

# Refat Garments Ltd (Extension 2)

144,147,148 Narashingpur, Ashulia, Savar, Dhaka.

(23.929766, 90.303905)

20 February 2024



## **1. Building Information:**

Dining & Printing: Single-storied steel shed.

Chemical Store: Single-storied RC building.

ETP Large: Two-storied RC building.

ETP Substation: Single-storied RC building.

Guard Room: Single storied partial RC part and partial steel part.

Utility and Storage Building: Six-storied (G+5) RC building.

ETP Small (Old): 3 single-storied steel sheds (Shed 1, 2 & 3) on the ETP tank and a two-storied RC structure with a lightweight steel roof (Shed 4) beside the ETP tank.

Substation & Generator Building: Two-storied RC building.

## 2. Observations

### Observation-01: Lack of roof lateral stability. (Dining & Printing)



**Description:** Lack of lateral stability system (absence of load transfer media) & improper connections were observed in the structure. The building engineer is required to check the stability of the structure and suggest proper remedial actions accordingly.

### Observation-02: Absence of concrete compressive strength test result. (Chemical Store)

#### 2.3. Concrete

- A) Recommended Minimum Concrete Compressive Strength  $f'_c$  (28 days cylinder crushing strength).
- Columns = 3500 psi, with Mix Ratio = 1:1.5:3 by volume with w/c = 0.42
  - Footing = 3500 psi with Mix Ratio = 1:1.5:3 by volume with w/c = 0.42
  - Beams and Slabs = 3500 psi with Mix Ratio = 1:1.5:3 by volume with w/c = 0.45
- Concrete strength must be verified from the test results of the representative specimens.

#### 5.12.2 Frequency of Testing

5.12.2.1 Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 60 m<sup>3</sup> of concrete, nor less than once for each 250 m<sup>2</sup> surface area for slabs or walls.

5.12.2.2 On a given project, if the total volume of concrete is such that frequency of testing required by Sec 5.12.2.1 above would provide less than three strength tests for a given class of concrete, tests shall be made from at least three randomly selected batches or from each batch if three or fewer batches are used.

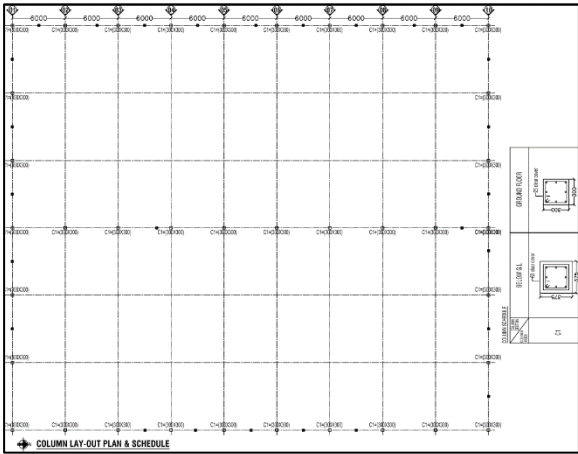
5.12.2.3 When the total quantity of a given class of concrete is less than 20 m<sup>3</sup>, strength tests are not required when evidence of satisfactory strength is submitted to and approved by the Engineer.

5.12.2.4 A strength test shall be the average of the strengths of at least two 150 mm by 300 mm cylinders or at least three 100 mm by 200 mm cylinders made from the same sample of concrete and tested at 28 days or at test age designated for determination of  $f'_c$ .



**Description:** In the design report, the compressive strength of concrete was considered as 3500 psi for column, footing, beam & slab etc. However, no concrete compressive strength test result was available onsite. The building engineer is required to verify in-situ material strength by taking a minimum adequate number of concrete cores and review the analysis & design report.

**Observation-03: Inconsistency in as-built drawing. (Chemical Store)**



**Description:** During the inspection, in the C-1 (300X300) column, 6 nos. rebar was found instead of 8 nos. rebar. The building engineer is required to survey the whole structure & update the as-built drawing.

**Observation-04: Crack was found on the slab soffit. (Chemical Store)**



**Description:** During the inspection, a crack was found on the slab soffit of the chemical store building. The building engineer is required to investigate the reason for cracks & repair as per the investigation report.

**Observation-05:** Adequacy of gantry girder, corbel and columns for overhead crane need to be checked (ETP Large).



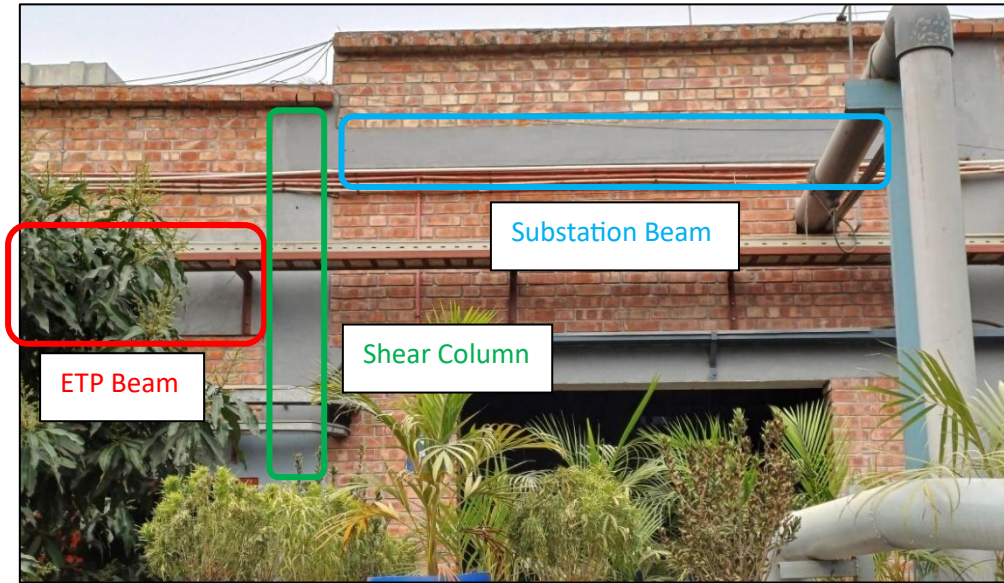
**Description:** In the design report, no adequacy check of gantry girder, corbel and columns for overhead crane have been found. The building engineer is required to incorporate the adequacy check of gantry girder, corbel and columns for overhead crane in design report.

**Observation-06:** Dampness was found on the brick wall. (ETP Large)



**Description:** During the inspection, dampness was found on some brick walls in ETP. The building engineer is required to repair dampness with a suitable method.

**Observation-07:** ETP Large & ETP Substation building are structurally connected.



**Description:** During the inspection, the ETP large & ETP substation was found structurally connected. However, in the design report, these two structures were analyzed separately. The building engineer is required to revise the design report considering these two structures as one structure.

**Observation-08:** Lack of as-built documents for the RC part of the Guard Room.



**Description:** During the inspection, as-built documents for the RC part of the Guard Room were not available.

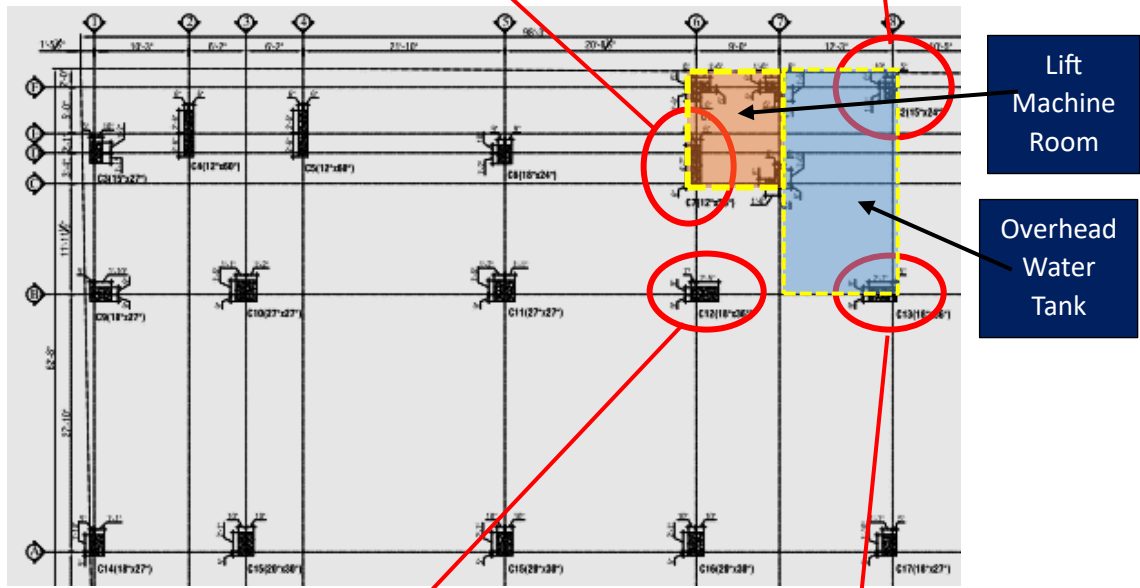
**Observation-9: Inconsistency in the design documents (Utility & Storage Building).**



Column size reduced above roof level  
12'X56" to 12" X24"



Column size reduced above the roof  
15'X24" to 15' X18"



Column Layout



Column size reduced above the roof  
18'X36" to 18" X18"



Column size reduced above the roof  
18'X36" to 18" X18"



100 mm thick build-up at 1<sup>st</sup> floor is not shown in the drawing or not incorporated in the design report

- a) TYPE : COMPRESSIVE STRENGTH BASED ON 28-DAY CYLINDER TEST CONSIDERED AS FOLLOWS :
- i) FOR FOUNDATION (FOOTING)  
 $f_c = \text{MINIMUM } 24 \text{ Mpa (3,500 psi)}$
  - ii) COMPRESSIVE STRENGTH FOR COLUMN / LIFT CORE/ SHEAR WALL:  
 $f_c = \text{MINIMUM } 28 \text{ Mpa (4,000 psi)}$
  - iii) COMPRESSIVE STRENGTH FOR GRADE BEAM.  
 $f_c = \text{MINIMUM } 24 \text{ Mpa (3,500 psi)}$
  - vi) COMPRESSIVE STRENGTH FOR BEAM, SLAB,  
OVER HEAD WATER TANK.  
 $f_c = \text{MINIMUM } 21 \text{ Mpa (3,000 psi)}$

Snapshot from as-built drawing

### 3.0 MATERIAL PROPERTY

The principal material of construction is reinforced concrete. As per design drawings, the following material properties have been used:

- Yield strength of steel (Rebar),  $f_y = 72,500 \text{ psi}$  and  $f_y = 60,000 \text{ psi}$
- Compressive strength of concrete,  $f_c = 4500 \text{ psi}$  for column and  $3500 \text{ psi}$  for beam and slab.

Snapshot from design report

Table 1: Floor occupancy and live load

| SL no | Floor  | Live Load (psf) |
|-------|--|-----------------|
| 01    | G. Floor                                       | N/A             |
| 02    | 1 <sup>st</sup> Floor                          | 125             |
| 03    | 2 <sup>nd</sup> Floor                          | 100             |
| 04    | 3 <sup>rd</sup> floor to 5 <sup>th</sup> floor | 100             |
| 05    | Roof   | 40              |

Live load was mentioned in the design report but no live load plan was available

**Description:** The size of 4 columns below the lift machine room and overhead water tank has been reduced from the roof level. 100 mm thick buildup was found on the 1st floor which was not incorporated in as-built drawing & design report. Mismatch found in concrete compressive strength between as-built drawing and design report (For column: 4500 psi in design report but 4000 psi in drawing, for beam & slab: 3500 psi in design report but 3000 psi in drawing). Live load was mentioned in the design report but no load plan was available during inspection.

The building engineer is required to revise the as-built drawing as per onsite condition, produce the load plan as per BNBC minimum requirement, update the design report as per the revised as-built drawing and load plan and submit all documents to RSC for review.

**Observation-10:** Lack of lateral stability system [Shed 1, ETP small (Old)].



**Description:** Truss action was observed in the short direction. No compression strut or load transfer media was observed in the long direction. The building engineer is required to check the lateral stability of the shed and submit it to the RSC review.

**Observation-11:** Apparently lack of lateral stability system [Shed 2 & 3, ETP small (Old)].



No bracing (Shed 2)



No bracing and no compression strut along eave (Shed 3)

**Description:** The portal frame was observed in the short direction. No bracing (Shed 2 & 3) and no compression strut along the eave (Shed 3) were observed in the long direction. The building engineer is required to check the lateral stability of the sheds as part of the Engineering Assessment (EA).

**Observation-12:** Lightweight steel roof shed [Shed 4, ETP small (Old)].



**Description:** Apparently inadequate members and connections were observed at the roof shed. The building engineer is required to check the member and connection adequacy check of the shed.

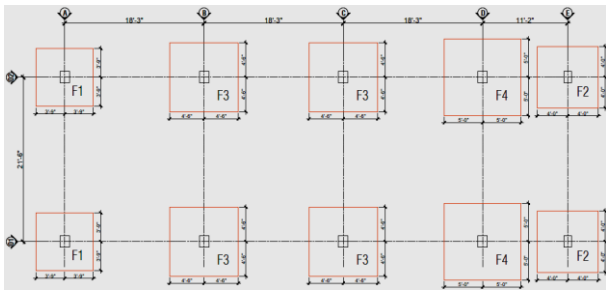
**Observation-13:** Corrosion on steel member [Shed 1 & 2, ETP small (Old)].



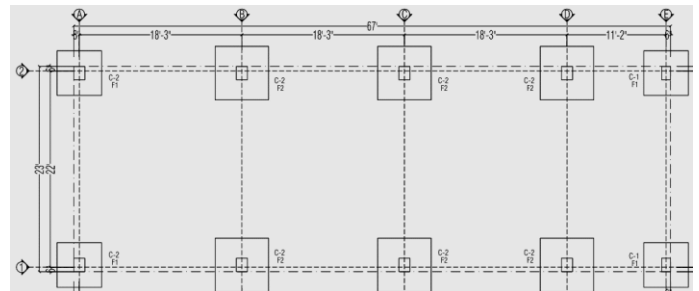
Shed 1

**Description:** Corrosion was observed on steel members of sheds 1 & 2. The building engineer is required to remove rust and apply anti-corrosive paint on steel members.

**Observation-14:** Inconsistency between construction drawing and as-built drawing (Substation & Generator Building).



Footing Layout (Construction Drawing)



Footing Layout (As-built Drawing)

| FOOTING SCHEDULE |              |        |                 |     |    |     |               |               |
|------------------|--------------|--------|-----------------|-----|----|-----|---------------|---------------|
| FOOTING INDEX    | FOOTING AREA |        | FOOTING SECTION |     |    |     | REINFORCEMENT |               |
|                  | X            | Y      | H               | h1  | h2 | a   | Asx           | Asy           |
| F1               | 7'-6"        | 7'-6"  | 18"             | 12" | 6" | 12" | Ø 16 @ 6" C/C | Ø 16 @ 6" C/C |
| F2               | 8'-0"        | 8'-0"  | 20"             | 15" | 5" | 12" | Ø 16 @ 6" C/C | Ø 16 @ 6" C/C |
| F3               | 9'-0"        | 9'-0"  | 20"             | 15" | 5" | 12" | Ø 16 @ 6" C/C | Ø 16 @ 6" C/C |
| F4               | 10'-0"       | 10'-0" | 20"             | 15" | 5" | 12" | Ø 16 @ 5" C/C | Ø 16 @ 5" C/C |

Footing Details (Construction Drawing)

| SCHEDULE OF INDIVIDUAL FOOTING AND REINFORCEMENT |          |           |           |     |    |                |                |
|--|----------|-----------|-----------|-----|----|----------------|----------------|
| TYPE   | LENGTH L | BREADTH B | THICKNESS |     |    | REINFORCEMENT  |                |
|  |          |           | D         | T1  | T2 | R <sub>L</sub> | R <sub>S</sub> |
| F1   | 5.40'    | 5.40'     | 20"       | 16" | 4" | 16mmØ@ 5" c/c  | 16mmØ@ 6" c/c  |
| F2   | 6.40'    | 6.40'     | 20"       | 16" | 4" | 16mmØ@ 5" c/c  | 16mmØ@ 5" c/c  |

Footing Details (As-built Drawing)

| COLUMN SCHEDULE |                |            |                |
|-----------------|----------------|------------|----------------|
| COLUMN INDEX    | COLUMN SECTION | BELOW G.L. | GROUND TO ROOF |
|                 |                | C1         | 14"            |
| C2              | 17"            |            |                |

Column Schedule (Construction Drawing)

| SCHEDULE OF COLUMN SIZE AND REINFORCEMENT |                       |             |                       |             |
|---|-----------------------|-------------|-----------------------|-------------|
| COLUMN ID                                 | BELOW GROUND LEVEL    |             | GF TO 1ST             |             |
|   | NOS. OF REINFORCEMENT | COLUMN SIZE | NOS. OF REINFORCEMENT | COLUMN SIZE |
| C1  | ● 10-20mmØ            |             | ● 10-20mmØ            |             |
| C2  | ● 12-20mmØ            |             | ● 12-20mmØ            |             |

Column Schedule (As-built Drawing)

**Description:** During the inspection, mismatches (some snapshots were provided above) were found in all structural elements (foundation, column, beam, slab etc.) between construction drawing and as-built drawing. The building engineer is required to survey the whole structure & update the as-built drawing as per onsite condition.

**Observation-15:** Inconsistency in compressive strength of concrete (Substation & Generator Building).

a) MINIMUM  $f_c$  (28 DAY'S CYLINDER STRENGTH ) ARE AS FOLLOWS:  
 FOUNDATION AND COLUMN  $f_c = 4000 \text{ psi}$  WITH 1:1.25:2.5  
 AND ALL OTHER CASES = 3500 psi WITH MIX RATIO = 1:1.5:3  
 CONCRETE STRENGTH SHOULD BE VERIFIED FROM THE TEST RESULTS OF THE REPRESENTATIVE SPECIMENS.  
 b) MINIMUM CYLINDER STRENGTH IS BASED ON CYLINDER WITH DIAMETER = 6" & HEIGHT = 12"

Snapshot taken from construction drawing

| Serial No. | Considering $f_c$                             | Sample for          | Material | Strength (psi) |
|------------|---|---------------------|----------|----------------|
| 1          | Compressive strength of concrete, $f_c$ (psi) | Column, Beam & Slab | Stone    | 3,000          |

Snapshot taken from design report

**Description:** In construction drawing, compressive strength of concrete has been considered as 4000 psi for footing and column but in design report, 3000 psi were mentioned. In addition, the available test results are insufficient to meet the evaluation and acceptance criteria of BNBC. The building engineer is required to evaluate concrete strength as per BNBC, revise design report accordingly and submit to RSC for review.

**Observation-16:** Building Permit from the local authority - not available (All Structures)



**Description:** During the inspection, a building permit from the local authority was not available for all the buildings. The factory authority is required to collect building permits from the local authority for the building.

### 3. Action Plan

| Observation  | Action Plan   | Timeline        |
|--|---|-----------------|
| Lack of roof lateral stability. (Dining & Printing)  | The building engineer is required to check the stability of the roof shed & revise the design report accordingly.                             | within 6 weeks  |
|  | Carry out remediation work if required.   | within 6 months |
| Absence of concrete compressive strength test result. (Chemical Store)                           | Verify in situ concrete strength (100mm dia. cores from 4 columns) from the lower tier of the building.                                       | within 6 weeks  |
|  | The building engineer is required to revise the design report for the concrete strength and submit it to RSC for review.                      | within 6 weeks  |
|  | Carry out suggested remedial works if required.   | within 6 months |
| Inconsistency in as-built drawing (Chemical Store)   | The building engineer is required to survey the whole structure & update the as-built drawing.  | within 6 weeks  |
| Crack was found on the slab soffit. (Chemical Store)   | The building engineer is required to investigate the reason for cracks & repair as per the investigation report.                              | within 6 months |
| Adequacy of gantry girder, corbel and columns for overhead crane need to be checked (ETP Large). | The building engineer is required to incorporate the adequacy check of gantry girder, corbel and columns for overhead crane in design report. | within 6 weeks  |
|  | Carry out suggested remedial works if required.   | within 6 months |
| Dampness was found on the brick wall. (ETP Large)  | The building engineer is required to repair the dampness with a suitable method.  | within 6 months |
| ETP Large & ETP Substation building are structurally connected.                                  | The building engineer is required to revise the design report considering these two structures as one structure                               | within 6 weeks  |
|  | Carry out suggested remedial works if required.   | within 6 months |

|  |  |                 |
|--|--|-----------------|
| Lack of as-built documents for the RC part (Guard Room)                    | The building engineer is required to survey the structure and prepare as-built documents.  | within 6 weeks  |
| Inconsistency in the design documents (Utility & Storage Building)         | The building engineer is required to survey the full structure and produce accurate as-built drawings.   | within 6 weeks  |
|  | The building engineer is required to revise the EA report for as-built condition based on in-situ material strength and submit the EA to RSC for review. | within 6 weeks  |
|  | Produce and actively manage a loading plan for all floor plates within the factory considering floor capacity and column capacity.                       | within 6 weeks  |
|  | Carry out remedial work where required.  | within 6 months |
| Lack of lateral stability system [Shed 1, ETP small (Old)].                | Building engineer is required to check the lateral stability of the shed and submit it to the RSC review.  | within 6 weeks  |
|  | Carry out remedial work where required.  | within 6 months |
| Apparently lack of lateral stability system [Shed 2 & 3, ETP small (Old)]. | Building engineer is required to check the lateral stability of the shed and submit it to the RSC review.  | within 6 weeks  |
|  | Carry out remedial work where required.  | within 6 months |
| Lightweight steel roof shed [Shed 4, ETP small (Old)].                     | Building engineer is required to check the lateral stability of the shed and submit it to the RSC review.  | within 6 weeks  |
|  | Carry out remedial work where required.  | within 6 months |
| Corrosion on steel member [Shed 1 & 2, ETP small (Old)].                   | The building engineer is required to remove rust and apply anti-corrosive paint on steel members.  | within 6 weeks  |

|  |   |                 |
|--|---|-----------------|
| Inconsistency between construction drawing and as-built drawing (Substation & Generator Building). | The building engineer is required to survey the whole structure & update the as-built drawing as per onsite condition.                              | within 6 weeks  |
| Inconsistency in compressive strength of concrete (Substation & Generator Building).               | Verify in situ concrete strength (100mm dia. cores from 4 columns) from the lower tier of the building.   | within 6 weeks  |
|  | The building engineer is required to revise the design report for the concrete strength & updated as-built drawing and submit it to RSC for review. | within 6 weeks  |
|  | Carry out suggested remedial works if required.   | within 6 months |
| Building Permit from local authority not available (All Structures)                                | Factory authority is required to building permit from the local government authority for the building.  | within 6 months |