

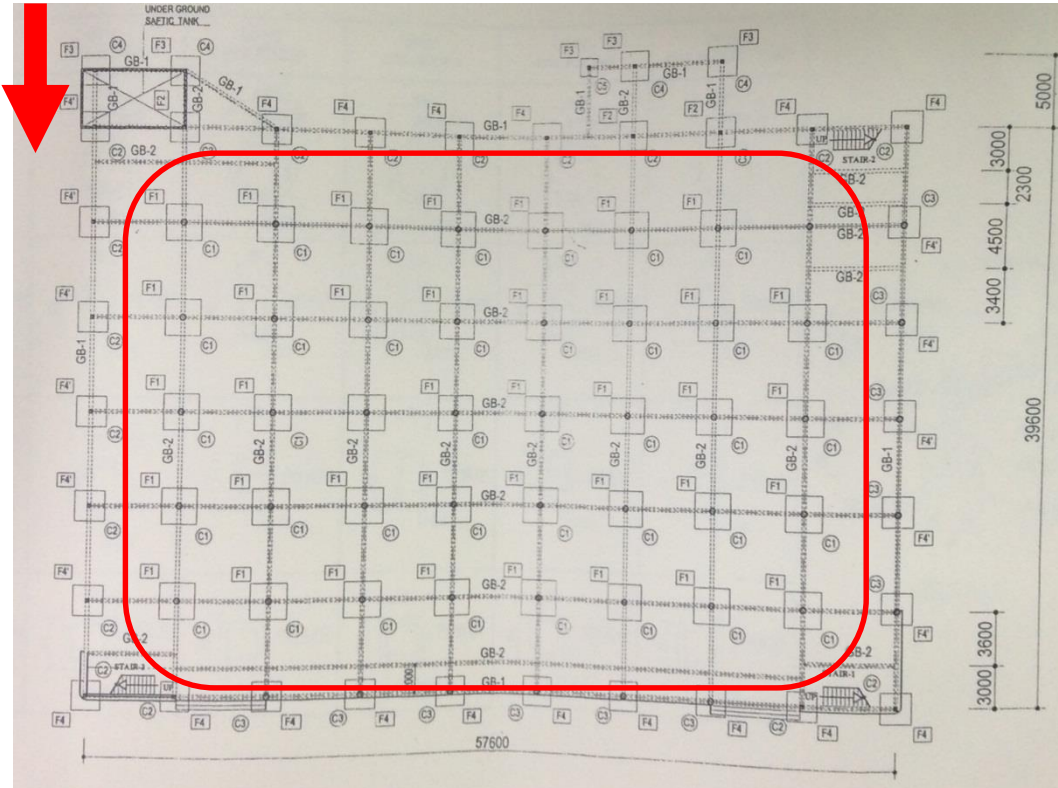
Haesong Korea Ltd.

Han Complex, Bara Rangamatia, Zirabo, Savar, Dhaka, Bangladesh
(23.909859, 90.303641)
10th June, 2014



Observations

N



Ground Floor Column Layout

- cursory calculations indicate that column size appears to be smaller than required by code for the applied dead and live load, assuming typical concrete strength
- In the absence of testing certificates, concrete strengths are assumed based on historical BUET data.
- As built concrete strength and as built reinforcement to be surveyed and used to verify the column capacities

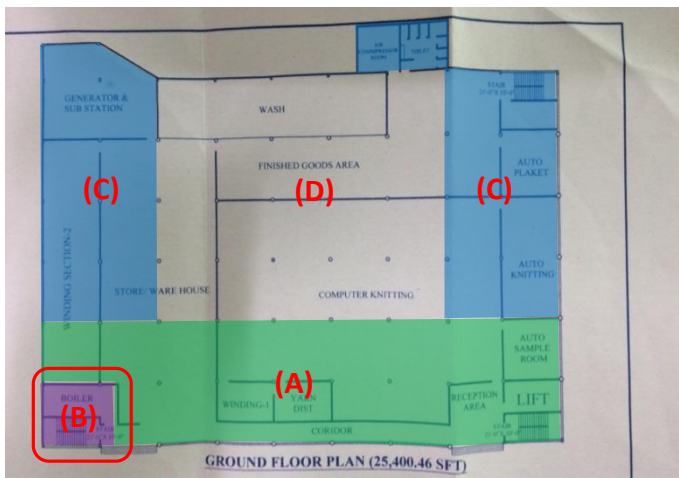
High concrete stress in columns



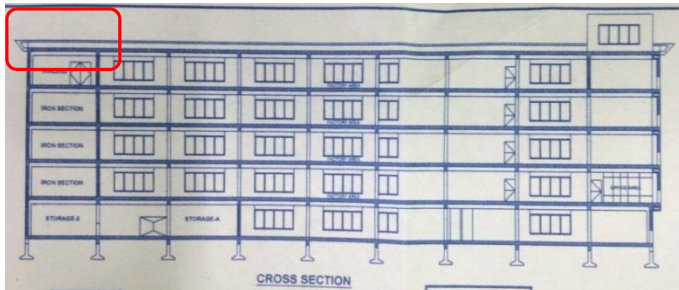
RC Tank over North East Stair Core

- Cursory calculations indicate that weight of roof-top concrete tank and its contents contribute significantly to the potential overloading of supporting columns, assuming typical concrete strength

Weight of Tank over North-East Stair Core



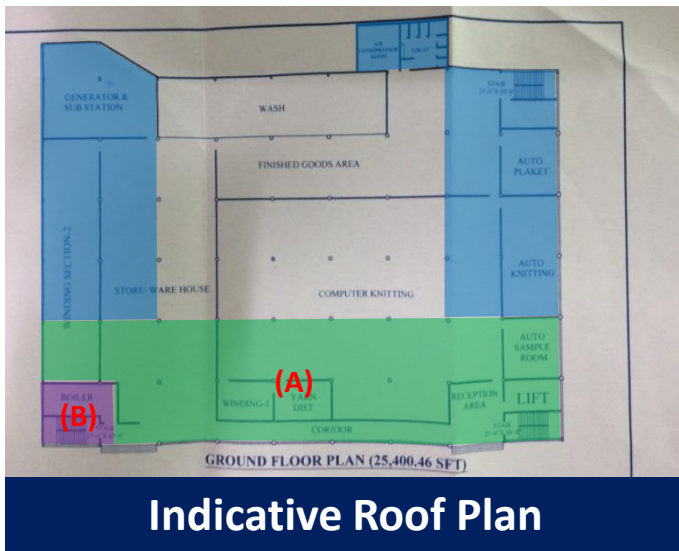
Indicative Roof Plan



Permit Drawing Cross Section

- Permit drawings show a 5 storey building and Slab & Beam construction to Roof Slab, similar to typical floor slabs, and no water tank.
- As constructed:
 - Roof slab (A) has not yet been constructed over full building footprint
 - Flat Slab has been used in lieu of Slab & Beam construction to roof slab (A)
 - North-east stair core lid (B) is higher than roof slab (A)
 - Steel roof frames have been installed to dining and prayer rooms (C)
 - Area of the Fourth Floor Slab is acting as a roof to the Third Floor (D)
 - Two additional columns constructed at 4th Floor to support Flat Slab roof edges near raised stair core lid. These columns bear on 4th Floor beams.

Building permit drawings do not match as-built building details



Indicative Roof Plan



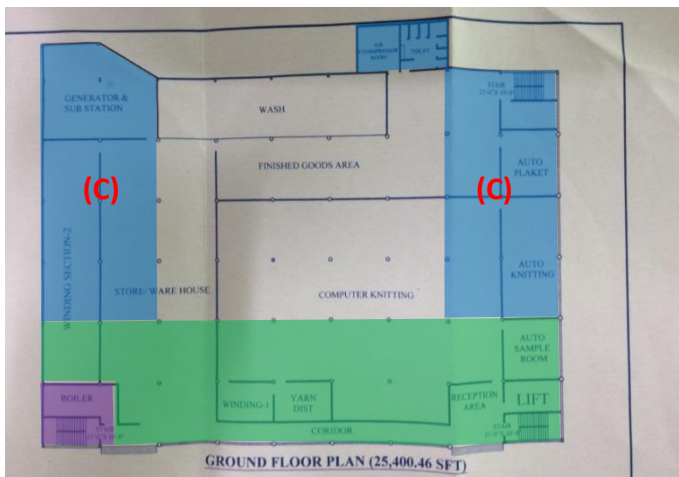
Raised stair lid and tank over to North-east stair core

- Minor differential movement observed to short infill walls between main roof slab (A) and stair core lid (B)
- No moment continuity exists between the two roof surfaces
- Two columns constructed to support main roof slab bear on Fourth Floor beams
- Minor flexural cracking observed to main roof slab (A) approximately between additional columns



Additional columns to main roof slab (A) near stair core (B)

Building permit drawings do not match as-built building details



Indicative Roof Plan



Small Prayer Room



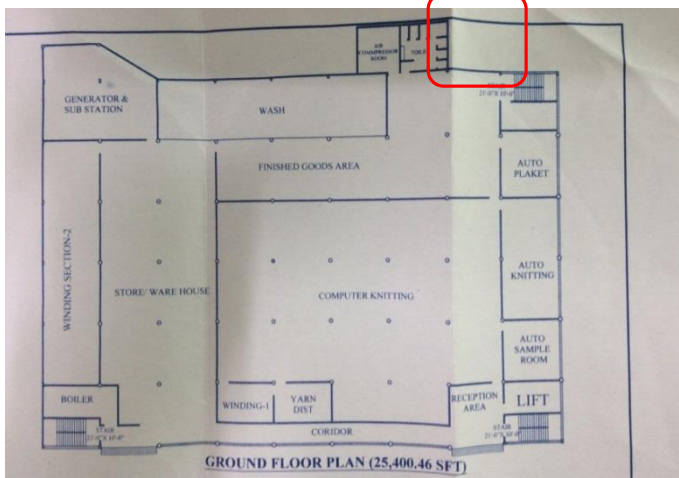
Dining Area

- Light metal roof frames have been installed over columns and walls to prayer and dining areas
- Lateral stability and tie down details do not appear to be engineer-designed



Large Prayer Room

Building permit drawings do not match as-built building details



Permit Drawing Floor Plan



Two storey Residence and Child Care addition

- A two storey extension has been constructed, beyond what is shown on the Building Permit Drawings
- The extension appears to be structurally independent of the main factory building



Residence Interior (1st Floor)

Building permit drawings do not match as-built building details



Stairs to Main Roof Slab



Stair to Residence

Structural integrity of light steel roof access stairs

- Two sets of stairs have been constructed to allow access from Fourth Floor to Roof
- A similar stair has been constructed to access the Residence over the Child Care room
- All stairs appear non-engineered and are constructed from welded light-gauge steel Equal Angle elements
- Element sizes, balustrade details and connection details appear non-engineered and potentially unsafe

Problems Observed

Item 1: High concrete stress in some columns

Item 2: Building permit drawings do not match as-built building details:

- North-East Stair Core Lid and Concrete Roof
- Metal roof frames to Dining and Prayer Rooms
- Childcare and Residence Building

Item 3: Structural integrity of light steel stairs

Item No.	Observation	Recommended Action Plan	Recommended Timeline
1	High concrete stress in some columns	Empty roof level water tank	Immediate - Now
2	High concrete stress in some columns	The imposed load in all areas on all levels must not exceed 1.5 kN/m ²	Immediate - Now
3	High concrete stress in some columns	Qualified Structural Engineer to review design, loads and stresses in all columns as part of a Detailed Engineering Assessment (DEA) (see scope below).	Immediate - Now
4	High concrete stress in some columns	Verify in-situ concrete strength by testing 100mm diameter cores taken from 4 no. columns (minimum). Qualified Structural Engineer to determine safe locations for coring. Prior to coring, the floor beams supported by the column should be propped through all levels to ground floor. The column reinforcement should be exposed to ensure that it will not be damaged during coring. Following coring, the column should be repaired using suitable repair mortar before de-propping the floor beams.	Immediate - Now

Item No.	Observation	Recommended Action Plan	Recommended Timeline
5	High concrete stress in some columns	Detailed Engineering Assessment to be completed.	6-weeks
6	High concrete stress in some columns	Provide calculations showing the structural adequacy of all columns. Provide results of concrete strength tests.	6-weeks
7	High concrete stress in some columns	Develop remediation measures as required by findings of DEA.	6-weeks
8	High concrete stress in some columns	Produce and actively manage a loading plan for all floor plates within the factory giving consideration to floor capacity and column capacity.	6-weeks
9	High concrete stress in some columns	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
10	Building permit drawings do not match as-built building details: * North-East Stair Core Lid and Concrete Roof * Metal roof frames to Dining and Prayer Rooms * Childcare and Residence Building	Building engineer to check, collect information and produce accurate and complete as-built documentation as part of the Detailed engineering Assessment (refer to item 1 above).	6-weeks
11	Building permit drawings do not match as-built building details: * North-East Stair Core Lid and Concrete Roof * Metal roof frames to Dining and Prayer Rooms * Childcare and Residence Building	Building Engineer to review as-built structure and if required, prescribe relevant structural improvements to ensure these meets BNBC requirements for stability, strength and serviceability under all gravity and lateral loads	6-weeks
12	Building permit drawings do not match as-built building details: * North-East Stair Core Lid and Concrete Roof * Metal roof frames to Dining and Prayer Rooms * Childcare and Residence Building	Building Engineer to develop accurate and complete as-built structural drawings	6-months
13	Structural integrity of light steel stairs	Building Engineer to review as-built light steel stairs structure and if required, prescribe relevant structural improvements to ensure these meets BNBC requirements for stability, strength and serviceability	6-months