

# Kenpark Bangladesh Apparel (Pvt) Ltd

## K-5 (Extension)

Plot no # 14-23, Sector # 2, Karnaphuli EPZ Chatrogram  
(22.2779809264, 91.7883133872)

14 September 2023



# Buildings Information

1. Building-C is a seven-storied (G+M+6) reinforced concrete (RC) building with a mezzanine floor.
2. Utility Building-2 is a two-storied (G+1) RC building.
3. Diesel Tank Room is a single-storied steel struct.
4. CMS Shed is a single-storied steel structure.
5. Guard Room-1 East is a single-storied RC building.
6. Guard Room-2 West is a single-storied RC building.
7. Garbage Fired Boiler Room is a single-storied RC building.
8. Garbage Storage Shed is a single-storied light weight steel structure.
9. Garbage Segregation Shed is a single-storied lightweight steel structure.
10. Guard Room is a single-storied RC structure.
11. Car Parking and Driver Waiting Shed is a single-storied steel structure.

# Observations

## **Overstressed Columns considering BNBC live load**



## **FoS of the pile foundation below BNBC requirement**

Table 4.1.1: Pile Capacity check for BNBC Loading

| POINT | Foundation Type | No. of Pile | Ultimate Capacity per Pile (Kip) | Ultimate Capacity of Pile Group (Kip) | Dead Load (kip) | Live Load (kip) | Reaction (kip) | Factor of Safety (FOS) | Remarks (Min FOS=1.5) |
|-------|-----------------|-------------|----------------------------------|---------------------------------------|-----------------|-----------------|----------------|------------------------|-----------------------|
| 1     | PC1             | 3           | 181.97                           | 546                                   | 180             | 27              | 207            | 2.64                   | OK                    |
| 31    | PC4             | 6           | 181.97                           | 1092                                  | 322             | 68              | 390            | 2.80                   | OK                    |
| 71    | PC5             | 7           | 181.97                           | 1274                                  | 383             | 88              | 471            | 2.70                   | OK                    |
| 100   | PC5             | 7           | 181.97                           | 1274                                  | 377             | 88              | 465            | 2.74                   | OK                    |
| 99    | PC5             | 7           | 181.97                           | 1274                                  | 382             | 89              | 471            | 2.70                   | OK                    |
| 98    | PC5             | 7           | 181.97                           | 1274                                  | 484             | 101             | 584            | 2.18                   | OK                    |
| 97    | PC5             | 7           | 181.97                           | 1274                                  | 570             | 100             | 670            | 1.90                   | OK                    |
| 101   | PC2             | 4           | 181.97                           | 728                                   | 373             | 52              | 425            | 1.71                   | OK                    |
| 2     | PC3             | 5           | 181.97                           | 910                                   | 266             | 54              | 320            | 2.84                   | OK                    |
| 32    | PC7             | 9           | 181.97                           | 1638                                  | 452             | 134             | 586            | 2.79                   | OK                    |
| 72    | PC8             | 10          | 181.97                           | 1820                                  | 522             | 171             | 693            | 2.63                   | OK                    |
| 104   | PC8             | 10          | 181.97                           | 1820                                  | 500             | 174             | 674            | 2.70                   | OK                    |
| 129   | PC8             | 10          | 181.97                           | 1820                                  | 492             | 166             | 658            | 2.77                   | OK                    |
| 165   | PC8             | 10          | 181.97                           | 1820                                  | 449             | 100             | 549            | 3.31                   | OK                    |
| 187   | PC8             | 10          | 181.97                           | 1820                                  | 472             | 108             | 580            | 3.14                   | OK                    |
| 102   | PC4             | 6           | 181.97                           | 1092                                  | 449             | 79              | 528            | 2.07                   | OK                    |
| 14    | PC4             | 6           | 181.97                           | 1092                                  | 405             | 60              | 465            | 2.35                   | OK                    |
| 33    | PC7             | 9           | 181.97                           | 1638                                  | 625             | 106             | 731            | 2.24                   | OK                    |
| 73    | PC7             | 9           | 181.97                           | 1638                                  | 660             | 148             | 808            | 2.03                   | OK                    |
| 105   | PC9             | 11          | 181.97                           | 2002                                  | 594             | 204             | 798            | 2.51                   | OK                    |
| 130   | PC7             | 9           | 181.97                           | 1638                                  | 495             | 154             | 649            | 2.52                   | OK                    |
| 164   | PC4             | 6           | 181.97                           | 1092                                  | 605             | 164             | 770            | 1.50                   | OK                    |
| 166   | PC5             | 7           | 181.97                           | 1274                                  | 425             | 65              | 491            | 2.60                   | OK                    |
| 188   | PC4             | 6           | 181.97                           | 1092                                  | 451             | 82              | 533            | 2.05                   | OK                    |
| 210   | PC5             | 7           | 181.97                           | 1274                                  | 543             | 147             | 690            | 1.85                   | OK                    |
| 103   | PC5             | 7           | 181.97                           | 1274                                  | 491             | 72              | 563            | 2.26                   | OK                    |
| 167   | PC4             | 6           | 181.97                           | 1092                                  | 630             | 137             | 767            | 1.50                   | OK                    |
| 189   | PC4             | 6           | 181.97                           | 1092                                  | 607             | 128             | 736            | 1.50                   | OK                    |
| 34    | PC4             | 6           | 181.97                           | 1092                                  | 566             | 124             | 689            | 1.58                   | OK                    |
| 74    | PC4             | 6           | 181.97                           | 1092                                  | 522             | 115             | 637            | 1.71                   | OK                    |
| 163   | PC4             | 6           | 181.97                           | 1092                                  | 367             | 77              | 444            | 2.46                   | OK                    |
| 15    | PC5             | 7           | 181.97                           | 1274                                  | 479             | 113             | 592            | 2.15                   | OK                    |
| 18    | PC7             | 9           | 181.97                           | 1638                                  | 590             | 175             | 765            | 2.14                   | OK                    |

| POINT | Foundation Type | No. of Pile | Ultimate Capacity per Pile (Kip) | Ultimate Capacity of Pile Group (Kip) | Dead Load (kip) | Live Load (kip) | Reaction (kip) | Factor of Safety (FOS) | Remarks (Min FOS=1.5) |
|-------|-----------------|-------------|----------------------------------|---------------------------------------|-----------------|-----------------|----------------|------------------------|-----------------------|
| 75    | PC8             | 10          | 181.97                           | 1820                                  | 541             | 170             | 711            | 2.56                   | OK                    |
| 106   | PC10            | 12          | 181.97                           | 2184                                  | 602             | 227             | 829            | 2.63                   | OK                    |
| 131   | PC9             | 11          | 181.97                           | 2002                                  | 549             | 197             | 746            | 2.68                   | OK                    |
| 168   | PC9             | 11          | 181.97                           | 2002                                  | 609             | 228             | 837            | 2.39                   | OK                    |
| 190   | PC6             | 8           | 181.97                           | 1456                                  | 672             | 223             | 896            | 1.63                   | OK                    |
| 211   | PC5             | 7           | 181.97                           | 1274                                  | 433             | 95              | 527            | 2.42                   | OK                    |
| 220   | PC5             | 7           | 181.97                           | 1274                                  | 505             | 90              | 596            | 2.14                   | OK                    |
| 3     | PC3             | 5           | 181.97                           | 910                                   | 344             | 58              | 403            | 2.26                   | OK                    |
| 36    | PC8             | 10          | 181.97                           | 1820                                  | 564             | 182             | 746            | 2.44                   | OK                    |
| 76    | PC10            | 12          | 181.97                           | 2184                                  | 690             | 258             | 949            | 2.30                   | OK                    |
| 107   | PC10            | 12          | 181.97                           | 2184                                  | 597             | 227             | 823            | 2.65                   | OK                    |
| 132   | PC10            | 12          | 181.97                           | 2184                                  | 595             | 226             | 821            | 2.66                   | OK                    |
| 169   | PC10            | 12          | 181.97                           | 2184                                  | 590             | 224             | 813            | 2.69                   | OK                    |
| 191   | PC10            | 12          | 181.97                           | 2184                                  | 593             | 190             | 783            | 2.79                   | OK                    |
| 221   | PC6             | 8           | 181.97                           | 1456                                  | 392             | 60              | 451            | 3.22                   | OK                    |
| 16    | PC1             | 3           | 181.97                           | 546                                   | 200             | 19              | 219            | 2.49                   | OK                    |
| 30    | PC1             | 3           | 181.97                           | 546                                   | 218             | 46              | 264            | 2.07                   | OK                    |
| 4     | PC4             | 6           | 181.97                           | 1092                                  | 361             | 45              | 406            | 2.69                   | OK                    |
| 38    | PC8             | 10          | 181.97                           | 1820                                  | 615             | 176             | 791            | 2.30                   | OK                    |
| 77    | PC10            | 12          | 181.97                           | 2184                                  | 685             | 255             | 941            | 2.32                   | OK                    |
| 108   | PC10            | 12          | 181.97                           | 2184                                  | 594             | 225             | 818            | 2.67                   | OK                    |
| 133   | PC10            | 12          | 181.97                           | 2184                                  | 592             | 224             | 816            | 2.68                   | OK                    |
| 170   | PC10            | 12          | 181.97                           | 2184                                  | 592             | 225             | 816            | 2.68                   | OK                    |
| 192   | PC9             | 11          | 181.97                           | 2002                                  | 564             | 184             | 749            | 2.67                   | OK                    |
| 222   | PC3             | 5           | 181.97                           | 910                                   | 393             | 58              | 450            | 2.02                   | OK                    |
| 212   | PC3             | 5           | 181.97                           | 910                                   | 465             | 131             | 596            | 1.53                   | OK                    |
| 223   | PC4             | 6           | 181.97                           | 1092                                  | 450             | 106             | 555            | 1.97                   | OK                    |
| 17    | PC4             | 6           | 181.97                           | 1092                                  | 384             | 81              | 465            | 2.35                   | OK                    |
| 39    | PC9             | 11          | 181.97                           | 2002                                  | 624             | 212             | 836            | 2.39                   | OK                    |
| 78    | PC10            | 12          | 181.97                           | 2184                                  | 670             | 257             | 927            | 2.36                   | OK                    |
| 109   | PC10            | 12          | 181.97                           | 2184                                  | 595             | 225             | 820            | 2.66                   | OK                    |
| 134   | PC10            | 12          | 181.97                           | 2184                                  | 593             | 225             | 818            | 2.67                   | OK                    |
| 171   | PC10            | 12          | 181.97                           | 2184                                  | 591             | 224             | 815            | 2.68                   | OK                    |
| 193   | PC8             | 10          | 181.97                           | 1820                                  | 609             | 199             | 808            | 2.25                   | OK                    |
| 213   | PC4             | 6           | 181.97                           | 1092                                  | 462             | 113             | 575            | 1.90                   | OK                    |
| 224   | PC4             | 6           | 181.97                           | 1092                                  | 372             | 69              | 441            | 2.48                   | OK                    |
| 18    | PC5             | 7           | 181.97                           | 1274                                  | 479             | 135             | 614            | 2.08                   | OK                    |

FoS of some group piles is below 2.5 which is the requirement of BNBC. Building engineer is required to review the design of the foundation.

# Inconsistencies in EA report

**Bureau of Research, Testing and Consultancy (BRTC)**  
**Department of Civil Engineering**  
**Chittagong University of Engineering and Technology (CUET)**  
 Chittagong - 4340, Bangladesh

**TEST REPORT**

Memo No. : BRTC/TEST/CE/2015/1147 Date : 17/06/2015  
 Supplier : Chief Financial Officer, Kenpark Bangladesh Apparel (Pvt.) Ltd. (Unit-7), Ctg.  
 Ref. No. : Application Date : 17/06/2015  
 Name of the Test : Compressive Strength Test for CYLINDER  
 Location Project : 2nd Floor Column, Main Building, Kenpark Bangladesh Apparel (Pvt.) Ltd. (Unit-7), Plot # 14-23, Sector # 02, KEPZ, Chittagong.  
 Sample : Unsealed  
 Target Strength : Nil Ratio : 1:1.5:3

| Sample No | Diameter (cm) | Date of Casting | Date of Crushing | Strength MPa (psi) | Avg. Strength MPa (psi) |
|-----------|---------------|-----------------|------------------|--------------------|-------------------------|
| 1         | 15.83         | 20/05/15        | 18/06/15         | 25.9 (3760)        | 25.8 (3740)             |
| 2         | 15.63         | 20/05/15        | 18/06/15         | 27.5 (3990)        |                         |
| 3         | 15.80         | 20/05/15        | 18/06/15         | 23.8 (3460)        |                         |
| Remarks   |               |                 |                  |                    |                         |

Countersigned by  
 Head of Department  
 Department of Civil Engineering  
 Chittagong University of Engineering and Technology

Test Conducted by  
 Dr. Mst. Farzana Rahman Zuthi  
 Assistant Professor  
 Department of Civil Engineering  
 Chittagong University of Engineering and Technology  
 Chittagong-4340

Tel: 031 714948 Cell: 01765 596552 Fax: 031 714948, 714910 E-mail: headce@cuet.ac.bd Web: www.cuet.ac.bd

### 3.3 MATERIAL PROPERTY

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

- ❖ Yield strength of steel (Rebar),  $f_y$  = 72,500 lb/in<sup>2</sup>
- ❖ Design strength of concrete for column,  $f_c'$  = 3,500 lb/in<sup>2</sup>
- ❖ Design strength of concrete for beam and slab,  $f_c'$  = 3,500 lb/in<sup>2</sup>
- ❖ Young's modulus of concrete,  $E_c$  = 57,000  $\sqrt{f_c'}$

The yield strength of steel is taken from purchase document.

Inadequate number of concrete cylinder test reports was found on site to confirm the design strength of 3500 psi.

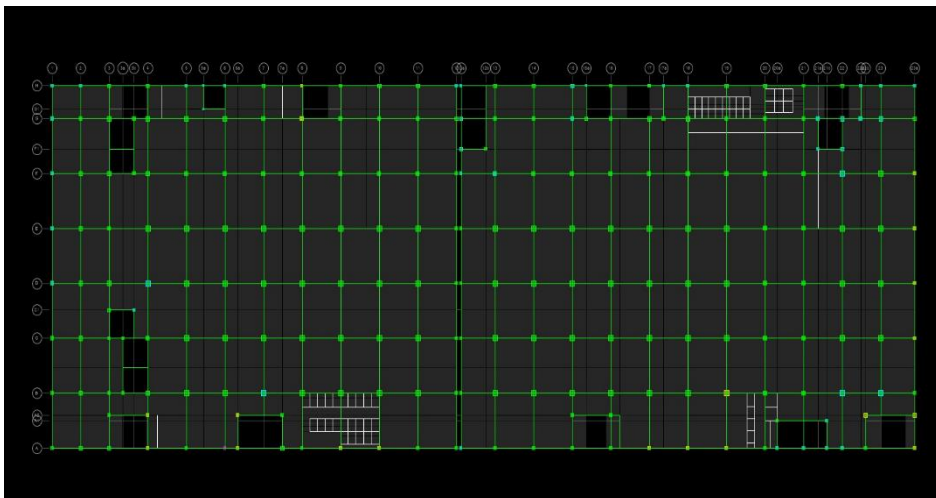
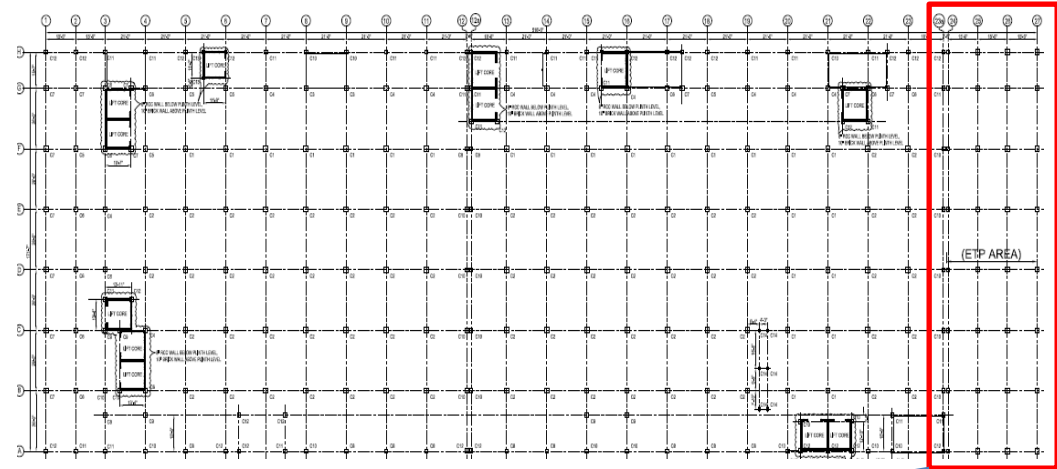
### 3.4.4 Earthquake Load (E)

Proper structural design of any building structure must include loads due to earthquake shaking. Although there has been no major incident of earthquake hazard in the recent past of Bangladesh, earthquakes are not uncommon in this area. Scientific geological study of the earth crust below Bangladesh shows that Bangladesh does fall in moderate to high seismic risk zone. Statistical evidence from past major and minor earthquake incidents shows that a major earthquake is overdue in the recent times of geological scale. Therefore, it is necessary to prepare against any possible earthquake hazard. It should be kept in mind that the objective of earthquake resistance building design is not to make a strong building which can resist any damage due to earthquake. Instead, earthquake resistant design basically aims at minimizing the possible damage and casualty to an acceptable level.

Regarding the earthquake resistant structural design, it essential that the specific design code is followed. For the analysis and design checking of this building, *Equivalent Static Force Method* of BNBC (2006) is followed. The main considerations for calculation of earthquake load are given below.

- ❖ Zone co-efficient,  $Z = 0.15$  (zone 2, As Per BNBC 2006)
- ❖ Structure importance co-efficient,  $I = 1.00$  (Standard Occupancy, Table 6.2.23, BNBC 2006)
- ❖ Response modification co-efficient,  $R = 8.0$  (IMRF, Table 6.2.24, BNBC)
- ❖ Site co-efficient,  $S_2 = 1.2$  (type 2 soil as suggested in Table 6.2.25, BNBC)

Response modification co-efficient, R value considered as 8 for IMRF but no calculation/justification is provided for the consideration.



This portion (ETP) of the building is not included in the FEM analysis.

## **Live load consideration**

| INDUSTRIAL, STORAGE & HAZARDOUS<br>(Occupancy - G, H & J) | Workshop, factory, warehouse |                                                               |      |                    |
|-----------------------------------------------------------|------------------------------|---------------------------------------------------------------|------|--------------------|
|                                                           |                              | 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                                       | 6.0  | 4.5                |
|                                                           |                              | heavy                                                         | 12.0 | 9.0 <sup>(5)</sup> |
|                                                           |                              | ice                                                           | 15.0 | 9.0 <sup>(5)</sup> |
|                                                           |                              | 5 Printing plant :                                            |      | (5)                |
|                                                           |                              | Press room                                                    | 7.0  | 11.0               |
|                                                           |                              | Composing and linotype room                                   | 5.0  | 9.0 <sup>(5)</sup> |
|                                                           |                              | Paper storage room                                            | 12.0 | 9.0 <sup>(5)</sup> |
|                                                           |                              | 6 Motor room, fan room etc. including the weight of machinery | 7.5  | 4.5                |
|                                                           |                              | 7 Cold storage, grain storage                                 | 15.0 | 9.0 <sup>(5)</sup> |
|                                                           |                              | 8 Storage warehouses : light                                  | 6.0  | 4.5                |
|                                                           |                              | heavy                                                         | 12.0 | 9.0                |
|                                                           |                              | 9 Foundries                                                   | 20.0 | 12.0               |

Minimum storage live load 6 kPa in BNBC

Live load considered 3 kPa on the storage areas which doesn't comply BNBC requirement.



Live load consider 3 kPa on the storage areas



Storage on floor



## **Damage on column due to trolly impact**



Damaged on the column due to trolley impact was observed. Building engineer is required repair to the columns and provide protective barriers around the columns.

## **Non-engineered RO Shed**



Non-engineered RO shed was observed on the roof.  
Building engineer is required to check the stability of the uplift forces.

## **Signage of water stagnant**



Stagnant of water was observed on the roof. Building engineer is required to improve the roof drainage system.

## **Absence of Design report**



Design report was not available for the boiler room.  
Building engineer is required to prepare design report as per BNBC  
requirements.

## **Connection adequacy for uplift force**



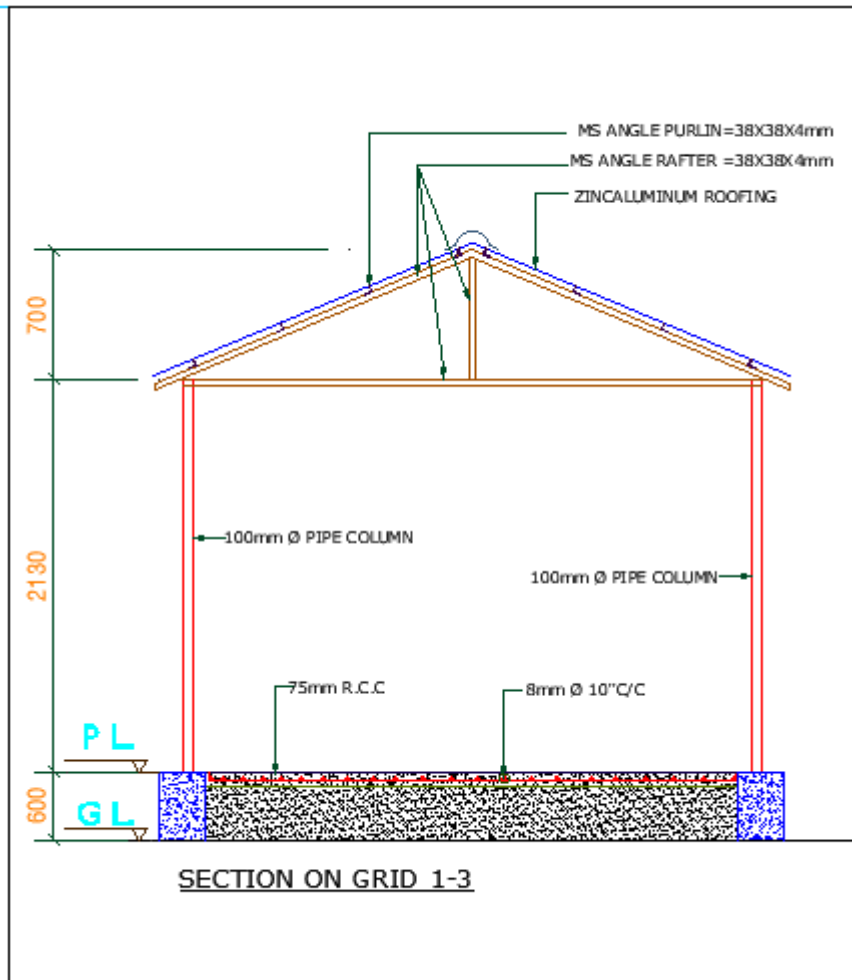
Apparently, inadequate connection was observed in the sheds for the uplift force due to lateral loading. Building engineer is required to check the connection adequacy for uplift forces.

**Damage on column due to trolly impact**



Damaged on the column due to trolley impact was observed. Building engineer is required to repair the columns and provide a protective barrier around the columns.

## Discrepancies in drawing



MS Angle rafter shown in the as-built drawing, but on-site MS tube truss observed. Building engineer is required to revise the as-built drawing.

# Problems Observed

## **Building C**

Item 1: Overstressed Columns considering BNBC live load.

Item 2: FoS of the pile foundation below BNBC requirement.

Item 3: Inconsistencies in EA report.

Item 4: Live load consideration.

Item 5: Damage on column due to trolley impact.

Item 6: Non-engineered RO Shed.

Item 7: Sign of water stagnant.

## **Boiler Room**

Item 8: Absence of Design report.

## **Garbage Storage & Garbage Segregation**

Item 9: Connection adequacy for uplift force.

Item 10: Damage on column due to trolley impact.

## **CMS Shed**

Item 11: Discrepancies in drawing.

# Priority Actions

| Item No. | Observation                                                     | Recommended Action Plan                                                        | Recommended Timeline |
|----------|-----------------------------------------------------------------|--------------------------------------------------------------------------------|----------------------|
| 01       | Overstressed Columns considering BNBC live load. (Building C)   | Building is required to review the design, load and column stresses.           | 6-weeks              |
| 02       | Overstressed Columns considering BNBC live load. (Building C)   | Carryout remedial works where required.                                        | 6-months             |
| 03       | FoS of the pile foundation below BNBC requirement. (Building C) | Building engineer is required to design, load and pile foundation stress.      | 6-weeks              |
| 04       | FoS of the pile foundation below BNBC requirement. (Building C) | Carryout remedial works where required.                                        | 6-months             |
| 05       | Inconsistencies in EA report. (Building C)                      | Building engineer is required to address the inconsistencies in the EA report. | 6-weeks              |

| Item No. | Observation                                         | Recommended Action Plan                                                                                  | Recommended Timeline |
|----------|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------|
| 06       | Live load consideration. (Building C)               | Building engineer is required to prepare live load plan as per BNBC requirements.                        | 6-weeks              |
| 07       | Live load consideration. (Building C)               | Implement and maintain the floor live load as per the prepared load plan.                                | 6-weeks              |
| 08       | Damage on column due to trolly impact. (Building C) | Building engineer is required to repair the columns and provide a protective barrier around the columns. | 6-months             |
| 09       | Non-engineered RO Shed. (Building C)                | Building engineer is required to check the stability of the uplift forces.                               | 6-weeks              |
| 10       | Non-engineered RO Shed. (Building C)                | Carryout remedial works where required.                                                                  | 6-months             |

| Item No. | Observation                                                                   | Recommended Action Plan                                                           | Recommended Timeline |
|----------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------|
| 11       | Signage of water stagnant. (Building C)                                       | Building engineer is required to fill the tested areas by suitable method.        | 6-months             |
| 12       | Absence of Design report. (Boiler Room)                                       | Building engineer is required to prepare design report as per BNBC requirements.  | 6-weeks              |
| 13       | Absence of Design report. (Boiler Room)                                       | Carry out remedial works where required.                                          | 6-months             |
| 14       | Connection adequacy for uplift force. (Garbage Storage & Garbage Segregation) | Building engineer is required to check the connection adequacy for uplift forces. | 6-weeks              |
| 15       | Connection adequacy for uplift force. (Garbage Storage & Garbage Segregation) | Carry out remedial works where required.                                          | 6-months             |

| Item No. | Observation                                                                     | Recommended Action Plan                                                                                  | Recommended Timeline |
|----------|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------|
| 16       | Damage on column due to trolley impact. (Garbage Storage & Garbage Segregation) | Building engineer is required to repair the columns and provide a protective barrier around the columns. | 6-months             |
| 17       | Discrepancies in drawing. (CMS Shed)                                            | Building engineer is required to revise the drawing as per site condition.                               | 6-weeks              |