

# Colour & Co. Ltd.

Tepirbari, Sreepur, Gazipur

(24.231968, 90.423694)

3 March 2024



## 1. Building Information

**Building-1 (Garments Production Building):** An eight-storied (G+7) reinforced concrete (RC) building.

**Building-2 (Admin Building):** A two storied (G+1) RC building.

**Building-3 (Security Building):** A single-storied RC building.

**Shed-1 (Utility Shed):** A single-storied steel shed.

**Shed-2 (Pump House Shed):** A single-storied steel shed.

**Water Tanks-1&2:** Single-storied RC water tanks.

## 2. Observations

**Observation-1:** Lack of adequate material test report & inconsistencies in the design report (Building-1)

**BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY (BUET)**  
DEPARTMENT OF CIVIL ENGINEERING  
CONCRETE LABORATORY

SPCC No: 150-0315 (R-2012), DL-480219  
Serial No: 150-0315 (R-2012)  
Test No: 150-0315 (R-2012)  
Project: 150-0315 (R-2012)  
Location: 150-0315 (R-2012)  
Test: 150-0315 (R-2012)  
Date of Test: 15/03/2019

**TEST REPORT**

| Sl. No. | Part of Casting in per No. of Test | Specimen Shape/Size | Area (mm <sup>2</sup> ) | Load (kN)         | Displacement (mm) | Average Load/Displacement | Modulus of Elasticity (GPa) |
|---------|------------------------------------|---------------------|-------------------------|-------------------|-------------------|---------------------------|-----------------------------|
| 1       | 150-0315 (R-2012)                  | 150-0315 (R-2012)   | 150-0315 (R-2012)       | 150-0315 (R-2012) | 150-0315 (R-2012) | 150-0315 (R-2012)         | 150-0315 (R-2012)           |
| 2       | 150-0315 (R-2012)                  | 150-0315 (R-2012)   | 150-0315 (R-2012)       | 150-0315 (R-2012) | 150-0315 (R-2012) | 150-0315 (R-2012)         | 150-0315 (R-2012)           |
| 3       | 150-0315 (R-2012)                  | 150-0315 (R-2012)   | 150-0315 (R-2012)       | 150-0315 (R-2012) | 150-0315 (R-2012) | 150-0315 (R-2012)         | 150-0315 (R-2012)           |

Notes: Samples were received in sealed condition. \*Combined in Slab and Aggregate Matrix.

Checked by: Dr. Md. Akbarul Kabir  
Professor  
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BUET, Dhaka 1000, Bangladesh

Test Performed by: Dr. Md. Akbarul Kabir  
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**2.3 Material Specifications**

Concrete compressive strength

- 1)  $f_c = 27.58$  MPa. (Foundation, Beam & Slab)
- 2)  $f_c = 31.03$  MPa. (Column)

Rebar yield strength

- 1)  $f_y = 413.79$  MPa for all structural elements.

**2.4 Load Cases**

Four load cases have been considered for analysis. They are described below.

**2.4.1 Dead Load**

The loads of the beams, columns, shear walls, slabs, foundation etc. are the dead load of a structure. Also floor finish, ceiling, partition wall and nonstructural elements attribute to dead loads. Dead load is calculated for this building based on BNBC 2006, table 6.2.2. In structural analysis the dead loads included the following items in table below.

Table - 1.2: Dead Load Considered for The Building.

| Load ID            | Applied Loads                                                        |
|--------------------|----------------------------------------------------------------------|
| Self Weight        | Actual weight of the column, beams, slab, stair etc.                 |
| Wall Load on floor | Distributed actual wall loads on panel as line load applicable.      |
| Wall Load on beam  | Distributed actual wall loads on beam as line load where applicable. |
| Floor Finish       | 25 pcf                                                               |

**2.4.2 Live Load**

Live loads are consists of occupant loads in building. Live load is considered for this building based on BNBC 2006, table 6.2.3. In structural analysis, the live loads included the following items in table below.

Table - 1.3: Live Load Considered for The Building.

| Level         | Zone                        | Live Load (KN/m <sup>2</sup> ) |
|---------------|-----------------------------|--------------------------------|
| Ground Floor  | Storage Purpose             | 3                              |
| Typical Floor | Light Manufacturing Purpose | 3                              |
| Stair         | All Floor                   | 5                              |
| Roof Floor    | Open to Sky                 | 1.5                            |

### 2.3 Material Specifications

Concrete compressive strength

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- 2)  $f_c = 31.03$  MPa. (Column)

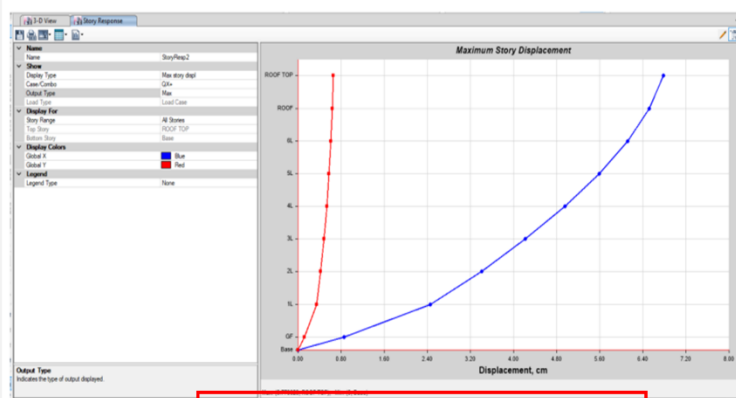
Cylinder test report (Column and slab)

Concrete strength considered in design report

### 3.6 Serviceability Check.

#### 3.6.1 Deflection

The value of deflection at top level has been found 97.56mm ( $L/400$ ) for wind at short direction. So sway of the structure is within the acceptable limit.



Mismatch in load case in lateral sway check

|     |    |              |        |            |          |           |                       |       |
|-----|----|--------------|--------|------------|----------|-----------|-----------------------|-------|
| C26 | GF | C 900X900    | Bottom | 13747.5369 | 580.696  | 0         | 02. 1.4D+1.7L         | 1.64% |
| C27 | GF | C600X600     | Top    | 6798.0679  | 225.9678 | 84.0939   | 30. 1.4D+1.4L+1.4EQY- | 2.62% |
| C27 | GF | C600X600     | Bottom | 6812.3189  | -        | 0         | 30. 1.4D+1.4L+1.4EQY- | 2.62% |
| C28 | GF | C375X600     | Top    | 913.5704   | -30.3671 | 0.2275    | 31. 1.05D+1.275L      | 1%    |
| C28 | GF | C375X600     | Bottom | 920.2506   | -30.5891 | 0         | 31. 1.05D+1.275L      | 1%    |
| C29 | GF | C600X600     | Top    | 6660.0151  | 221.3789 | 170.6014  | 30. 1.4D+1.4L+1.4EQY- | 2.42% |
| C29 | GF | C600X600     | Bottom | 6674.2661  | 221.8526 | 0         | 30. 1.4D+1.4L+1.4EQY- | 2.43% |
| C30 | GF | C 900X900    | Top    | 13249.8231 | -7.8991  | -559.6725 | 02. 1.4D+1.7L         | 1.34% |
| C30 | GF | C 900X900    | Bottom | 13281.8878 | -        | 0         | 02. 1.4D+1.7L         | 1.36% |
| C31 | GF | C 900X900    | Top    | 13680.1984 | -        | -32.2782  | 02. 1.4D+1.7L         | 1.60% |
| C31 | GF | C 900X900    | Bottom | 13712.2631 | 579.206  | 0         | 02. 1.4D+1.7L         | 1.62% |
| C32 | GF | C 900X900    | Top    | 13674.7764 | -1.9664  | 577.6225  | 02. 1.4D+1.7L         | 1.59% |
| C32 | GF | C 900X900    | Bottom | 13706.8411 | 578.977  | 0         | 02. 1.4D+1.7L         | 1.61% |
| C35 | GF | C 900X900    | Top    | 13741.6856 | 0.2121   | 580.4488  | 02. 1.4D+1.7L         | 1.63% |
| C35 | GF | C 900X900    | Bottom | 13773.7503 | 581.8032 | 0         | 02. 1.4D+1.7L         | 1.65% |
| C36 | GF | C600X600     | Top    | 6802.8835  | 2.2995   | 226.1279  | 02. 1.4D+1.7L         | 2.61% |
| C36 | GF | C600X600     | Bottom | 6817.1345  | -        | 0         | 02. 1.4D+1.7L         | 2.63% |
| C37 | GF | C375X600     | Top    | 1237.5413  | 41.1359  | -8.3479   | 31. 1.05D+1.275L      | 1%    |
| C37 | GF | C375X600     | Bottom | 1244.2214  | 41.3579  | 0         | 31. 1.05D+1.275L      | 1%    |
| C38 | GF | C750X750X375 | Top    | 2578.296   | -97.3049 | -87.4927  | 31. 1.05D+1.275L      | 1%    |
| C38 | GF | C750X750X375 | Bottom | 2590.8212  | 97.7776  | 0         | 31. 1.05D+1.275L      | 1%    |
| C39 | GF | C600X600     | Top    | 8215.8768  | 207.0772 | -273.0958 | 30. 1.4D+1.4L+1.4EQY- | 4.59% |
| C39 | GF | C600X600     | Bottom | 8230.1278  | 0        | 273.5695  | 30. 1.4D+1.4L+1.4EQY- | 4.63% |

### Possible overstress in column as per design report

#### 4.4 Floor Beam Design (1<sup>ST</sup> FLOOR):

##### 4.4.1: Sample Calculation of 1st Floor Beam (FB-300X600)

| Beam Element Details (Summary) |         |             |            |                      |         |             |      |              |
|--------------------------------|---------|-------------|------------|----------------------|---------|-------------|------|--------------|
| Level                          | Element | Unique Name | Section ID | Combo ID             | Station | Length (mm) | LLRF | Type         |
| 1L                             | B59     | 1072        | FB300X600  | 08.<br>0.9D+1.43EQX- | 375     | 2544        | 1    | Sway Special |

| Section Properties |        |                     |                     |                     |                     |
|--------------------|--------|---------------------|---------------------|---------------------|---------------------|
| b (mm)             | h (mm) | b <sub>l</sub> (mm) | d <sub>l</sub> (mm) | d <sub>u</sub> (mm) | d <sub>u</sub> (mm) |
| 300                | 600    | 300                 | 0                   | 60                  | 60                  |

| Material Properties  |                      |                        |                      |                       |
|----------------------|----------------------|------------------------|----------------------|-----------------------|
| E <sub>c</sub> (MPa) | f <sub>c</sub> (MPa) | LLWF Factor (Unitless) | f <sub>y</sub> (MPa) | f <sub>yk</sub> (MPa) |
| 24855.58             | 27.58                | 1                      | 413.69               | 413.69                |

| Design Code Parameters |                   |                   |                   |                |                |
|------------------------|-------------------|-------------------|-------------------|----------------|----------------|
| Φ <sub>t</sub>         | Φ <sub>ctad</sub> | Φ <sub>ctad</sub> | Φ <sub>ctad</sub> | Φ <sub>u</sub> | Φ <sub>u</sub> |
| 0.9                    | 0.65              | 0.75              | 0.75              | 0.6            | 0.85           |

| Design Moment and Flexural Reinforcement for Moment, M <sub>u</sub> |                       |                       |                                  |                                  |                                  |                                   |
|---------------------------------------------------------------------|-----------------------|-----------------------|----------------------------------|----------------------------------|----------------------------------|-----------------------------------|
|                                                                     | Design Moment<br>kN-m | Design Moment<br>kN-m | -Moment Rebar<br>mm <sup>2</sup> | +Moment Rebar<br>mm <sup>2</sup> | Minimum Rebar<br>mm <sup>2</sup> | Required Rebar<br>mm <sup>2</sup> |
| Top (+2 Axis)                                                       | -166.5396             |                       | 0                                | 870                              | 540                              | 870                               |
| Bottom (-2 Axis)                                                    |                       | 83.2698               | 0                                | 424                              | 540                              | 540                               |

| Shear Force and Reinforcement for Shear, V <sub>u</sub> |                            |                            |                            |                                          |                                          |
|---------------------------------------------------------|----------------------------|----------------------------|----------------------------|------------------------------------------|------------------------------------------|
| Shear V <sub>u</sub><br>kN                              | Shear V <sub>u</sub><br>kN | Shear V <sub>u</sub><br>kN | Shear V <sub>u</sub><br>kN | Rebar A <sub>s</sub> /mm <sup>2</sup> /m | Rebar A <sub>s</sub> /mm <sup>2</sup> /m |
| 211.0141                                                | 0                          | 211.0141                   | 209.2458                   | 1259.47                                  |                                          |

| Torsion Force and Torsion Reinforcement for Torsion, T <sub>u</sub> |                        |                                        |                                 |                                          |                                         |
|---------------------------------------------------------------------|------------------------|----------------------------------------|---------------------------------|------------------------------------------|-----------------------------------------|
| Φ <sup>2</sup> f <sub>u</sub><br>kN-m                               | T <sub>u</sub><br>kN-m | Area A <sub>s</sub><br>cm <sup>2</sup> | Perimeter, p <sub>s</sub><br>mm | Rebar A <sub>s</sub> /mm <sup>2</sup> /m | Rebar A <sub>s</sub><br>mm <sup>2</sup> |
| 0.3369                                                              | 5.8868                 | 917.1                                  | 1444.4                          | 0                                        | 0                                       |

#### 2.4.4 Seismic Load

Seismic loading parameters are being considered in accordance with BNBC 2006, Chapter 2 titled "Load".

Table 4.4: Seismic Parameters Considered for The Building.

| Description                           | Data |
|---------------------------------------|------|
| Seismic Zone "Z"                      | II   |
| Site Coefficient Factor, "S"          | 1.5  |
| Response Modification Coefficient "R" | 8    |
| Structure Importance Coefficient "I"  | 1    |

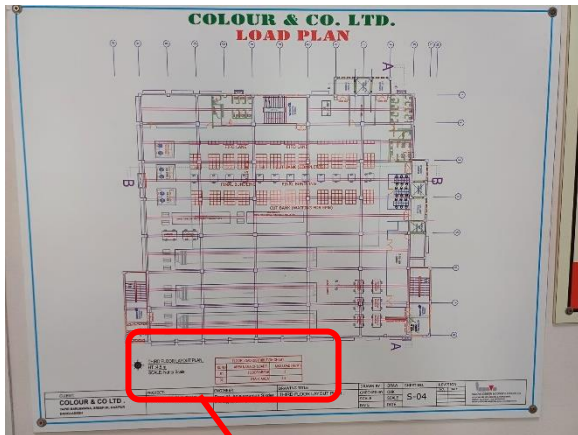
### Beams designed as sway special

**Description:** In the design report, concrete strength of columns and beams were considered 31 MPa and 27.6 MPa respectively. However, to consider this concrete strength, the number of cylinders taken are not adequate as per the frequency test criteria of BNBC (Section 5.12) since there are only 9 sets of cylinder test reports (2 from columns, 7 from slabs). The building engineer is required to take adequate core samples to verify the in-situ strength of concrete.

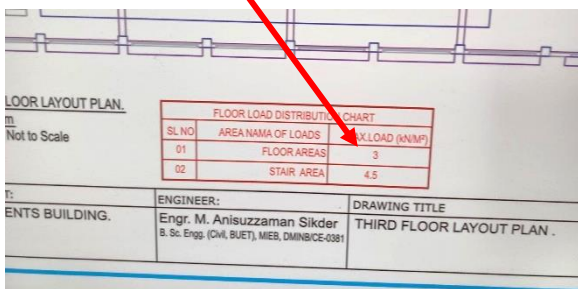
In the design report, lateral sway is checked for earthquake load cases although the deflection limit is provided for wind load case. The building engineer is required to check the lateral sway for wind load also. As per design report, maximum required reinforcement of 600X600 column is 4.63% at ground floor, however, maximum provided reinforcement of any 600X600 column is 2.11%. The grade and floor beams have been designed as sway special although value of R has been considered for Intermediate Moment Resisting Frame.

The building engineer is required to revise the Detailed Engineering Assessment (DEA) report and submit it to the RSC for further review.

**Observation-2:** Storage live load limit does not comply with BNBC requirement. (Building-1)



storage areas in 3<sup>rd</sup> floor



load plan of 3<sup>rd</sup> floor

| BUILDING                                                        |                                                                                           | (1)<br>w<br>kN/m <sup>2</sup> | (2)<br>P<br>kN                | BUILDING                                                                    |                                       | (1)<br>w<br>kN/m <sup>2</sup> | (2)<br>P<br>kN     |
|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------|-------------------------------|-----------------------------------------------------------------------------|---------------------------------------|-------------------------------|--------------------|
| Occupancy                                                       | Use of floor                                                                              |                               |                               | Occupancy                                                                   | Use of floor                          |                               |                    |
| RESIDENTIAL<br>(Occupancy - A)<br>One- or two- family dwellings | 1 Room, internal corridor, private stair                                                  | 2.0                           | 1.8                           | BUSINESS AND MERCANTILE<br>(Occupancy - F)<br>Office, bank, laboratory etc. | 1 General office room, banking hall   | 3.0                           | 9.0 <sup>(3)</sup> |
|                                                                 | 2 External stair and corridor                                                             | 3.0                           | 2.7                           |                                                                             | 2 Laboratory, kitchen                 | 3.0                           | 4.5                |
|                                                                 | 1 Bed room, living room, bath room, toilet, dressing room                                 | 2.0                           | 1.8                           |                                                                             | 3 Computer, business machine room     | 3.5                           | 9.0                |
|                                                                 | 2 Office room                                                                             | 2.5                           | 2.7                           |                                                                             | 4 File room, filing and storage space | 6.0                           | 4.5                |
|                                                                 | 3 Cafeteria, restaurant, kitchen, laundry, lobby, lounge, game room, dining hall, balcony | 3.0                           | 4.5                           |                                                                             | 5 Vaults in office and bank           | 5.0                           | 4.5                |
|                                                                 | 4 Corridor, retail store, staircase                                                       | 4.0                           | 4.5                           |                                                                             | 6 Telephone exchange                  | 6.0                           | 4.5                |
| 5 Store room                                                    | 5.0                                                                                       | 4.5                           | 1 Retail store                | 4.0                                                                         | 3.6                                   |                               |                    |
| 6 Garage, car parking floor, ramp (See Occupancy - K)           | -                                                                                         | -                             | 2 Wholesale store             | 6.0                                                                         | 13.5 <sup>(3)</sup>                   |                               |                    |
| H-CARE<br>Nursing homes, hospitals, medical institutions, etc.  | 1 Bed room, dressing room, toilet, hospital ward and cabin, cell blocks of jail           | 2.0                           | 1.8                           | 3 Storage : light heavy                                                     | 6.0                                   | 4.5                           |                    |
|                                                                 |                                                                                           |                               |                               |                                                                             | 12.0                                  | 14.0 <sup>(3)</sup>           |                    |
|                                                                 |                                                                                           |                               |                               | 1 Light workroom without storage                                            | 3.0                                   | 2.7                           |                    |
|                                                                 |                                                                                           |                               |                               | 2 Machinery hall & circulation area                                         | 4.0                                   | 4.5                           |                    |
|                                                                 |                                                                                           |                               | 3 Factory, workshop etc.      | 5.0                                                                         | 4.5                                   |                               |                    |
|                                                                 |                                                                                           |                               | 4 Manufacturing : light heavy | 6.0                                                                         | 4.5                                   |                               |                    |
|                                                                 |                                                                                           |                               |                               | 12.0                                                                        | 9.0 <sup>(3)</sup>                    |                               |                    |

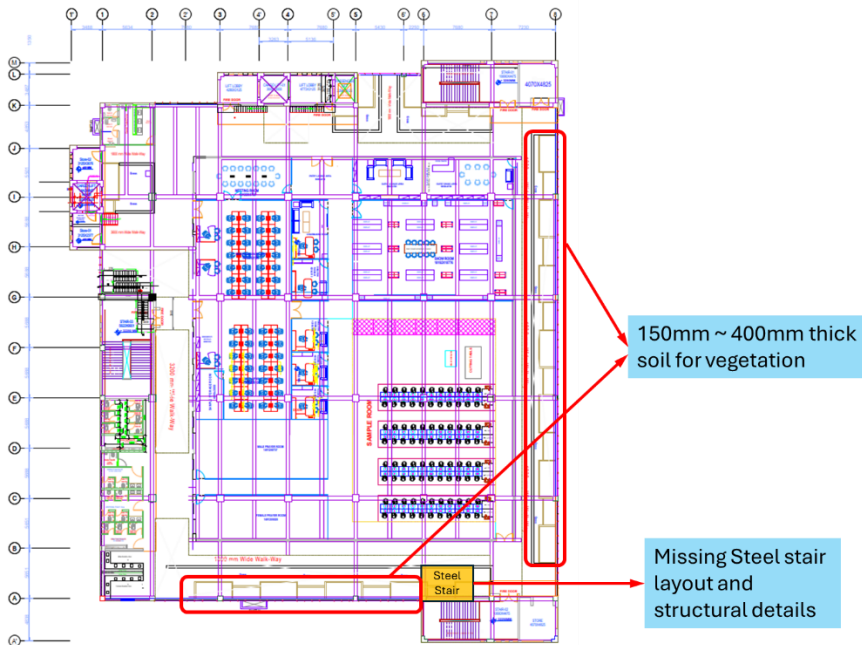
Floor live load in storage areas as per BNBC

**Description:** As per BNBC, 6 kPa is required to consider floor loading for the light storage facilities. During the inspection, the load plan was found posted considering 3 kPa at the storage area. Height marking was not provided.

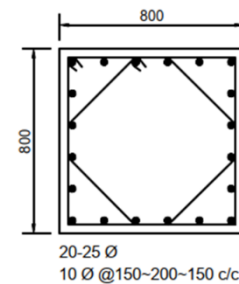
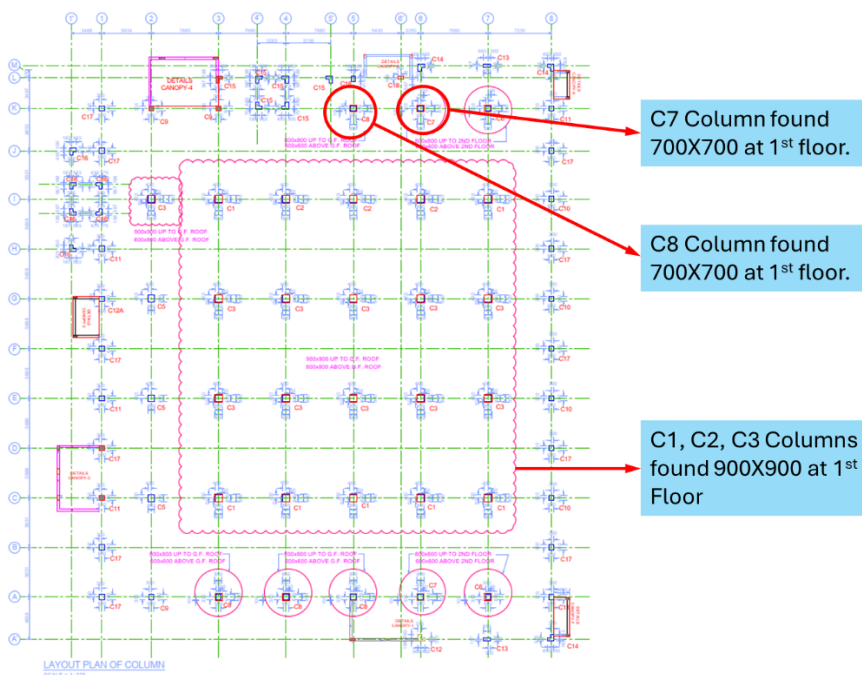
The Building Engineer is required to update the storage live load limit as per BNBC requirements and revise the structural analysis & DEA report accordingly. Post the updated load plan and provide storage height markings.



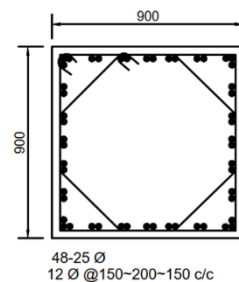
### Observation-3: Mismatch in as-built drawing (Building-1)



#### Missing details of steel stairs and soil thickness at the roof



C7, C8 Column at 1<sup>st</sup> floor.



C1, C2, C3 Column at 1<sup>st</sup> floor.

#### Mismatch in column size

**Description:** During the inspection, a few mismatches were found in the as-built drawing which are given below.

- Mismatch was found in the marked column sizes (C1, C2 and C3 column sizes were found 900X900 at 1<sup>st</sup> floor, C7 and C8 column sizes were found 700X700 at 1<sup>st</sup> floor).
- Layout and structural details of steel stairs at the roof were found missing.
- There is Gardening on the roof. However, in architectural drawings, there is no mention of soil thickness.

The building engineer is required to survey the full structure and update the as-built drawings and DEA report accordingly.

**Observation-4:** Lack of anchorage in the storage rack. (Building-1)



**Description:** During inspection, storage racks were found not anchored. The building engineer is required to anchor/ laterally brace all non-structural elements including storage racks to resist earthquake forces.

**Observation-5:** Rebar on the roof is not properly sealed. (Building-1)



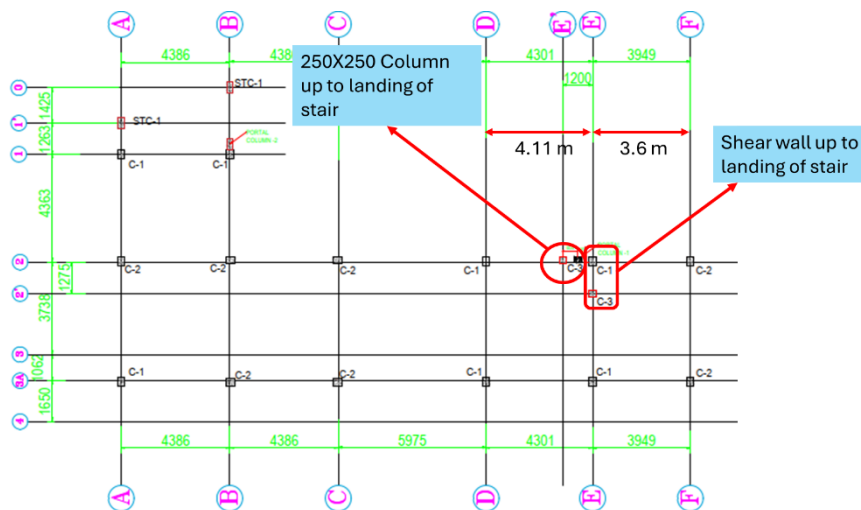
**Description:** During inspection, reinforcements of columns at the roof were found improperly sealed and prone to corrosion. The building engineer is required to cover all the exposed rebars in suitable method.

**Observation-6:** Lack of design report (Building-2)

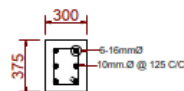
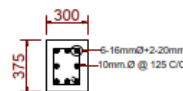
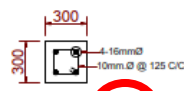
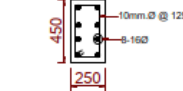


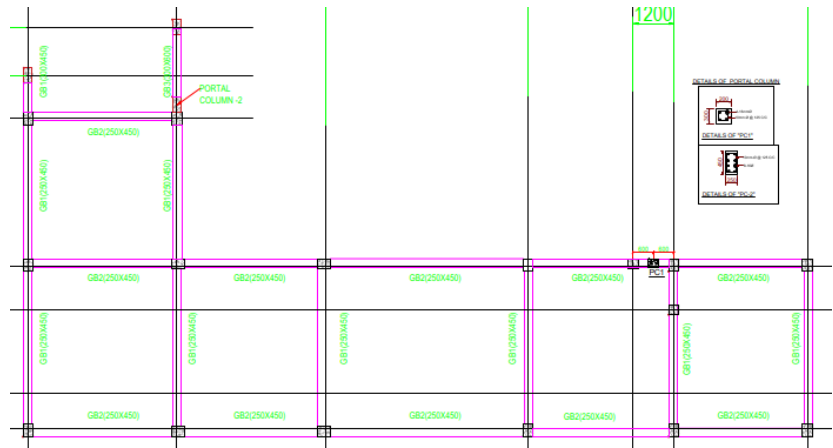
**Description:** As per BNBC, every building or structure designed shall have its design documents prepared following the provision of Section 1.9.1. The design document shall include a design report, a set of as-built drawings and load plans which shall be prepared in compliance with section 1.9.1.1 and section 1.9.1.2, part-6 of BNBC.

**Observation-7:** Mismatch in as-built drawings (Building-2)



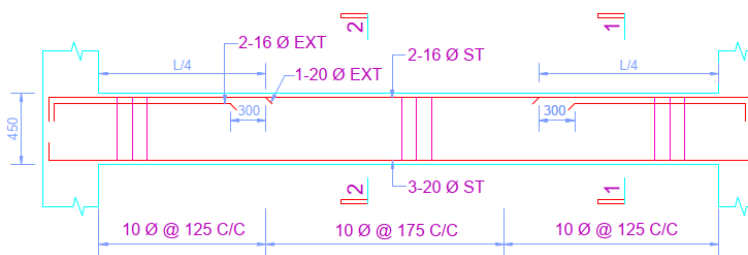


| COLUMN DETAILS                                                                                           |                                                                                                             |
|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
|  <p>DETAILS OF "C1"</p> |  <p>DETAILS OF "C2"</p>    |
|  <p>DETAILS OF "C3"</p> |  <p>DETAILS OF "STC-1"</p> |

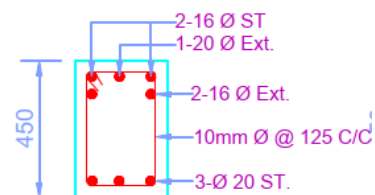


Missing schedule of C3 Column

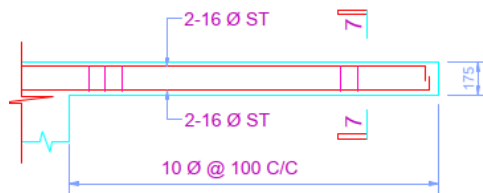
Grade Beam size shown 250X450 in layout



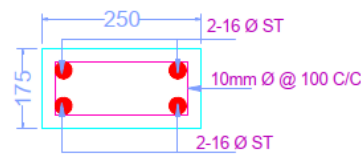
**LONG SECTION OF GB1 (250X450)**



**SEC. ON 1-1**



**LONG SECTION OF FB3 (150X250)**



**SECTION - 7-7**

Mismatch in grade beam and floor beam sizes between beam layout and section

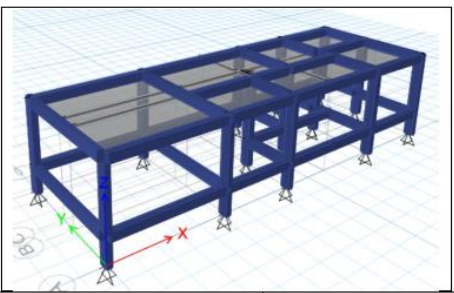
**Description:** During the inspection, a few mismatches were found in the as-built drawing which is given below.

- Mismatch was found in the marked grid distances.
- A shear wall was found supporting the landing of the stairs. In structural drawing, two columns are shown in place of the shear wall.
- In grid 2-E', C3 column is shown. However, a 250X250 RC column was found in place of the C3 column. Another 250X250 RC column was found supporting the landing of the stairs in place of the brick pier shown in the drawing. Details of C3 column are missing in the column schedule.
- Mismatches were found between the grade beam and floor beam layouts and sections.

The building engineer is required to survey the whole structure and update the as-built drawings as per site conditions.

**Observation-8:** Lack of material test report & inconsistencies in the design report (Building-3)

  
**DESIGN REPORT**  
**ON**  
**G+1 STORIED RC STRUCTURE (GUARD HOUSE BUILDING)**  
**FOR**  
**COLOUR & CO LTD.**  
**ADDRESS: TAPIR BARI, MAWNA, SREEPUR, GAZIPUR- 1740.**



|                                                                                                                                                                                                                                     |                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Submitted By -</b><br><b>INNOVO DESIGN &amp; CONSTRUCTION LTD.</b><br>Address: House # 183(GF), Road No-02,<br>Mirpur DOHS<br>Mirpur-12, Dhaka-1216, Bangladesh.<br>Phone: 01707077756, 01819257080<br>Email: innovobd@gmail.com | <b>Report Prepared By -</b><br><b>Engr. M. Anisuzzaman Sikder</b><br>B.Sc. Engg. (Civil), MIEB/17888<br>Rajuk Reg. No.: DMIN/ICE-0381 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|

Concrete compressive strength

- 1)  $f_c = 27.58$  MPa. (Footing, Beam & Slab)
- 2)  $f_c = 31.03$  MPa. (Column)

Rebar yield strength

- 1)  $f_y = 413.79$  Mpa for all structural elements.

**2.4 Load Cases**

Concrete strength in the design report

Mismatch in the load case in the lateral sway check

**3.6 Serviceability Check.**

**3.6.1 Deflection**

The value of deflection at top level has been found  $8.625\text{mm}$  ( $L/400$ ) for wind at short direction. So sway of the structure is within the acceptable limit.

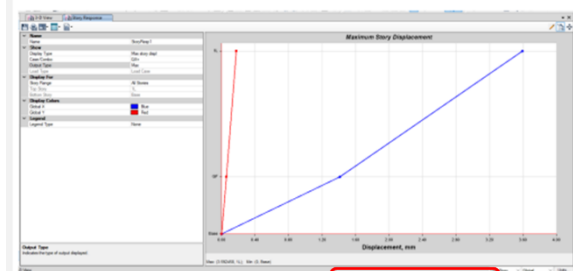
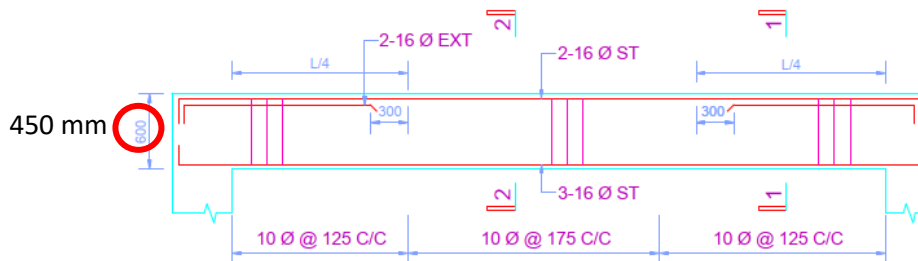


Figure - 3.0: Max Story displacement for QX+ (3.6mm) of Structure.



**LONG SECTION OF FB1 (250X450)**

Floor Beam Section

**2.4.4 Seismic Load**

Seismic loading parameters are being considered in accordance with BNBC 2006, Chapter 2 titled "Load".

**Table- 1.4: Seismic Parameters Considered for The Building.**

| Description                           | Data |
|---------------------------------------|------|
| Seismic Zone "Z"                      | II   |
| Site Coefficient Factor. "S"          | 1.5  |
| Response Modification Coefficient "R" | 8    |
| Structure Importance Coefficient "I"  | 1    |

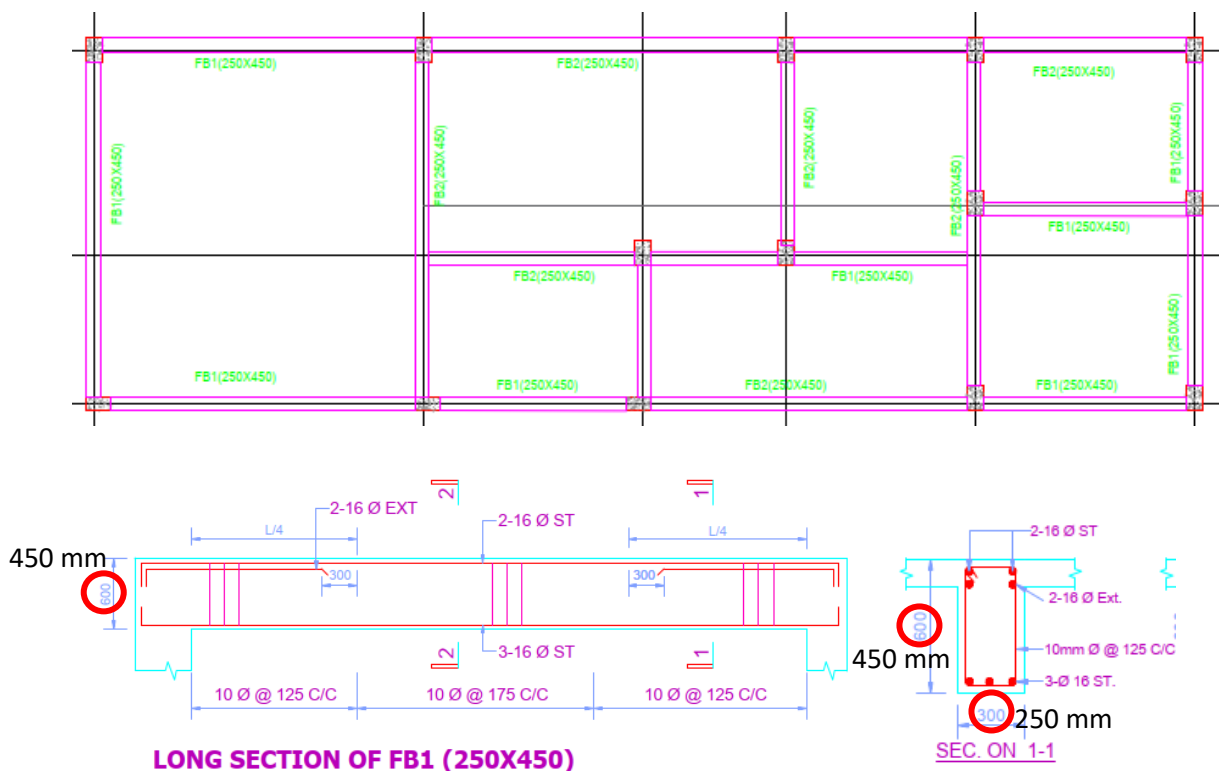
Response Modification Factor (R) considered in the design report

**Description:** In the design report, the concrete strength of columns and beams was considered 31 MPa and 27.6 MPa respectively. However, there were no cylinder test reports found on-site to verify the concrete strength. The building engineer is required to take adequate core samples to verify the in-situ strength of concrete.

In the design report, lateral sway is checked for earthquake load cases although the deflection limit is provided for wind load cases. The building engineer is required to check the lateral sway for wind load also. Floor beam sizes were found 250X450 on-site. As per the design report, the value of R has been considered for the Intermediate Moment Resisting Frame (IMRF). However, the spacing of transverse reinforcement of the beams doesn't comply with the requirement of IMRF.

The building engineer is required to revise the Engineering Assessment (EA) report and submit it to the RSC for review.

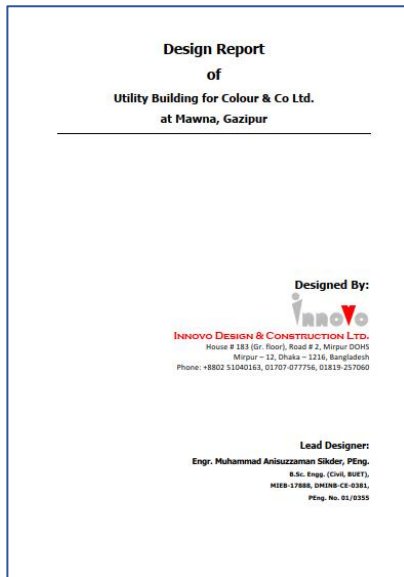
#### Observation-9: Mismatch in as-built drawings (Building-3)



#### Mismatch in grade beam and floor beam sizes between beam layout and beam section

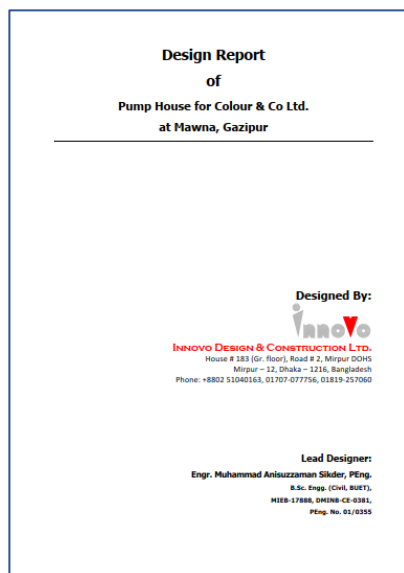
**Description:** During the inspection, mismatches were found in the as-built drawings of the floor beam and grade beam. The floor beam size was found 250X450 on-site whereas the section of floor beams in the as-built drawing shows 300X600. The building engineer is required to survey the full structure and update the as-built drawings and EA report accordingly.

**Observation-10:** Design documents need to be reviewed for lateral forces. (Shed-1)



**Description:** During the inspection, a structural design report and as-built drawings were available on site which need to be reviewed by RSC in depth for lateral forces. Serviceability checks have not been provided in the design report and connection adequacy checks are also missing. The building engineer is required to revise the Engineering Assessment (EA) report, submit it to the RSC for review and implement remedial works if required.

**Observation-11:** Design documents need to be reviewed for lateral forces. (Shed-2)



**Description:** During the inspection, a structural design report and as-built drawings were available on site which need to be reviewed by RSC in depth for lateral forces. Serviceability checks have not been provided in the design report and connection adequacy checks are also missing. The building engineer is required to revise the Engineering Assessment (EA) report, submit it to the RSC for review and implement remedial works if required.



### 3. Action Plan

| Serial | Observation                                                                               | Action Plan                                                                                                                                   | Timeline        |
|--------|-------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 1      | Lack of adequate material test report & inconsistencies in the design report (Building-1) | The building engineer is required to take adequate core samples to verify the in-situ strength of concrete.                                   | within 6 weeks  |
| 2      | Lack of adequate material test report & inconsistencies in the design report (Building-1) | The building engineer is required to revise the Detailed Engineering Assessment (DEA) report and submit it to the RSC for further review.     | within 6 weeks  |
| 3      | Lack of adequate material test report & inconsistencies in the design report (Building-1) | Carry out suggested remedial works if required.                                                                                               | within 6 months |
| 4      | Lack of adequate material test report & inconsistencies in the design report (Building-1) | Implement an allowable floor loading plan.                                                                                                    | within 6 months |
| 5      | Storage live load limit does not comply with BNBC requirements. (Building-1)              | The Building Engineer is required to update the storage live load limit as per BNBC requirements.                                             | within 6 weeks  |
| 6      | Mismatch in the as-built drawing. (Building 1)                                            | The building engineer is required to survey the full structure and update the as-built drawings and DEA report accordingly.                   | within 6 weeks  |
| 7      | Lack of anchorage of storage rack. (Building-1)                                           | The building engineer is required to anchor/ laterally brace all non-structural elements including storage racks to resist earthquake forces. | within 6 months |
| 8      | Rebar on the roof is not properly sealed. (Building-1)                                    | The building engineer is required to cover all the exposed rebars in a suitable method.                                                       | within 6 months |
| 9      | Lack of design report (Building-2)                                                        | The building engineer is required to prepare design documents in compliance with section 1.9.1.1 and section 1.9.1.2, part-6 of BNBC.         | within 6 weeks  |
| 10     | Lack of design report (Building-2)                                                        | Carry out suggested remedial works if required.                                                                                               | within 6 months |
| 11     | Mismatch in as-built drawings (Building-2)                                                | The building engineer is required to survey the whole structure and update the as-built drawings as per site conditions.                      | within 6 weeks  |

|    |                                                                                  |                                                                                                                            |                 |
|----|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------|
| 12 | Lack of material test report & inconsistencies in the design report (Building-3) | The building engineer is required to take adequate core samples to verify the in-situ strength of concrete.                | within 6 weeks  |
| 13 | Lack of material test report & inconsistencies in the design report (Building-3) | The building engineer is required to revise the Engineering Assessment (EA) report and submit it to the RSC for review.    | within 6 weeks  |
| 14 | Lack of material test report & inconsistencies in the design report (Building-3) | Carry out suggested remedial works if required.                                                                            | within 6 months |
| 15 | Lack of material test report & inconsistencies in the design report (Building-3) | Implement an allowable floor loading plan.                                                                                 | within 6 months |
| 16 | Mismatch in as-built drawings (Building-3)                                       | The building engineer is required to survey the full structure and update the as-built drawings and EA report accordingly. | within 6 weeks  |
| 17 | Design documents need to be reviewed for lateral forces. (Shed-1)                | The building engineer is required to revise the Engineering Assessment (EA) report and submit it to the RSC for review.    | within 6 weeks  |
| 18 | Design documents need to be reviewed for lateral forces. (Shed-1)                | Carry out remedial work if required.                                                                                       | within 6 months |
| 19 | Design documents need to be reviewed for lateral forces. (Shed-2)                | The building engineer is required to revise the Engineering Assessment (EA) report and submit it to the RSC for review.    | within 6 weeks  |
| 20 | Design documents need to be reviewed for lateral forces. (Shed-2)                | Carry out remedial work if required.                                                                                       | within 6 months |