Mega Dyeing Ltd.

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13 & 26 April 2014

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Observations

Building 4 - High stress in columns requires immediate review and the preparation of a Detail Engineering Assessment

Cursory calculations indicate that columns within Building 4 are highly stressed and require immediate review.

A Detail Engineering Assessment of Building 4 is required (See attached Scope). Building Engineer is to perform detailed calculations based on as constructed dimensions and concrete tests to prove column size and (if required) :

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

Building 4- High stress in columns

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Building 3 – Columns are stressed in excess of normal design levels

Outline calculations indicate that columns within Building 3 are stressed in excess of the normal design levels. Building Engineer is to perform detailed calculations based on as constructed dimensions and concrete tests to prove column size and (if required) :

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

Building 3- Column Stresses

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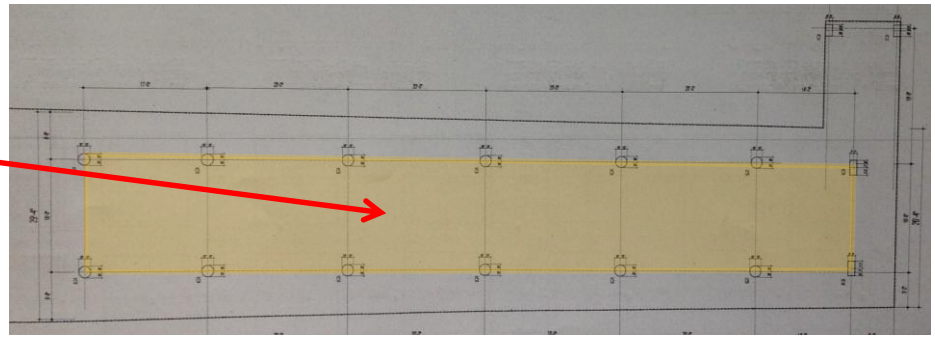
Building 2 - High stress in columns

Storage loading within Building 2 on upper floors. Estimated loading in areas up to 4.9kPa. Cursory calculations indicate that column stresses are fairly high.

Large water tank on roof of Building 2 (currently empty). Factory management indicate no intention to fill this tank. Tank should remain empty until checks completed.



High stress in columns in Building 2

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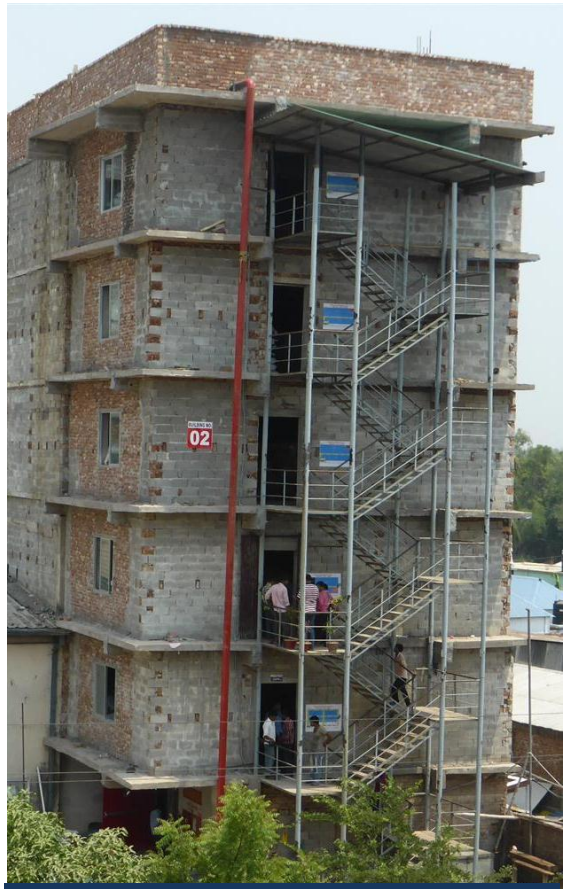
Non-engineered steel stairs around and within buildings

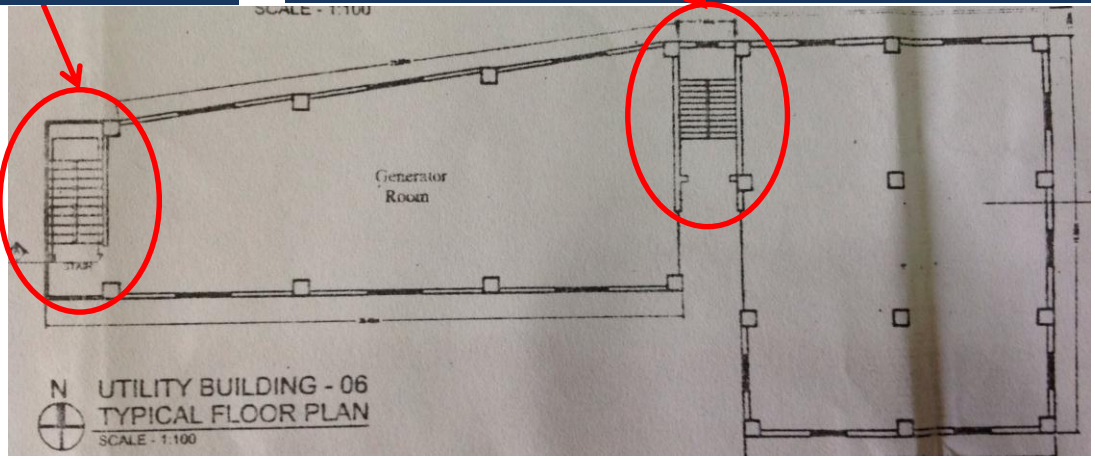


Escape stairs to Building 2

Access to mezzanine level within Building 5

Steel escape stairs provided between Buildings 3 and 6.

Stairs within Building 6 not constructed. Factory management indicate this will be constructed in future.



Numerous steel stairs around and within buildings which appear to be non-engineered.

Steel stairs around and within buildings

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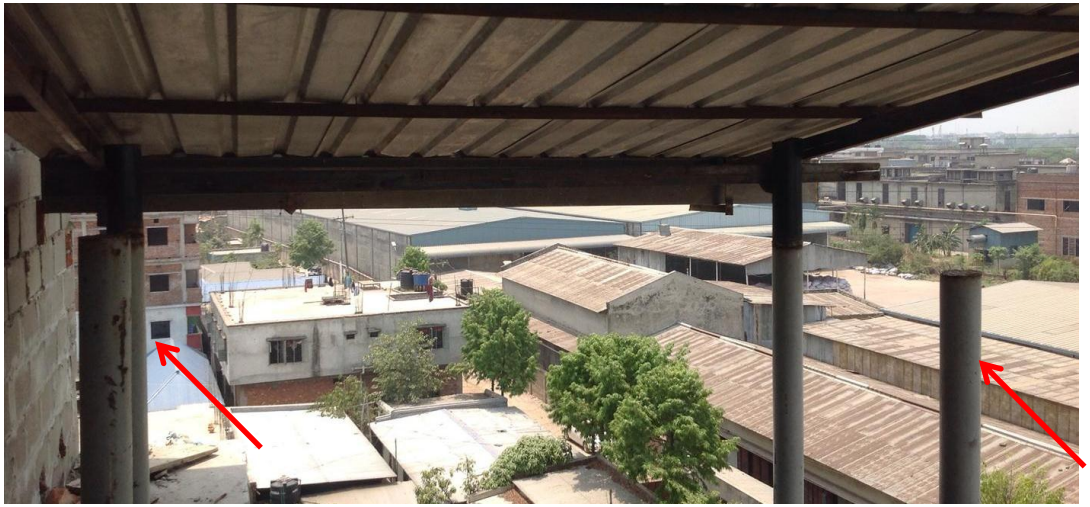
Stairs have limited independent lateral stability systems and poor connections to neighbouring buildings.



Some evidence of minor corrosion to steelwork. Water flowing down stairs between Building 3 and Building 6.

Steel stairs around and within buildings

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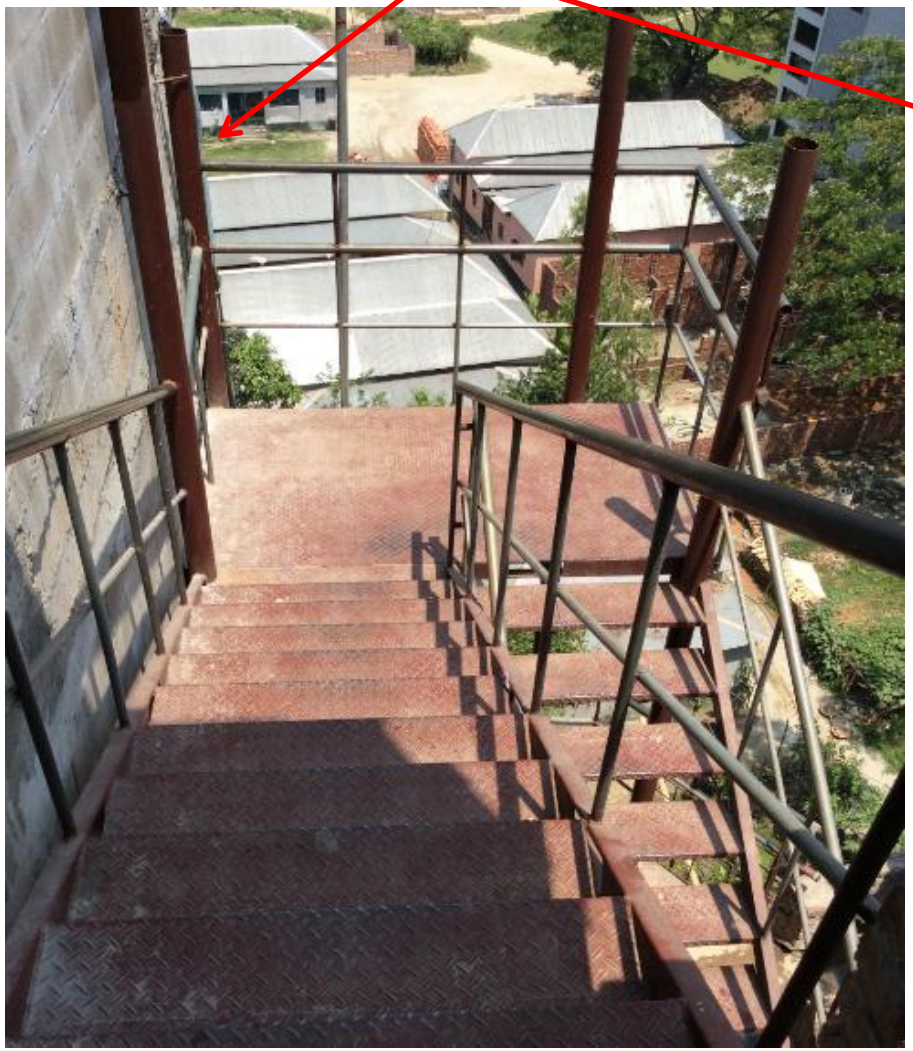
Fire escape stairs adjacent to Building 3 has no apparent lateral stability system and is not tied into the Building 3 structure.



View of North facing side

Steel stairs around and within buildings

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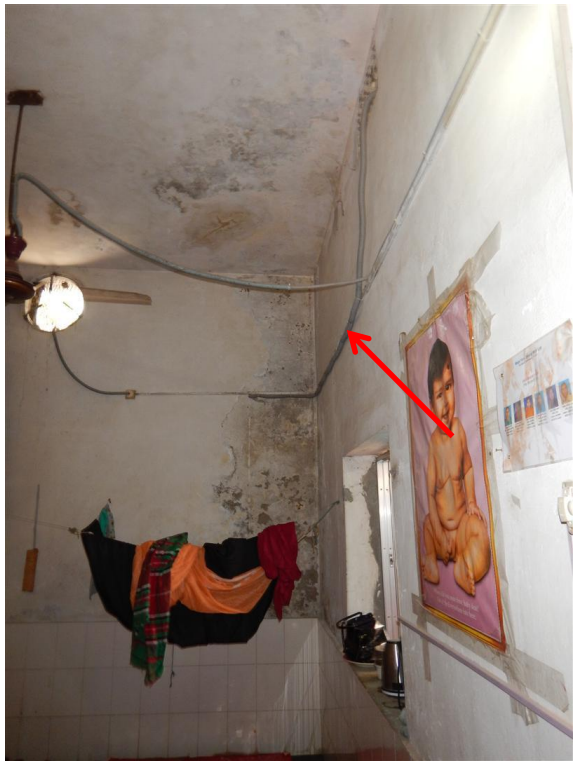
Structural cracking in Doctor's Room and Crèche



Areas of dampness observed on walls and ceiling of Crèche/Doctor's Room. Solid concrete water tank located directly above.

Structural cracking observed in beam in Doctor's Room.

Water tank above Crèche

Structural cracking observed in column in Crèche/Doctor's Room.

Structural cracking in Doctor's Room and Crèche

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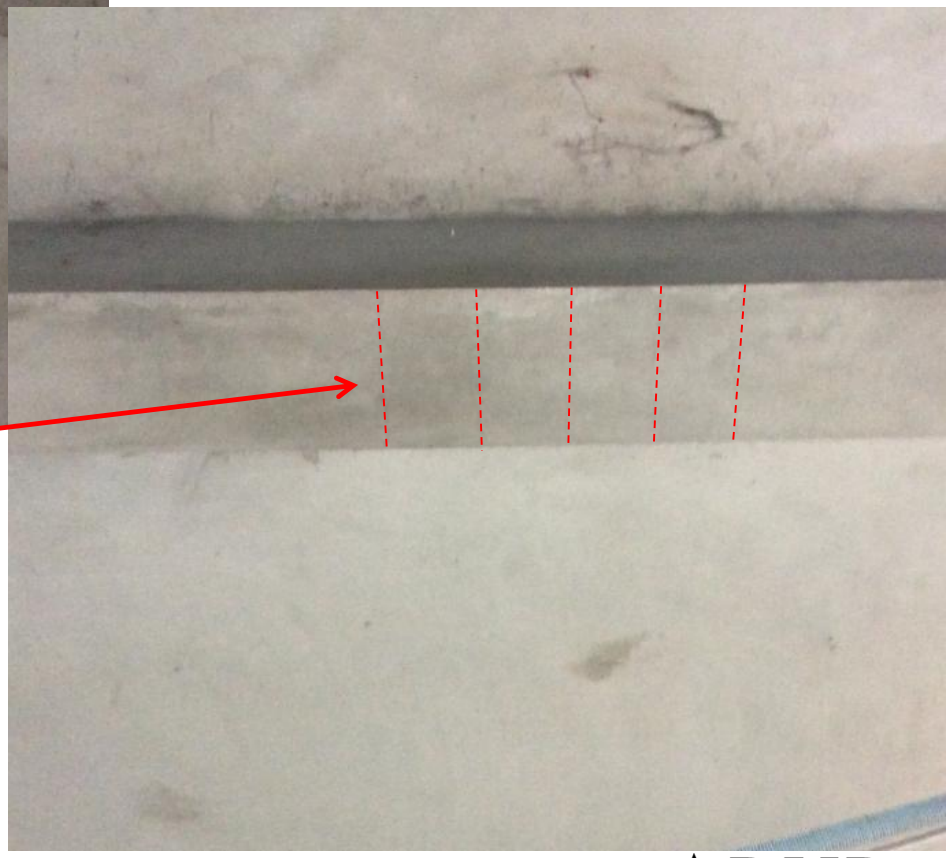
Building 4 - Cracking of beams on the underside of 1st floor



Cracking at mid-span in beams in Building 4 at underside of 1st floor. Building Engineer to investigate cause of cracks and to inspect if cracks go through plaster to the structure.

Cracking in Beams

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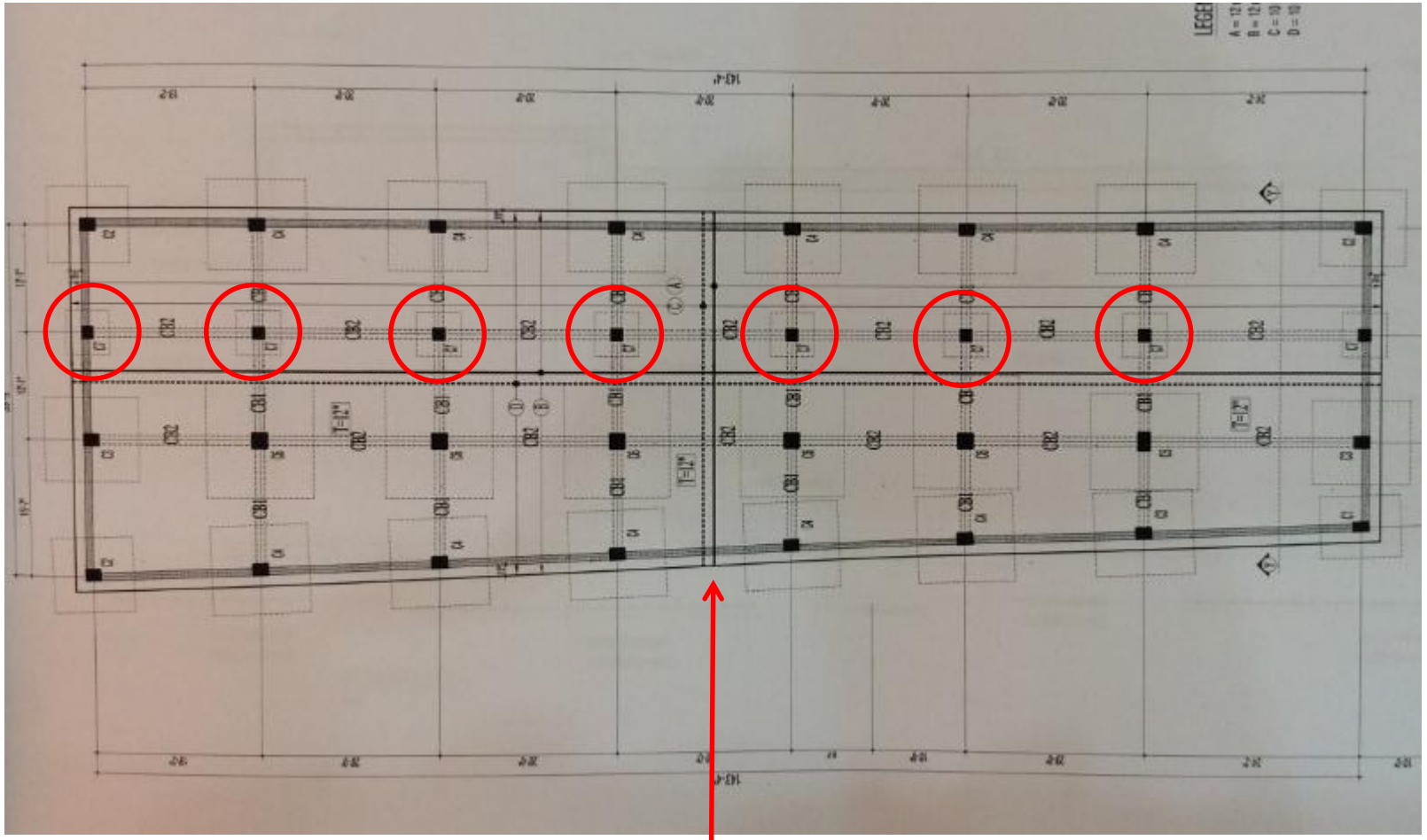
Building 3 – No access for inspection of columns within reservoir below ground floor level



Large reservoir located under the entire footprint of the ground floor. Additional columns to support the slab below ground floor noted in red. This reservoir was concreted over, by the ground floor slab, so no access was available to inspect. We recommend that the reservoir is periodically drained for a Building Engineer to inspect these columns

Building 3 Inspection of critical columns

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Building 3 - Water pooling on roof

Water pooling on roof due to lack of drainage routes and leak in water tank.

Building Engineer to review and ensure that

- **Debris is cleared from roof**
- **Roof weatherproofing is provided**
- **A roof drainage system is provided**

Building 3 – Water pooling on roof

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Building 3 - Work to parapet wall to be completed

Work to parapet wall to be completed by removing highlighted area to give access to roof from stairs.

View of North facing side

View of roof

Building 3 - Parapet wall

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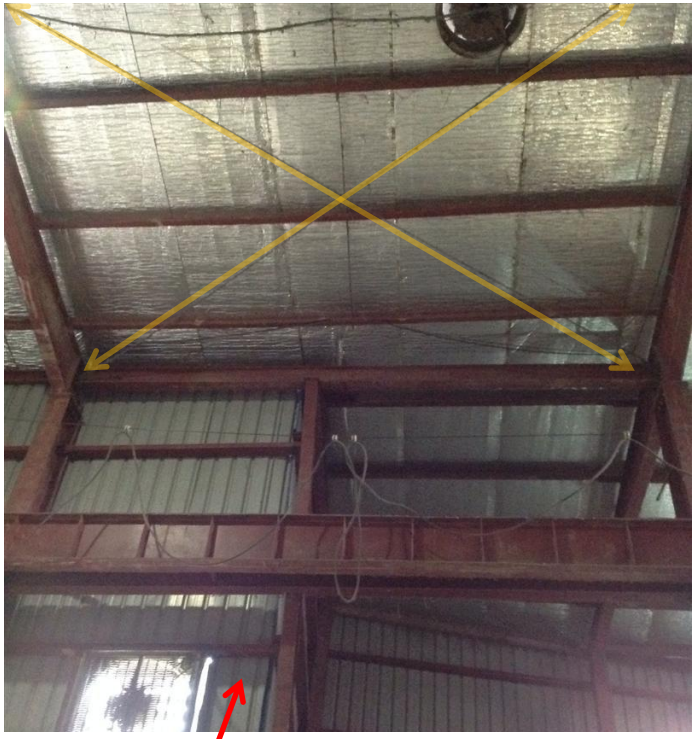
Unclear lateral stability systems in Building 5 and Building 9

Building 5 steelwork supported on Building 4 columns, but do not appeared to be tied in. Concrete beams have not been cast.



Unclear lateral stability system in Building 5 (dyeing shed). Plan bracing does not coincide with vertical braced bay. Generally well engineered steelwork otherwise.

Unclear lateral stability system in Building 5

One way slab in two storey extension

Flat slab construction

Unclear lateral stability system in Building 9 (office) for mix of 'beam and slab' and 'flat slab' construction for main building and 'one way slab' for two storey extension.

Beam and slab construction

Unclear lateral stability system in Building 9

Non-engineered structures within the complex

Fabric roof with no plan bracing. No apparent stability system for storage building.

Lightweight roofs with no apparent stability system. Roofs susceptible to wind uplift due to inadequate holding down connections.

Numerous non-engineered sheds and outbuildings observed within the complex. Generally to south of site.

Non-engineered structures within the complex

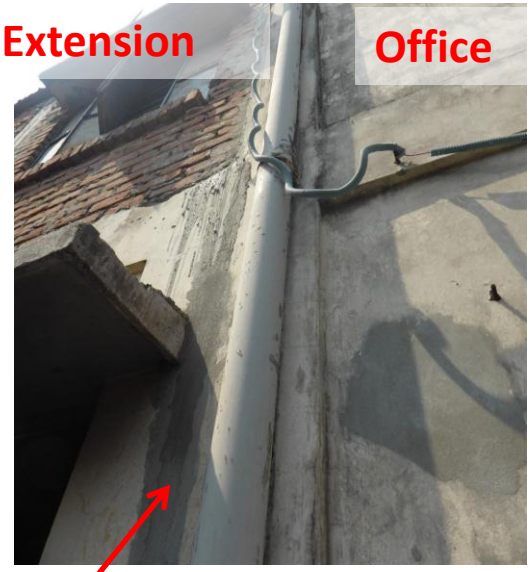
Masonry piers used to support concrete beams.

Poor maintenance to buildings within the complex.

Non-engineered structures within the complex

Settlement of office building and ETP

Marsh land observed to rear of office and ETP.



Evidence of settlement of outbuildings at rear of office building and of ETP tank. Cracking at joints between structures.

Cracking to ground bearing slabs observed in Building 9 (office) and noticeable deflections in ground floor slab.

Settlement of office building and ETP

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Workmanship issues with concrete

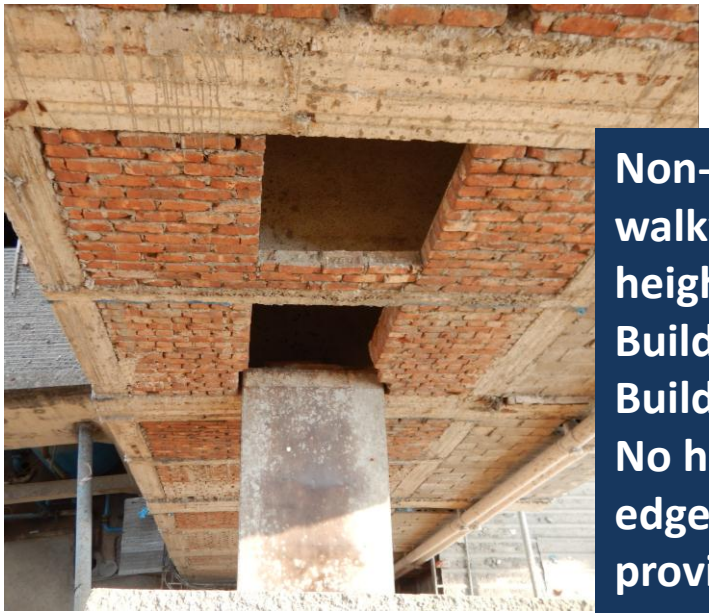
Rough finish to concrete – slab soffits, beams and columns. Rust staining on soffits.

Poor compaction of concrete in columns and other structural elements observed.

Workmanship issues with concrete

Non-structural observations

Unprotected open edges at mezzanine level in Building 5.



Non-engineered walkway at height between Building 2 and Building 4.
No handrails or edge protection provided.

Numerous undocumented openings within Building 5 mezzanine slab.

Many open drains, gulleys and large excavations throughout the factory complex – both within and around buildings.

Non-structural observations

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Priority Actions

Problems Observed

1. Building 4 - High stress in columns requires immediate review
2. Building 3 – Columns are stressed in excess of normal design levels
3. Building 2 - High stress in columns
4. Inadequacy of steel stairs around and within buildings
5. Structural cracking in Doctor's Room and Crèche
6. Building 4 - Cracking of beams on the underside of 1st floor
7. Building 3 – No access for inspection of columns within reservoir below ground floor level
8. Building 3 - Water pooling on roof and incomplete parapet wall
9. Unclear lateral stability systems in Building 5 and Building 9
10. Non-engineered structures within the complex
11. Settlement of office building and ETP tank
12. Non-structural observations

Item No.	Observation	Recommended Action Plan	Recommended Timeline
1	Building 4 - High stress in columns requires immediate review and the preparation of a Detail Engineering Assessment	Building Engineer to review design, loads and column stresses in production Building 4.	**Immediate - Now**
2	Building 4 - High stress in columns requires immediate review and the preparation of a Detail Engineering Assessment	Verify in-situ concrete strengths either by cores or existing cylinder strength data for ground floor columns or by taking cores from 4 columns in Building 4.	**Immediate - Now**
3	Building 4 - High stress in columns requires immediate review and the preparation of a Detail Engineering Assessment	A Detail Engineering Assessment of Building 4 only to be commenced, see attached Scope.	**Immediate - Now**
4	Building 4 - High stress in columns requires immediate review and the preparation of a Detail Engineering Assessment	Produce and actively manage a loading plan for all floor plates within the factory giving consideration to floor capacity and column capacity.	**6-weeks**
5	Building 4 - High stress in columns requires immediate review and the preparation of a Detail Engineering Assessment	Detail Engineering Assessment to be completed for Building 4.	**6-weeks**
6	Building 4 - High stress in columns requires immediate review and the preparation of a Detail Engineering Assessment	Continue o 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. 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 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
7	Building 3 – Columns are stressed in excess of normal design levels	Factory Engineer to review design, loads and column stresses in Building 3 as identified above.	**6-weeks**
8	Building 3 – Columns are stressed in excess of normal design levels	Verify in-situ concrete strengths either by cores or existing cylinder strength data for ground floor columns or by taking cores from 4 columns in Building 3.	**6-weeks**
9	Building 3 – Columns are stressed in excess of normal design levels	Produce and actively manage a loading plan for all floor plates within the factory giving consideration to floor capacity and column capacity.	**6-months**
10	Building 2 - High stress in columns	Factory Engineer to review design, loads and columns stresses in area identified above.	**6-weeks**
11	Building 2 - High stress in columns	Verify insitu concrete stresses either by existing cylinder strength data for by 100mm dia. cores from 4 columns.	**6-weeks**
12	Building 2 - 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.	**6-months**
13	Inadequacy of steel stairs around and within buildings	All steel stair structures within the complex to be reviewed and assessed for adequacy by Building Engineers. Strength, stability and detailing of connections to other structures to be considered.	**6-weeks**
14	Inadequacy of steel stairs around and within buildings	A fire evacuation scenario to be used to determine loading requirements on all stairs.	**6-weeks**
15	Inadequacy of steel stairs around and within buildings	Strengthening works to steel stair structures as required by Building Engineer assessment to be completed.	**6-months**

Item No.	Observation	Recommended Action Plan	Recommended Timeline
16	Structural cracking in Doctor's Room and Crèche	Empty water tank above and do not use until Building Engineer has reviewed the building and any strengthening works are complete.	**6-weeks**
17	Structural cracking in Doctor's Room and Crèche	Building Engineer to identify all cases of cracking and distress of structural elements in the Doctor's Room and Crèche. Strength and integrity of existing structural elements to be assessed.	**6-weeks**
18	Structural cracking in Doctor's Room and Crèche	Strengthening works and crack repairs to be implemented, as necessary, to Building Engineer's details.	**6-weeks**
19	Structural cracking in Doctor's Room and Crèche	Strengthening works and crack repairs to be completed.	**6-months**
20	Structural cracking in Doctor's Room and Crèche	Continue to monitor cracking and signs of element distress in this area.	**6-months**
21	Building 4 - Cracking of beams on the underside of 1st floor	Monitor cracks in beams. Conduct regular inspection of cracks. Investigate if cracks are only in the plastering.	**6-months**
22	Building 4 - Cracking of beams on the underside of 1st floor	If cracks grow larger, remove all items above the beams and close working areas below the affected areas . Engage an engineer to investigate, repair and strengthen the beam.	**6-months**
23	Building Engineer to inspect the columns under the ground floor of Building 3 once the reservoir has been drained.	Reservoir to be drained to undertake annual inspections to satisfy the Building Engineer that corrosion is not occurring. After this time, if no corrosion is present, inspections to be at a less frequent period of 3-5 years.	**6-months**
24	Building Engineer to inspect the columns under the ground floor of Building 3 once the reservoir has been drained.	Due attention to safety of inspection when undertaking assessment of reservoir columns in confined space.	**6-months**

Item No.	Observation	Recommended Action Plan	Recommended Timeline
25	Roof of Building 3: Water accumulation and leaking with potential to cause corrosion and lasting damage to roof slab. Parapet wall works to be completed.	Repair leaks in water tanks.	**6-months**
26	Roof of Building 3: Water accumulation and leaking with potential to cause corrosion and lasting damage to roof slab. Parapet wall works to be completed.	Roof weatherproofing to be provided	**6-months**
27	Roof of Building 3: Water accumulation and leaking with potential to cause corrosion and lasting damage to roof slab. Parapet wall works to be completed.	Building Engineer to inspect drainage routes to ensure they are functioning properly.	**6-months**
28	Roof of Building 3: Water accumulation and leaking with potential to cause corrosion and lasting damage to roof slab. Parapet wall works to be completed.	Parapet wall works to be completed	**6-months**
29	Unclear lateral stability systems in Building 5 and Building 9	Building Engineer to review overall building stability systems in Building 5 and Building 9.	**6-months**
30	Unclear lateral stability systems in Building 5 and Building 9	Strengthening works for buildings to be implemented as necessary, to Building Engineer's details.	**6-months**

Item No.	Observation	Recommended Action Plan	Recommended Timeline
31	Non-engineered structures within the complex	Building Engineer to undertake structural assessment of all sheds and outbuildings within complex and specify upgrades as required to meet code vertical and wind loading.	**6-months**
32	Non-engineered structures within the complex	All sheds and outbuildings connected to factory buildings to be documented on as built drawings.	**6-months**
33	Settlement of office building and ETP tank	Trial pit to be dug to establish footing of extensions to office building and ETP tank and Building Engineer to assess whether foundation is adequate	**6-months**
34	Settlement of office building and ETP tank	Remedial works to foundations and/or cracking, where required, to be developed to Building Engineer's details.	**6-months**
35	Settlement of office building and ETP tank	Continue to monitor settlement and cracking in and around Building 9 and ETP as required.	**6-months**
36	Non-structural observations	All open edges around mezzanines and on walkway structures to be provided with edge protection – kick plates and handrails to Building Engineer's specifications.	**6-months**
37	Non-structural observations	All open gulleys, channels and excavations to be covered or enclosed. Alternatively, handrails to be provided around all openings.	**6-months**