Rio Fashion Wear Ltd

Industrial Plot No.3, Milk Vita Road, Section 7, Mirpur, Dhaka
(23.81596N, 90.3625E)

2 November 2013

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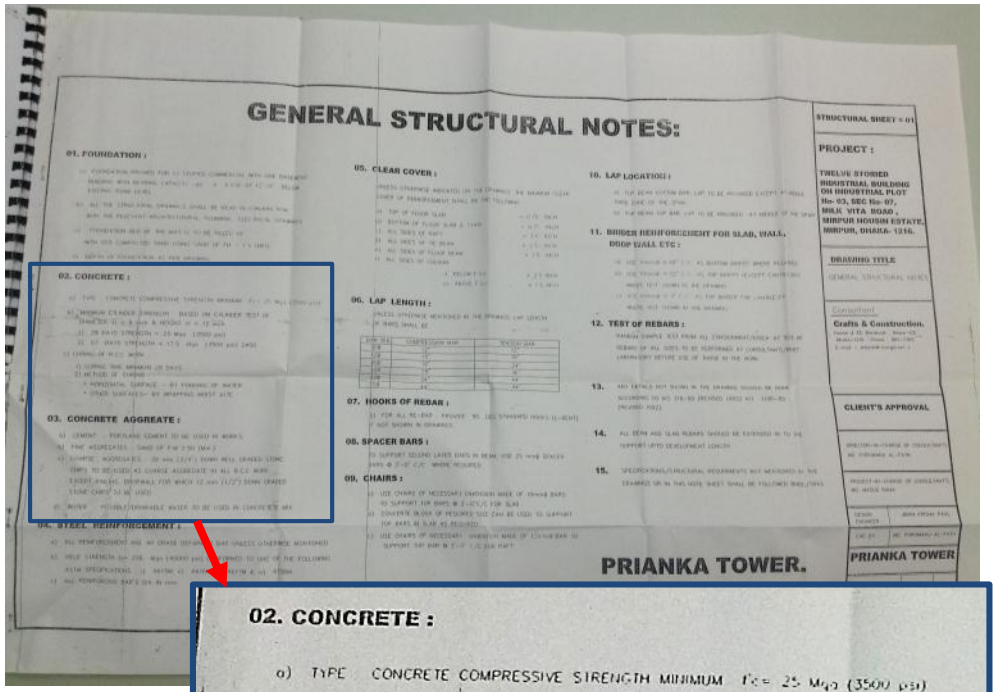
ARUP

Site Observations



Design drawings indicate stone aggregate concrete was to be used. 8th floor column opened for Schmidt Hammer test clearly showing concrete contains brick aggregate

3 columns opened up at basement level were found to be stone aggregate. It is unknown at what level the columns change to brick aggregate. This needs to be confirmed as the column working stress is very high for brick aggregate concrete.

02. CONCRETE :

a) TYPE CONCRETE COMPRESSIVE STRENGTH MINIMUM f'c = 25 Mpa (3500 psi)

b) MINIMUM CYLINDER STRENGTH : BASED ON CYLINDER TEST OF DIAMETER, D = 6 inch & HEIGHT, H = 12 inch

1) 28 DAYS STRENGTH = 25 Mpa (3500 psi)

2) 07 DAYS STRENGTH = 17.5 Mpa (3500 psi) 2450

c) CURING OF R.C.C WORK

1) CURING TIME MINIMUM 28 DAYS

2) METHOD OF CURING :

* HORIZONTAL SURFACE – BY PONDING OF WATER
* OTHER SURFACES– BY WRAPPING MOIST JUTE

03. CONCRETE AGGREATE :

a) CEMENT : PORTLAND CEMENT TO BE USED IN WORKS

b) FINE AGGREGATES : SAND OF F.M 2.50 (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) WOTER : POTABLE/DRINKABLE WATER TO BE USED IN CONCRETETE MIX

Column aggregate type

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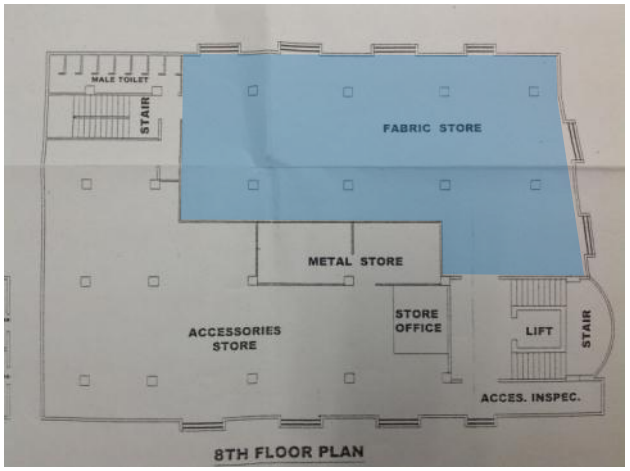

Rolls of denim stacked 2m high over areas of 1.5m x 3m

Loading in this area needs to be reduced See below

Heavily loaded bonded warehouse

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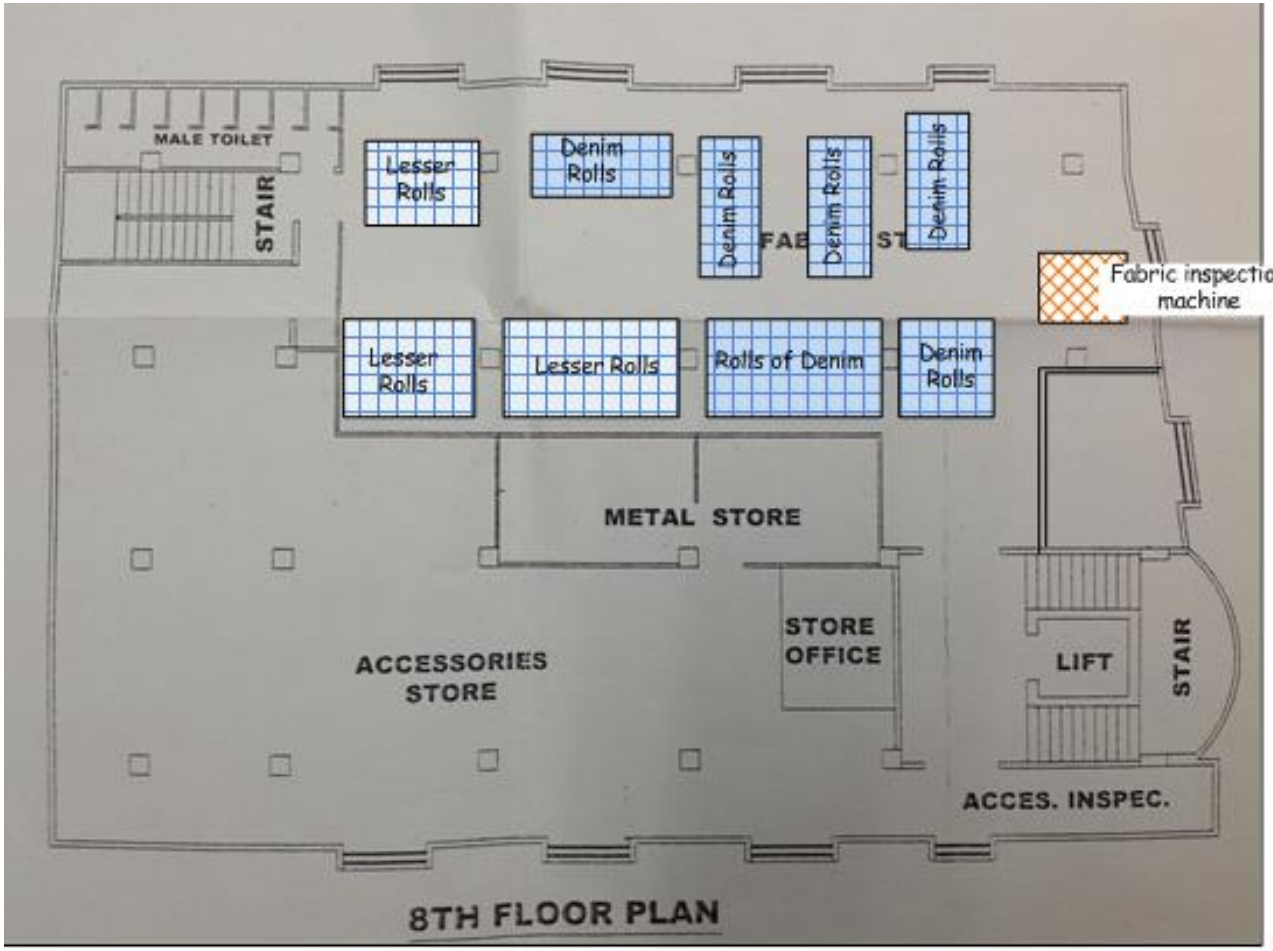

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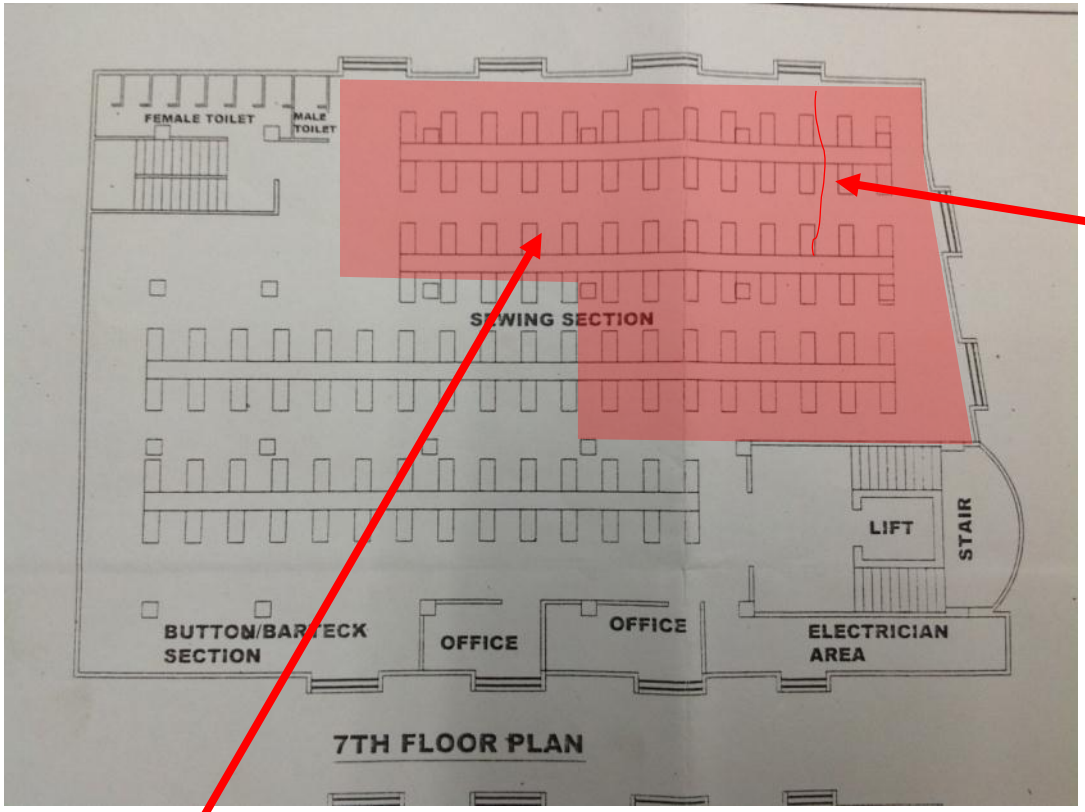

Multiple hairline cracks in underside of 8th floor slab

Crack opened up with hammer revealed voids in concrete

Heavily loaded bonded warehouse

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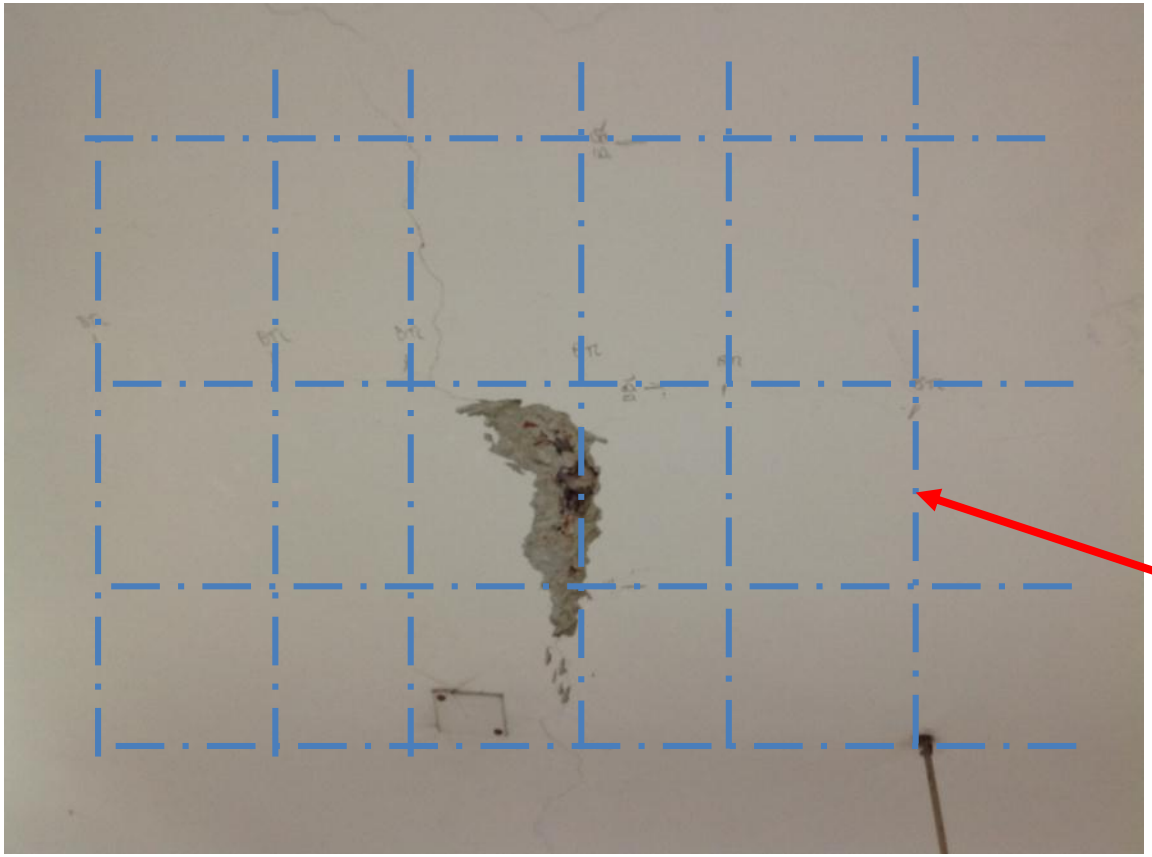

Ferroscan of slab soffit indicates reinforcement at depth approx 60mm at 150mm to 200mm centres in both directions.
Bar could not be located in formed opening

Heavily loaded bonded warehouse

Structure not on permit drawings and walls do not align with columns or beams below

Store room and water tank

Structure not on permit drawings

High loads due to weight of soil. It is unlikely the slab will have been designed for this load

Medical room and roof top planter

High loading on roof slab

Stability system is by column-slab moment frame

Building Engineer must carry out a stability analysis of the full 13 storey building.

Stability system

Poor compaction of concrete on cantilevered balcony roof slab

Other localised areas of high load

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Steps in façade at 2nd and ground not shown on drawings

Steps in rear facade

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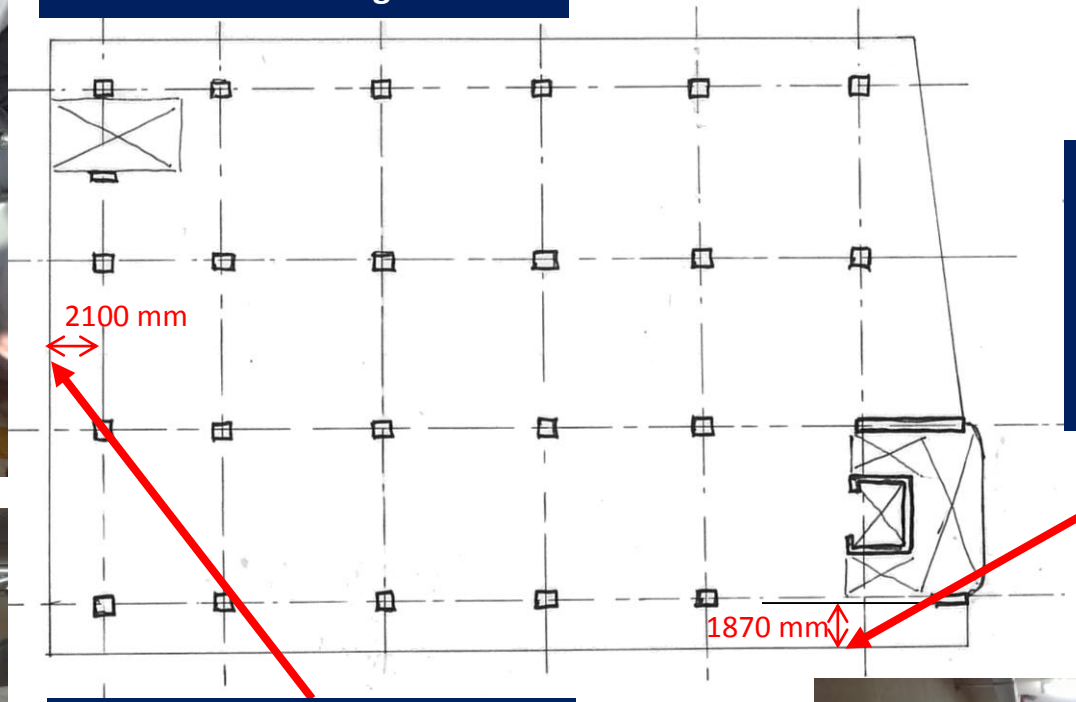
Crack in floor tiles due to deflection of slab edge



35mm deflection at tip of cantilever (edge of slab at wall is 35mm lower than slab at column position)

25mm deflection at tip of cantilever (edge of slab at wall is 25mm lower than slab at column position)

Deflections of cantilevered slab at perimeter walls

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General Non Structural Observations

Slender wall without end restraint. Vulnerable to horizontal impact when moving material or machinery.

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Priority Actions

Issues Observed

1. Column stresses are high
2. Cracking to 7th floor soffit (under 8th floor structure) of slabs and beams
3. Loading on roof slab (medical room, water tank and planter)
4. Heavy loading on areas of a number of floors
5. Overall stability – tall moment frame
6. Discrepancies between drawings and as built structure over steps in slab edge (steps in façade at 2nd and ground not shown on drawings).
7. Large deflections of cantilever, loads appear to be carried by perimeter brick walls. Load path should be determined.

Item No.	Observation	Recommended Action Plan	Recommended Timeline
1	Check Column stresses and verify aggregate type in columns at basement and ground floor level	Remove plaster from a minimum of 4 columns at basement and a minimum of 4 columns at ground floor and a minimum of 4 columns at first floor to verify aggregate type. Remove plaster from sufficient columns at upper floors to determine when the aggregate type changes from stone to brick.	**Immediate - Now**
2	Check Column stresses and verify aggregate type in columns at basement and ground floor level	If brick aggregate concrete is found in either the basement, ground or first floor columns then ALL storage loads need to be removed	**Immediate - Now**
3	Check Column stresses and verify aggregate type in columns at basement and ground floor level	A full Detailed Engineering Assessment of Factory is to be commenced.	**Immediate - Now**
4	Check Column stresses and verify aggregate type in columns at basement and ground floor level	Factory Engineer to review design, loads and columns stresses in columns at basement and ground floor level.	**Immediate - Now**
5	Check Column stresses and verify aggregate type in columns at basement and ground floor level	Verify insitu concrete strengths either by cores [minimum of 4 columns] or existing cylinder strength data for columns at basement and ground floor level.	**Immediate - Now**

Detail Engineering Assessment

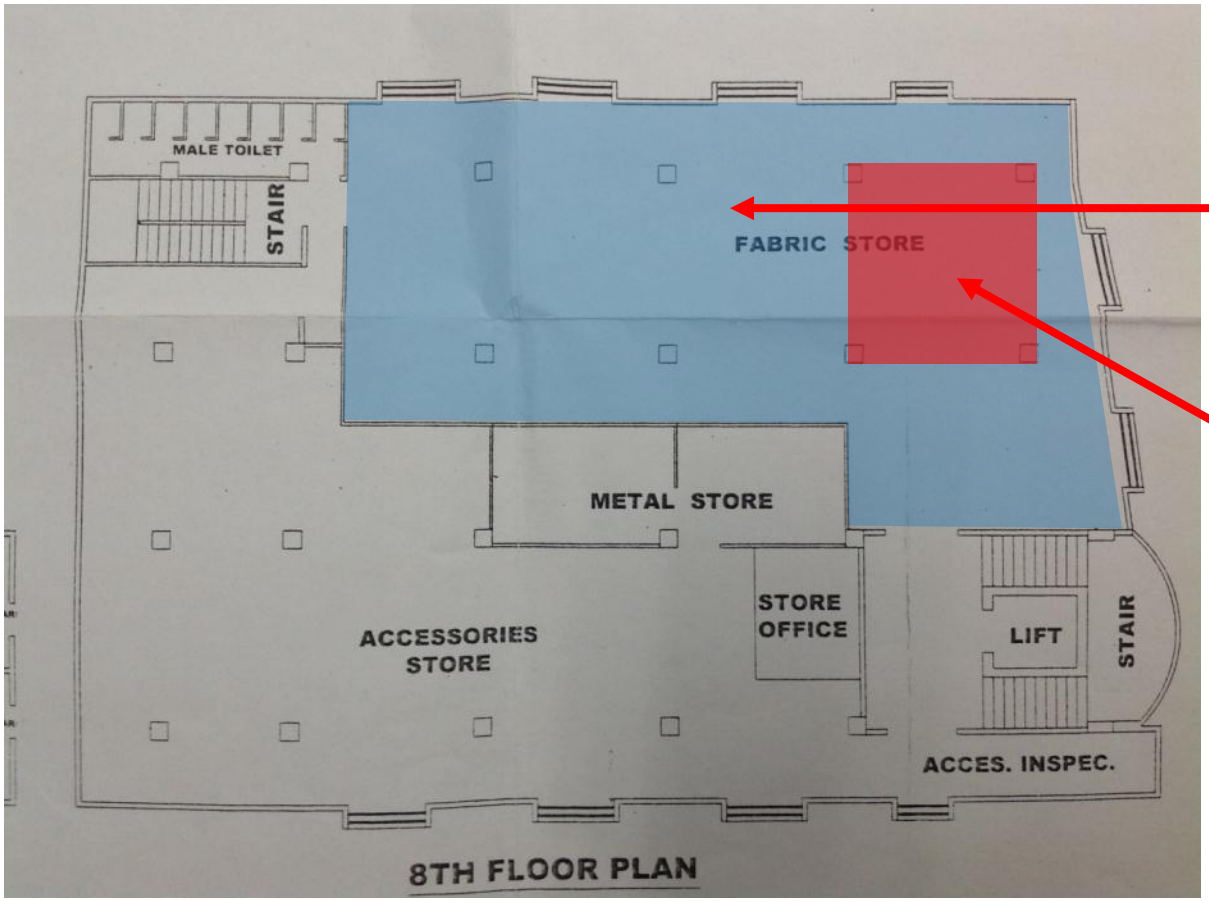
This Schedule develops a minimum level of information, Analysis and testing expected as part of a Detail Engineering Assessment.
The Building(s) have been visually assessed and it is deemed necessary that a detailed engineering assessment be carried out by a competent Engineering Team employed by the 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. T his 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
6	Check Column stresses and verify aggregate type in columns at basement and ground floor level	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	Check Column stresses and verify aggregate type in columns at basement and ground floor level	Detail Engineering Assessment to be completed	**6-weeks**
8	Check Column stresses and verify aggregate type in columns at basement and ground floor level	Continue to implement load plan	**6-months**
9	Heavy loading in fabric store on 8th floor has resulted in overloading of the slab and cracking to the soffit of the 7th floor	Reduce loading on 8th floor. Assuming 1.5m x 1.5m area limit height of rolls of fabric to 1.5m height . Ensure 1m clear pathway around 4 sides of every 1.5m x 1.5m pallet. Remove all loading in bay directly over crack.	**Immediate - Now**
10	Heavy loading in fabric store on 8th floor has resulted in overloading of the slab and cracking to the soffit of the 7th floor	Qualified Engineer to assess slab, confirming reinforcement diameter, condition and cover depth). Check for voids in slab under storage area using Non-Destructive Testing apparatus.	**6-weeks**
11	Heavy loading in fabric store on 8th floor has resulted in overloading of the slab and cracking to the soffit of the 7th floor	If voiding is not extensive in situ repair may be feasible with imposed loads on 8th floor limited to a quantified design capacity. If voiding is extensive slab will need to be propped and strengthening options developed.	**6-weeks**
12	Heavy loading in fabric store on 8th floor has resulted in overloading of the slab and cracking to the soffit of the 7th floor	Manage loads on 8th Floor. Do not exceed capacity of slab determined from above assessment (Priority 2).	**6-months**



Reduce height of stacked fabric rolls to a maximum height of 1.5m

Remove all items from the column bay directly over cracked area. No imposed load permitted until slab is assessed and repaired

Item 1 and Actions
Heavily loaded bonded warehouse

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Item No.	Observation	Recommended Action Plan	Recommended Timeline
13	Loading on roof slab (medical room, water tank and planter)	Remove water tank / storage room and planter Or Factory Engineer to review design, loads and slab/beam stresses in roof slab and provide evidence that roof slab has adequate capacity for loads.	**6-weeks**
14	Heavy loading on areas of a number of floors	Produce and actively manage a loading plan for all floor plates within the factory giving consideration to floor capacity and column capacity.	**6-months**
15	Stability system for building	Detail Engineering Assessment of Factory to be commenced and in particular Stability and foundation aspects to be investigated in detail, see attached Scope (Item 1)	**Immediate - Now**
16	Stability system for building	Detail Engineering Assessment to be completed	**6-weeks**

Item No.	Observation	Recommended Action Plan	Recommended Timeline
17	Discrepancies between drawings and as built structure over steps in slab edge (steps in façade at 2nd and ground not shown on drawings).	Survey and drawing work required under Detail Engineering Assessment (Item1)	**Immediate - Now**
18	Discrepancies between drawings and as built structure over steps in slab edge (steps in façade at 2nd and ground not shown on drawings).	Factory Engineer to review design of slab edge cantilevers taking in to account steps in rear facade. Update structural and permit drawings to reflect as built geometry.	**6-weeks**
19	Large deflections have occurred at slab edges. External brickwork is possibly now carrying vertical load for which it would not have been originally designed	Detail Engineering Assessment to look at deflections and Cantilevers	**Immediate - Now**
20	Large deflections have occurred at slab edges. External brickwork is possibly now carrying vertical load for which it would not have been originally designed	Factory Engineer to review design of slab edge cantilevers taking in to account large deflections at edge of slab. Engineer to determine if perimeter walls are now providing support to slab edge and if they are found to do so then the Engineer is to provide a clear statement on what constraints this places on any future alterations to the facades.	**6-weeks**