

Radial International Ltd. Array International Ltd.

Zirani Bazar, Kashmirpur, Gazipur Sadar.
(23.997823, 90.254950)
20th April 2014



Observations

Steel Roof over Main Production Building, Fifth Floor



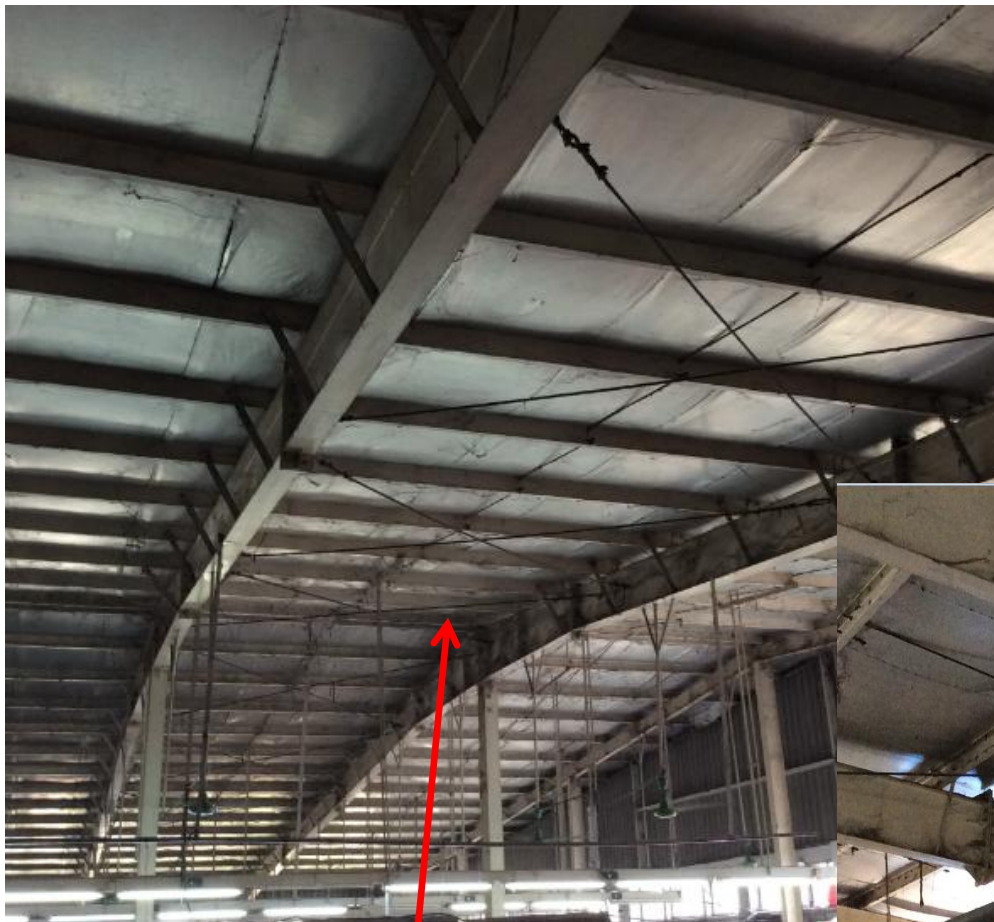
New composite floor

Changes have been made to the structure with part of the portal frame removed and replaced with a composite deck for fire safety reasons. This modification has removed an entire bay of roof bracing.

Some bracing elements are slack and should be tightened to ensure they are functioning properly.



Steel Roof over Main Production Building



Bracing in steel roof for lateral restraint.

Bracing elements missing on elevation both sides (north and south).



Steel Roof over Main Production Building



Displacement

Deck is constructed from a mixture of welded box/channel sections and I-Sections.

New composite deck above the 5th Floor appears to be deflecting slightly.



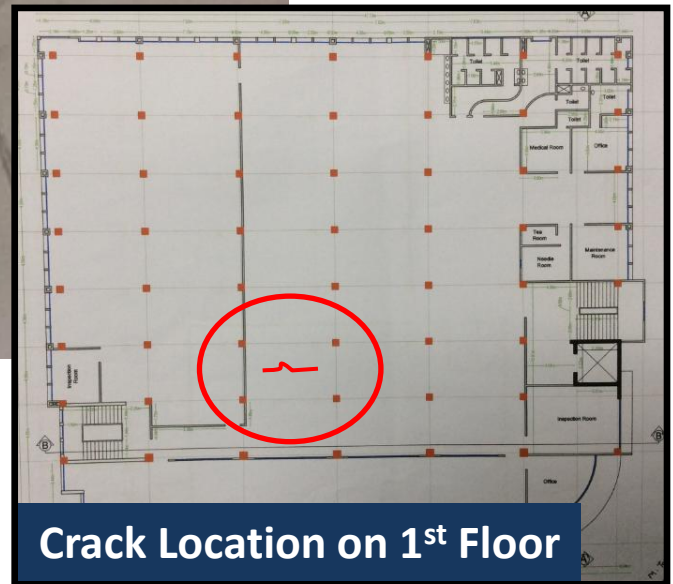
Composite Deck

Cracking to the soffit of 1st Floor in Main Production Building



Crack in the soffit of the 1st Floor

Cracking to Soffit of the Main Production Building, First Floor



Crack Location on 1st Floor

Drainage to Concrete Flat Roof to part of Main Production Building



**No other drainage routes provided to the roof.
New concrete parapet walls.**

**Only one drainage route on the roof to let water escape.
Surrounding debris can block this one route and can cause an accumulation of water in a severe weather event.**



Drainage to Flat Roof of Main Building

Local Damage to Beams and Slabs In Main Building



New service opening broken in slab at toilet block to allow for pipes to pass through. Not good practice but has not compromised strength here.

New service openings broken/drilled in beams to allow electric cables to pass through. Not good practice but has not compromised strength here.



Local Damage to Beams and Slabs

Single-Storey Building: Boiler House



Boiler house columns are larger section at higher levels than at lower levels. Bolted connection at mid-height is poorly aligned.

Boiler house steel structure is tall without the benefit of floors or effective bracing.



Single-Storey Building: Boiler House

Single-Storey Building: Dyeing Sheds



The steel sections in the portal frame in the dyeing shed appear extremely lightweight for the large span.

No lateral stability cross-bracing observed in roof structure of the portal frame in Dyeing shed.

Single-Storey Building: Dyeing Shed



**Gutter and part roof collapse –
Dyeing Shed**

**Lightweight steel roof over part
of Dyeing Shed**



Single-Storey Building: Dyeing Shed

**Steel purlins in roof
of Dyeing Shed are
deflecting heavily.**

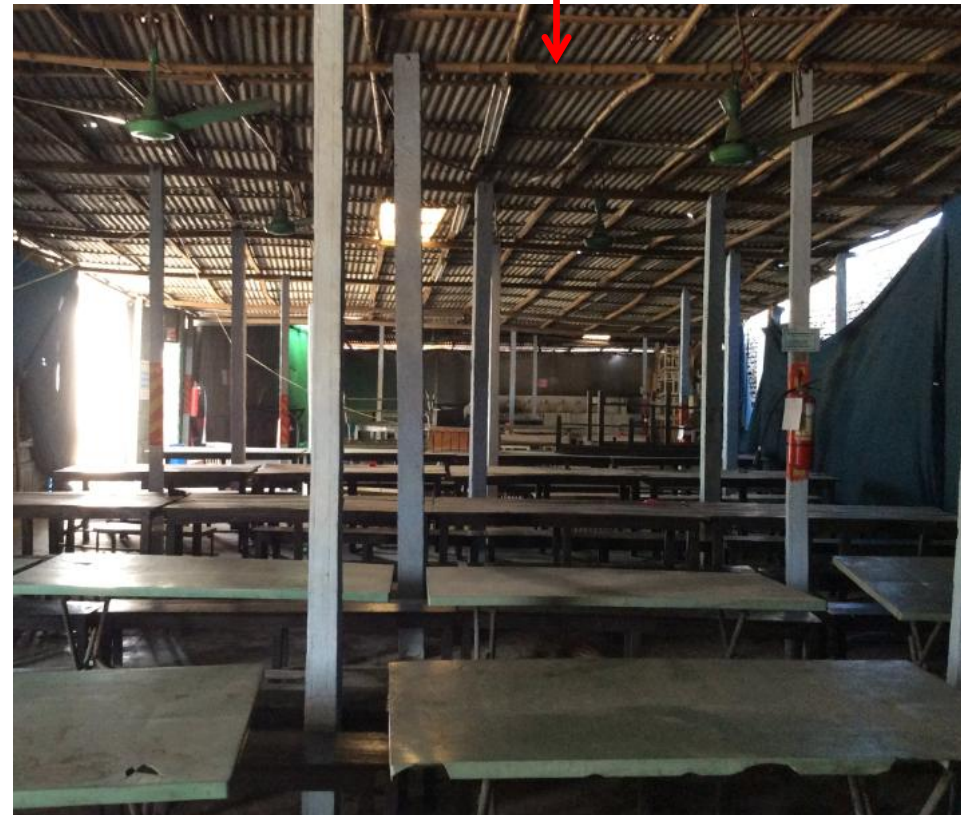


Single-Storey Building: Dyeing Shed

Single-Storey Shed: Dining Area



Ad-hoc
bamboo/timber/steel roof
on concrete posts arranged
haphazardly over canteen
area used by approx. 300
workers.



Single-Storey Shed: Dining Area

Ancillary Single-Storey Buildings: Ad-hoc structures



Bamboo/timber/steel/concrete used randomly and ad-hoc in single-storey miscellaneous structures. Stability of structures very questionable.

Non-engineered structures – Materials



No lateral stability in the second raw material storage shed.



No lateral stability in both directions is a common issue across all non-engineered single-storey structures.

Non-engineered structures – Lateral Stability



Bottom section of truss removed to make way for machinery piping.

Bottom section of the truss has either been removed or has failed locally. Bamboo currently in place to support section.



Non-engineered structures - Modifications

Angle section supporting roof has either buckled or has been hit by a vehicle



Concrete removed at base and column base and is in danger of collapse.

Non-engineered structures - Modifications

Problems Observed

1. Stability of Main Production Building Steel Roof , Fifth Floor
2. Cracking to the soffit of 1st Floor in Main Production Building
3. Drainage on Flat Roof of Main Production Building
4. Single-Storey Building: Boiler House Steelwork
5. Single-Storey Building: Dyeing Sheds Steelwork
6. Single-Storey Building: Dining Area Structure
7. Ancillary Buildings: Ad-hoc structures

Priority Actions

Item No.	Observation	Recommended Action Plan	Recommended Timeline
1	Main Building Steel Roof Structures over Fifth Floor	Full structural survey and analysis of existing steel roof structures to be carried out by Factory Building Engineer	Immediate - Now
2	Main Building Steel Roof Structures over Fifth Floor	Lateral stability of roof to be assessed	Immediate - Now
3	Main Building Steel Roof Structures over Fifth Floor	Support bearings and connections to be assessed	Immediate - Now
4	Main Building Steel Roof Structures over Fifth Floor	Slight sagging in beams under new concrete roof (West side) to be assessed	Immediate - Now
5	Main Building Steel Roof Structures over Fifth Floor	Strengthening measures to be designed where required by Building Engineer	Immediate - Now
6	Main Building Steel Roof Structures over Fifth Floor	Diagonal bracing, removed to construct new concrete flat roof, to be replaced	6-weeks
7	Main Building Steel Roof Structures over Fifth Floor	Missing diagonal bracing (walls and roof) to be installed	6-weeks
8	Main Building Steel Roof Structures over Fifth Floor	Tension in all cross-bracing to be restored	6-weeks
9	Main Building Steel Roof Structures over Fifth Floor	Strengthen bearings, connections, support brackets and structural sections where required by the Building Engineering Structural analysis	6-months
10	Main Building Steel Roof Structures over Fifth Floor	Implement other Building Engineer's recommendations.	6-months

Item No.	Observation	Recommended Action Plan	Recommended Timeline
11	Cracking to the soffit of 1st Floor in Main Production Building	Sections of plaster finish to the soffit of the 1st floor of the Main Production Building to be removed to investigate if cracks are reflected in the building structure.	6-weeks
12	Cracking to the soffit of 1st Floor in Main Production Building	Building Engineer to carry out design check on the slab to confirm that these cracks are within normal structural behaviour	6-weeks
13	Cracking to the soffit of 1st Floor in Main Production Building	Strengthening measures installed if required.	6-months
14	Drainage to flat roof of Main Production Building.	Clear all rubbish and building materials from roof area	Immediate - Now
15	Drainage to flat roof of Main Production Building.	Monitor storm water flows during rainy periods	6-weeks
16	Drainage to flat roof of Main Production Building.	Install additional rainwater outlets from roof to ensure no build-up of water is possible, which could potentially overload the structure	6-weeks
17	Drainage to flat roof of Main Production Building.	Continue to ensure no debris can block drainage routes	6-months

Item No.	Observation	Recommended Action Plan	Recommended Timeline
18	Single-Storey Buildings: Boiler House Steelwork	Full survey and structural analysis of the Boiler House steel structure to be carried out by the Factory Building Engineer to assess section sizes, connection details and lateral stability.	Immediate - Now
19	Single-Storey Buildings: Boiler House Steelwork	Additional steelwork and strengthening measures to be designed by the Factory Building Engineer.	6-weeks
20	Single-Storey Buildings: Boiler House Steelwork	Strengthening works to be implemented before the cyclone season to ensure the building is laterally stable against wind loads.	6-months
21	Single-Storey Buildings: Dyeing Shed Steelwork Roof	Full survey and structural analysis of the Dyeing Shed roof steel structures to be carried out by the Factory Building Engineer to assess section sizes, connection details and lateral stability.	Immediate - Now
22	Single-Storey Buildings: Dyeing Shed Steelwork Roof	Additional steelwork, support bearings and strengthening measures to be designed by the Factory Building Engineer.	6-weeks
23	Single-Storey Buildings: Dyeing Shed Steelwork Roof	Additional lateral stability elements to be designed by the Factory Building Engineer.	6-weeks
24	Single-Storey Buildings: Dyeing Shed Steelwork Roof	Strengthening works to be implemented before the cyclone season to ensure the building is laterally stable against wind loads and structurally complete to take normal design loads.	6-months

Item No.	Observation	Recommended Action Plan	Recommended Timeline
25	Single-Storey Buildings: Dining Area Shed	Provide alternative dining accommodation which is safe and structurally sound until the existing roof structure is properly strengthened or replaced	Immediate - Now
26	Single-Storey Buildings: Dining Area Shed	Provide a safe and structurally sound Dining Area for employees	6-weeks
27	Single-Storey Buildings: Ancillary Ad-hoc Structures	Carry out an assessment for current building requirements to cater for the miscellaneous other uses required on the site.	Immediate - Now
28	Single-Storey Buildings: Ancillary Ad-hoc Structures	Factory Building Engineer to design warehouse structures which comply with Bangladesh building standards and meet the required site demands into the future.	6-weeks
29	Single-Storey Buildings: Ancillary Ad-hoc Structures	Demolish existing ad-hoc structures	6-months
30	Single-Storey Buildings: Ancillary Ad-hoc Structures	Construct new warehousing as required.	6-months