

New Age Garments Ltd New Age Apparels Ltd Kei Lock Garments Ltd

Nishchintopur, Asulia, Savar, Dhaka
(23.924895, 90.308234)
9th April 2014



Executive Summary (continued)

We do have some concerns that need to be addressed within 6 weeks, with a number of immediate actions also outlined in the priority actions section of this report. A high-level and non-exhaustive list of key concerns are:

- Undocumented and non-engineered External Steel Stairs (Building 2 & 3) **Immediate Action**
- Load management (All buildings) **Immediate Action**
- Construction Health and Safety (Construction and Factory Workers) **Immediate Action**
- Non-engineered warehouses with no structural information; unusual structural arrangements (Buildings 4 & 5)
- Steel Frame Details (Building 2)
- High column stresses for toilet core loading (Building 1) **Immediate Action**
- Protection of key structural elements (Building 1 & 3) **Immediate Action**
- Loading and structural distress of secondary slabs in toilets (Building 1 and Building 2)
- Lack of relevant structural design or documentation (Buildings 2 and 3) **Immediate Action**

No further construction is permitted until a Detail Engineering Assessment for Building 3, and an assessment of the toilet core areas in Building 1, are carried out.

We see no reason to suspend operations in the building due to structural concerns (subject to the required actions noted at the end of this report).

Further actions with associated priorities and timeframes are given at the end of this report. Please note that these actions should be completed as soon as practically possible and certainly within the timeframe noted.

We have reviewed the property from an outline seismic perspective and would consider that the building, along with many others in the Dhaka region, to be at significant risk of damage in a major Seismic event.

Our Limitations and Assumptions are also noted at the end of this report.

Observations

Undocumented and non-engineered External Steel Stairs (Buildings 2 & 3)

- External steel stairs do not appear to be engineered.
- Fixed to structure by tack welds to rebar.
- Slenderness of posts and structural capacity of sections appear to be insufficient for spans under full loading.



Load management (All buildings)



Instances of high construction loads (particularly rubble and sand piled up to approx. 2m) on a number of upper levels in Building 1.



Localised areas of high load observed in buildings 1, 2 and 3 relating to toilet core build-ups, water tanks, material storage, solid partitions.

Construction Health and Safety (Construction and Factory Workers)



- No edge protection for workers building levels above. Risk of workers or objects falling to levels below.
- Risk to workers accessing lower levels from falling objects from above (partial protection in place as shown).

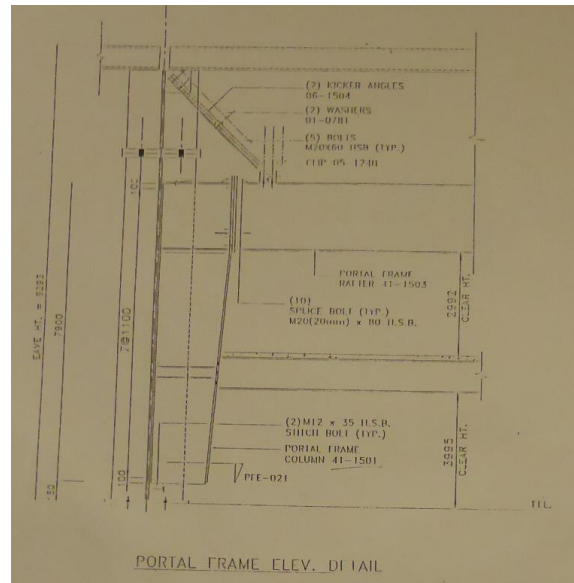
Non-engineered warehouses with no structural information; unusual structural arrangements (Buildings 4 & 5)



Buildings 4 and 5:

- Irregular structural support arrangements for roof trusses.
- No cross-bracing in roof plane to transfer lateral loads to perimeter walls.
- Posts fixed at slab level; no foundation details available.
- Limited capacity of welded details of trusses observed.
- Cracking of floor slabs.
- No relevant structural drawings available.

Steel Frame details (Building 2)



Connection details generally (and specifically the splice and connection details for the main structural frame) do not appear to match the structural drawings:

- **Significantly fewer bolts provided;**
- **Connections do not appear to be appropriate to achieve the full capacity of the steel section size provided.**



- Bolts missing from beams supporting mezzanine floor.
- Structural capacity of 4-bolt connections for floor loading is not clear.
- Cracking of floor finish over mezzanine steel beam position in a number of locations, indication structural distress of slab.

High column stresses for toilet core loading (Building 1)



- Solid build-up at stacked toilet cores includes solid partitions, secondary soffit slab and additional build-up on floor at ground level.
- Cursory calculations indicate high working stress in columns supporting toilet areas.



Stone Aggregate

Engineer is to perform detailed calculations and concrete tests to prove column as-built is sufficient.
Pending the outcome of this assessment, discontinue construction of additional toilet cores on upper floors.

Protection of key structural elements from vehicle impact (Buildings 1 & 3)



Potential impact of truck with building support columns in Building 1 is currently mitigated with lightweight fences and bollards.

Potential impact of truck with building support columns in Building 3 would be onerous for undocumented extension / loading bay with 3 columns to front section (no redundancy for columns apparent).



Loading and structural distress of secondary slabs in toilets (Buildings 1 and 2)



Evidence of distress on soffit of secondary ceiling slab (Building 1). Loading above not confirmed.



Water tank loading on shallow secondary slab above toilet areas in Building 2.

Corrosion of structural steelwork (Building 2)

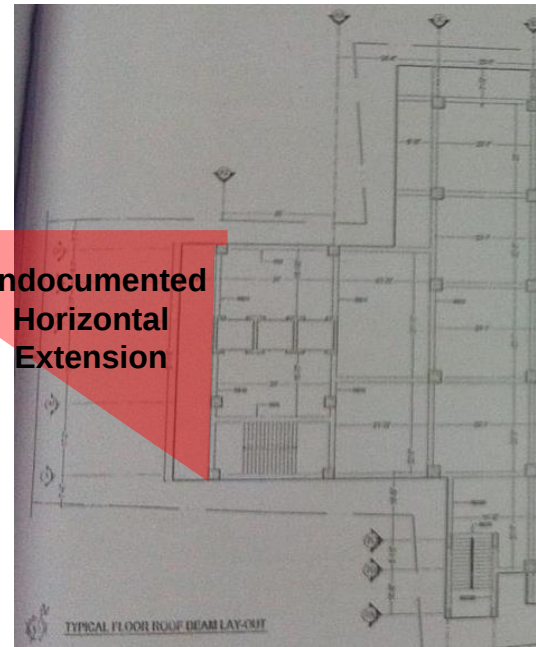


- Corrosion of steelwork and deterioration of the corrosion protection noted in a number of locations in Building 2.
- Corrosion most evident in toilet areas where steel is exposed.



Example of mezzanine support beam (as viewed from top of secondary shallow ceiling slab above Building 2 toilets) and metal deck showing signs of significant corrosion due to leaking at drainage drop.

Lack of relevant structural documentation (Buildings 2 and 3)



**Undocumented
Horizontal
Extension**



Undocumented structure to the south-west of Building 3

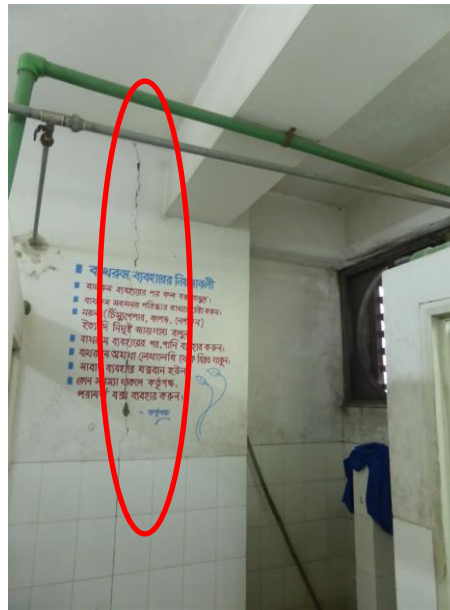
- No structural or permit drawings available.
- Some irregular structural arrangements, including 5.8m cantilever beam.
- Evidence of distress of façade due to deflection of cantilevers.



Undocumented slab over roof of toilets in Building 2

- Water tanks on slab

Building cantilevers with distress evident on supported facades (Building 3)



Numerous examples of damage or repair to facades which appears to be related to excessive deflections of building edge cantilevers.

Cracking in undocumented Generator Building



Evidence of repair to numerous cracks in suspended floor levels in generator building. Suspended levels are currently unoccupied.

Non-engineered structures within and around principal buildings



Numerous non-engineered structures on site including plant sheds, waste sheds, security rooms, shelters to staircore over-runs, shelters over suspended walkways and a temporary atrium roof cover to Building.

Structures were generally not occupied and not focused on during rapid visual assessment.

Priority Actions

Problems Observed

1. Undocumented and non-engineered External Steel Stairs (Building 2 & 3)
2. Load management (All buildings)
3. Construction Health and Safety (Construction and Factory Workers)
4. Non-engineered warehouses with no structural information; unusual structural arrangements (Building 4 & 5)
5. Steel Frame Details (Building 2)
6. High column stresses for toilet core loading (Building 1)
7. Protection of key structural elements (Building 1 & 3)
8. Loading and structural distress of secondary slabs in toilets (Building 1 and Building 2)
9. Corrosion of structural steelwork (Building 2)
10. Lack of relevant structural design or documentation (Buildings 2 and 3)
11. Building cantilevers with distress evident on supported facades (Building 3)
12. Cracking in undocumented Generator Building
13. Non-engineered structures within and around principal buildings.

Item 1 and actions

Undocumented and non-engineered external steel stairs.

Priority 1

(Immediate - Now)

- Immediately prop all external steel escape stairs at steel stringer and at tack welded connections to concrete landings.
- Building engineer to supervise propping.



Priority 2

(within 6-weeks)

- Building Engineer to review **escape stairs** 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 fire escape strategy for all areas.

Priority 3

(within 6-months)

- Complete strengthening works and appropriate as-built drawings.

Item 2 and actions

Localised areas of high loading (all buildings).

Priority 1

(Immediate - Now)

- Building Engineer to review all construction loading and advise safe load limits
- Maintain current use of the floors within Buildings 2 & 3 and do not change use or increase occupation or loading prior to completion of safe loading plans by the building engineer.

Priority 2

(within 6-weeks)

- Building Engineer to create controlled loading plans for all floors, which account for existing solid partition loads, extra finishes, heavy fixed items etc. and are based on the structural capacity of supporting slabs, beams and columns.
- Factory management to display plans and educate all relevant factory management on implementation.

Priority 3

(within 6-months)

- Continue to implement load plan.

Item 3 and actions

Construction Health and Safety (Construction and Factory Workers)

Priority 1

(Immediate - Now)

- Review edge protection to prevent workers falling / items falling on factory workers.

Priority 2

(within 6-weeks)

- Factory Management to consider edge protection measures during on-going construction works.
- Ensure all access/ egress routes from factory are protected from falling items from above.

Priority 3

(within 6-months)

- Maintain edge protection as required.

Item 4 and actions

Non-engineered warehouses with no structural information; unusual structural arrangements (Buildings 4 & 5)

Priority 1

(Immediate - Now)

- None required

Priority 2

(within 6-weeks)

- Building Engineer to undertake an engineering assessment of the roof and vertical support structures, structural stability and perimeter of Buildings 4 and 5, with calculations and as-built drawings.

Priority 3

(within 6-months)

- Carry out all recommendations from the engineering assessment.
- Undertake strengthening as required.
- Finalise appropriate structural as-built drawings incorporating any strengthening works to the structural frame.

Item 5 and actions

Steel Frame Details (Building 2)

Priority 1

(Immediate - Now)

- None required

Priority 2

(within 6-weeks)

- Building Engineer to undertake an engineering assessment of the as-built steelwork connections and splice details, with calculations and drawings.

Priority 3

(within 6-months)

- Carry out any strengthening or remedial works arising from the engineering assessment.
- Complete relevant as-built drawings.

Item 6 and actions

High column stresses for toilet core loading (Building 1)

Priority 1

(Immediate - Now)

- Construction of new toilet core fit-out (solid partitions and secondary slabs) on upper incomplete levels **to cease immediately** pending design check.

Priority 2

(within 6-weeks)

- Building Engineer to review design, loads and column stresses at the toilet core areas in Building 1, accounting for all solid partitions, build-ups and secondary slabs.
- Check column capacity for applied loading taking account of concrete cylinder tests as appropriate.

Priority 3

(within 6-months)

- Modify toilet design or column strengthening based on findings of engineering assessment of columns.
- Produce and actively manage a loading plan for all floor plates within the Building, giving consideration to floor capacity and column capacity.

Item 7 and actions

Protection of key structural elements (Building 1 & 3)

Priority 1

(Immediate - Now)

- Maintain temporary traffic measures to warn vehicles of potential impact with columns (Building 1).
- Install warning measures / bollards for columns to front of Building 3 – Building Engineer to review and advise.

Priority 2

(within 6-weeks)

- Building Engineer to review column designs for strength & building durability for vehicle impact load on loading bay columns (Buildings 1 and 3).
- A permanent / solid impact protection solution to prevent truck impact is suggested.

Priority 3

(within 6-months)

- Undertake actions arising from assessment of impact load on columns.

Item 8 and actions

Loading and structural distress of secondary slabs in toilets (Buildings 1 and 2)

Priority 1

(Immediate - Now)

- None required.

Priority 2

(within 6-weeks)

- Building engineer to check toilet ceiling slab design and determine cause of cracking (Building 1).
- Building Engineer to undertake design check on slab for water tank loading applied (building 2).

Priority 3

(within 6-months)

- Repair cracks and move heavy loads on Building 1 secondary slabs above toilets as required.
- Undertake actions arising from assessment of secondary toilet slabs supporting water tanks in Building 2.

Item 9 and actions

Corrosion of structural steelwork (Building 2)

Priority 1

(Immediate - Now)

- None required.

Priority 2

(within 6-weeks)

- Engineer to assess extent of corrosion of steelwork in Building 2.
- Where section capacity has been compromised, structural capacity of the corroded section should be assessed.
- Causes of corrosion to be determined and repaired (e.g. leaks around toilet drainage points).

Priority 3

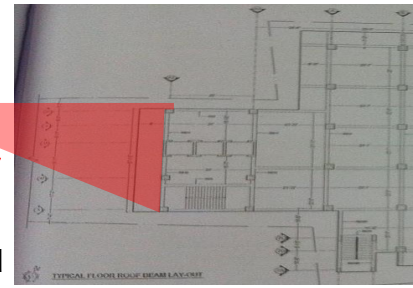
(within 6-months)

- Corroded steelwork to be thoroughly cleaned and remediated as required following engineering assessment.
- Corrosion protection to be repaired.

Item 10 and actions

Lack of relevant structural design or documentation (Building 3)

Undocumented
Horizontal
Extension



Priority 1

(Immediate - Now)

- Ensure no change of use or increase of applied loading to front office structure

Priority 2

(within 6-weeks)

- Undertake a Detail Engineering Assessment of the undocumented portion of Building 3 (see above) as per the scope outlined on the following page.
- Particular attention to be paid to the long-span cantilever on the front façade and slab cantilevers supporting facades which are demonstrating significant distress.

Priority 3

(within 6-months)

- Undertake any strengthening or modification of the undocumented extension arising from the Detail Engineering Assessment.

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 11 and actions

Building cantilevers with distress evident on supported facades (Building 3)

Priority 1

(Immediate - Now)

- None required.

Priority 2

(within 6-weeks)

- Engineer to assess capacity of slab cantilever for applied factory and façade loads (including assessment of as-built reinforcement and concrete material strengths).

Priority 3

(within 6-months)

- Undertake any strengthening required from the engineering assessment.
- Limit loading on cantilever slabs based on findings of design assessment.

Item 12 and actions

Cracking in Undocumented Generator Building.

Priority 1

(Immediate - Now)

- Do not occupy spaces currently under repair.

Priority 2

(within 6-weeks)

- Undertake an engineering assessment of the reinforced concrete structure prior to occupying space on suspended floor slabs.
- Produce calculations and as-built drawings as part of the assessment.

Priority 3

(within 6-months)

- Limit loading or undertake strengthening based on findings of assessment.

Item 13 and actions

Non-engineered structures within and around principal buildings.

Priority 1

(Immediate - Now)

- None required.

Priority 2

(within 6-weeks)

- None required.

Priority 3

(within 6-months)

- Building engineer to assess non-engineered structures within the complex, with particular attention to roof tie-down details and structural stability.
- Strengthen occupied buildings as required.