



Post-mortem of a disaster

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OVER the past few years, there have been several instances of building collapse, as in structural failure, some with devastating and telling tolls so much so as to awaken concerned professionals to search for answers as to who, why and how 'Where' was as obvious as the heaped debris, burial mounds may be more appropriate an expression, and 'when' was a simpler inquest.

In the infamous Spectra Sweater Factory building cave-in in April 2005, sixty-four people were killed, more than seventy injured. Within a year on 25 February 2006 a five-story building in Dhaka's Tejgaon industrial area collapsed during unauthorized renovations of the building housing Phoenix Garments killing 22 and injuring 50.

On both occasions the city's emergency and rescue resources, meagre as they are, were exposed as severely under prepared, materially and technically, for such disasters, imminent they are in view of our total disregard for compliance with building codes.

The incongruity is that the incidents, not to be confused with accidents, could have been avoided. Both were, as are most others, the result of simple greed and a strange hunger for power, an ailment that affects people steeped in political or governing power. The absolute failure of the actors concerned cannot be overemphasised.

The very unfortunate and uncalled for occurrences have highlighted the need for 'forensic engineering', that is, the investigation of materials, products, structures or components that fail or do not operate or function as intended, causing injury and fatality.

Any building collapse, accidental or due to sabotage, unintended or intentional, demand inquiry to search for answers to

what led to the horrific calamity and for means of preventing a replication.

Soon after the Savar tragedy, Institution of Engineers Bangladesh (IEB) formed an Investigation Committee to probe the catastrophic failure and to determine the lessons learnt with Dr. Engr. A.M.M. Saifullah, incumbent Vice Chancellor, BUET, as its Convener. This week we present the first half of the IEB report.

Considering the grievous consequences of building subsidence, there is the growing want for Emergency Medical Technician (EMT) and Emergency Medical Service (EMS), a point illustrated in the first part of Clark Staten's paper this week on rescue technology.

We dedicate the current issue to the expectant mother who defied her husband's plea to stay home that fateful night. She argued that she had to work the nightshift at Spectra because the management had promised to pay her monthly dues, if she did so. She and her baby are no more.

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Savar Spectra sweater factory failure

Institute of Engineers Bangladesh (IEB) Investigation Report: Part I

ONE 9-storied sweater factory building owned by Spectra Sweaters Ltd., located at Palashbari Village under Savar Thana of Gazipur District collapsed in the early hours (1.15 am) on April 12, 2005 killing more than 60 and injuring more than 100 workers. The nation was deeply shocked by the incident. The Honourable President and Prime Minister of the Peoples' Republic of Bangladesh visited the site a short time after the incident. The site was also visited by political leaders, members of IEB, RAJUK, BGMEA, BUET, BACE and other concerned organizations a short time after the incident and several times later. Separate investigation committees were formed by different organizations to find out the causes and frame comprehensive recommendations to prevent this type of failure in future.

This report has been prepared on behalf of IEB by a Committee constituted by it but does not necessarily reflect the opinion of the IEB.

Description of the incident

On the eastern side of the Kaliakoir-Nabinagar Highway is the 5-storied Shahrar Garments Factory building, which is unaffected. The collapsed 9-storied building is located east of the Shahrar Garments Factory and adjacent to a ditch further towards the east. Both the factories belong to the same owner. The collapse took place in a sudden failure without any warning.

Soon after the collapse the Fire Brigade, Engineers Corps of Bangladesh Army, and other different agencies started the rescue operation, which continued for 8 days (up to the 19 April 2005) till all the debris over the fallen building was cleared/all the trapped victims were rescued, and the dead bodies were recovered.

The IEB Investigation Committee

Soon after the incident, Institution of Engineers Bangladesh formed an Investigation Committee to investigate into the causes of this catastrophic failure. The Committee consisted of the following members:

Dr. Engr. A.M.M. Saifullah	Convener
Engr. M.A. A.Sobhan, PEng	Member
Engr. Md. Mahmud Hussain	Member
Engr. Md. Abdur Rouf	Member
Engr. Emdadul Haque	Member
Engr. A.H.M. Shahiduzzaman	Member
Later the Committee co-opted the following members into the Committee:	
Engr. Muz Zahir Hossain	Member
Dr. Engr. S.L.M. Yasir	Member
Dr. Engr. A.B.M. Saiful Amin	Member Secretary

As per the terms of reference of IEB, the Committee is to "find the causes that triggered the failure process and resulted in complete collapse of the structure". The committee further extended its scope to make recommendations so that such situation can be prevented in future.

Methodology used for the investigation

The investigation has been conducted based on information received through the owner, news media, available photographs, field visits, and critical observations made during the rescue operation and after removal of debris of the collapsed building from the site. The following steps were taken to find out the cause(s) of the disastrous collapse of the building:

Step-1 A layout plan and design prepared by the Engineer employed

by the Owner was obtained.

Step-2 In absence of the As-built drawings, the building's layout plan was reconstructed from the visible column locations after the site was cleared.

Step-3 A pre-design soil boring report (of March 1999) used by the designer was collected from the owner. Subsequently a report on the post-failure field investigations including SPT bore log prepared on behalf of BGMEA was collected and super-imposed over the pre-design borelog.

Step-4 The test results of some materials of the collapsed building (tests performed at BUET Laboratory) were obtained for analysis.

Step-5 An account of additional installations in the building and loading conditions prevailing at the time of collapse was reconstructed by interviewing some workers who were on duty at the time of the incident.

Step-6 A description of the piling work and sinking operation of the two tube wells adjacent to the pile foundations was obtained through interviewing the piling and tube well sub-contractors for use in the review and analysis.

Step-7 A three-dimensional finite element model of the structure was developed to simulate different probable failure modes and verify those with the post-failure revelations, based on the re-constructed layout plan, post-failure survey information and design sheets provided by the design engineer.

Step-8 The design of the respective foundations was checked to assess their design adequacy. To this end, the capacity of the pile groups was calculated based on the both pre-failure and post-failure soil exploration reports.

Step-9 After completion of the normal clearance of the debris, foundation of the

northeast end corner column and the pile cap was exposed by additional removal of debris and excavation. The conditions thus revealed gave evidence as to how collapse of the building was initiated.

ground floor slab had gone down by about 11 feet from the surrounding surface and there was little settlement of the floors or footings.