

Bottoms Gallery (Pvt) Ltd.

Bulbul Tower, Dighir Chala, Chandana, Gazipur
(23.994592, 90.382016)

11th May 2014



Punching shear in flat slabs requires immediate action

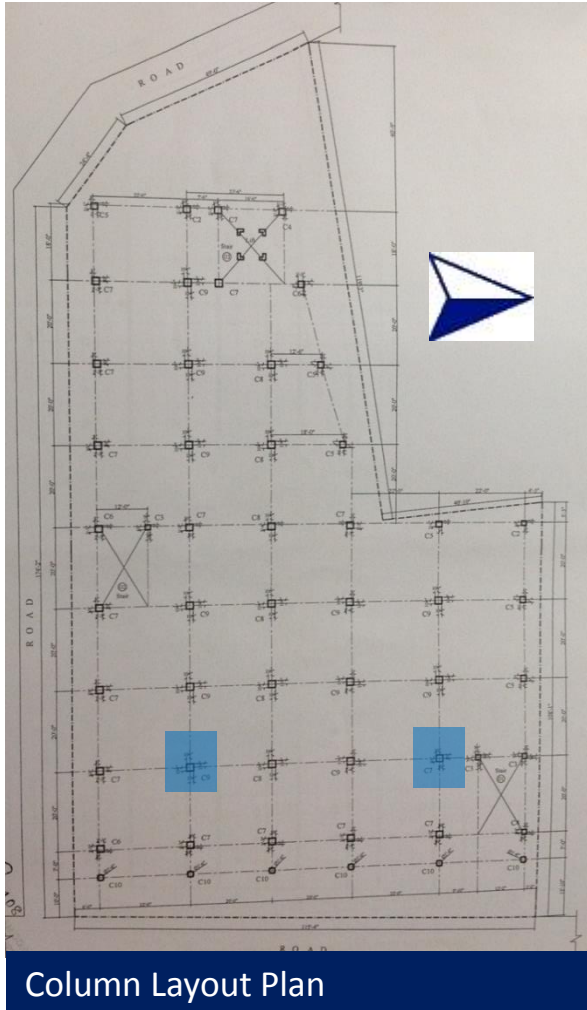
- Flat slabs were observed at all levels, some of which were subject to storage loads.
- There were no shear links referred to in the drawings.
- Detail Engineering Assessment required to determine capacity of slab with regard to punching shear.



Flat slab at Level 4

Stress levels in columns

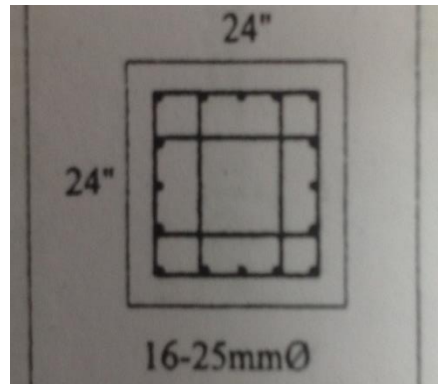
- Cursory calculations indicate that the working stresses to the Basement columns are highly stressed.



Tested Basement Columns



Brick aggregate



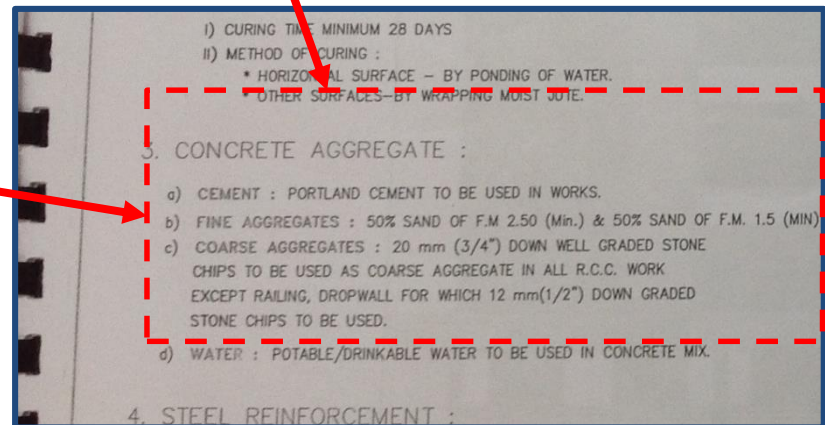
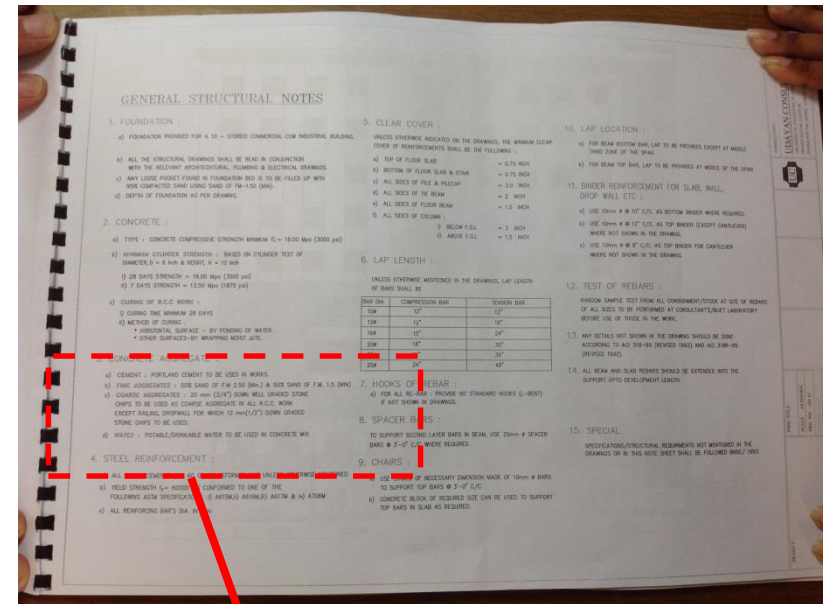
Internal Column detail at Basement

- Grade 60 steel is called up in the structural drawings. The reinforcement quantities recorded at Basement level using the Ferro-scanner appeared to coincide with the values provided in the Column Schedule.
- Brick aggregate was observed in the Basement columns in lieu of the specified stone aggregate.
- No loading plan was provided for the building. From inspection, the critical columns support garment and fabric storage, toilet slab build-up on levels one to six and water tanks at roof level.
- The building was originally approved by Rajuk as a 10-storey industrial building.

Stress levels in columns require immediate action



Design drawings indicate stone aggregate concrete was to be used. Basement columns opened up clearly show concrete contains brick aggregate



Column aggregate type



Critical Internal Column at Level 5



Water tanks on Level 7 (current roof)



Storage of fabric rolls on Level 1

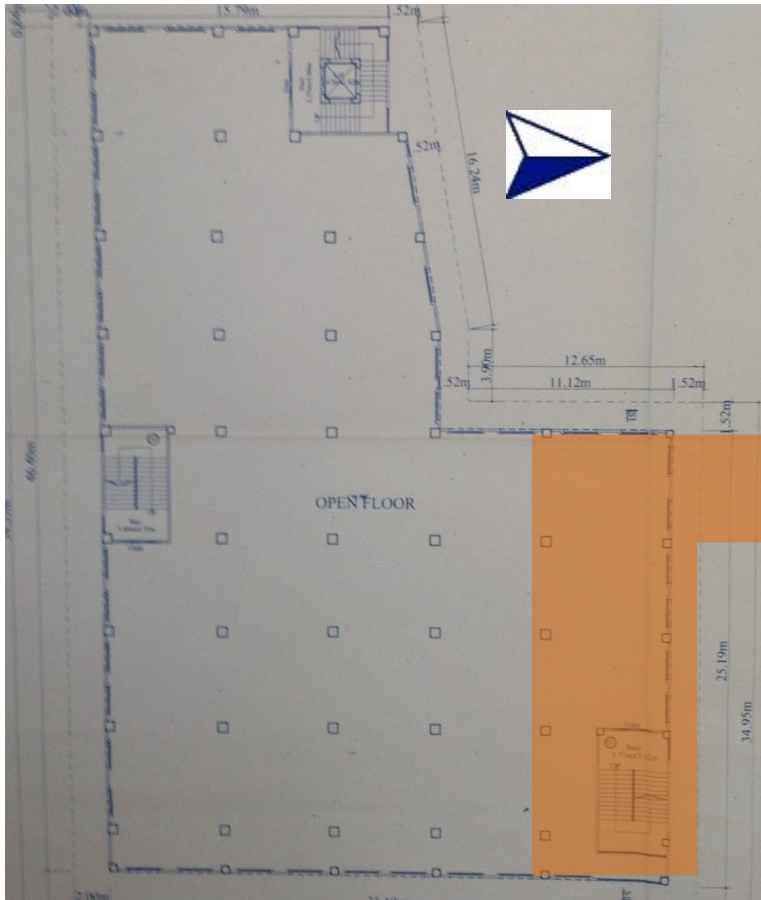


Garment storage at Level 4

Stress levels in columns require immediate action

Heavy Loading (A) - Storage

The floor load management system was incomplete as no loading plans were observed for any of the levels. Garment storage was present on 2nd to 6th floors, and fabric storage was present on 1st floor.



Location of garment storage on 2nd to 6th floors

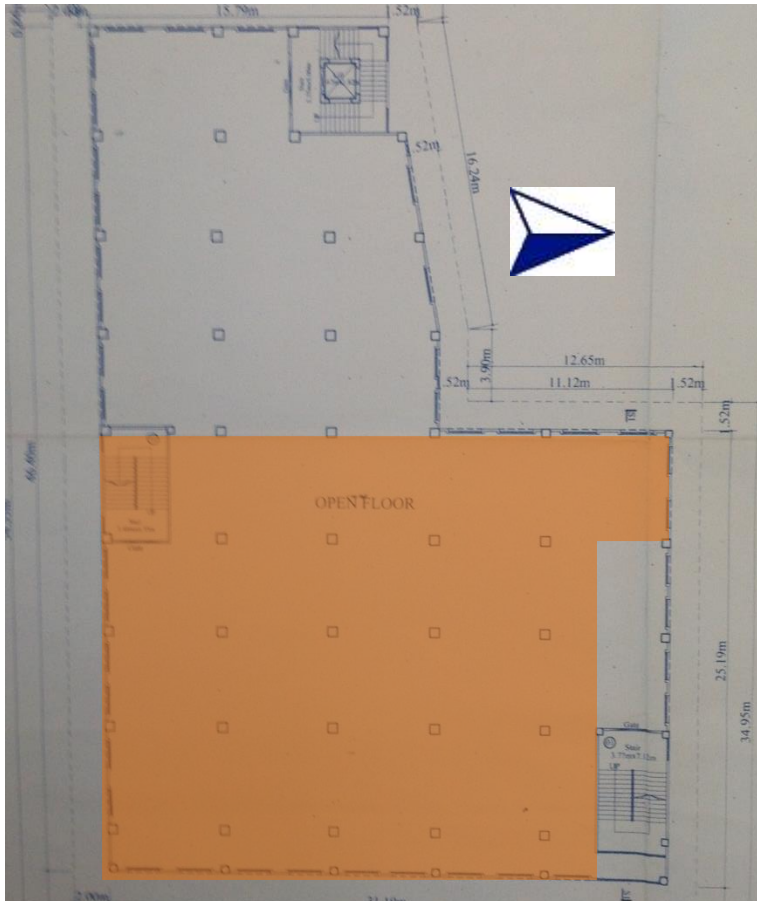
Location of observed heavy loading
imposed by garment storage



Finished garment storage on 6th floors

Heavy Loading (A) - Storage

Storage for rolls of fabric was present on 1st floor.



Location of fabric storage on 1st floor



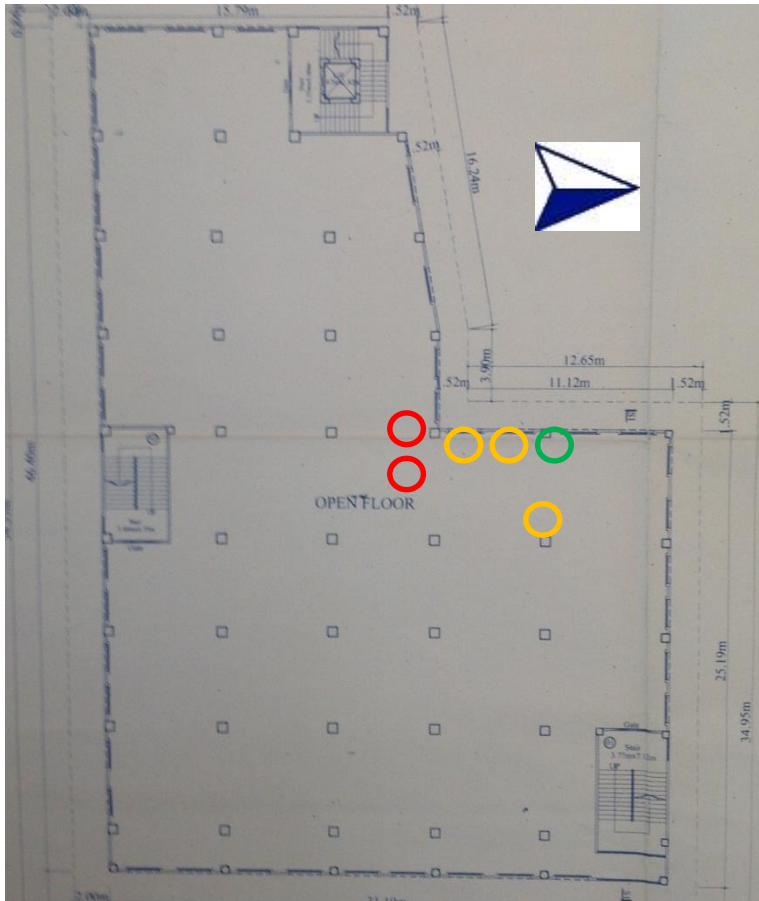
Rolls of fabric stored on 1st floor

Location of observed heavy loading imposed by rolls of fabric

Heavy Loading (A) - Storage

Heavy Loading (B) – Water Storage Tanks

- Six water tanks were observed at 7th floor (roof). The combined capacity of these tanks is 17,500 litres.
- In addition, a 2000 litre tank is located in a plant room on the Ground Floor.



Location of water tanks on 7th floor (current roof)



5000 litre water tank



2000 litre water tank



Water tanks on 7th floor (current roof)

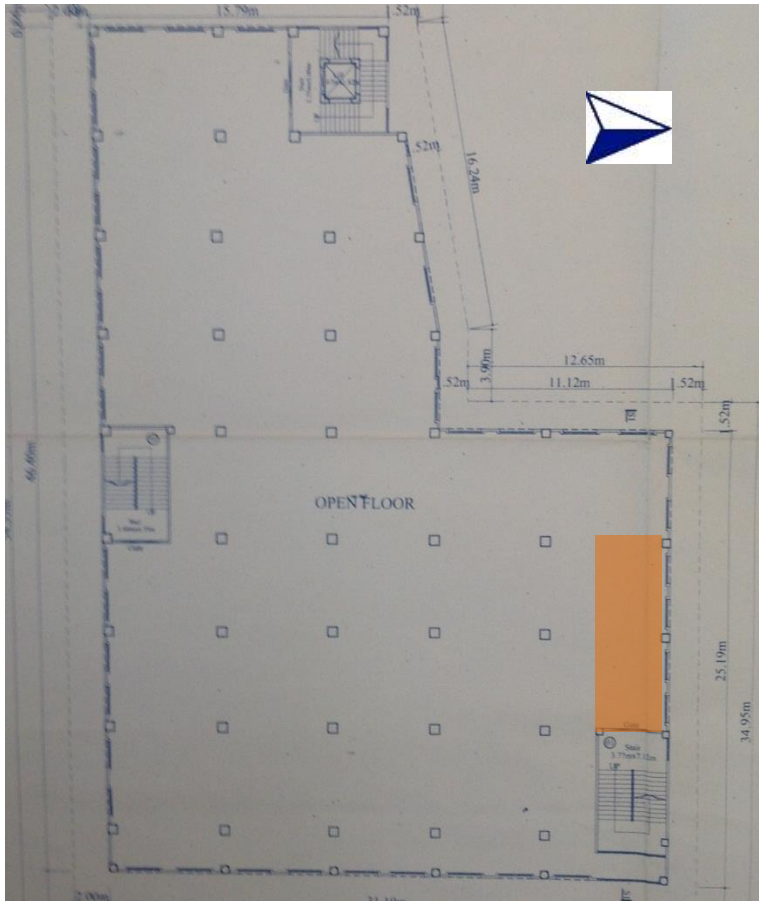


1500 litre water tank

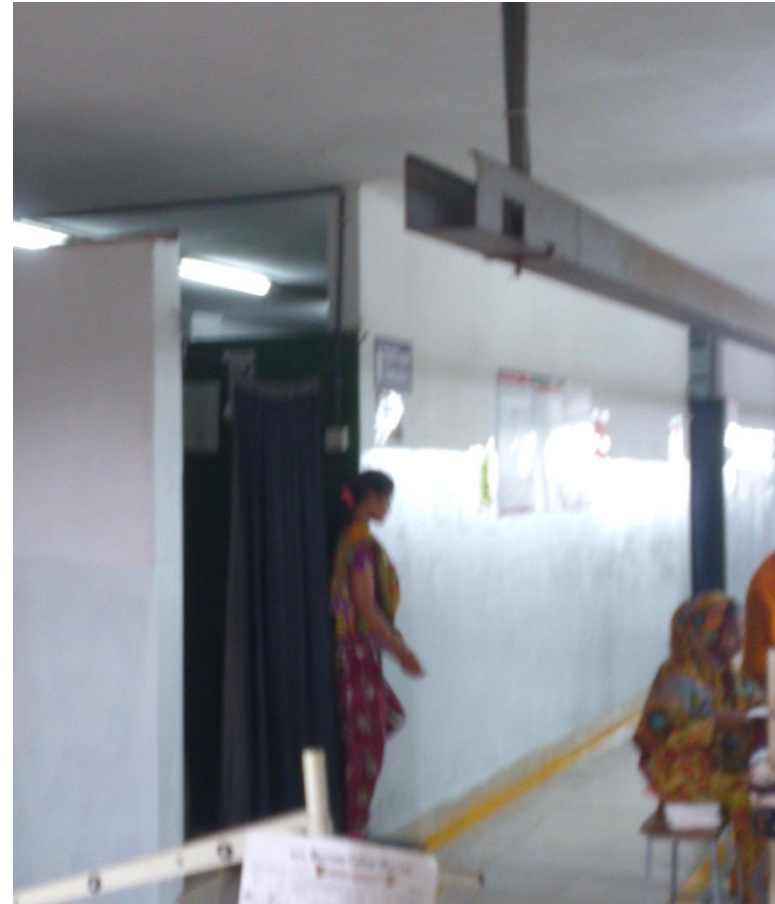
Heavy Loading (B) – Water Storage Tanks

Heavy Loading (C) – Floor build-up in toilet areas

- Slab build up was present in the toilet areas.
- The average build-up depth observed was 308mm.



Location of toilets on 1st to 6th floors

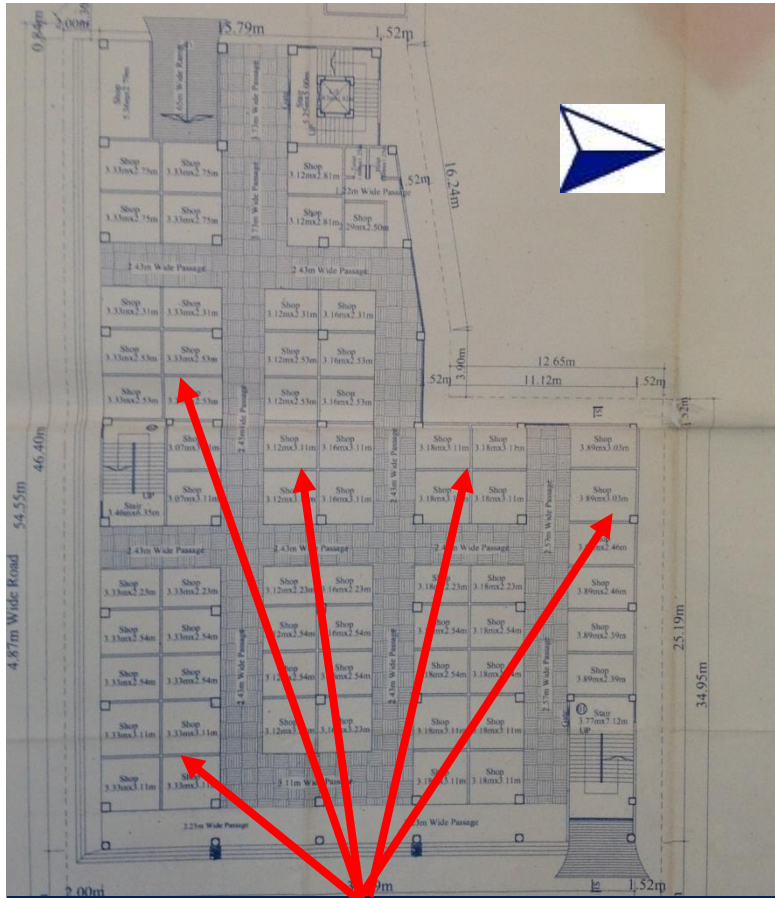


Toilet block on 6th floor

Location of toilets

Heavy Loading (D) – Ground Floor Brick Walls

Heavy weight brick partitions were present on the suspended ground floor.
Demolition of these walls had commenced, and the resulting rubble was observed on ground floor.



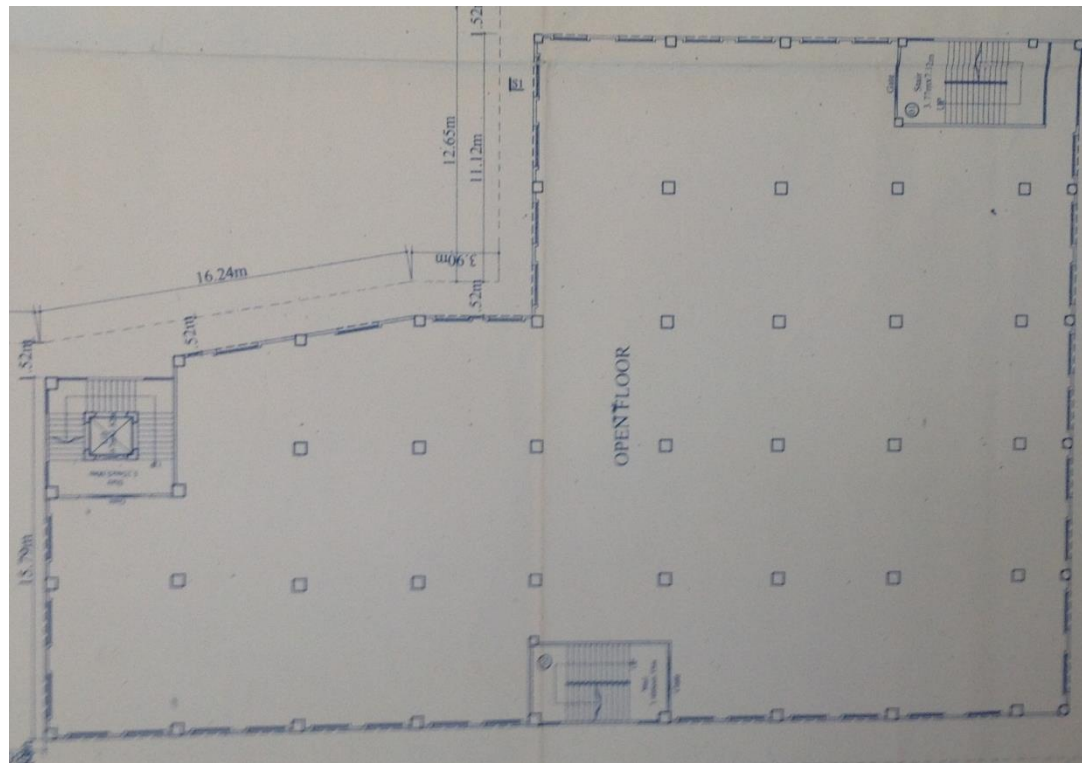
Location of brick wall partitions on Ground Floor



Rubble from brick wall demolition

Lateral stability system unclear

- The lateral stability system to the building is unclear.
- The structural system of the building is flat-slab construction with no drop panels at the column location. There are no shear walls indicated on the provided drawings.
- It is assumed that the lateral stability of the structure is provided through frame action between the slabs and the columns.
- Building Engineer to carry out a lateral stability analysis of the building and provide the necessary remedial works for lateral stability if required.



General arrangement for 1st to 7th floors with a 212mm flat slab on columns. No shear walls are indicated.

Floor cantilevers

Cantilever slabs were observed on the East and South elevations of the building. Building Engineer to check structural adequacy of the cantilever, and propose and implement any strengthening works if required.



Cantilever on East elevation.



Cantilever on South elevation.

Inconsistencies in documents provided

- There are a number of inconsistencies between the permit drawings and the constructed buildings, the principal of which is brick aggregate being used although stone aggregate was specified.
- Building Engineer to provide an updated Permit drawing and a full set of as-built structural and architectural drawings for all of the buildings on the site.



Stairs shown on drawings not present

2. CONCRETE :

- a) TYPE : CONCRETE COMPRESSIVE STRENGTH MINIMUM $f'_c = 18.00 \text{ Mpa (3000 psi)}$
- b) MINIMUM CYLINDER STRENGTH : BASED ON CYLINDER TEST OF DIAMETER, $D = 6 \text{ inch}$ & HEIGHT, $H = 12 \text{ inch}$
 - i) 28 DAYS STRENGTH = $18.00 \text{ Mpa (3000 psi)}$
 - ii) 7 DAYS STRENGTH = $13.50 \text{ Mpa (1875 psi)}$
- c) CURING OF R.C.C WORK :
 - i) CURING TIME MINIMUM 28 DAYS
 - ii) METHOD OF CURING :
 - * HORIZONTAL SURFACE – BY PONDING OF WATER.
 - * OTHER SURFACES—BY WRAPPING MOIST JUTE.

3. CONCRETE AGGREGATE :

- a) CEMENT : PORTLAND CEMENT TO BE USED IN WORKS.
- b) FINE AGGREGATES : 50% SAND OF F.M 2.50 (Min.) & 50% SAND OF F.M. 1.5 (MIN)
- c) COARSE AGGREGATES : 20 mm (3/4") DOWN WELL GRADED STONE CHIPS TO BE USED AS COARSE AGGREGATE IN ALL R.C.C. WORK EXCEPT RAILING, DROPWALL FOR WHICH 12 mm(1/2") DOWN GRADED STONE CHIPS TO BE USED.
- d) WATER : POTABLE/DRINKABLE WATER TO BE USED IN CONCRETE MIX.

4. STEEL REINFORCEMENT :

- a) ALL REINFORCEMENTS ARE 60 GRADE DEFORMED BAR UNLESS OTHERWISE MENTIONED.
- b) YIELD STRENGTH $f_y = 60000 \text{ psi}$ CONFORMED TO ONE OF THE FOLLOWING ASTM SPECIFICATIONS : i) A615M, ii) A616M, iii) A617M & iv) A706M
- c) ALL REINFORCING BAR'S DIA. IN mm

Stone chip aggregate specified.
Brick aggregate was observed

Lightweight roof structures

- Additional roof structures were present on level 7 that were not shown on the provided drawings.
- Unreinforced masonry walls were present around the stairwells, there was a steel roof structure at the generator on ground floor, and a rooftop mast structure was cantilevering from a column stub.
- These structures do not appear to be engineered.
- Building Engineer to review the design of these structures and to implement any required strengthening works.



Unreinforced masonry wall



Steel roof to generator



Mast and unreinforced masonry wall

Priority Actions

Problems Observed

1. Heavy imposed loading (4 issues):
 - A. Storage
 - B. Water storage tanks
 - C. Floor build-up in toilet areas
 - D. Ground Floor brick walls
2. Stress levels in columns
3. Lateral stability system unclear
4. Floor cantilevers
5. Missing documentation and Inconsistencies in documents provided
6. Lightweight roof structures

Item No.	Observation	Recommended Action Plan	Recommended Timeline
1	Heavy loading on slabs	Reduce the load in the area highlighted in full report to 2kPa immediately on all suspended floors (this is approximately maximum 4 boxes high or 4 bags high). Do not increase loads in other areas.	Immediate - Now
2	Heavy loading on slabs	Building Engineer to check the capacity of the flat slab floors and columns against the design loading, particularly punching shear at columns.	Immediate - Now
3	Heavy loading on slabs	Verify insitu concrete stresses either by taking 100mm dia. cores at all suspended levels from non- critical areas of slabs (remote from columns), or from existing cylinder strength data.	Immediate - Now
4	Heavy loading on slabs	A Detail Engineering Assessment of the Factory to be commenced, see attached Scope.	Immediate - Now
5	Heavy loading on slabs	Detail Engineering Assessment to be completed.	6-weeks
6	Heavy loading on slabs	Produce and actively manage a loading plan for all floor plates within the factory giving consideration to floor capacity and column capacity.	6-weeks
7	Heavy loading on slabs	Continue to implement load plan.	6-months

Detail Engineering Assessment

This Schedule develops a minimum level of information, Analysis and testing expected as part of a Detail Engineering Assessment.

The Building(s) have been visually assessed and it is deemed necessary that a detailed engineering assessment be carried out by a competent Engineering Team employed by the factory Owner.

This Request should be read in conjunction with the BUET developed Tripartite Guideline document for Assessment of Structural Integrity of Existing RMG Factory Buildings in Bangladesh (Tripartite Document), the latest version of this document should be referenced. This document also gives guidance on required competency of Engineering Team.

We expect that the following will be carried out:

1. Development of Full Engineering As-Built Drawings showing Structure, loading, elements, dimensions , levels, foundations and framing on Plan, Section and Elevational drawings .
2. The Engineering team are to carry out supporting calculations with a model based design check to assess the safety and serviceability of the building against loading as set out in BNBC-2006, Lower rate provisions can be applied in accordance with the Tripartite Guidelines following international engineering practice, justification for these lower rate provisions must be made.
3. A geotechnical Report describing ground conditions and commenting on foundation systems used/proposed.
4. A report on Engineering tests carried out to justify material strengths and reinforcement content in all key elements studied.
5. Detailed load plans shall be prepared for each level showing current and potential future loading with all key equipment items shown with associated loads.
6. The Engineering team will prepare an assessment report that covers the following:
 - As-Built drawings including
 - Plans at each level calling up and dimensioning all structural components
 - Cross sectional drawings showing structural beams, slabs, floor to floor heights, roof build-ups and Basic design information of the structure
 - Highlight any variation between As-built compared to the designed structure
 - Results of testing for strength and materials
 - Results of geotechnical assessment and testing/investigation
 - Details of loading, inputs and results of computer modelling
 - Commentary on adequacy/inadequacy of elements of the structure
 - Schedule of any required retrofitting required for safety or performance of Structure

Any proposals for Retrofitting to follow guidance developed in the Tripartite Document

Item No.	Observation	Recommended Action Plan	Recommended Timeline
8	Stress levels in basement columns	As part of Detail Engineering Assessment (see Item 1), Building Engineer to review design, loads and column stresses in basement columns.	Immediate - Now
9	Stress levels in basement columns	Verify insitu concrete stresses either by 100mm diameter cores from, or existing cylinder strength data from min. 4 basement columns. Reinforcement quantities also to be confirmed.	Immediate - Now
10	Stress levels in basement columns	Input data from column design review into Loading Plan (see Item 1).	6-weeks
11	Stress levels in basement columns	Continue to implement load plan.	6-months
12	Lateral stability system unclear	As part of Detail Engineering Assessment (see Item 1), Building Engineer to carry out a stability analysis of the full 7 storey building.	6-weeks
13	Lateral stability system unclear	Propose additional stability works if necessary.	6-weeks
14	Lateral stability system unclear	Implement remedial action if required.	6-months

Item No.	Observation	Recommended Action Plan	Recommended Timeline
15	Floor Cantilevers	As part of Detail Engineering Assessment (see Item 1), Building Engineer to assess the cantilever slab design for the floor and façade loads applied.	6-weeks
16	Floor Cantilevers	Carry out any remedial or strengthening works as required.	6-months
17	Inconsistencies in documents provided	Building Engineer to update the structural and architectural drawings to reflect the as-built layouts.	6-months
18	Lightweight roof structures	Lightweight structures to be checked to ensure adequacy for code vertical and wind loads by the Building Engineer.	6-months
19	Lightweight roof structures	Undertake strengthening if required.	6-months
20	Lightweight roof structures	Building Engineer to produce appropriate documentation and as-built drawings.	6-months