Russel Garments (Unit-2)

East Delpara, Kutubpur, Fatullah, Narayangonj.
(23.66505N, 90.47964E)

22 April 2014

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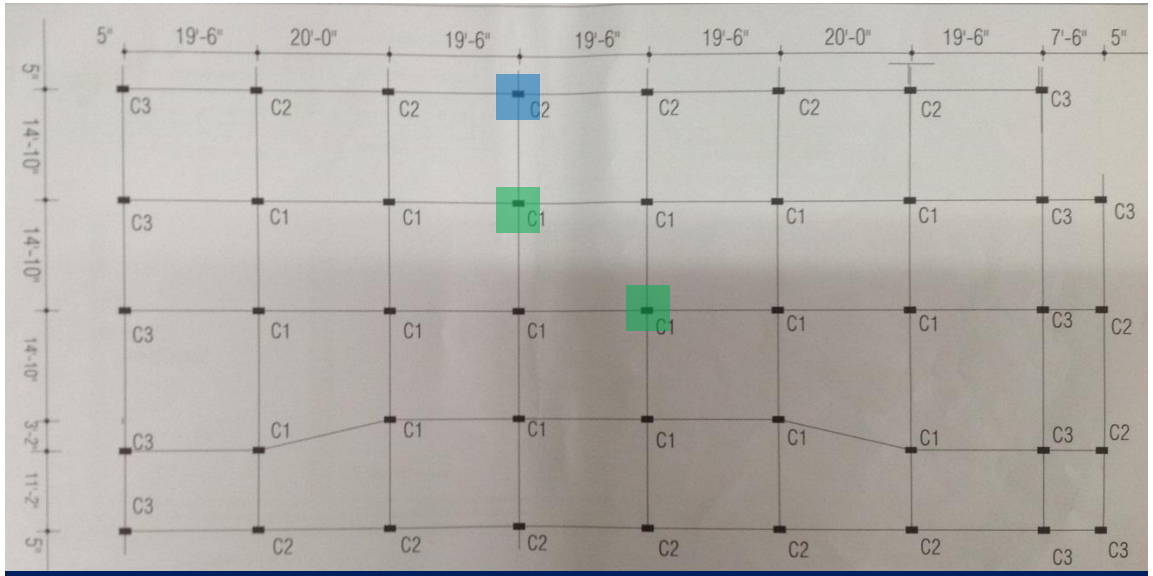
Observations

Column Stress Levels

Cursory calculations indicate that the working stress of the columns at Ground Floor level of the Main Factory Building are at a high level. Detailed Engineering Assessment required.



Column Layout Plan

Columns Tested - Arup

Columns Tested - Bureau Veritas

Tested Column - Arup

Tested Column - Bureau Veritas

N

No original Structural, Architectural or Permits Drawings were made available for review on the day of the survey. Similarly, no information was provided confirming when the building was built, although it is believed that construction may have commenced between 2003 and 2005. Russel Garments (Unit-2) first occupied the constructed site in 2010, comprising the existing 7- and 4-storey buildings, as well as the Godown Warehouse and the Generator Room. Brick aggregate was observed in the Ground Floor columns of the Main Factory Building, in accordance with the As-built Structural Drawings.

We note that, while the As-built Structural and Architectural Drawings are not dated, it appears as though these predate the survey by a matter of weeks – refer to Item 2.

Column strength

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Missing Original Documents and Inconsistencies in Drawings

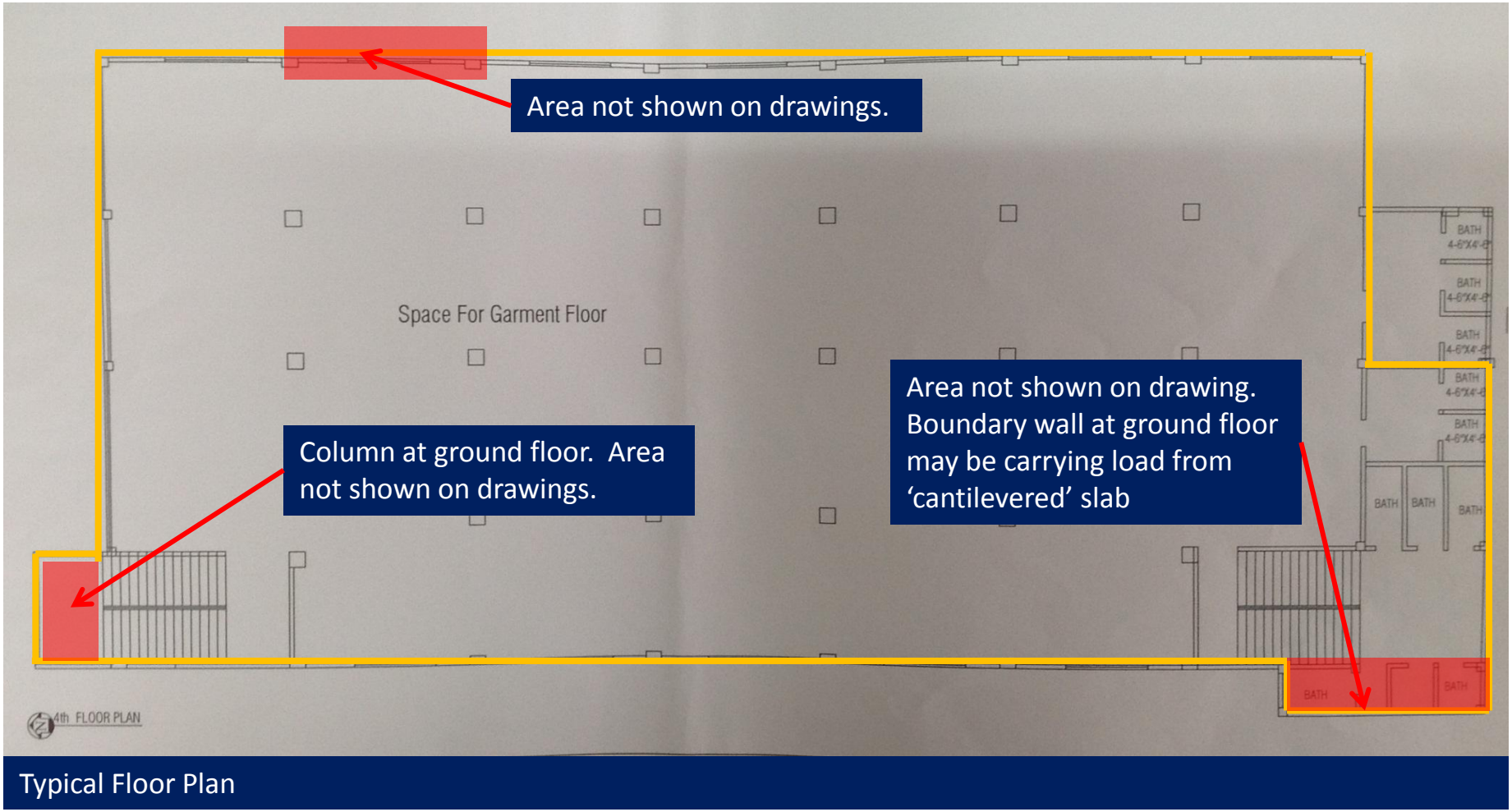
Important documentation was missing from the information presented on the day of the survey, including original Structural, Architectural and Permit Drawings for all structures, and a factory loading plan.

The following documents, only, were made available for review on the day of the survey:

- Incomplete as-built Structural and Architectural Drawings for the 7- and 4-storey buildings, by NEER Consultant. These drawings are undated, but it appears as though they were prepared in April 2014, as comments made in relation to the 7-storey building, as recorded in the structural inspection report prepared by Bureau Veritas (see below) have been included;
- A LGED-approved Permit Drawing, dated 2010;
- A Preliminary Structural Assessment Report of the 7-storey building by Bureau Veritas (BD) Private Ltd, dated April 14th 2014, prepared for C&A;
- A soil report by Alpha Soil and Foundation Engineers, dated April 2011, which relates to the planned construction of a 10-storey building to be built at the location of the existing 4-storey building and the Godown Warehouse.

Building Engineer to provide clarification.

Missing Documentation



Typical Floor Plan

N

Areas requiring clarification in relation to support structure

Observed Building Footprint

Drawing Inconsistencies

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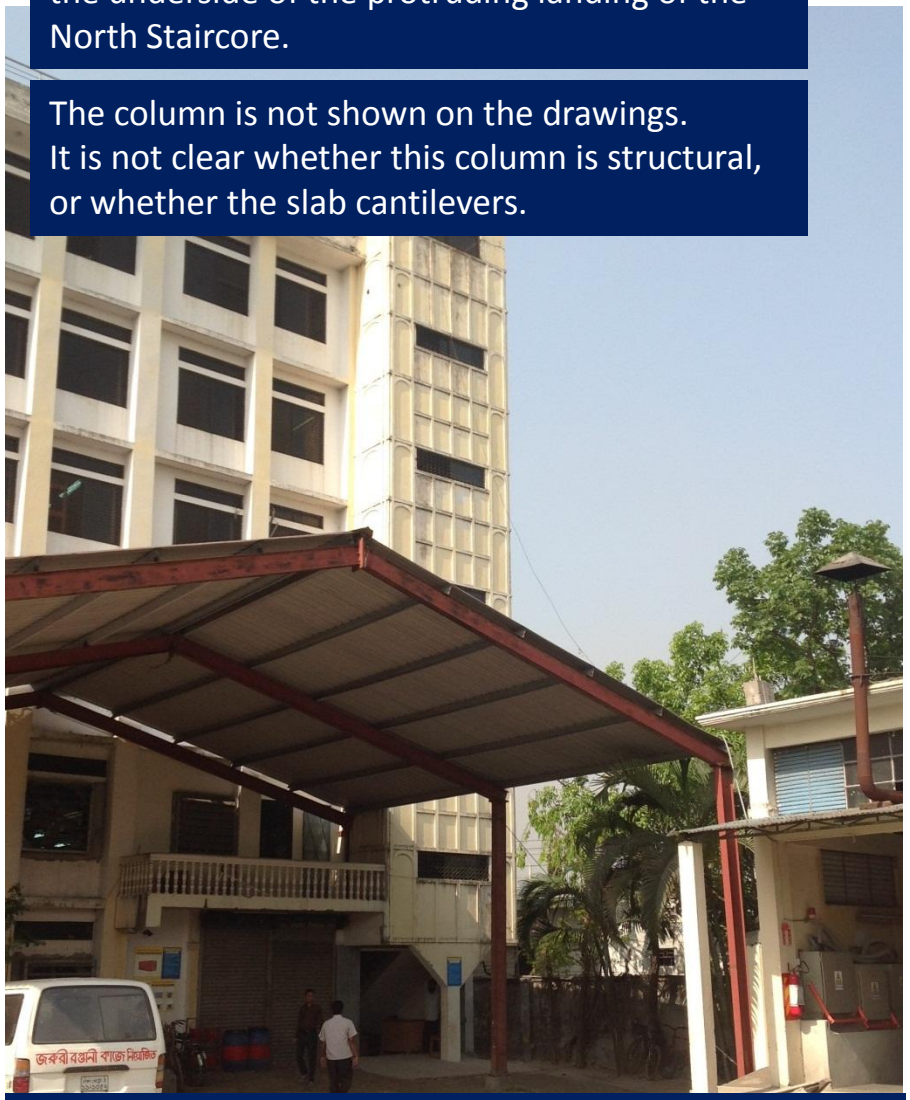
Single column observed at Ground Floor level to the underside of the protruding landing of the North Staircore.

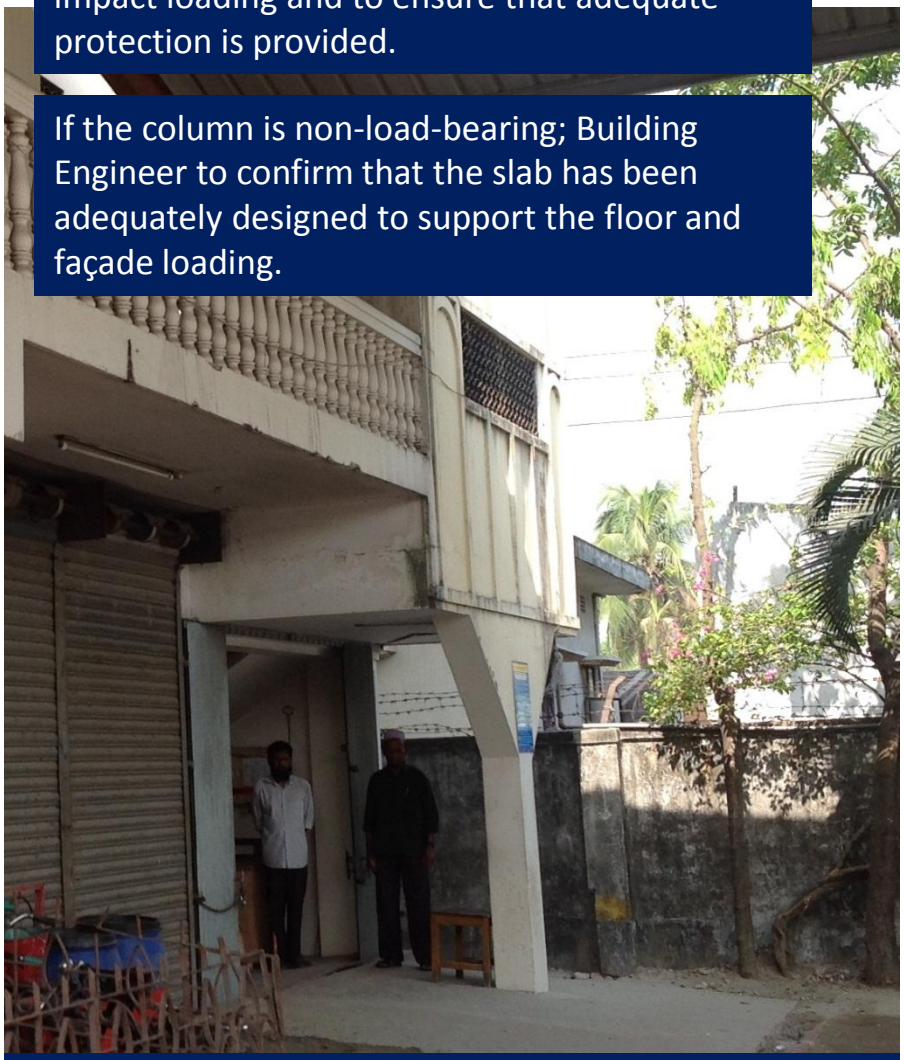
The column is not shown on the drawings.
It is not clear whether this column is structural, or whether the slab cantilevers.



Staircore to North Elevation

If column is structural ; Building Engineer to confirm if the column has been designed for impact loading and to ensure that adequate protection is provided.

If the column is non-load-bearing; Building Engineer to confirm that the slab has been adequately designed to support the floor and façade loading.



Column not shown on Structural Drawings

Drawing Inconsistencies

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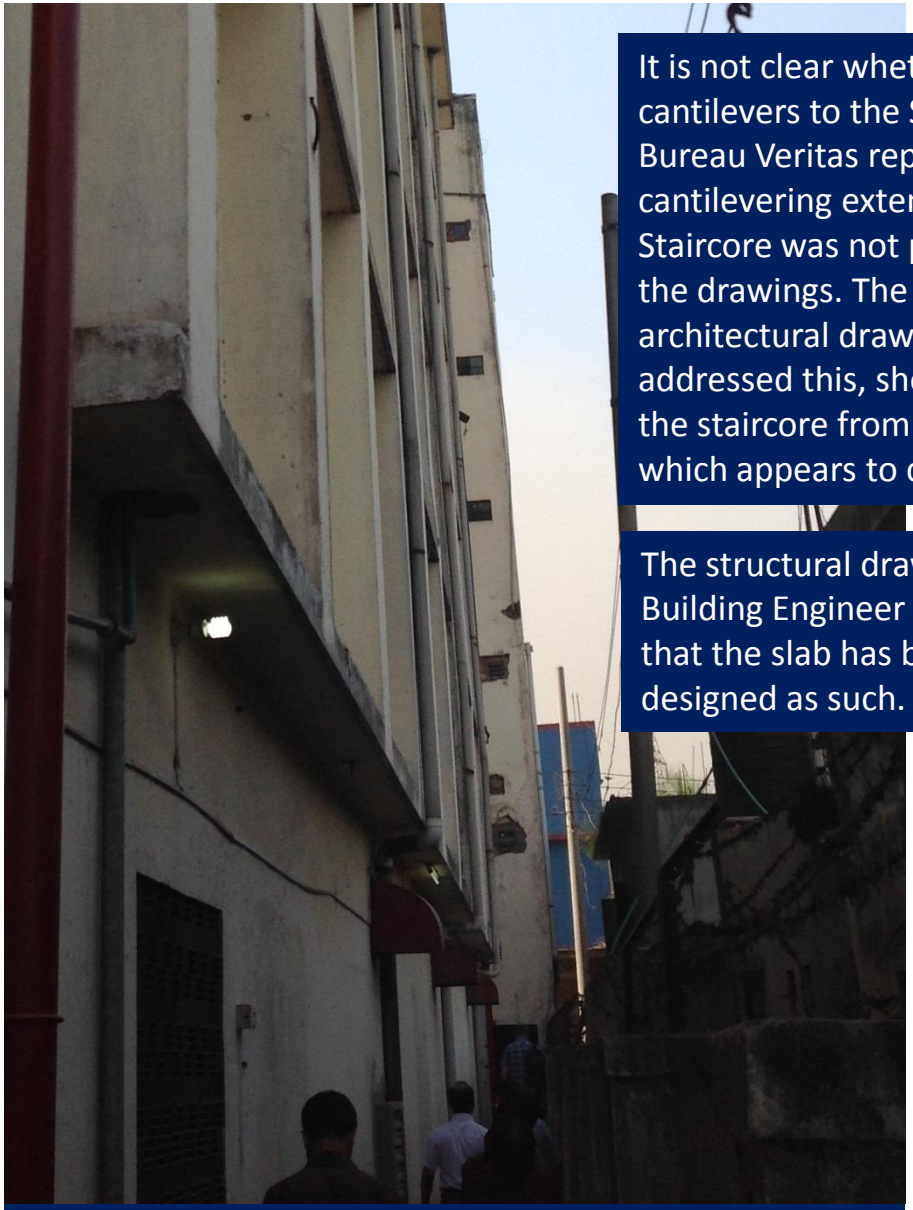
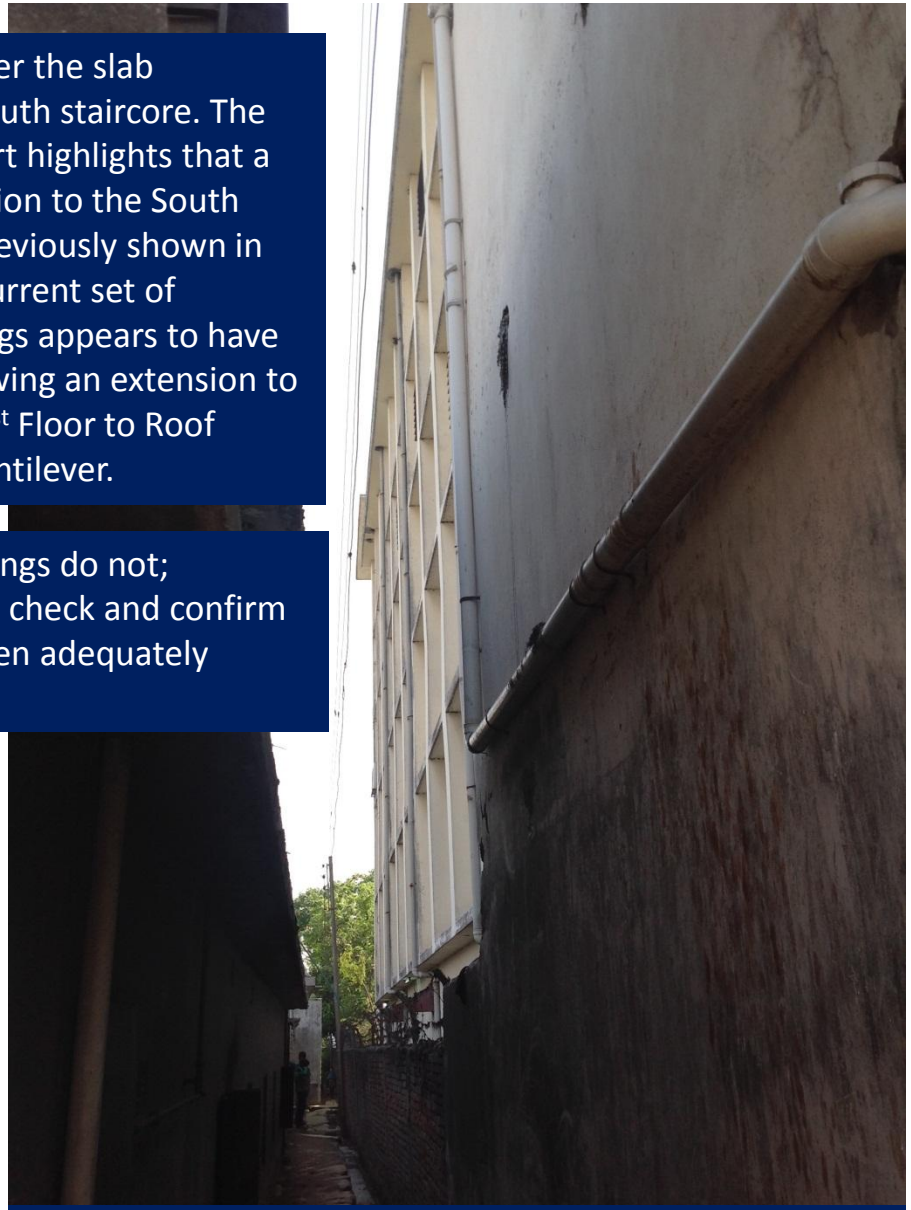


South Staircore to West Elevation

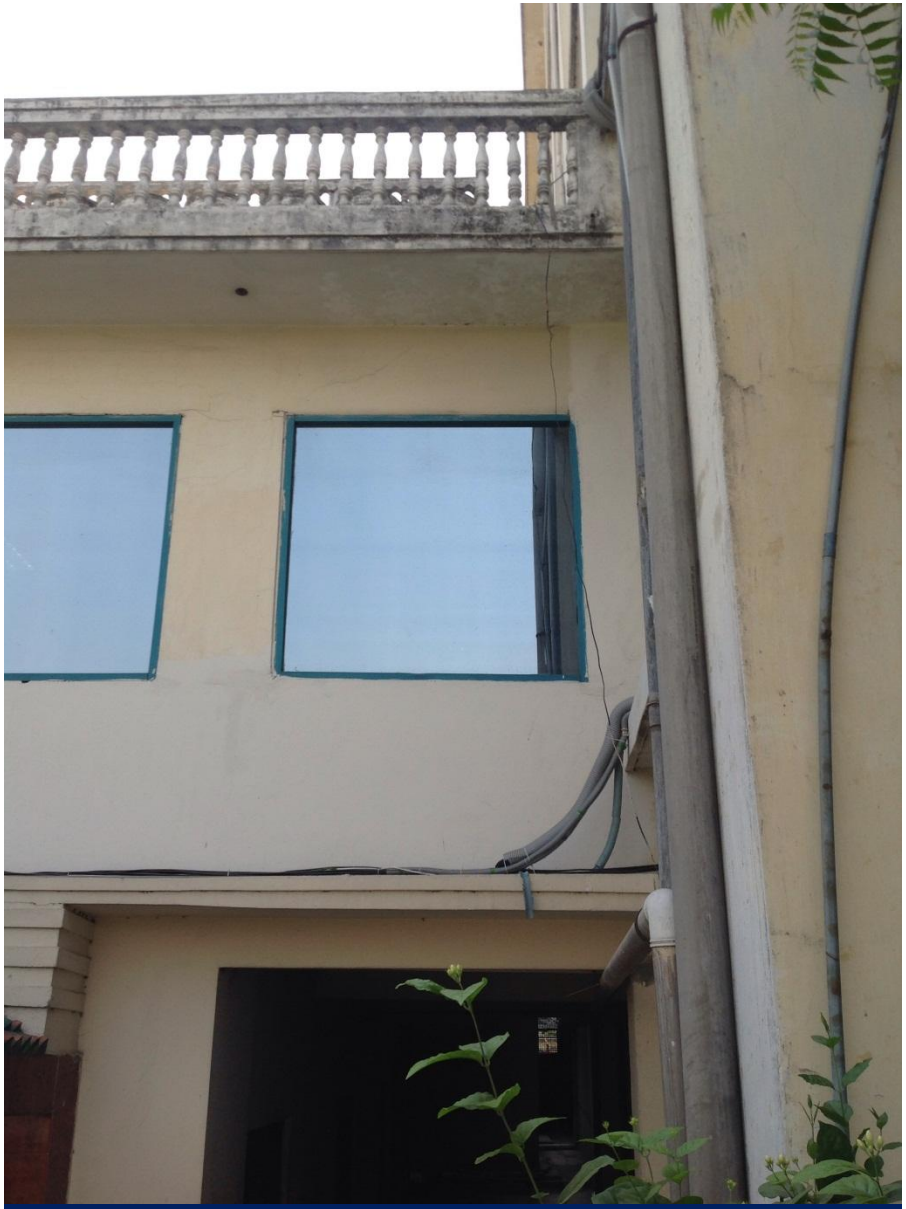
It is not clear whether the slab cantilevers to the South staircore. The Bureau Veritas report highlights that a cantilevering extension to the South Staircore was not previously shown in the drawings. The current set of architectural drawings appears to have addressed this, showing an extension to the staircore from 1st Floor to Roof which appears to cantilever.

The structural drawings do not; Building Engineer to check and confirm that the slab has been adequately designed as such.



Extension appears to be supported on perimeter wall

Drawing Inconsistencies



Junction between 4- and 7-Storey Buildings

Junction between 4- and 7-Storey Buildings

Drawing Inconsistencies

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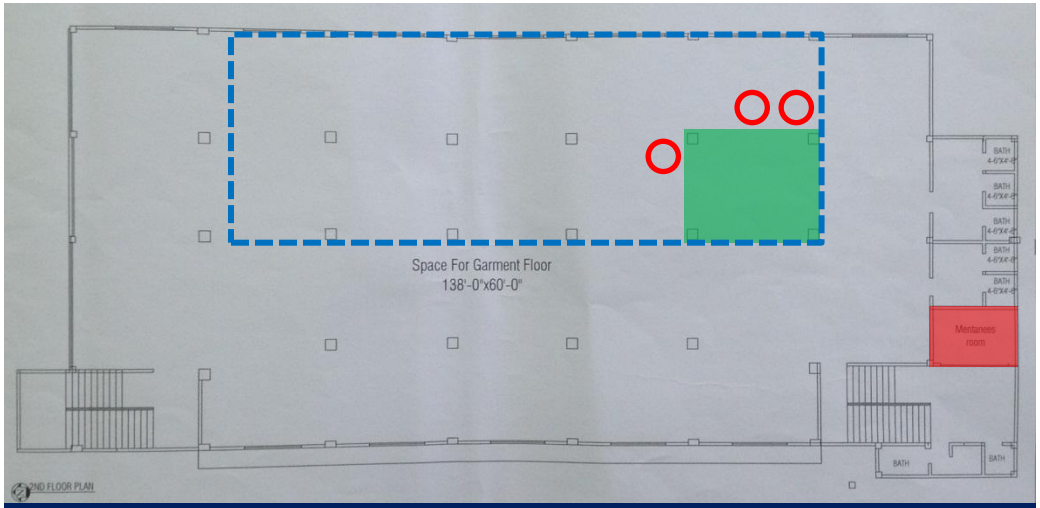
Heavy Loading

Areas of high loading were noted at the water tanks at Roof level, at the Finished Goods Storage area at 4th Floor level, and at the toilets at all floors, as well as at the 3rd Floor level storage area to the 4-storey building. Building Engineer to check that the different slab constructions have been adequately designed to accommodate this loading, and to develop a factory floor loading plan to include maximum floor loading capacities for each floor.



Typical Floor Plan of 7-storey Building

Water Tanks at Roof Levels

4th Floor Finished Goods Storage Area

- Concrete 50000L Water Tank at Roof Level
- Plastic Water Tanks (3 no.) at Roof Level
- Extent of Finished Goods Storage Area at 4th Floor level
- Possible 800mm Build-up (Average) in Toilets to all Floors

Heavy floor loading

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Possible 800mm Build-up (Average) in Toilet Area to South Staircore Half-Landing to all Floors

Heavy floor loading

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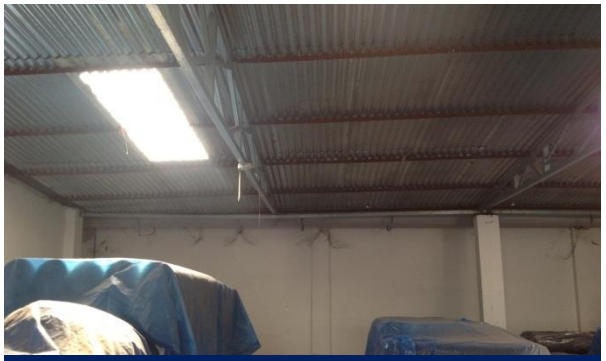
Lightweight Steel Structures;

Concern over deflections, lack of horizontal bracing and connections.

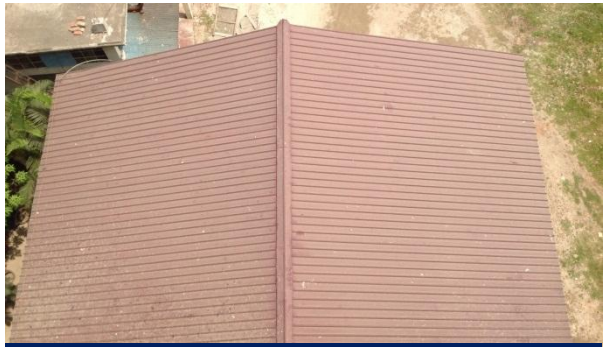
The Godown Warehouse, comprising a lightweight steel-trussed roof on RC columns, does not appear to be engineered. The cross beams are deflecting excessively, there is no horizontal bracing to the roof, and the connections do not appear adequate. Similarly, the Entrance Canopy to the Main Factory Building, a lightweight steel structure, lacks adequate bracing. Building Engineer to review the design of these lightweight structures for lateral and uplift loading, and to implement any upgrade works as required.

Godown Warehouse



Deflection of Cross-Beams

Truss to Column Connection Detail



View of Entrance Canopy from Main Factory Building Roof

Lack of Horizontal Bracing to Entrance Canopy Roof

Loose Vertical Bracing to Entrance Canopy Frame

Lightweight Steel Structures

Cracking

Cracking was observed to the soffit of a number of beams and slabs at 3rd, 4th, 5th and 6th Floor levels of the 7-storey Building. Cracking of the walls was also observed. Building Engineer to investigate cracking and carry out remedial works to the structure as required.

Hairline Cracking to Soffit of 6th Floor Slab

Filled Crack to 5th Floor Beam

Hairline crack to 5th Floor Slab

Hairline Crack to 3rd Floor Slab

Filled Crack to 6th Floor Wall

Cracking

Priority Actions

Problems Observed

ITEM 1: High Column Stresses in main factory buildings

ITEM 2: Missing Original Documents and Inconsistencies in Drawings

ITEM 3: Cantilevered areas but with ground floor column or boundary wall appearing to carry load; vertical loadpath needs clarification

ITEM 4: Lightweight Steel Structures; The cross beams are deflecting excessively, there is no horizontal bracing to the roof, and the connections do not appear adequate.

Item 1 and actions

High Column Stresses in main factory buildings

Priority 1 (Immediate - Now)	• Building Engineer to review design, loads and column stresses in structure. • A **Detailed Engineering Assessment** of Factory is to be commenced – see attached scope. • Verify insitu concrete stresses by taking 100mm diameter cores from 4 (central) columns at ground floor level.
Priority 2 (within 6-weeks)	• Produce and actively manage a loading plan for all floor plates within the factory giving consideration to floor capacity and column capacity. • Detailed Engineering Assessment to be completed.
Priority 3 (within 6-months)	• Continue to implement loading plan.

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 Elevation 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

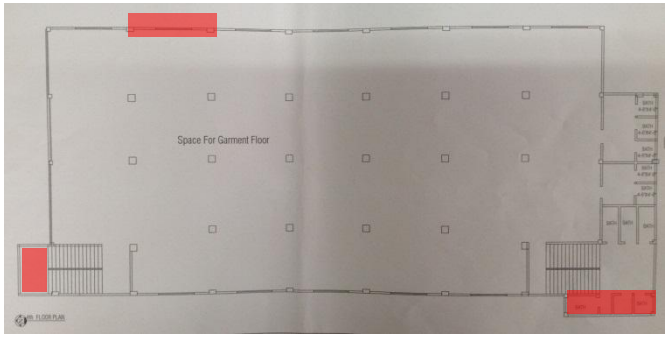
Item 2 and actions

Missing Original Documents and Inconsistencies in Drawings

Priority 1 (Immediate - Now)	• None required.
Priority 2 (within 6-weeks)	• As part of the Detailed Engineering Assessment, the Building Engineer should check the design of the areas of the buildings where there are inconsistencies between the Permit drawings, the as-built drawings and as-observed structural arrangement and produce accurate record documentation.
Priority 3 (within 6-months)	• None required.

Item 3 and actions

Cantilevered areas but with ground floor column or boundary wall appearing to carry load; vertical loadpath needs clarification



Priority 1

(Immediate - Now)

- None required.

Priority 2

(within 6-weeks)

- As part of the Detail Engineering Assessment. The Building Engineer is to review the projecting areas of slabs to check if the slabs are cantilevered or there is an adequate vertical load path.

Priority 3

(within 6-months)

- None required.

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Item 4 and actions

Lightweight Steel Structures; The cross beams are deflecting excessively, there is no horizontal bracing to the roof, and the connections do not appear adequate.

Priority 1 (Immediate - Now)	• None required.
Priority 2 (within 6-weeks)	• Building Engineer to check the design and capacity of the lightweight steel structures/connection details as part of the Detailed Engineering Assessment and make any necessary alterations.
Priority 3 (within 6-months)	• None required.