Moon Readywears Ltd.

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(23.937438,90.299281)
13 April 2014

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ARUP

Observations

Discrepancies between Design & Construction which affect Stability

Undocumented Structure / As built discrepancies – Building 1

A. As built edge of lift core and adjacent column do not align as shown on structural drawings. Beam cantilever created.

B. From review of the level 6 soffit it is clear the beam support arrangement within the men's toilet area does not match other floors. Design load path at level 6 unclear.

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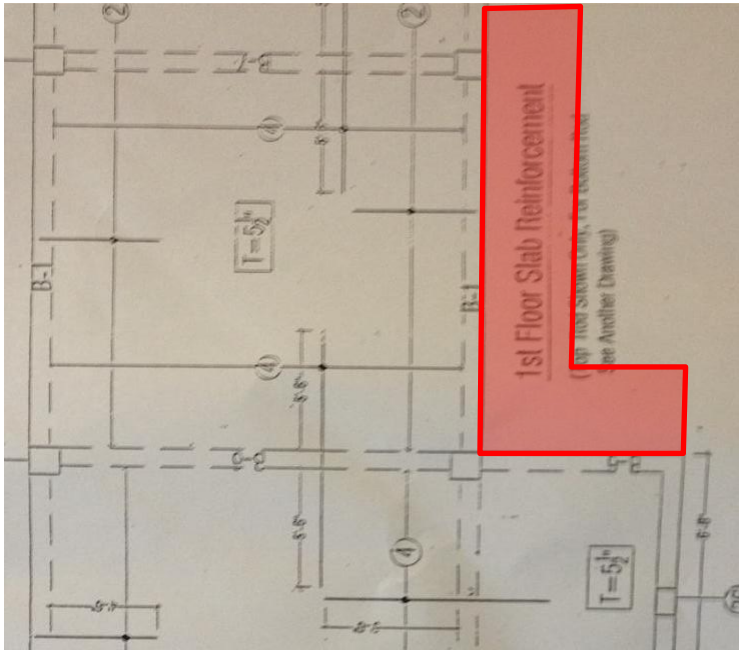
Undocumented Structure / As built discrepancies – Building 2



D. Undocumented first floor slab cantilever noted above in red. Similar cantilever is reflected in roof above. Deflection induced distress observed in non structural elements. Concrete cracking in roof perimeter downstand likely induced by hanging load path to cantilevered roof edge.

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Severe Distress in Roof Parapet

Undocumented non-engineered roof parapet shows signs of severe distress. Large cracks evident at base of cantilever within wall and pier. Redundancy limited.

Non-engineered Escape Stairs and Site Structures

- Steel stairs and RC landings are not documented on structural drawings.
- Stair bridges across movement joint from ground to level 3.
- Corrosion evident at treads and landings.
- Stringer welded connection to undocumented concrete landing reinforcement susceptible to corrosion, fatigue and large axial forces. Axial forces induced by main building thermal movement due to bridging of movement joint by stair.
- Stair braced at each floor level.

Numerous single storey small buildings, remote from the main buildings identified, are not included in structural documentation and are not specifically addressed in this structural inspection report. Note the uninhabited structure pictured left is clearly unsafe and should be demolished or remediated as per the building engineers instructions immediately.

Lack of Relevant Documentation

Undocumented Structure – Building 3 and 4

Building 3

Building 3

Building 4

Building 3/4sim

Building 3

- No relevant drawings for building 3 and 4 steel and concrete structure including trusses, connection details, reinforced concrete structure, foundations, ground floor slab details.
- Member arrangement and connection configuration suggests buildings have not been engineered.
- Lateral stability of steel roofs unresolved.
- Signs of distress in both structures evident.

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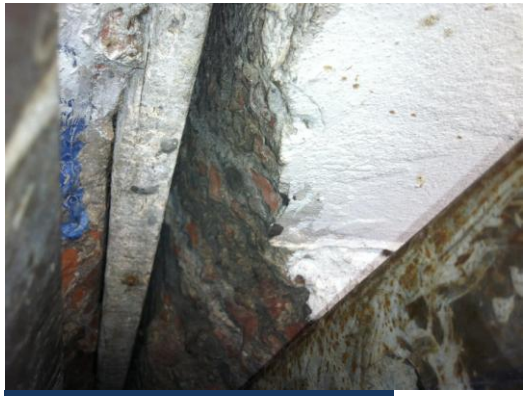
Ambiguous Specification of Materials & As-Built Material Variation within Structure

ROD	Yield Strength (fy) = 60000 psi for columns = 40000 psi for all others
STRUCTURAL CONCRETE	Minimum Compressive Strength (f 'c) after 28 days = 3500 psi upto SLAB-2. excluding SLAB-2) = 3000 psi from SLAB-2 to above)
	Mix Proportion (Cement : Fine aggregate (sand) : Coarse Aggregates) = 1 : 1.5 : 3 with volume basis
CEMENT	Cement Should be Confirmed BDS 232. local produced cement is recommended
COARSE AGGREGATES	Crushed Stone Chips with maximum size = $\frac{3}{4}$", for 3500 psi concrete Pick Jhama Chips with maximum size = $\frac{3}{4}$", for 3000 psi concrete

Photocopy Attested
For Prime Bank Limited
Mouchak Branch, Dhaka.
Authorised Signature
Md. Faizur Rahman Mazumder.
A. S. no—144

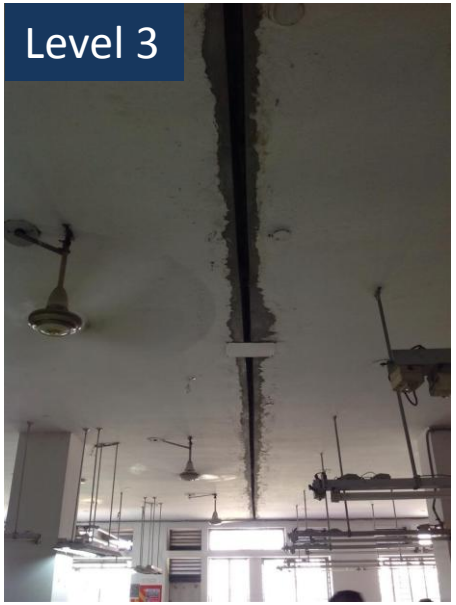


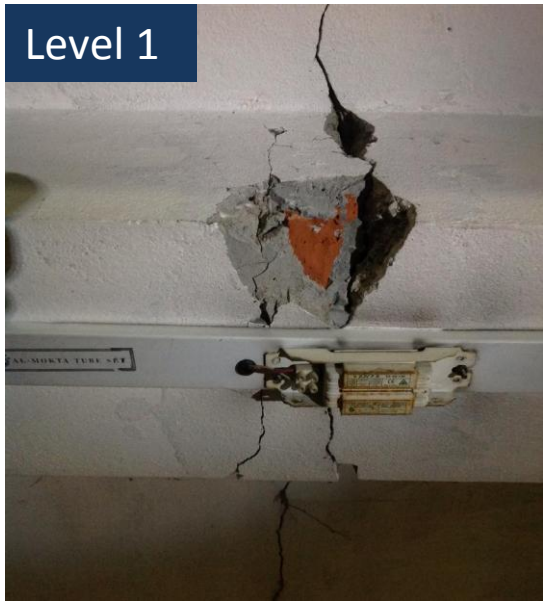
Building 1 slab

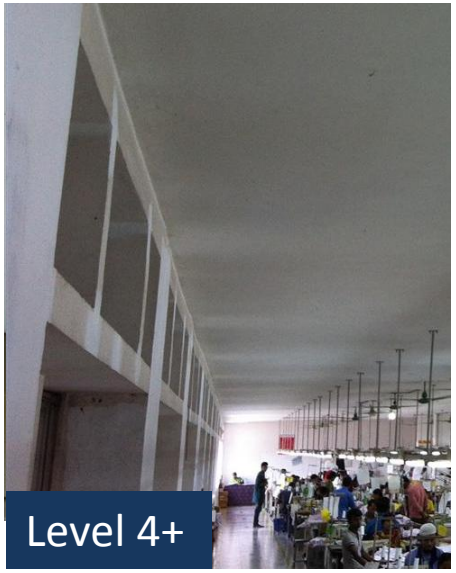
- Structural design documents specify natural stone and brick aggregate. SLAB-2 element designation not found within structural documents hence specification ambiguous.
- Brick aggregate observed throughout building 2 and within building 1 slabs and beams.
- It is not clear if brick aggregate concrete achieves minimum compressive strength required by design. I.e. 3000 psi specification is consistent with stone aggregate.
- Stone aggregate observed within building 1 columns.

Building 2 column

Design Assumptions Regarding Movement Joints







- Structural design documents specify an expansion joint at all floors.
- Expansion joint filled with brick/render finish at level 1 and 2.
- Expansion joint not constructed above level 3.
- Lateral system design may not account for forced compatibility at levels where joint not installed/ improperly installed.

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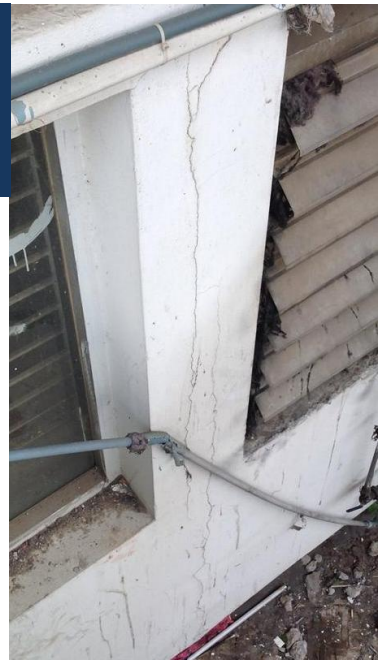
Level 3 façade

Ground Level façade



- Distress evident where façade bridges across movement joint.
- Distress in beams and slabs evident where movement joint not installed. Number and size of cracks is maximum at roof where thermal load magnitude is highest.

Level 6 slab soffit

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Floor Load Management

- Floor load management system incomplete as no loading plans observed at the suspended floors.
- Localised areas of storage loading.
- Heavyweight internal brick partitions constructed on suspended floors.

Problems Observed

1. Discrepancies between design and construction.
2. Severe distress in roof parapet.
3. Non-engineered steel stairs and site structures.
4. Lack of relevant design documentation.
5. Ambiguous specification of materials and as-built material variation within structure.
6. Design assumptions regarding movement joints.
7. Floor load management.

Item 1 and actions

Discrepancies between design and construction.

Priority 1 (Immediate - Now)	• None Required
Priority 2 (within 6-weeks)	• Undertake a detailed as built survey of building 1 and 2 recording all undocumented structures and extensions. • Record relevant materials used in construction. • Building engineer to check design where discrepancies exist. Design appropriate strengthening and/or additional support as required.
Priority 3 (within 6-months)	• Construct strengthening and/or additional support specified by the building engineer. • Complete as-built drawings for buildings 1 and 2 incorporating any remedial or strengthening works undertaken.

Item 2 and actions

Severe distress in roof parapet

Priority 1 (Immediate - Now)	• Secure top of parapet to top of roof floor slab using details specified by the building engineer.
Priority 2 (within 6-weeks)	• Building engineer to review design of roof parapet and specify any strengthening and/or additional support required in the permanent condition.
Priority 3 (within 6-months)	• Construct strengthening and/or additional support specified by the building engineer. • Complete as-built drawings for parapet incorporating any remedial or strengthening works undertaken.

Item 3 and actions

Non-engineered escape stairs and site structures.

Priority 1 (Immediate - Now)	• Provide temporary support to the site structure circled in red within observation 3.
Priority 2 (within 6-weeks)	• Building Engineer to review **escape stair** structural elements and all connection details for full access loads on stairs. • Building engineer to design appropriate strengthening works as required. • Factory manager to manage and co-ordinate any strengthening works with the fire escape strategy for all areas. • Factory Engineer to review single storey support buildings and advise on any strengthening or demolition works required.
Priority 3 (within 6-months)	• Complete strengthening works and/or demolition. Complete as built drawings for single storey structures and escape stairs.

Item 4 and actions

Lack of relevant design documentation

Priority 1 (Immediate - Now)	• None Required
Priority 2 (within 6-weeks)	• Undertake Detailed Engineering Assessment **of Building 3 and 4**. Pay particular attention to structural stability, steelwork connection details, the as built concrete frame and determining if the as built foundation systems is appropriate.
Priority 3 (within 6-months)	• Carry out all recommendations resulting from the Detailed Engineering Assessment. • Finalise appropriate structural as built drawings which incorporating the completed structural system.

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 5 and actions

Ambiguous specification of materials & as-built material variation within structure

Priority 1 (Immediate - Now)	• None Required
Priority 2 (within 6-weeks)	• Building Engineer to organising sufficient coring (100mm min) to determine the in situ strength of reinforced concrete beams and slabs (building 1) • Building Engineer to review design of all beams and slabs on the basis of actual in-situ strengths and advise appropriate load limits. • Loading plans (see Item 7) to be based on as constructed capacities of beams, slabs and columns. • Building Engineer to design any strengthening works required.
Priority 3 (within 6-months)	• Carry out any strengthening or remedial works recommended by the building engineer. • Record as built materials for structural elements on as built drawings.

Item 6 and actions

Design assumptions regarding movement joint

Priority 1 (Immediate - Now)	• None.
Priority 2 (within 6-weeks)	• Building engineer to review design of lateral load support system and floor diaphragms. • Design review to ensure in plane loading of diaphragms is considered. E.g. shrinkage and thermal effects in combination with lateral loads as appropriate. • Building engineer to review façade and advise if any remediation is necessary to ensure structural sufficiency for the full design life.
Priority 3 (within 6-months)	• Construct strengthening and/or additional support specified by the building engineer. • Complete as-built drawings for any façade or primary structure modified to incorporate remedial works undertaken.

Item 7 and actions

Floor load management

Priority 1 (Immediate - Now)	• None
Priority 2 (within 6-weeks)	• Building engineer to produce loading plans to be displayed at each floor level. Allowable load allowance to be calculated considering existing super imposed dead loads (E.g. floor finishes and partition walls). Factory manager to actively manage floor usage in accordance with the loading plan.
Priority 3 (within 6-months)	• Continue to implement load plan.