

# BUILDING INTEGRITY | DEA SUMMARY REPORT

---

<b>SUPPLIER NAME</b>	Kenpark Bangladesh Pvt. Ltd.
<b>UNITS AUDITED</b>	1-storied prefabricated steel structure- Dry process unit 3 D Building Wash Extension Building Wash steel building
<b>SUPPLIER ADDRESS</b>	CEPZ, Chittagong, Bangladesh.
<b>AUDIT DATE</b>	10 <sup>th</sup> May, 2014
<b>AUDIT PERFORMED BY</b>	Sthapona Consultant
<b>AUDIT TEAM</b>	4 members lead by structural engineers

---

## BUILDING OVERVIEW

### DRY PROCESS UNIT

Item	Description
Building Usage Type	Used as Garments Dry process units
Structure System	Prefabricated Steel Structure
No of Stories / Floor area	One storied / Total building area approx. 16,000 sft
Floor Load:	<b>Ground Floor:</b> Dry process units
Design drawing	Available
Foundation Type	Spread Footing
Soil Report	Available

### 3 D BUILDING

Item	Description
Building Usage Type	Wash plant
Structure System	RC beam slab structure
No of Stories / Floor area	Three storied / Total building area approx. 11,820 sft
Floor Load:	Ground floor: 3D pattern marking, Curing oven, Boiler, Electrical control panel, Generator; 1 <sup>st</sup> floor: 3D finishing section, Teflon section; 2 <sup>nd</sup> floor: Chemical store, GYM room;
Design drawing	Available
Foundation Type	Spread Footing
Soil Report	Available

## WASH EXTENSION BUILDING

Item	Description
Building Usage Type	Wash plant
Structure System	Reinforced concrete beam-slab
No of Stories / Floor area	Two storied + Steel roof shed / Total building area approx. 23,850 sft
Floor Load:	<b>Ground floor:</b> Washing machineries, Dryer, Sample section, ; <b>1<sup>st</sup> floor:</b> : After wash quality checking, product development center; <b>2<sup>nd</sup> floor (steel roof shed):</b> Sample section
Design drawing	Available
Foundation Type	Spread Footing
Soil Report	Available

## WASH STEEL BUILDING

Item	Description
Building Usage Type	Wash plant
Structure System	Multi-Gable framed steel structure
No of Stories / Floor area	One storied / Total building area approx. 19,430 sft
Floor Load:	<b>Ground floor:</b> Washing machines, Dryer, Boiler, Chiller, Generator & Electrical sub-station.
Design drawing	Available
Foundation Type	Spread footing
Soil Report	Available

---

## BRIEF DESCRIPTION OF METHODOLOGY

Detailed Engineering Analysis (DEA) as Bangladesh National Building Code (BNBC)

---

## DETAILED CONTENT

EVALUATION AND TEST .....	3
Conclusion& RECOMMENDATIONS.....	3
Dry process unit.....	3&4
3 D Building .....	4
Wash Extension Building.....	4&5
Wash steel building.....	5
DETAILED DESCRIPTION OF METHODOLOGY.....	5&6

---

## EVALUATION AND TEST

- Destructive and Non Destructive Test
  - Evaluation of concrete strength from core test.
  - Verification of Rebar of structural members by Ferro Scanning
- Analysis of structural adequacy
- Assessment of Foundation
- Evaluation of Column
- Evaluation of Beams
- Evaluation of Slabs

---

## DRY PROCESS UNIT:

### CONCLUSIONS

- The factory building is a single storied prefab steel frame with light roofing. The plan of the building was approved by the CEPZ authority. As per verbal information by the user, it is gathered that single story prefab structure was constructed in 2008. The single story steel prefab building is used for various processes of garment production.
- We have performed Non-Destructive concrete strength test by Ultrasonic Pulse Velocity at Eight (08) spots in the pedestal. This test was done basically to get the concrete strength. The result shows the concrete strength is 1957- 3178 psi. We have performed concrete strength test by cutting Core (Destructive) at Six (6) spots. We found the concrete strength is on a range from 4080 psi to 5100 psi in foundation & 1780 psi to 2610 psi in grade beam.
- We have analyzed the building according to BNBC 2006 code considering a wind speed of 260 Km/h and found that all the side columns of internal bays are highly overstressed & not adequate.
- For the same wind load (260Km/h) we found all the rafter beams are around 15% overstressed which can be acceptable as we can allow up to 33% over stress for ASD design.
- We found all the pedestal & foundations are adequate as per as built structural drawings provided by Kenpark. Some of the Grade Beams are overstressed by small amount which can be acceptable.
- We have analyzed the slender column (mid tube column) and found that this column is adequate under all type of lateral load (Wind & Earthquake load) as per BNBC 2006. As per BNBC this building is in zone-2, which is moderate earthquake zone. From analysis we found this column carries only 2.9kip dead load which will participate as mass source in the time of earthquake. From analysis & mathematical model we can say this value is very insignificant. Beam column capacity ratio is applicable for SMRF. But our structure is not having SMRF detail & not mandatory to be SMRF as it is in the Zone-2. So From the discussion stated above we can conclude that this building is safe from the earthquake point of view.

### **Recommendations:**

- Considering the all the observation, tests & mathematical model we can conclude that this prefab steel building need retrofiting for columns.
- Also for better stability we need to provide some additional bracings at roof level & side wall and some of the bracings at roof needs to be changed to the higher grade.
- However a new lateral support needs to be added to the outer columns at long elevation to reduce the unsupported length against Lateral Torsional Buckling.

### **3 D BUILDING**

#### **CONCLUSIONS:**

- We found equivalent concrete strength for column is 5,13 psi, for beam is 2,145 psi according to ACI 562.
- Considering 20 psf live load, all the columns and beams are adequate.
- Considering BNBC 2006 with all its load combinations (i.e. gravity and lateral load) all of the columns are overstressed.
- Considering 63/42 psf live load, all the foundations are adequate for factor of safety more than 1.86.
- Slab is adequate for 42 psf live load.
- The structure is non-redundant as it is having only one frame in one direction.

#### **RECOMMENDATIONS:**

- We recommend to maintain live loads in 1st& 2nd floor upto 20 psf (maximum) to continue its operation.
- We recommend to rectify the overstressed structural members to meet BNBC requirement.
- During this rectification time the chemical storage of 2nd floor must be relocated to ground floor and 1st& 2nd floor must not exceed 20 psf weight as an average.
- We also recommend to distribute the loads over the whole floors rather than keeping overload in small area whereas other areas are empty to control the centre of mass of the building.

### **WASH EXTENSION BUILDING**

#### **CONCLUSIONS:**

- We found equivalent concrete strength for column is 2,315 psi, for beam is 2,920 psi.
- All foundations except one is adequate for 63 psf live load.
- Slab is adequate for 63psf live load.
- Eight columns among twenty four are adequate for 63 psf live load considering lateral loads according to BNBC 2006.

- Fifteen columns among twenty four are adequate for 42psf live load considering RMG Guidelines. Besides most of the columns are adequate in 42 psf live without considering lateral loads.
- Most of the beams except two-three are adequate for 63 psf live load.

#### **RECOMMENDATIONS:**

- We recommend to maintain live loads in 1st& 2nd floor up to 42 psf (maximum) to continue its operation until retrofitting design and construction.
- We recommend to rectify the overstressed structural members to meet the BNBC requirement (for 63 psf live load & lateral loads).
- During this rectification times the floors except ground floor must not exceed 42 psf live load.
- We also recommend to distribute the loads over the whole floors rather than keeping overload in small area whereas other areas are empty to control the centre of mass of the building.

#### **WASH STEEL BUILDING**

##### **CONCLUSIONS:**

- The principal material of construction is steel. We found minimum yield stress of steel is 36 ksi.
- The foundation is adequate.
- Most of the columns are overstressed due to wind & earthquake loading.
- Most of the rafters are overstressed due to wind & earthquake loading.

##### **RECOMMENDATIONS:**

- We recommend to rectify the overstressed structural members.
  - Until rectification, operation of the steel building can be continued as there is no risky static gravity loading condition. For resisting lateral forces like earthquake, wind-storm etc. rectification is needed.
- 

#### **DETAILED DESCRIPTION OF METHODOLOGY**

##### **Specification for Detail Structural Assessment**

Structural Analysis will be carried on according to BNBC (1993) and ACI code.

- I. Testing of Materials:**
  - Sub-soil Investigation

- Core/Pullout/CAPO Test (Destructive Test) for Concrete Strength
- UPV (Ultrasonic Pulse Velocity) Test (Non-destructive Test) for Concrete Strength
- Ferro-Scanning in Column, Beam and Slab for Rebar Detection.

**II. Investigation of Foundations**

- Foundation Explorations

**III. Structural Evaluation (Design check):**

- Analysis of sub-soil investigations report
- Development of computer simulated model
- Checking of structural stability and geometry
- Checking adequacy of foundation i.e. pile & pile cap or footing/raft
- Checking of lateral load resistance capacity of the Building
- Design check for soft story & Dynamic Load