BUILDING INTEGRITY | DEA SUMMARY REPORT

SUPPLIER NAME	OPEX Apparels Ltd.
UNITS AUDITED	Washing Plant 3 WG -5 WG – 5 Extension (SKL) WG -3 Security Building
SUPPLIER ADDRESS	Kanchipur, Narayangonj, Dhaka, Bangladesh
AUDIT DATE	December 2014
AUDIT PERFORMED BY	Arko Consults Environment & Infrastructure Management Solution (EIMS)
AUDIT TEAM	4 team members consisting of structural engineer.

BUILDING OVERVIEW

WASHING PLANT 3

Item	Description
Building Usage Type	Garment Manufacturing
Structure System	RC frame structure with steel roof shed.
No of Stories / Floor area	8 story/ approx.9500 sq.ft/floor
Floor Load:	Ground floor: Washing plant; 1st floor: Miscellaneous store; 2nd floor: Dry Process Unit 2 – Garments Unit; 3rd floor: Miscellaneous store; 4th floor: Miscellaneous store; 5th floor: Vacant; 6th floor: Vacant; 7th floor: Miscellaneous Store.
Design drawing	Available
Foundation Type	Single and Combine footing
Soil Report	Available

WG- 5

Item	Description
Building Usage Type	Garment Manufacturing
Structure System	Reinforced concrete flat slab structure with peripheral beam
No of Stories / Floor area	Ten storied / Total building area approx. 246,500 sft
Floor Load:	Ground floor: Textile machineries 1st floor: Central store 2nd floor: Central machine store

	3rd floor: Machine store 4th floor: Dinning, CTPAT, Prayer room, Finished goods store 5th & 6th floor: Sewing, Finishing & Cutting section 7th floor: Finished goods, Fabric store 8th & 9th floor: Fabric store
Design drawing	Available
Foundation Type	Cast-in-situ concrete pile (24 in dia and 80 ft. long according to the drawing)
Soil Report	Available

WG-5 EXTENSION (SKL BUILDING)

Item	**Description**
Building Usage Type	Garment Manufacturing
Structure System	Reinforced concrete flat slab structure with peripheral beam
No of Stories / Floor area	Ten storied / Total building area approx. 1,45,350 sft
Floor Load:	Ground floor: Washing plants 1st floor: Finished Goods Store 2nd floor: Left over store 3rd & 4th floor: Sewing, Finishing & Cutting section 5th floor: Left over store 6th -8th floor: Sewing, Finishing & Cutting section 9th floor: Fabric & accessories store
Design drawing	Available
Foundation Type	24 in dia 80 ft. cast-in-situ concrete pile
Soil Report	Available

WG 3

Item	**Description**
Building Usage Type	Garment Manufacturing
Structure System	RC frame structure with steel roof shed.
No of Stories / Floor area	8 story/ approx.9500 sq.ft/floor
Floor Load:	Ground floor: Washing plant; 1st floor: Miscellaneous store; 2nd floor: Dry Process Unit 2 – Garments Unit; 3rd floor: Miscellaneous store; 4th floor: Miscellaneous store; 5th floor: Vacant; 6th floor: Vacant; 7th floor: Miscellaneous Store.
Design drawing	Available
Foundation Type	Single and Combine footing
Soil Report	Available

SECURITY BUILDING

Item	Description
Building Usage Type	Garment Manufacturing
Structure System	RCC frame structure with steel roof shed .
No of Stories / Floor area	8 story/ approx.9,400 sq.ft/floor
Floor Load:	Ground floor: Fabric Store; 1st floor: Office of Textile & Garments Unit, Store & Embroidery section ; 2nd floor: Security Barak (Dormitory for factory security, govt. security and junior staff); 3rd floor: Security Barak (Dormitory for factory security, govt. security and junior staff); 4th floor: Security Barak (Dormitory for factory security, govt. security and junior staff); 5th floor: Vacant ; 6th floor: Vacant; 7th floor: Vacant.
Design drawing	Available
Foundation Type	Single and Combine footing
Soil Report	Available

BRIEF DESCRIPTION OF METHODOLOGY

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

DETAILED CONTENT

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

WASHING PLANT 3:
CONCLUSIONS

- No signs of distress or cracks were observed in any structural members of the building. No diagonal cracks were observed in the partition wall due to differential settlement. Hence foundation is considered to be safe at prevailing load conditions.
- The column is found safe in in gravity loading for a live load of 3 kN/sqm. For lateral load (Earthquake and Wind), some members are found overstressed.

Recommendations:

- Retrofit work is required of the lateral load (earthquake & Wind) within 12 months.
- Maintain the storage with limit(max.3.0 KN/sqm) in upper floor.
- Detail retrofitting design of the building should be undertaken as soon as possible.

WG 5:

CONCLUSIONS

- It was found that average concrete strength for column is 3,882 psi, for beam is 4,352 and for slab is 3,200. The average concrete strength has been calculated according to ACI 562.
- All the peripheral beams in typical floor are adequate considering lateral loadings however some stair beams and grade beams are overstressed for both existing and BNBC recommended live load.
- All the columns except two are adequate for gravity loadings but most of the columns are overstressed due to lateral loadings, when considering existing load.
- Considering BNBC recommended 63 psf live load, all the columns except three are adequate for gravity loadings but most of the columns are overstressed due to lateral loadings.
- All the foundations are adequate for existing loading with factor of safety above 2.0 except three (F.S above 1.5).
- All the foundations are adequate for 63 psf live load with factor of safety above 2.0 except four (F.S above 1.5).

- Vertical extension is possible with proper design and retrofitting of structural members as per DEA report.

Recommendations:

- We found 3.1 inch floor finish in most of the floors which weight is approximately 39 psf dead load. We recommend replacing this floor finish (mosaic) with very light weight tiles.
- We recommend rectify the overstressed structural members however during this rectification times the storage of 8^{th} and 9^{th} floor must be relocated to ground floor if needed 1^{st} and 2^{nd} floor can be used as partial storage area (not more than 30 psf weight as an average).

WG 5 EXTENSION (SKL BUILDING)

CONCLUSIONS

- It was found that the average concrete strength for column is 2,460 psi, for beam is 3,622 psi and for slab is 3,724 psi. The average concrete strength has been calculated according to ACI 562.
- The flat slab is adequate for gravity loading condition but it is overstressed for punching shear due to lateral loadings (seismic and wind load) considering both existing live load and BNBC recommended live load.
- All the peripheral beam's size in typical floors are adequate considering lateral loadings however some stair beams and lift core beams are overstressed. However, provided reinforcement at support is less than the required amount at most of the positions for both existing live load and BNBC recommended live load.
- All the columns (except sixteen number of columns) are adequate for gravity loadings. However, most of the columns are overstressed due to lateral loadings for existing live load.
- For BNBC recommended, 63 psf live load most the columns are overstressed (except nine number of columns) in gravity loading condition and in lateral loading condition only six columns are adequate.
- All the foundations are adequate for existing live load 63 psf live load with factor of safety above 2.0.

Recommendations:

- We highly recommend to remove all storage from SKL building as some structural members are over stress for only gravity load.
- We recommend to strengthen the overstressed structural members with proper retrofitting design as soon as possible.

- The connecting bridges with the WG-5 building and Denim generator building should remove and if needed reconstruct steel bridges with proper base isolation or bearings.
- Regarding unreinforced brick masonry we suggest to follow the recommendation made by BUET expert.

WG 3 :

CONCLUSIONS

- Structure was analyzed under actual present loading conditions and under BNBC 2006 loading conditions.
- Under gravity loading, for a live load of 2.0 kN/sqm, the building is found safe. Hence, the factory can operate under this live load for the next 9 months.
- Column members are found overstressed under Live load of 3.0 kN/sqm, as well as lateral loading. Foundation is considered safe at prevailing loading condition.
- Grade Beams were not provided for better stability**.**
- Floor Edge Beams and Slab are adequate.

Recommendations:

- Retrofit the column within 9 months and it is recommended to relocate the storage in ground floor.
- Detail retrofitting design of the building should be undertaken as soon as possible.

SECURITY BUILDING :

CONCLUSIONS

- No sign for of distress or crack were observed in any structural members of the building. Moreover, no diagonal cracks were observed in the partition walls due to differential settlement. Hence foundation is considered to be safe at prevailing loading conditions.
- Most of column is safe in gravity loading for a live load of 2.0 kN/sqm. However some columns are found slightly overstressed in gravity loading. Under lateral load (Earthquake and wind) few members are found overstressed. Retrofit woks are necessary.

Recommendations:

- Storage is advised to be relocated in ground floor.
- Light weight partition to be installed in the toilet is. Reduce 5 inch internal wall from floor.

- Most of column is safe in gravity loading for a live load of 2.0 kN/sqm. However some columns are found slightly overstressed in gravity loading. Under lateral load (Earthquake and wind) few members are found overstressed. Retrofit woks are necessary.
- Slabs and beams are adequate under vertical load for lateral load retrofitting 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