos.) godowns (60 Nos.) and boundary wall (175 metre) of DPHE have been damaged and in addition transport of DPHE (truck - 3 nos motor cycles 15 Nos. and speed boats 8 Nos.) have been damaged.

About 100 Nos. village sanitation centres have been damaged and the material stock of village sanitation centres of main land and of offshore islands have been washed away by the wind and tidal surge.

About 10,000 platforms of tubewells were reported to be damaged and programmed to be reconstructed by the DPHE.

c) Methodology of damage assessment and programming for rehabilitation/reconstruction work.

After the cyclone the Executive Engineer Programme & Co-ordination Division, sent a specific proforma to all the Division offices (Districts) for reporting the damage caused by the cyclone of 29-30th April 1991. From the reports of the field Divisions of DPHE a consolidated list of damage was prepared in a tabular form. The quantum of damage, cost thereof and the way of rehabilitation is stated in the table (Table 3.18). The cost for some of the items assessed on the lump sum basis and for some of the items as per rate analysed by them.

During the assessment of damage and cost for rehabilitation/reconstruction the exchange rate of US \$ considered Tk. 35.50. During the study period by the DCMU the value of the US dollar raised and considered Tk. 38.00. The cost for rehabilitation/reconstruction of damage

**Cyclone Damage to Rural (Handpump) Tubewells, Latrines and Properties
of DPHE and Rehabilitation Programme : 1991-92, 1992-93 & 1993-94**

Cost : (Tk.in Lac)

Sl. No.	Description of Reconstruction Requirements	Unit	Total damage		Rehabilitated/Repa upto June/92		Further requirements/ Remaining to Rehabil		Donor	Remarks
			Qty.	Cost	Qty.	Cost	Qty.	Cost		
1.	Sinking of Tubewell in place of Damaged tubewells: a) Cyclone affected 11 Nr. Coastal District i. Deep tubewells ii. Shallow tubewells b) Cyclone affected Southern District (8,500 Tubewells) i. Deep tubewells ii. Shallow tubewells	No. No. No. No.	3,000 6,500	1,254.00 456.00	2,000 7,000				Saudi Grant Saudi Grant	New T.Ws. were sunk in 11 different cyclone affected districts from Saudi grant Total program: DTW = 3,000; STW = 6,500
	Sub-Total of "1":			1,710.00	900 4,100	483.00 1612.3	0	0		This T.Ws. were newly sunk in the cyclone affected districts from Block allocation
2.	Reconstruction of damaged DPHE Building: a) Office b) Godown c) Boundary Wall	No. No. M	40 60 175	11.40 38.00 49.40			40 60 175	11.78 39.25 51.03	UNICEF	
3.	Repairing of damaged vehicles: a) Truck b) Motorcycles c) Speed/Diesel Boat	No. No. No.	3 15 8	7.60 3.80 11.40			3 15 8	7.85 3.98 11.77	UNICEF & GOB	Additional 723 Deep Tubewells (Hand pump) are programmed to be sunk with the savings of Saudi Grants.
4.	Reconstruction of damaged Union and Upazila Village Sanitation (VS) Centres: a) Shed	No. No.	100	76.00			100	78.50	UNICEF	
5.	Damage of VS Materials at the VS Centres (both Upazila & union including tools & plants) 100 nos. @ Tk. 10,000 each	No.	100	11.40			100	11.78	UNICEF	
6.	Maintenance/Repair of damaged handpump through use of spare parts : 20,000 TWs @ \$10 each.	No.	20,000	76.00			20,000	78.50	UNICEF & GOB	
7.	Reconstruction of 10,000 (approx.) cyclone damaged platforms @ \$25 each. Sub-Total of (2 - 7) :	No.	10,000	95.00 380.00		0.00	10,000	98.13 392.57	UNICEF	
8.	Sanitary latrine for each family in most severely affected Upazilas @ \$4 each.	No.		570.00	436,767	137.62			UNICEF & GOB	Manufacturing of Latrine through out the country 20% of total no. is assumed cons- truction cyclone affected area by June '92.
	Grand Total (Tk.in Lac) (US \$ in Millions)			2,660.00 7.00	1,750.00 4.61		392.57 1.03			

Note : US \$ 1.00 = Tk. 38.00

* Cost of Sanitary latrine @ US\$ 4 each

Source : Planning Directorate DPHE, Dhaka

Operation Sheba. Zonal Relief Co-ordinator, Chittagong

BVT/UNCTC-TWA/WZ

TABLE 3.18
Department of Public Health Engineering

Damage Estimates : Rehabilitation and Reconstruction

Description of Reconstruction Requirements (GOB)	DPHE's Damage Estimate (US \$ Million) (UN rate of exchange US \$ 1 = Tk. 38.00)	Donor	Proposed Activity/Programme
01. Sinking of Tubewell in place of damaged tubewells a) 3,000 deep tubewells b) 6,500 shallow tubewells	3.30 1.20	Saudi Arabia	Sinking of new Tubewells in places of damaged/choked up Tubewells. Cost including materials, sinking and carrying of materials
02. Reconstruction of damaged DPHE Building a) Office b) Godown c) Boundary Wall	40 Nos. 60 Nos. 17 m. 0.03 0.10 0.13		Reconstruction and repair of office building in the cyclone affected area including replacement of office stationeries and furniture.
03. Repairing of damaged vehicles a) Truck b) Motor cycles c) Speed/Diesel Boat 8 Nos.	3 Nos. 15 Nos. 8 Nos. 0.02 0.01 0.03	UNICEF & GOB	Reconditioning and major repair works
04. Reconstruction of damaged Union and Upazila Village Sanitation (VS) Centres.	100 nos. shed 0.20	UNICEF	Reconstruction of 100 Nos. Village Sanitation Production Centres
05. Damage of VS Materials at the VS Centres (both Upazila & main including tools & plants) 100 Nos. @ Tk. 10,000 each	100 nos. 0.03	UNICEF	Replenish the materials lost during the cyclone which include local as well as offshore islands production materials.
06. Maintenance/Repair of damaged hand-pumps through use of spare parts 20,000 TWs @ US\$ 10 each	0.20		Supply of spare parts for No.6 handpump. (To replenish stocks of normal programme)
07. Reconstruction of 10,000 (approximate cyclone damaged platform @ US\$ 25 each)	0.25		Reconstructin of damaged platform as per existing platform specification
08. Sanitary latrine for each family in most severely affected upazilas @ \$4 each (3,75,000 family)	1.50		Supplying raw materials for production of 500,000 latrine units to be sold at subsidised rate
Total :	US\$ (Million) 7.00 Tk. in Lac 2,660.00		

Source : DPHE

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TABLE 3.19

Department of Public Health Engineering
Damage to Tubewells and Latrines

Page 1 of 2

Sl. No.	District	Thana	Tubewell Damaged	
			Deep Tubewell Nr.	Shallow Tubewell Nr.
01.	Chittagong	Anwara	370	*
		Banshkhali	683	*
		Boalkhali	389	*
		Chandanaish		*
		Fatikchhari	93	*
		Hat Hazari	1	*
		Lohagara		*
		Mirsarai	46	*
		Patiya	710	*
		Rangunia		*
		Raozan		*
		Sandwip	2567	*
		Satkania		*
		Sitakunda	13	*
		Total	4872	
02.	Cox's Bazar	Cox's Bazar Sadar	550	*
		Chakaria	875	*
		Kutubdia	500	*
		Moheshkhali	900	*
		Ramu	60	*
		Teknaf	743	*
		Ukhia	110	*
		Total	3738	
03.	Noakhali	Noakhali Sadar	104	*
		Begumganj		*
		Chatkhil		*
		Companiganj	92	*
		Hatiya	255	*
		Senbagh		*
04.	Lakshmipur	Total	451	
		Lakshmipur Sadar	65	435
		Raipur	8	200
		Ramganj		250
		Ramgoti	76	1174
05.	Feni	Total	149	2059
		Feni Sadar	0	0
		Chhagalnaiya	0	0
		Daganbhuiyan	0	0
		Parshuram	0	0
		Sonagazi	107	0
		Total	107	0

* Not available

contd...

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Sl. No.	District	Thana	Tubewell Damaged	
			Deep Tubewell	Shallow Tubewell
			Nr.	Nr.
06.	Bandarban	Bandarban Sadar	0	0
		Alikadam	0	0
		Lama	0	0
		Nakhysngchari	0	0
		Rowangachari	0	0
		Ruma	0	0
		Thanchi	0	0
		Total	0	0
07.	Rangamati	Rangamati Sadar	0	0
		Baghaichari	0	0
		Barkal	0	0
		Belaichari	0	0
		Jurachari	0	0
		Kaptai	0	0
		Kawkhali	0	0
		Langadu	0	0
		Nannerchar	0	0
		Rajasthali	0	0
		Total	0	0
08.	Khagrachari	Khagrachari Sadar	0	0
		Dighinala	0	0
		Laksmichari	0	0
		Manikchari	0	0
		Hatiranga	0	0
		Mohakchari	0	0
		Panchari	0	0
		Ramgar	0	0
		Total	0	0
09.	Bhola	Bhola Sadar	16	0
		Boharnuddin	6	0
		Daulat Khan	15	0
		Tajumuddin	22	0
		Lalmohan	10	0
		Char Fession	34	0
		Monpura	45	0
		Total	148	0
Grand Total			9317	2059

Source : "Operation Sheba" – ZRC, Chittagong

Note : It is not confirmed that the number of Tubewells shown in the deep tubewells for Chittagong, Cox's Bazar, Noakhali districts are practically all deep tubewells or not.

as evaluated by the DPHE is US \$ 7.00 Million.

The number of tubewells damaged due to 1991 cyclone were not received by the Executive Engineer, Programme & Co-ordination Division from all the DPHE field Divisions. However the department made the programme for sinking 3,000 deep tubewells and 6,500 shallow tubewells in the cyclone affected area. There was no clear statement regarding the priority of works of rehabilitation/reconstruction. The DPHE firstly undertook the work of resinking the tubewells for facilitating the supply of drinking water among the cyclone affected people.

d) Rehabilitation of Cyclone Damage

Just after the devastation of the cyclone the mechanics and other personnel of DPHE along with the Community members started repairing the damaged tubewells with the available spare parts from the stock of the department. The department also took necessary steps in repairing the cracked platforms of the tubewells.

Up to June 1992 DPHE installed total 2,900 deep tubewells and 11,100 shallow tubewells in the cyclone affected coastal districts.

With the financial assistance of the GOB, 900 deep tubewells and 4,100 shallow tubewells were sunk in the cyclone affected districts. The work was completed by June 1992 and expenditure incurred for the work was Tk.483.00 lac. DPHE defines this work as the work from the "Block allocation". Also with the Saudi grant 2,000 new deep tubewells and 7,000 new shallow tubewells were sunk at the sites of the damaged tubewells with a cost equivalent to US \$ 2.88 Million (all new and handpumps) in 11 cyclone affected coastal districts.

At the end of the FY 1991-92 a sum of Tk. 103.57 lac was found a savings after the expenditure of Tk. 1,129.38 Lac (Saudi Grant). With this savings DPHE made a programme to install further 723 Nos. deep tubewells (hand pumps) in the cyclone affected area during 1992-93 FY. This work may be considered as the work of 2nd priority.

e) Availability of fund for rehabilitation/reconstruction work

For the rehabilitation/reconstruction works of Public Health Engineering Department the following donors committed their financial assistance.

- | | |
|---------------------|------------------|
| 1. Saudi Arabia | Tk. 1,517.05 Lac |
| 2. UNICEF | Tk. 981.19 Lac |
| 3. GOB Contribution | Tk. 783.00 Lac |

Total Tk. 3,281.24 Lac

The revised estimated cost for rehabilitation was for Tk. 2,213.49 Lac. The commitment of financial assistance received for Tk. 3,281.24. With the excess of Tk. 1,067.75 Lac. DPHE has programmed to sink more deep tubewells in the cyclone affected area.



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TABLE 3.20

Assistance to Ministry of Relief
Estimate, Programme and Progress of 1991 Cyclone damage reconstruction/rehabilitation (Financial)

Department/Agency : Department of Public Health Engineering (DPHE)		Tk.in lac				
Priority	Years	Preliminary estimate Prepared by (Agency/Dept)	Revised estimate (by SMEC)	Final estimate Prepared by Agency/Consul	Value of work Programme	Contract Value
					Value of work completed by 30-06-92 (percent total)	30-09-92 (percent total)
01.	1991-1992	2,280.00	1,833.56	1,833.56	2,120.00	--
					1,750.00 (83)	--
02.	1992-1993	380.00	827.00	827.00	687.67	--
03.	1993-1994	--	--	--	222.33	--
Total (Lac Tk.)		2,660.00	2,660.56	2,660.56	1,750.00 (67)	--
(US \$ Million)		7.00	7.00	7.00	4.61	--

US\$ 1 = Tk. 38.00

Donor : Saudi Arabi Tk. 1,517.05 Lac
UNICEF : Tk. 981.19 Lac
GOB : Tk. 783.00 Lac

Source: Planning Directorate, DPHE

BULETIN 1992

Tube well Sunk
DTW = 3000
STW = 6500
Sanitary Latrine Constructed
436,767 Nos (assumed 20%
installed in cyclone affected
areas).
Programme for sinking 723 no.
DTW with the previous year's
savings of Tk. 370.62 lac.

3.8 Local Government Engineering Department

a) Introduction

A severe cyclone associated with storm surges hit the eastern coast of Bay of Bengal in the night of 29/30th April, 1992 and caused devastation and damage of lives, crops, livestock and to the properties of Govt. and of the people of 16 Southern districts of Bangladesh including the off-shore islands.

The roads and bridges were damaged due to storm surge and wave action. The worst of the road and bridge damage is near the sea. The typical examples of damage are scoured shoulders, eroded embankments, scoured road surface, breaches in the roads, road pavement deformation, movement of bridges & culverts resulting in cracks, dislocation and collapse. Heavy rain caused addition of damage.

Roads & Bridges

Pavement deformation was caused by traffic movement (of relief goods) over the roads when their subgrade and shoulders were saturated and very weak. The factors in regard to the extent of damage of structures & roads are the (i) old age, (ii) lack of maintenance (iii) poor construction techniques.

It was noted that roads with new bituminous carpeting suffered much less deformation than those without. Although the carpeting itself has some strength its major advantage is that it keeps the subgrade dry and therefore at full strength.

Roads with properly constructed concrete pavement suffered very little cyclone damage. Damaged concrete pavements are invariably the result of either poor construction techniques or were under designed.

Road embankments with good vegetation cover, especially bamboo are much more resistant to erosion than those without. Trees also provide some erosion protection. Steep embankments with poor vegetation cover offer little resistance to the effects of wave action flood water.

In older concrete bridges and composite bridges with concrete elements, weak concrete and insufficient steel cover have brought about the premature demise of many. Masonry abutments and wingwalls have not had their plaster covering maintained with the result that mortar has been eroded, bricks have fallen out and many have collapsed.

Bridge decks with holes in them are common and are frequently the only reason for wheeled traffic being unable to use a road. Unfortunate in all observed cases, the poor construction techniques which caused the deck failure were also used for the rest of the bridge and so replacement of the complete bridge is necessary.

Buildings

Buildings, which includes the (i) Thana Headquarters (ii) Cyclone Shelters & Killas (iii) Growth Centre and market Building (iv) Other Thanas Pourashava Buildings, sustained comparatively less damage.

Upazila head quarters: Most of these are masonry and concrete with exception of some tin roofing blown off and suffered little damage.

Cyclone Shelters : There exists 312 Cyclone shelters in the cyclone and storm surge affected area. No structural damage occurred because of the cyclone and storm surge. Only the doors and windows were damaged. The windows and doors were old and no maintenance was done for those.

Growth Centre: A large number of these open sided buildings were completely destroyed in some of the cyclone of areas with high velocities. Concrete columns were in a very poor condition and collapsed. Timber columns were usually rotten break off at the base and roof frames were not properly secured to the columns and were detached.

Delineation of cyclone affected/cyclone prone area:

The cyclone prone area preliminarily delineated as Risk Zone occupies a land mass of 11,400 sq. kms and about 6.2 million inhabitants as per 1981 census along the 710 km coastal close of Bangladesh. The area comprises four regions and 13 districts of the country. The spatial organisations of the cyclone risk area have been presented below in tabular form.

Settlement Organisation	Chittagong Region (Nr.)	Khulna Region (Nr.)	Barisal Region (Nr.)	Noakhali Region (Nr.)	Total (Nr.)
District Hqs.	2	3	5	3	13
Upazila Hqs	14	6	20	7	47
Union Hqs	124	26	140	48	338
Growth Centres	41	14	68	28	151
Mouza/Village	462	95	1,166	284	2,007
Cyclone Shelter	58	nil	182	72	312
Killa	17	nil	81	59	157

Source : Multipurpose Cyclone Shelter Programme

b) Extent of damage and its assessment

Due to high speed of wind (225 km/hr) along with storm surge (on rush of water in the high

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risk area with height of 4 to 6m), about 450km seasonal roads were damaged. Roads and bridges and other infrastructure of Chittagong, Cox's Bazar, Laxmipur, Noakhali, Patuakhali, Bhola district were damaged severely. The cost of damage as per assessment is shown in (Table 3.21).

Special Projects

Some works have been recommended by the consultant to be done, though those are not damaged works of '91 cyclone. Those works are named as special projects. Construction of jetties, construction of road in the off-shore islands and mechanical equipment for the development work/repair work of remote thanas and in off-shore islands.

i) Construction of Jetties for easy landing to islands

Construction of 7 Nos jetties at (a) Sandwip (West bank) (b) Sandwip (East Bank) (c) Kumira (main land), (d) Hatiya (c) Kutubdia (f) Bhola and (g) Monpura (Minor jetty). The proposal of this special project considers for the following:

- Facilitating emergency evacuation
- Bringing islands for agricultural external programmes.
- Bringing islands under regular transport network of the country and making the islands more economically efficient and making habitable for all.
- Supporting in addition other transport investments
- Supporting project investment that may develop on the islands.
- Removing hesitation of the potential passengers to travel to islands.
- Increasing associated industrial development possibilities
- Improvement of better contact/communication with main land
- Improvement of exchange of commerce and wealth
- Reduction of freight of commodities in islands

a) Cost has been estimated by the consultant for (Table 3.22)
Tk. 1,850.00 Lac

b) Price contingency has been considered 38% (Approx.)
Tk. 703.00 Lac

Total cost of the project
Tk. 2,553.00 Lac

ii) Construction of 80km road in Off-shore islands

It is proposed to construct 80 Km concrete road in the off-shore islands of Bangladesh for improving the facility of internal communication. Katcha roads and herring bone brick pavement are easily washable by any tidal surge than that of

TABLE 3.21

Local Government Engineering Department
Estimated Project Rehabilitation Cost
(including Special Project)

	Tk.in Lac	US \$ Million
Civil Works Base Cost		
Roads and Bridges		
Priority 1	3,687.60	9.70
Priority 2	3,561.12	9.37
Priority 3	5,516.93	14.52
Rural Infrastructure		
Priority 1	630.87	1.66
Priority 2	139.50	0.37
Priority 3	7.00	0.02
Pourashavas		
Priority 1	230.90	0.61
Priority 2	180.10	0.47
Priority 3	260.30	0.69
Civil Works Base Cost	14,214.32	37.41
Contingencies		
Physical 10% (of base cost)	1,421.43	3.74
Price 20% (of base cost)	2,842.86	7.48
Total Contingency Cost	4,264.29	11.22
Nett Cost of Civil Works	18,478.61	48.63
Consultancy fee (5% of Civil works)	923.93	2.43
Project Rehabilitation Cost (A)	19,402.54	51.06
Spcecial Projects		
i) Jetties (including contin. 38% of the base cost)	2,553.00	6.72
ii) Roads (including contin. 38% of the base cost)	2,194.20	5.77
iii) Mech. Const. Equipment	358.65	0.94
Total special project Cots (B)	5,105.85	13.44
Grand Total of Project Cost (A+B) (Including Special Projects)	24,508.39	64.50

US \$ 1 = Tk. 38.00

Source : SMEC

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TABLE 3.22

Local Government Engineering Department
Special Project (i)
Proposed LGED Jetties

Location	Suggested type of Jetty	Estimated Length/Width (m x m)	Area + 200 (m ²)	Estimate (Tk. Lac)	Estimate (US\$ Million)
Sandwip West	R.C. Deck on perm Supports	600.00	800.00	200.00	0.53
Sandwip East	R.C. Deck on perm Supports	1,400.00	1,600.00	400.00	1.05
Kumira	R.C. Deck on perm Supports	1,200.00	1,400.00	350.00	0.92
Hatiya	R.C. Deck on perm Supports	800.00	1,200.00	300.00	0.79
Kutubdia	R.C. Deck on perm Supports	600.00	800.00	200.00	0.53
Bhola	R.C. Deck on perm Supports	1,200.00	1,400.00	350.00	0.92
Monpura	Wooden Jetty	400.00	400.00	50.00	0.13
Sub-Total				1,850.00	4.87
Add 38% (approx.) Contingency				703.00	1.85
Total				2,553.00	6.72

US\$ 1 = Tk. 38.00

Source : LGED

well compacted pucca road. The cost of maintenance of Katcha road thus become more than that of the paved road. The concrete pavement becomes serviceable just after the storm/tidal surge; even during the surge people may walk along the road in order to find out safe shelter.

The project of concrete pavement is recommended for the following considerations and advantages:

- low maintenance cost
- long design life (30-40 yrs)
- suited for poor sub-grade (enables the rigid concrete pavement to share the load widely)
- improved reability
- construction is relatively simple
- provides an all weather road
- enables people to move quickly to shelters from the approach of a cyclone
- concrete roads can be used immediately after a cyclone for the distribution of relief aid.

a) Cost for the construction of 80 km road @ Tk. 20 Lac/km (as estimated by the consultant) Tk.1,590.00 Lac

b) Contingency 38% (approximately) (Table 3.36) Tk. 604.20 Lac

Total Tk.2,194.20 Lac



There are also considerations for not adopting concrete road pavements the disadvantages which are:

- high initial cost
- repairs can be difficult and expensive
- underground services need to be planned well before construction and service ducts adopted to avoid having to open the road
- severe settlement of the base/sub-base will result in cracks or failure of the pavement
- quality control of construction and materials must be well supervised (although this applies to all roads).

For the better interest, the factor of higher cost to be ignored and project to be executed after proper planning and maintaining full specification of works.

iii) Mechanical Construction Equipment (Special Project)

To have a good road system, maintenance is a very important requirement. It is not good enough to continually construct new roads and new structures every time there is a failure. There must be a systematic approach of deciding how to prevent deterioration of the road

system. It is believed that if the roads and structures were better constructed and maintained there would have been much less cyclone damage.

Developed countries are finding that they cannot afford to continue funding for new roads construction. A greater emphasis is now being placed on providing funds to manage the existing roads infrastructure before the road network deteriorates to a condition where reconstruction is necessary.

One of the tasks of the LGED is to repair damaged infrastructure after a flood or a cyclone. It would appear reasonable that the work force used in executing this work could be utilised to carry out a year round road maintenance programme. Periodic and routine maintenance programmes can provide activities that are labour intensive, and coupled with mechanised construction, would be much more cost effective and would result in a very efficient and well managed thana road system. The technical competency of all staff would be greatly enhanced. The consultant recommended that the equipment shown in the **Table 3.24** should be provided in 15 Nos.thana.

Estimated cost of the project as prepared by the Consultant for a single thana is for Tk. 23.91 Lac.

Cost of providing in 15 Nos.thana (Tk. 23.91 Lac x 15) = Tk. 358.65 Lac

Proposal for providing the mechanical equipments to all the 15 mentioned thanas are on very high side to start with providing the mechanical equipment to off-shore islands (Sandwip, Hatiya, Moheshkhali, Kutubdia) and the remote thana Banshkhali (5 thanas) seems reasonable. So the cost in this special project may come down to **Tk. 119.55 Lac** in place of Tk. 358.65 Lac.

c) Methodology

In order to carry out the cyclone damage assessment, questionnaires prepared by the consultant, SMEC (in association with BCL), sent to each of the field division offices of LGED (Located at district headquarters). The Department also issued instructions to the field offices for cooperating in the assessment of damage caused by cyclone. The consultant also pointed out what is included and what is excluded under definition outlined for them. In the questionnaire it was requested to mention the damage type, structure, location, order of priority and approximate rehabilitation cost. Also it was requested to locate the point of damage in maps. The consultant formed two teams; one for Western Zone (Khulna Division) and other for Eastern Zone (Chittagong Division). The teams had discussion on the questionnaire and inspected the claimed damaged sites along with the local officers of LGED of the rank of Executive Engineer or equivalent to finalise the assessment. From the department one Executive Engineer was also invited to join the assessment team.

TABLE 3.24

Local Government Engineering Department
Special Project (iii)
Proposed Mechanical Construction Equipment

			Tk.in Lac	
Equipment	Type	Name of Thana (Refer to Note Below)	Estimated (Tk. Lac)	Estimated (US \$)
Tractor	Farm Type	Sandwip	2.92	8,000.00
Attachments		Kutubdia		
		Hatiya		
		Monpura		
Trailer	To Suit	Moheshkhali	0.73	2,000.00
		Anawara		
Small Grader Blade	To Suit	Chokoria	0.73	2,000.00
		Mirsarai		
Ripper	To Suit	Banshkhali	0.55	1,500.00
		Sitakunda		
Self Propelled	Pad foot/DR	Teknaf	18.25	50,000.00
Vibratory Roller	2-3 tons	Companignaj		
		Sonagazi		
Concrete Mixer	Capacity	Ramgati	0.73	2,000.00
	05 to 1 m	Ukhia		
Sub-Total :			23.91	65,500.00
Total :			358.65	982,500.00
15 nos. Thanas				

The above Thanas were chosen not on the basis of cyclone damage, but by the assessment teams knowledge of the remotness of the Thana/Island maintenane and construction work.

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The damage caused under the three heads as detailed:

- i) **Feeder Roads:** (roads which connecting growth centres, Cyclone Shelters and river ports.
 - Damage to road embankment and pavement structure caused by water passing and over the road surface;
 - Breaches in the road embankments caused by wave/action or scour;
 - Damage to road bridge and culvert structures due to displacement or collapse of abutments or piers;
 - Loss of wingwalls, protection works retaining walls or mattresses;
 - Loss or displacement of box or pipe culverts;
 - Loss or damage due to action of cyclonic winds, including the collapsing of trees buildings or equipment.
- ii) **Rural Infrastructure - other than Roads**
 - Damage to growth centre structures due to cyclonic winds and associated flooding;
 - Damage to Thana buildings and existing cyclone shelters, ponds and landing jetties due to cyclonic winds, flying debris and flooding.
- iii) **Pourashava**
 - Damage to road embankment and pavement structure caused by water passing over the road surface;
 - Breaches in the road embankments caused by wave action on scour
 - Damage to road bridge and culvert due to displacement or collapse of abutment or piers;
 - Loss of wingwalls, protection works, retaining walls or mattresses;
 - Loss or displacement of box or pipe culverts;
 - Loss or damage to action of cyclonic winds including the collapse of buildings and related equipment damage and damage caused by falling trees on buildings and equipment;

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- Damage to street lighting, solid waste disposal canals, tubewells drainage and other municipal services due to cyclonic wind and flooding.

The data from questionnaire amended as necessary by detailed field inspection was entered into micro-computer based spread sheets and edited correctness. The spread sheets record in separate field, agency, Division, damage location, damage type, suggested rehabilitation, priority and estimated cost.

The total damaged cost for rural infrastructure, roads, bridges and Paurashava is assessed by the Consultant for Tk. 14,214 lac (Table 3.25)

The damaged works were classified in 3 major groups:

- a) Rural Infrastructure (other than roads & bridges Table 3.26, 3.27 & 3.28)
- b) Rural roads and bridges (Table 3.29, 3.30, 3.31)
- c) Pourashavas (Table 3.32, 3.33, 3.34, 3.35 and 3.36)

The works of Pourashava again divided into 2 groups;

- Pourashava roads & bridge (Table 3.35, 3.36)
- Pourashava Infrastructure (Table 3.39)

The cost of damage has been considered (Table 3.25) adding 10% as physical contingency, 20% as price contingency and 5% as the cost for consultancy with the base cost as shown in the Table 3.26.

For the special projects 38% cost has been added (Table 3.25) with base as shown in Table 3.22 and 3.23 except with cost of mechanical equipment (Table 3.37).

d) Rehabilitation/reconstruction of damaged works

The Local Govt. and Engineering Department executed different types of cyclone affected works of their programme (Priority-1) during the FY 1991-1992. The works are repair of Killahs, repair of rural roads, bridges and culverts. The embankment reconstruction of the rural roads and killas were mainly executed under the FFW Programme.

The World Food Programme donated about 2,500 mt of wheat for the repair of 40 Killas, 5,000 mt of wheat for repair of rural roads and 2,500 mt of wheat for the repair of growth centre connection road bridges and culverts. The works of FFW scheme have been completed during 1991-1992 fiscal year. The quantum of wheat utilised and the cost is shown in Table 3.43, 3.46.

Repair work of 10 Nos. cyclone shelter in the off island Kutubdia with IFAD donation of about Tk. 70 million (through the cabinet division) is in progress.

TABLE 3.25

Department of LGED
Summary of Cost for Rural Infrastructure + Roads
& Bridges and Paurashava of Chittagong and Khulna Division

Division : Chittagong and Khulna					Cost in Tk. Lac	
Sl. No.	Head of works	Works			Total	Remarks
		Priority-1	Priority-2	Priority-3		
01.	Rural roads & bridges	3,687.57	3,561.12	5,516.93	12,765.62	
02.	Rural Infrastructure	630.87	139.50	7.00	777.37	
03.	Pourashava	230.9	180.1	260.3	671.30	
	Total : (Tk. Lac)	4,549.34	3,880.72	5,784.23	14,214.29	
	(US \$ Million)	11.97	10.21	15.22	37.41	

US \$ 1 = Tk. 38.00

Source : SMEC's Assessment Report

TABLE 3.26

Department of LGED
Summary of Cost for Reconstruction/Rehabilitation
of '91 Cyclone affected rural infrastructure

Division : Chittagong and Khulna

Cost in Tk. Lac

Sl. No.	Division	Works			Total	Remarks
		Priority-1	Priority-2	Priority-3		
01.	Chittagong	384.05	67.70	0.00	451.75	
02.	Khulna	246.82	71.80	7.00	325.62	
	Total : (Tk.in Lac)	630.87	139.50	7.00	777.37	
	(US \$ Million)	1.66	0.37	0.02	2.05	

US \$ 1 = Tk. 38.00

Source : SMEC's Assessment Report

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TABLE 3.27

Department of LGED
Cost for reconstruction/rehabilitation of
'91 Cyclone affected rural infrastructure

Division : Chittagong (Rural Infrastructure)

Cost in Tk. Lac

Sl. No.	Name of District	Works			Total	Remarks
		Priority-1	Priority-2	Priority-3		
01.	Chittagong	98.00	4.00	0.00	102.00	
02.	Bandarban	9.30	0.00	0.00	9.30	
03.	Cox's Bazar	60.00	0.00	0.00	60.00	
04.	Khagrachhari	1.90	0.00	0.00	1.90	
05.	Rangamati	95.50	17.00	0.00	112.50	
06.	Comilla	0.00	0.00	0.00	0.00	
07.	Chandpur	10.50	3.00	0.00	13.50	
08.	NOakhali	51.35	39.00	0.00	90.35	
09.	Feni	21.40	4.70	0.00	26.10	
10.	Lakshmipur	36.10	0.00	0.00	36.10	
Total : (Tk.in Lac)		384.05	67.70	0.00	451.75	
(US \$ Million)		1.01	0.18	0.00	1.19	

US \$ 1 = Tk. 38.00

Source : SMEC's Assessment Report

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TABLE 3.28

Department of LGED
Cost for reconstruction/rehabilitation of
'91 Cyclone affected rural infrastructure

Division : Khulna (Rural Infrastructure)					Cost in Tk. Lac	
Sl. No.	Name of Dist.	Work			Total	Remarks
		Priority-1	Priority-2	Priority-3		
01.	Bagerhat	0.00	0.00	0.00	0.00	
02.	Barguna	5.00	14.00	0.00	19.00	
03.	Barisal	59.50	14.45	0.00	73.95	
04.	Bhola	56.00	7.50	0.00	63.50	
05.	Jhalakati	0.00	0.00	0.00	0.00	
06.	Patuakhali	87.60	27.15	0.00	114.75	
07.	Pirojpur	0.00	0.00	7.00	7.00	
08.	Shariatpur	38.72	8.70	0.00	47.42	
Total : (Tk.in Lac)		246.82	71.80	7.00	325.62	
(US \$ Million)		0.65	0.19	0.02	0.86	

US \$ 1 = Tk. 38.00

Source : SMEC's Assessment Report

TABLE 3.29

Department of LGED
Cost for reconstruction/rehabilitation of
Rural Roads & Bridges

Division : Chittagong & Khulna

Cost in Tk. Lac

Sl. No.	Division	Works			Total	Remarks
		Priority-1	Priority-2	Priority-3		
01.	Chittagong	3,451.17	3,272.62	3,574.00	10,297.79	
02.	Khulna	236.40	288.50	1,942.93	2,467.83	
	Total : (Tk.in Lac)	3,687.57	3,561.12	5,516.93	12,765.62	
	(US \$ Million)	9.70	9.37	14.52	33.59	

US \$ 1 = Tk. 38.00

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TABLE 3.30

Department of LGED
Cost for reconstruction/rehabilitation of
'91 Cyclone affected Rural Roads and Bridges

Division : Chittagong (Rural Roads and Bridges)

Cost in Tk. Lac

Sl. No.	Name of District	Work			Total	Remarks
		Priority-1	Priority-2	Priority-3		
01.	Chittagong	1,731.48	1,895.72	1,548.00	5,175.20	
02.	Bandarban	0.00	0.00	82.30	82.30	
03.	Cox's Bazar	984.90	1,066.55	965.10	3,016.55	
04.	Khagrachhari	0.00	0.00	7.00	7.00	
05.	Rangamati	0.00	0.00	230.90	230.90	
06.	Comilla	0.00	16.00	0.00	16.00	
07.	Chandpur	140.30	53.50	0.00	193.80	
08.	Noakhali	333.19	138.15	657.1	1,128.44	
09.	Feni	116.50	54.40	0.00	170.90	
10.	Lakshmipur	144.80	48.30	83.60	276.70	
Total : (Tk.in Lac)		3,451.17	3,272.62	3,574.00	10,297.79	
(US \$ Million)		9.08	8.61	9.41	27.10	

US \$ 1 = Tk. 38.00

Source : SMEC's Assessment Report

TABLE 3.31

Department of LGED
 Cost for reconstruction/rehabilitation of
 '91 Cyclone affected Rural Roads and Bridges

Division : Khulna (Rural Roads & Bridges)

Cost in Tk. Lac

Sl. No.	Name of District	Work			Total	Remarks
		Priority-1	Priority-2	Priority-3		
01.	Bagerhat	0.00	0.00	58.03	58.03	
02.	Barguna	0.00	15.00	82.00	97.00	
03.	Barisal	0.00	0.00	385.50	385.50	
04.	Bhola	100.40	174.50	945.37	1,220.27	
05.	Jhalakati	0.00	0.00	142.75	142.75	
06.	Patuakhali	136.00	99.00	68.65	303.65	
07.	Pirojpur	0.00	0.00	179.63	179.63	
08.	Shariatpur	0.00	0.00	81.00	81.00	
Total : (Tk.in Lac)		236.40	288.50	1,942.93	2,467.83	
(US \$ Million)		0.62	0.76	5.11	6.49	

US \$ 1 = Tk. 38.00

Source : SMEC's Assessment Report

TABLE 3.32

Department of LGED
Summary of Cost for reconstruction/rehabilitation of Pourashava
of '91 Cyclone affected Chittagong and Khulna Division

Division : Chittagong & Khulna

Cost in Tk. Lac

Sl. No.	Name of Pourashava	Infrastructure + Roads & Bridges			Total	Remarks
		Priority-1	Priority-2	Priority-3		
01.	Chittagong Division	230.90	180.10	15.00	426.00	
02.	Khulna Division	0.00	0.00	245.30	245.30	
	Total : (Tk in Lac)	230.90	180.10	260.30	671.30	
	(US \$ Million)	0.61	0.47	0.69	1.77	

US \$ 1 = Tk. 38.00

Source : SMEC's Assessment Report

TABLE 3.33

Department of LGED
 Cost for reconstruction/rehabilitation of
 '91 Cyclone damaged infrastructure & roads
 and Bridges of Chittagong Pourashava

Division : Chittagong

Cost in Tk. Lac

Sl. No.	Head of Works	Chittagong Pourashava			Total	Remarks
		Priority-1	Priority-2	Priority-3		
01.	Infrastructure	17.00	4.00	15.00	36.00	
02.	Roads & Bridges	213.90	176.10	0.00	390.00	
	Total : (Tk in Lac)	230.90	180.10	15.00	426.00	
	(US \$ Million)	0.61	0.47	0.04	1.12	

US \$ 1 = Tk. 38.00

Source: SMEC's Assessment report

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TABLE 3.34

Department of LGED
Cost for reconstruction/rehabilitation
of '91 Cyclone affected Infrastructure

Division : Chittagong (Pourashava : Infrastructure)

Cost in Tk. Lac

Sl. No.	Name of District	Work			Total	Remarks
		Priority-1	Priority-2	Priority-3		
01.	Basurhat	0.00	0.00	0.00	0.00	
02.	Chandpur	10.00	0.00	15.00	25.00	
03.	Chaumuhani	0.00	0.00	0.00	0.00	
04.	Cox's Bazar	7.00	4.00	0.00	11.00	
05.	Feni	0.00	0.00	0.00	0.00	
06.	Lakshmipur	0.00	0.00	0.00	0.00	
07.	Noakhali	0.00	0.00	0.00	0.00	
Total : (Tk in Lac)		17.00	4.00	15.00	36.00	
(US \$ Million)		0.04	0.01	0.04	0.09	

US \$ 1 = Tk. 38.00

Source : SMEC's Assessment Report

TABLE 3.35

Department of LGED
Cost for reconstruction/rehabilitation
of '91 Cyclone affected Infrastructure of Pourashava

Division : Chittagong (Pourashava : Roads & Bridges)

Cost in Tk. Lac

Sl. No.	Name of District	Work			Total	Remarks
		Priority-1	Priority-2	Priority-3		
01.	Basurhat	0.00	0.00	0.00	0.00	
02.	Chandpur	10.00	0.00	0.00	10.00	
03.	Chaumuhani	46.40	0.00	0.00	46.40	
04.	Cox's Bazar	59.00	73.00	0.00	132.00	
05.	Feni	54.30	43.60	0.00	97.90	
06.	Lakshmipur	24.20	17.50	0.00	41.70	
07.	Noakhali	20.00	42.00	0.00	62.00	
Total : (Tk in Lac)		213.90	176.10	0.00	390.00	
(US \$ Million)		0.56	0.46	0.00	1.03	

US \$ 1 = Tk. 38.00

Source: SMEC's Assessment report

TABLE 3.36

Department of LGED
Cost for reconstruction/rehabilitation
of '91 Cyclone affected Structure of Pourashava

Division : Khulna (Paurashava : Roads)

Cost in Tk. Lac

Sl. No.	Name of District	Work			Total	Remarks
		Priority-1	Priority-2	Priority-3		
01.	Bagerhat	0.00	0.00	34.00	34.00	
02.	Barguna	0.00	0.00	29.30	29.30	
03.	Barisal	0.00	0.00	49.60	49.60	
04.	Bhola	0.00	0.00	0.00	0.00	
05.	Jhalakati	0.00	0.00	37.40	37.40	
06.	Patuakhali	0.00	0.00	45.00	45.00	
07.	Pirojpur	0.00	0.00	50.00	50.00	
08.	Shariatpur	0.00	0.00	0.00	0.00	
Total : (Tk in Lac)		0.00	0.00	245.30	245.30	
(US \$ Million)		0	0	0.65	0.65	

US \$ 1 = Tk. 38.00

Source: SMEC's Assessment report



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TABLE 3.37

Assistance to Ministry of Relief
Estimate, Programme and Progress of 1991 Cyclone damage re-construction/rehabilitation (Financial)

Department/Agency : Local Govt. Engineering Department

Tk. in Lac

Priorty	Years	Preliminary estimate Prepared by (Agency/Deptt)	Revised Estimate	Final estimate Prepared by (Agency/Consult)	Value of work Programme	Contract Value	Value of work completed by		Remarks
							30-06-1992 (Percent Total)	30-09-1992 (Percent Total) (Cumulative)	
01.	1991-1992		4,549.34	4,549.34	1,350.00	55.00	562.00 (71%)	--	a) Cost of works executed under scheme FFW Tk. 561.16 Lac
02.	1992-1993	18,000.00	3,880.72	3,880.72	6,689.00	5,956.00	--	3,927.00 (58%)	
03.	1993-1994		5,784.23	5,784.23	--	--	--	--	
Total : Tk.in Lac		18,000.00	14,214.29	14,214.29	8,039.00	6,011.00	562.00	3,927.00	
US \$ Million			37.41	37.41	21.16	15.82	1.48	10.33	

Source : LGED

US \$ 1 = Tk.38.00

Note : Estimates excluding contingency and consultancy (35%)

TABLE 3.38

Department of LGED
Component wise Achievement of Cyclone Rehabilitation work

Division : Chittagong & Khulna : Rural Infrastructure & Pourashava

Tk.in Lac

Sl. No.	Name of the Component	Unit	Total Length	Total Achieve	Total Contact amount (Tk.in Lac)	Total Fund spent (Tk.in Lac)	Remarks
01.	Road	Km	300	254.50	3,196.10	2,037.88	
02.	B/Culvert	M	2100	1,074.40	1,837.71	1,191.75	
03.	Drain	M	4000	1,719.00	422.59	312.60	
04.	R/Wall	M	2000	1,354.10	554.50	374.49	
Total :		Tk.in Lac			6,010.90	3,916.72	
		US \$ Million			15.82	10.31	

Source : LGED

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TABLE 3.39

Summary : Cyclone damage
Total schievement of rehabilitation work of Districts and Pourashava

Name of City Corporation/ Pourashava	Component wise Achievement				Tk.in Lac	
	Road (Km)	Bridge/Culvt. (M)	Drain (M)	R/Wall (M)	Contract amount (Tk.in Lac)	Amount spent Tk.in Lac)
District's Total	163.50	810.40	350.00	275.00	4,058.98	2,503.66
Pourashava Total	91.00	264.00	1,369.00	1,079.10	1,951.92	1,413.06
Grand Total	254.50	1,074.40	1,719.00	1,354.10	6,010.90	3,916.72

TABLE 3.40

Department of LGED
Pourashava wise Achievement Progress of Cyclone Rehab. Works

Division : Chittagong						Tk.in Lac		
Sl. No.	Name of City Corporation/ Pourashava	Component wise Achievement				Contract amount (Tk.in Lac)	Amount spent Tk.in Lac)	Progress (%)
		Road (Km)	Bridge/Culvt. (M)	Drain (M)	R/Wall (M)			
01.	C.C.C.	56.00	215.00	—	250.00	1,254.92	947.16	75
02.	Cox's Bazar	2.00	2.50	25.00	601.00	77.79	44.26	56
03.	Bandarban	3.00	—	300.00	—	52.90	52.51	99
04.	Khagrachari	4.50	—	500.00	—	52.10	48.82	93
05.	Rangamati	3.50	—	242.00	178.00	94.90	69.06	72
06.	Feni	2.50	—	252.00	50.10	29.72	28.79	96
07.	Chowmuhan	4.00	1.50	—	—	78.76	37.53	47
07.	Noakhali	4.50	20.00	—	—	115.38	73.20	63
08.	Laxmipur	3.50	25.00	—	—	62.78	46.43	73
09.	Chandpur	4.50	—	—	—	101.32	44.52	43
10.	Haziganj	3.00	—	50.00	—	31.35	20.78	66
Total Pourashava's		91.00	264.00	1,369.00	1,079.10	1,951.92	1,413.06	

Source : LGED

C.C.C. = Chittagong City Corporation

BURUNDI - POURASHAVA

TABLE 3.41

Department of LGED
District wise achievement progress of Cyclone Rehabilitation Works

Division: Chittagong & Khulna : (Rural Infrastructure)

						Tk.in Lac		
Sl. No.	Name of District	Component wise Achievement				Contract amount (Tk.in Lac)	Amount spent (Tk.in Lac)	Progress (%)
		Road (Km)	Bridge/Culvt. (M)	Drain (M)	R/Wall (M)			
01.	Chittagong	50.00	70.00	—	—	1,046.18	726.71	70
02.	Cox's Bazar	8.50	115.00	—	275.00	831.04	584.19	72
03.	Bandarban	6.50	10.00	350.00	—	88.15	87.92	99
04.	Khagrachari	5.00	11.50	—	—	85.32	56.62	66
05.	Rangamati	5.50	—	—	—	77.74	61.79	79
06.	Feni	23.50	210.00	—	—	371.73	261.42	73
07.	Noakhali	18.00	100.90	—	—	628.50	351.72	55
08.	Laxmipur	36.00	91.00	—	—	363.50	229.95	63
09.	Chandpur	6.50	86.00	—	—	398.54	87.99	22
10.	Bhola	4.00	116.00	—	—	168.28	55.35	56
Total:	Tk.in Lac	163.50	810.40	350.00	275.00	4,058.98	2,503.66	
	US \$ Million	0.43	2.13	0.92	0.72	10.68	6.59	

US \$ 1 = Tk. 38.00

Source : LGED

BULN/7/SUM-RUL.WE

TABLE 3.42

Department of LGED
Financial Progress of GCCR Appurtenant
Structure Scheme of 1991 - 1992

Division : Chittagong		Tk.in Lac			
Name of District	No. of Structure	Approved Estimated Cost (Tk.in Lac)	Work Started (No.)	Value of work Accomplished till 30th Sept/92 (Tk. in Lac)	Fund Paid (Tk. in Lac)
Noakhali	9	43.45	5	0.07	--
Laxmipur	7	21.26	5	2.95	--
Feni	2	6.18	2	4.92	--
Chittagong	8	15.73	8	2.36	--
Cox's Bazar	8	24.78	8	--	--
Total	Tk.in Lac 34 US \$ Million	111.40 0.29	28	10.30 0.03	

Source : LGED
US \$ 1 = Tk .38.00

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TABLE 3.43

Summary of financial progress of Earthwork executed under FFW
Scheme in 1991 - 1992 for Road repair, Killa repair, GCCR repair

Division : Chittagong & Khulna

Head of work	Affected Scheme/ length (Km)	Scheme length completed (Km)	Wheat Alloted (Mt)	Wheat Utilised (Mt)	Cost of the utilised wheat (Tk. Lac)	Carr. Cost & Contin Fund (Tk. Lac)	Total Cost of Rehab (Tk. Lac)
Road repair/ reconst. scheme	422.66	369.31	4,999.90	4,551.62	309.51	5.11	314.62
Repair/reconst. of earthen killah	--	--	2,512.75	1,775.45	120.73	1.68	122.41
Repair/reconst. of GCCR	82.71	73.64	2,433.81	1,799.45	122.36	1.77	124.13
Total: Tk. in Lac	505.37	442.95	9,946.46	8,126.52	552.60	8.55	561.16
US\$ in Million					1.45	0.02	1.48

1 US\$ = Tk. 38.00
Cost of wheat = Tk. 6,800/Mt
GCCR = Growth Centre Connection Road
Source : LGED

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TABLE 3.44

Department of LGED
Financial Progress of Road Scheme Executed
under FFW Scheme in 1990 - 1991 and 1991 - 1992

Division : Khulna & Chittagong

Name of Dist	Affected Scheme length (Km)	Scheme length completed (Km)	Wheat Alloted (Mt)	Wheat Utilised (Mt)	Cost of utilised Wheat (Tk. Lac)	Carr. Cost & Contin Fund (Tk. Lac)	Total Cost of the work (Tk. Lac)
Barguna	12.28	12.28	213.92	206.74	14.06	0.18	14.24
Bhola	8.04	7.91	117.61	116.21	7.90	0.13	8.03
Patuakhali	42.14	40.49	821.86	773.06	52.57	0.97	53.53
Barisal	41.41	37.86	607.80	557.37	37.90	0.58	38.48
Feni	6.39	4.80	41.15	31.18	2.12	0.04	2.16
Laxmipur	18.70	13.68	163.83	160.33	10.90	0.19	11.09
Noakhali	40.94	34.52	399.98	325.94	22.16	0.35	22.51
Chittagong	160.66	136.97	1,488.45	1,335.00	90.78	1.59	92.37
Cox's Bazar	92.11	80.81	1,145.30	1,045.79	71.11	1.10	72.21
Total : Tk.in Lac	422.66	369.31	4,999.90	4,551.62	309.51	5.11	314.62
US\$ Million					0.81	0.01	0.83

US \$ 1.00 = Tk. 38.00

Value of wheat = Tk.6,800/Mt

Source : LGED

BULZ/7/NEW-8/DSCH/WK

TABLE 3.45

Department of LGED
Financial Progress of Earthen Killa Scheme
Executed under FFW Scheme in 1991 - 1992

Division : Chittagong & Khulna

Name of Dist	Affected Scheme (No.)	Wheat Alloted (Mt)	Wheat utilised (Mt)	Cost of utilised wheat (Tk.Lac)	Carr.Cost & Contin Fund (Tk. Lac)	Total Cost of the work (Tk. Lac)
Barguna	2.00	135.45	154.00	10.47	0.18	10.65
Bhola	6.00	427.02	354.84	24.13	0.20	24.33
Patuakhali	2.00	112.12	105.39	7.17	0.14	7.31
Barisal	0.00	0.00	0.00	0.00	0.00	0.00
Feni	1.00	65.02	40.50	2.75	0.04	2.79
Laxmipur	2.00	111.04	108.14	7.35	0.13	7.48
Noakhali	6.00	374.29	355.31	24.16	0.39	24.55
Chittagong	6.00	382.03	260.00	17.68	0.25	17.93
Cox's Bazar	15.00	905.78	397.28	27.01	0.35	27.36
Total :						
Tk.in Lac	40.00	2,512.75	1,775.45	120.73	1.68	122.41
US\$ Million				0.318	0.004	0.322

US \$ 1 = Tk. 38.00

Cost of Wheat = Tk. 6,800/Mt

Source : LGED

TABLE 3.46

Department of LGED
Financial Progress of Earthwork of GCCR Schemes
under FFW Programme in 1991-92

Division : Chittagong

Name of District	Affected Scheme length (Km)	Scheme length completed (Km)	Wheat Alloted (Mt)	Wheat Utilised (Mt)	Cost of utilised Wheat (Tk. Lac)	Carr. Cost & Contin Fund (Tk. Lac)	Total expenditure (Tk. Lac)
Noakhali	28.49	28.67	747.24	632.08	42.98	0.73	43.71
Laxmipur	11.01	11.02	322.89	298.20	20.28	0.37	20.64
Feni	8.03	8.03	138.52	138.52	9.42	0.12	9.54
Chittagong	14.51	12.73	482.01	412.58	28.06	0.37	28.42
Cox's Bazar	20.67	13.19	743.15	318.07	21.63	0.19	21.82
Total : Tk.in Lac	82.71	73.64	2,433.81	1,799.45	122.36	1.77	124.13
US\$ Million					0.322	0.005	0.327

US \$ 1 = Tk. 38.00

Cost of wheat = Tk.6,800/Mt

GCCR = Growth Centre Connecting Road

Source : LGED

BULZ/TAEW - RDSCH W30



TABLE 3.47

Local Government Engineering Department

Availability of fund for the rehabilitation of cyclone damaged works

Sl. No.	Donor Agency		Amount	Name of works against which fund placed/committed	Status of Project works
	F.C.		(Tk. in lac)		
1.	IFAD		700.00	10 Nos. Cyclone Shelter at Kutubdia	Work is in progress
2.	IFAD		658.00	Minor Irrigation Project (Commanded area – 6000 acres) at Chokoria	–Do–
3.	Saudi Govt.	10 Million (S. Rial)	1,000.00	Cyclone Shelter, Roads and Bridges growth Centre repair/reconstruction in greater Noakhali District	Under Feasibility Study
4.	ADB loan	15 Million US\$	5,700.00	Repair of 415 Nos. Rural Primary School (10mm US\$) and 50 Nos. Secondary School (5 Million US\$)	Work Completed
5.	ADB loan	15 Million US\$	5,700.00	Repair of bridges & culverts in cyclone affected areas.	Progressing
6.	DANIDA		–	Reconstruction of jetties in greater Barisal and Patuakhali District.	Not started
7.	EEC		111.00	Reconstruction of GOCR appurtenant structure	Work Progressing
Total			13,869.00		

TABLE 3.48

Local Government Engineering Department

Availability of wheat for repair/rehabilitation of cyclone damaged roads & killahs

Sl. No.	Donor Agency	Quantity (m. ton)	Amount (Tk. in lac)	Name of work against wheat Utilised/to be utilised	Status of Project Work
1.	WFP	5,000.00	340.00	Rural road repair in cyclone affected areas	Work completed
2.	WFP	2,500.00	170.00	40 Nos. Killa in cyclone affected areas.	Work completed
3.	WFP	2,500.00	170.00	Repair of GOCR in cyclone affected areas.	Work completed
Total		10,000.00	680.00		

US \$ 1 = Tk. 38.00

1 Saudi Rial = Tk. 10.35

Cost of wheat = Tk. 6,800/mt.

Source : LGED & Annual Development Programme

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LGED has taken up the construction work of jetty (Special project) at Kutubdia (Borogoph) and at Chokoria (Magnama). The design of the Jetty is in progress.

Works of growth centre connection road appurtment structure aided by EEC, are progressing in Noakhali, Laximpur, Feni, Chittagong and Cox's Bazar districts.

The total value of reconstruction/rehabilitation work completed by LGED under FFW scheme till 30th June 1992 is for Tk. 562.00 Lac and till 30th September 1992 work has been completed valued Tk. 3,927.00 Lac (Cumulative) (Table 3.37 to Table 3.46)

e) **Availability of Fund for rehabilitation/reconstruction/construction of LGED works:**

Commitments for financial assistance so far obtained for the reconstruction/ rehabilitation of LGED's cyclone damaged works are for Tk. 13,869.00 Lac. The quantum of wheat allotted for the reconstruction of roads, and Killas is 10,000 metric tons. Details of fund is presented in Tables 3.47 and 3.48.

3.9 Ministry of Education (Facilities Department)

a) **Introduction**

In cyclone of 29-30th April, 1991 with a maximum wind speed of 225 km/hr and a high intensity storm surge of 4-6 metres damaged about 8,148 schools of coastal districts of Chittagong and Khulna division. Out of those 8,148 schools 5,375 were Primary Schools and 2,773 were secondary schools. The cyclone caused damage to some of the colleges of those districts and to the Chittagong University also.

Just after the cyclone the World Bank entrusted the Snowy Mountains Engineering Corporation (SMEC) to assess the damage caused due to cyclone of '91 in association with the Bangladesh Consultant Limited (BCL). Information are mostly taken from the consultants report. The officials of facilities department were contacted several times for up dating the information.

b) **Assessment of Damage**

The SMEC and BCL constituted a team consisting of an expatriate engineer and a local engineer who visited damaged sites of most of the cyclone affected districts. Due to the large number of sites it was not possible for them to visit all the sites. A sampling was used as described in the methodology. The facilities department claimed the damage repairs for 12,000 schools (Primary, Secondary, Madrasha & College). The initial information regarding the damage received by the Consultant indicated that the damage occurred for 9,500 schools and colleges. The assessment team of SMEC in association of BCL after the visit of sites found that about 8,148 Nos. Schools (Primary and Secondary) were damaged by the cyclone (Table 3.49).

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TABLE 3.49
Ministry of Education
Facilities Department

Districtwise List of Schools which were Damaged by 1991 Cyclone

Division : Chittagong

Sl. No.	Name of District	Primary School				Secondary School			
		100% Damaged	75% Damaged	50% Damaged	Total Number	100% Damaged	75% Damaged	50% Damaged	Total Number
1.	Chittagong	308	420	691	1,419	161	156	281	598
2.	Cox's Bazar	182	152	78	412	111	3	43	157
3.	Rangamati	179	95	103	377	33	—	22	55
4.	Bandarban	60	54	90	204	2	11	4	17
5.	Feni	57	39	130	226	17	16	81	114
6.	Noakhali	166	100	206	472	23	63	224	310
7.	Laxmipur	16	25	63	104	13	132	73	218
8.	Comilla	13	33	24	70	5	8	5	18
9.	Chandpur	36	30	79	145	3	2	3	8
10.	Khagrachari	114	54	90	258	3	27	14	44
Sub-Total		1,131	1,002	1,554	3,687	371	418	750	1,539

Division : Khulna

Sl. No.	Name of District	Primary School				Secondary School			
		100% Damaged	75% Damaged	50% Damaged	Total Number	100% Damaged	75% Damaged	50% Damaged	Total Number
1.	Khulna	1	4	20	25	2	2	2	6
2.	Patuakhali	119	183	185	487	41	189	115	345
3.	Bhola	97	212	149	458	25	113	136	274
4.	Jhalokathi	17	34	72	123	7	56	77	140
5.	Perojpur	9	7	25	41	7	18	27	52
6.	Barisal	102	36	164	302	3	19	203	225
7.	Barguna	65	67	61	193	47	65	71	183
8.	Satkhira	1	—	1	2	—	—	2	2
9.	Bagerhat	9	8	16	33	1	1	4	6
10.	Shariatpur	4	16	4	24	—	—	1	1
Sub-Total		424	567	697	1,688	133	463	638	1,234
Total		1,555	1,569	2,251	5,375	504	881	1,388	2,773

Total Nos. of School Damaged : $5375 + 2773 = 8148$

Source : SMEC's Cyclone Damage Assessment Report



- Special Provision

During the assessment, the consultant provided the replacement of 500 school's roof slab which were found very weak in the structural point of view, reinforcement are exposed due to the spalling of concrete. The consultant has also provided for the replacement of damaged Katcha school sheds with semi-pucca buildings.

For many of the severely damaged buildings of the cyclone damaged area under the jurisdiction of the Ministry of Education (i.e. facilities for both Govt. and non-Govt., Primary and Secondary School) the damaged sections of the buildings or complete building needs replacement of structure which have been designed to meet cyclone resistant design requirements for wind load. The cost of the replacement also have been provided.

- Assessment of Cost of Cyclone Damaged Structures.

The consultant estimated the cost of damage of 8,148 Primary and Secondary, schools for Tk. 25,067.19 Lac. and Tk. 1,350 Lac has been provided against the replacement of 500 school's roof slab. The consultant considered 10% cost for contingency, 22% for escalation price and about 6% for consultancy. Therefore, the total cost for rehabilitation and reconstruction comes to Tk.36,455.72 Lac (Table 3.50 and 3.51) including the cost of replacement of slabs for some schools of vulnerable condition.

The rehabilitation and reconstruction of cyclone affected land works have been divided in 3 phases as, Priority-1, Priority-2 and Priority-3. The slab replacement and other special works have been provided in Priority-4 (Table 3.51).

On completion of the field trips, the assessment teams prepared preliminary estimates based on costs and the priority they considered appropriate for the various works.

The preliminary estimate and priorities were discussed with appropriate department officials.

There was general agreement between the Education Department and the Consultant on the total number of schools with cyclone damage and the estimated costs of repair of a typical school building.

The discussions with the Department became the basis for the preparation of the report and the final cost estimate.

c) Methodology

After receipt of the initial information from the field, the consultant had several discussions with senior officials of the primary schools and secondary schools. The assessment team collected list of damaged schools of each area from the departmental heads. The consultant's assessment team visited the cyclone affected districts as well as the off shore island. Initially the list collected by the assessment team was found at lower side.

TABLE 3.50
Ministry of Education
Facilities Department

Summary of Cyclone Damage Costs
Total of Priority 1, 2 and 3

Sl. No.	Division	Cyclone Damage				Replacement of roof/slab					
		Primary		Secondary		Total		Total			
		No.	Amount (Tk. in lac)	No.	Amount (Tk. in lac)	No.	Amount (Tk. in lac)	No.	Amount (Tk. in lac)		
1.	Chittagong	3,687	10,327.80	1,539	6,200.98	5,226	16,528.78	130	350.00	5,356	16,878.78
2.	Khulna	1,688	4,541.60	1,234	3,996.81	2,922	8,538.41	370	1,000.00	3,292	9,538.41
	Total	5,375	14,869.40	2,773	10,197.79	8,148	25,067.19	500	1,350.00	8,648	26,417.19

Total Nos. of School Damaged : 5375 + 2773 = 8148 Nos.

TABLE 3.51
Ministry of Education
Facilities Department
Rehabilitation Costs for Cyclone Damaged Education Facilities

Sl. No.	Division	Consultant's Estimate	Cyclone Damage (Tk. in lac)			Total of Priority 1,2&3	Replacement of Roof/Slab Priority 4 (Tk. in lac)
			Priority 1	Priority 2	Priority 3		
1.	Chittagong	16,878.78	7,644.29	6,611.51	2,272.98	16,528.78	350.00
2.	Khulna	9,538.41	3,869.52	3,415.37	1,253.52	8,538.41	1,000.00
	Sub-Total (Tk. Lac)	26,417.19	11,513.81	10,026.88	3,526.50	25,067.19	1,350.00
	38% Cont. Allowance	10,038.53	4,375.25	3,810.21	1,340.07	9,525.53	513.00
	Total (Tk. Lac.)	36,455.72	15,889.06	13,837.09	4,866.57	34,592.72	1,863.00
	Total (US\$ Million)	95.94	41.81	36.41	12.81	91.03	4.90

US\$ 1 = Tk. 38.00

Source : SMEC's Cyclone Damage Assessment Report

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The damaged buildings classified by the assessment team as :

- | | |
|--------------|---|
| ■ Pucca | Buildings having concrete floor, brick wall and roof slab. |
| ■ Semi Pucca | Buildings having concrete floor, brick wall and C.I. sheet roofing. |
| ■ Katcha | Buildings having earthen floor, bamboos or C.I. sheet wall and C.I. sheet roof. |

- **Sampling Procedure**

It was not possible for the consultant to visit all the sites (more than 8,000) within stipulated time. The consultant, therefore, had to base his assessment on a small sample. The consultant selected 287 samples and related the findings to the total number of schools. According to intensity of damage the consultant classified the damaged buildings as:

- In need of complete replacement
- Very badly damaged
- Badly damaged
- Partly damaged.

The cost of repairing the damage to these schools were considered to be a fair representation of the actual cost and has been correlated with the department's cost of repairing similarly damaged sites. Where Katcha building were damaged those were replaced with semi-pucca buildings.

- **Basis of estimate**

Unit rates for the various types of works required to reconstruct the facilities were carried out by the consultant based on;

- the cost of material
- the cost of labour
- the profit of the contractor

The unit rates were discussed with the departmental officials and became the basis for the project cost estimates. Lump sum amount for the replacement of furniture, science equipment and books were discussed with local officials. Replacement of tubewells and sewage facilities were also considered by the consultant where required.

The typical repair costs per school has been considered by the consultant during cost estimate is summarised as

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Type of Damage	Primary Schools (Tk.in Lac)	Secondary Schools (Tk. in Lac)
Replacement of katcha	5.00	9.15
Very badly damaged	3.20	4.06
Badly damaged	1.60	2.41
Partly damaged	0.80	1.01

The reason for assigning higher percentage of damaged primary school to priority 1 and lower percentage of primary schools to priority-3 than was done with the secondary schools is due to the fact that more secondary schools are pucca or semi-pucca structures. The katcha and semi-pucca structures generally suffered higher cyclone damage than pucca structures.

The estimated cost for the rehabilitation of the cyclone damaged education facilities of the Chittagong and Khulna Division has been summarised as below from Tables 3.52, 3.53, 3.54, 3.55, but excluding the cost for replacement of slabs.

Cost Estimate for Cyclone Damage to Education Facilities (Tk.in Lac)

Administrative Division	Education Facilities	
	Primary	Secondary
Chittagong Division	10,327.80	6,200.98
Khulna Division	4,541.60	3,996.81
Base Estimate	14,869.40	10,197.79
Sub-Total	25,067.19	
Plus 10% Physical Contingency	2,506.72	
Plus 22% Pirce Escalation	5,514.78	
Plus Consultancy Fee (6%)	1,504.03	
Total	34,592.72	

Special Projects

The consultant during the damage assessment made provision for some worst affected schools not damaged by cyclone, as special project. Those were not being maintained by the department for long time due to the non availability of fund.

The following schools have been considered under the special project:

- Chinkardi Govt. Primary school, Galachipa, Patuakhali;
2-storied cyclone shelter constructed by Rotary in 1974. Replacement of the School is necessary.

TABLE 3.52
Ministry of Education
Facilities Department

Estimated Cost for Repair/Reconstruction of Schools

Type of Schools : Primary			Tk. in Lac													
Division		:	Chittagong													
Sl. No.	Districts	No.	To be Replaced		Very Badly Damaged		Badly Damaged		Partly Damaged		Total					
			Unit Rate Tk. Lac/No.	Amount Tk. Lac	No.	Unit Rate Tk. Lac/No.	Amount Tk. Lac	No.	Unit Rate Tk. Lac/No.	Amount Tk. Lac	No.	Amount Tk. Lac				
1.	Chittagong	308	5.00	1,540.00	315	3.2	1,008.00	451	1.60	721.60	345	0.8	276.00	1419	3,545.60	
2.	Cox's Bazar	182	5.00	910.00	114	3.2	364.80	77	1.60	123.20	39	0.8	31.20	412	1,429.20	
3.	Rangamati	179	5.00	895.00	71	3.2	227.20	75	1.60	120.00	52	0.8	41.60	377	1,283.80	
4.	Bandarban	60	5.00	300.00	41	3.2	131.20	58	1.60	92.80	45	0.8	36.00	204	560.00	
5.	Feni	57	5.00	285.00	29	3.2	92.80	75	1.60	120.00	65	0.8	52.00	226	549.80	
6.	Noakhali	166	5.00	830.00	75	3.2	240.00	128	1.60	204.80	103	0.8	82.40	472	1,357.20	
7.	Laxmipur	16	5.00	80.00	19	3.2	60.80	37	1.60	59.20	32	0.8	25.60	104	225.60	
8.	Comilla	13	5.00	65.00	25	3.2	80.00	20	1.60	32.00	12	0.8	9.60	70	186.60	
9.	Chandpur	36	5.00	180.00	23	3.2	73.60	47	1.60	75.20	39	0.8	31.20	145	360.00	
10.	Khagrachari	114	5.00	570.00	41	3.2	131.20	58	1.60	92.80	45	0.8	36.00	258	830.00	
Total		1,131		5,655.00	753		2,409.60	1,026		1,641.60	777		621.60	3,687	10,327.80	

Source : SMEC's Cyclone Damage Assessment Report

TABLE 3.53
Ministry of Education
Facilities Department

Estimated Cost for Repair/Reconstruction of Schools

Type of Schools : Secondary

Division : Chittagong

Tk. in Lac

Sl. No.	Districts	No.	To be Replaced		Very Badly Damaged			Badly Damaged			Partly Damaged			Total	
			Unit Rate Tk. Lac/No.	Amount Tk. Lac	No.	Unit Rate Tk. Lac/N	Amount Tk. Lac	No.	Unit Rate Tk. Lac/No.	Amount Tk. Lac	No.	Unit Rate Tk. Lac/No	Amount Tk. Lac	No.	Amount Tk. Lac
1.	Chittagong	161	9.15	1,473.15	117	4.06	475.02	180	2.41	433.80	140	1.01	141.40	598	2,523.37
2.	Cox's Bazar	111	9.15	1,015.65	2	4.06	8.12	22	2.41	53.02	22	1.01	22.22	157	1,099.01
3.	Rangamati	33	9.15	301.95	0	4.06	0.00	11	2.41	26.51	11	1.01	11.11	55	339.57
4.	Bandarban	2	9.15	18.30	8	4.06	32.48	5	2.41	12.05	2	1.01	2.02	17	64.85
5.	Feni	17	9.15	155.55	12	4.06	48.72	45	2.41	108.45	40	1.01	40.40	114	353.12
6.	Noakhali	23	9.15	210.45	47	4.06	190.82	128	2.41	308.48	112	1.01	113.12	310	822.87
7.	Laxmipur	13	9.15	118.95	99	4.06	401.94	69	2.41	166.29	37	1.01	37.37	218	724.55
8.	Comilla	5	9.15	45.75	6	4.06	24.36	4	2.41	9.64	3	1.01	3.03	18	82.78
9.	Chandpur	3	9.15	27.45	2	4.06	8.12	2	2.41	4.82	1	1.01	1.01	8	41.40
10.	Khagracharr	3	9.15	27.45	20	4.06	81.20	14	2.41	33.74	7	1.01	7.07	44	149.46
		Total		3,394.65	313		1,270.78	480		1,156.80	375		378.75	1,539	6,200.98

Source : SMEC's Cyclone Damage Assessment Report

TABLE 3.54
Ministry of Education
Facilities Department

Estimated Cost for Repair/Reconstruction of Schools

Type of Schools: Primary			Tk. in Lac																	
Division: Khulna			To be Replaced				Very Badly Damaged				Badly Damaged				Partly Damaged				Total	
Sl. No.	Districts	No.	Unit Rate Tk. Lac/No.	Amount Tk. Lac	No.	Unit Rate Tk. Lac/N	Amount Tk. Lac	No.	Unit Rate Tk. Lac/No.	Amount Tk. Lac	No.	Unit Rate Tk. Lac/No.	Amount Tk. Lac	No.	Unit Rate Tk. Lac/No.	Amount Tk. Lac	No.	Amount Tk. Lac		
1.	Khulna	1	5.00	5.00	3	3.20	9.60	11	1.60	17.60	10	0.8	8.00	25		40.20				
2.	Patuakhali	119	5.00	595.00	137	3.20	438.40	138	1.60	220.80	93	0.8	74.40	487		1,328.60				
3.	Bhola	97	5.00	485.00	159	3.20	508.80	127	1.60	203.20	75	0.8	60.00	458		1,257.00				
4.	Jhalokathi	17	5.00	85.00	26	3.20	83.20	44	1.60	70.40	36	0.8	28.80	123		267.40				
5.	Perojpur	9	5.00	45.00	5	3.20	16.00	14	1.60	22.40	13	0.8	10.40	41		93.80				
6.	Barisal	102	5.00	510.00	27	3.20	86.40	91	1.60	145.60	82	0.8	65.60	302		807.60				
7.	Barguna	65	5.00	325.00	50	3.20	160.00	47	1.60	75.20	31	0.8	24.80	193		585.00				
8.	Satkhira	1	5.00	5.00	0	3.20	0.00	0	1.60	0.00	1	0.8	0.80	2		5.80				
9.	Bagerhat	9	5.00	45.00	6	3.20	19.20	10	1.60	16.00	8	0.8	6.40	33		86.60				
10.	Shariatpur	4	5.00	20.00	12	3.20	38.40	6	1.60	9.60	2	0.8	1.60	24		69.60				
Total		424		2,120.00	425		1,360.00	488		780.80	351		280.80	1,688		4,541.60				

Source : SMEC's Cyclone Damage Assessment Report

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TABLE 3.55
Ministry of Education
Facilities Department

Estimated Cost for Repair/Reconstruction of Schools

Type of Schools : Secondary

Division : Khulna

Tk. in Lac

Sl. No.	Districts	No.	To be Replaced		Very Badly Damaged			Badly Damaged			Partly Damaged			Total	
			Unit Rate Tk. Lac/No.	Amount Tk. Lac	No.	Unit Rate Tk. Lac/N	Amount Tk. Lac	No.	Unit Rate Tk. Lac/No.	Amount Tk. Lac	No.	Unit Rate Tk. Lac/No.	Amount Tk. Lac	No.	Amount Tk. Lac
1.	Khulna	2	9.15	18.30	2	4.06	8.12	1	2.41	2.41	1	1.01	1.01	6	29.84
2.	Patuakhali	41	9.15	375.15	142	4.06	576.52	104	2.41	250.64	58	1.01	58.58	345	1,260.89
3.	Bhola	25	9.15	228.75	85	4.06	345.10	96	2.41	231.36	68	1.01	68.68	274	873.89
4.	Jhalokathi	7	9.15	64.05	42	4.06	170.52	52	2.41	125.32	39	1.01	39.39	140	399.28
5.	Perojpur	7	9.15	64.05	14	4.06	56.84	17	2.41	40.97	14	1.01	14.14	52	176.00
6.	Barisal	3	9.15	27.45	14	4.06	56.84	106	2.41	255.46	102	1.01	103.02	225	442.77
7.	Barguna	47	9.15	430.05	49	4.06	198.94	51	2.41	122.91	36	1.01	36.36	183	788.26
8.	Satkhira	0	9.15	0.00	0	4.06	0.00	1	2.41	2.41	1	1.01	1.01	2	3.42
9.	Bagerhat	1	9.15	9.15	1	4.06	4.06	2	2.41	4.82	2	1.01	2.02	6	20.05
10.	Shariatpur	0	9.15	0.00	0	4.06	0.00	1	2.41	2.41	0	1.01	0.00	1	2.41
Total		133		1,216.95	349		1,416.94	431		1,038.71	321		324.21	1,234	3,996.81

Source : SMEC's Cyclone Damage Assessment Report

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- Dakhin Charjabbar Pirmary schools &
- Shaheed Joynal Abnedin H. school, Noakhali - The schools need replacement of slab as those were not being maintained from long before.
- Pakhia Govt. Primary school
- Jhataburia M.E. High school
- Shubid khali Govt. Primary school - Patuakhali district
- Kabirhat High school, Noakhali district - The spalling of concrete from roof slab and beams. Replacement of roof slab is recommended by the consultant.

The rehabilitation cost of such type of structure about (500 nos) have been provided under the head **special project**.

d) **Rehabilitation**

For the rehabilitation of the cyclone damaged works (Primary & Secondary Schools, Madrashes) plan has been made to implement in 3 phases:

- Priority-1,
- Priority-2 and
- Priority-3).

The works of the special project have been kept under Priority-4.

The total estimated cost of damage is for Tk. 25,067.19 Lac (excluding the cost for special project). For undertaking the rehabilitation work an overall contingency of 38% has been added to the basic cost of construction. The allowances are ;

- Physical contingency
(about 10%)
- Price contingency (about 22%)
- Consultancy fee (about 6%)

Thus the cost for rehabilitation of cyclone damaged works comes to Tk. 34,592.72 Lac. The rehabilitation cost in total comes to Tk. 36,455.72 Lac considering the cost of the special project (Replacement of roofs;) Table 3.51).

In rehabilitation works priority of the same has been determined considering the condition as;

- Priority-1 Repairs (temporary or permanent) required to make the facility useable and other work necessary to permit the facility to function in an orderly manner. All work within this category is to be completed before the start of the 1992 monsoon season i.e., by June 1992.
- Priority-2 Permanent repairs which are required to return a partly damaged facility to a fully operational status and which would be completed before the 1993 monsoon season i.e., by June 1993.

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- Priority-3 The completion of repairs of any non-urgent nature and the replacement of a severely damaged facility which could not be adequately repaired and which would be completed after June 1993.
- Priority-4 Non-cyclone damage. This includes structures which the Consultant considers to be too far deteriorated to be able to be successfully repaired and demolition and replacement is recommended.

- **Progress of Rehabilitation Works**

During the period of 1st priority execution of works, programme was taken up for Tk. 9,150 Lac and achievement made worth Tk. 1,373 Lac. Programme for Tk. 13,927.50 Lac has been kept by the department for the fiscal year 1992-1993. Till 30th September 1992 about 14% work of Tk. 13,927.50 Lac is completed. Estimates, programme and progress is presented in **Table 3.56**

c) **Availability of Fund for '91 Cyclone Rehabilitation Work**

For executing the rehabilitation of cyclone damaged work of facilities department different donor agency came forward. An account of the availability of fund is presented in a tabular form **Table 3.57**.

3.10 Bangladesh Inland Water Transport Authority (BIWTA) & Bangladesh Inland Water Transport Corporation (BIWTC)

3.10.1 Introduction

The Cyclone which crossed the coast of Bangladesh on 29-30th April '91 was accompanied by high wind in excess of 225 km/hr, a storm surge in excess of 4 to 6 metres high and torrential rainfall which lasted for several days after the event. The cyclone caused damage to properties of BIWTA and BIWTC.

a) **Bangladesh Inland Water Transport Authority (BIWTA)**

The cyclone caused massive devastation to infrastructure to all sectors and loss of life. The cyclone caused wide spread loss of navigational aids, potoons, jetties, gangways and buildings along 1,100 km of water ways administered by the BIWTA.

BIWTA is to administer the following:

- i) 1,100 km of water ways
- ii) 25 Nos. terminal buildings (Jetty building) are in existence

5 Nos. terminal building have been damaged and washed away which were located at;

TABLE 3.56
Assistance to Ministry of Relief
Information of 1991 Cyclone damage reconstruction/rehabilitation (Financial)

Department/Agency : Ministry of Education (Facilities Department)		Tk. In Lac				
Priority	Years	Preliminary Estimate Prepared by (Agency/Deptt)	Revised Estimate	Final Estimate Prepared by (Agency/Sonsult)	Value of Works Programme	Contract Value of
						Value of Works completed by 30-06-92 (Percent total)
						30-06-92 (Percent total)
01.	1991-1992	9,150.00	15,889.08	15,889.06	9,150.00	9,154.00
						1,373.00 (15%)
						--
02.	1992-1993	6,150.00	13,837.09	13,837.09	13,927.50	13,892.90
						--
						1,921.50 (13.79%)
						85% of work has been carried over
03.	1993-1994	--	6,729.57	6,729.57	--	--
						--
						--
Total :	Tk. in Lac	15,300.00	36,455.74	36,455.72	23,077.50	23,046.90
	US \$ Million	40.26	95.94	95.94	60.73	60.65
						1,373.00
						3.61
						1,921.50
						5.06

Source : MOE
US \$ 1 : Tk. 38.00

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TABLE 3.57
Ministry of Education
Facilities Department

Project Title	Total Amount (Tk.in Lac)	ADP 1992-93 (Tk.in Lac)	Donor
A. Financial assistance for rehabilitation/reconstruction of schools (facilities)			
Rehabilitation of cyclone affected Primary schools	4,690.80	3,383.95	ADB
Rehabilitation of cyclone affected Primary schools	3,979.00	205.00	IDA
Reconstruction of cyclone affected Govt. Primary schools	5,746.28	540.00	ADB
Rehabilitation of cyclone affected Secondary schools	1,847.00	1,100.00	GOB
Rehabilitation of cyclone affected College at B.A.F Jahur base Ctg.	120.00	120.00	GOB
Repair of cyclone affected infras- tructure of Chittagong University	200.00	200.00	GOB
Sub-Total :	16,583.08	5,548.95	
B. Financial assistance for construction of new schools-cum-cyclone shelter			
Construction of cyclone shelter, Msque, Clinic and Schools	98,109.08	10,200.00	Saudi Arabia
Construction of M.P. cyclone shelter and Primary schools	1,979.86	1,050.00	IDB
Construction of M.P. cyclone shelter and Primary schools	10,016.80	1,030.00	EEC
Construction of M.P. cyclone shelter and Primary schools	3,352.50	230.00	OPEC
Construction of M.P. cyclone shelter and Primary schools	2,712.49	330.00	Japan
Construction of Govt. Primary school and cyclone shelter	1,690.09	210.00	Maly
Sub-Total :	117,860.82	13,050.00	
Total (A + B) :	Tk.in Lac 134,443.90	18,598.95	
	US \$ Million 353.80	48.94	

Source : Annual Development Programme 1992-1993
US \$ 1 = Tk. 38.00

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- Shawtal Khal at Sandwip
- Kumira at Sitakunda
- Tajumuddin at Bhola
- Chital khal at Laxmipur
- Hatiya at North Hatiya

iii) 9 Nos. inland river ports located at Bangladesh, Nagarbari, Aricha, Dhaka, Narayanganj, Chandpur, Barisal, Patuakhali, Pirojpur and Khulna.

iv) Telecommunication stations at Chittagong Chowkighata (Bhola), Patuakhali, Barisal Kaukhali (Pirojpur) Hironpoint (Khulna), Mongla (Khulna, Chandpur, Bhairab bazar, Aricha, Bagherhat, Sirajganj and Chilmari, Rangpur.

v) 68 Nos. Jetties

vi) Hydrographic and allied survey equipment

vii) Recording equipment auto gauge: 10 Nos. Auto gauge structure damaged in cyclone '91.

b) Bangladesh Inland Water Transport Corporation (BIWTC)

The cyclone caused damage to different types of vessels by capsizing in Karnafuly river at Chittagong or dragging to shore of Bay of Bengal or on the offshore islands.

The BIWTC provides a valuable service to the people of Bangladesh particularly those located on the islands in the Bay of Bengal who rely on water transport as their sole means of conveying goods and services.

BIWTC owns the following:

- i) River transport vessels and sea going vessels
- ii) Jetties 1 and 2 at Chittagong port terminal 1, steel truss gang ways supported on potoons damaged partially by Cyclone.
- iii) Jetties 1 and 2 at Chittagong port terminal-2 (Partially damaged).
- iv) 6 Nos. ware houses at Chittagong, (5 Nos. have been damaged beyond repair and sixth needs replacement of roof).

3.10.2 Extent of Damage

a) Bangladesh Inland Water Transport Authority (BIWTA)

The cyclone caused damage to jetties, potoons, terminal buildings, gang ways and approach roads of the ports of Chittagong, Barisal Patuakhali, Khulna and Chandpur districts.



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A marine repair workshop at Barisal was damaged together with 2 vessels under going repair at the time.

A list of damage is shown in Table 3.58 as presented by the Consultant and Summary of damage is presented in Table 3.59

b) Bangladesh Inland Water Transport Corporation (BIWTC)

The cyclone caused considerable damage to docking and wharf handling infrastructure and 5 Nos. warehouses out of 6 at Chittagong. 49 Nos. ships were reported grounded or damaged in Chittagong port, 2 on Sandwip Island and one each at Hatiya and Kumira.

Most of the reported damage to grounded vessels has occurred below the water line and cannot be confirmed or otherwise without Diver inspection or dry docking.

Damage estimates provided by BIWTC for grounded vessels is based on the known condition of the vessels at last dry docking together with historical records of repair costs to other vessels which have been involved in similar grounding incidents.

In the absence of any other source of damage estimate the information provided by BIWTC has been accepted by the Consultant for the purpose of arriving at an unconfirmed amount.

Firm damage estimates can only be obtained during docking with the help of a salvage expert or similar authority experienced in this type of damage assessment. SHIL, The Summary of cyclone damage cost for rehabilitate reconstruction of BIWTC's excluding the special project and including the special project are presented in Table 3.60 and 3.61 respectively

3.10.3 Methodology of damage assessment

After the occurrence of devastating cyclone, which caused heavy casualty and damage to all sectors of the country, the World Bank entrusted the consultant SMEC in association with BCL to assess the damage to Infrastructure of different sectors of Bangladesh Government.

In course of the assessment the SMEC forwarded letter to the Chairman

- Bangladesh Water Transport Authority (BIWTA)
- Bangladesh Water Transport Corporation (BIWTC)

requesting their co-operation by completing the questionnaire, sent by the consultant, detailing damage to their assets as a result of the cyclone and further that responsible personnel to be made available from their departments to participate in a joint inspections with the consultant to agree on damage incurred.

TABLE 3.58

Bangladesh Inland Water Transport Authority (BIWTA)
Details of Cyclone Damage (1991)

Sl. No.	General description of structure port facilities, Vessel, dredgers navigation aid, equipment etc.	Damaged Quantity (No.)	Type of Damage	Location of Damage	Type of Repair	Estimate of Repair.		Priority
						BIWTA Tk. in Lac	Const Tk. in Lac	
01.	Gas operated lighted steel buoy	10	Destroyed/Sunk	Chittagong - Chowkighata	Replace			1
02.	Electric operated steel buoy	4	Destroyed/Lost	Chittagong - Chowkighata	Replace			1
03.	Electric operated shore beacon	9	Destroyed/Lost	Chittagong - Chowkighata	Replace			1
04.	Electric operated shore beacon	7	Destroyed/Lost	Chittagong - Cox's Bazar	Replace			1
05.	Electric operated steel buoy	3	Destroyed/Lost	Chowkighata - Barisal	Replace	633.30	380.00	1
06.	Gas operated shore beacon	13	Destroyed/Lost	Chowkighata - Barisal	Replace			1
07.	Gas operated shore beacon	14	Destroyed/Lost	Barisal - Khrepupara	Replace			1
08.	Electric operated steel buoy	5	Destroyed/Lost	Chowkighata - Chandpur	Replace			1
09.	Electric operated shore beacon	5	Destroyed/Lost	Chowkighata - Chandpur	Replace			1
10.	Spare parts & consumables	--	--	Chowkighata - Chandpur	Replace			1
11.	Steel pontoons & cons.	31	Destroyed/Damaged	Various	Replace/Repair	823.40	375.00	1
12.	Jetties	68	Damaged	Various	Replace/Repair	177.00	41.00	1
13.	Jetty buildings	40	Damaged	Various	Replace/Repair	132.00	89.00	1
14.	Spare parts dohazari decca station	--	Spare parts	Chittagong	Purchase	449.50	0.00	--
15.	Autogauge purchase	--	Destroyed/Lost	Various	Purchase/repair	90.00	90.00	1
16.	Spare parts & consumables	--	--	Various	Purchase	280.00	0.00	--
17.	Marine workshop	--	Damaged	Barisal	Repair	16.00	16.00	1
	Total					2,601.20	991.00	1

Source : SMEC

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TABLE 3.59
Bangladesh Inland Water Transport Authority (BIWTA)
Summary of Costs for Cyclone Damage in 1991

Sl. No.	Description	Tk.in Lac			Total	US \$ Total
		Base Price	Contingency	Consultant		
10.	Navigation aids	380.00	38.00	21.17	439.17	1.16
02.	Pontoons	375.00	37.50	20.81	433.31	1.14
03.	Jetties	41.00	4.10	2.19	47.29	0.12
04.	Jetty buildings	89.00	8.90	5.11	103.01	0.27
05.	Autogauge	90.00	9.00	5.11	104.11	0.27
06.	Marine Workshop	16.00	1.60	1.09	18.69	0.05
	Total (Tk.in Lac	991.00	99.10	55.48	1,145.58	3.01
	Total (US\$ Million)	2.61	0.26	0.15	3.01	

Base Price : Is shown in Table D-3.52

Source : SMEC

US \$ 1 = Tk. 38.00

a) **Bangladesh Inland Water Transport Authority (BIWTA)**

Initially the consultant, SMEC, did not find any response from BIWTA. In August 1991 when all site inspections and assessments were completed the consultant was contacted by and met with officials from BIWTA. At the meeting the consultant received a copy of a paper "A Preliminary Project Concept Paper for Aided Project" prepare by BIWTA dated May 1991. The paper detailed the strategy for rehabilitations, re-construction and development of BIWTA port terminals, navigation aids, hydrographic equipment and other facilities in the coastal area of Bangladesh destroyed/ damaged by the 1991 cyclone and tidal bore.

The consultant explained that there was insufficient time to carryout any damage inspections and that a desk study made on the claim based on various assessment teams observations.

A further meeting was held with BIWTA at the consultants office for discussion and rationalisation of the damage claim. The Table 3.60 is the desk study (as reported by the consultant, SMEC). While working out the rehabilitation cost the consultant added 10% and 5.5% of the base cost respectively as the cost of contingency and consultancy.

b) **Bangladesh Inland Water Transport Corporation (BIWTC)**

Officials form BIWTC were most co-operative with the consultant in early completion of the questionnaires and responsible personnnel assisted at joint Inspection. The joint inspection included damage at terminal 1 and 2 in the Chittagong port and all damaged vessels along the Banks of Karnafuly River.

Information obtained from the questionnaires were entered on to spread sheets and ammended where appropriate by the consultant. A further meeting between the consultant and officials from BIWTC was arranged to discuss the findings and to seek any further comment from BIWTC on the consultant's assessment.

Summary of the spread sheets which include BIWTCs claim for damages and consultants assessment is presented in a summarised form in Table 3.61.

All prices are Tk. in Lac and are base price estimates. While working out the rehabilitation cost, the consultant added 10% and 5% of the base cost respectively as the cost of contingency and cost of consultancy.

3.10.4 Damage Assessment

a) **Bangladesh Inland Water Transport Authority (BIWTA)**

The revised cost of damage to BIWTA comes to Tk. 991.00 lac (Table 3.58) and cost for rehabilitation/reconstruction cost comes to Tk. 1,145.58 lac including 10% physical contingency and about 5% of consultancy (Table 3.59).

TABLE 3.60

Bangladesh Inland Water Transport Corporation (BIWTC)
Summary of Cyclone damage (1991 cyclone) excluding cost for civil work and special project

Tk. in Lac

	Vessels		Civil Works		Vessels + Civil Works	
	BIWTC	Revised	BIWTC	Revised	BIWTC	Revised
Priority 1	981.40	981.40	843.00	4.48	1,824.40	985.88
Priority 2	471.80	471.80	124.28	227.80	596.08	699.60
Special Project (Const R.C.C. Jetty) Terminal-1	--	--	625.00	625.00	--	625.00
Total : Tk.in Lac	1,453.20	1,453.20	1,592.28	857.28	2,420.48	2,310.48
US \$ Million	3.82	3.82	4.19	2.26	6.37	6.08

US \$ 1 = Tk.38.00

Source : BIWTC

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TABLE 3.61

Bangladesh Inland Water Transport Corporation (BIWTC)
Summary of Costs for Cyclone Damage in 1991
(including cost of civil work & special project)

Sl. No.	Description	Tk.in Lac				US \$
		Base Price	Contingency	Consultant	Total	Total
10.	Priority 1 vessels	981.40	98.14	54.75	1,134.29	2.98
02.	Priority 2 vessels	471.80	47.18	24.82	543.80	1.43
03.	Building and Civil works	232.28	23.23	11.68	267.19	0.70
	Total Cyclone Damage	1685.48	168.55	91.25	1945.28	5.12
04.	R.C. Jetty (Special Proj)	625.00	62.50	34.31	721.81	1.90
	Total (Tk.in Lac)	2,310.48	231.05	125.56	2,667.09	7.02
	(US\$ Million)	6.08	0.61	0.33	7.02	

Base Price : is shown in Table D-3.50

Source : SMEC

US \$ 1 = Tk. 38.00

b) **Bangladesh Inland Water Transport Corporation (BIWTC)**

The original assessment questionnaires completed by responsible persons from BIWTC based this assessment of damage on current building and repair rates currently used in the corporation.

■ **Physical contingencies**

The assessment team was unable to determine accurately the estimate for vessel repair and the amount included should be considered to be provisional only (10% of the base cost).

■ **Consultancy**

There is 5% allowance for consultancy included in the overall price to allow for design input for jetties and buildings.

The total revised cost of damage is for Tk. 2,310.48 Lac (Table 3.60) and the rehabilitation/reconstruction cost comes to Tk. 2,667.09 lac including the contingency and consultancy and also including the cost of special projects (Table 3.61).

3.10.5 Rehabilitation Work

a) **Bangladesh Inland Water Transport Authority (BIWTA)**

After the devastation of the cyclone the department rehabilitated/repared the damage of jetties, shore connection gangways, approach road protection at expending Tk. 101.00 Lac from their own fund to meet up the emergency need. (Table 3.62) Further work will be taken up if some financial assistance is obtained. District wise distribution of cost of rehabilitation is as follows:

Chittagong	Tk. 47.00 Lac
Barisal	Tk. 20.50 Lac
Patuakhali	Tk. 10.00 Lac
Khulna	Tk. 21.25 Lac
Chandpur	Tk. 2.25 Lac
Total	Tk. 101.00 Lac

b) **Bangladesh Inland Water Transport Corporation (BIWTC)**

The rehabilitation cost of BIWTC is for Tk. 39.42 Lac till 30th June, 1992 and for Tk. 2.5 Lac till 30th September, 1992 (for FY 1992-93). (Table 3.63) It is learnt from the discussion with the Secretary, BIWTC, the Assistant Engineer and also from the copy of the letter written to the Ministry of Shipping from the department that out of damaged 29 ships (13

TABLE 3.62

Assistance to Ministry of Relief
Estimate, Programme and Progress of 1991 Cyclone damage re-construction/rehabilitation (Financial)

Department/Agency: Bangladesh Inland Water Transport Authority (BIWTA)

Tk. in Lac

Priority	Years	Preliminary estimate Prepared by (Agency/Deptt)	Revised Estimate	Final estimate Prepared by (Agency/Consult)	Value of work Programme	Contract Value	Value of work completed		Remarks
							(Commulative) by 30-06-1992 (Percent Total)	30-09-1992 (Percent Total)	
01.	1991-1992	3,000.00	1,145.58	1,145.58	100.00	--	101.00 (10.19)	--	No financial assistance obtained by the deptt.
02.	1992-1993	--	--	--	--	--	--	--	
03.	1993-1994	--	--	--	--	--	--	--	
Total : Tk.In Lac		3,000.00	1,145.58	1,145.58	100.00		101.00		
US \$ Million		7.89	3.01	3.01	0.26		0.27		

Source : IWTA

US \$ 1 = Tk. 38.00

Note : Estimates are included contingency 10% and consultancy (5.5%)

B-123(2)DFT-IWTA.WK1

TABLE 3.63

Assistance to Ministry of Relief
Estimate, Programme and Progress of 1991 Cyclone damage re-construction/rehabilitation (Financial)

Department/Agency: Bangladesh Inland Water Transport Corporation (BIWTC)

Tk. in Lac

Priority	Years	Preliminary estimate Prepared by (Agency/Dept)	Revised Estimate	Final estimate Prepared by (Agency/Consult)	Value of work Programme	Contract Value	Value of work completed by		Remarks
							30-06-1992 (Percent Total)	30-09-1992 (Percent Total) (Cumulative)	
01.	1991-1992	2,098.00	1,131.50	1,086.00	1,086.00	--	39.42 (3.6%)	--	No financial assistance obtained from GOB or any other donor agency/ country.
02.	1992-1993	688.00	811.40	527.00	527.00	--	--	2.50 (0.5%)	
03.	1993-1994	--	721.97	76.00	--	--	--	--	
Total : Tk. in Lac		2,786.00	2,664.87	1,689.00	--	--	39.42	2.50	
US \$ Million		7.33	7.01	4.44			0.10	0.01	

Source : IWTC

US \$ 1 = Tk. 38.00

Note : Estimates are included contingency (10%) and consultancy (5.5%)

BA123(2)DPT-IWTC.WK1

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Nos. were damaged partly, 16 Nos. were damaged severely) all the 29 ships have been repaired to make them navigable with the own resource of BIWTC.

Other works such as repair jetties (3 Nos.), warehouses, staff quarters etc. could not be rehabilitated for the paucity of fund. Unless financial assistance is given by the Government or by any donor agency the remaining works could not be possible to be repaired.

3.11 Bangladesh Telegraph and Telephone Board (including Postal Department)

- a) **Introduction :** The cyclone of 29-30th April 1991 along with a strong wind and a high intensity storm surge of to 6 metres damaged the residential buildings, Telecommunication building, dormitory, approach road to T&T compound, boundary walls and post offices. It also disrupted the microwave link between Chittagong and Betbunia. After the occurrence of the cyclone there was no telecommunication link between the capital city Dhaka and the Port city Chittagong.
- b) **Extent of Damage :** Though the extent damage to the telecommunication sector of the national infrastructure was not so high, still the telecommunication restoration is most important. The extent of damage to the sector is as follows:
- i) Damaged to Chittagong to Betbunia microwave link.
 - ii) 112 nos. post offices were damaged. 105 nos. were damaged partially and 7 nos. were damaged completely along with Postal equipment and furniture.
 - iii) Power line, water supply line of Agrabad T&T compound (Chittagong) was damaged.
 - iv) 7 nos. residential buildings at Cox's Bazar, Mirsarai, Barabkunda, Chowmuhani, Sholashahar, Pahartali and at Paradisehill were severely damaged.
 - v) 10 nos. dormitories were damaged at Teknaf, Ukhia, Cox's Bazar, Chokoria, Potiya, Mirsarai, Sitakunda, Kaptai, Begumganj and at Patuakhali.
 - vi) 7 nos. telecommunication buildings at Bandarban, Gohira (Anwara), Abu Torab, Ilisha (Bhola), Badarkhali (Cox's Bazar) Banshkhali and Anwara were severely damaged.

The estimate for reconstruction of cyclone damage to Telegraph and Telephone Department is shown in a tabular form.



Bangladesh Telephone and Telegraph Department (T&T)

Estimate for reconstruction of cyclone damaged work

Priority	Description of work	Quantity Nos/Acre	Cost Tk.in Lac
1	a) Land aquisition Aquisition of land for the cons- truction of Telecommunication and residential building.	6.1 Acre	9.85
	b) Civil Construction Construction of Telecommunication building.		
2	i) Construction of Telecommunication building	9 Nos.	183.00
2	ii) Construction of residential building	2 Nos.	10.45
1	iii) Renovation of residential building	7 Nos.	25.30
1	iv) Reconstruction of dormitory	10 Nos.	21.75
1	v) Renovation of Telecommunication	7 Nos.	9.00
1	vi) Reconstruction of boundary wall	6 Nos.	49.50
	c) Machinery and Equipments		
1	i) Construction of 2 Nos. Microwave towers	2 Nos.	1,300.00
2	ii) Installation of Microwave Radio link between Chittagong - Betbunia	1	780.00
2	iii) Establishment of 120 channel digital VHF link	4	490.00
1	iv) Purchase of 2,000 lines NWD exchange installation external cable	2000	755.00
2	v) Establishment 3/6 channel radio link	50 Nos.	350.00
	d) Transport		
2	i) Purchase of pickup	2	28.00
2	ii) Purchase of Motor cycle	6	3.75
	e) Other Cost		
1	i) Consultancy	L.S.	20.60
1	ii) Furniture	L.S.	6.00
1	iii) Personal computer	1 Nos.	1.00
1	iv) Photocopier	1 Nos.	0.80
1	v) Type writer	2	0.30
1	vi) Bank Insurance charge etc.	L.S.	0.81
Total :		Tk.in Lac	4,045.11
		US\$ Million	10.65

Source : Department T&T

US\$ 1 = Tk. 38.00

Damage Cost of the Works under Priority 1	2,199.91
Damage Cost of the Works under Priority 2	1,845.20
Total Tk.in Lac	4,045.11

So, the sum of the estimated cost of the damage to Postal Department and Telegraph and Telephone is as below :

i) Estimated base cost of damage of T&T	=Tk. 4,045.11 Lac
(ii) Estimated base cost of damage of Post office	=Tk. 200.00 Lac
T o t a l	=
	Tk. 4,245.11 Lac

d) **Methodology**

For the purpose of the damage assessment of the works concerned with department of Telephone and Telegraph, no consultant was engaged. The officers from the head office compiled the damage report as they received from the departmental personnel posted at different places in the cyclone affected area.

Some new works such as construction of 9 nos. telecommunication buildings, construction of 2 nos. residential buildings, along with necessary land acquisition for the buildings have been provided in the cyclone damage cost.

The cost for installation of Microwave radio link between Chittagong and Betbunia and establishment of 120 channel digital VHF link have been accommodated in the cyclone damage estimate.

The cost for the purchase of 2,000 lines EMD exchange installation cable has been included in the cyclone damage.

Cost for 2 nos. pick up and 2 nos. motor cycles also has been added to the cyclone damage cost as those transports are needed for proper supervision of the cyclone damage reconstruction work.

In the other cost, consultancy fee, cost for the purchase of furniture, personal computer, photocopier, typewriter and Bank insurance charge have been provided.

e) **Rehabilitation of Cyclone Damage Works**

- **Telegraph and Telephone Department**

The infrastructure damaged due to cyclone '91 has been phased for reconstruction in two priorities such as works of Priority-1 and works of Priority-2. The works which need immediate repair or reconstruction were considered as the works of Priority-1 and were programmed for taking up for reconstruction or repair during financial year 1991-1992. The works which were of less emergent nature or required design and planning as well as detailed study were provided under Priority-2 and are targeted to be completed by June 1993.

Against the works of Priority-1 a sum of Tk. 600.00 lac was allocated in the ADP for execution of works. Work of valued Tk. 300.03 Lac was completed till 30th June 1992 i.e., by the end of FY 1991-1992. A sum of Tk. 1,800.00 Lac has been allocated in the ADP for the Financial Year 1992-93. Till 30th September 1992 work of valued Tk. 308.65 Lac

(cumulative) was completed. The progress achieved (cumulative) in executing the cyclone damage reconstruction works as reported by the department till 30th September, 1992 as follows (Table 3.63/1):

Total progresss

- i) Financial : 50.48%
- ii) Physical : 7.35%

- Bangladesh Post Office

The estimated cost for rehabilitation of the post office department due to the cyclone damage of 1991 is for Tk. 200.00 Lac (including F.E of Tk. 20.75 Lac). The assessment of damage and cost estimate made by the department. No special fund was allocated.

During the fiscal Year 1991-1992 allocation for Tk. 10.00 Lac has been given. For the rehabilitation work programmed to be completed during the FY 1992-1993 (June 1993) allocation for Tk. 50.00 Lac has been given to the department.

During the fiscal year 1991-1992, the repairing work of 105 no. post offices and reconstruction of 7 nos. of the same were taken up. The project work has been carried over to the FY 1992-1993 Financial Year (Table 3.64).

f) Availability of Fund

- Telegraph and Telephone (T&T)

For the reconstruction and rehabilitation of the cyclone damaged works of Telegraph and Telephone Department the following fund was available.

Sl. No.	Donor Agency/Country	Amount		Work for which the fund is to be utilised
		F.C.	Tk.in Lac	
1.	Saudi Arabian Grant	-	1,300.00	
2.	France	-	300.00	
3.	GOB	-	2,225.00	
	Total		4,200.00	

Source : Directorate of Building Construction, T&T

- Bangladesh Post Office

No special fund was allocated for the reconstruction and rehabilitation of Post Offices. Estimated cost in total, was for Tk. 200.00 Lac and GOB allocation for this department was Tk. 10.00 Lac in F. Y. 1991-1992 and Tk. 50.00 lac has been allocated in the fiscal year 1992-1993.

TABLE 3.63/1

Assistance to Ministry of Relief
Information of 1991 Cyclone damage re-construction/rehabilitation (Financial)

Department/Agency : Bangladesh Telegraph & Telephone (T&T)

Priority	Years	Preliminary estimate Prepared by Agency/Dept	Revised estimate	Final estimate Prepared by Agency/Consult.	Value of work Programme	Contract Value	Value of work completed by 30-06-92 (percent total)	30-09-92 (percent total)	Remarks	Tk.in lac
01.	1991-1992	2,199.11	2,199.91	2,199.91	600.00	--	293.00 (49%)	--	Progress Calculated on programme	
02.	1992-1993	2,000.00	2,000.00	2,000.00	1,800.00	--	--	15.65 (0.86%)		
03.	1993-1994	--	--	--	1,800.00 *	--	--	--		
Total		4,199.11 (US \$ Million)	4,199.91 11.05	4,199.91 11.05	4,200.00 11.05	--	293.00 0.77	15.65 (0.86%)		

Source : T&T Department

US \$ 1 = Tk. 38.00

ADP - 1992-1993

* Expected value of work programme

TABLE 3.64

Assistance to Ministry of Relief
Information of 1991 Cyclone damage re-construction/rehabilitation (Financial)

Department/Agency : Bangladesh Post Office									
Priority	Years	Preliminary estimate Prepared by Agency/Dept	Revised estimate	Final estimate Prepared by Agency/Consult.	Value of work Programme	Contract Value	Value of work completed by 30-06-92 (percent total) 30-09-92 (percent total)		Tk.in Lac Remarks
01.	1991-1992	200.00	200.00	200.00	10.00	10.00	10.00	100%	--
02.	1992-1993	--	--	--	50.00	--	--	--	--
03.	1993-1994	--	--	--	--	--	--	--	--
(Tk. in Lac)		200.00	200.00	200.00	60.00	10.00	10.00	0.03	--
Total		200.00	200.00	200.00	60.00	10.00	10.00	0.03	--
Source : Postal Department									
US \$ 1 = Tk. 38.00									

3.12 Department of Health and Family Welfare

a) Introduction

Cyclone of 29-30th April, 1991 with a wind speed of 225 km/hr and a high intensity storm surge of 4-6 metre high damaged infrastructure of Health facilities of southern 16 districts and off-shore islands of Bangladesh. The Director General, Health's Control Room informed the number of damaged health infrastructure damaged is 655 and the SMEC reported after site inspection that the number of damaged infrastructure is 437. Of these 437 damaged infrastructure 4 categories of health facilities are there and those are ;

A.	District Hospital		17 Nrs.
	i) Chittagong Division	13 Nrs.	
	ii) Khulna Division	4 Nrs.	
B.	Thana (Upazila) Health Complex		51 Nrs.
	i) Chittagong Division	33 Nrs.	
	ii) Khulna Division	18 Nrs.	
C.	Health Centres and dispensaries		152 Nrs.
	i) Chittagong Division	122 Nrs.	
	ii) Khulna Division	30 Nrs.	
D.	Family Welfare Centre		217 Nrs.
	i) Chittagong Division	155 Nrs.	
	ii) Khulna Division	62 Nrs.	

After the cyclone the World Bank entrusted the Snowy Mountains Engineering Corporation (SMEC) Ltd. in association with Bangladesh Consultants Limited (BCL) to assess the damage caused due to cyclone of 29-30th April, 1991. The Consultants carried out the assessment with accuracy as far as practicable within time allowed for. Information and data used here are mostly taken from the assessment report of SMEC. The officials of the Ministry of Health and Family Welfare and officials of the Director General, Health & Family Planning were contacted several occasions. Officials of Implementation Monitoring & Evaluation Division, and Economic Relation Division of Planning Commission were contacted several Occasions for having information regarding the implementation of projects and financial matter relating to the works.

b) Extent of Damage

The SMEC in association with BCL constituted two field assessment teams for the visit of damaged infrastructure, one for Khulna Division and other for Chittagong Division and off-shore islands. Each of the teams was accompanied by officials of the Health Department. The number of Health infrastructure damaged, as reported by the Directorate of Health is 655 nrs. and the SMEC reported the number of damaged infrastructure is 437. Probably the consultant omitted some of the infrastructures which were of minor damage. While collecting detail list of the rehabilitation of the damaged infrastructure from the Ministry of Health it

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is seen that 413 nrs. damaged infrastructure have been re-habilitated in 1991-92 FY with own resource of Bangladesh.

The financial loss due to cyclones as claimed by the Directorate of Health (as per initial assessment) is for US\$ 81 million in the Health Sector. Probably the loss and damage including loss of every thing i.e., the facilities, equipments and infrastructure also. The cyclone damage cost as assessed by the SMEC after visiting the sites is for Tk. 1,320.84 Lac (base cost) (Table 3.65). The rehabilitation cost including the rehabilitation of special projects comes to Tk. 2,369.01 Table 3.66 lac i.e., US\$ 6.23 million which is much less than Tk. 81.00 million as reported from the control room of Director General, Health. The initial assessment made by the officials who were not Engineers, and cost of medicine, medical equipment, furniture etc. all were included in the assessment for this reason the cost varied so much.

c) Assessment of Damage

After the cyclone the consultant constituted two field visiting teams consisting an expatriate engineer and a local Engineer, who visited the health facilities of the cyclone affected districts along with officials from the Health Department. Due to the large number of sites it was not possible to visit all the sites and a sampling technique was used in assessing the damage.

- Special Provision

For many of the severely damaged buildings of the Ministry of Health will have to be replaced with a structure to meet cyclone resistant design requirements (for resisting wind load).

The cost of providing for these requirements is only a small portion of the cost of the reconstruction of the buildings if these details are allowed for before reconstruction commences. Where temporary repairs have been made to provide a usable building the additional cost will be greater but should be made to prevent the building failing in the next cyclone.

The costs of these category have been included.

Where the consultant has considered it is necessary to provide for the reconstruction of some non-cyclone damage an allowance has been made under priority-4.

- Estimates

Based on the assessment and subsequent review the total estimated cost stands as below :

- i) The total estimated cost for reconstruction (excluding the special projects, Priority-4) is for Tk. 1,830.69 lac, (Table 3.66) and

TABLE 3.65

Cyclone damage to Health Facilities
Summary of Costs and Priorities for rehabilitation/reconstruction
(including special projects)

Sl. No.	Division	Consultant's Estimate (incl. special proj.)	Priority			Tk.in Lac	
			1	2	3	Total of P1, P2 & P3	Priority 4 (special proj.)
01.	Chittagong	1,203.14	458.37	484.06	57.31	999.74	203.40
02.	Khulna	506.10	155.37	143.51	22.22	321.10	185.00
	Sub - Total	1,709.24	613.74	627.57	79.53	1,320.84	388.40
	32 % cont. allowance	546.96	196.40	200.82	25.45	422.67	124.29
	Consultancy fees (6.6%)	112.81	40.51	41.42	5.25	87.18	25.63
	Total Tk.in Lac	2,369.01	850.64	869.81	110.23	1,830.68	538.32
	US \$ Million	6.23	2.24	2.29	0.29	4.82	1.42

Source : SMEC's damage assessment report

TABLE 3.66

Ministry of Health
Cyclone Damage to Health Facilities
Summary of Costs for rehabilitation/reconstruction
(Excluding special Project)

Sl. No.	Type of Facility	Tk.in Lac		
		Consultant's Base Cost estimate	Allowance for Contingencies (32%)	Consultant Fees (6.6%)
01.	District Hospitals and Specialised Institutions	136.44	43.66	9.01
02.	Upazila Health Complex	372.03	119.05	24.55
03.	Health Sub – Centres and Dispensaries	387.06	123.86	25.55
04.	Family Welfare Centres	425.31	136.10	28.07
Total		1,320.84	422.67	87.18
				1,830.69

Source: SMEC's damage assessment report

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- ii) The total estimated cost for reconstruction (including the special project under Priority-4) is for Tk. 2,369.01 lac. (Table 3.65).

d) **Methodology**

- **Initial Information**

Prior to award of the consultancy various Ministries of the Govt. of Bangladesh collected information on the extent of damage and had made a preliminary estimate of the total cost of the damage.

The Consultant was supplied a list of all the Hospitals, Thana Health Complexes and Family Welfare Centres which have been reported damaged by the Ministry of Health and Family Welfare against

- District
- Upazila
- Union

The assessment based on the degree of damage as :

- Very badly damaged
- Badly damaged
- Partly damaged

The list supplied included data on:

- District Hospitals
- Thana Health Complex
- Health Sub-Centre and
- Family Welfare Centre

With this information the consultant undertook inspection of the affected districts. They reviewed and assessed the damage caused by cyclone. The consultants team classified the building as :

- Pucca : Buildings which have concrete floor, brick wall and roof slab.
- Semi-Pucca : Buildings which have concrete floors, brick walls and corrugated iron (C.I.) roof.
- Katcha : Buildings which have dirt floors, bamboo or C.I. walls and C.I. roof.

- **Field Inspection**



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To assist the inspection teams a detailed questionnaire was prepared and finalised after discussion with department heads. The consultant formed two field visit teams - one for Chittagong Zone and other for Khulna Zone. During the field trips more detailed damage and cost assessment lists were obtained from district officers.

The two field assessment teams of the consultant consisted of the consultants Engineers and one or more Health Department officials.

Damage was noted on the questionnaire and at the end of the tour the local officer in charge confirmed the extent of damage and signed the questionnaire.

- Site Visit

Of the total number of damage sites it not possible to visit all the sites of the affected/damaged infrastructure, only a small percentage was visited. The questionnaire were sent to the local officials to send those back after filled in.

The practice was not successful as the local officials included some non-cyclone damage in their estimate. Another factor contributing to this problem was the fact that the local officials were not engineers and were not trained to make qualified assessment regarding the structural damage to the facilities. The consultant had therefore, to use judgement to determine the extent of damage for the sites not inspected and this was done by determining a typical lay out plan for the facility either Union Family Welfare Centre (217 Nrs. affected) or Union Health Centre/Dispensaries (152 affected). As the latter varied the former more standard centre were selected. These determined damage cost similar to those obtained for the inspected centres and considered to give good average result.

The consultants visiting team visited the off-shore islands also.

- Fixing Priority

On completion of the field trips the assessment teams prepared preliminary estimates based on costs and the priority they considered appropriate for the various works. The priorities were;

Priority 1 : Repairs (temporary or permanent) required to make the facility useable and other works necessary to permit the facility to function in an orderly manner.

All work within this category is to be completed before the start of the 1992 monsoon. i.e., by June 1992.

Priority-2 : Permanent repairs which are required to return a partly damaged facility to a fully operational status and which would be completed before the start of the 1993 monsoon, i.e., by June 1993.

Priority-3 : The completion of repairs which were of a non-urgent nature and the replacement of a severely damaged facility which could not be adequately

repaired and which would be completed after June 1993.

Priority-4 : Non-Cyclone Damage

The Consultant has only included under this priority work which they were able to provide an estimated cost for. Works which could not reasonably be costed such as the repair and rehabilitation of structures with spalling concrete should be reviewed by the consultant appointed to supervise the reconstruction works.

For all costing purposes the ratio of expenditure for Family Welfare Centre and Health Sub-Centres/Dispensaries for the three priorities has been taken as :

Priority-1	50%
Priority-2	40%
Priority-3	10%

These ratios were established after the costing of many of the questionnaires had been completed and takes into account the necessity of completing many of the temporary repairs very quickly to make the facilities serviceable, the need to upgrade some of the early repairs to suit cyclone resistant design requirements and an appreciation of the supply problems that the sheer quantity of materials the repair works will require.

The preliminary estimates and priorities were programmed to be discussed with appropriate department officials. This meeting could not be arranged and the rates and the priorities are as determined by the Consultant.

e) Project Estimates

Basis of Estimate

A detailed assessment of the unit rates for the various types of work required to reconstruct the health facilities was carried out based on :

- the cost of materials
- the required labour input
- an allowance for contractor's profit

These unit rates were to have been discussed with department officials and when agreed become the basis for the project cost estimates. However, a meeting to discuss these rates could not be arranged.

Lump sum allowances for the replacement of furniture, books etc. were agreed with local officials during the field trips as was the need for the replacement of damaged tubewells, medicines, equipment etc. As the cost of replacing a tubewell is dependent on the degree of damage suffered by the existing tubewell and the depth required to reach a suitable aquifer

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a fixed lump sum was used for all the tubewells.

An acceptable schedule of unit rates was used for this cyclone damage assessment. The estimated base cost for reconstruction Health facilities stands as below : (Table 3.65 & 3.67)

- i) Excluding special project : Tk.1,320.84 lac (Table 3.67)
- ii) Including special project : Tk.1,709.24 lac (Table 3.65)

- **Final Estimate**

Once the various unit rates and allowances had been finalised the rates and priorities were added to the questionnaires and the questionnaires were costed. The data from the questionnaires were then entered into spreadsheets and the total cost of works under each priority determined.

The cyclone damage repair cost per health facility could only be estimated on the basis of an average cost per building as it was impossible to visit every single facility in the cyclone affected area during the short time available for the assessment.

Table 3.65 and 3.66 summarise the Consultant's estimate of costs for the rehabilitation of the health facilities to pre-cyclone conditions based on the total number of facilities having reported cyclone damage.

Table 3.68, 3.69, 3.70 and 3.71 shows the number of facilities damaged and the estimated cost for re-construction of respectively the District Hospitals, Thana Health Complexes, Health Sub-Centres and Family Welfare Centre.

f) **Rehabilitation of Cyclone damage works of Health facilities**

The rehabilitation works of the Health facilities have been phased as :

- | | |
|--------------|---|
| ■ Priority-1 | Works which are completed by June 1992 |
| ■ Priority-2 | Works which are to be completed by June 1993 |
| ■ Priority-3 | Works which are to be completed by June 1994 |
| ■ Priority-4 | Works (special project works), which are expected to be completed by after June 1994. |

The rehabilitation programme has been shown in Table 3.73. The sum of works under priority 3 and 4 has been shown together in the table under priority-3 only.

During the fiscal year 1991-92 programme for a sum of Tk. 2,075.00 lac was allotted for the procurement of Medical Equipment, Ambulance, Emergency Hospital and Emergency Medical relief and Rehabilitation under Japan and French financial assistance. For the procurement tender have been received. A sum of Tk. 110.79 lac has been expended for the reconstruction of damaged infrastructure (which is 5.34% of the target Tk. 2,075 as fixed

TABLE 3.67

Ministry of Health
Districtwise cyclone damage to infrastructure of health facilities

Sl. No.	District Name	Total		District Hospital		Thana Health Complex		Health Sub-Centre		Family Welfare Centre		Tk.in Lac
		No. of facilities	Estimated Base Cost	No. of facilities	Estimated Base Cost	No. of facilities	Estimated Base Cost	No. of facilities	Estimated Base Cost			
Chittagong Division												
01.	Chittagong	170	506.30	7	103.05	11	72.61	77	185.39	75	145.25	
02.	Cox's Bazar	37	118.95	2	3.27	6	44.10	10	37.75	19	33.83	
03.	Bandarban	2	20.60	--	--	2	20.60	--	--	--	--	
04.	Rangamati	22	76.19	1	5.00	4	41.21	4	7.67	13	22.31	
05.	Khagrachari	2	20.60	--	--	2	20.60	--	--	--	--	
06.	Feni	26	57.57	1	--	2	14.67	7	14.85	16	28.05	
07.	Noakhali	31	119.65	1	11.53	4	49.23	11	28.89	15	30.00	
08.	Laxmipur	33	79.88	1	4.12	2	10.30	13	31.46	17	34.00	
	Sub - Total	323	999.74	13	126.97	33	273.32	122	306.01	155	293.44	
Khulna Division												
09.	Bhola	33	86.82	1	--	6	27.95	6	18.17	20	40.70	
10.	Barisal	32	78.58	--	--	4	20.85	11	22.81	17	34.92	
11.	Patuakhali	17	54.16	1	7.97	4	9.06	6	23.13	6	14.00	
12.	Jhalakathi	2	18.50	1	--	1	18.50	--	--	--	--	
13.	Barguna	20	58.79	1	1.50	3	22.35	7	16.94	9	18.00	
14.	Pirojpur	0	0.00	--	--	--	--	--	--	--	--	
15.	Bagerhat	5	10.00	--	--	--	--	--	--	5	10.00	
16.	Khulna	2	6.58	--	--	--	--	--	--	2	6.58	
17.	Satkhira	3	7.67	--	--	--	--	--	--	3	7.67	
	Sub - Total	114	321.10	4	9.47	18	98.71	30	81.05	62	131.87	
	Total (Ctg + KIn)	437	1,320.84	17	136.44	51	372.03	152	387.06	217	425.31	

* Source : SMEC's damage assessment report

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TABLE 3.68

Ministry of Health
Cyclone Damage to Health Facilities
District Hospitals and Specialised Institutions

							Tk.in Lac
Sl. No.	District Name	No. of facilities	Estimated Cost		Priority		
			Health Department	Consultant	1	2	3
Chittagong Division							
01.	Chittagong	7	209.46	103.05	31.77	71.28	0.00
02.	Cox's Bazar	2	10.00	3.27	1.34	1.74	0.19
03.	Rangamati	1	5.00	5.00	5.00	0.00	0.00
04.	Noakhali	1	5.00	11.53	6.26	5.27	0.00
05.	Feni	1	3.00	0.00	0.00	0.00	0.00
06.	Laxmipur	1	0.00	4.12	0.00	4.12	0.00
	Sub – Total	13	232.46	126.97	44.37	82.41	0.19
Khulna Division							
07.	Bhola	1	3.00	0.00	0.00	0.00	0.00
08.	Barguna	1	0.00	1.50	0.00	1.50	0.00
09.	Jhalakathi	1	3.00	0.00	0.00	0.00	0.00
10.	Patuakhali	1	0.00	7.97	0.00	7.97	0.00
	Sub – Total	4	6.00	9.47	0.00	9.47	0.00
	Total :	17	238.46	136.44	44.37	91.88	0.19

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TABLE 3.69

Ministry of Health
Thana Health Complexes

Sl. No.	District Name	No. of facilities	Estimated Cost		Priority			Tk.in Lac
			Health Department	Consultant	1	2	3	
Chittagong Division								
01.	Chittagong	11	85.00	72.61	33.39	39.08	0.14	
02.	Cox's Bazar	6	65.00	44.10	13.89	30.21	0.00	
03.	Noakhali	4	30.00	49.23	16.88	32.35	0.00	
04.	Feni	2	10.00	14.67	8.21	6.46	0.00	
05.	Laxmipur	2	10.00	10.30	4.12	6.18	0.00	
06.	Bandarban	2	10.00	20.60	8.24	12.36	0.00	
07.	Khagrachari	2	10.00	20.60	8.24	12.36	0.00	
08.	Rangamati	4	20.00	41.21	16.48	24.73	0.00	
	Sub – Total :	33	240	273.32	109.45	163.73	0.14	
Khulna Division								
01.	Bhola	6	50.00	27.95	10.23	17.72	0.00	
02.	Barisal	4	35.00	20.85	8.49	12.36	0.00	
03.	Barguna	3	30.00	22.35	8.24	14.11	0.00	
04.	Patuakhali	4	30.00	9.06	3.62	5.44	0.00	
05.	Jhalokathi	1	0.00	18.50	10.57	6.88	1.05	
	Sub – Total :	18	145.00	98.71	41.15	56.51	1.05	
	Total (Ctg + Kln)	51	385.00	372.03	150.60	220.24	1.19	

Source : SMEC's damage assessment report

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TABLE 3.70

Ministry of Health
Cyclone Damage to Health Facilities
Health Sub-Centres and Dispensaries

Sl. No.	District Name	No. of facilities	Estimated Cost		Tk.in Lac		
			Health Department	Consultant	Priority		
					1	2	3
Chittagong Division							
01.	Chittagong	77	89.00	185.39	94.43	73.19	17.77
02.	Cox's Bazar	10	13.50	37.75	21.73	13.12	2.90
03.	Noakhali	11	15.65	28.89	13.49	13.22	2.18
04.	Feni	7	7.00	14.85	7.59	5.81	1.45
05.	Laxmipur	13	13.00	31.46	15.73	12.58	3.15
06.	Rangamati	4	4.00	7.67	4.04	2.90	0.73
	Sub – Total :	122	142.15	306.01	157.01	120.82	28.18
Khulna Division							
01.	Bhola	6	8.50	18.17	9.76	6.96	1.45
02.	Barisal	11	15.50	22.81	11.90	8.97	1.94
03.	Barguna	7	10.50	16.94	8.47	6.78	1.69
04.	Patuakhali	6	9.00	23.13	18.37	2.27	2.49
	Sub – Total :	30	43.5	81.05	48.5	24.98	7.57
	Total (Ctg+Kln)	152	185.65	387.06	205.51	145.80	35.75

TABLE 3.71

Ministry of Health
Cyclone Damage to Health Facilities
Family Welfare Centre

Tk.in Lac							
Sl. No.	District Name	No. of facilities	Estimated Cost		Priority		
			Health Department	Consultant	1	2	3
Chittagong Division							
01.	Chittagong	75	63.50	145.25	73.67	57.38	14.20
02.	Cox's Bazar	19	20.50	33.83	16.51	14.12	3.20
03.	Noakhali	15	12.50	30.00	15.00	12.00	3.00
04.	Feni	16	12.00	28.05	14.05	11.20	2.80
05.	Laxmipur	17	12.75	34.00	17.00	13.60	3.40
06.	Rangamati	13	9.75	22.31	11.31	8.80	2.20
	Sub'-Total :	155	131.00	293.44	147.54	117.10	28.80
Khulna Division							
01.	Bhola	20	17.25	40.70	20.09	16.81	3.80
02.	Barisal	17	14.50	34.92	16.10	14.02	4.80
03.	Barguna	9	7.75	18.00	9.00	7.20	1.80
04.	Patuakhali	6	5.25	14.00	7.00	5.60	1.40
05.	Bagerhat	5	3.75	10.00	5.00	4.00	1.00
06.	Khulna	2	1.50	6.58	4.03	2.15	0.40
07.	Satkhira	3	2.25	7.67	4.50	2.77	0.40
	Sub - Total :	62	52.25	131.87	65.72	52.55	13.60
	Total (Ctg+Kln)	217	183.25	425.31	213.26	169.65	42.40

Source : SMEC's damage assessment report

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TABLE 3.72

Ministry of Health
Districtwise Cyclone Damage and Reconstruction/Rehabilitation
work executed in 1991-1992 fiscal year

Sl. No.	District	No. of Health Facilities Damaged/ Affected	No. of Infrastructure of Health facilities reconstructed (till 30-6-92)	Estimated Cost of damage (base cost)	Tk.in Lac
					Expenditure incurred in FY (1991-1992) for the reconstruct/ rehabilitation
01.	Chittagong	170	27	506.30	36.55
02.	Cox's Bazar	37	33	118.95	42.49
03.	Bandarban	15	2	42.91	0.28
04.	Khagrachhari	2	--	20.60	--
05.	Rangamati	9	1	53.88	12.95
06.	Feni	--	--	--	--
07.	Noakhali	31	4	119.65	2.55
08.	Laxmipur	33	4	79.88	1.4
09.	Bhola	33	12	86.82	5.12
10.	Barisal	32	22	78.58	4.17
11.	Patuakhali	17	--	54.16	--
12.	Jhalakhati	4	4	18.50	2.18
13.	Barguna	20	3	58.79	3.1
14.	Bagerhat	5	--	10.00	--
15.	Khulna	2	--	6.58	--
16.	Satkhira	3	--	7.67	--
Total		413	112	1,263.27	110.79

Source : Ministry of Health

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TABLE 3.73

Assistance to Ministry of Relief
Information of 1991 Cyclone damage re-construction/Rehabilitation (Financial)

Department/Agency : Ministry of Health		Tk. in Lac				
Priority	Years	Preliminary estimate Prepared by (Agency/Deptt)	Revised Estimate	Final estimate Prepared by (Agency/Consult)	Value of work Programme	Contract Value
				Value of work completed by		
				30-06-1992 (Percent Total)	30-09-1992 (Percent Total) (Cumulative)	Remarks
01.	1991-1992		850.64	110.79 2,075.00 *	110.79 (5%)	Donors Tk. in Lac: German 2,400.00 France 3,462.00 Japan 2,500.00 Italy 545.00
02.	1992-1993	992.36	869.81	1,700.00 *	1,250.00 (74%)	
03.	1993-1994		648.56			
Total : Tk. in Lac		992.36	2,369.01	3,775.00	1,250.00	
US \$ Million		2.61	6.23	9.93	0.29	3.29

Source : SMEC's Damage Assessment Report, ADP, Planning Commission, Director, IMED/Health

US \$ 1 = Tk. 38.00

Note : Sum of costs of Priority-3 & Priority-4 shown in Priority-3

* Work programme for procurement of Medical Equipment and Instruments only

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in the ADP allocation. A list of rehabilitation work as done during 1991-1992 is shown in Table 3.72 as collected from Ministry of Health.

For the FY 1992-1993, SMEC has shown a programme for Tk. 869.80 lac for reconstruction of the infrastructure, a ADP provided and sum of total Tk.4,460 lac for the procurement of emergency mobile Hospital, X-ray Instruments and othre medical equipments. A sum of Tk. 1,250 lac has been expended by September 1992 which is 74 % of the yearly ADP allocation.

g) **Availability of fund for the rehabilitation 1991 cyclone damaged works.**

For mitigation of the disaster diferent countries came forward to help Bangladsh in rehabilitation of Health facilities damaged due to cyclone as well as procurement of new equipments and instruments. The following countries/donors agencies committed the amount shown against them.

Sl. No.	Donor Agency/ Country	Amount			Name of works against which committed for funding	Tk.in Lac
		Total	F.C.	Local		Status of Project works
01.	Japan	2,500.00	1,300.00	1,200.00	Procurement of Ambulances, Medical Instruments and Equipments.	Tendered for supply. Awaiting work order for the decision from the Ministry
02.	France	3,462.60	3,462.60	--	Procurement of Emergency Hospital, Emergency Medical Relief Rehabilitation.	
03.	Germany	2,400.00	2,400.00	--	Procurement of Medical equip- ments & Instruments and spare parts for Health Institutions.	
04.	Italy	544.76	55.55	489.21		Design & Planning work progressing
Total		8,907.36	7,218.15	1,689.21		

Source : Annual Development Programme, Planning Commission

The above financial assistance are only for the rehabilitation of Health Institutions and replacement of damage medical equipments. For the rehabilitation of Health infrastructure no donor agency came forward. During 1991-1992 fiscal year a sum of Tk. 101.00 lac was expended for the reconstruction of Health infrastructure which were of most imergency nature. For the reconstruction of the Health infrastructure no financial assistance obtained from any external agency. Without any external help, the infrastructure of Health could not be rehabilitated as necessary with the own resource of Bangladesh.



3.13 Chittagong Water Supply and Sewerage Authority

a) Introduction

The Cyclone of 29-30th April 1991 with a wind speed of 225 km per hour and a high intensity storm surge of 4-6 metre high caused the damage to the infrastructure of Chittagong Water Supply and Sewerage Authority.

b) Extent of Damage

The tidal surge inundated a booster station at Patenga and tube well at Kalurghat. Electric motors and switch Boards were affected due to entrance of saline tidal surge water in the machine rooms. Damage to office buildings and residential quarters occurred partly. Corrugated iron sheets from the roofs of the semi pucca buildings were flown away and the buildings were exposed to rainfall.

Portions of a pipe line were damaged when scouring to shoulder exposed the pipeline.

The cost of reconstruction/rehabilitation as assessed by SMEC is for Tk.104.4 lac including contingency of Tk. 9.46 lac. (Table 3.74 and 3.75). The Chief Engineer CWASA informed the cost of damage for Tk. 27.03 lac only which is found much less than the assessment made by SMEC (Table 3.76). The Chief Engineer, CWASA might have considered the repair of only the most essential components of the project or part of the entire damage.

c) Assessment of Damage

Methodology : After the cyclone, World Bank entrusted SMEC in association with BCL for assessing the damage of CWASA facilities. The consultant sent the questionnaire to the Chittagong Water Supply and Sewerage Authority with a request to compile a list of damaged projects and to be retained with them. The consultant's assessment team collected the questionnaire prior to joint inspection of claimed damaged works.

Following inspection and assessment the list of the projects submitted were entered in the spreadsheets amended where necessary by the consultant to arrive at a damages total.

At a final meeting with CWASA and the consultant, the findings of the assessment were explained and agreement reached on the final list of projects to be included and total cyclone damage estimate.

Damage Estimate: Division wise assessment of damage to CWASA facilities due to cyclone which the Consultant made is shown in Table D-3.74. The amounts shown are in Tk. Lac and the contingency amount (10%) has been added to determine the rehabilitation cost.

The consultant provided all the works under a single priority. The cost of reconstruction including contingency for escalation of price, as assessed by the consultant is for Tk. 104.40 lac. All the works, as per assessment were programmed to be completed by 1991-92 financial

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TABLE 3.74

Assistance to Ministry of Relief
Summary of Costs for Cyclone Damage to CWASA

Sl. No.	CWASA Division	Estimate to Repair (Tk.in Lac)
01.	Boioster Pump Station	0.99
02.	Construction Division 1	50.35
03.	Mohara Division	0.97
04.	Stoes Division	17.10
05.	Maintenance & Operation Division 1	9.97
06.	Maintenance & Operation Division 2	15.20
	Total Cyclone damage	94.58
	Contingency Tk. Lac	9.46
	Total	104.04
	US \$ Million	0.27

US \$ 1 == Tk. 38.00

Source : SMEC's assessment report

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TABLE 3.75

Assistance to Ministry of Relief
Divisionwise '91 Cyclone Damage Assessment

Department : Chittagong Water Supply & Sanitary Authority (CWASA)

Sl. No.	Name of Division	General Description of Structure	Tk.in Lac	
			Estimated cost WASA	Revised
01.	Booster Pump Station	Area Lighting Window glass panes Wooden door Sign board along with elect. accessories etc. Sub-Total	0.35 0.16 0.18 0.30 0.99	0.35 0.16 0.18 0.30 0.99
02.	Construction Division	8" dia 11500'-0" 6" dia 18000'-0" 4" dia 82000'-0" PVC pipe/C.I. pipe line Electric line of area light and guard shed Sub-Total	200.00 0.35 200.35	50.00 0.35 50.35
03.	Mohana Division	CWASA Mohona 20 MGD water treatment plant consisting of intake structure, raw water pumps, high pumps chemical process etc. and guard shed Sub-Total	0.97 0.97	0.97 0.97
04.	Store Division	137m(450 ft) boundary wall h-10' Thickness 5" Spares pumps, motors, electrical materials & water meters etc. (10 motors of 40-60 HP) Area & security lighting 61m (200 ft) boundary wall Tin roof shed L-52' B-35 A portion of tin roof shed L-36' B-9 Sub-Total	5.00 8.00 1.10 2.00 0.90 0.10 17.10	5.00 8.00 1.10 2.00 0.90 0.10 17.10
05.	M & O Division-1	Overhauling, servicing heat vernishing of pumps 3 Nos. Damage repair to Building 32 Nos. Sub-Total	0.45 9.52 9.97	0.45 9.52 9.97
06.	M & O Division-2	Repair of pumps 4 Nos. Repairs of electrical works 6 Nos. Repair of Building 5 Nos. Repairs of Boundary wall Surface drain M.S. cover plate, water measuring scale Sub-Total	0.06 1.44 4.58 8.24 0.90 15.22	0.06 1.44 4.58 8.24 0.90 15.22
		Total	Tk.in Lac 244.60	94.60
			US \$ Million	0.64
				0.25

US \$ 1 = Tk.38.00

Source : SMEC's cyclone damage assessment report

TABLE 3.76

Statement of damage due to cyclone of 1991 and their rehabilitation/reconstruction
Chittagong WASA (Reported by Chief Engineer, Chittagong WASA)

Name of Division : Chittagong		Tk. In Lac									
Sl. No.	Item of Damage	Unit	Extent of Damage		Rehabilitation made up to June 1992		Remaining Rehabilitation works		Donor Country for Rehabilitation work		Remarks
			Qty.	Cost	Qty.	Cost	Qty.	Cost	Name of Country	Amount	
01.	Repairing of office building, officer and staff quarter			12.03							
02.	Repairing of pump houses and stores boundary walls			10.77		21.25		5.78			
03.	Washing and cleaning of Machineries, Rools equipments and underground reservoirs			0.99							
04.	Repairing of installed pump and machineries			3.24							
Total				27.03		21.25		5.78			
				0.07		0.06		0.02			
				Tk. in Lac		US\$ Million					

Source : Chittagong WASA
US \$ 1 = Tk. 38.00

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The CWASA, so far reconstructed/rehabilitated the works worth Tk. 5.78 lac only which is only 5.5% of the total programmed work as assessed by the consultant and 21.28% of the cost of damage as claimed by the Chief Engineer, CWASA.

d) **Availability of Fund :** No external financial assistance was obtained by the Department. The rehabilitation, so far done, from their own fund.

e) **Rehabilitation Work**

The total rehabilitation cost as assessed by the consultant is for Tk. 104.04 lac including the contingency for cost of Tk. 9.46 lac. But the CWASA made their estimate for rehabilitation for Tk. 27.03 lac only. Till 30th June 1992 the progress achieved about 79%. Value of the work remaining to be done is only for Tk. 5.78 lac (Table 3.77)

3.14 Chittagong City Corporation

a) **Introduction**

The cyclone which crossed the coast of Bangladesh on 29-30th April 1991 was accompanied by high winds of speed exceeding 225 km/hr, a tidal surge of 4-6 metres and torrential rainfall which lasted for several days after the event.

Like all other department the infrastructure of Chittagong City Corporation were severely damaged due to flooding and wind flow.

The Chittagong City Corporation (CCC) is divided into 41 administrative wards and is responsible for city streets, drainage and solid waste disposal. The CCC also has a responsibility for school, Health Centre, Community Centres, markets, recreation areas and its own residential & administrative building. Of these 41 wards. 13 Nrs. wards which are adjacent to the coastline and the Karnafuli river were the most severely affected by the wind rain and tidal surge, 18 wards more remote were partly affected by the wind, rain and the surge and 10 wards were wind and rain affected only.

b) **Extent of Damage**

Damage to roads and bridges and street and traffic lighting was by far, the most significant item of damage and totalling to Tk. 3,047 lac. Sum of damage figure to health & education facilities together comes to Tk. 145 lac and that to staff quarter, ward office and commercial buildings comes to Tk. 175 lac. Thus the total cost of damage stands for Tk. 3,367 lac (Table 3.78).

c) **Assessment of Damage**

Methodology : Following the cyclone the World Bank assigned the SMEC in association with

TABLE 3.77

Assistance to Ministry of Relief
Estimate, Programme and Progress of 1991 Cyclone damage re-construction/rehabilitation (Financial)

Department/Agency: Chittagong Water Supply and Sewerage Authority (CWASA)

Priority	Years	Preliminary estimate Prepared by (Agency/Deptt)	Revised Estimate	Final estimate Prepared by (Agency)	Value of work Programme	Contract Value	Value of work completed by		Remarks
							30-06-1992 (Percent Total)	30-09-1992 (Percent Total) (Cumulative)	
01.	1991-1992	244.60	94.60	27.03	27.03	2,703.00	21.25 (79%)	--	
02.	1992-1993	--	--	--	5.78	--	--	--	Remaining work carried over to 1992-93 FY
03.	1993-1994	--	--	--	--	--	--	--	
Total : Tk. in Lac		244.60	94.60	27.03			21.25		
US \$ Million		0.64	0.25	0.07			0.06		

Source : Chittagong City Corporation (CCC)
US \$ 1 = Tk. 38.00

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TABLE 3.78

Chittagong City Corporation
Estimate of Total Project Cost Cyclone Damage 1991

Sl. No.	Description	Tk.in Lac						US\$ Million
		Priority-1	Priority-1	Total	Cont.	Consultant	Total	Total
01.	Road and Bridges	1,798.85	1,182.88	2,981.73	895.00	194.00	4,070.73	10.71
02.	Staff Quarters	61.40	0.00	61.40	19.00	0.00	80.40	0.21
03.	Educations Facilities	60.60	0.00	60.60	18.00	0.00	78.60	0.21
04.	Health Facilities	44.50	40.00	84.50	26.00	6.00	116.50	0.31
05.	CCC Word Offices	27.60	0.00	27.60	8.00	4.00	39.60	0.10
06.	CCC Commercial Bldgs.	86.20	0.00	86.20	26.00	0.00	112.20	0.30
07.	Street/Traffic Lighting	65.00	0.00	65.00	20.00	0.00	85.00	0.22
Total		Tk.Lac	2,144.15	1,222.88	3,367.03	1,012.00	204.00	4,583.03
		US\$ Mill.	5.64	3.22	8.86	2.66	0.54	12.06

US\$ 1 = Tk. 38.00

Source : SMEC's damage assessment report

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BCL to assess the cyclone damage of the infrastructure of different agency/departments.

The Consultant prepared the questionnaire and sent to the officials of the city corporation for recording the details of the cyclone damage. The officials of the corporation also requested to retain the sheets with them till the assessment team of the consultant visited the damaged sites and carried out a joint inspection of the claimed cyclone damage.

Data from the questionnaire was logged on spread sheets, ammended where necessary by the consultant to arrive at a damage estimate.

A further meeting help between the CCC and the consultant for explaining the assessment to CCC and agreement reached on a final list of projects and a total cyclone damage estimate. Basis of the estimate is Standard Schedule of rates for work carried out by contract of CCC.

d) Damage Estimates

The estimated base cost for reconstruction/rehabilitation comes to Tk.3,367.03 lac (Table 3.79) and the total cost of rehabilitation of the projects of the department comes to Tk. 4,584 lac including the physical and price contingency of 20% and 10% (on average) respectively.

An allowance of 5% for consultancy has been allowed to arrive at overall project cost.

The total commulative contingency factor for physical price and consultancy contingencies is 1.38.

The total cyclone damage to CCC assets comes to Tk. 4,583 lac details of which is presented in Table 3.78.

e) Reconstruction/Rehabilitation Work

While in rehabilitating the cyclone damage assets, the entire volume of work has been divided in to two phases or (appropriately) two Priorities, Viz. Priority-1 and Priority-2.

Priority-1: Works are those of an immediate nature and economic and of social priority, which should be carried out immediately be completed before June, 1993. The estimated cost of the works under phase-I is for Tk. 2,144.15 lac excluding contingency & consultancy (Table 3.79).

Priority-2: Works of an urgent nature which should be completed before June 1993. The estimated cost of the works under priority 2 is for Tk.1,222.88 lac excluding the contingency and consultancy (Table 3.79).

TABLE 3.79

Cyclone Damage Assessment 1991
Chittagong City Corporation
Summary

Sl. No.	Name of Structure	Priority-1						Priority-2						Priority-3						Total		Tk.in Lac				
		CCC.Est		Rev.Est		Repair Cost		CCC.Est		Rev.Est		Repair Cost		CCC.Est		Rev.Est		Repair Cost		CCC.Est			Rev.Est		Repair Cost	
		Repair Cost		Repair Cost		Repair Cost		Repair Cost		Repair Cost		Repair Cost		Repair Cost		Repair Cost		Repair Cost		Repair Cost			Repair Cost		Repair Cost	
01.	Damage to Roads Bridges	3,467.07		1,798.85		3,894.32		1,182.88																	7,361.39	2,981.73
02.	Damage to Street Lights and Traffic Signals	129.33		65.00		0.00		0.00																	129.33	65.00
	Sub - Total	3,596.40		1,863.85		3,894.32		1,182.88																	7,490.72	3,046.73
03.	Damage to Education Facilities	60.63		60.60		0.00		0.00																	60.63	60.60
04.	Damage to Health Facilities	44.35		44.50		0.00		40.00																	44.35	84.50
	Sub - Total	104.98		105.10		0.00		40.00																	104.98	145.10
05.	Damage to Staff Quarters of Ctg. City Corpn.	68.98		61.40		0.00		0.00																	68.98	61.40
06.	Damage to Ward Offices of Ctg. City Corpn.	40.28		27.60		0.00		0.00																	40.28	27.60
07.	Damage to Commercial Blds. of Ctg. City Corpn.	180.35		86.20		0.00		0.00																	180.35	86.20
	Sub - Total	289.61		175.20		0.00		0.00																	289.61	175.20
	Total	3,990.99		2,144.15		3,894.32		1,222.88																	7,885.31	3,367.03
	Tk.in Lac																									8.86
	U\$ Million	10.50		5.64		10.25		3.22																	20.75	

US\$ 1 = Tk. 38.00

Source : SMEC's damage assessment report

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Table D-3.78 shows the cost against priorities. Estimate, Programme and Status of rehabilitation work has been shown in Table 3.80 on the basis of data obtained from Chittagong City Corporation (CCC) and SMEC's Damage Assessment Report.

f) Availability of Fund

No information is available from CCC.

3.15 Ministry of Industries

a) Introduction

Cyclone which crossed the coast of Bangladesh on the evening of 29-30th April 1991 was accompanied by high winds of speed about 225 km/per hour, a high intensity of storm surge of 4-6 metre and torrential rainfall which lasted for several days after the event.

The storm and tidal surge caused damage to 892 industrial units in private sector, public sector and the Chittagong Export processing Zone both big and small. Of the total 892 industrial units, 13 belonged to the Public sector and the rest of the Private Sector. 4,942 nrs. small and cottage industries were also damaged by cyclone (Industries Minister, Shamsul Islam Khan in the Parliament).

b) Export Promotion Zone (Chittagong)

In the Zone there are 221 industrial Units, 37 units are of Foreign Investments and 184 are joint venture.

The sea coast is very close to the Export Promotion Zone. Due to the tremendous wave thrust and cyclonic surge pressure the protective work of the embankment, in front, was destroyed and the embankment failed. The sea water along with mud and silt on rush in to the zone and inundated all the equipments, machineries, goods and raw materials.

The public sector industrial units affected by cyclone are ;

- Chittagong Urea Fertilizer Factory
- TSP Complex
- Karnafuli Paper Mills
- Karnafuli Rayon Chemicals
- Chittagong Chemical Complex
- Usmania Glass Sheet Factory
- Chittagong Cement Chinker Grinding Co.Ltd.
- Chittagong Steel Mill
- Chittagong Dry Dock Ltd.
- Eastern Cables Ltd.
- General Electric Manufacturing Co.
- Gazi Wires Ltd.

TABLE 3.80

Assistance to Ministry of Relief
Information of 1991 Cyclone damage re-construction/rehabilitation (Financial)

Department/Agency : Chittagong City Corporation (CCC)

Tk. in Lac

Priority	Years	Preliminary estimate Prepared by (Agency/Deptt)	Revised Estimate	Final estimate Prepared by (Agency/Consult)	Value of work Programme	Contract Value	Value of work completed by		Remarks
							30-06-1992 (Percent Total)	30-09-1992 (Percent Total) (Cumulative)	
01.	1991-1992	3,991.00	2,144.15	2,144.15	1,250.00	1,250.00	1,000.00 (80%)	--	Financed by ADB
02.	1992-1993	3,894.32	1,222.88	1,222.88	1,222.88	1,222.88	--	1,200.00 (98%)	
03.	1993-1994	--	--	--	--	--	--	--	
Total : Tk. In Lac		7,885.32	3,367.03	3,367.03			1,000.00		
US \$ Million		20.75	8.86	8.86			2.63		

Source : Chittagong City Corporation (CCC)

: SMEC's cyclone damage assessment report.

US \$ 1 = Tk. 38.00

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- Bangladesh Can Co. Ltd.

c) **Extent of Damage**

No consultant was assigned to assess the damage. Individual agency or organisation of the Industrial Sector reported the damage to the Ministry. The extent of damage due to cyclone of 1991 to industries as obtained from the Planning Commission, Ministry of Finance is US\$ 355.00 Million.

Damage to industries of	
Public Sector	: US\$ 54.08 million
Private Sector	: US\$ 259.26 million
Export Processing Zone	
i) Govt. Sector	: US\$ 0.98 million
ii) Private Sector	: US\$ 42.00 million
Total damage US\$ 356.32 million	

Under the Public Sectors the infrastructure of the following industrial wing sustained a damage of Tk. 5,060.00 lac (Ministry of Industries).

- Chittagong Steel Mills Corporation
- Chittagong Dry dock Limited
- Eastern Cable Ltd.
- General Electrical Manufacturing Company
- Gazi wire Ltd.

The TSP complex of Chittagong under the sub-sector BCIC was affected by the cyclone and a sum of Tk. 906.00 lac has been allocated for rehabilitation of the Project.

The total damage to Bangladesh Export Processing Zone (Govt. Sector) is assessed by the Department the is found for Tk. 249.00 lac only (Govt.Sector).

d) **Assessment of Damage**

The ToR does not cover the scope of assessment of damage by this study team. For obtaining damage cost of infrastructure the related Ministry and Department was contacted. Concrete and complete informat was not possible to obtain. Bangladesh Export Processing Zone Authority (BEPZA) responded the best and supplied information. The information so far obtained is presented **Table 3.81** which concerns only with Industry under Public Sector

Reconstruction/rehabilitation cost to industrial sectors:

- Public sector	US\$ 54.00 million	
- Small & Cottage Industry		US\$ 1.32 million
- Medium and Large Industry		US\$ 258.02 million

TABLE 3.81

Assistance to Ministry of Relief
Information of 1991 Cyclone damage re-construction/rehabilitation (Financial)

Department/Agency : Ministry of Commerce & Industries (Including BEPZA)									Tk. in Lac
Priority	Years	Preliminary estimate Prepared by (Agency/Deptt)	Revised Estimate	Final estimate Prepared by (Agency/Consult)	Value of work Programme	Contract Value	Value of work completed by		Remarks
							30-06-1992 (Percent Total)	30-09-1992 (Percent Total) (Cumulative)	
01.	1991-1992	21,272.00	12,245.00	12,119.00	1,664.00	--	1,308.00 (11%) *	1,315.00 (11%) *	
02.	1992-1993		9,027.00	9,027.00	558.00	--	--	--	Work stopped
03.	1993-1994	--	--	--	--	--	--	--	
Total : Tk.in Lac		21,272.00	21,272.00	21,146.00	2,222.00		1,308.00	1,315.00	
US \$ Million		55.98	55.98	55.65	5.85		3.44	3.46	

Source : Planning Commission, Ministry of Finance
; Annual Development Programme, 1992-93
US \$ 1 = Tk. 38.00
BEPZA = Bangladesh Export Promotion Zone Authority

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- Export Processing Zone:-
 - i) Private sector US\$ 42.00 million
 - ii) Govt. sector US\$ 0.98 million
 - Total US\$ 356.32 million**

The Govt. of Bangladesh so far taken up the programme partly for the rehabilitation/reconstruction work as :

1)	Public Infrastructure (Govt. Sector)	Tk.in Lac
-	Bangladesh Chemical Industries Corporation (BCIC)	906.00
	• Rehabilitation of Cyclone damaged TSP complex	
-	Bangladesh Steel & Industrial Corporation (BSIC) & Bangladesh Small & Cottage Industries Corporation (BSCIC)	10,964.00
	• Rehabilitaiton of Cyclone damaged Enterprise of BSCIC located at Chittagong	
	• Chittagong Dry Dock.	
	• Eastern Cable	
	• General Electric Manufacturing Co.	
	• Gazi wire Ltd.	
-	Chittagong Export Promotion Zone (Govt. Sector) Tk. 249.00 lac	249.00
	Total	12,119.00

Thus the cost of rehabilitation of the industries to the public sector of the above listed industries/organisations stands at Tk. 12,119.00 lac (estimated cost shown in the ADP 1992-1993 and the information from the Ministry of Industries and Bangladesh Export Processing Zone Authority (BEPZA).

d) Rehabilitation/reconstruction of Damaged Infrastructure to Industrial Sector

Programme for reconstruciton/rehabilitation work was taken up for the Chittagong Steel Mills Corporation, Chittagong Dry Dock Limited, Eastern Cable Limited, General Electric Manufacturing Company and Gazi Wire Limited with a sum of **Tk. 10,964.00 lac**. Till 30th September 1992 work accomplished for a sum of Tk. 1,115 lac. The rehabilitation work has been stopped due to unavoidable circumstances. Only a sum of Tk. 100 lac has been allocated for fiscale year 1992-1993.

Rehabilitation/reconstruction work of Export Processing Zone was taken up with a programme of Tk. 249.00 lac. Work was taken up for Tk. 200.00 lac. Till 30th September the work of Tk. 200.00 lac has been completed. Programme for further Tk. 49.00 lac has yet not been confirmed.

For rehabilitation/reconstruction of damaged works of Bangladesh Chemical Industries Corporation (BCIC) Tk. 906.00 lac was estimated and no work was taken up during 1991-

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1992 fiscal year as no fund was allocated for the work. During the fiscal year 1992-1993 a fund amounting to Tk. 458 lac has been allocated. Present status of the reconstruction work could not be known till December 1992.

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
BR	Bangladesh Railway
CEA	Canadian Executing Agency (Rail II Projects)
CIDA	Canadian International Development Agency
CGPY	Chittagong Port Yard
CHC	Canadian High Commission
CPCS	CPCS Ltd. (CEA Project 4 Rail II)
CTG	Chittagong
DEN	Divisional Engineer(s)
DSW	Divisional Superintendent of Workshops
GM	General Manager
IRC	International Rail Consultants (CEA Project 1-2 Rail II)
PHT	Pahartali
SMEC	Snowy Mountain Engineering Co.
WM	Workshop Manager
ECNEC	Executive Committee of National Economic Council
RPA	Reimbursible Project Aid
PA	Project Aid

REFERENCE

REFERENCES

- | | | |
|--|------|---|
| Institute of Engineers, Bangladesh (IEB) | 1991 | Report of Task Force on Cyclone and Storm Surge, April 29-30, 1991. |
| BUET/BIDS | 1992 | Multipurpose Cyclone Shelter Programme. Inception Report. UNDP/World Bank/GOB Project BGD/91/025. |
| BUET/BIDS | 1992 | Multipurpose Cyclone Shelter Programme. Inception Report. UNDP/World Bank/GOB Project BGD/91/025. Volume II and VI. |
| SMEC & BCL | 1991 | Damage Assessment of General Infrastructure. World Bank/GOB. Volume 1 to Volume 10. |
| UNDP | 1991 | Cyclone Damage in Bangladesh; Nagua, Japan. |
| Leedshill De-Leow Engineers | 1962 | Coastal Embankment Project, Engineering and Economic Evaluation. |
| Zonal Relief Co-ordinator Feni, (M.M. Haque) | 1991 | 'Operation Sheba', Relief and Rehabilitation Plan for Chittagong, Cox's Bazar, Noakhali, Feni, Laxmipur, Rangamati, Khagrachhari and Bandarban. |
| Ministry of LGRD & Co-operatives/GOB | 1991 | Integrated Protection Plan Proposal for Lives and Properties exposed to risk of Cyclone and Storm Surge in Coastal Areas of Bangladesh. |
| MOH & FFW | 1992 | Workshop Procedures on Lessons Learnt During Cyclone - April, 1991. |
| LRP | 1991 | Proceedings of the Workshop "Living with Cyclones" Land Reclamation Project, Bangladesh Water Development Board. |
| UNCRD | 1991 | Cyclone Damage in Bangladesh, Japan. |

ANNEX A

Correspondance regarding the estimate, Programme and Progress of 1991
Cyclone damage to different Departments

**A Correspondence regarding the Estimate, Programme
and Progress of 1991 Cyclone damage to different
Departments on 13.07.92**



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Ministry of Relief
Government of the People's Republic
of Bangladesh

Disaster Co-ordination and
Monitoring Unit (DCMU)
House 38, Road 11
Dhanmondi R/A, Dhaka-1209

Ref: 5126/TECH/Rural Inf.

Date: 9 July 1992

From Joint Secretary
Ministry of Relief
and
Project Director

To Please see distribution below

INFORMATION REGARDING REHABILITATION OF DAMAGES CAUSED BY APRIL 1991 CYCLONE

The Ministry of Relief is presently executing a project "Assistance to Ministry of Relief in Disaster Coordination and Monitoring" Funded by UNDP

The project study requires information regarding the damages caused by April 1991 Cyclone and the status of rehabilitation/repair of those damages. Mr. M. Rahman, has been appointed a consultant under the project to assess the extent of repair and rehabilitation of the infrastructure damaged by 91 Cyclone. He will be contacting at the appropriate level of your organisation for obtaining necessary information in this regard. You are requested kindly to direct the concerned officers to extend necessary co-operation to him and provide him the relevant information.


A. Z. M. Hossain Khan

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Distribution:

1. The Chairman, BWDB, WAPDA Bhaban, Motijheel C/A, Dhaka
2. The Chairman, BPDB, Motijheel C/A, Dhaka
3. The Chairman, BIWTC, IWTC Bhaban, Motijheel C/A, Dhaka
4. The Chairman, BIWTA, IWTA, Dilkusha C/A, Dhaka
5. The Chairman, BADC, Motijheel C/A, Dhaka
6. The Chairman, Bangladesh Red Crescent Society, Dhaka
7. The Chairman, Telephones & Telegraphs, T&T Bhaban, Rmana, Dhaka
8. The Chief Engineer, PWD, Purta Bhaban, Shegun Bagicha, Dhaka
9. The Chief Engineer, RHD, Sharak Bhaban, Ramna, Dhaka
10. The Chief Engineer, DPHE, Moon Mansion, Dhaka
11. The Engineering Adviser, LGEB, 5/7 Lalmatia, Block-B, Dhaka
12. The Director General, Department of Agricultural Extension, Khamarban, Farmagate, Dhaka
13. The Director General, Health Services, Mohakhali, Dhaka
14. The Director General (Food), Ministry of Food, Khadday Bhaban, Dhaka
15. Mr. Monowar H. Chowdhury, Superintending Engineer, LGEB, 5/7 Lalmatia, Block-B, Dhaka
16. The Director, Facilities Department, Shikkha Bhaban, A. Gani Road, Dhaka
17. The Director, Cyclone Preparedness Project, Bangladesh Red Crescent Society, Maghbazar, Dhaka

Assistance to Ministry of Relief
Damage assessment of 1991 cyclone & rehabilitation

Category/Item (Road/Building/Bridge & Culvert Cyclone shelter Growth Centre etc.)

District Name	Total Damage		Repaired by June 1992		Further Programme			Donor	Remarks
	Quantity	Cost	Quantity	Cost	Damage repair	New	Cost		
					Quantity	Quantity	Cost		

Disaster Co-ordination & Monitoring Unit BGD/91/021

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**B Correspondence regarding the Estimate, Programme
and Progress of 1991 Cyclone damage to different
Departments on 13.07.92**



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Ministry of Relief
Government of the People's Republic
of Bangladesh

Disaster Co-ordination and
Monitoring Unit (DCMU)
House 38, Road 11
Dhanmondi R/A, Dhaka-1209

Ref : 5126/Tech/Rural Inf.

Date : October 20, 1992

From : Joint Secretary
Ministry of Relief & Project Director

To : Please see the distribution

Sub : Information regarding the damage of Infrastructure caused by
the Cyclone of April 1991, and status of rehabilitation till 30th
June, 1992.

The Ministry of Relief has been executing a project "Assistance to Ministry
of Relief in Disaster Co-ordination and Monitoring" funded by UNDP.

The project study requires information regarding the damages caused by
the Cyclone of April 1991, and the status of rehabilitation/re-construction/
repair work till 30th June 1992. Enclosed please find a format concerning
infrastructure. Requested sending back the same at the earliest
convenience duly filled in enabling fulfillment of the study.


20/10/92
A.Z.M. Hussain Khan
Joint Secretary, MOR
and
Project Director
(BGD/91/021)

- ১১৩
1. Mayor
Chittagong City Corporation
Chittagong
 2. The Secretary
Ministry of Health and Family Planning
Bangladesh Secretariat, Dhaka
 3. Secretary
Ministry of Education
Bangladesh Secretariat, Dhaka
 4. The Secretary
Ministry of Commerce & Industries
Bangladesh Secretariat, Dhaka
 5. The Chairman
BIWTC
Motijheel C/A, Dhaka
 6. The Chairman
Civil Aviation
Zia International Air Port, Dhaka
 7. The Chairman
Bangladesh Railway Board
Rail Bhaban, Abdul Gani Road, Dhaka
 8. The Chairman
Chittagong Port Authority
Chittagong Port, Chittagong
 9. The Chairman
Chittagong, WASA
Chittagong
 10. The Chief Engineer
LGED, Lalmatia, Dhaka

Chittagong WASA

Name of Division : Chittagong

Cost Lac Tk.

[illegible]

B:1127ASTA-WAŠA WIT/

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Cost Tk. in Lac

Cost Tk. in Lac

**C Correspondence to Superintending Engineers of
Bangladesh Power Development Board and
C.E./RHD, C.E./BWDB & C.E./BPDB on 03.11.92.**





Ministry of Relief
Government of the People's Republic
of Bangladesh

Disaster Co-ordination and
Monitoring Unit (DCMU)
House 38, Road 11
Dhanmondi R/A, Dhaka-1209

Ref : 5126/Tech/Rural Inf.
Date : October 28, 1992

From : Joint Secretary
Ministry of Relief

- To :
1. The Superintending Engineer
Greater Chittagong Power Distribution Circle
Bangladesh Power Development Board (BPDB)
Chittagong.
 2. The Superintending Engineer
Chittagong North O&M Circle
Bangladesh Power Development Board (BPDB)
Chittagong.
 3. The Superintending Engineer
Chittagong South O&M Circle
Bangladesh Power Development Board (BPDB)
Chittagong.
 4. The Superintending Engineer
Barisal O&M Circle
Bangladesh Power Development Board (BPDB)
Barisal.
 5. The Superintending Engineer
Khulna O&M Circle
Bangladesh Power Development Board (BPDB)
Khulna.
 6. The Superintending Engineer
Comilla O&M Circle
Bangladesh Power Development Board (BPDB)
Comilla.

Sub : Programme and progress of reconstruction/rehabilitation
works of 1991 cyclone damage.

Ministry of relief has been executing the Project "Assistance to Ministry of Relief
in Disaster Co-ordination and Monitoring" funded by UNDP.

For the interest of the project study the data and information as per format attached
will be necessary. These information may please be sent to the Team Leader, DCMU, House
Nr.38, Road Nr.11, Dhanmondi R/A, Dhaka-1209 at your earliest convenience.

Thanking you,


A Z M Hossain Khan
Joint Secretary, MOR and
Project Director

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Assistance to Ministry of Relief
1991 Cyclone damage re-construction/rehabilitaion cost

BPDB Circle : (Greater Chittagong/Chittagong North O&M/Chittagong South O&M/Barisal O&M/Khulna O&M/Comilla O&M)

Million Taka

Priority	Years	Estimated Cost (Preliminary)	Estimated Cost (Final)	Value of Works Programme	Contract Value	Value of Works Completed by 30th June/92	Value of Works Completed by 30th Sept/92 (Cumulative)	Remarks
1	1991-92							
2	1992-93					----		
3	1993-94					-----	-----	
Total :								

Signature :
Designation :
Tele No. :



২০৭
Ministry of Relief
Government of the People's Republic
of Bangladesh

Ref : 5126/Tech/Rural Inf
Date : 26 October 1992

Disaster Co-ordination and
Monitoring Unit (DCMU)
House 38, Road 11
Dhanmondi R/A, Dhaka-1209

From : Joint Secretary
Ministry of Relief

- To :
1. The Chief Engineer
Roads and Highways Department
Sarak Bhaban
Ramna, Dhaka
 2. The Chief Engineer
Monitoring and Evaluation
Bangladesh Water Development Board, BWDB
WAPDA Building
Motijheel C/A, Dhaka
 3. The Chief Engineer
Planning and Design
Bangladesh Power Development Board (BPDB)
WAPDA Building, Motijheel C/A, Dhaka

Sub: Programme and progress of reconstruction/rehabilitation works of
1991 cyclone damage

Ministry of Relief has been executing Project "Assistance to Ministry of Relief
in Disaster Coordination and Monitoring" funded by UNDP.

For the interest of the project study I would like to request you to furnish the
data as per format attached. The data may please be sent directly to the Team Leader,
DCMU, House Nr 38, Road Nr 11, Dhanmondi R/A, Dhaka-1209.

Information so far collected by member of the team Engineer Md. Motior
Rahman working as Rural Infrastructure Specialist is also enclosed for your information and
comments, if any.


A Z M Hossain Khan
Joint Secretary, MOR and
Project Director

