Sterling Apparels Ltd.
Optimum Garments Ltd.
Unicorn Sweaters

Baron, Earpur Union, Ashulia, Dhaka
Baron, Earpur Union, Ashulia, Dhaka
(23.936253N, 90.296288E)

12 MARCH 2014

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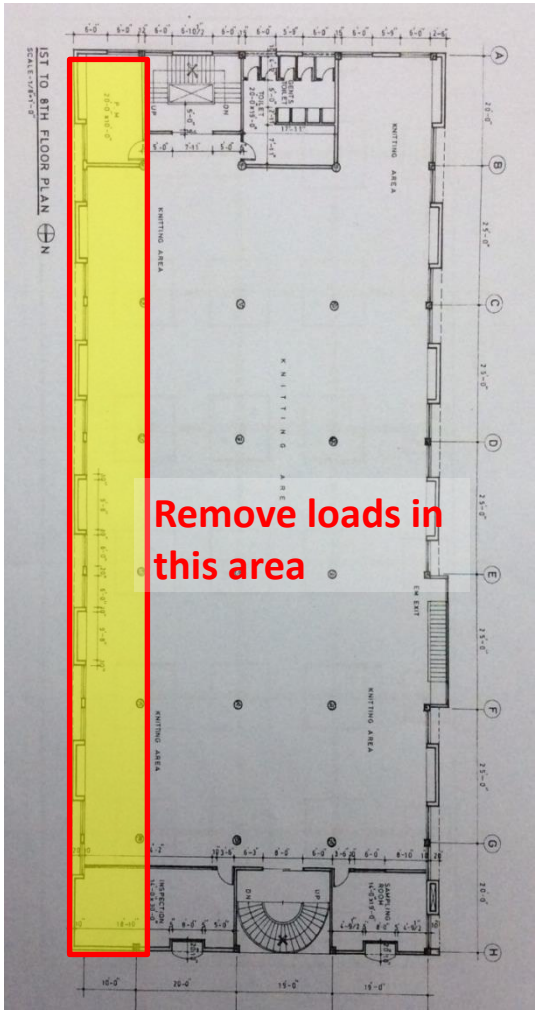
ARUP

Executive Summary (Continued)

We do have some important concerns with the Main Production Building that need to be addressed immediately. These concerns are due to the following:



- A significant building cantilever imposes high loading on the building perimeter columns.
- Crushed brick aggregate was encountered in columns which does not appear to be consistent with design strength required as noted on the structural drawings

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

1. **All loads, including equipment, garments and personnel, in the area highlighted on levels 1 to 7 are to be removed pending verification of column capacity by the Building Engineer. Maintain Loads in all other areas at current levels.**

3. **A Detail Engineering Assessment** of the as constructed **Main Production Building** is requested and this should be commenced immediately to the requirements of the scope attached and addressing the concerns as noted. We would recommend that the Detail Engineering Assessment for this building be completed **within 6 weeks** of receiving the report.

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Observations

Highly Stressed Column

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

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

- **Reduce loads by vacating floors and removing addition structures**
- **Reinforce columns**

Brick Aggregate Observed

Highly stressed column

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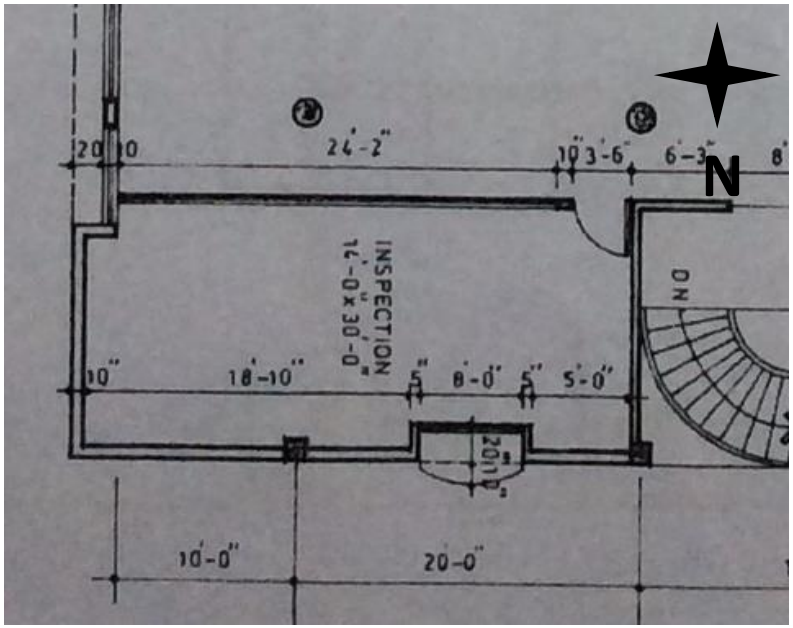
Long Span Cantilever



Cantilever on east façade along full length of building

Long spanning cantilever on east façade. Showing evidence of excessive deflection and distress of facades

Structural drawings show a length of 3.535m.

Numerous signs of distress are visible on walls supported on façade.

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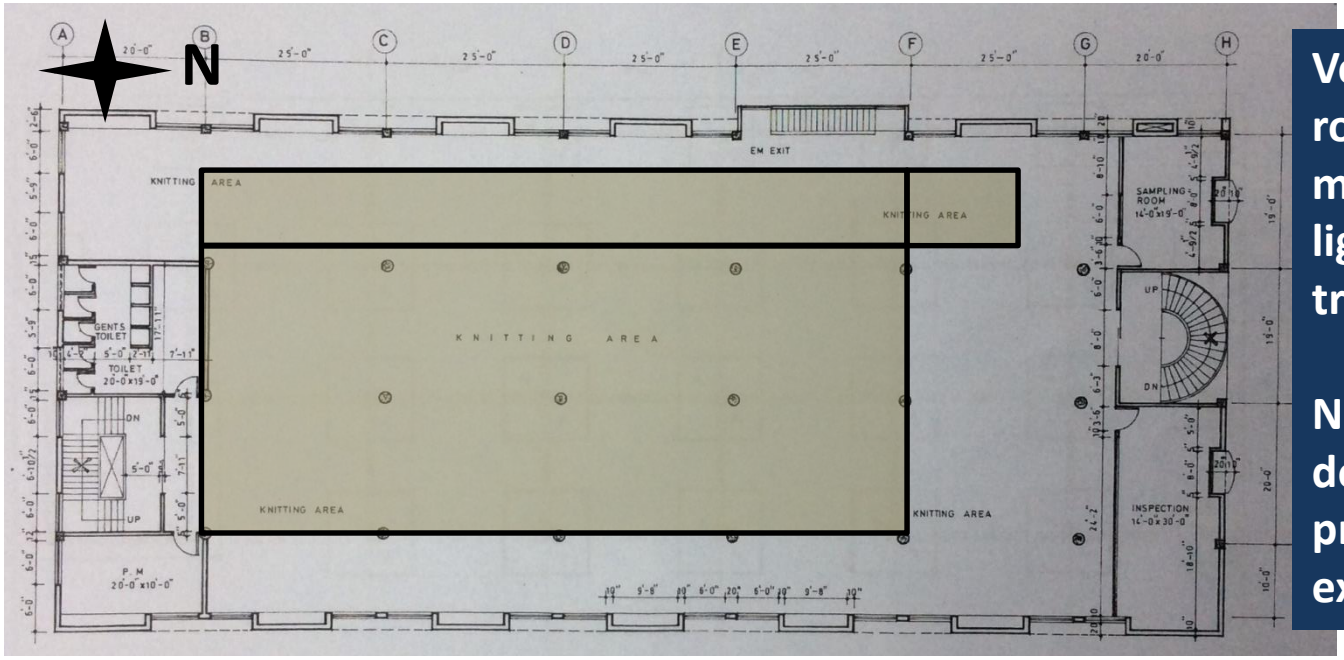
Vertical Extension



Vertical extension on roof comprising of brick masonry walls with a lightweight steel trussed roof.

No structural or design documentation provided for canteen extension.

Check on roof additions required

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

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

Check on roof additions required

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Localised Areas of High Loading

NOTE: Remove all Loads including storage on Cantilever Area as highlighted on Page 2

Areas of high loading on structure.

Storage Area for rolled unworked fabric at northern end of 4th Floor

Bonded warehouse located on 1st Floor of structure (including long span cantilever).

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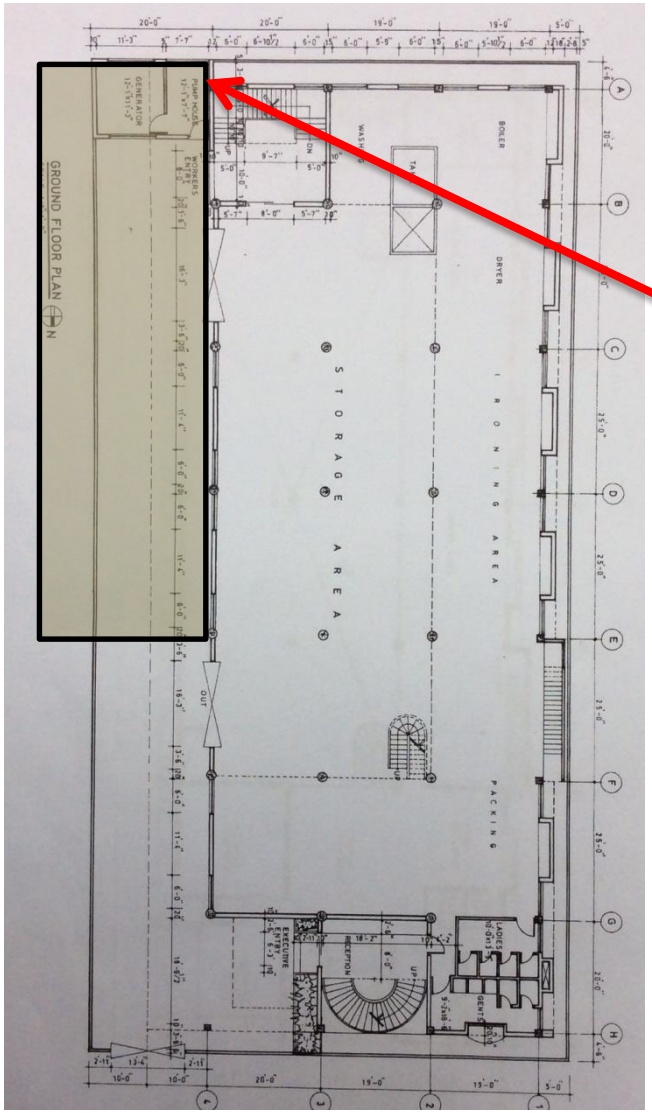
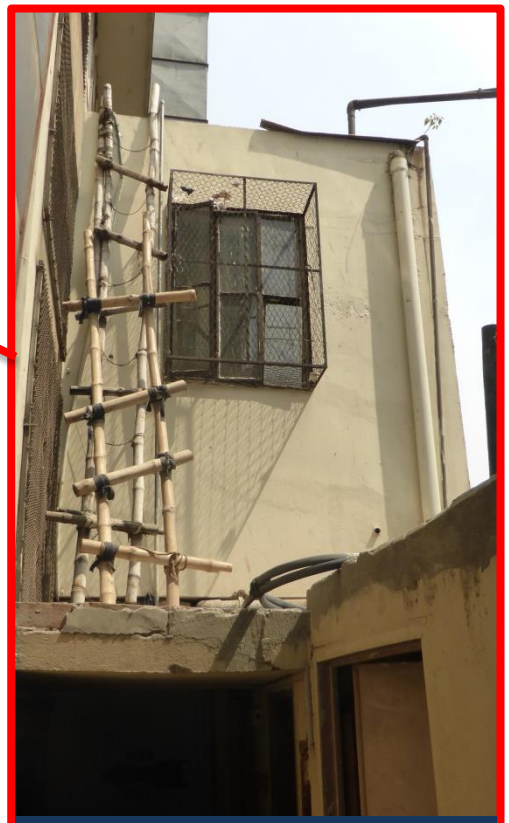
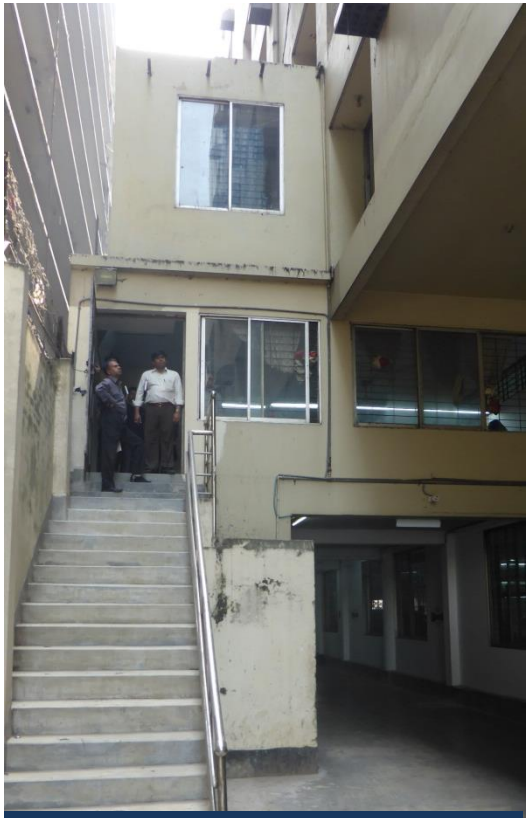
Horizontal Extension





View at rear of Building



View from Front of Building

Horizontal extension on east face of building.
Extension from ground to first floor.

No structural or design documentation provided for horizontal extension.

Building engineer to carry out detailed structural analysis of extension.

Horizontal Extension

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Horizontal extension support column was opened to note the aggregate type.
Found that support consist of a brickwork column with render.
Assessment of adequacy and working stress on column must be carried out by Building Engineer.

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Protection for Critical Element Adjacent to Vehicular Access

Critical element located at front of structure adjacent to truck access. Assessment of impact to column required by Building Engineer. Consider impact protection as appropriate

Protection for Critical Column

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Soils Report –
Recommendation vs Design Drawings

15. CONCLUSIONS:

On the basis of above analysis and discussions, the following conclusions may be drawn regarding the sub-soil condition of the project area.

a. The overall soil formation of the investigated site are more or less regular in between the bore hole locations.

b. The top layer of the investigated site have been encountered with comprising gray silt with clay (Ref. bore logs).

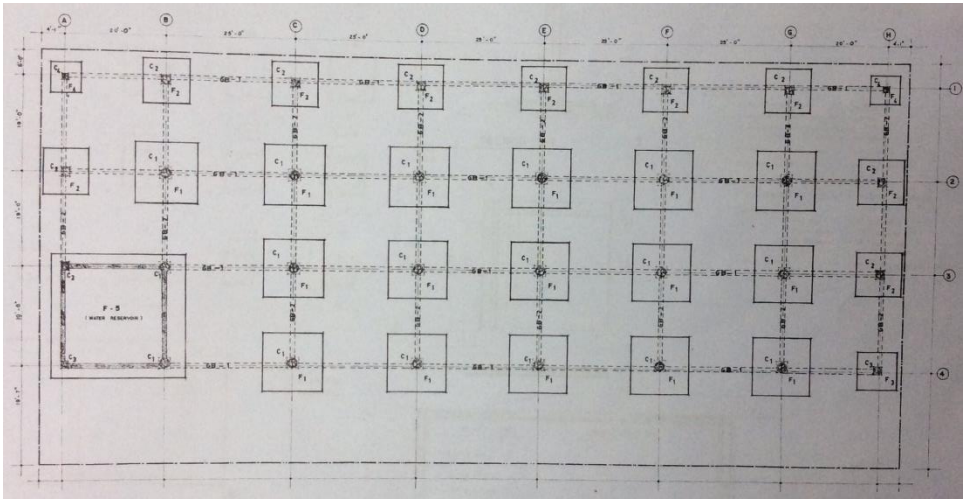
c. The underlying soil is of fine to medium sand extending up to the final depth of borings (Ref. bore logs).

d. Bearing capacities for Shallow Foundation as Isolated column footing are not moderate / suitable for all borings (Ref.Table-5).

e. Raft Foundation may be provided as moderate at the site.

f. R.C. C. Cast-in-situ Pile may be provided for all borings at project site.

13



Soils Report – Point d. suggests that shallow foundations are not suitable for all foundation locations.

Structural drawings show that pad foundations have been used as the foundation.

According to structural information provided, pad foundation were constructed to 1.8m below existing ground level.

Assessment of adequacy of foundation needs to be assessed by Building Engineer.

Soils report – Recommendation vs Constructed

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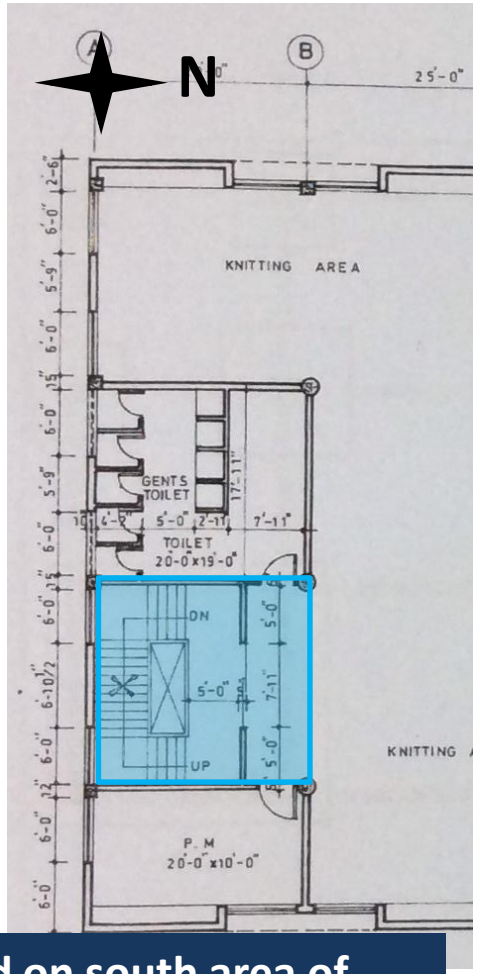
Cracks to Water Tank Support Columns



Water tank located on south area of structure over the stair core.

Visible cracking to columns supporting water tank to be investigated.

Cracks to Water Tank Support Column

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Stability of Single Storey Warehouse

Lateral Stability System for Single Storey industrial unit unclear.

No roof bracing, perimeter walls only evident stability structure.

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Priority Actions

Problems Observed

1. Highly stressed columns.
2. Long spanning cantilever with signs of distress.
3. Vertical extension of canteen area on roof.
4. Localised areas of high loading.
5. Horizontal extension on east façade.
6. Protection of critical element adjacent to vehicular access.
7. Soil report – Recommendation vs As-Constructed
8. Cracking to water tank support columns.
9. Lateral Stability of Single Storey Industrial Building

Item No.	Observation	Recommended Action Plan	Priority
1	Highly stressed columns.	All loads, including equipment, garments and personnel, in the area highlighted on Levels 1-7 to be removed pending verification of column capacity by the Building Engineer. Maintain Loads in all other areas	**Immediate - Now**
2	Highly stressed columns.	Factory Engineer to review design, loads and columns stresses for all columns.	**Immediate - Now**
3	Highly stressed columns.	Verify insitu concrete stresses either by cores (min 100mm diameter) or existing cylinder strength data for all the columns or cores from a minimum of 4 non-critical columns.	**Immediate - Now**
4	Highly stressed columns.	A Detail Engineering Assessment (DEA) of Factory to be commenced, see attached Scope	**Immediate - Now**
5	Highly stressed columns.	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	Highly stressed columns.	Detail Engineering Assessment to be completed	**6-weeks**
7	Highly stressed columns.	Carry out strengthening as required.	**6-months**
8	Highly stressed columns.	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. 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	Priority
9	Long spanning cantilever with signs of distress.	Reduce Cantilever loading & commence DEA as per item 1 above.	**Immediate - Now**
10	Long spanning cantilever with signs of distress.	Detail Engineering Assessment to be completed as per item 1.	**6-weeks**
11	Long spanning cantilever with signs of distress.	Building Engineer to carry out design check on support structure to façade to confirm adequate strength and stiffness.	**6-weeks**
12	Long spanning cantilever with signs of distress.	Building Engineer to prepare Allowable Floor Loading Plans.	**6-months**
13	Long spanning cantilever with signs of distress.	Carry out strengthening as required.	**6-months**
14	Engineering Assessment of vertical extension for canteen on roof and horizontal extension on east face	Reduce loading as per item 1 requirements.	**Immediate - Now**
15	Engineering Assessment of vertical extension for canteen on roof and horizontal extension on east face	Detail Engineering Assessment to be completed as per item 1 to take account of additional areas.	**6-weeks**
16	Engineering Assessment of vertical extension for canteen on roof and horizontal extension on east face	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**
17	Engineering Assessment of vertical extension for canteen on roof and horizontal extension on east face	Engineer to submit design for revised structures if required.	**6-months**
18	Engineering Assessment of vertical extension for canteen on roof and horizontal extension on east face	Building engineer to check, collect information and produce accurate and complete as-built documentation soonest.	**6-months**

Item No.	Observation	Recommended Action Plan	Priority
19	Localised areas of high loading.	Reduce loading on areas highlighted for immediate action as per item 1.	**Immediate - Now**
20	Localised areas of high loading.	Create controlled loading plans for all floors, designating where storage can be placed and can not be placed taking findings of DEA and Item 1 findings into account.	**6-weeks**
21	Localised areas of high loading.	Continue to implement load plan.	**6-months**
22	Protection of critical element adjacent to vehicular access	Place temporary warning /protection (e.g. traffic cone, sand filled barrels as deemed appropriate by Building Engineer) at 1m from column faces.	**Immediate - Now**
23	Protection of critical element adjacent to vehicular access	Building engineer to design appropriate impact protection for critical column adjacent to truck access zone.	**6-weeks**
24	Protection of critical element adjacent to vehicular access	Continue to assess and maintain protection	**6-months**
25	Assessment of design of foundations in comparison to recommendations of soils report	Detail Engineering Assessment to be completed as per item 1.	**6-weeks**
26	Assessment of design of foundations in comparison to recommendations of soils report	Building Engineer to review the Geotechnical (Soils) Report by comparison with the construction drawings and the use of pad foundations rather than piled /raft foundations as recommended within the Soils Report.	**6-weeks**
27	Assessment of design of foundations in comparison to recommendations of soils report	Building Engineer to confirm by calculations and records of site construction that foundation bearing is adequate.	**6-weeks**
28	Assessment of design of foundations in comparison to recommendations of soils report	Implement actions arising from DEA.	**6-months**

Item No.	Observation	Recommended Action Plan	Priority
29	Cracking observed to water tank support structure	Detail Engineering Assessment to be completed as per item 1.	**6-weeks**
30	Cracking observed to water tank support structure	Sections of plaster finish to walls to be removed to investigate if cracks penetrate the building structure.	**6-weeks**
31	Cracking observed to water tank support structure	Verify that beam/slab has sufficient capacity to support fully filled water tank.	**6-weeks**
32	Cracking observed to water tank support structure	Limit water to appropriate level if required.	**6-weeks**
33	Cracking observed to water tank support structure	Carry out repair or strengthening as required.	**6-months**
34	Lateral Stability of Single Storey Warehouse Building	Building Engineer to verify that building has an appropriate lateral stability system and submit relevant design documents	**6-weeks**
35	Lateral Stability of Single Storey Warehouse Building	Carry out strengthening work if required.	**6-months**