

# Crown Fashion & Sweater Ind. Ltd. Crown Knitwear Ltd. (Building 3)

Plot 781/782, Vogra, Joydevpur, Gazipur.  
(23.982841, 90.38177)  
02 April 2014



# Executive Summary (continued)

**We do, however, have a high-level and non-exhaustive list of key concerns** as follows:

List of key concerns:

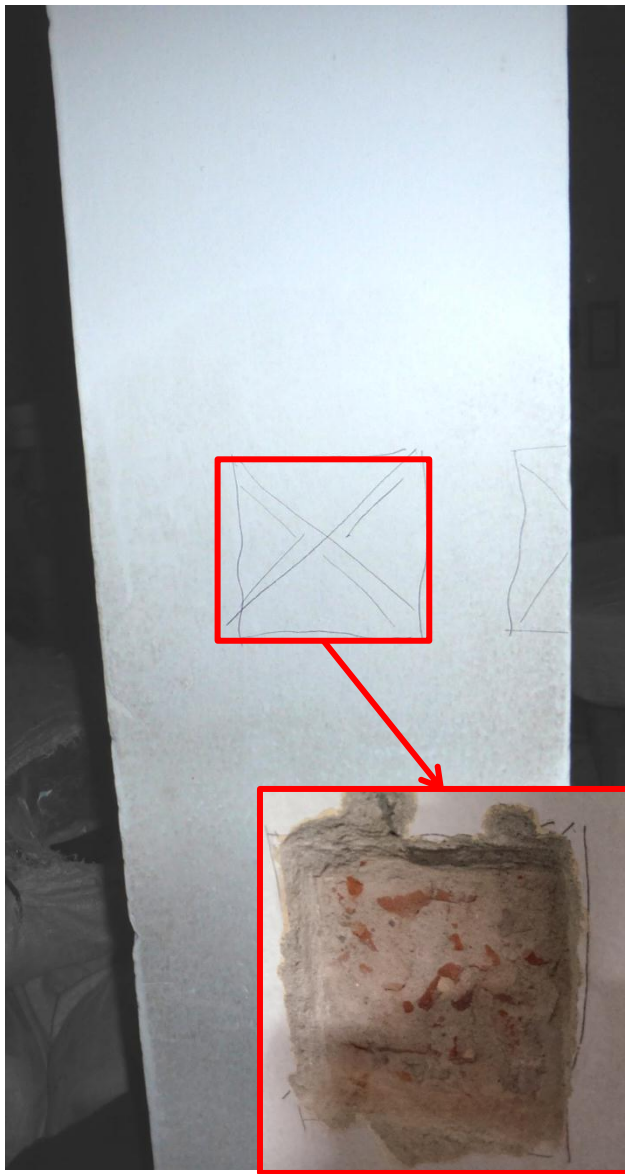
- Highly-stressed columns particularly at perimeter cantilevers
- Localised areas of high loading
- Cracks above surface of slab
- Change in structural system
- Undocumented vertical extension
- Unrestrained roof parapets
- Ill-defined movement joint between Buildings 3 and 1

At this point we see **no reason to suspend operations in the facility due to these concerns**. However, the stress levels within a number of the columns at ground floor level are considered high enough to warrant an immediate **Detail Engineering Assessment**. We would recommend that the Detail Engineering Assessment for this building be completed **within 6 weeks** of receiving the report.

Further actions with associated priorities and timeframes are given at the end of this report. Please note that these actions should be completed as soon as practically possible and certainly within the timeframe noted.

# Observations

# High Stress in Columns



**Tested column  
at ground level.  
Brick aggregate  
observed.**

Preliminary calculations indicate that some internal and external column working stresses are at a high level.

A Detailed Engineering Assessment is required (see attached Scope) along with Buildings 1, 2 & 4 as outlined in previous report.

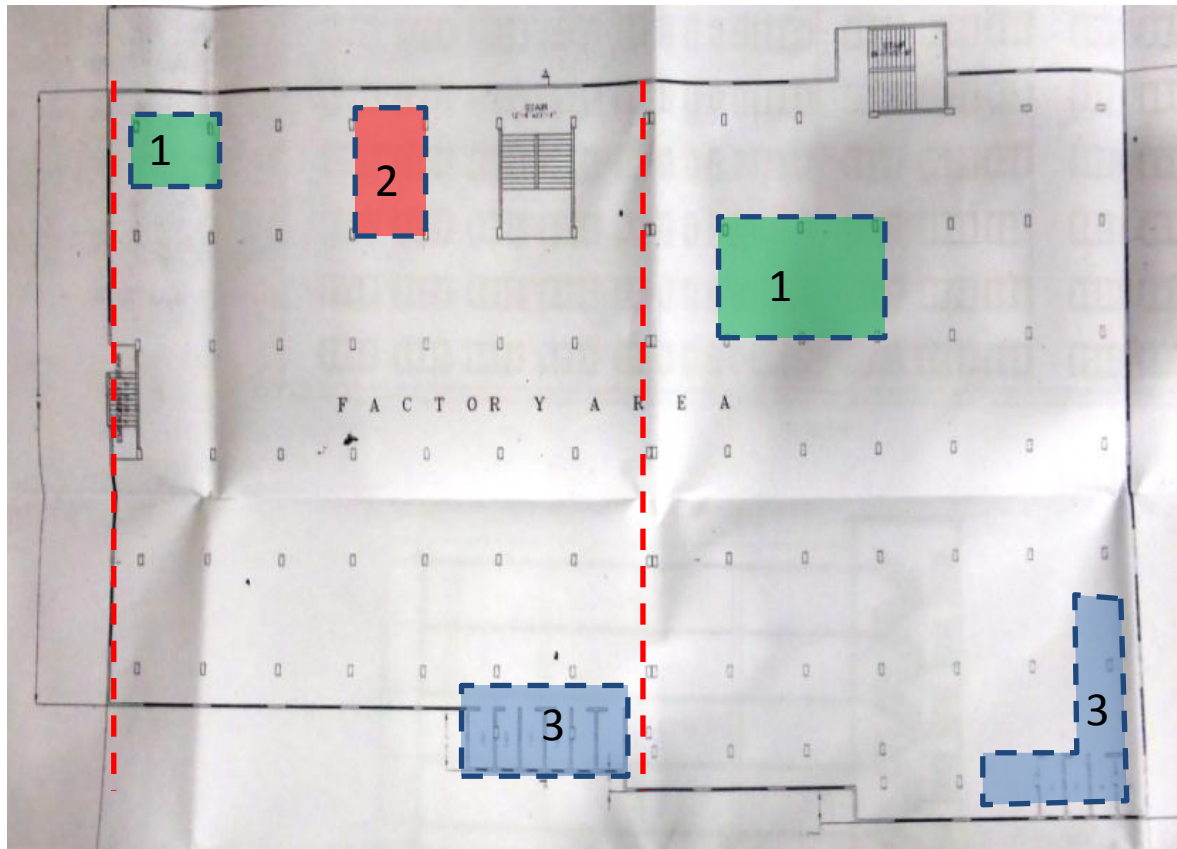
Engineer is to perform detailed calculations based on as-constructed dimensions and concrete tests to prove column size is adequate.

Scanned reinforcement observed to be less than specified on the engineering drawings.

**Immediate Actions Outlined in  
Executive Summary**

## High Stress in Columns

# Localised areas of high loading



Areas were observed with higher than typical loading in the building, including:

1. Water tanks at roof level
2. Storage loading
3. Increased build-ups in toilet blocks at all levels

Storage loading and increased build-ups were observed in a number of other areas, including storage of brick aggregate at roof level.

**Local areas of high loading**



**Material storage on roof**



**Water Tank locations at roof level and storage of aggregate.**

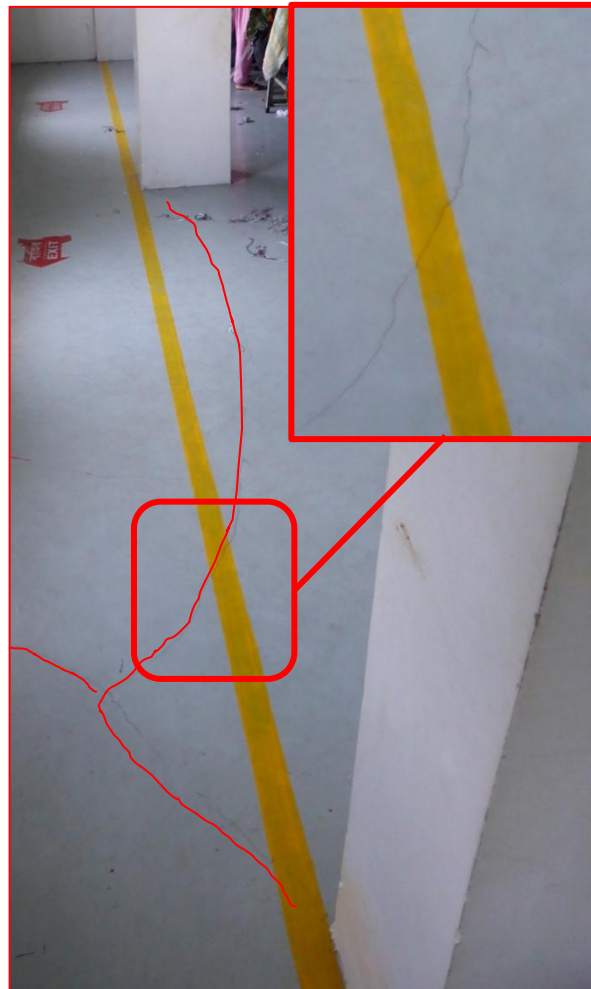


**Increased floor buildup in toilet areas in addition to brick partition walls and 150mm thick concrete ceiling.**

# Cracks above top surface of slab



Crack above flat slab in level 4



Crack above cantilever beam in level 3

Cracks have been noted in the finishes on top of slabs in a number of locations and floors for both the flat slab and beam constructions. The crack patterns suggest they arise from flexure over the columns and beams.

Screed was removed from one location and a hairline crack was noted as continuing through to the structural slab.



## Cracks above slabs

# Change in Structural System



Flat slab – 5<sup>th</sup>  
(part), 6<sup>th</sup> and  
Roof floors



Beam and  
slab system  
1<sup>st</sup> - 4<sup>th</sup> Floors  
and part of  
5<sup>th</sup> floor

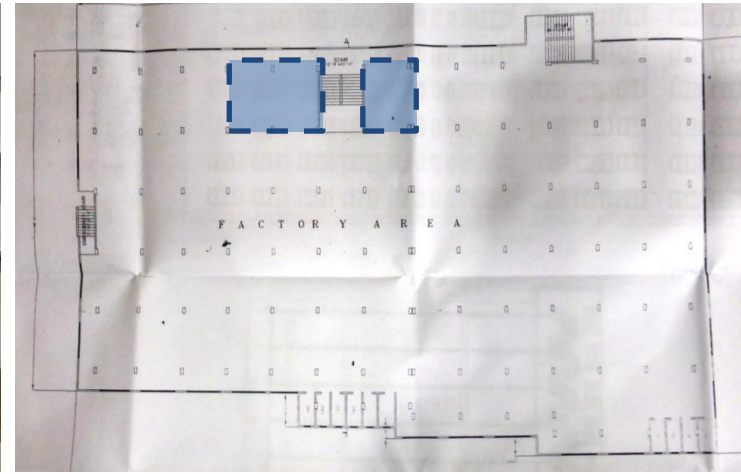
The change in structural system could indicate that Building 3 may have been constructed in a number of phases both horizontally and vertically, contradicting the information given at the Manager Interview that the building was constructed in one phase in 2003.

Drawings indicate a beam and slab construction at all floors.

Building Engineer should check that lateral stability is maintained through the two structural systems.

## Change in Structural System

# Undocumented Vertical Extension



**Undocumented vertical extension on roof comprising brick masonry walls with a lightweight steel roof.**

**No structural or design documentation provided for extensions.**

**Adequacy of tie-downs and lateral stability need to be assessed by Building Engineer.**

**Additional vertical loading applied to building below to be assessed.**



# Unrestrained parapets at roof level



Single brick masonry parapets unrestrained at roof level around perimeter of the building.

**Unrestrained roof parapets**

# Priority Actions

# Problems Observed

1. High Stress in Columns
2. Localised areas of high loading
3. Cracks above surface of slab
4. Change in Structural System
5. Undocumented vertical extension
6. Unrestrained roof parapets
7. Movement Joint between Buildings 3 and 1 ill-defined

Item No.	Observation	Recommended Action Plan	Recommended Timeline
1	High Stress in Columns	Maintain current use of the floors in each building and do not change use or increase occupation, either of which could increase loading	<b>Immediate - Now</b>
2	High Stress in Columns	Building Engineer to review design, loads and stresses in all columns	<b>Immediate - Now</b>
3	High Stress in Columns	<b>A Detail Engineering Assessment of Factory to be commenced, see attached Scope</b>	<b>Immediate - Now</b>
4	High Stress in Columns	Produce and actively manage a loading plan for all floor plates within the factory giving consideration to floor capacity and column capacity. Loading plans to be put on each factory floor	<b>6-weeks</b>
5	High Stress in Columns	Detail Engineering Assessment to be completed	<b>6-weeks</b>
6	High Stress in Columns	Verify in-situ concrete strengths either by 100mm diameter cores or existing cylinder strength data for cores from minimum 4 no. columns	<b>6-weeks</b>
7	High Stress in Columns	Continue to implement load plan	<b>6-months</b>
8	High Stress in Columns	Implement strengthening measures where required	<b>6-months</b>

# 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
9	Localised areas of high loading in buildings	<b>Detail Engineering Assessment to be completed as per Item 1</b>	<b>6-weeks</b>
10	Localised areas of high loading in buildings	Extent of build-up loading in toilet and wash areas to be surveyed and weight of water tanks on roof to be assessed. The capacity of floor & roof slabs to be assessed to confirm if the structure is designed to carry these loads.	<b>6-weeks</b>
11	Localised areas of high loading in buildings	Implement strengthening measures if required	<b>6-months</b>
12	Localised areas of high loading in buildings	Continue to implement load plan as per item 1	<b>6-months</b>
13	Cracks above surface of slabs in a number of locations	As part of Detail Engineering Assessment required under Item 1, confirm if the slabs have sufficient capacity to support applied loading. If cracking continues through to the structural slab, confirm if the cracks are within acceptable limits for normal structural behaviour.	<b>6-weeks</b>
14	Cracks above surface of slabs in a number of locations	Punching shear also to be assessed for the flat slab structures in the upper levels	<b>6-weeks</b>
15	Cracks above surface of slabs in a number of locations	Implement strengthening measures if required	<b>6-months</b>
16	Cracks above surface of slabs in a number of locations	Continue to implement load plan as per item 1	<b>6-months</b>

Item No.	Observation	Recommended Action Plan	Recommended Timeline
17	Change in Structural System in upper floors	As part of the Detail Engineering Assessment of Factory required for Item 1, the change in structural system should be assessed in terms of the overall lateral stability of the building	<b>6-weeks</b>
18	Change in Structural System in upper floors	Complete Detail Engineering Assessment and identify adequacy or otherwise of the lateral stability system	<b>6-weeks</b>
19	Change in Structural System in upper floors	Implement strengthening measures if required.	<b>6-months</b>
20	Undocumented vertical extension on roof.	Building engineer to assess lightweight roof structure and confirm its ability to withstand all wind loading pressure, suctions and uplift forces.	<b>6-weeks</b>
21	Undocumented vertical extension on roof.	Additional loading to main production building to be identified and incorporated in Detail Engineering Assessment for the building.	<b>6-weeks</b>
22	Undocumented vertical extension on roof.	Carry out remedial work if required.	<b>6-months</b>

Item No.	Observation	Recommended Action Plan	Recommended Timeline
23	Unrestrained parapet at roof level	Building engineer to assess stability and condition of the roof parapets.	6-weeks
24	Unrestrained parapet at roof level	Repairs and strengthening to be carried out as required by engineering assessment.	6-months
25	Ill-defined movement joint between Buildings 3 and 1.	Building engineer to investigate extent of this movement joint at all levels.	6-weeks
26	Ill-defined movement joint between Buildings 3 and 1.	Remedial work to be carried out as required by engineering assessment.	6-months