

# Belamy Textiles Ltd. Golden Son Ltd

Khowaz Nagar, Azimpura, Karnafuli, Chittagong  
18 MARCH 2014



# Executive Summary (Continued)

These concerns are due to the following:

- The column sizes observed are less than half the area of those indicated on the structural drawings
- Outline calculations indicate that the building columns are highly stressed

The following **immediate** actions are required to be carried out:

1. **All loads, including equipment, garments and personnel, in the area highlighted on the following page for all suspended levels are to be removed pending verification of column capacity by the Building Engineer.**
2. **All loads generally to be limited to 1.5 kN/m<sup>2</sup> pending verification of column capacity by the Building Engineer.**
3. **Detail Engineering Assessment** of the as-constructed Building is requested and this should be commenced immediately to the requirements of the scope attached and addressing the concerns as noted.

If the Building owners are not in a position to complete these actions immediately, the **Factory Building** should be re-classified as **Category Red** and evacuated.

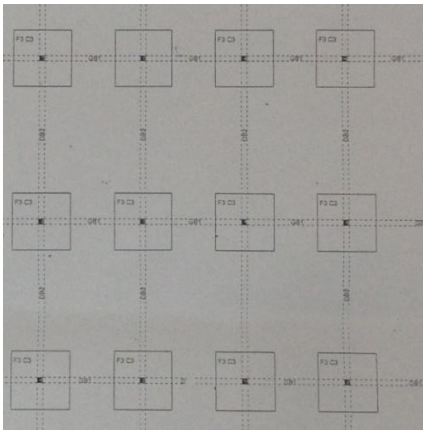


# Observations

# Highly Stressed Column

## Immediate Actions Outlined in Executive Summary

Outline calculations indicate column working stress is at high risk level.



Column sizes observed smaller than shown on structural drawings.

Observed as 380mm x 300mm vs 510 sq. according to design drawings.

Engineer is to perform detailed calculations and concrete tests to prove column size and (if required):

- Reduce loads by vacating floors and removing additional structures
- Reinforce columns

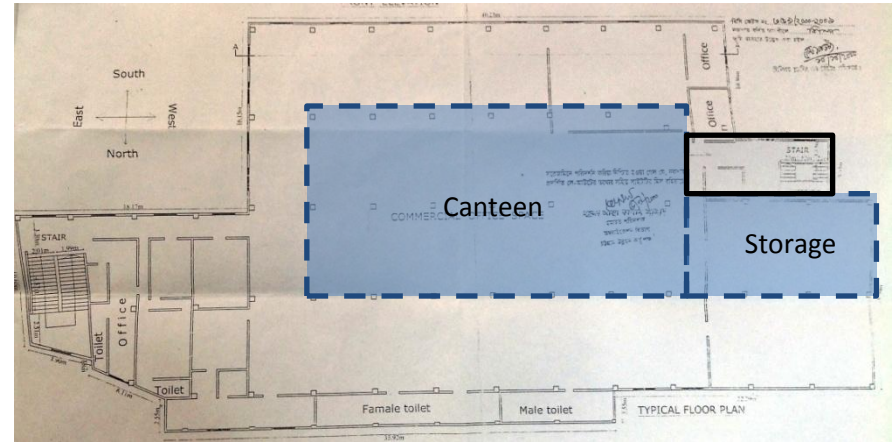


Brick Aggregate Observed

Highly stressed column

# Vertical Extension





**Vertical extension on roof comprising lightweight steel trussed roof on concrete columns with brick masonry and glass infill.**

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





**Lightweight steel structure, not on permit plans, subject to wind uplift.**

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



**Check on roof additions required**

# Localised areas of high loading



**Water tanks at roof level**



**Materials Store – 1<sup>st</sup> Floor**

**Areas of high loading on structure.**

**(Non-exhaustive examples)**



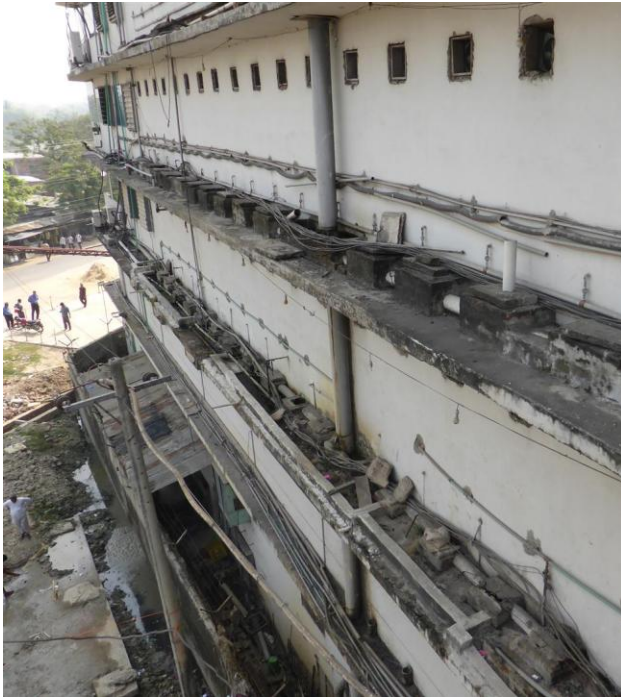
**Storage of Material Rolls**



**Packaged Clothing**



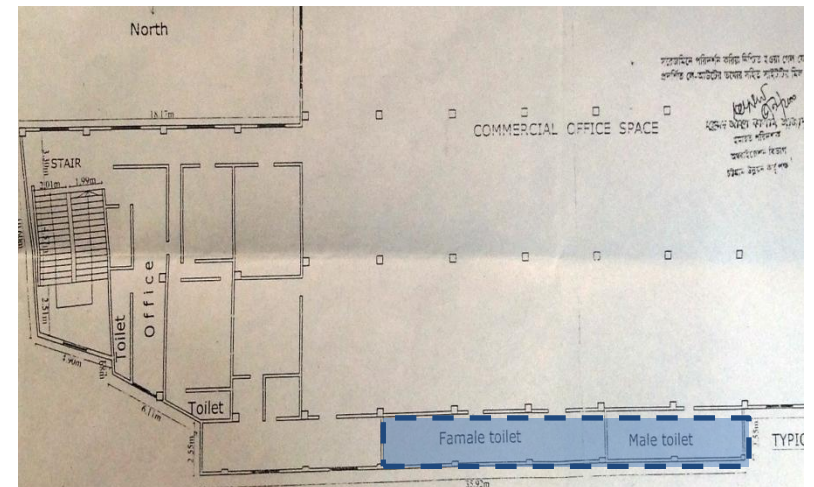
## High loading at facade line along the toilet blocks



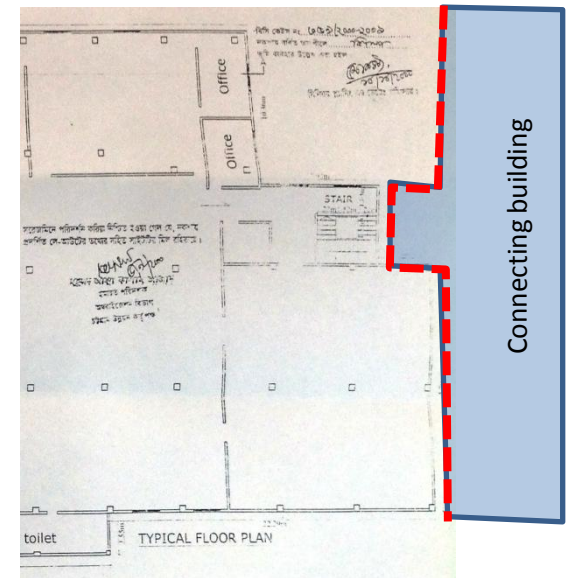
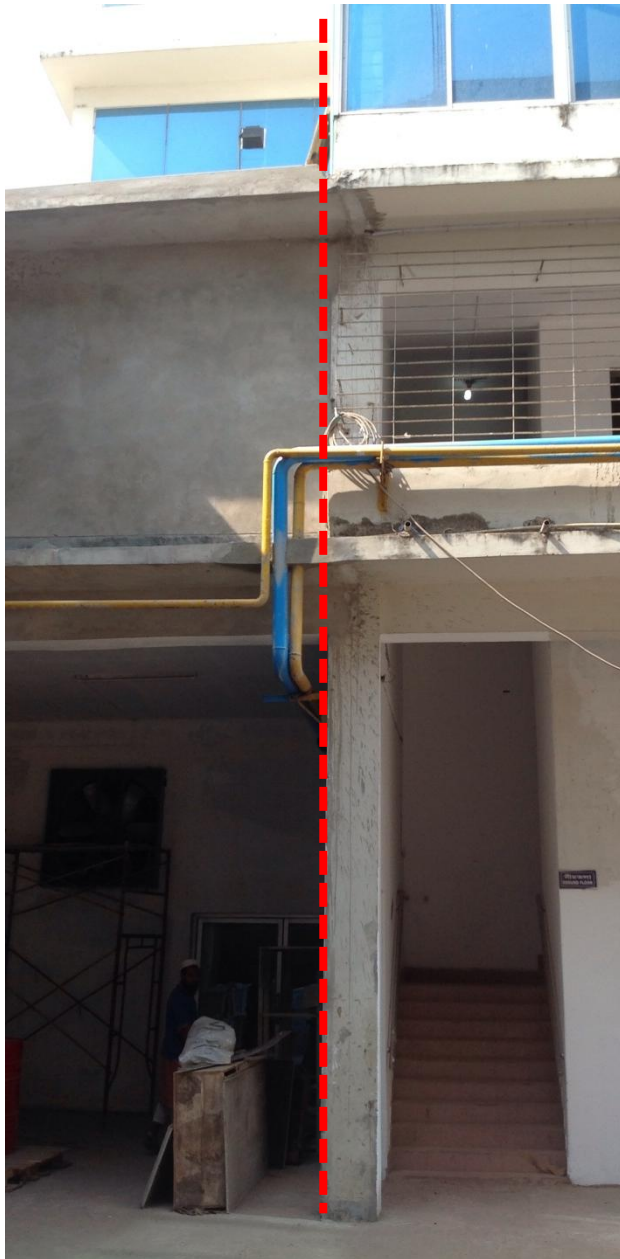
## Brick masonry facade walls with external drainage system on cantilever



## Increased floor build-up and partition loads in toilets



# Loading from neighbouring building

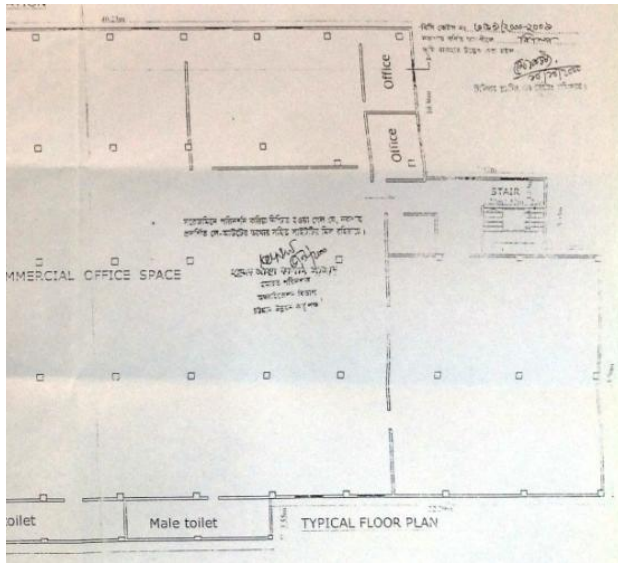


**No structural or design documentation provided for connected neighbouring building.**

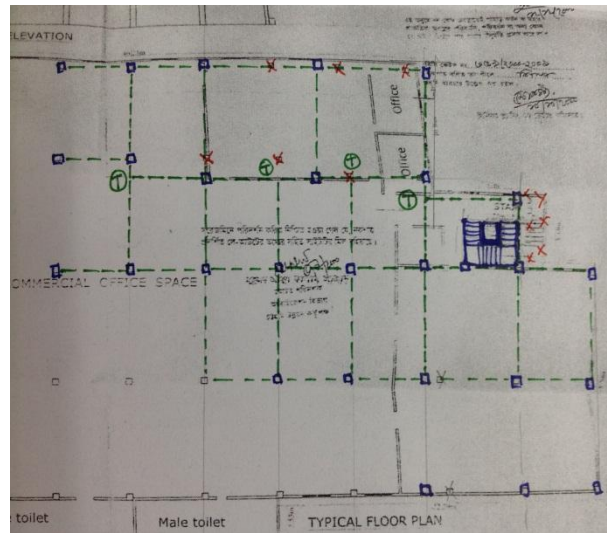
**Shared columns between the extension and factory.**



# **Substantial differences between as-built structure and design drawings provided**



**Floor layout as per design documentation.**



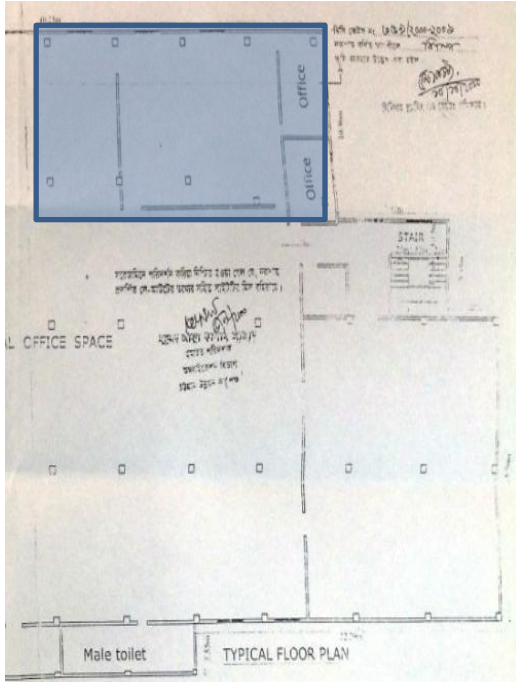
**Observed floor layout**



**Design drawings are not consistent with the as-built structure.**

**Differences in column locations and beam arrangement.**

**Floor beam acts as structural beam to transfer the reaction from the orthogonal floor beam to the column positions in a number of locations.**



**Undocumented double-height space from ground level inconsistent with structural drawings.**

**Crane beams supported on column corbels in a number of locations on ground floor.**

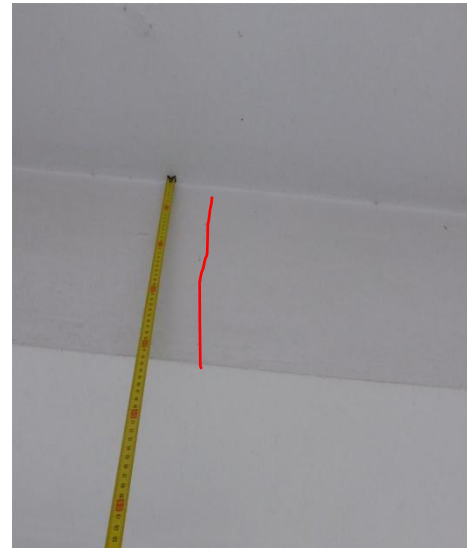
## Inaccurate Building Documentation

# Cracking over structural elements



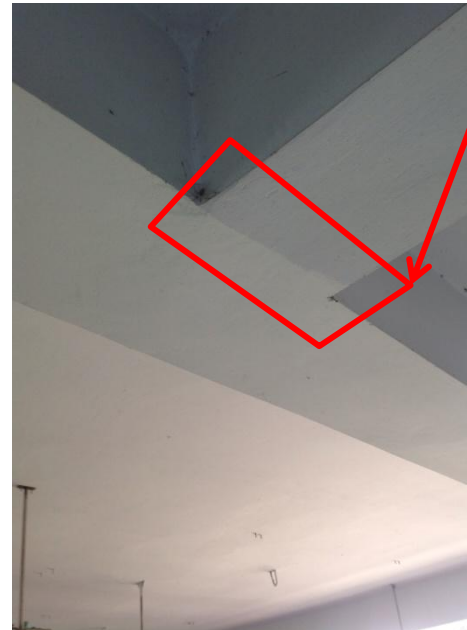
**Cracking on surface at a number of locations above long-spanning beams.**

**Cracks run parallel to beam span.**



**Vertical cracking on a number of beams.**

**Evidence that selected beams have been recently decorated at locations consistent with cracks observed.**

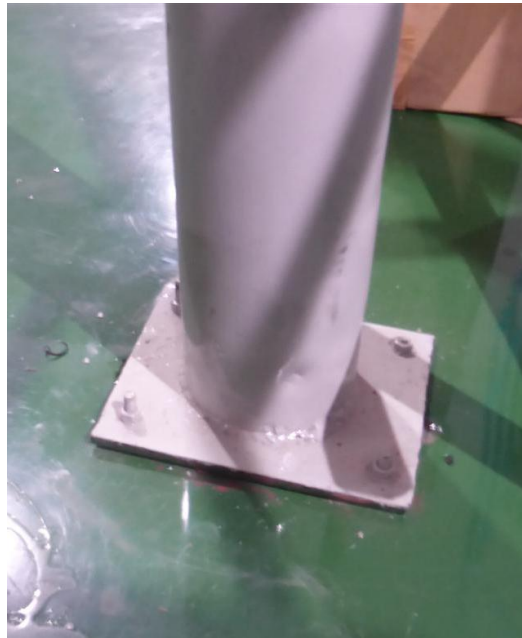


## **Cracking over structural elements**



# Undocumented mezzanines

# Crane structure stabilised from structure



**Crane beam structure stabilised from beam and column elements.**

**Posts fixed directly to ground floor slab**



**Crane structure stabilised from structure**

# Priority Actions

# Problems Observed

1. Highly stressed columns.
2. Vertical extension of canteen area on roof.
3. Loading from neighbouring building
4. Localised areas of high loading.
5. Inaccurate building documentation
6. Cracking over structural elements
7. Undocumented mezzanines
8. Crane structure stabilised from structural elements



| Item No. | Observation                                                                                                                  | Recommended Action Plan                                                                                                                                        | Recommended Timeline |
|----------|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 1        | High working stress observed in columns<br>See Executive Summary for further Immediate Actions regarding Live Load reduction | Factory Engineer to review design, loads and columns stresses for all columns                                                                                  | Immediate - Now      |
| 2        | High working stress observed in columns<br>See Executive Summary for further Immediate Actions regarding Live Load reduction | Verify insitu concrete stresses either by cores or existing cylinder strength data for all the columns or 100mm dia. cores from minimum 4 non-critical columns | Immediate - Now      |
| 3        | High working stress observed in columns<br>See Executive Summary for further Immediate Actions regarding Live Load reduction | A Detail Engineering Assessment (DEA) of Factory to be commenced - see attached Scope                                                                          | Immediate - Now      |
| 4        | High working stress observed in columns<br>See Executive Summary for further Immediate Actions regarding Live Load reduction | Detail Engineering Assessment to be completed                                                                                                                  | 6-weeks              |
| 5        | High working stress observed in columns<br>See Executive Summary for further Immediate Actions regarding Live Load reduction | Produce and actively manage a loading plan for all floor plates within the factory giving consideration to floor capacity and column capacity.                 | 6-weeks              |
| 6        | High working stress observed in columns<br>See Executive Summary for further Immediate Actions regarding Live Load reduction | Carry out strengthening as required                                                                                                                            | 6-months             |
| 7        | High working stress observed in columns<br>See Executive Summary for further Immediate Actions regarding Live Load reduction | 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 |
|----------|---------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 8        | Engineering Assessment of vertical extension for canteen on roof and additional loading from new adjoining building | Reduce loading as per item 1 requirements.                                                                                                                                          | Immediate - Now      |
| 9        | Engineering Assessment of vertical extension for canteen on roof and additional loading from new adjoining building | Detail Engineering Assessment to be completed as per item 1 to take account of additional areas                                                                                     | 6-weeks              |
| 10       | Engineering Assessment of vertical extension for canteen on roof and additional loading from new adjoining building | Building engineer to verify structural design of additional structures.                                                                                                             | 6-weeks              |
| 11       | Engineering Assessment of vertical extension for canteen on roof and additional loading from new adjoining building | The Building Engineer should check the load plans and confirm that the main building structure is capable of safely supporting the additional structures, to ensure no over-loading | 6-weeks              |
| 12       | Engineering Assessment of vertical extension for canteen on roof and additional loading from new adjoining building | Implement the actions arising from the Detail Engineering Assessment                                                                                                                | 6-months             |
| 13       | Localised areas of high loading                                                                                     | Reduce loading on areas highlighted for immediate action as per item 1                                                                                                              | Immediate - Now      |
| 14       | Localised areas of high loading                                                                                     | Create controlled loading plans for all floors, designating where storage can / cannot be placed, taking the findings of the DEA and of Item 1 into account                         | 6-weeks              |
| 15       | Localised areas of high loading                                                                                     | Continue to implement load plan                                                                                                                                                     | 6-months             |

| Item No. | Observation                                                                                                                                             | Recommended Action Plan                                                                                                                  | Recommended Timeline   |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| 16       | Modifications to building structure not reflected on the design documents (including double height space, gantry crane support & change of column size) | Commence production of relevant documentation required for DEA (as per items 1 & 2).                                                     | <b>Immediate - Now</b> |
| 17       | Modifications to building structure not reflected on the design documents (including double height space, gantry crane support & change of column size) | Detail Engineering Assessment to be completed as per items 1 & 2.                                                                        | <b>6-weeks</b>         |
| 18       | Modifications to building structure not reflected on the design documents (including double height space, gantry crane support & change of column size) | Slabs, Beams and supporting Columns that differ in load condition and span from original design to be assessed by the building engineer. | <b>6-weeks</b>         |
| 19       | Modifications to building structure not reflected on the design documents (including double height space, gantry crane support & change of column size) | Building engineer to check, collect information and produce accurate and complete as-built documentation                                 | <b>6-weeks</b>         |
| 20       | Modifications to building structure not reflected on the design documents (including double height space, gantry crane support & change of column size) | Implement the actions arising from the Detail Engineering Assessment                                                                     | <b>6-months</b>        |

| Item No. | Observation                              | Recommended Action Plan                                                                                                                                     | Recommended Timeline |
|----------|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 21       | Cracking observed on structural elements | Detail Engineering Assessment to be completed as per item 1.                                                                                                | 6-weeks              |
| 22       | Cracking observed on structural elements | Sections of plaster finish and screeds to be removed to investigate if cracks penetrate into the building structure.                                        | 6-weeks              |
| 23       | Cracking observed on structural elements | Verify that beam/slab has sufficient capacity to support applied load and structural arrangements                                                           | 6-weeks              |
| 24       | Cracking observed on structural elements | Carry out repair or strengthening as required                                                                                                               | 6-months             |
| 25       | Cracking observed on structural elements | Apply load limits as required.                                                                                                                              | 6-months             |
| 26       | Additional Mezzanine Structures          | Reduce loading as per item 1 requirements                                                                                                                   | Immediate - Now      |
| 27       | Additional Mezzanine Structures          | Detail Engineering Assessment to be completed as per item 1 to take account of additional areas                                                             | 6-weeks              |
| 28       | Additional Mezzanine Structures          | Building engineer to assess design of mezzanine areas, including construction sequence (and connection to building columns) and loading on affected columns | 6-weeks              |
| 29       | Additional Mezzanine Structures          | Implement the actions arising from the Detail Engineering Assessment                                                                                        | 6-months             |

| Item No. | Observation                                         | Recommended Action Plan                                                                                                                                       | Recommended Timeline   |
|----------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| 30       | Crane structure stabilised from structural elements | All loads on the building structure arising from the gantry crane to be accounted for in the DEA required from Item 1.                                        | <b>Immediate - Now</b> |
| 31       | Crane structure stabilised from structural elements | Building Engineer to verify that structural elements used to support the gantry crane have adequate structural capacity and stiffness for the applied loading | <b>6-weeks</b>         |
| 32       | Crane structure stabilised from structural elements | Carry out strengthening work if required                                                                                                                      | <b>6-months</b>        |
| 33       | Crane structure stabilised from structural elements | Limit gantry crane safe working load as required                                                                                                              | <b>6-months</b>        |