

Taqwa Fabrics Ltd. Libas Knitwear

Bohera chala, Gilabereed, Kewa, Shreepur
(24.195779, 90.407035)

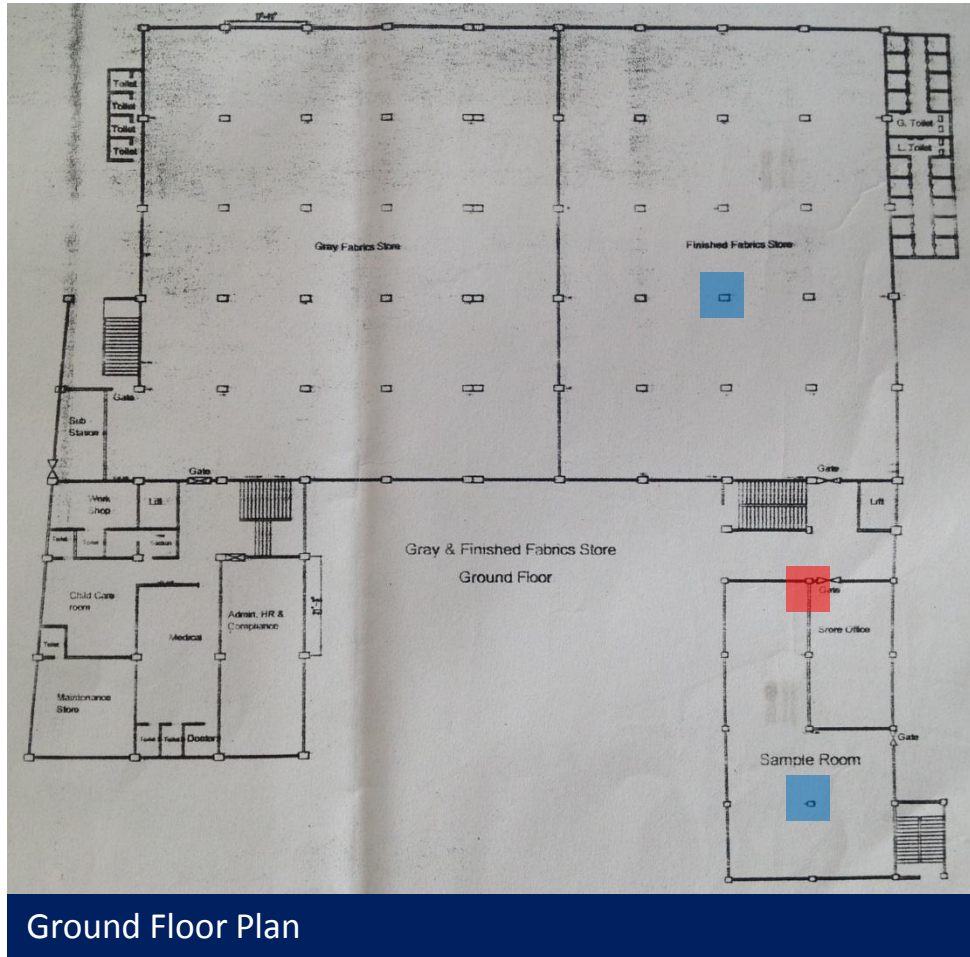
16th April 2014



Observations

Stress levels in columns, with particular reference to internal column beneath 3-storey vertical extension to Packing Section of Main Building

Cursory calculations indicate that the working stress of the columns at Ground Floor levels of the Main Building are at a high level, particularly at the internal column beneath the 3-storey extension to the Packing Section. Detail Engineering Assessment required.



- Construction of the Main Building began in 2007, with the first two storeys completed in 2009.
- Construction of the 3rd to 5th storeys commenced in 2010 and was completed in 2012.
- Construction of the 6th storey currently ongoing.
- Limited information on the structural drawings, and drawings for the central section of the building only were provided for review.
- Brick aggregate observed in Ground Floor columns and at Roof level.
- Mild steel reinforcement called up on drawings, but high yield steel bars observed at Roof level.



Tested Columns

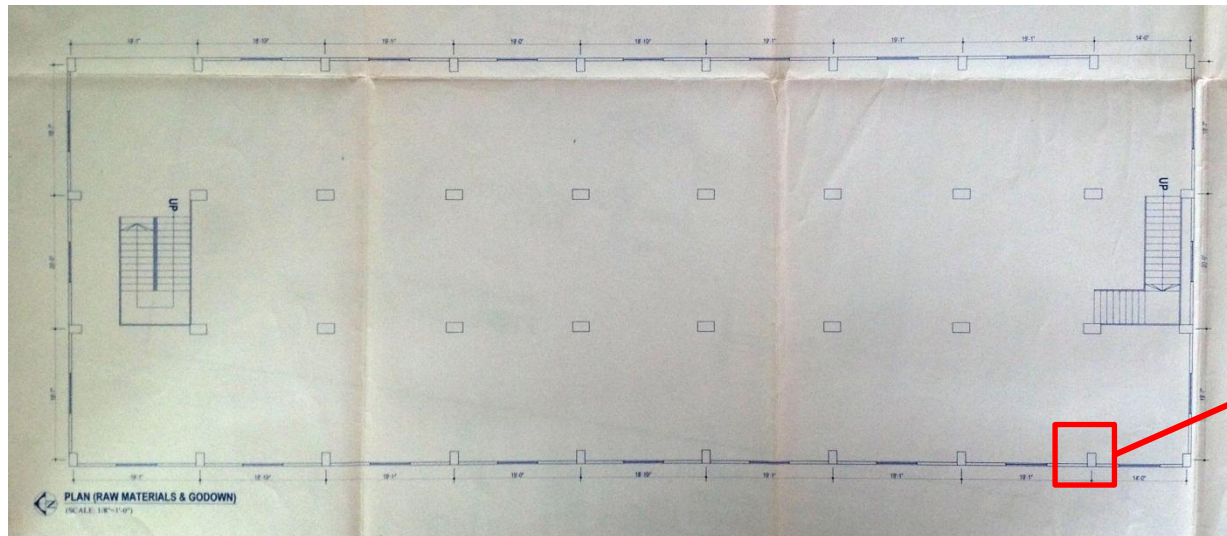
Critical Column



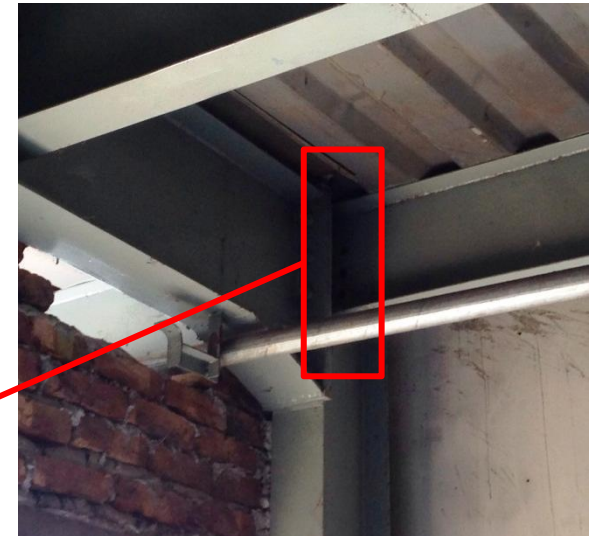
Column strength

Missing bolts to primary structural steelwork in Knitting & Raw Materials Godown Building

A number of bolts were observed to be missing at connections to the primary steelwork in the two-storey Raw Materials Godown Building. Special emphasis is drawn to the steel edge beam supporting the first floor, as identified below, where **all** bolts are missing at the column connection. It is not clear how the beam is adequately supported. Building Engineer to review all connections as a matter of urgency, and to carry out remedial works to the structure as required.



Floor Plan of Raw Materials Godown Building (Extract from Sreepur-Municipality-approved Permit Drawing)



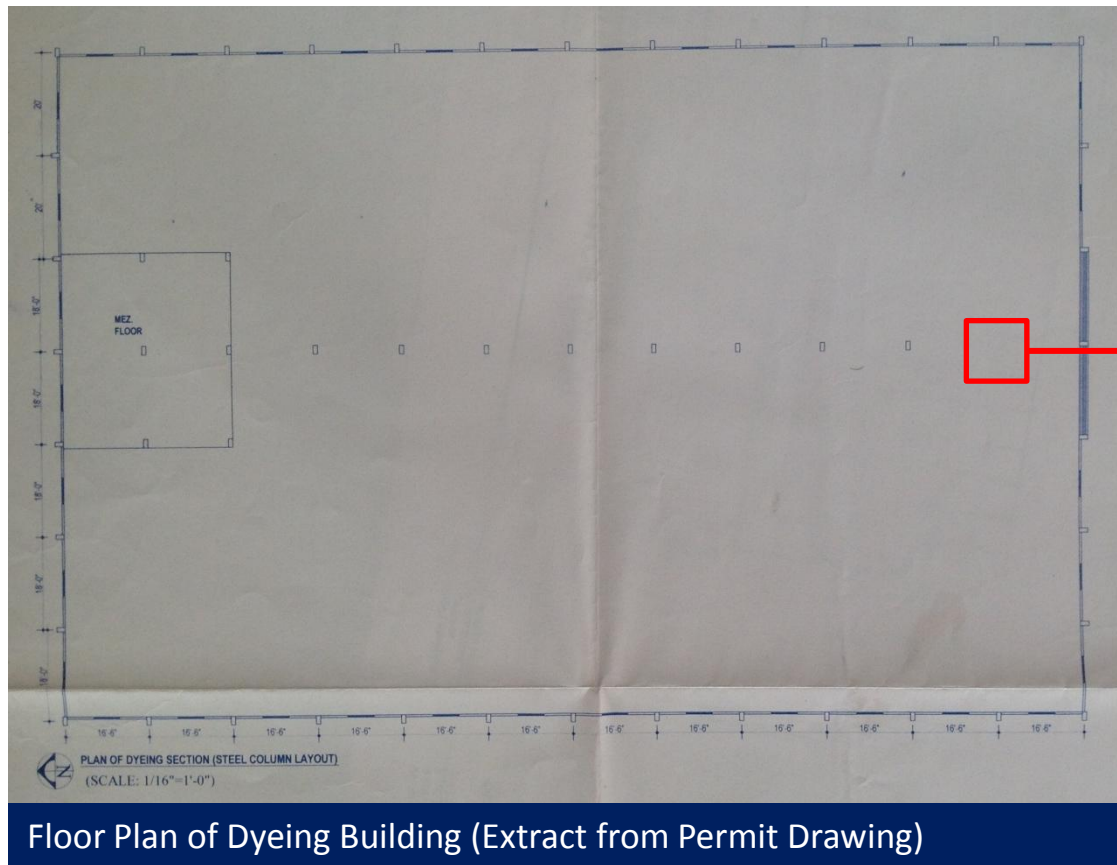
All bolts are missing at Edge Beam-to-Column Connection

 Location of Connection Detail where all bolts are missing



Slender column to Dyeing Building

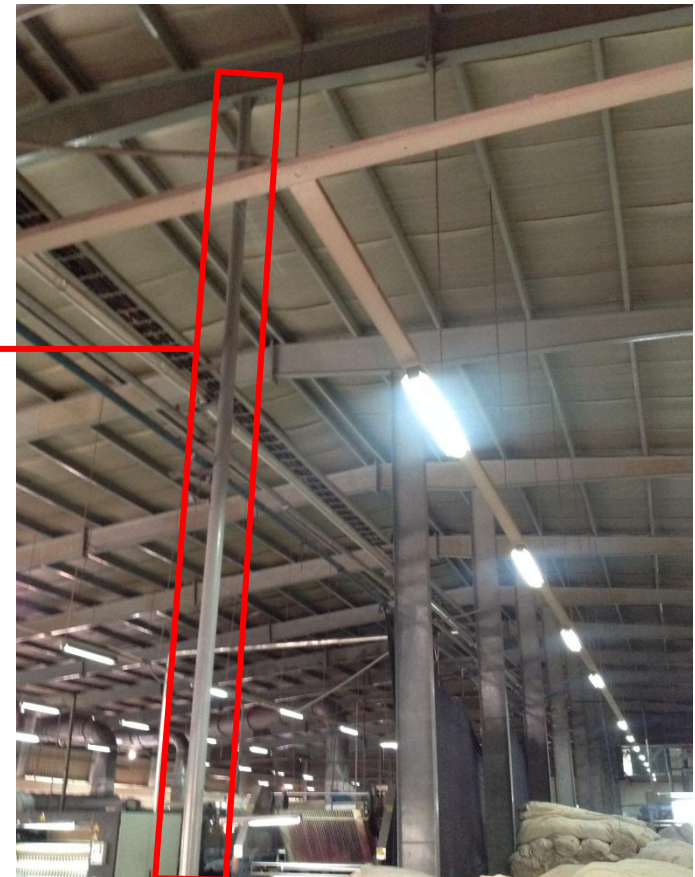
A slender circular hollow section was observed in the Dyeing Building, providing support to the rafter. This is not in accordance with the structural drawings, where a 450x150 I-section is typically shown. It does appear as if the column section is missing from the Sreepur Municipality-approved permit drawing (see below). Building Engineer to review design as a matter of urgency, and to carry out remedial works to the structure as required.



Floor Plan of Dyeing Building (Extract from Permit Drawing)



Location of Slender Column



Slender Column



Lack of edge protection at Roof Level of Main Building (5th and 6th Floor levels)

Ground Floor

Gray & Finished Fabrics Store

Gray Fabrics Store

Finished Fabrics Store

Sub Station

Work Shop

Child Care room

Maintenance Store

Medical

Admin. HR & Compliance

Dietary

Lift

Sample Room

Gates

Toilets

6-Storey Roof

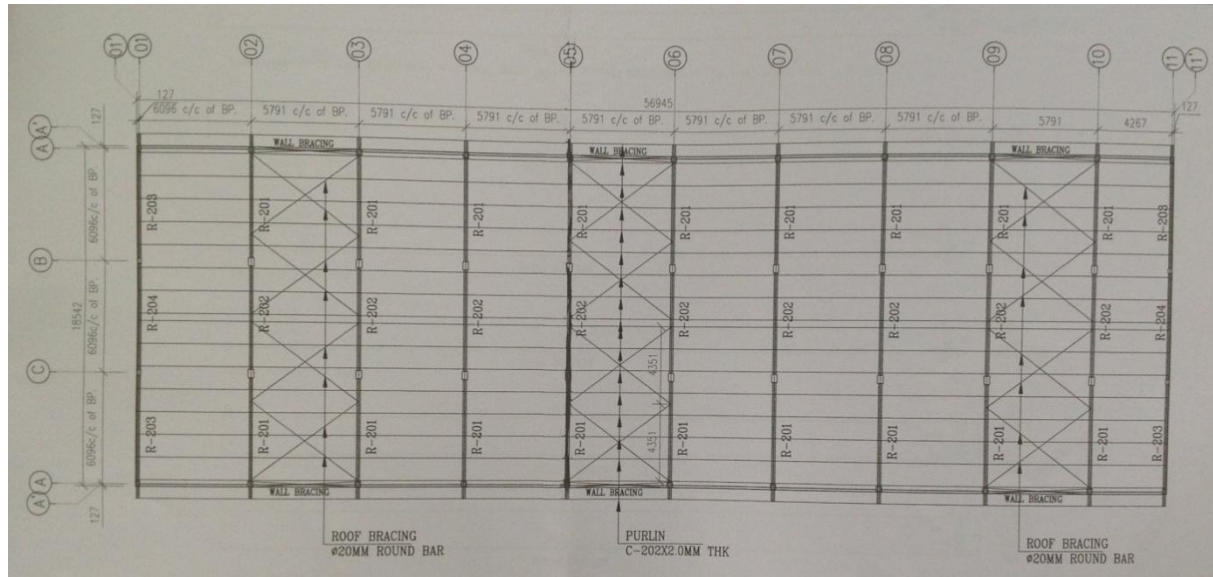
5-Storey Roof

Perimeter With Edge Protection

Edge Protection Missing

Missing bracing systems to Raw Materials Godown Building and Dyeing Building

Question stability system to the prefabricated structural steel sheds. Horizontal and vertical bracing has not been provided to the Raw Materials Godown Building and the Dyeing Building. Building engineer to carry out a stability analysis and provide stability system as required.



Horizontal bracing system to Raw Materials Godown Building Roof as shown on extract from Structural Drawings - missing on site.



Bracing system missing from Raw Materials Godown Building



Bracing system missing from Dyeing Building

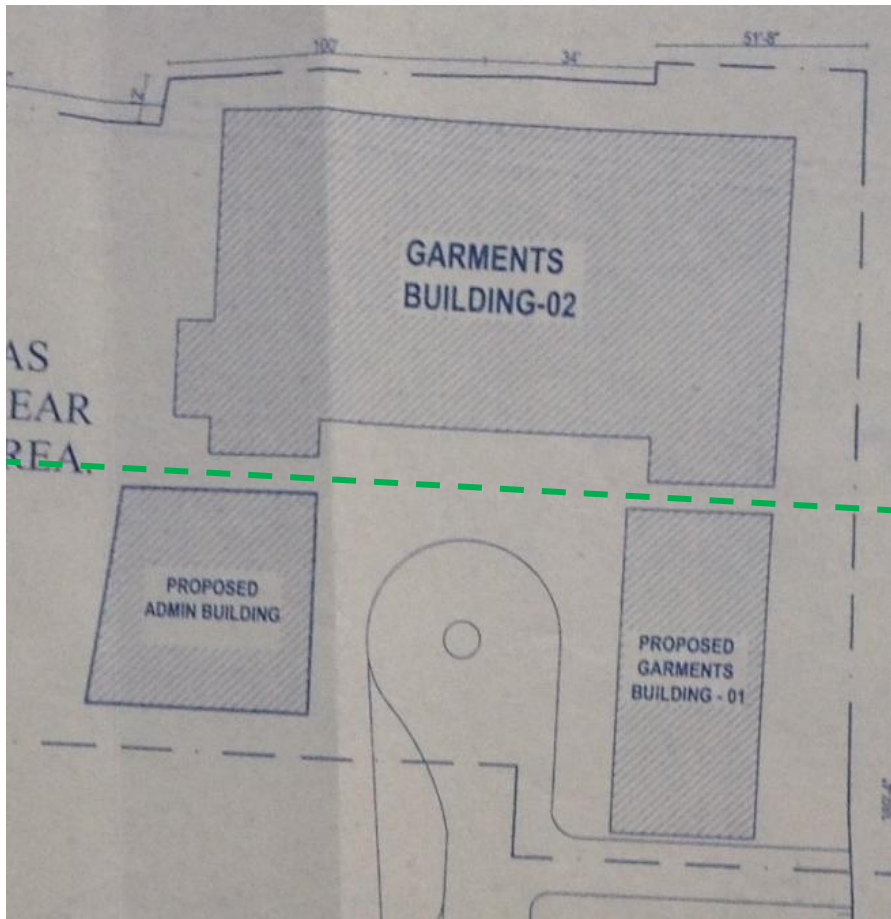


Inconsistencies between Permit / Structural Drawings and Constructed buildings

A set of Structural Drawing for the Main building, as well as for the Dyeing Building and the Raw Materials Godown Building, were made available for review on the day of the survey. A Sreepur-approved Building Permit Drawing was also made available for review. The main differences between the drawings and the constructed building include, but are not limited to:

- The permit drawing and structural drawings show the Main Factory Building as three separate units, comprising the Packing Section, the Administration Section and the Central Factory Section. They are actually built as a single unit with a movement joint running through the Central Factory Section.
- A 3 storey extension has been added above the Packing Section of the Main Factory Building. This has not been approved, and the column beneath this extension is proving critical (refer to Item 1).
- The longitudinal bracing for the Raw Materials Godown Building is referenced in the drawings, but is missing on site.
- Inconsistencies in rebar quantities for the Main Building.

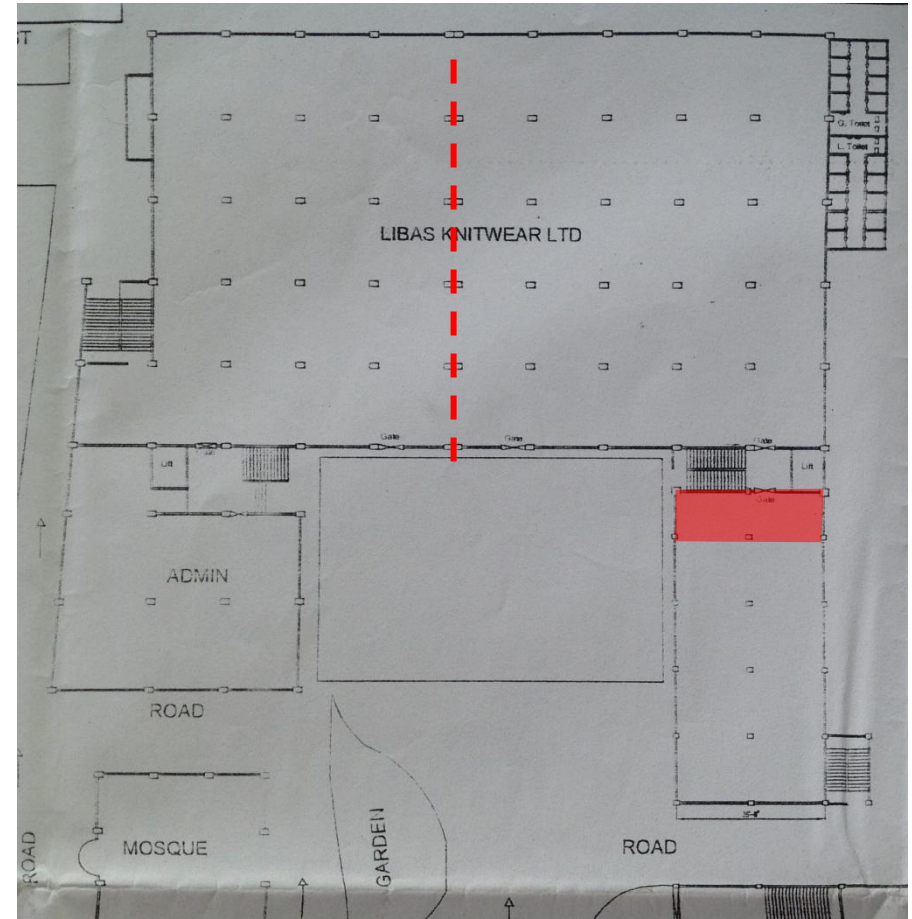
Building Engineer to review and provide clarification.



Main Building Layout – Original Permit Drawing



Original Location of Movement Joint



Main Building Layout – Permit for New Construction



Extent of 3-storey vertical extension



Actual Location of Movement Joint

Heavy loading

Areas of high loading were noted at the water tanks at roof level, the 1st Floor Finished Goods Storage area, and the toilets plinths and suspended ceiling slabs at all floors of the Main Building, and at the yarn storage area in the Knitting & Raw Materials Godown Building at 1st Floor level. Building Engineer to check that the different slab constructions have been adequately designed to accommodate this loading, particularly the 1st floor cantilever.



Typical Site Layout

- Water Tanks at Roof Level
- 1st Floor Finished Goods Storage Area
- Extent of Toilet Plinths & Slabs to all Floors
- Yarn Storage at 1st Floor of RMG Building



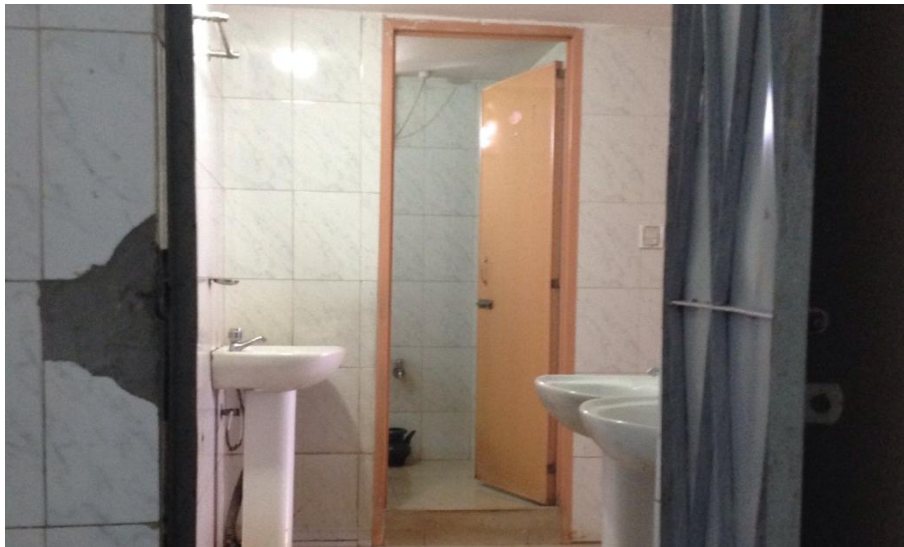
Water Tanks to Roof



1st Floor Finished Goods Storage at Cantilever Location



1st Floor Finished Goods Storage Area



Plinths & Suspended Ceiling Slabs to Toilets (All Floors)



Yarn Storage to Raw Materials Godown Building

Check required for adequacy of existing splice and haunch connections in Raw Materials Godown Building

There appears to be inadequate bearing of the endplates (gaps evident) in a number of splice and column-to-haunch connections in the Knitting & Raw Materials Godown Building. Building Engineer to review connections, and to carry out remedial works to the structure as required.



Column-to-Haunch Connection Detail



Splice Detail

Lightweight structures to Ancillary Buildings, including Dining Area, Staff Accommodation, Chemical Storage and Boiler Room

The factory compound includes a number of lightweight structures, namely the Dining Shed, the Leftover Storage Shed, the Staff Compound, the Chemical Storage Shed and the Boiler Room, all of which are outside of the main factory building at ground floor level. These structures, which include lightweight roofs on steel or RC columns, do not appear to be engineered. Building Engineer to review the design of these structures, with special emphasis on connections and bracing, and to implement any upgrade works as required.



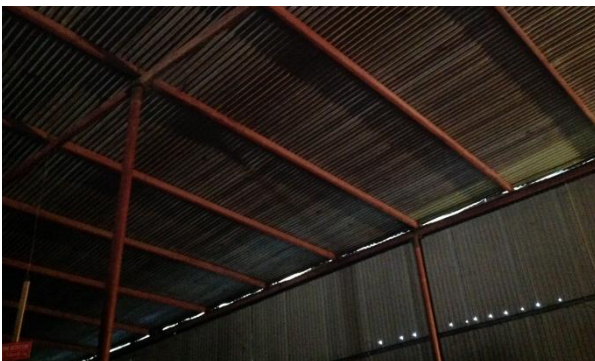
Dining Area Shed



Dining Shed Connection Detail



Leftover Storage Shed



Chemical Storage Shed



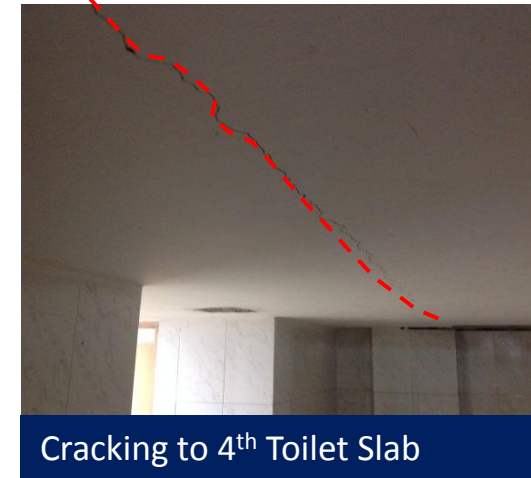
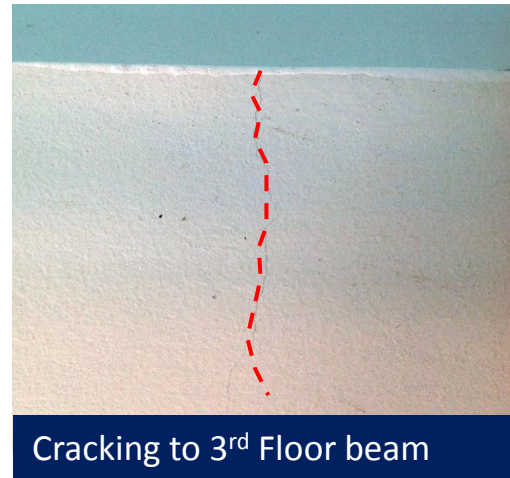
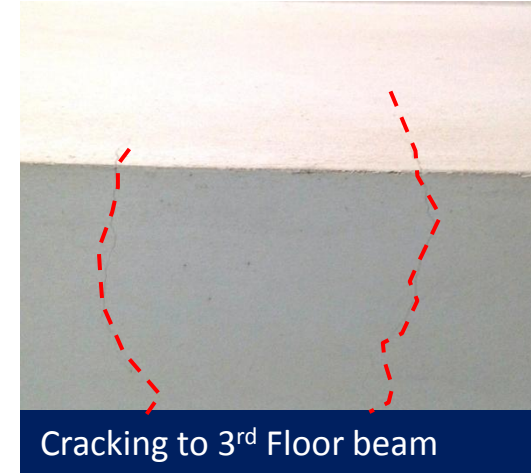
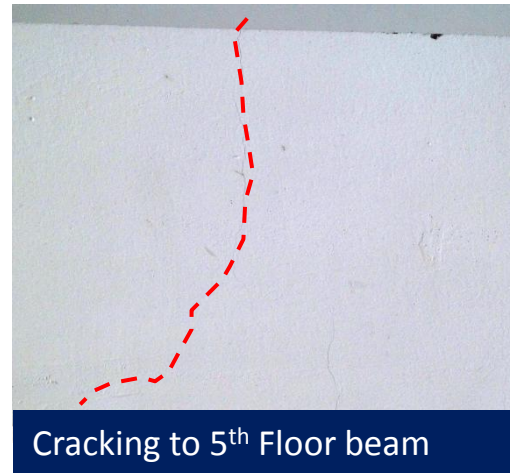
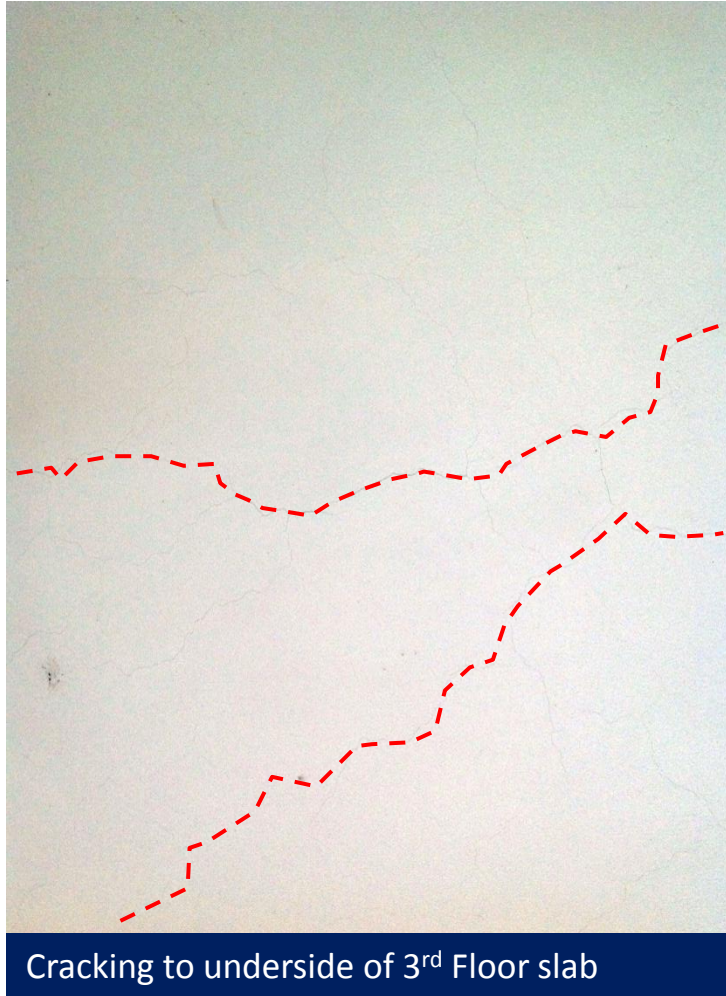
Boiler Room



Staff Accommodation

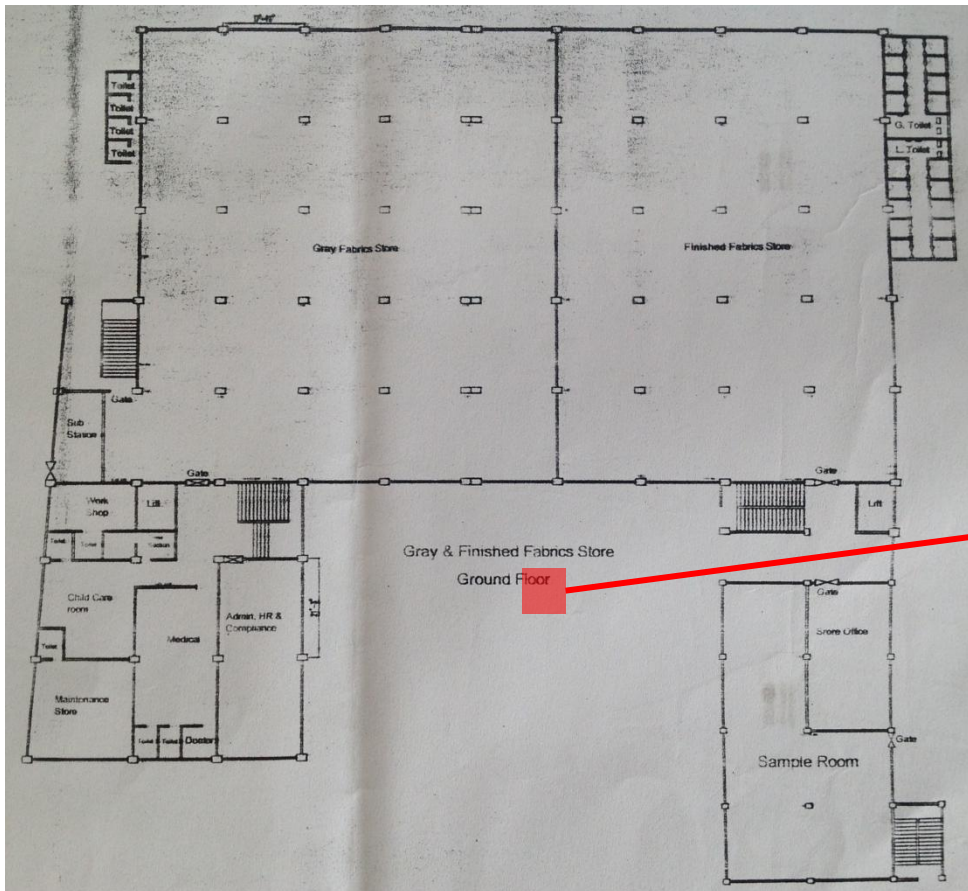
Hairline cracking to soffit of beams and slabs to all levels from 1st Floor to Roof of Main Building

Hairline cracking was observed to the soffit of a number of beams and slabs at 1st, 2nd, 3rd, 4th and 5th Floor levels. Building Engineer to investigate and carry out remedial works to the structure as required.



The central column at the delivery entrance to the Main Building is at risk of being accidentally struck by a vehicle

The central column at the delivery entrance to the Main Building is at risk of being accidentally struck by a vehicle. Building Engineer to check that the column has been adequately designed for impact loading, and to ensure that adequate protection is provided.



Ground Floor Plan



Delivery Area

Column at risk of impact loading



Design check required for the escape stairs currently under construction

The fire-escape stair to the east of the Main Building was observed to be under construction at the time of the survey. Building engineer to check the suitability of the fire-escape stair.



Fire Escape Stair



Fire Escape Stair to East Elevation of Main Building

Steel Columns in Chemical Store at risk of corrosive attack (Caustic Soda)

The structural columns in the Chemical Storage Shed are at risk of corrosion by Sodium Hydroxide solutions (caustic soda) currently stored on site immediately adjacent to the columns. Building Engineer to ensure that the columns have adequate protection.

Table 3
This table shows general recommendations for the separation or segregation of different classes of dangerous substances.

Class	1	2	3	4	5	6	7	8	9	10
Compressed Gases 2.1 Flammable	KEEP APART	Segregate from 2.2	Segregate from 2.3	Segregate from 2.4	Segregate from 2.5	Segregate from 2.6	Segregate from 2.7	Segregate from 2.8	Segregate from 2.9	Segregate from 2.10
2.2 Non-flammable, non-toxic	KEEP APART	KEEP APART	KEEP APART	Segregation may not be necessary	Segregation may not be necessary	Segregation may not be necessary	Segregation may not be necessary	Segregation may not be necessary	Segregation may not be necessary	KEEP APART
2.3 Toxic	Segregation may not be necessary	KEEP APART	Segregation from 2.4	KEEP APART	Segregation from 2.5	Segregation may not be necessary	Segregation from 2.6	Segregation may not be necessary	Segregation may not be necessary	KEEP APART
Flammable Liquids	Segregation from 2.1	KEEP APART	Segregation from 2.3	KEEP APART	Segregation from 2.4	Segregation from 2.5	Segregation from 2.6	Segregation from 2.7	Segregation from 2.8	KEEP APART
Flammable Solids 4.1 Readily combustible	Segregation from 2.1	Segregation may not be necessary	KEEP APART	KEEP APART	KEEP APART	Segregation from 2.5	Segregation from 2.6	Segregation from 2.7	Segregation from 2.8	Segregation may not be necessary
4.2 Spontaneously combustible	Segregation from 2.1	Segregation from 2.2	Segregation from 2.3	Segregation from 2.4	KEEP APART	KEEP APART	Segregation from 2.6	Segregation from 2.7	Segregation from 2.8	KEEP APART
4.3 Dangerous when wet	Segregation from 2.1	Segregation may not be necessary	KEEP APART	Segregation from 2.4	KEEP APART	KEEP APART	Segregation from 2.6	Segregation from 2.7	Segregation from 2.8	Segregation may not be necessary
Oxidizing Substances 5.1 Oxidizing substances	Segregation from 2.1	Segregation may not be necessary	Segregation may not be necessary	Segregation from 2.4	Segregation from 2.5	KEEP APART	Segregation from 2.6	Segregation from 2.7	Segregation from 2.8	KEEP APART
5.2 Organic peroxides	Segregation from 2.1	Segregation from 2.2	Segregation from 2.3	Segregation from 2.4	Segregation from 2.5	Segregation from 2.6	Segregation from 2.7	Segregation from 2.8	Segregation from 2.9	KEEP APART
Toxic substances	KEEP APART	Segregation may not be necessary	Segregation may not be necessary	KEEP APART	KEEP APART	KEEP APART	Segregation may not be necessary	KEEP APART	KEEP APART	Segregation may not be necessary
Corrosive substances	KEEP APART	KEEP APART	KEEP APART	KEEP APART	Segregation may not be necessary	KEEP APART	KEEP APART	KEEP APART	KEEP APART	Segregation may not be necessary

COMPATIBILITY CHART TERMINOLOGY:
 Keep Apart: Keep at minimum 3m apart.
 Segregate: Keep in separate compartments of the same store, separated by at least a 1.8m wall or in a separate building.
 Isolate: Keep in separate building or isolate within a cabinet designed for this purpose.

24. ENVIRONMENTAL HEALTH AND SAFETY HANDBOOK, April 2007

Chemical Storage Chart



Columns at Risk of Corrosion

Priority Actions

Problems Observed

1. Column Stress levels, with particular reference to column beneath 3 Storey Vertical Extension to Packing Section of Main Building
2. Missing bolts to primary structural steelwork in Knitting & Raw Materials Godown Building
3. Slender column to Dyeing Building
4. No edge protection at Roof Level of Main Building (5th and 6th floor levels)
5. Missing longitudinal bracing to Raw Materials Godown Building & Dyeing Building
6. Inconsistencies between Permit / Structural Drawings and Constructed building
7. Heavy loading in Main Building
8. Check required for adequacy of existing splice and haunch connections in Raw Materials Godown Building
9. Lightweight structures to Ancillary Buildings, including Dining Area, Staff Accommodation, Chemical Storage and Boiler Room
10. Hairline cracking to soffit of beams and slabs of Main Building
11. Provide impact protection to central column supporting entrance plinth structure
12. Escape stair does not appear robust
13. Steel structure in Chemical Store at risk of corrosive attack (Caustic Soda)

Item 1 and actions

Column Stress Levels, with particular reference to Column beneath 3 Storey Vertical Extension to Packing Section of Main Building

Priority 1

(Immediate - Now)

- Building Engineer to review design, loads and column stresses in structure.
- A **Detail Engineering Assessment** of Packing Section in Main Building is to be commenced – see attached scope.
- Verify insitu concrete stresses by taking 100mm diameter cores from min. 4 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.
- Detail 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. 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 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 Bolts to Primary Structural Steelwork in Raw Materials Godown Building

Priority 1

(Immediate - Now)

- Provide temporary prop to end of steel beam. Building Engineer to ensure correct connection detail is designed, fabricated and installed on site.

Priority 2

(within 6-weeks)

- None required.

Priority 3

(within 6-months)

- None required.

Item 3 and actions

Slender Column to Dyeing Building.

Priority 1

(Immediate - Now)

- None required.

Priority 2

(within 6-weeks)

- Building Engineer to check the design and capacity of the slender circular hollow section supporting the steel roof and make any necessary alterations.

Priority 3

(within 6-months)

- None required.

Item 4 and actions

No edge protection at Roof Level of Main Building (5th and 6th Floor levels)

Priority 1

(Immediate - Now)

- Provide immediate edge protection to both roof levels whilst construction work continues on site.

Priority 2

(within 6-weeks)

- None required.

Priority 3

(within 6-months)

- None required.

Item 5 and actions

Missing longitudinal bracing to Raw Materials Godown Building & Dyeing Building

Priority 1

(Immediate - Now)

- None required.

Priority 2

(within 6-weeks)

- Building Engineer to check the design of the building for longitudinal stability and provide roof and wall bracing as necessary.

Priority 3

(within 6-months)

- None required.

Item 6 and actions

Inconsistencies between Permit / Structural Drawings and Constructed building.
(Undocumented extension; Main Building comprises 3 buildings; slab rebar runs through movement joint; column rebar, etc.)

Priority 1

(Immediate - Now)

- Refer to Item 1 for 3-storey extension over package building.

Priority 2

(within 6-weeks)

- None required.

Priority 3

(within 6-months)

- Factory Engineer to survey the structure and prepare a full set of “as-constructed” drawings.

Item 7 and actions

Heavy loading in Main Building

Priority 1

(Immediate - Now)

- None required.

Priority 2

(within 6-weeks)

- Factory Engineer to investigate the loading from water tanks, 1st floor storage area and toilet floor build-up (and slabs over) and advise on any necessary alterations taking account of floor capacity and column capacity.

Priority 3

(within 6-months)

- Implement actions arising from investigation.

Item 8 and actions

Check required for adequacy of existing splice and haunch connections in Raw Materials Godown Building.

Priority 1

(Immediate - Now)

- None required.

Priority 2

(within 6-weeks)

- Building Engineer to check the design and capacity of the splice connection details and make any necessary alterations.

Priority 3

(within 6-months)

- None required.

Item 9 and actions

Lightweight structures to Ancillary Buildings, including Dining Area, Staff Accommodation, Chemical Storage and Boiler Room.

Priority 1

(Immediate - Now)

- None required.

Priority 2

(within 6-weeks)

- Building Engineer to check the design and capacity of the lightweight roof structures/connection details and make any necessary alterations.

Priority 3

(within 6-months)

- None required.

Item 10 and actions

Hairline cracking to soffit of beams and slabs to all levels form First Floor to Roof of Main Building

Priority 1

(Immediate - Now)

- None required.

Priority 2

(within 6-weeks)

- None required.

Priority 3

(within 6-months)

- Monitor cracks to beams and slab soffit. Factory Engineer to investigate if cracks are limited to the plastering.
- Factory Engineer to advise on load reduction and repair and strengthening of the slab if required.

Item 11 and actions

Provide impact protection to central column supporting entrance plinth structure

Priority 1

(Immediate - Now)

- None required.

Priority 2

(within 6-weeks)

- Building Engineer to check if the column has been adequately designed for impact loading, and to ensure that adequate protection is provided.

Priority 3

(within 6-months)

- None required.

Item 12 and actions

External escape stair to Main Building (under construction) does not appear robust

Priority 1

(Immediate - Now)

- None required.

Priority 2

(within 6-weeks)

- Building Engineer to check the design of the external steel staircase and connection to existing building and make any necessary alterations.

Priority 3

(within 6-months)

- None required.

Item 13 and actions

Steel structure in Chemical Store at risk of corrosive attack (Caustic Soda)

Priority 1

(Immediate - Now)

- None required.

Priority 2

(within 6-weeks)

- None required.

Priority 3

(within 6-months)

- Engage Building Engineer to review storage location and ensure columns are protected from potential corrosive chemical attack.