Comfit Composite Knit LTD (Unit 2)

Amtola, Kathgora Bazar, Ashulia, Savar, Dhaka

(+23.907331N, 90.288456E)

29th March 2014

ACCORD on Fire and Building Safety in Bangladesh

ARUP

Executive Summary (Continued)

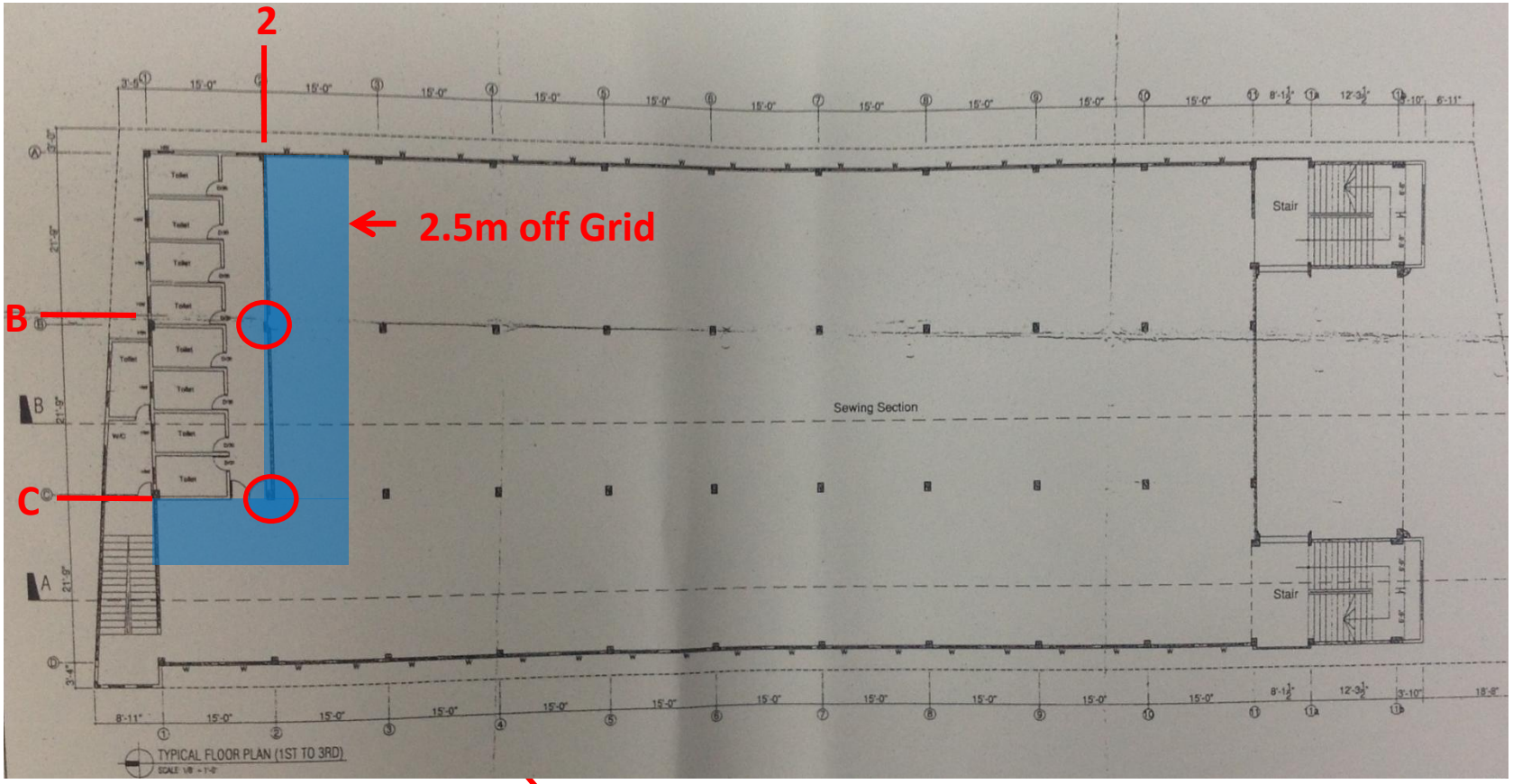
We do have important and urgent concerns in relation to the adequacy of the structural support columns. A Detail Engineering Assessment should be carried out and this needs to be addressed immediately.

The principal reasons for our concern is that columns appear to be stressed to levels that require **immediate** review and there are significant differences between the design drawings and the permit drawings/as constructed structure. We would recommend that the Detail Engineering Assessment for this building be completed **within 6 weeks** of receiving the report.

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

1. **Loads to be reduced in the areas highlighted on the following sheet pending verification of column capacity by the Building Engineer.**
2. A Detail Engineering Assessment of the as constructed **Factory Building** is requested and this should be commenced immediately to the requirements of the scope attached and addressing the concerns as noted. The DEA should be completed within 6 weeks of issue of this report.

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.



- Vacate highlighted area on 1st to 3rd floors (Live load reduced to 0 KN/m^2 - toilets may be accessed through this area)
- All storage in highlighted area to be removed

Immediate Action Required

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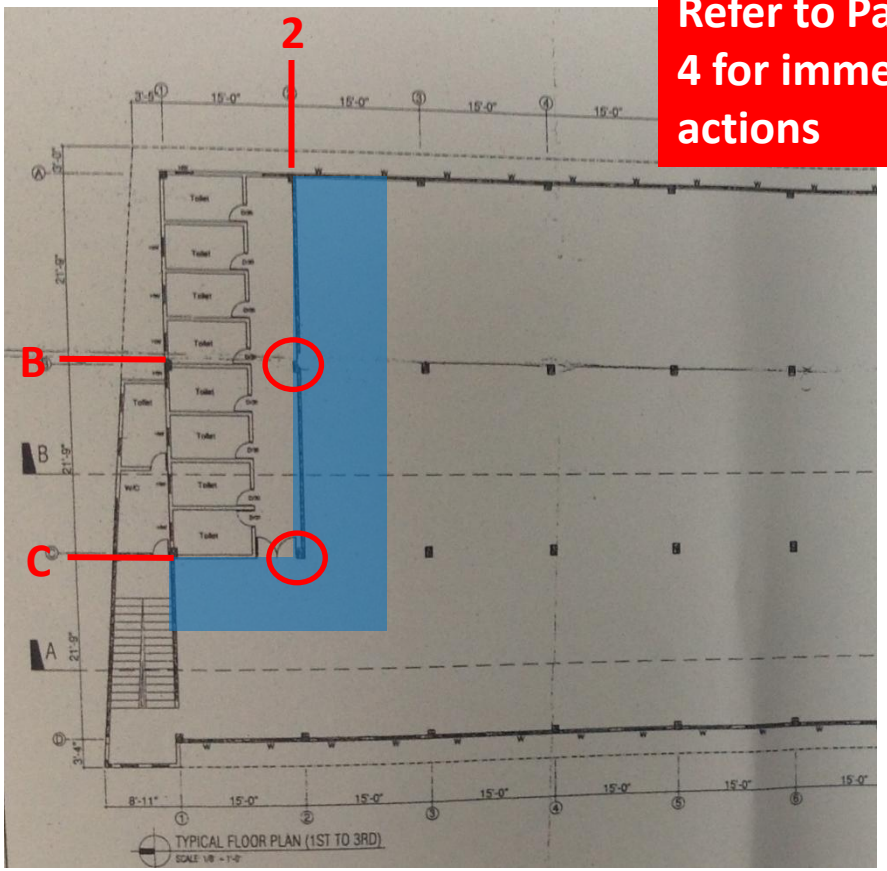
Building Observations

Columns appear to be stressed in excess of normal design limits

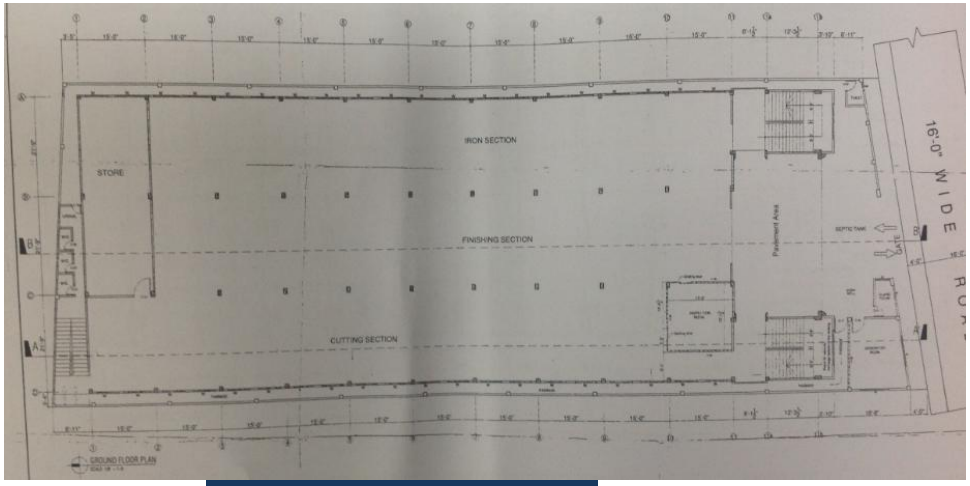
Due to the heavy floor construction in the toilet areas at 1st to 3rd Floors, outline calculations indicate that the columns on Gridline 2 are highly stressed to levels that require immediate review



Refer to Pages 3 and 4 for immediate actions

Area highlighted to be vacated and Specific design check to be carried out on columns at ground floor level which support heavy toilet floor construction

Column Strength



Typical column layout

Outline calculations indicate that column sizes appears to be smaller than required by code for the applied dead and live load, assuming typical concrete strength

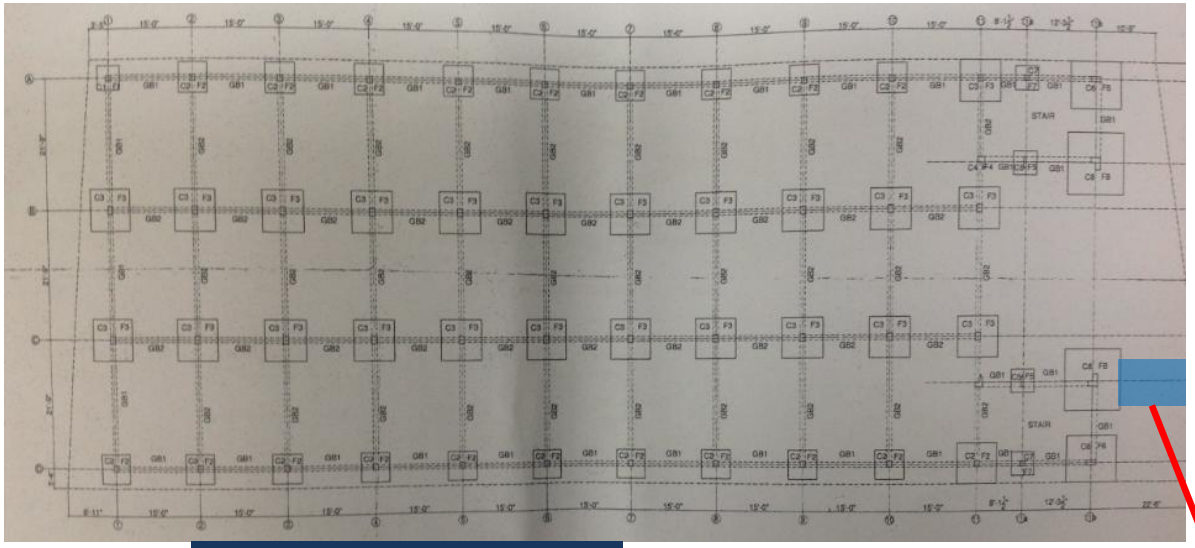
Building Engineer to perform detailed calculations and concrete tests to prove column size and (if required) :

- Reduce loads further by preparation of allowable floor loading plans
- Carry out strengthening works

Tested Ground Floor Column – Brick Chip aggregate concrete

Column Strength

Undermining of existing foundations during excavation for new generator bases.



Foundation layout plan

Risk that the existing foundation is undermined by excavation. Building Engineer to review excavation and existing foundation depth immediately

Stability of steel roof to dining area to be reviewed by Building Engineer

Roof structure held in place with reinforcement from columns
Roof truss support to be checked

Bottom Chord of Truss not supported at connection node – Check Bending of member.

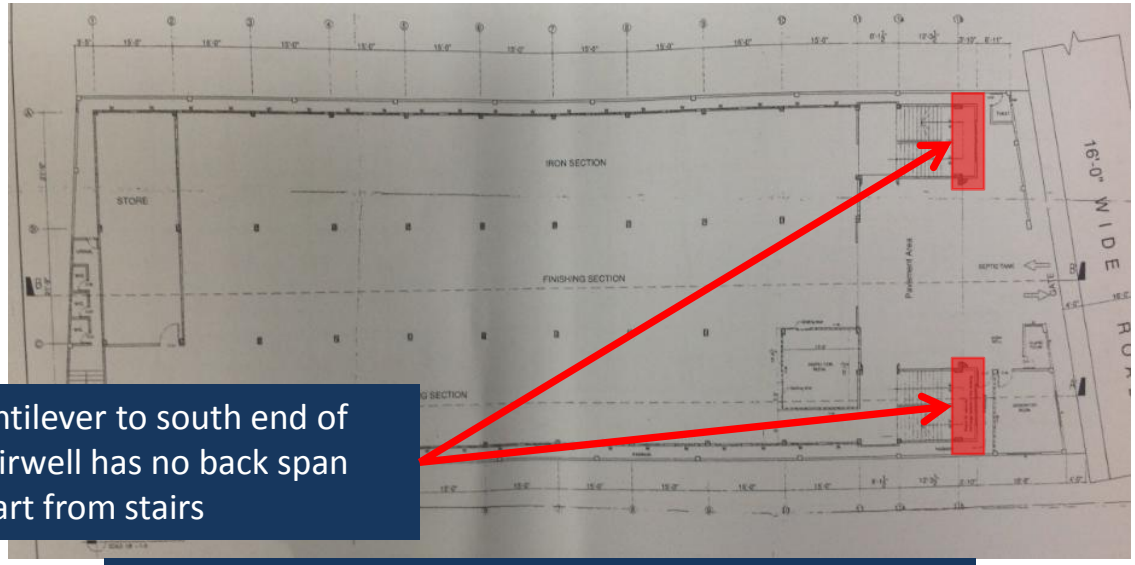
Roof structure to dining area may be susceptible to wind uplift. Check required to confirm that the trusses to the steel roof over the dining area are adequately designed and braced to resist high wind loading. Building Engineer to review.

Roof structure not shown on the permit or structural design drawings.

Steel Roof to Dining Area

Adequacy of stairwell cantilevers

Stairwell cantilever beam



Cantilever to south end of stairwell has no back span apart from stairs

Typical floor plan showing cantilevering half landings

Engineer to verify as-built arrangement of stairwells, including cantilever beam, landing slab and supporting column adequacy.

Cracking was noted in brickwork on exterior of stairwell

Adequacy of stairwell cantilevers

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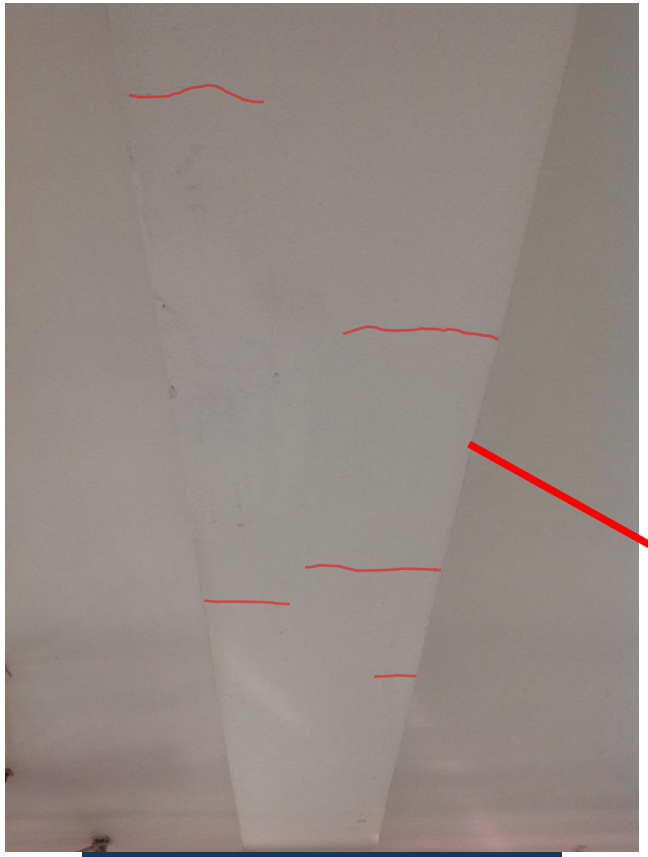
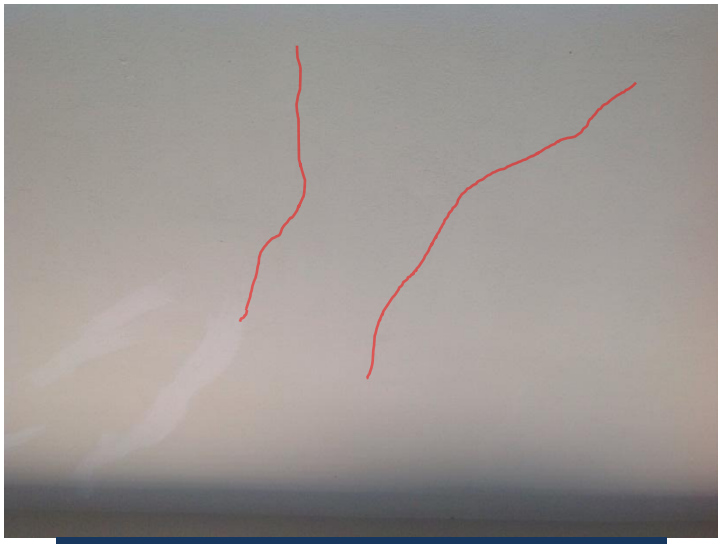
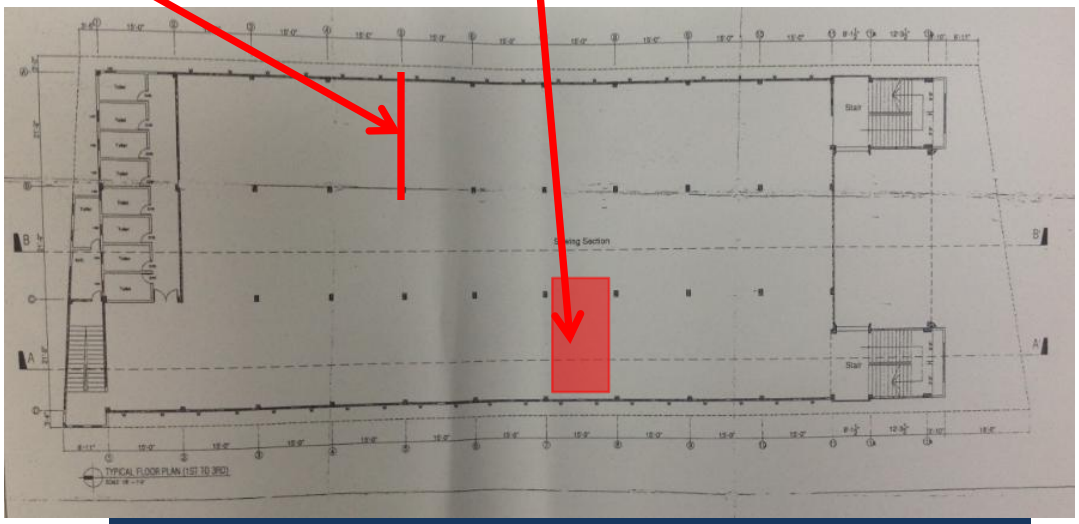
Hairline cracking to beams and soffits of slabs



Cracking at soffit to beam supporting 2nd floor slab



Cracking at soffit to fourth floor slab



Typical plan showing crack locations on suspended slabs

Cracking to concrete structure

Water ingress

Roof slab does not have any protection from water ingress and limited falls to small drainage outlets.

Potential for water load and damage in heavy rainfall

Water Proofing and Drainage at roof Level

Priority Actions

Problems Observed

Item 1; Columns appear to be stressed in excess of normal design limits

Item 2; Undermining of existing foundations during excavation for new generator bases

Item 3; Stability of steel roof to dining area

Item 4; Adequacy of stairwell cantilevers

Item 5; Water ingress

Item No.	Observation	Recommended Action Plan	Recommended Timeline
1	Columns appear to be stressed to levels that require immediate review	Reduce floor loading immediately as detailed on pages 3 and 4. Maintain current use of the floors, in remaining areas, and do not change use or increase occupation, either of which could increase loading.	**Immediate - Now**
2	Columns appear to be stressed to levels that require immediate review	Factory Engineer to review design, loads and stresses in all columns.	**Immediate - Now**
3	Columns appear to be stressed to levels that require immediate review	Verify insitu concrete strength either by 100mm diameter cores or existing cylinder strength data for cores from 6 columns. Verify reinforcement within as built columns.	**Immediate - Now**
4	Columns appear to be stressed to levels that require immediate review	A Detail Engineering Assessment of Factory to be commenced, see attached Scope.	**Immediate - Now**
5	Columns appear to be stressed to levels that require immediate review	Detail Engineering Assessment to be completed	**6-weeks**
6	Columns appear to be stressed to levels that require immediate review	Produce and actively manage a loading plan for all floor plates within the factory giving consideration to floor capacity and column capacity.	**6-weeks**
7	Columns appear to be stressed to levels that require immediate review	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	Recommended Timeline
8	Undermining of existing foundations during excavation for new generator bases.	Building Engineer to review excavation and existing foundation depth immediately	**Immediate - Now**
9	Undermining of existing foundations during excavation for new generator bases.	Structure should be examined on an on-going basis for signs of settlement in the affected area.	**6-months**
10	Stability of steel roof to Dining Area to be reviewed by Building Engineer to confirm that it is braced and adequately designed to resist high wind loading	Steel roofs to dining area should be assessed by the Building Engineer including the provision of a lateral stability system and, if required, upgraded to support code vertical and wind loads.	**6-weeks**
11	Stability of steel roof to Dining Area to be reviewed by Building Engineer to confirm that it is braced and adequately designed to resist high wind loading	Implement recommendations for roof structure as required by the Building Engineer.	**6-months**

Item No.	Observation	Recommended Action Plan	Recommended Timeline
12	Adequacy of stairwell cantilevers	Engineer to review as-constructed layout of stairwells and complete a design check on the cantilevers and supporting columns.	**6-weeks**
13	Adequacy of stairwell cantilevers	Erect temporary propping if required by Building Engineer	**6-weeks**
14	Adequacy of stairwell cantilevers	Implement requirements of Building Engineer to ensure structure meets building code requirements.	**6-months**
15	Water Ingress	Building Engineer to investigate source of water ingress and remedy if necessary with appropriate water proof sealant.	**6-months**
16	Water Ingress	Protective coating or membrane to be installed at roof level to prevent moisture ingress and damage to the concrete floor structure	**6-months**
17	Water Ingress	Continue to monitor for water ingress throughout building and implement corrective procedures if necessary.	**6-months**