

FGS Denim Wear Ltd.

Kathgora, Zirabo, Ashulia, Dhaka-1340 , Bangladesh

(23.912285N,90.297988E)

30 April 2014



Observations

Structural design of Building 2



- Members in top boom of truss are not connected at apex of roof.
- Vertical members appear to be tack welded.
- Truss does not appear to be continuous over central support.



- Unclear lateral stability system in Building 2 in east-west direction.
- Unclear connection details between circular steel columns and trusses.

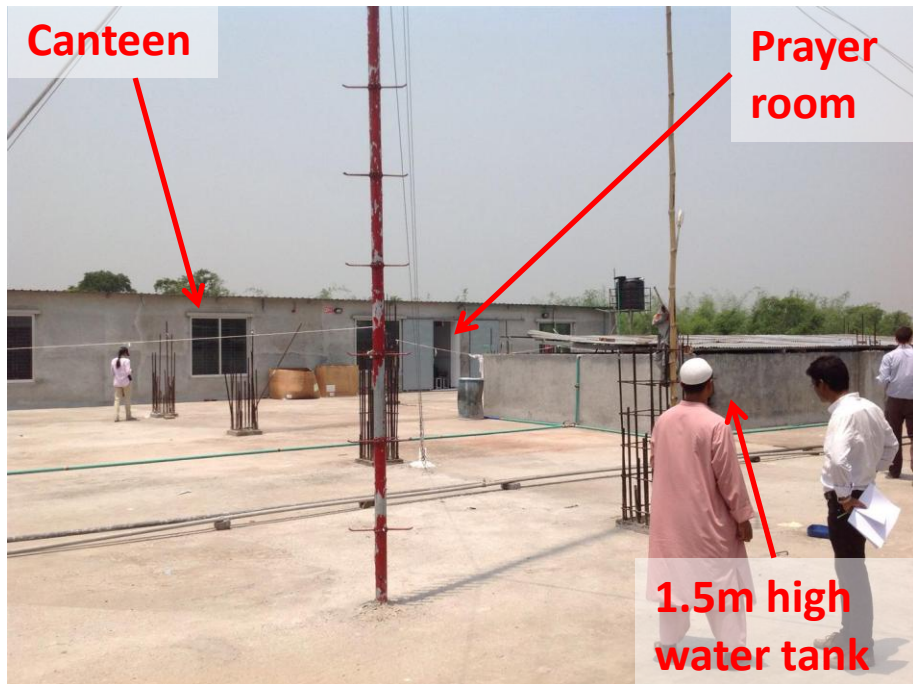


- Unclear lateral stability system in Building 2 in north-south direction.
- No plan bracing apparent in roof.



- Non-engineered trusses at north end of Building 2.
- Diagonal members do not 'node out' with vertical members of truss.

Undocumented extensions to Building 1



- Canteen and prayer room structures at roof level are not included on permit drawings.
- No structural information was available for these buildings.

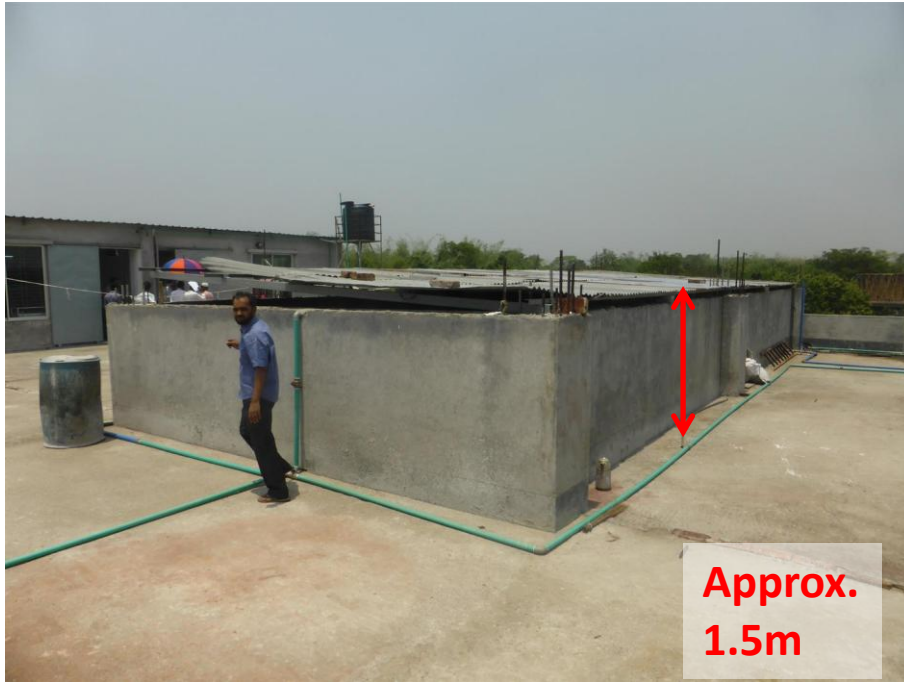


Factory management indicate that they intend to add three additional storeys to the building.



- Extension to the East of Building 1 is not included on structural drawings. Factory management indicate that this was built at the same time as Building 1.
- Different floor level observed between Building 1 and extension at 1st floor level.

Concentrated areas of high loading



- 1.5m high masonry water tank at roof level. Concrete walls 280mm thick.
- Flat slab construction below, although beam and slab construction indicated on drawings.

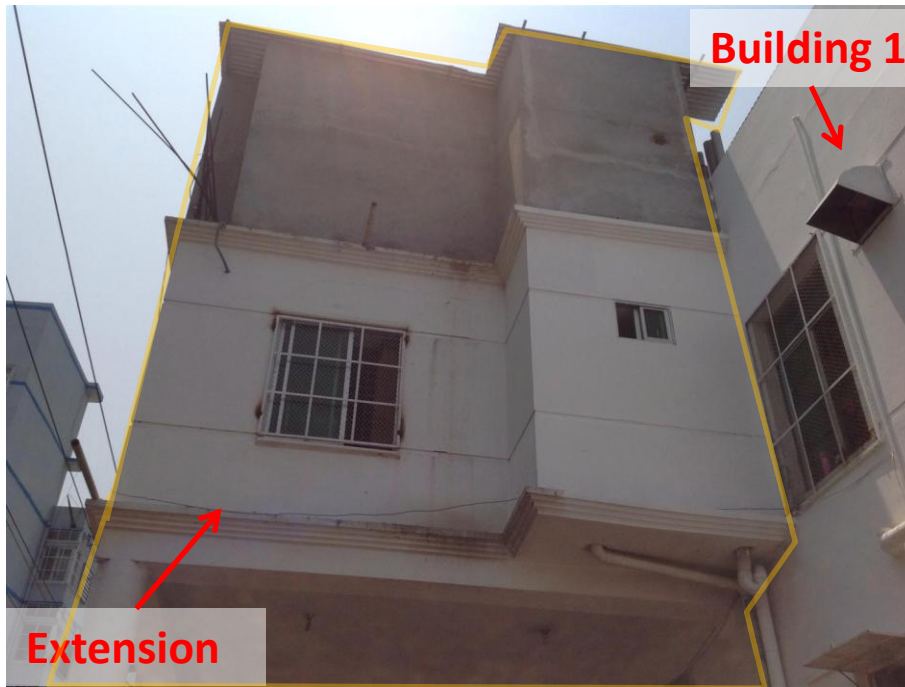


- 3no. 2000 litre water tanks provided at roof level.
- Flat slab construction below, although beam and slab construction indicated on drawings.

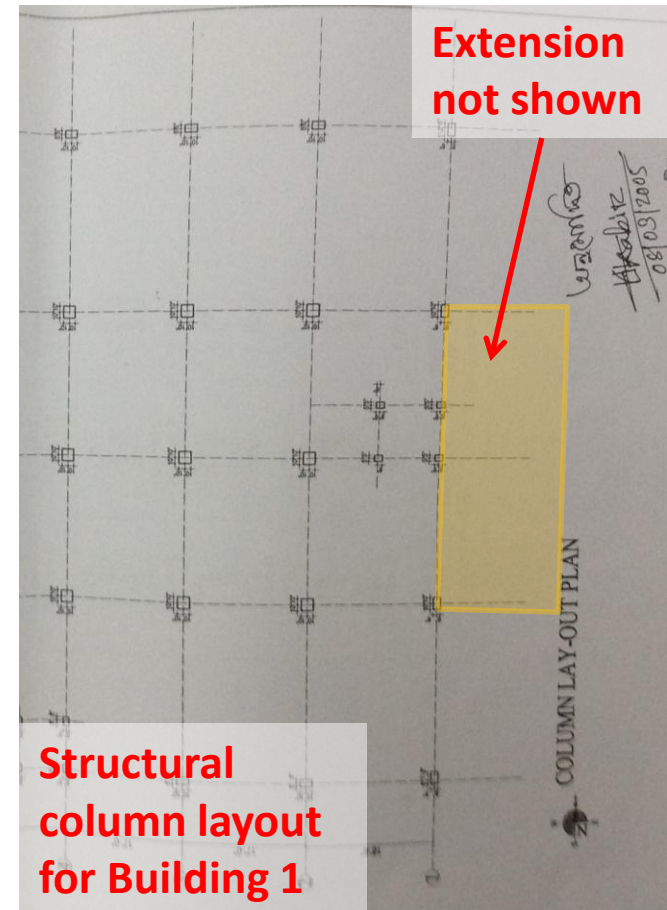


- Storage area at roof level contains stacked cardboard and boxes.
- No loading management system in place.

Inconsistencies between structural drawings and buildings on site



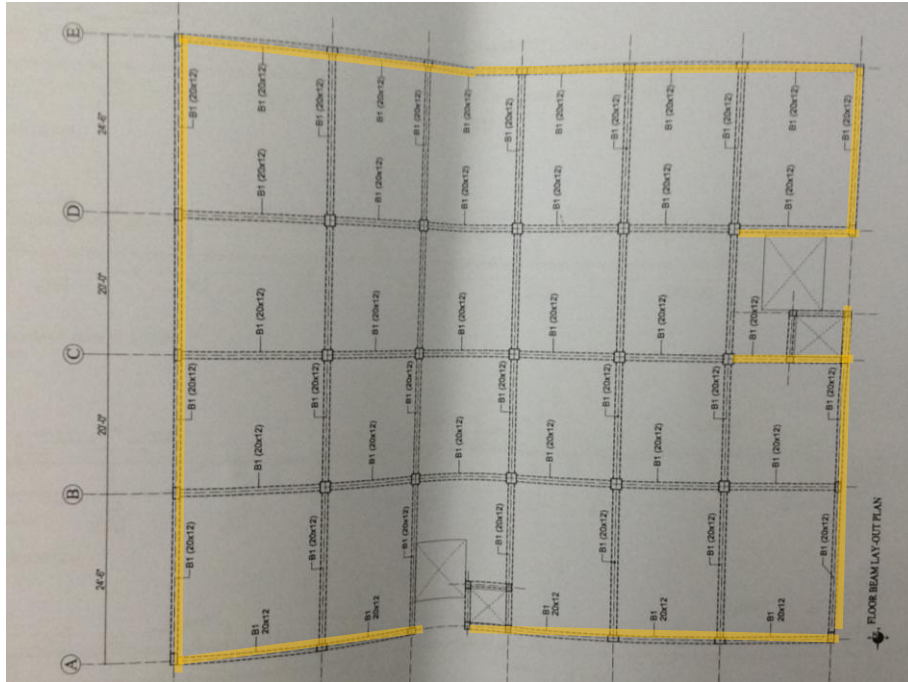
Extension to east of building. View looking south.



- Two storey extension to Building 1 not indicated on structural drawings.
- Extension is supported by edge columns of Building 1.
- Factory management indicate extension and Building 1 constructed at same time.

Inconsistencies between structural drawings and buildings on site

General beam arrangement



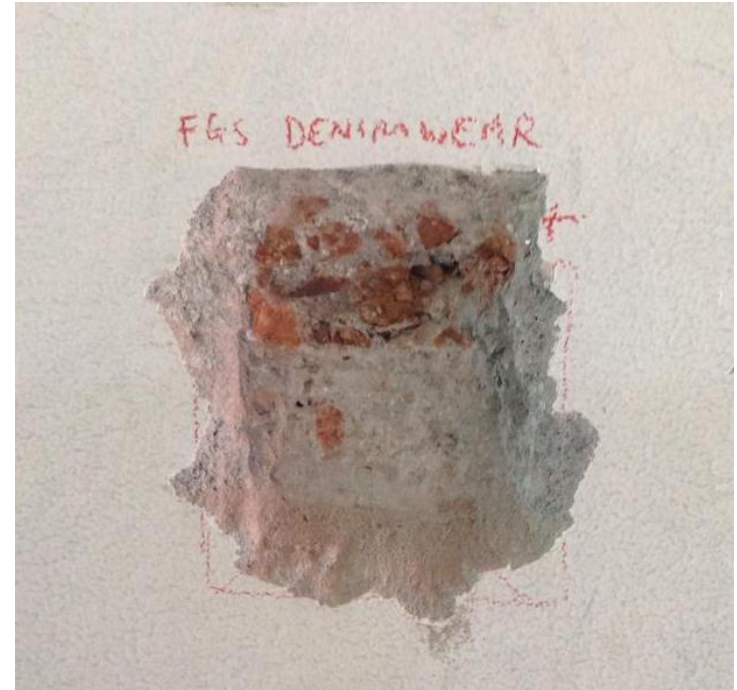
- Structural beam drawing for Building 1 indicates beam & slab construction throughout.
- Flat slab construction observed generally at 1st and 2nd (roof) floors of Building 1.

Inconsistencies between structural drawings and buildings on site

3. CONCRETE :

- a) Materials used to produce concrete shall comply with the requirements of BNBC, 1993
 - i) 20mm down graded crushed stone chips shall be used for concrete of 25MPa (3600 psi) as specified in structural drawings.
 - ii) 20mm down graded 1st class picked brickchips shall be used for concrete of 21MPa(3000 psi) as specified in structural drawings.
- b) 28 days cylinder compressive strength, $f_c = 25 \text{ MPa}$ (3600 psi) for all RCC works.

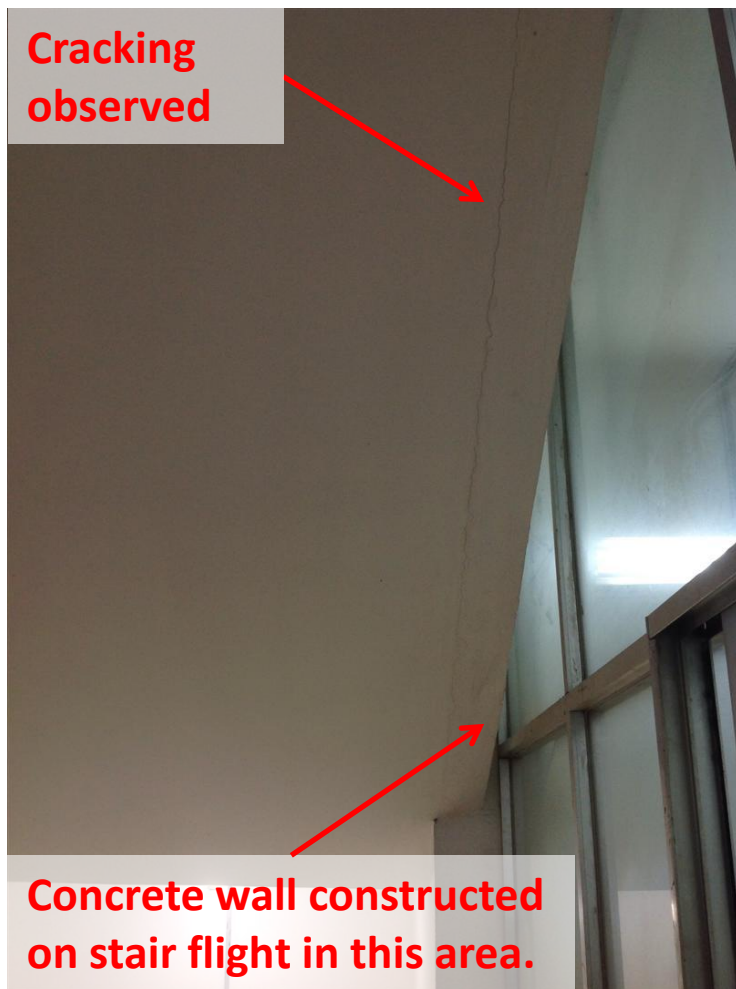
Structural drawings indicate crushed stone chips to be used for all concrete works.



Brick chip aggregate observed in ground floor column on site.

Inconsistencies between structural drawings and buildings on site

Evidence of cracking and damage to structural elements



- Cracking observed in stair flight between first floor and roof in Building 1.
- No handrails provided to stair flight up to roof level.

Evidence of cracking and damage to structural elements



- Numerous openings observed in slab and beams at corner column in Building 1.



- Cracks observed between masonry walls and concrete columns.
- A small number of cracks observed in slab soffits in Building 1.

Non-engineered structures



Store to south of Building 2



Wastage shed

Non-engineered outbuildings and lean-tos throughout the complex

- Structures have lightweight roofs with no plan bracing system.
- Roofs susceptible to wind uplift due to inadequate holding down details.



Entrance to Building 2



Entrance to Building 1

- Non-engineered canopies observed throughout complex, generally outside building entrances.
- Lightweight steel structures have inadequate independent lateral stability systems and are susceptible to wind uplift.



- Rooftop mast does not occur over column.
- Building Engineer to assess slab in terms of vertical and lateral loadings transmitted by mast.

Columns vulnerable to vehicle impact



- Edge columns in Building 1 extension may be vulnerable to vehicle impact.
- Building Engineer to assess columns to see if independent protection barriers are required.



Problems Observed

1. Structural design of Building 2
2. Undocumented extension to Building 1
3. Concentrated areas of high loading
4. Inconsistencies between structural drawings and buildings on site
5. Evidence of cracking and damage to structural elements (Building 1)
6. Non-engineered structures
7. Columns vulnerable to vehicle impact

Item No.	Observation	Recommended Action Plan	Recommended Timeline
1	Structural design of Building 2	Building Engineer to review the structural design of Building 2. Particular attention to be paid to i) steelwork connections and design assumptions, ii) lateral stability of the structure in north-south and east-west directions.	6-months
2	Undocumented extension to Building 1	Supporting RC flat slabs, beams and columns to be checked for loads applied, including structures at roof level.	6-months
3	Undocumented extension to Building 1	Check ground floor columns for buckling.	6-months
4	Undocumented extension to Building 1	As-built structural drawings to be updated to include undocumented extensions at roof level.	6-months
5	Concentrated areas of high loading	Building Engineer to develop loads plans for all buildings, accounting for usage, floor build-ups, solid partition walls and areas of concentrated loading.	6-months
6	Concentrated areas of high loading	Building Engineer to verify capacity of existing roof structure (flat slab, beams and columns) to support full water tanks.	6-months
7	Concentrated areas of high loading	Factory management to implement load plans.	6-months

Item No.	Observation	Recommended Action Plan	Recommended Timeline
8	Inconsistencies between structural drawings and buildings on site	As-built structural drawings to be generated for all buildings on factory complex, including horizontal and vertical extensions.	6-months
9	Inconsistencies between structural drawings and buildings on site	As-built drawings to be revised as necessary as future modifications or strengthening works are implemented.	6-months
10	Evidence of cracking and damage to structural elements (Building 1)	Building Engineer to identify areas of structural cracking throughout Building 1.	6-months
11	Evidence of cracking and damage to structural elements (Building 1)	Building Engineer to continue to monitor size, length and location of structural cracking throughout Building 1.	6-months
12	Evidence of cracking and damage to structural elements (Building 1)	All future penetrations through slabs and beams to be agreed with Building Engineer.	6-months
13	Non-engineered structures	Building Engineer to review the adequacy of non-engineered structures throughout complex. Particular attention should be paid to the lateral stability of these structures.	6-months
14	Non-engineered structures	Building Engineer to assess the effect of the rooftop mast on the roof slab.	6-months
15	Columns vulnerable to vehicle impact	Building Engineer to assess the edge columns to the Building 1 extension for their capacity to withstand vehicle impact loading.	6-months
16	Columns vulnerable to vehicle impact	Implement any action arising from assessment (e.g. independent protection barriers).	6-months