Delivered By Hand 14 January 2019

Rajdhani Unnayan Kartripakkha (RAJUK)
Urban Resilience Project: RAJUK Part
RAJUK Commercial Complex cum Car Parking Building (8th - 9th Floor)
Gulshan - 1, Dhaka -1212, Bangladesh.

Attention: Mr. Abdul Latif Helaly, Project Director

Gentlemen,

# FINAL INCEPTION REPORT

## "DESIGN AND SUPERVISION OF URBAN RESILIENCE UNIT (URU) BUILDING INCLUDING RESEARCH, TRAINING, AND TESTING LABORATORY FACILITIES UNDER RAJUK IN DHAKA, BANGLADESH"

## (CONTRACT NO. - 1565864; *PACKAGE NUMBER: URP/RAJUK/S-11)*

Further to our submittals of 8 November 2018 and 11 December 2018, we are leased to provide this submittal, which combines all elements contained in our Inception Report concerning the above captioned project, we would ask that you provide written acceptance of the Inception Report together with full progress payment of same, which has been previously submitted to you.

As time is of the essence, in order for us to proceed with our consultancy work and maintain schedule, we would ask for your written acceptance of the contents of this submittal.

Please find herewith the inception report of "DESIGN AND SUPERVISION OF URBAN RESILIENCE UNIT (URU) BUILDING INCLUDING RESEARCH, TRAINING, AND TESTING LABORATORY FACILITIES UNDER RAJUK IN DHAKA, BANGLADESH" (CONTRACT NO. - 1565864; *PACKAGE NUMBER: URP/RAJUK/S-11).* Please provide your valuable opinion on inception report and inform us shortly. Also noted that we have already completed reconnaissance survey, topographical survey, soil exploration, etc. & EIA study is continuing.

Our team and the writer are at your services at any time to respond to any questions or concerns. Thank you for your attention to the above.

Best regards,

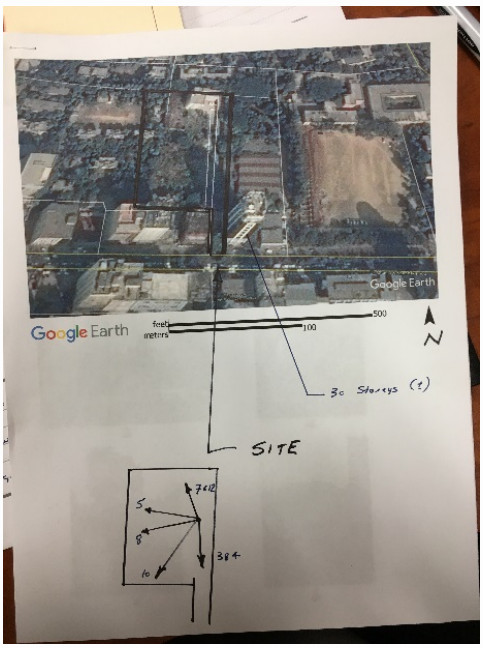
For and on behalf of *BAUM Architects, Inc., Structural Engineers Company and The Planners and Engineers Limited JV*

Andrew Netupsky, PE, SE, P. Eng.
(Structural Engineers Company representing the Consultant)
Former President Structural Engineers Association of Arizona
Recipient SEAoA Award for Excellence in Structural Engineering 2018, 2016 & 2009

**DESIGN AND SUPERVISION OF URBAN RESILIENCE UNIT (URU) BUILDING INCLUDING RESEARCH, TRAINING, AND TESTING LABORATORY FACILITIES UNDER RAJUK IN DHAKA, BANGLADESH"**
**(CONTRACT NO. - 1565864; *PACKAGE NUMBER: URP/RAJUK/S-11)***

# INCEPTION REPORT

## SITE PLAN




Google Earth Aerial View of Site
With Photos and Key Plan of Photos

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Cell: +88 01730 041 544, +88 01730 041 542; Phone: +88-02-8418680, e-mail: planners1981@gmail.com

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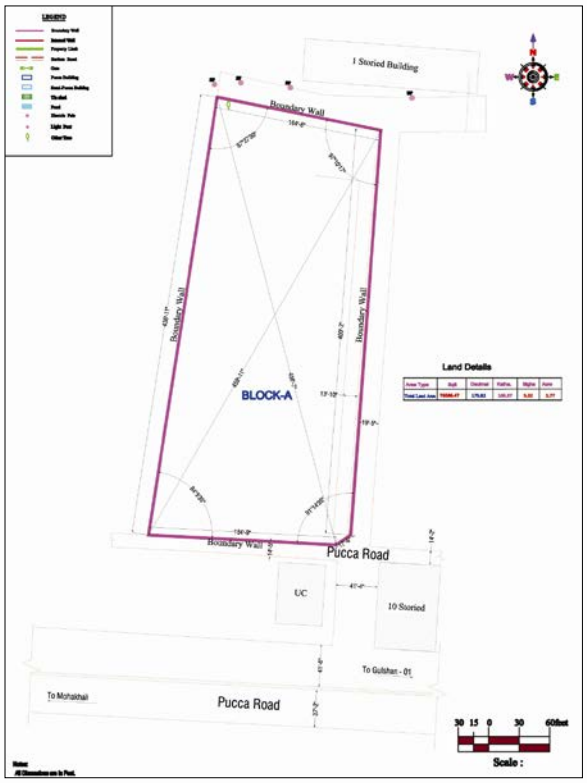
A survey plan of the site is depicted below:



In response to questions posed by RAJUK, our response has been as indicated in RED.

| **Reconnaissance survey** |
|---|
| Topographical survey |
| Spot level or contour of the site |
| Need assessment for space of buildings |
| EIA study report of the project |
| Soil test/ soil exploration |

The site survey, EIA study and soil test together with interpretation by Structural Engineers has been done and submitted to you.

Insofar as the "Need Assessment", we have been instructed to develop the site to its maximum building potential. This has been done.

As for a Topographic Survey including contours, we saw no need for this as the site is flat and will be entirely excavated to accommodate building coverage of 75% of the site area with a four (4) level basement area. This matter was discussed during our meeting at your office on 10 December 2018 and it is our understanding that you have agreed that there is no need for a Topographic Survey with contours.

- **It is important to mention that without the approval of the design brief (i.e. preliminary survey phase in ToR) we cannot review and endorse any activity carried out with regard to conceptual designs which is the second phase of the studies.**

It is the view of the JV that the conceptual design with respect to the basement area and in particular the restraint of the vertical cut for the building excavation and the fact that the water table is indicated at approximately 6m below grade as of September 2018, at the end of your rainy season is significant and has major implications as to the cost of the site development.

In any case, two options for the construction methods practical for your site were given. It was the opinion of the JV that the material given was appropriate, relevant, of particular interest especially as to cost implications.

- **As such, we have not reviewed any of the concept designs provided for this purpose. Please also note that during phone conversation with the head of the BAUM architect our team had referred to all these issues.**

Your comment noted. The spokesperson and/or point of contact for our JV is Andrew Netupsky. We would ask that any instructions from RAJUK be addressed to Mr. Netupsky in writing.

Referring to above it is expected the consultant during the inception report elaborates upon the Design Brief that covers:

1. The status of the activities, any changes in workplan and way forward, data collection results, surveys, geotechnical studies, methodologies for the project development, local constraints etc. or 16 August 2018.

There is no change as to our activities as per our contract agreement. We confirm that we will complete the work within 9 months of the contract signing. As stated earlier, it is the view of the JV that re-writing the above points is redundant.

2. Scope of the Project,

Our response is the same as for point 1 above.

3. The site and the urban context

The site is identified in our Inception Report together with site photos and a survey plan and geotechnical study. Our instructions are to develop the site to the maximum permitted by the Authorities having jurisdiction over the site, which include 75% site coverage for the basement levels and a building podium up to 12m above grade. The office tower is to consist of 28 additional floors with an area of 50%of the site area and a floor to floor height of 3.5m thus yielding a building with a total height of 110m above grade. We are further advised that the building height limitation is 120m. Thus, an additional 2 or 3 floors could be added if RAJUK so decided.

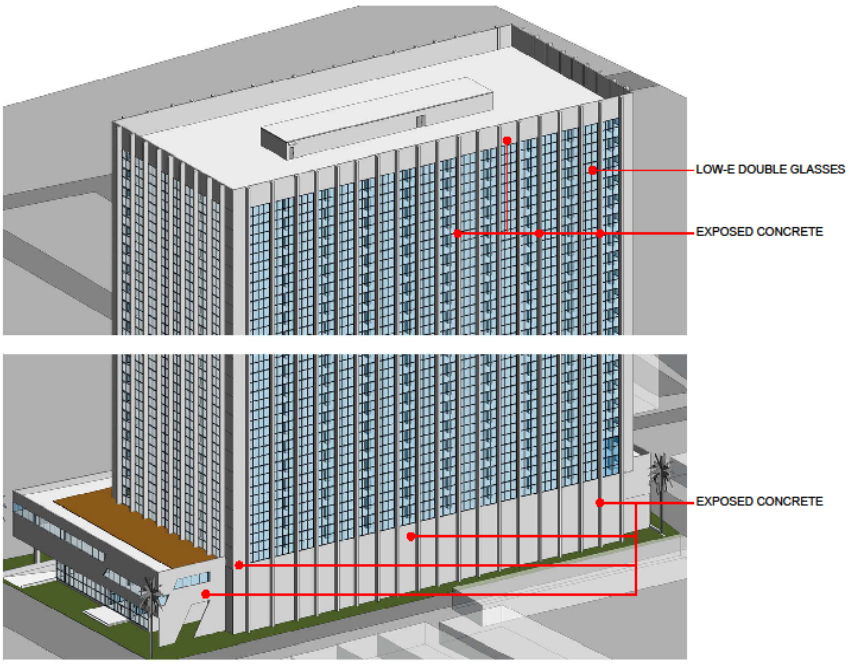
Three specific layout options for the building on the site is depicted below:

Layout drawings are appended in the appendix attached.

## Comparison Table

| | Option1 | Option 2 | Option 3 (Recommended) |
|---|---|---|---|
| Site Plan |  |  |  |
| Area | 1. Site Coverage : 5,187.36m² (72.90%)<br>2 GFA up to 3F 36,796.23m²<br>3. Total GFA (92.46%)<br>- Required Area : 137,700.00 m²<br>- Planned Area : 127,316.64 m²<br>4. Landscape : 1,227.16 m² (17.25%) | 1. Site Coverage : 4.698.67m² (66.03%)<br>2. GFA up to 3F :35.924.50m²<br>3. Total GFA (90.10%)<br>- Required Area : 137,700.00 m²<br>- Planned Area : 124,062.62 m²<br>4. Landscape : 1,706.49 m² (23.98%) | 1. Site Coverage : 5,097.20m² (71.13%)<br>2. GFA up to 3F : 37.822.33m²<br>3. **Total GFA (95.79%)**<br>- Required Area : 137,700.00 m²<br>- **Planned Area : 131910.96 m²**<br>4. Landscape : 1,373.70 m² (19.31%) |
| Summary | 1. Central Core with 6 mail elevators<br>2. No. of Parking : 559<br>3. Main Car Entry : West<br>4. Loading/Unloading : East<br>5. Possible rooftop garden to add 12.25% of Landscape area<br>6. It is not suitable for curtainwall design (very limited condition) | 1. Central Core with 6 mail elevators<br>2. No. of Parking : 567<br>3. Main Car Entry : East<br>4. Loading/Unloading : West<br>5. Possible rooftop garden to add 1.02% of Landscape area<br>6. It is not suitable for curtainwall design (very limited condition) | 1. Central Core with 6 mail elevators<br>2. No. of Parking : 564<br>3. Main Car Entry : West<br>4. Loading/Unloading : East<br>5. Possible rooftop garden to meet 10.69% of Landscape area<br>6. ***By set-back of main columns, building can have much various elevations (more ideas can come out)*** |

Perspective Drawings




[Architectural Blow-up Elevations showing building materials]

The General building requirements were stated in the RFP and given by RAJUK. The commentary and perspective drawings shown above were done by our Team Architect BAUM in consultation with other team members SEC and PEL.

4. 9Traditional/Modern Architectural Design Principles, State of accommodation etc.

Local culture and climate elements such as natural sunlight and warm/hot temperature of the city through year should be considered for architectural design and engineering but the building will take the modern life style by the advanced building operating system, equipment and technologies.

5. Permeability and connectivity

Please amplify as we do not understand the question.

6. Visual permeability / silhouette

Please amplify as we do not understand the question.

7. Transforming existing site and status of the buildings on the site

Please refer to our answer to question 3. In our view, our response at question 3 responds to this question.

8. Proposed design scenario

For the requirement of maximum size of basement, podium and tower for full completion of the building at the end, architectural design for all major and support space, structure, MEP&F system will be provided even though there can be a phasing plan for construction. Within the maximized volume, the required programs will be included at appropriated floors – Parking lot and MEP plant at basement and ground level, Laboratory and Commercial Spaces at podium, and Office Tower above the podium.
In order to allow potential design background, perimetric columns of the tower are shifted toward inside for iconic building design.
If we don't have proper building code and regulations in the BNBC for international level of building quality, we will refer international guidelines to make the building comfortable and safe.

9. Pedestrian and Vehicle access strategy

We are advised that a great many people will visit the building and as such the entrance will require multiple lanes at the building entrance to accommodate: through traffic, passenger traffic via car, baby taxi and/or rickshaw. A visitor study has not been done.

Additionally, we have provided for a crescent road to access the site off the main access road with one way traffic from east to west, consistent with the traffic pattern on the main civic road. Of course, the parking garage is accessed via the through traffic lanes.

We have also provided access for trucks to provide general deliveries to the building but also for shipping and receiving to the laboratory area, which is situated at the rear of the building and occupying some 2,000 sq m (+ or -)

Basic concept of the building (**Option 1**) is to meet the client's requirement for maximizing the total GFA within the limited site condition, which we plan a podium larger than the main building at the ground level.

We have planned the space as a laboratory at the back of podium by considering the size of equipment such as overhead crane, which needs at least 10m of height clearance. This brings open aisle for loading/unloading trucks to access easily direct to the back of the building.

To prevent interference of two circulation between normal vehicles for parking and loading/unloading vehicles, we separate the access into the parking lots at the basement and access into the loading/unloading dock at the ground level. However, main access for parking is located at the west according to the drivers' convenience.

For **Option 2**, we allocate main access into the parking lots at the East because we don't want to see big trucks for loading/unloading infront of the building before the main gate. This also changes the location of parking ramp and arrangement. Also, change of basement brings a change of podium and tower with limited and smaller GFA than Option 1.

For **Option 3**, basically the design concept and plan is same as option 1. However, by considering the elevation of the tower we adjusted the location of columns with long span, which we can challenge more exterior design variation of our building. In addition, we gain more GFA than any other options which is 131,910.96 $m^2$.

*We consider additional landscaping on the top of the podium to give the users much eco-friendly working condition.*

## GEOTECHNICAL AND STRUCTURAL ISSUES

**Foundations**: The geotechnical study was commissioned by RAJUK, prepared by Al-Mayeda Survey Consultants dated October 2018 and provided to our design team.

Structural Engineers has taken the data from the Al-Mayeda Report and provided our interpretation of its meaning and given, among other things, bearing capacities at relevant depths as well as pile capacities in end bearing and friction for both gravity loads and uplift. Our interpretation is given below:

Geotechnical Testing & Inspections was retained to review the geotechnical report prepared by Al-Mayeda Survey Consultants dated October 2018. GTI was requested to provide the following information:

- Provide Allowable Soil Bearing Capacity at the bottom of the proposed excavation, which is anticipated at 19± meters below the existing ground surface.
- Provide uplift and downward drilled pier capacities for various diameter shafts below the 19± meter excavation depth.

Based on review of the geotechnical report and laboratory test data, GTI recommends the following soil allowable bearing capacities be utilized below 19± meters. These values take into account the depth to the groundwater table. Figure 1 shows the recommended allowable bearing capacity with depth.

Drilled Pier capacities are provided in the following Figures:

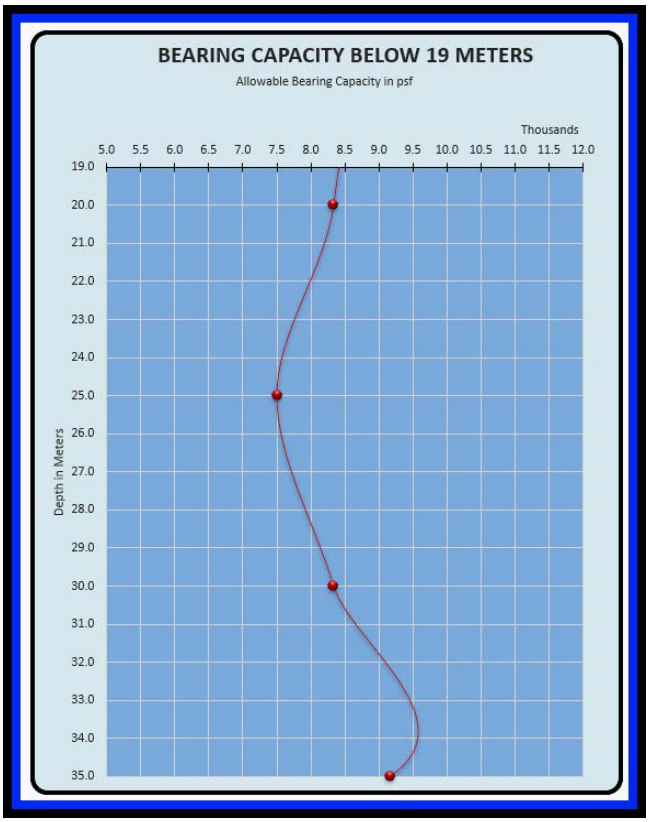



*Figure 1 - Allowable Bearing Capacity below 19 Meters*



Office: House # 390, Lane # 06, Baridhara DOHS (1st floor), Dhaka Cantt., Dhaka # 1206, Bangladesh
Cell: +88 01730 041 544, +88 01730 041 542; Phone: +88-02-8418680, e-mail: planners1981@gmail.com

Figure 2 - shows uplift capacity of piers in Tons ranging from 2.0 feet to 6.0 feet in diameter starting at 19± meters (62± feet below the ground surface).

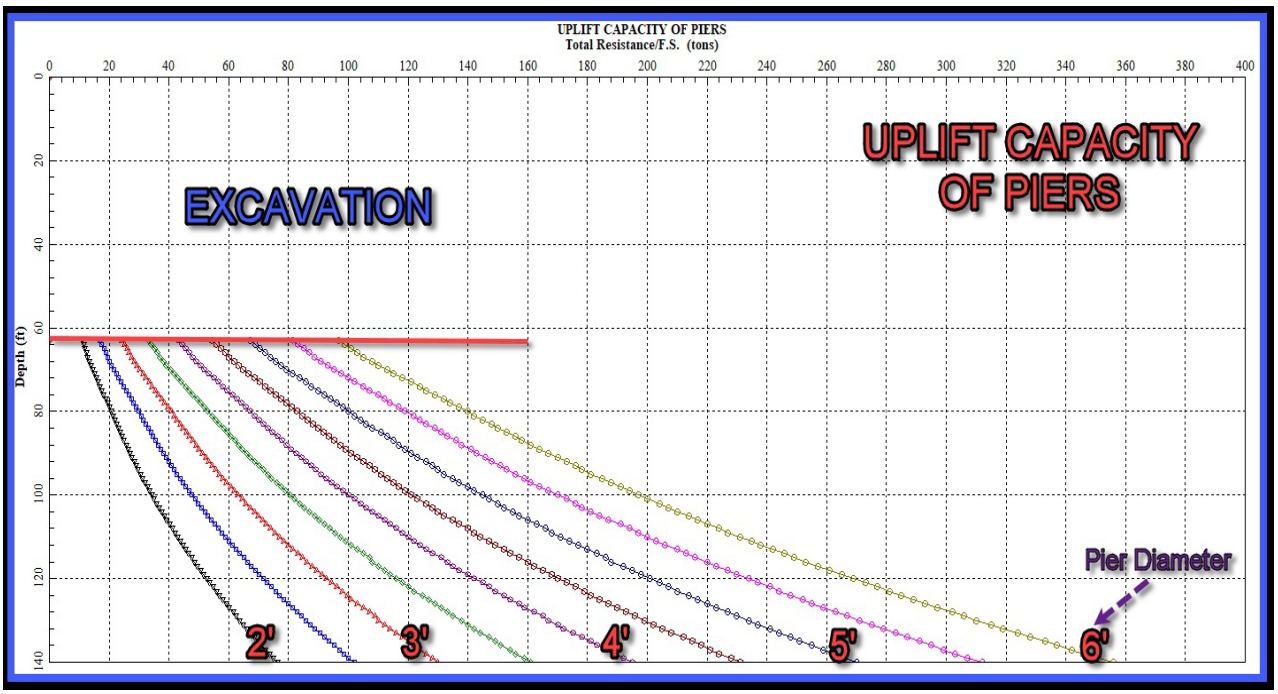



*Figure 2 - Uplift Capacity of Drilled Piers below 19± Meters*

Figure 3 - shows downward axial capacity of piers in Tons, below excavation level for 2.0 to 6.0 foot diameter piers.

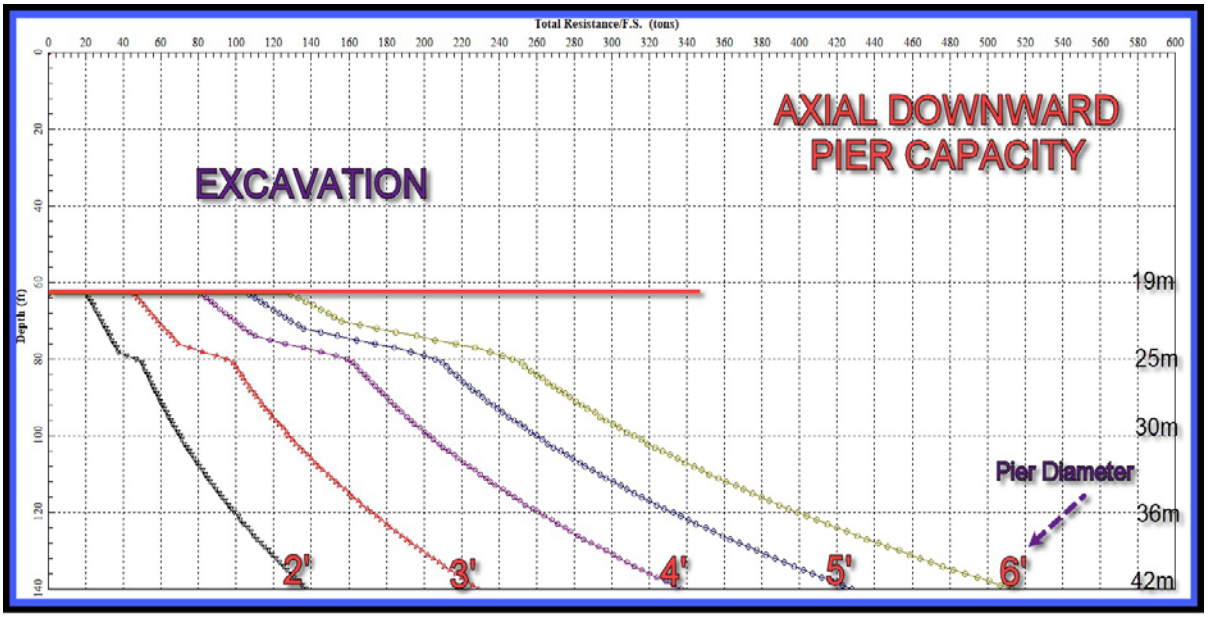
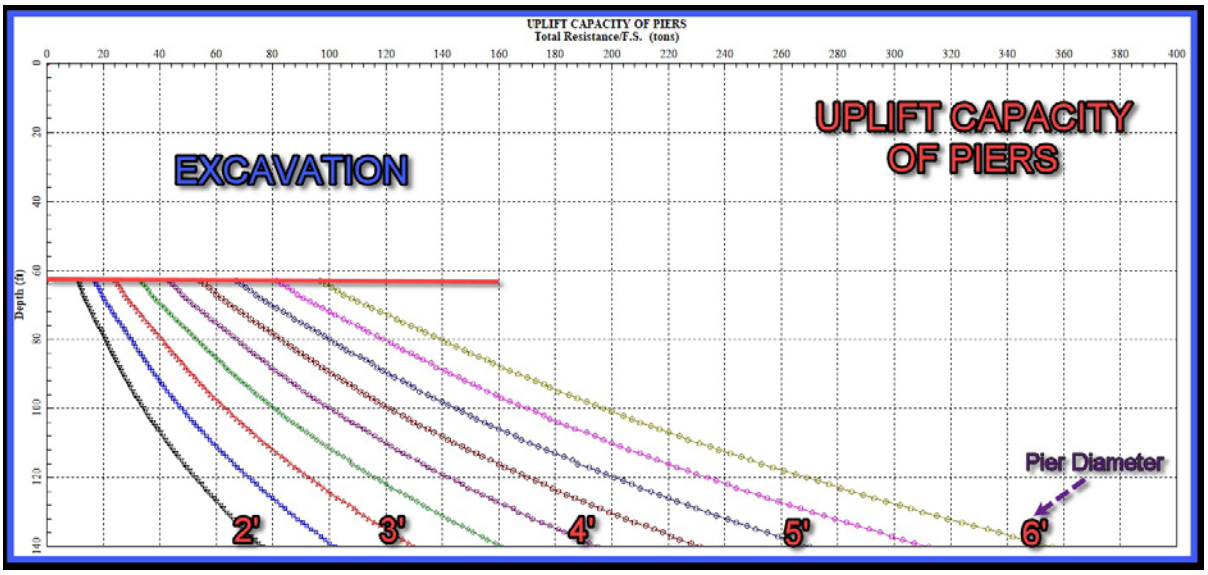
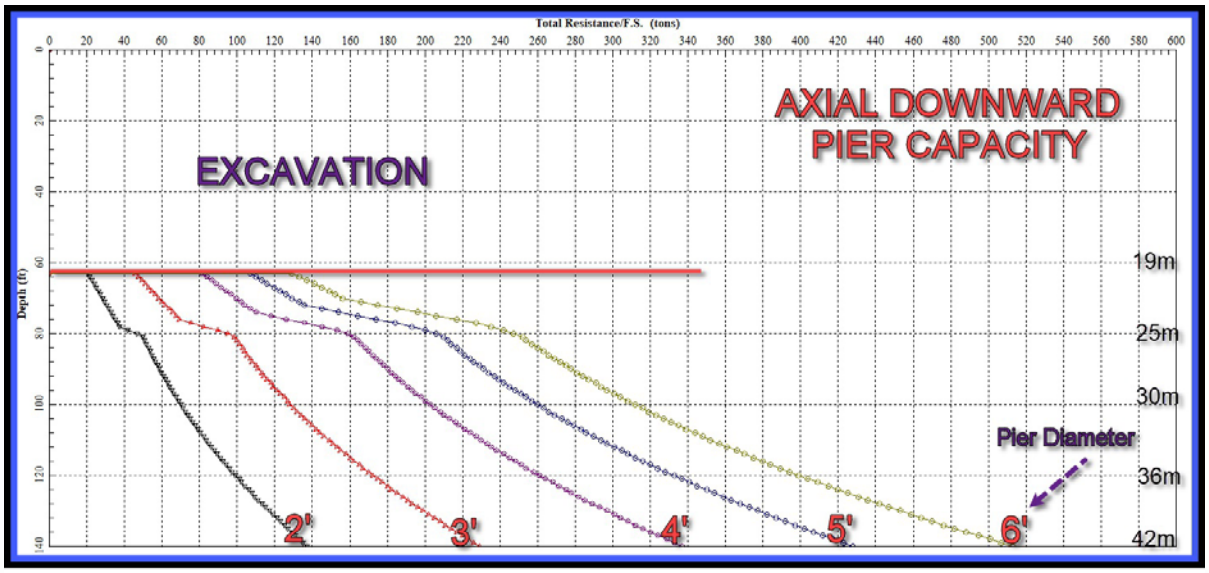



*Figure 3 - Axial Downward Capacity of Piers*

The above charts include a Factor of Safety of 2.5 for friction and 3.0 for end bearing.



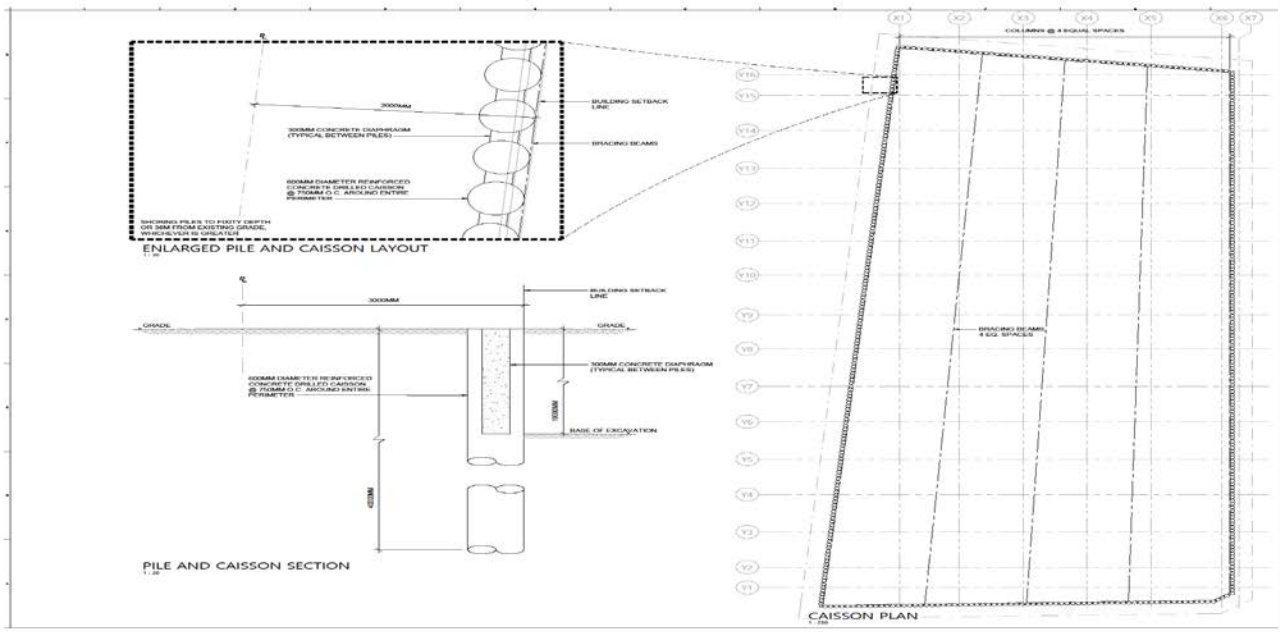




Some challenges to be met by the design team include:

- Maximum Column loads to the base foundation of 3,000 Tonnes
- Excavation of some 19metres as the Basement floor elevation is at (-16.5m)
- Water table located at approximately (-6.5meters), which applies a very large buoyant force to the excavation and slab located at -16.5m during the foundation construction
- Dewatering the site
- Lateral restraint of the excavation sidewalls
- Pile support parameters including tip bearing plus friction for gravity and lateral loads as well as friction capacity of the pile group in uplift due to hydrostatic pressure during construction and specifically during the excavation and basement construction

The team will suggest two alternatives to deal with the excavation and construction of the basement 4 floors.

1. Utilizing 600mm piles to an approximate depth of 40m, depending upon the results of a fixity test for said piles, and spaced at 750 mm. The free space between piles will be filled with a 300mm thickness of concrete. This pile wall will be placed at the outboard edge of the 3m setback to the building and will ultimately serve as the external form for the building perimeter basement wall. This design provides for a concrete retaining structure around the entire perimeter of the building basement and, in addition to providing a form for the building concrete walls, provides a surface so that the building perimeter can be rendered watertight as an impervious membrane can be applied to the pile/diaphragm wall surface




10. Structural conceptual design alternatives and possible interventions with specific focus on the critical locations of the buildings (I,e, laboratories)

The most economical building design will be of reinforced concrete construction from the bottom basement at level (-4) to the top of the podium and also the building elevator, stairway and service core which goes from the bottom of the building to its top. The office tower is proposed as a steel frame utilizing steel columns, girders and beams supporting typical floors of steel deck and concrete topping.

We are further advised that the Laboratory will require a space of approximately 2,000 sq m at ground level and to include a gantry crane of 40 tonne capacity with an appropriate height clearance.

It is noted that the structural design of the building will be governed by wind forces specified by the Bangladesh National Building Code and that it is the intention of the JV to conduct "Wind Tunnel" testing at the laboratories of RWDI in Guelph, Ontario, Canada to provide structural design criteria and also to provide advice to the architectural profile of the building to mitigate wind effects to the building and also to pedestrian traffic at the building base.

11. The Master plan and DAP of the location including reference to limitations, barriers, recommendations and permit processes including building codes

The Building will be designed in accordance with the current edition of the Bangladesh National Building Code augmented by the latest United States published building standards which include, but are not limited to:

American Concrete Institute Standard AC! 318
American Society of Civil Engineers Standard 7
American Institute of Steel Construction – Steel Construction Manual
Detail Area Plan (DAP) Guidelines

Option 1 Foundation Solution at Basement Perimeter

2. We propose a Basement Perimeter Wall referred to as a “Diaphragm Wall” or a “Slurry Wall” whereby a machine is capable of excavating a trench at the building perimeter of up to 1.5m thickness, which triples as an impervious wall to the passage of water, the temporary basement retaining wall (requiring external steel bracing) and the final building basement wall and perimeter foundation.

## Environmental impact

• Vibration-free installation

• Low noise pollution: engine noise only

• Removal of soil and disposal of bentonite

• The groundwater level must be located at least 2 meters below the working level.

• Wide working platform for the bentonite mixing process and large enough to create a material stockpile area: a minimum of 300 m² is necessary.

• Workspace surface: at least 17 m wide (minimal 15 m from the axis of the wall and 2 m in front of the wall)

• Removal of debris, demolition of old foundations and backfill with stabilized sand

• A stable, dry and flat work platform is required

## Technical specifications

• Thickness of the wall from 0.5 m up to 1.5 m (0.50 m, 0.60 m, 0.80 m, 1 m, 1.20 m and 1.50 m)

• Standard depth of the wall up to 35 m, exceptionally up to 55 m and more

• The height of the retaining wall can be in excess of 20 .

• The installation of guide walls to stabilize the soil in the upper diaphragm level and guide the grab is necessary.

• The width of the trench is minimum one time up to 2.5 times the clam shell size width.

• Normally, a lamella is excavated in 3 successive sections: panel 1, panel 2 and the central panel or ‘merlon’, where the first two correspond with the clam shell width of the grab: 2.85 up

to 3.30 m. The last section (central part or merlon) has a width of at least the thickness of the wall.

• The different trenches are connected together by means of joints so as to form a continuous enclosure inside the excavation (one single unit).

• Upon completion of the wall, provision of a uniform distribution beam is to be made (connection with the raft / slab and the structure)

**A diaphragm wall may be described as an artificial membrane made of reinforced concrete constructed in the ground by means of a process of trenching with the aid of a fluid support. The most popular use of a diaphragm wall is for the construction of multilevel basements.**

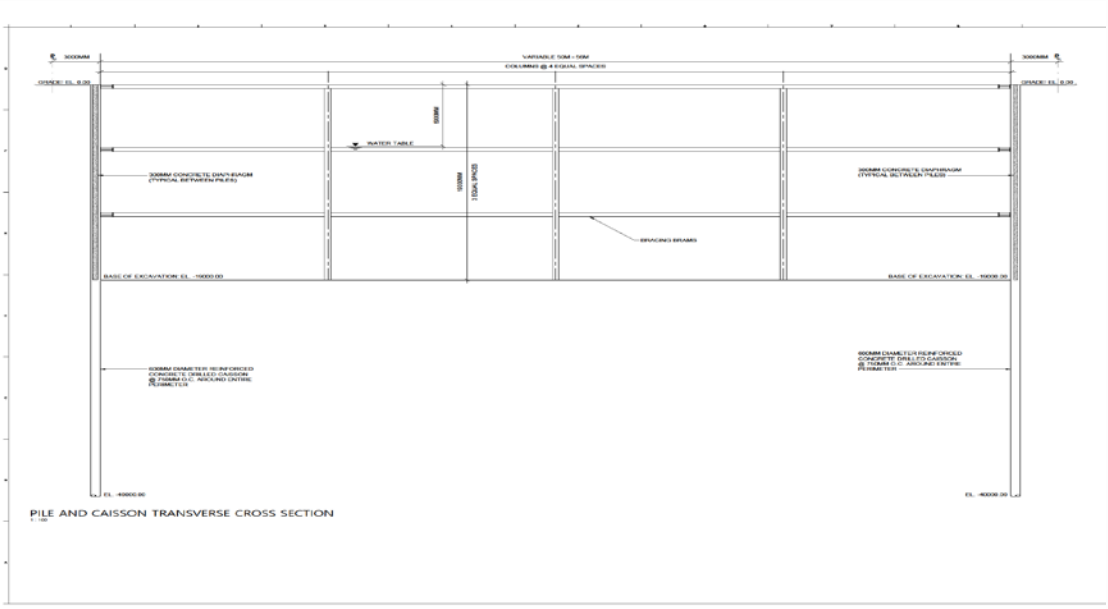
**The Origin of the diaphragm wall can be traced to the post war years in Italy (early 1950's) where adjacent reinforced concrete piles (known as secant piles) were used to construct a barrage or a cut-off wall for hydroelectric dams. To answer the need for increased water-tightness which could be provided by minimizing the number of vertical joints and due to the fact that the secant pile technique involved the partial destruction of a completed pile by the boring of an overlapping pile (a seemingly wasteful technique)a more elegant solution of excavating a trench in sections in which to cast a series of in- situ adjacent reinforced concrete panels was developed.**

**The application of the diaphragm wall technique was gradually extended to solve problems involving the building of underground tunnels for rapid transit systems along busy streets, construction of deep basements without endangering the stability of the foundations of the nearby buildings, and the construction of closed-type docks and wharfs.**

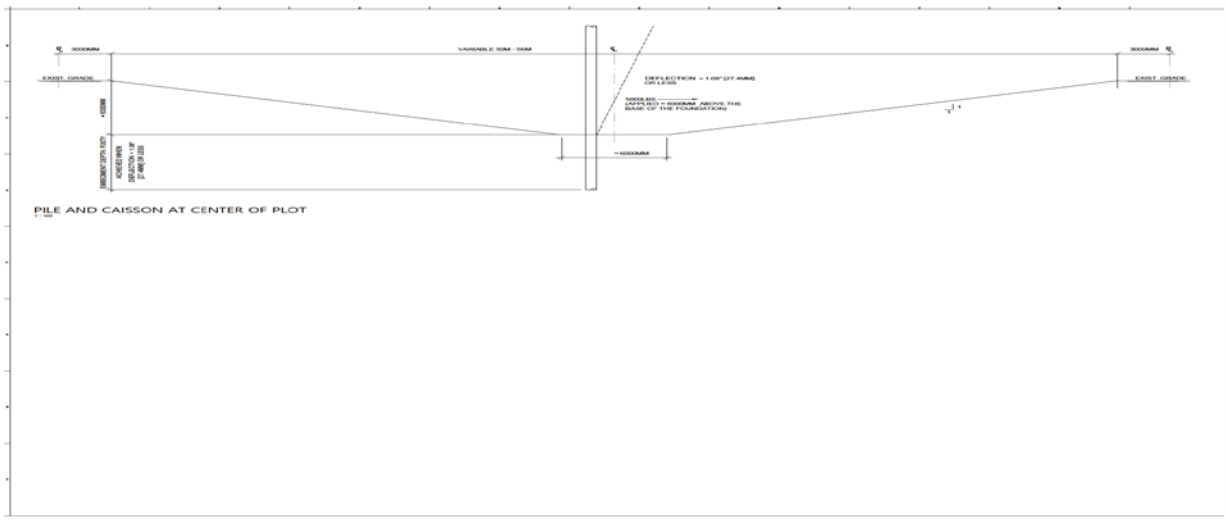
Diaphragm wall rigs

Diaphragm wall reinforcing bar cage with steel plates to be used for installation of pipe racks.
Diaphragm wall for City land 10

For both options, steel bracing will be required during construction to restrain the wall against a very high lateral pressure from the saturated soil, thus:



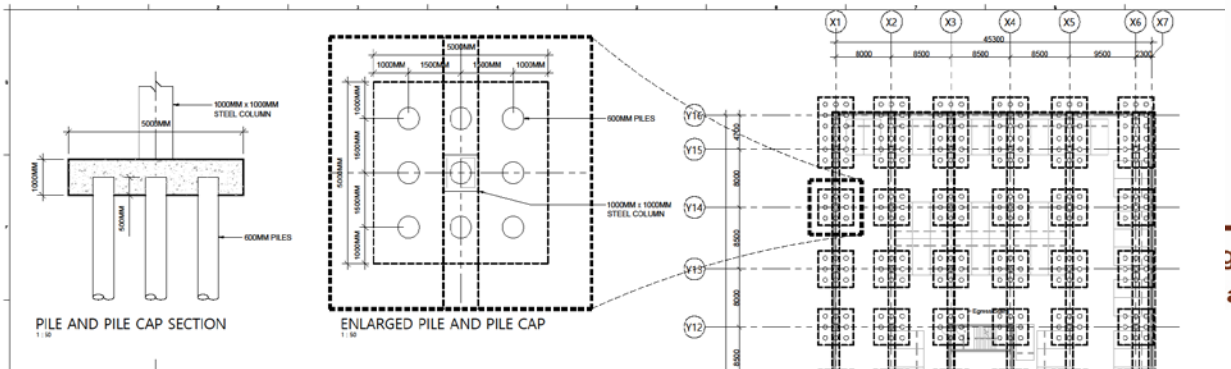

Additionally, we intend to request the geotechnical group, provide a load test of a single steel pipe pile to determine the depth that the pile must be driven to achieve lateral “fixity” of the pile. Lateral fixity is determined such that the base of the pile at its tip is restrained from rotation. The proposed test is described in the drawing below:




The above test provides for a conservative determination as to the depth of embedment of the pile to achieve fixity as the test is conducted above the water table at a depth of only 6m below existing surface grade where the soil characteristics are substantially weaker than at the excavation final depth of (-19m).

Finally, the lowest level of the basement slab is subject to a very large hydrostatic "Uplift" before the building is built. The base excavation will go to (-19m) below surface grade with the water table established at (-6.5m) below surface grade. The perimeter walls must, of course, be waterproof as well as the basement slab. Joints will require the use of heavy duty "waterstops" additionally, the base slab must be string enough to resist the large uplift forces as well as ultimately, the building gravity load enhanced by any lateral load.

Our structural solution would be to provide a pile supported mat for the central elevator and service core of the building, grade beams running longitudinally the length of the building. These grade beams would be of reinforced concrete with approximate dimension 1m wide by 2m deep, all crete of which are pile supported for both gravity and uplift forces. The grade beams would additionally support a heavy basement reinforced concrete slab approximately 1m thick, as per the drawing below:



It is anticipated that construction from the lowest basement floor to the top of the 2 storey podium would be of cast-in-situ reinforced concrete design. Additionally, to deal with the large lateral forces, particularly in the east/west direction, we propose an elevator and service core for the entire building height to be of cast-in-situ reinforced concrete construction.

As for the typical floors above the podium level, we propose a steel frame structure of steel girders, steel beams, steel floor deck and a concrete topping to the steel floor deck for the entire tower.

## CONSTRUCTION REQUIREMENT

Due to traffic congestion generally in Dhaka and the restricted access to the site, we recommend the contractor provide a concrete batching plant on the south side of the site such that a confirmed, reliable source of concrete is immediately available as required.

## CIVIL DESIGN

**GENERAL SITE DEVELOPMENT:** The design team will specify that the site must address and have sympathy to the following:

- Site security
- Provision for a mosque facility within the project
- All necessary utilities to the site including: water, sewer, electricity, communications
- The possibility of expansion
- Ample room for truck maneuvering and parking.
- Appropriate site landscaping which will enhances the project and softens its impact upon the general neighborhood.

## ADDITIONAL QUESTIONS FROM RAJUK WITH RESPONSE

11. The Master plan and DAP of the location including reference to limitations, barriers, recommendations and permit processes including building codes

The Building will be designed in accordance with the current edition of the Bangladesh National Building Code augmented by the latest United States published building standards which include, but are not limited to:

American Concrete Institute Standard AC! 318
American Society of Civil Engineers Standard 7
American Institute of Steel Construction – Steel Construction Manual
Detail Area Plan (DAP) Guidelines

12. Needs assessment and tentative area schedule based on the requirements.

Please refer to our answer at points 3, 9 & 10 above.

The 4 basement levels of 5400 sq m each will be exclusively for parking and will accommodate some 550 cars. The podium level at the ground floor will accommodate the laboratory area of some 2,000 sq m. The lab will be equipped with a single bay gantry crane of 40 tonne capacity.

The balance of the ground floor podium of some additional 2,500 sq m will form the building entrance and may include some restaurant/coffee shop space as well as building security and other functions typical of ground floor office towers. The entrance will be recessed to accommodate multiple traffic lanes required for RAJUK visitors.

13. Sustainability and Accessibility concepts

For the sustainability of the building, passive design elements to be adapted as much as possible considering local climate such as natural ventilation system, vertical & horizontal louvers, etc. Renewable energy by using BIPV and gray water and rainwater recycling system for toilet and irrigation can be considered as well.

To the maximum extent possible, local products will be specified for use in this building.

14. Landscape design principles

Upon the maximum volume requirement for the building as required in the RFP and Contract, the landscape design area will be limited within the code required area at ground level which is 25% of the property. But roof garden as green area at the top of podium can enlarge the landscape area of the building in addition to the ground level landscaping.

## MECHANICAL, ELECTRICAL, PLUMBING & LANDSCAPING

### Electrical installation:

Illumination:-

- Required values of illumination for offices is 300 lx
- Required values of illumination for laboratories is 300 lx
- Required values of illumination for staff and common rooms is 150 lx
- Required values of illumination for corridors is 70 lx
- Required values of illumination for stairs is 100 lx
- Required values of illumination for bathrooms is 100 lx
- Required values of illumination for above mirror in bathrooms is 300 lx
- Required values of illumination for entrance lobby and reception area is 150 lx
- Required values of illumination for conference rooms and executive offices is 300 lx
- Required values of illumination for general offices is 300 lx
- Required values of illumination for business machine operation is 450 lx
- Required values of illumination for general drawing office 300 lx
- Required values of illumination for board and tracing drawing office is 450 lx
- Required values of illumination for lift cars is 70 lx
- Required values of illumination for lift landings is 150 lx

1. Minimum load densities for office and commercial spaces – for A/C – (95 watt per sqm) and for non A/C – (35 watt per sqm)
2. Modern design practices call for separation of loads into known and unknown loads. General lamination is a known load.
3. Length of lighting circuits shall be limited to a max of 30m
4. Individual Branch circuit must have spare capacity to permit at least 20% increase in load before reaching the level of max permitted load for the circuit
5. 1 spare circuit must be allowed in the distribution board for each 5 circuits in use
6. Size of wire to be used in a branch circuit shall be at least one size larger than the computed if the overcurrent protective device to the first outlet is over 15 meter
7. When Distance from the overcurrent protective device to the first socket outlet on a receptacle circuit is over 30 m the minimum size of wire used for a 15 A branch circuit shall be 4 sq mm ( 7/0.036 )

Estimation:

1. LED lamps – 13 watts to 18 watts
2. Incandescent lamps – 100 watts

3. CFL – nominal length ( 600 mm ) – 12 watts
4. Fluorescent LED lamps – nominal length ( 1200 mm ) – 20 watts
5. Fan ( ceiling / table ) – 70 watts
6. Fan ( Exhaust ) – 90 watts
7. 5A socket – 200 watts
8. 15A socket – 1000 watts

## Substation:

1. Required for office buildings with a total plinth area of 5000 sqm. Even buildings with smaller plinth areas with large loading.
2. Size of a substation – load factor of 70% shall be applied to the estimated load of the building
3. Location should be on lowest floor with direct access from the street
4. Floor level of substation or switch level shall be above flood level
5. Electrical substation to locate adjacent to the air conditioning plant room (if any)
6. For transformers having large oil capacity more than 2000 liters soak pits are must
7. Minimum length of substation room shall be 3.6 m

### Minimum area for substation room:

| Capacity of transformer (KVA) | Transformer room area (sqm) | Total substation area (sqm) |
|---|---|---|
| 1*150 | 12 | 42 |
| 1*250 | 13 | 45 |
| 2*250 | 26 | 90 |
| 1*400 | 13 | 45 |
| 2*400 | 26 | 90 |
| 3*400 | 39 | 135 |
| 2*630 | 26 | 90 |
| 3*630 | 39 | 135 |
| 2*1000 | 26 | 90 |
| 3*1000 | 39 | 135 |

### Area required for standby generator:

| **Capacity ( KVA )** | **Area (sqm)** |
|---|---|
| 1*25 | 20 |
| 1*48 | 24 |
| 1*100 | 30 |
| 1*150 | 36 |
| 1*300 | 48 |
| 1*500 | 56 |

## ADDED COMMENTRAY ON ELECTRO MECHANICAL WORK

15. Electrical design principles

Electricity is fundamental in the modern world, providing an energy source for building systems, home appliances, and even our mobile electronic gadgets. With electrical design services, we can make sure our building has a safe power supply. Ideally, electrical installations should also be designed for efficient operation, reducing power bills in the long run. Sustainable design practices incorporate alternative energy and energy conservation techniques to cut down on energy supplied by fossil fuels that a building will use. Solar source can provide significant cost savings and lessen a building's carbon footprint. We need to optimize the site for this renewable source, making sure solar panels receive adequate daylight. Building can be designed to reduce the energy consumption by providing energy-efficient lighting design, properly maintained HVAC systems, and daylighting. Following items to be incorporated with Electrical System design:

- Renewable Energy/ Solar Panel System
- Intelligent Inverter System
- Ultraviolet ray free Lighting System
- Glare less Hidden/ Cavity/ Indirect Lighting System
- Electronic dimming device to be incorporated where necessary
- Emergency Foot-step stair case lights to be used
- Emergency Lobby and corridor lights to be used
- Anti-insect Lighting System
- Outdoor Insect Killing Lights to be incorporated with emergency power supply
- Photocell System should be incorporated with Aviation/ Aircraft Lighting
- Photocell System should be incorporated with Building Wash Lighting
- Photocell System should be incorporated with Area Lighting
- Photocell System should be incorporated with Pavement Lighting
- Kitchen equipment should be connected with emergency power supply
- Battery operated cordless Calling Bells should be used
- Motor driven applications
- Energy reduction by optimizing the individual components
- UPS/IPS System
- Security System with Motion Sensitive equipment
- Using of cable termination kit like Lugs, Shrouds, Guard, Bushing, Gasket, Heat Shrinkable Termination kit & Jointing kits of appropriate types & sizes
- Temperature Management System to be known by laser gun
- All power sockets & plugs should be 3-pin type
- 3-wires in Single phase system
- 5-wires in Three phase system
- Wiring of office machines should be concealed
- Bus Bar Trunking (BBT) System to be incorporated
- Floor Distribution Board (FDB) & Emergency Floor Distribution Board (EFDB) should be connected with BBT respectively
- Ground/ Earth resistance to be maintained below 1 ohm
- Fire proof/ Fire resistant cables to be used
- Earthing/ Grounding System must be separated
- Lightning Protection System
- Risk factors for Lightning Protection System must be maintained
- Ring main wiring should be followed for switch & Socket System
- Type Tested Distribution Board should be used
- SLD should be provided in each Panel &Distribution Board

- Proper Lux level to be maintained
- Maintenance free Cast-resin type Transformer with internal cooling system to be used
- Ring Main Unit to be used for incoming feeder
- Sound Proof Canopy to be used for Gas Generator to maintain proper dB level
- ATS & Synchronizing Panel to be incorporated
- BNBC/IEE regulations to be followed for Electrical design

16. Mechanical design principles

Humans spend most of their time indoors in modern society. Mechanical design services deals with a wide range of building systems that make built environments habitable. Their functions include delivering potable water, renovating indoor air, and keeping temperature at healthy and comfortable levels. Building mechanical systems are characterized by requiring plenty of space – they include some of the largest equipment pieces in a building, such as chillers and boilers. As a result, one of the main challenges in mechanical design is using the available space as efficiently as possible. Following items to be incorporated with Electrical System design:

- VRF/ VRV system
- Zero use of Chloro-Fluoro Carbon based Refrigerant
- Ventilation system
  a) Exhaust fan (noise free)
  b) Cooling pad
  c) Mosquito net
  d) Internal gutter system
  e) Carbon di-oxide & Carbon mono-oxide removal process to be incorporated
  f) Central/ Individual Toilet Ventilation System
- BNBC regulations to be followed for Mechanical design

Mechanical systems relate to heating ventilation and air conditioning systems, but they can also relate to transportation systems such as lifts and escalators, and so on.

Heating ventilation and air conditioning can be used in building to:

- Maintain internal air quality.
- Regulate internal temperatures.
- Regulate internal humidity.

Plumbing refers to any system that allows the movement of fluids, typically involving pipes, valves, plumbing fixtures, tanks and other apparatus. Plumbing systems might be used for:

- Heating and cooling.
- Waste removal.

- Potable cold and hot water supply.
- Water recovery and treatment systems.
- Rainwater, surface and subsurface water drainage.
- Fuel gas piping.

## Fire Fighting:

1. Basement floors shall be enclosed with one hour fire resistive construction.
2. Doors shall be made of noncombustible materials
3. Progression of fire, smoke and fume through the voids of fire resistive floors and walls shall be restricted by sealing with approved materials
4. Openings in the exterior wall in two consecutive floors lying within 1.5 m laterally shall be separated with a flame barrier projecting at least 75 cm from exterior face
5. Fixed partitions should be of noncombustible materials, fire retardant treated wood and one hour fire resistive construction
6. Fire separating walls shall not have opening exceeding 11.2 sqm in area
7. The max allowable opening may be doubled with a minimum distance of 0.9 m between adjacent openings
8. Doors and other openings shall be limited to 5.6 sqm in area with a max height of 2.75 m and width of 2.1 m
9. Opening of service lines shall be protected by enclosures having a fire resistance rating of at least 2 hours
10. Exit access travel distance is maximum 25 m
11. Vent area and spacing of the vents:

| Hazard condition | Vent area to floor area ratio | Max spacing of vent centres |
|---|---|---|
| G1 – Low hazard | 1 : 100 | 30m |
| G2 – Moderate hazard | 1 : 75 | 20m |
| H1 – Low hazard | 1: 100 | 30m |
| H2 – Moderate Hazard | 1: 75 | 20m |
| J1 – High hazard | 1 : 30 | 15m |
| J2 – High Hazard | 1 : 30 | 15m |
| K1 - Low hazard | 1 : 100 | 30m |

12. Properly designed fire dampers shall be installed within air conditioning ducts
13. Plastic, wood or other flammable materials in interior or exterior have the potential to generate smoke and toxic fume and also works as a fuel during a fire
14. Fire lifts shall be used in buildings more than 20m in height with a minimum capacity of 8 persons
15. Exit aisles and approaches shall not be obstructed by placing check out stand
16. Exits and exit access shall not be used as supply or return air ducts or any other purposes
17. All exits shall be clearly visible and marked
18. Minimum required width of corridors and passageways – 1.1 m serving an occupant load of more than 50

19. Minimum clear height of the corridors shall not be less than 2.4 m
20. Maximum travel distance for spaces with one exit door is 23 m for max occupant load of 50
21. Revolving doors must not be used as a mean of exit
22. For Occupant load of more than 1000 , minimum 4 exits required

## ADDED COMMENTARY CONCERNING FIRE SUPPRESSION

Fire protection systems must be capable of detecting fire and smoke, warning occupants, and activating automatic measures to prevent or mitigate damage. Automatic sprinklers are among the most effective fire protection measures, since they can quench most fires when they are still small. Following items to be incorporated with Electrical System design:

- Fire Safety System to be incorporated in accordance with BNBC guide lines
- All Fire Safety devices must be radiation free and made of non-toxic material
- Smoke, Heat & Multi Detectors should be used as per occupancy type
- Fire alarm sound level should not create sound pollution
- Fire Pumps should be installed in positive suction position
- Yard Hydrant Line should be installed
- Fire Hose Nozzle should be based on proper area calculation
- Fire Sprinkler System must be incorporated
- Low flow fire protection systems like water mist should be incorporated.
- Mulsifyre System to be incorporated in most fire hazardous area
- Environmentally safe clean agents, those with zero ozone depletion potential or one global warming potential, should be utilized for fire suppression

## Stairway:

1. Required width of stairway 1.5m
2. Landing between two stair flights in a straight run shall not be wider than 1.2 m in the direction of travel
3. Stair ways shall have hand rails on both sides. If the width exceeds 2.2 m intermediate handrails shall be provided

## Ramp:

1. Minimum width shall not be less than 1.1 m
2. Slope of exit ramp shall not exceed 1 in 8. For slopes steeper than 1 in 10 ramp shall be surfaced with non slip material
3. Guards and handrails shall be provided on both sides of ramp steeper than 1 in 10

## Horizontal exit:

1. Horizontal exit shall be protected with self closing doors
2. Width shall not be less than 1m
3. Slope shall not exceed 1 vertical in 10 horizontal

4. Required capacity of refuge shall be of 0.28 sqm per occupant
5. Exit stairways located more than 23 m above the ground level shall be protected by a smoke proof enclosure
6. There shall be access to the stairway from every storey by way od a vestibule or open balcony with a minimum width of 1.1 m. minimum length in the direction of escape travel shall be 1.8 m
7. Building having a floor area larger than 500 sqm on each floor shall have a minimum of two staircases

Exits shall be arranged such a way that the travel distance from any point in the area is maximum 30 m.

### Water Supply:

1. Water required for occupancy type F in liters per capita per day is - for full facilities 45 liters and restricted facilities 30 liters.
2. Capacity of storage shall be calculated according to rate of regularity of supply, frequency of replenishment of storage, occupancy classification, hours of supply of water, amount of water required for fire fighting
3. Storage tank shall be easily accessible
4. Reserve tanks shall be constructed with prestressed or reinforced concrete or galvanized steel
5. For tall buildings intermediate tanks and pressure reducing valves are to be provided

## Fixtures:

1. Water closet – Male ( 1 for 25 persons ) / female (1 for 15 persons )
2. Urinals –

- male :
- 1 for 7-20 persons
- 2 for 21-45 persons
- 3 for 46-70 persons
- 4 for 71-100 persons ( add 3% for 101-200 persons and 2.5% for over 200 persons)

3. Wash basins – 1 for 25 persons
4. Drinking fountain – 1 for 100 persons
5. Service sink – 1 per floor

### HVAC: for office

Minimum load densities for office and commercial spaces – for A/C – (95 watt per sqm) and for non A/C – (35 watt per sqm).

## Design conditions for summer

| Normal Practice | | | Special Practice | |
|---|---|---|---|---|
| Dry Bulb (celcius) | Relative humidity % | Temp. Swing (celcius) | Dry Bulb (celcius) | Relative humidity % |
| 24.5~26 | 55~50 | 1~2 | 23.5~24.5 | 50 |

## Outdoor air requirements

| Occupancy Classification | Outdoor air quantity (l/s per person) | |
|---|---|---|
| | recommended | minimum |
| Lobbies | 5~7.5 | 3.5 |
| Computer rooms | 3.5~5 | 2.5 |
| Conference rooms | 15~20 | 12.5 |
| Printing rooms | 5~7.5 | 3.5 |
| Office space | 7.5~12.5 | 7.5 |
| Waiting rooms | 7.5~10 | 5 |
| laboratories | 10~12.5 | 7.5 |

## Required mechanical ventilation air

| Occupancy Classification | Required ventilation air (l/s per person) |
|---|---|
| Lobbies | 7.5 |
| Computer rooms | 5 |
| Conference rooms | 17.5 |
| Printing rooms | 2.7 l/s per sqm of floor area |
| Office space | 12.5 |
| Waiting rooms | 17.5 |
| Laboratories | 10 |

1. Velocity of air in an air conditioned space , in the zone between the floor level and the 1.5 m level, shall be within 012m/s and 0.25m /s for comfort
2. Every space served by the air conditioning system shall be provided with outside fresh air
3. Outdoor air quantity shall be lower than 2.5 l/s per person

4. Air handling units shall be installed on vibration isolators to restrict transmission of vibration to the building surface. The base of the unit should be minimum 75 mm above the adjoining floor

## ADDED GENERAL COMMENTARY

Data & Communication System:

- LAN, WiFi System to be incorporated
- PA & Conference System to be incorporated
- Music & Sound System should be environmental friendly
- Acoustic reverberation to be incorporated

17. Façade design principles

Local climate and environment should be considered for façade design.
Based upon the maximum volume requirement, a tall tower just above the thin and wide podium is the given condition. Considering this, two scheme are being studied :

Scheme 1 : From the ground to the top of the building, Façade changes from solid to transparent gradaually.

Scheme 2 : Glass curtainwall with appropriate louvers are attached to the façade to control the sunlight and the louvers are extended to the podium to make the building as one figure.

Some additional comments are as follows:

**General:**

1. The inception report only covers the site-specific layout plan and geotechnical design aspect. No other topics within the scope of the contract were found in the report. A tentative timeline of all deliverables and possible coordination plan with the construction phase is also missing.

Our response herein deals with this question. As for the timeline, it is unchanged from our contractual agreement

2. The report does not state about the number of floors the design would consider and the construction phases to consider in the design and construction phase.

Our response herein deals with this question

3. Please ensure if the proposed floor area and Gross floor area for the URU (proposed 30 storied building) is satisfying the current code and standard requirement (e.g. FAR, MGC etc.) as per BNBC.

Yes it complies with BNBC in every way as well as Imarat Nirman Bidhimala/2008.

4. The codes going to be followed for the design purpose (Structural, MEP, Fire etc.) is not mentioned in the report.

Refer to point 11 above

5. For sharing any drawings with the Bank or through any report, please ensure the documents are signed and approved from concerned authority/person.

Noted

6. The inception report do not mention on the Green Building aspects within the design scope.

Design and engineering team will coordinate with the LEED special consultant when hired in order to achieve the highest level of 'Platinum'.

**Technical:**

1. Effect of ground water table and uplift pressure for the construction phases of URU; (i.e. up to proposed 04th floor within URP's scope and the rest) should be considered accordingly in all design and construction consideration with inclusion in reports and drawings.

Done and included in our Inception Report

2. We note that the final excavation depth is going to be -19 meters from EGL as per the report. All safety measures in the design and contraction phase should be well reported and maintained. Please also prepare a brief on the instrumentation and monitoring work to be covered for the substructure construction and the rest.

This is the responsibility of the chosen General Contractor supervised and managed by the JV team. This issue is premature at this time. However, it will be a prominent to be addressed by the Contractor in his response to the Construction Tender Document.

3. A survey of the adjacent structures should be carried out along with their proper consideration in the design and construction of the URU., especially diaphragm wall.

The adjacent existing structures are sufficiently distant such that the proposed building has no effect upon them from a technical point of view.

A survey of the existing structures will be done during the wind tunnel testing including providing for an estimation as to the size and location of future buildings constructed adjacent to the site.

4. All possible stability and hydraulic pressure issues should be considered accordingly.

Noted and Done

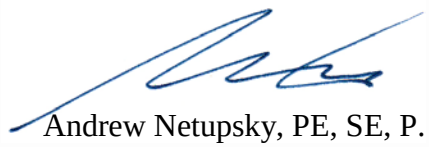
We thank you for your attention to this report and trust that it responds to your needs.

Naturally, we are pleased to respond any questions you may have concerning this report.

Our Invoice of 1st payment request has been submitted on 08/11/2018 and we respectfully request that the subject invoice be paid forthwith and without delay.

Yours truly,

For and on behalf of *BAUM Architects, Inc., Structural Engineers Company and The Planners and Engineers Limited JV*



Andrew Netupsky, PE, SE, P. Eng.
(Structural Engineers Company representing the Consultant)
Former President Structural Engineers Association of Arizona
Recipient SEAoA Award for Excellence in Structural Engineering 2018, 2016 & 2009