1. General notes

1.1. Do not scale the drawings. All dimensions shall be read from the drawing or computed. Elevations are in millimeters, distances and reinforcement bar sizes are in millimeters.

1.2. In the interpretation of these drawings, indicated dimensions shall govern and distances or sizes shall not be scaled for construction purposes.

1.3. The contractor shall coordinate with the ar, se, ee and other utility and equipment plans for the exact size, number and locations of all sleeves or openings through floor slabs, beams and walls. Any discrepancies or conflict in the setting out lines, levels, details, locations, sizes, reinforcement etc. Of the structural member shall be brought to the attention of the engineer prior to commencement of work.

1.4. All reinforced concrete work shall be done in accordance with the british structural code BS8110 or EC-EN2 building code.

1.5. All structural steel work shall be done in accordance with the british structural code BS 5950 parts 1 to 9 and EC-EN3 in so far as they do not conflict with the local building code requirements.

1.6. All slabs, beams and other structural elements which are not indicated, detailed, designated or inadvertently omitted but are necessary to be coordinated with architectural and other allied engineering plans as well as to complete the structural works in accordance with the intent of the plans and specifications shall be brought up during pre-bids/meetings/negotiations. It is understood that the contractor has provided and included all these items in his bid.

1.7. The contractor shall produce shop drawings and schedules as required for completion of the works and record drawings of the as-built and builder works for the consultant's approval.

1.8. Contractor shall do full coordination between structural, architectural and mep drawings in wet areas to allow for drainage pipes.

1.9. All discrepancies shall be brought to the attention of the consultant engineer proceeding with the work on site.

1.10. All materials to be used in conjunctions shall comply with the requirements of the specified codes, standards and ordinance of relevant building authorities unless noted otherwise in the project specification and/or drawings.

1.11. All dimensions and levels shown on the drawings shall be verified by the contractor. Any discrepancies shall be brought to consultant's attention prior to construction.

1.12. The contractor shall ensure that during construction, no part of the structure is overstressed by excessive construction loads until their completion. Temporary bracing and propping to be provided were required.

1.13. Once the excavation is done to a specified depth, the bearing capacity of the soil shall be confirmed by relevant test, if the value is less than the design bearing capacity the engineer is to be informed immediately.

1.14. The contractor shall submit a method statement for all elements of work and shall not proceed until consultant's written approval is given. The method statement shall provide the contractor's preferable options where such options are available.

1.15. The contractor shall comply with all requirements of the local regulations and requirements of all concerned authorities.

1.16. Quality of concrete finish for all non-plastered columns and beams is to be in accordance with - fair faced concrete as reflected on the architectural drawings and specifications.

1.17. Any structural requirements specified by relevant authorities, which are not covered in notes and specifications are assumed to be duly considered by the contractor.

1.18. All typical details and notes shown on drawings shall apply unless noted otherwise. Typical detail may not necessary be indicated on the plans but shall still apply as shown or described in the details where particular details are noted on the drawings the specified details shall be used.

1.19. The design life of the structure of this project shall maintain a minimum of 50 years life period. The primary structural components are to be designed and detailed to satisfy this requirement. Concrete mix supplier shall submit a life cycle analysis which reflect a 50 years design life without maintenance, inspection and repair requirement during this period.

2. Concrete

2.1. All concrete works shall conform to the BS8110 or EC-EN, a grade of C25/30 indicates that concrete shall have a fcu compressive strength of 30N/mm2 established from test cubes at 28 days equivalent to a compressive strength of 25N/mm2 established from cylinder tests at 28 days.

concrete mix design shall comply with EC-EN2 or BS8500-1:2006 as follows:

Miz Number	1	2	3	4
Grade	C30/37	C25/30	C25/30	C16/20
Min cement content (kg/m³)	380	340	340	300
Cement Type	OPC	OPC	OPC	OPC
Max free W/C ratio	0.4	0.45	0.45	0.55
Slump	75 ± 25	75 ± 25	75 ± 25	100 ± 25
Aggregate	20	20	20	20

mix 1 - used in reinforced concrete works for structures at sea/exposed to sea, water retaining structures and tank structures.

mix 2 - used in reinforced concrete works for ground level and below (sub-structutre) or any reinforced concrete works in contact with soil or water.

mix 3 - used in reinforced concrete works above ground floor level (superstructure) for horizontal members (beams/slabs) and vertical members (columns/walls).

mix 4 - used for plain concrete blinding and mass fill.

2.2. Contractor shall implement a trial mix in accordance with the project specifications & authority requirements. Trial mix results shall be submitted for engineer's review & approval prior to commencing concreting.

2.3. Contractor shall submit the details of additives, plasticizers, micro silica, curing compounds, waterproofing agents, etc. Application should follow strictly the manufacturer recommendation. It is contractors responsibility to ensure that all constituents of concrete are compatible to each other.

2.4. Maximum percentage (by weight) of salt contents permissible in aggregates used for concrete, hollow blocks & hourdi blocks, etc, shall be as follows:

a) acid soluble chlorides in aggregate - (fine 0.03%, coarse 0.02%)

b) acid soluble sulphate in aggregate - (fine 0.3%, coarse 0.2%)

2.5. Concrete shall be cured by an approved means in accordance with the specifications.

2.6. Aggregates shall be from approved source and in accordance with the specifications.

2.7. Openings, sleeves:

a) no holes, sleeves or penetrations be placed vertically or horizontally through beams unless approved by the engineer.

b) no holes to be made in slabs unless approved by the engineer.

2.8. Construction joints:

a) the contractor shall submit to the engineer for approval a plan marked up showing the location of all construction

joints

b) horizontal construction joints shall not be made in beams,

unless approved by the consultant or engineers.

c) vertical construction joints may be located at midspan of

slabs or beams after reviewed and approved by the engineers.

d) contractor shall submit shear friction and the additional required reinforcement calculation of construction joint (at any location) for engineers review and approval.

3. Reinforcement

3.1. The reinforcement used in the reinforced concrete shall be round, deformed Type 2 bars marked as (t) to indicate high yield strength of 460N/mm2 to BS4449 or Type 500B to EC-EN. The carbon equivalent of rebars should not exceed 0.51 for grade 460.

3.2. Reinforcement details shown are indicative. The contractor shall prepare detailed shop drawings & full bar schedules in accordance with the design drawings and shall be cut and bent in accordance with BS 8666 and aci 315-09 for the engineer's approval at least four weeks prior to commencement of reinforced concrete work and after coordinating with all concerned parties.

3.3. Lap lengths and anchorage lengths of reinforcement shall be as per BS 8110 and EC-EN. Additional lapping if required to be provided with engineer's approval. The minimum lap length of reinforcement shall be the maximum of (45 bar dia in general and 50 dia for tension) or the values of the table a.

Table a : schedule of lap splices

Bar dia	lap splices length (mm)
10	500
12	600
16	800
20	1000
25	1250

3.4. Spacer bars in beams shall be a minimum T25 or the size of bar if greater at 1000mm c/c; chairs in slabs shall be a minimum T12@1000mm c/c; and minimum ties in walls shall be T8@1000mm c/c.

3.5. Clear cover to reinforcement including links, stirrups, and ties shall be as follows:

A) structure in contact with ground

Footings	= 55mm
Wall and column	= 50mm
Ground beam	= 50mm
Slab at ground level	= 50mm

B) super structure

Columns	= 40mm
Beams	= 35mm
Slabs	= 30mm
Walls	= 40mm

All concrete elements in contact with salt water/splash zone = 75mm

3.6. Reinforcement bars to be cut, bent or adjusted to clear all openings and interfering structures to suit at site to the approval of the consultant or engineer.

3.7. For holes in slabs up to 300x300 sq., reinforcement is to be cut and replacement bars fixed adjacent to the hole extending 50x bar diameter beyond the hole.

4. Fire resistance

4.1. All structural concrete members between units on boundaries are designed to maintain fire resistance of 2 hours.

Notes:

1. First stirrups location shall be s/2 from the face of the column/ support.

2. Place one b bar in each bottom corner and one t bar in each top corner of the stirrup cage.

3. Condition shown is at columns. Where beams and girder intersect, use typical interior girder section.

4. All bottom bars and top bars shall be placed in one layer unless two layers are noted in the beam schedule. Where to layers are noted provide 25 mm clear between layers. If two layers are noted place bar b1 above bar b and bar t above t1.

5. Length of exterior top bars are given only when straight bar occurs otherwise hooked bars are required.

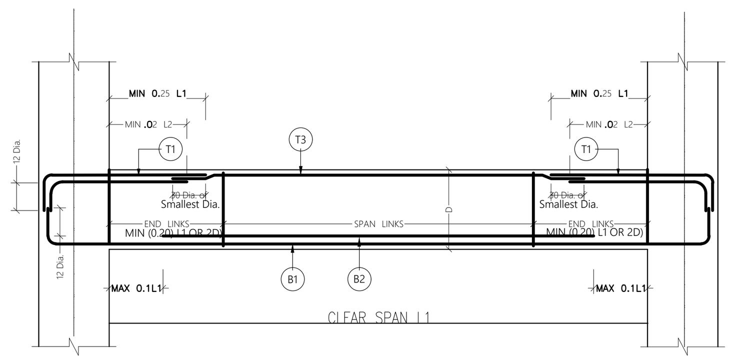
6. Where a member is supported by a column, but has another member running perpendicular to it at the same column, the first stirrup spacing shall start from the face of the column and not from the face of the transverse beam.

7. Top & bottom reinforcement lapping of both main rebars can be ignored if the main rebars at left and right side of lapping location are identical.

8. For 'column width less or equal 2m l*="column width'/2. For 'column width' greater than 2m, l*=1m

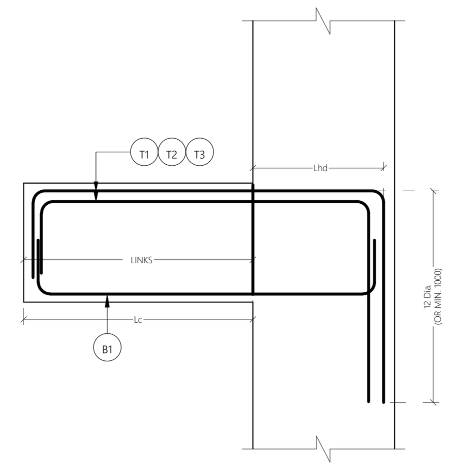
Supplementary abbreviations:

B1 - continuous bottom bars.
B2 - additional bottom bars
CE - cantilevered end
D - depth of member, mm
EE - each end
EF - each face
FL - full length
EW - each way
H - aci standard hook
ITB - interior top bar
LE - left end
LG - length
P - paired stirrups
RE - right end
REM - remainder
S - side bars
T1 - top bars at internal supports
T2 - top bars at mid-span
T3 - top bars at end support
W - width of member, mm



SIMPLE BEAM DETAILS

NTS

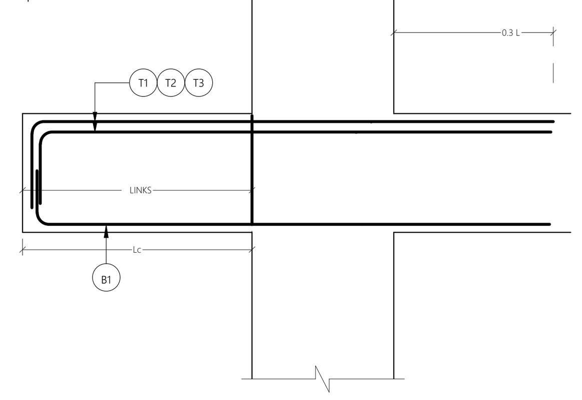


TYPICAL CANTELEVER BEAM FROM COLUMN

NTS

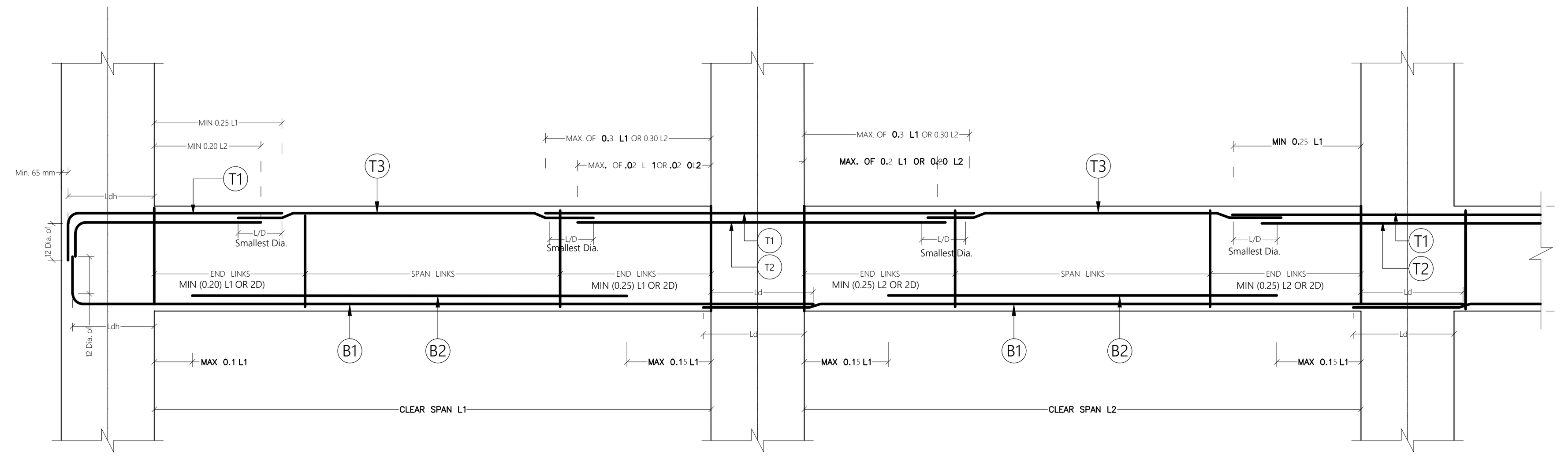
NOTES :

Incase of t1 & t3 have same diameter splice to be omitted.



TYPICAL CANTELEVER BEAM CONTINUOUS

NTS



CONTINUOUS BEAM DETAILS

NTS

5. Cracking

5.1. The cracking of the structural concrete in general is restricted to 0.30mm.

6. Earthwork & foundations

6.1. Foundation detail design is based on the assumed safe allowable bearing capacity has been taken as 150KPa. The actual requirement for the foundation design is to be verified based on final geotechnical report for the project.

6.2. Excavations for foundations down to formation level shall be carried out by mechanical means, except for the last 100mm of excavation which is to be carried out by manual methods and recommended by geotechnical consultant.

6.3. The formation level of foundation is to be inspected and approved by the geotechnical engineer before commencement of the work.

6.4. Engineering fill (unless specified otherwise as a higher quality material) shall be selected well graded granular material approved by the engineer with a minimum soaked cbr of 15% compacted not exceeding 250mm in layers to 95% maximum dry density as per geotechnical investigation report recommendations in accordance with the specification. However, a minimum cover of 250mm back fill material shall be provided at the top of foundations below the blinding to cast against.

6.5. Efficient site drainage during and after construction of the project should be provided by the contractor.

6.6. Site inspection by a qualified engineer should be carried out after completion of the excavation works and after preparation of the proposed foundation level to ensure that the contact surface is free from any loose/soft layer and properly prepared for the foundation.

7. Concrete workmanship

7.1. All concrete without plaster shall be fair finish unless noted otherwise.

7.2. All concrete surface to have plaster are to be hacked to have an adequate surface key.

7.3. All concrete is to be cured by an approved method-water pounding or curing compound.

7.4. All types of construction joints in concrete shall be at a specified locations and approved by the engineers.

7.5. All substructure concrete works shall be protected with water proofing as per standard details & specifications.

7.6. All concrete shall be compacted using a mechanical vibration process.

7.7. 25x25mm chamfers to external corners and edges shall be provided in accordance with specifications and directed by the engineer.

8. Structural steel

8.1. All structural steel works shall be in accordance with BS 5950 parts 1 to 9 or EC-EN3.

8.2. Maximum dimension of holes shall be in accordance with BS 5950 : part 1 : 2000 table 35, unless indicated otherwise.

8.3. The contractor shall provide whatever temporary ties or bracing necessary for a safe and proper erection of the steel structures.

8.4. Welding shall comply with BS EN 1011-1: 2009, BS EN 1011-2 : 2001 and BS EN 1011-8 : 2004.

8.5. Contractor shall do a detailed design for aluminum shades and to submit full design calculations and detailed shop drawings for all steel sections and connections to the engineer for approval prior to commencement of fabrication.

8.6. All rolled products and plates shall conform to BS EN 10025-2. Cold form welded structural hollow sections shall conform to BS EN 10219-1. Hot finish hollow sections shall conform to bs 10210-1 unless noted otherwise on drawings.

8.7. All connections shall be made with minimum 2nos. Galvanized grade 8.8 to BS 3692 with a minimum diameter of 20mm and minimum yield strength of 627MPa and minimum ultimate strength of 765MPa and electrodes to bsd 639, unless noted otherwise.

8.8. Unless noted otherwise on the drawings, all connections shall be in accordance with the following minimum requirements:

A) all welds shall be at least 6mm continuous fillet welds all around.

B) all structural bolted connections should be galvanized minimum 85 micron and with a minimum of 2 bolts per connection. Purlin bolts shall be in accordance with the suppliers recommendations.

C) all gusset plates shall be at least 4mm thick.

D) all cap plates shall be at least 4mm thick.

E) all base plates shall be at least 4mm thick.

8.9. As minimum all structural steel members shall be shot blasted to SA 2.5, galvanized, primed & painted as below unless noted otherwise:

A) hot galvanization (dft 200micron)

B) primer coat to contain 2 coats of zinc rich epoxy primer (dft 75 micron)

C) top coat to contain 2 coats of polyurethane enamel paint (dft 125 micron)

8.10. All structural steel work shall be corrosion protected in accordance with the structural specifications.

8.11. All steel should conform to the following:

A) SHS, RHS and CHS sections	BSEN 10210	S275	fy=275MPa
B) all angles and channels u.n.o	BSEN 10025	S275	fy=275MPa

8.12. All steel columns to be central on grids or equally spaced between grids unless noted otherwise.

8.13. All steel beams to be central on grids or equally spaced between grids unless noted otherwise.

8.14. All steel dimensions are to center line of section unless noted otherwise.

8.15. All bracing is to be set out on the centroids of bracing members and on the center line of beams and columns unless noted otherwise.

8.16. Where bracing is shown offset from center of members the contractor shall design and provide all necessary stiffeners.

8.17. Contractor to provide all leader railing as required to support free edges not trimmed with cold formed or mild steel work. To be provided in accordance with architect's drawings.

8.18. Location of any connections, splices not shown in the drawings shall be submitted with design for engineer's approval. No splices shall be made unless shown in the drawings and as approved by the engineers.

8.19. Contractor shall do a full coordination between architecture and structural drawings for the steel support for shade elements, locations and sizing connections with structural concrete elements and sections. Care shall be taken to prevent dissimilar metal corrosion.

9. Masonry blocks

9.1. Design and construction of all blocks shall comply with BS 5628 : parts 1.2 & 3 : 1992 or EN-EC6. The contractor shall submit a construction method statement prior to commencing the works.

9.2. Wall ties in accordance with BS 1248 - CP 121 part 1.73.

9.3. All block wall joints to manufacturers specifications.

9.4. All block work walls are to be considered as non-load bearing partitions unless noted otherwise in drawings.

9.5. Block walls shall be reinforced horizontally and vertically as per manufacturers requirements.

9.6. Masonry wall mechanical properties

young's modulus	= 3.5e+006 kN/m2
poisson's ratio	= 0.25
density	= 20kN/m3
min.compressive strength	= 3.5 MPa

10. Design & loading

10.1. Consultant design

Design and construction of reinforced concrete structural members, shall be in accordance with BS 8110 & EC-EN2 and the structural steel members to BS 5950 & EC-EN3.

10.2. Contractor design

The contractor is responsible for the design of all temporary works. (shoring for excavation, signage... Etc) and the following items of permanent secondary works. (subjected to engineers review and approval)

a) precast concrete elements

b) architectural facade and support steelwork

c) non load bearing feature columns

d) all secondary steel works

e) structural steelwork connections

f) structural support for mep services

g) shade structures

h) balustrade and crash barrier

i) structural glass

j) interior signage

the design of the primary structure is considering the interfaces with these structures) loading reactions, opening...etc.) And were detailed to accommodate these elements into the design.

the contractor shall submit a full detail design for the wall and boundary wall foundation, also the contractor to do full coordination between the structural foundation for buildings (including the water tanks, and the boundary wall for clashes, the contractor shall produce shop drawings for the boundary walls for engineer's approval.

10.3. Loading

a) superimposed (dead loads & live loads) as per BS 6399 or EN-EC1.

b) self-weight & densities as per BS 648 or EN-EC1.

c) wind loads as per BS 6399 or EN-EC1 (mean wind speed = 25m/s).

11. Timber

11.1. All timbers shall be in accordance with BS 5268 or EN-EC5

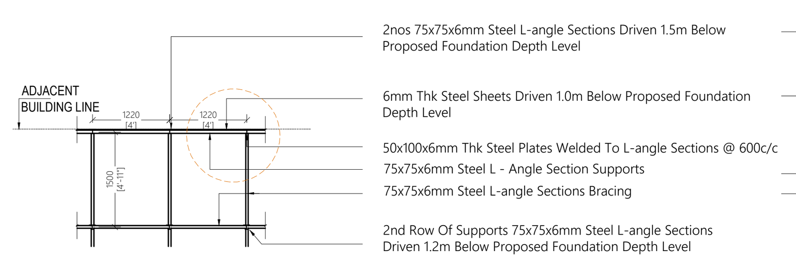
11.2. All timber members sizes are indicative. Contractor shall coordinate with supplier and submit detail designs for all prefab timber structure for approval.

PROPOSED METHODOLOGY FOR PROTECTION OF ADJACENT FOUNDATIONS DURING EXCAVATION

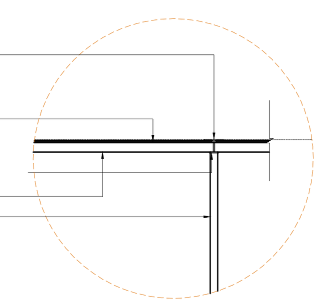
A 600mm Wide, 1200mm Long Pit Can Be Excavated At A Time Along The Adjoining Buildings. The Foundation Can Be Supported By Construction Of 150mm Thick Solid Block Retaining Wall On Top Of 250x250mm Precast Beams (4t12,r6@150c/c) Of 1200mm Long Segments, Which Starts At 300mm Below The Proposed Foundation Depth Up To The Underside Of Adjoining Foundation. To Provide Lateral Stiffness, 16mm Ø Reinforced Bars At 600mm Centers Should Be Planted Inside The Wall Vertically And Plastered On Side. The Retaining Wall Shall Be Braced Using 50mm Ø X 3.0mm Thick G.i Pipes Or 50x50x3.0mm Thick Steel L-angle Sections In All Feasible Directions. This Foundation Protection Process Will Be Continued Until All The Adjoining Buildings Foundations Are Supported.

The Above Stated Methodology Can Only Be Applied If The Adjoining Building Owner Permits Or Else The Lateral Pressure On The Material Adjacent To The Excavation Could Be Prevented Materially By Means Of Proper And Careful Placement Of Sheeting And Bracing, *i.e..* Around The Property Line, 6mm Thick Steel Sheets May Be Driven Down To A Depth Of 1000mm Below The Proposed Foundation Depth In Between 75x75x6mm Steel L-angle Sections At 1.22m Intervals. Grouting And Welding Will Be Done At All Joints To Minimize Water Seepage. To Provide Lateral Stiffness These Sheets Shall Be Braced Using 75x75x6mm Steel L-angle Sections In All Feasible Directions. Onsite Close Observation,frequent Measurements And Recoding Of The Vertical And Lateral Movements And Behavior Of The Sheeting And Bracing Should Be Done To Provide Early Warning Of Unfavorable Development Which Might Cause Settlement Of The Adjacent Road/property. De-watering Will Be Continued Throughout The Excavation Process And Until Casting Of The Foundation.

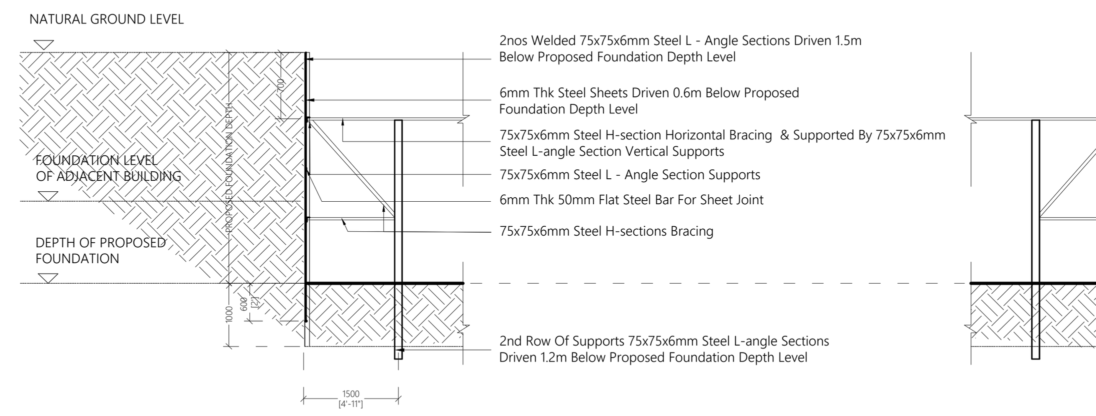
SCHEMATIC DIAGRAM,SHOWING THE ABOVE PROPOSED PROTECTION METHOD IS SHOWN BELOW.



PLAN



BLOW UP DETAIL



SECTION

PROPOSED 03 STOREY BUILDING AT
B.EYDHAFUSHI

MINISTRY OF HEALTH, MALDIVES

December 2019

Architect: Epoch Associates
Engineer: Epoch Associates
Drawn By: Epoch Associates

EPOCH ASSOCIATES

T: +960 333 3528 , E: info@epoch.associates
W: wwww.epoch.associates, A: M. Ahigasdhoshuge, Fareedhee Magu Male' Republic of Maldives

Rev:		Page:
---	----------	S.01
---	----------	
---	----------	