

Chapter 5

Quality Control and Monitoring

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5.1 Quality Control

The ultimate health of a project during the life span of its operational phase will depend largely on the quality achieved during its construction. It is also necessary that the materials and standard of execution fully satisfy the specifications to have a safe and durable structure. For this purpose, a strong quality control mechanism is required in flood control sector. It was, however, noticed in Audit that works were executed without ensuring the quality of materials as discussed below:

5.1.1 Testing of Cement not conducted

IS Code 4031:1988 (reaffirmed 2005) stipulates that the quality of cement is ensured with tests like Fineness Modulus test, Soundness test, Initial and Final setting time, Compressive Strength test *etc.*

It was noticed that three test checked Divisions⁸¹ used 8398.34 MT cement in 10 embankment protection works during the years 2014-17. Out of this quantity, samples of 6217.11 MT cement were tested from Malda Polytechnic and remaining 2181.23 MT (26 *per cent*) cement was used without conducting any tests. The agencies purchased the cement from the local markets. Quality of material purchased from local market was to be ensured before use in flood protective works. The Divisions, however, did not ensure the quality of cement used in works valuing ₹ 13.52 crore, putting the strength of embankment protection works at stake.

5.1.2 Testing of Geo-textile not conducted

Clause 20 of additional terms and conditions attached to NIT stipulated that for special type of materials like Geo Synthetic Bags, High Density Polyethylene (HDPE) Bags, Geo-textile Filter, Geo Jute Filter *etc.*, test reports had to be submitted by the supplying agency along with bills. Engineer-in-Charge (EIC) might conduct independent test on the samples drawn randomly before according approval for using the materials at site.

Test reports of Geo-textile valuing ₹ 1.61 crore used by two Divisions⁸² in 16 works as filter layer during 2013-14 and 2014-15 were neither attached to the bills nor could be produced to Audit by the concerned Divisions.

In the absence of such records, it could not be ascertained if the necessary tests had been done and the quality of materials used ensured by the executing Divisions before their use in the flood protection works.

5.1.3 Soil test not conducted for earthen embankment in KMP

As per IS code 1498:1970 and SP 36 (Part 1) 1987, construction of earthen embankment for flood control requires quality tests to assess permeability, compressibility as well as compaction of soil. Provision for raising of earthen embankment of 223 km was made in the DPR of KMP at a cost of ₹ 166.29 crore,

⁸¹ Malda Irrigation Division, Mahananda Embankment Division and Howrah Irrigation Division.

⁸² Mahananda Embankment Division and Hooghly Irrigation Division.

out of which 130 km has already been completed (March 2018) and the work for 64 km was in progress. No test report of soil used in the embankments under KMP was, however, available in any of the executing Divisions.

I&WD appeared to have not taken the onus to ensure the quality of the earthen embankments constructed.

5.1.4 Specific Gravity of stone boulder not determined

As per Para 3.2 of IS code 14262:1995, Specific Gravity of stone is required to be determined for calculating the weight, size of boulder/stone to be used as well as thickness of protection layer while designing and preparing estimates of revetment used for embankments and bank protection works. The thickness of the boulders to be used in the revetment works depends on the Specific Gravity of the boulders.

It was observed that in violation of the above provision, two Divisions⁸³, while preparing design of 22 bank protection works, did not conduct any tests for determining Specific Gravity of the boulders used as detailed in **Table 5.1**:

Table 5.1: Details of boulders used in works where Specific Gravity not assessed while preparing estimates

Name of the Division	Source of quarry	Specific Gravity considered	No. of estimates	Estimated quantity of boulders (in cum)	Estimated amount involved (₹ in crore)
Jalpaiguri Irrigation	Jaldhaka	2.40, 2.65, 2.70	03	32847	3.33
	Patharjhora	2.65	10	223393	23.35
Alipurduar Irrigation	Torsa	2.40, 2.60	05	216918	14.32
	Diana	2.65	01	71522	7.05
	Bhutan Ghat	2.40	02	32773	2.90
	Jayanti	2.40	01	11284	0.78
Total			22	588737	51.73

From the above, it is also evident that different values of Specific Gravity of boulders were considered even for boulders mined from the same quarry. Further, Specific Gravity of the boulders were not tested even during execution of works.

Thus, I&WD failed to check the quality of materials used in the construction of the flood control works. This could impact the structural design causing defects and leading to failure of the works impacting flood control measures.

5.2 Monitoring

5.2.1 Monitoring of FMP projects

5.2.1.1 Monitoring of progress through CPM/PERT Charts

Para 5.13 of FMP Guidelines (2013) stipulate that the State Governments shall ensure that the works are executed in a well-planned manner and completed within the scheduled period. The progress shall be monitored through Critical

⁸³ Jalpaiguri Irrigation Division and Alipurduar Irrigation Division.

Path Method (CPM)/Programme Evaluation Review Technique (PERT) Charts which shall be submitted within three months of release of first instalment of Central Assistance.

None of the test checked Divisions executing either of the FMP projects prepared CPM/PERT Chart to monitor the progress of the projects. As a result, progress of the work was not monitored efficiently. It was observed that both the projects (KMP and KKB) were delayed as detailed in paragraphs 3.2.1 and 3.2.2 above, and vulnerable areas remained prone to floods.

Further, as specified in Annexure-III attached to the RIDF loan requirement format, a certificate for monitoring the physical progress as per CPM/PERT chart is required to be sent to NABARD. It was noted in Audit that no such CPM or PERT chart was maintained by two Divisions⁸⁴ in respect of any of the four selected RIDF works executed during the period 2013-18.

5.2.1.2 Monitoring through Remote Sensing

Para 5.7 of FMP guidelines (2009) stipulates that the Department of Space/National Remote Sensing Agency (NRSA) may also be associated with the monitoring of physical progress of the schemes through Remote Sensing techniques. It was, however, observed that no such monitoring mechanism through Remote Sensing techniques was adopted for any schemes of Flood Control during the years 2013-18.

5.2.1.3 Monitoring visits of GFCC

Para 4.13 of FMP Guidelines (2009) stipulates that Monitoring Agency (GFCC) would inspect the works valuing more than ₹ 15 crore, at least once in every financial year, to monitor overall quality of works, technical specifications and progress at site before recommending further fund releases.

It was noticed that four monitoring visits (two each for KMP and KKB) were conducted by GFCC during the years 2013-18. Follow-up actions as per recommendations of GFCC were, however, not taken up for the KMP and KKB projects (paragraphs 3.2.1 and 3.2.2).

5.2.1.4 Preparation and updation of inventories of Flood Management schemes

GFCC instructed (July 2012) all the State Governments to prepare and periodically update inventory of assets created in a proper format (detailing reach in which embankments were constructed, completion year, cost, embankment details, area protected, etc.) for flood management schemes executed by the State Government. It was observed that none of the test checked Divisions maintained any inventory of assets. Land register was maintained only by KKB project division. As a result, I&WD has no database containing details of the assets created under FMP. Absence of the database affects proper planning for maintenance of the assets.

5.2.1.5 Visit of Departmental Authorities

Para 68 of I&WD Code stipulates that it is the duty of the concerned Superintending Engineer to inspect the state of the various works within his

⁸⁴ Alipurduar Irrigation Division and Jalpaiguri Irrigation Division.

Circle and to satisfy himself that the system of management prevailing is efficient and economical. It was observed that the departmental higher authorities (Chief Engineer, Superintending Engineer) had visited sites of execution of KKB project, however, in the absence of Inspection Reports, the outcome of such visits could not be assessed.

5.2.2 Monitoring of other flood control projects

5.2.2.1 Work Programme and Site Order Book

As per conditions of contract, the agency was required to submit Work Programme (detailing the items of works to be completed within stipulated time) within seven days from the receipt of work order. The Divisional Officer was also required to issue machine-numbered Site Order Books before commencement of work for recording instructions at site to the agency by inspecting officers and for noting the action taken in that matter by the agency as quickly as possible.

Scrutiny revealed that in four⁸⁵ out of six Divisions neither the Work Programmes nor the Site Order Books were available. In two Divisions⁸⁶ where Site Order Books were maintained, it was noticed that the agency did not mention the rectification measures taken by them against the instructions issued by the officers at the time of site visit.

Lack of proper monitoring by the executing levels was pointed out by the CE, North East and SE, NEIC-I in May 2016 and July 2017, respectively. Information on follow-up action taken, if any, was, however, not available on record.

Thus, the monitoring system was inadequate. This may adversely impact implementation of works and also leads to failure of any corrective action being taken while work is in progress.

5.3 Flood Forecasting

Flood forecasting is a non-structural measure in flood management by providing advance warning to flood prone areas. I&WD is responsible for maintenance, collection, compilation and dissemination of hydrological and meteorological data for the purpose of monitoring of flood situation for almost all river sub-basins of the State during monsoon. For this purpose, network of river gauges and rain gauges have been established at important locations. During monsoon, flood control rooms are set up in each district along with Central Flood Control Room at Department level.

The present flood monitoring and management system in the State comprises of the preparation of Daily Flood Report by Central Flood Control Room of I&WD and transmission of the same to the State Disaster Management Department during June to October each year. This report is also shared with other organisations like Railways, Defence, Kolkata Port Trust (KoPT) etc., regularly. During emergency, separate Flood Bulletin is also issued and the same is disseminated to the District Disaster Management Cells via e-mail, fax or SMS. This Daily Flood Report generally contains rainfall, river gauge and discharge, reservoir level/inflow/outflow data of different Stations within and

⁸⁵ Hooghly Irrigation Division, Jalpaiguri Irrigation Division, Alipurduar Irrigation Division and Coochbehar Irrigation Division.

⁸⁶ Malda Irrigation Division and Mahananda Embankment Division.

outside the State. Sometimes the location and extent of major damages, the status of affected areas under inundation *etc.*, are also included. These data are collected from different district control rooms under I&WD along with other agencies like Indian Meteorological Department (IMD), CWC and Damodar Valley Corporation (DVC) through telephone, e-mail or fax. Daily Flood Report is also uploaded in the departmental web site. Deficiencies observed in flood forecasting were as follows:

- There is no system of real time compilation and dissemination of flood data in I&WD. Though the information on river water level is collected on hourly basis in monsoon period by the river gauge stations, the data is uploaded only once during the day on the web-site of I&WD. As such, if there is a sudden surge of flood waters, it remains unreported.
- Warning levels of a river are different at different locations depending on the plinth level of residential and industrial areas. Hence, frequent river gauge stations are required to measure the level of water at different locations. River Bhagirathi-Hooghly passes through seven districts⁸⁷ in the State; however, only three river gauge stations are located in two districts⁸⁸. There are no gauge stations in the remaining five districts at the downstream of the river. Further, there is only one-gauge station (English Bazar) for the entire 129 km length of the Mahananda river within Malda district. There were no river gauge stations for 66 km length of Tangon river, 57.6 km length of Kalindri river, 24 km length of Punarbhaba river and 23 km length of Pagla river in Malda district. Thus, water level recording mechanism in these sub-basins is weak. In the absence of adequate water level recording and warning mechanism the State Government would be ill-prepared for rescue measures, leaving people at the mercy of flood waters. Although flood risks cannot be completely eliminated, real time flood data, as an important and integral part of a flood warning service, can help to provide timely flood warnings with an adequate lead time for the public and reduce flood damages.

⁸⁷ Murshidabad, Burdwan, Nadia, Hooghly, Howrah, Kolkata and South 24 Parganas.

⁸⁸ Murshidabad and Burdwan.

