Department of Civil Engineering, BUET

CE-404 : Capstone Project

Structural Drawing of

A Model Solid Waste Management System at Community Lavel

Group: 04

Group Member:
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Project Owner:
DEPT. OF CIVIL ENGINEERING, BUET.

Project Location:
WARD-20, LALBAGH, DHAKA-1000.

Date: 17-11-2024

CONSULTANTS:

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GENERAL NOTES FOR STRUCTURAL CONSTRUCTION

1. STRUCTURAL DESIGN NOTES

a. Design Code: BNBC 2020, ACI 318-08
b. Wind Speed: 237 kmph
c. Seismic Zone: 2
d. Live Load: BNBC 2020
e. Structural detailing shall follow ACI DETAILING MANUAL SP-66(04) unless otherwise shown.
f. All structural drawings shall be read in conjunction with relevant architectural drawings.

2. GENERAL INSTRUCTIONS

a. Please do not scale from the drawings.
b. All dimensions on these drawings shall be checked on site before the work commences. Figured dimensions shall be taken in preferences to scaled dimensions. Project engineer, site engineer, contractors and sub-contractors shall notify the consultant/owner about any discrepancies/ differences drawings before commencing the work.
c. Project engineer, site engineer, contractors and sub-contractors are to verify the followings at site: i) Reinforcement position, ii) Development length, iii) Clear cover, iv) Concrete mix ratio, v) Levels.

3. MEMBER SIZES AND DIMENSIONS

Unless otherwise noted elsewhere, the size and dimensions of structural members shown on the drawings are net or minimun dimensions that satisfy the structural design and safety requirements. These dimensions may not be reduced due to incorporation of architectural features such as must be outside/beyond the dimensions ornamental works, grooves etc. If any such architectural feature is to be included, such inclusion shown on the drawings and such addition must be approved project. by the designer/engineer of the

4. MATERIALS

a. Coarse aggregate:

Crushed natural stone chips with maximum size of 20mm. All coarse aggregate must be well graded. All coarse aggregates must be free from dust and particles of size less than 5mm. Aggregate grading shall meet the requirements of ASTM C33/C33M-13 specification. Los Angeles Abrasion value shall not exceed 25% (for Grading B).
TESTS: i) Sieve analysis, ASTM C136-14 ii) L.A. Abrasion Test ASTM C131-14.

b. Fine aggregate:

i) Sylhet sand of F.M.>2.4 shall be used for all structural components e.g. column, beam, slab, water tank etc.
ii) Local sand of F.M.>1.7 shall be used for non-structural components e.g. plastering, floor finish etc.
iii) Local sand of F.M.>1.2 shall be used for earth filling works.

Aggregate grading shall meet the requirements of ASTM C33/C33M-13 specification.
TESTS: i) Sieve analysis, ASTM C136-14

c. Cement:

As per standards BDS EN 197-1:2003, Type CEM-II/A-M or CEM-II/A-V CEM-II/A-W
TESTS: i) Setting time and soundness by EN 196-3, ii) Strength by EN 196-1, iii) Fineness by EN 196-6.

d. Steel Reinforcement:

BDS ISO 6935-2:2016, Grade B420DWR.

TESTS: i) Unit weight, yield strength, ultimate strength and elongation by ISO-6892-1-2009, ii) Bend test by ISO-7438-2005, iii) Deformation measurement.

e. Water:

Clean water free from impurities (e.g. salinity, hardness, chlorine/chloride, sulphate) shall be used for concreting. Amount of water shall be in accordance with concrete mix design.

5. CONCRETE

Concrete grade (design strength, fc', in MPa) and corresponding required average compressive strength, fcr' (as defined in BNBC 2020, Sec 5.6.2.2 of Part VI) for various components are as follows:

Structural element	Design strength, fc'	Req. avg. comp. str, fcr'
Foundation works	Grade 30	40 MPa
Reinforced concrete superstructure	Grade 30	40 MPa
Lean concrete in foundation bed	Grade 20	30 MPa

a. Concrete mix proportion shall be determined based on appropriate mix design to achieve the required target strength (fcr') following the guideline of BNBC 2020 section 5.6.2, Part 6.

b. To achieve workability, superplasticizer RHEOBUILD 1100 (BASF) or equivalent may be used. The dose and procedure of adding superplasticizer shall be as per the manufacturer's specifications.

c. Curing of concrete:

Minimum curing time shall be 28 days. Method of curing shall be; i) Slabs: ponding, ii) Columns/walls: wraping hessian and wetting it periodically, iii) Beams: periodically spraying water from underside.

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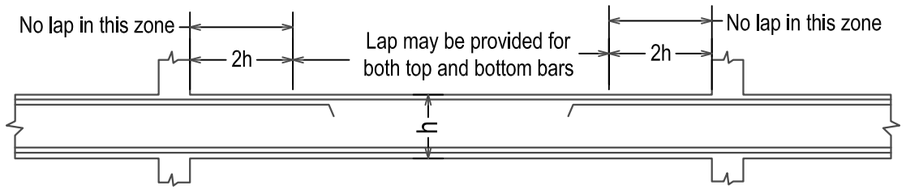
GENERAL NOTES FOR STRUCTURAL CONSTRUCTION

6. MINIMUM LAP LENGTH FOR REINFORCING BARS (mm)

Bar size	Top bars of slab, beam, footing	Bottom bars of slab, beam, footing	Column
10mmØ	520 (21")	410 (17")	410 (17")
12mmØ	620 (25")	490 (20")	490 (20")
16mmØ	830 (34")	650 (26")	650 (26")
20mmØ	1040 (42")	810 (33")	810 (33")

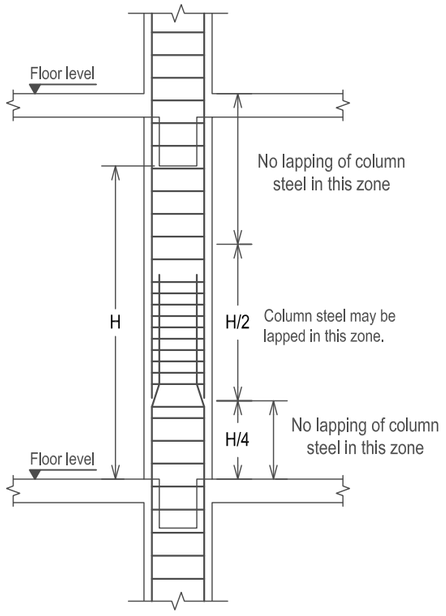
Note: Above lengths are derived for the type of concrete (fc') and rebar (fy) used specifically in this project. For other types of concrete and rebar, recalculation of length shall be needed.

7. LAP SPLICE LOCATION IN BEAMS

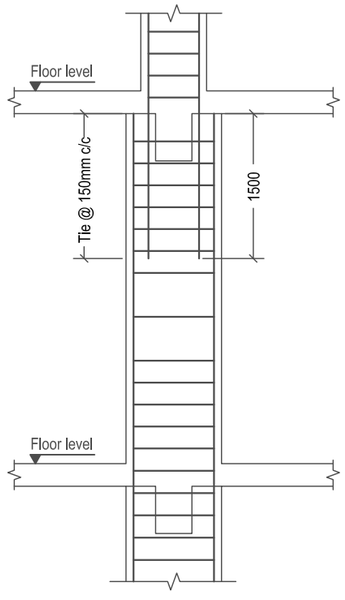


Not more than 50% of the bars shall be spliced at one place of the beam. Lap splices are to be confined by hoops/stirrups with maximum spacing of 100mm.

8. LAP SPLICE LOCATION IN COLUMNS AND COLUMN OFFSET DETAIL



Lap splices are to be confined by hoops/ties with maximum spacing of 125mm.

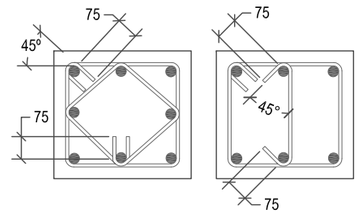


When column size is reduced the transition of column main reinforcement from lower floor to upper floor shall be detailed as shown.

9. COLUMN TIE DETAILS

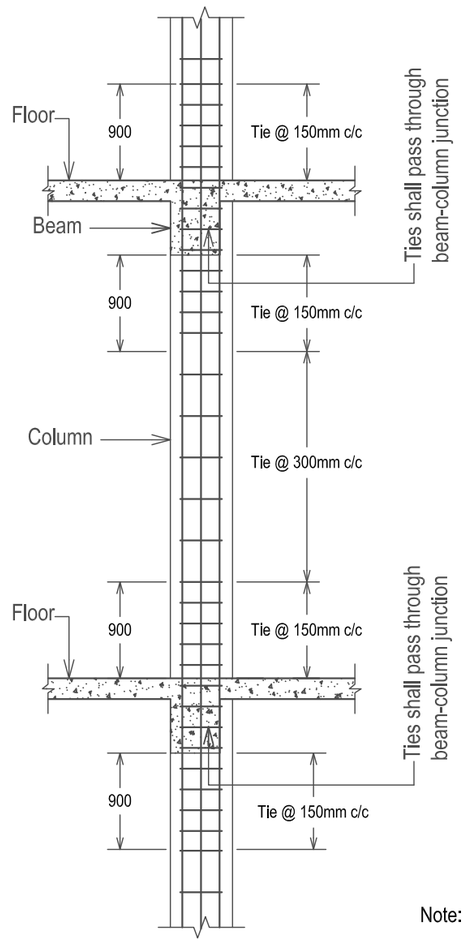
a. Hook's of column ties:

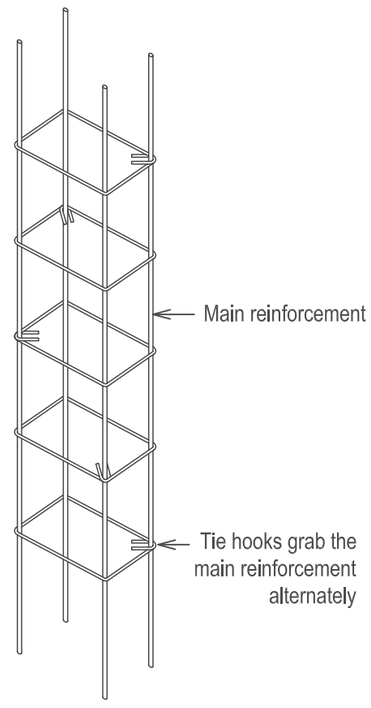
Hooks of column ties shall be bent 45° inwards and length of the hook shall be minimum 3" (75mm) as shown below. Ties shall be arranged such that corner hooks grab the main reinforcement in alternate fashion. Tie spacing shall be in accordance with that shown in fig below.



b. Spacing of column ties:

Spacing of column ties shall be as shown in fig below.





Note: Structural detailing shown on this sheet shall be followed only if specific detail of a structural component is not shown elsewhere on other sheets.

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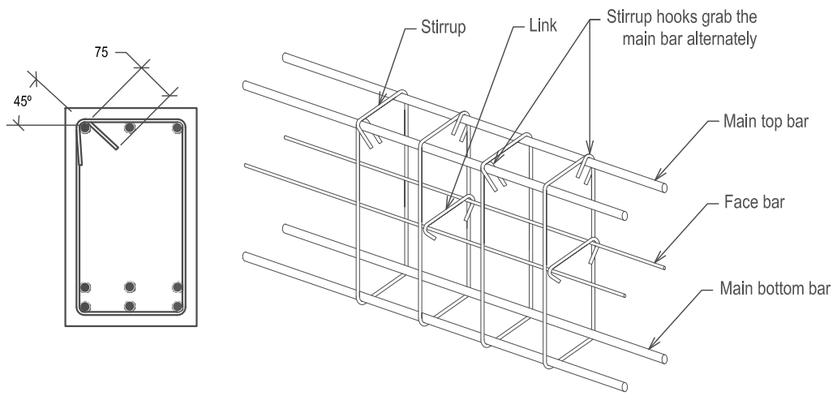
GENERAL NOTES FOR STRUCTURAL CONSTRUCTION

10. BEAM STIRRUP

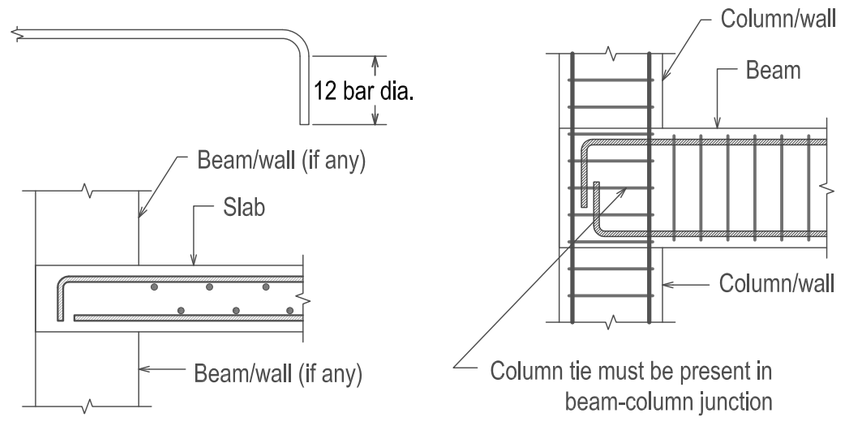
Hooks in beam stirrups shall be bent 45° inwards and length of the hook shall be minimum 3" (75mm) as shown below. Stirrups shall be arranged such that corner hooks grab the main reinforcement in alternate fashion.



11. END ANCHORAGE FOR HORIZONTAL REINFORCEMENT (IN BEAM, SLAB, MAT ETC).

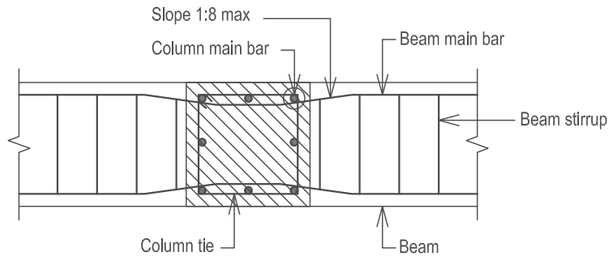
90° hooks shall be provided for i) all main bars of beams (top and bottom) which terminate into column or walls or other beams. ii) slab top bars terminating into supporting beams or walls. iii) mat reinforcement terminating at the periphery.

For all cases, the length of the hook shall be 12 times the bar diameter (12 d_b)



12. AVOIDING CONFLICT BETWEEN BEAM AND COLUMN REINFORCEMENT

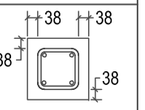
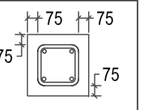
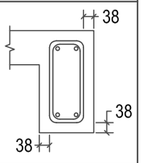
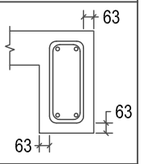
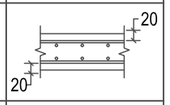
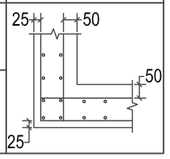
If conflict arises between beam and column or wall reinforcement when beam steel enters or passes through column, the beam reinforcement may be horizontally bent inwards into the column as shown in the following figure.



PLAN SECTION OF BEAM COLUMN JOINT

13. MINIMUM CLEAR COVER FOR REINFORCING BARS

Minimum concrete cover for reinforcing bars shall be as shown in the following table. In all cases the cover is measured from the concrete surface to the nearest reinforcement surface e.g. surface of ties in column, stirrups in beams etc.

Member	Condition	Thickness of Cover	Figure
Column	Above ground level	38mm	
	Below or in contact with ground	75mm	
Beam	Top, side & bottom	38mm	
	Water face inside water tank: side & bottom	63mm	
Slab	Top and bottom	20mm	
Water tank	Water face	50mm	
	Other face	25mm	

Note: Structural detailing shown on this sheet shall be followed only if specific detail of a structural component is not shown elsewhere on other sheets.

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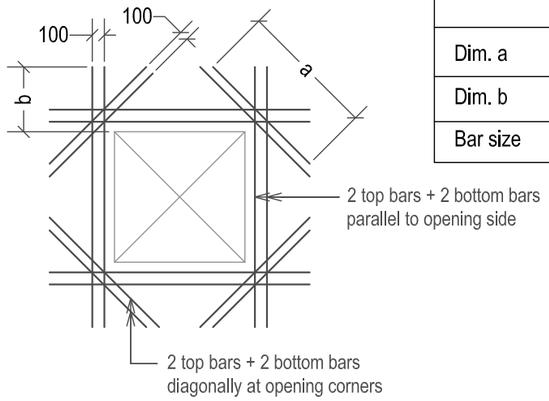
GENERAL NOTES FOR STRUCTURAL CONSTRUCTION

14. REINFORCEMENT DETAILING AROUND VOID/OPENING

Reinforcement details around void/opening in floor slabs shall be as shown in figure below. The detailing is valid for maximum void size of 900mm x 900mm. For void/opening of larger size contact the consultant.



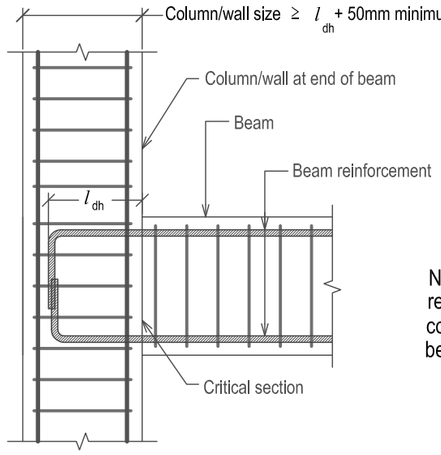
	Void/opening size less than 450mm	Void/opening size between 450 ~ 900mm
Dim. a	36"	60"
Dim. b	24"	36"
Bar size	Ø16	Ø20

15. BRICK WORK

All brick work shall use first class brick or as specified by the consultant. Morter for brick work shall constitute 1:4 mix ratio (cement:sand). Morter for plastering work shall be 1:4 mix ratio (cement:sand).

16. END ANCHORAGE OF BEAM REINFORCEMENT

Minimum end anchorage length l_{dh} as shown below for different bar sizes must be maintained throughout.



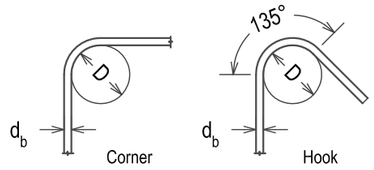
Bar size, mm	l_{dh} mm
10	125
12	166
16	210
20	250

Note: Above lengths are derived for the type of concrete (f'c) and rebar (fy) used specifically in this project. For other types of concrete and rebar, recalculation of embedment length shall be needed.

Note: Structural detailing shown on this sheet shall be followed only if specific detail of a structural component is not shown elsewhere on other sheets.

17. BAR BENDING PIN DIAMETER FOR HOOKS AND L-BENDS

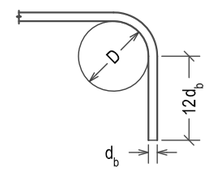
Stirrups of beams and ties of columns



D = inside bend diameter = 4 d_b
where d_b is the dia. of rebar.

Bar dia., d_b mm	Hook/Corner bend dia., D, mm
10	40
12	48
16	64
20	80

Main reinforcement

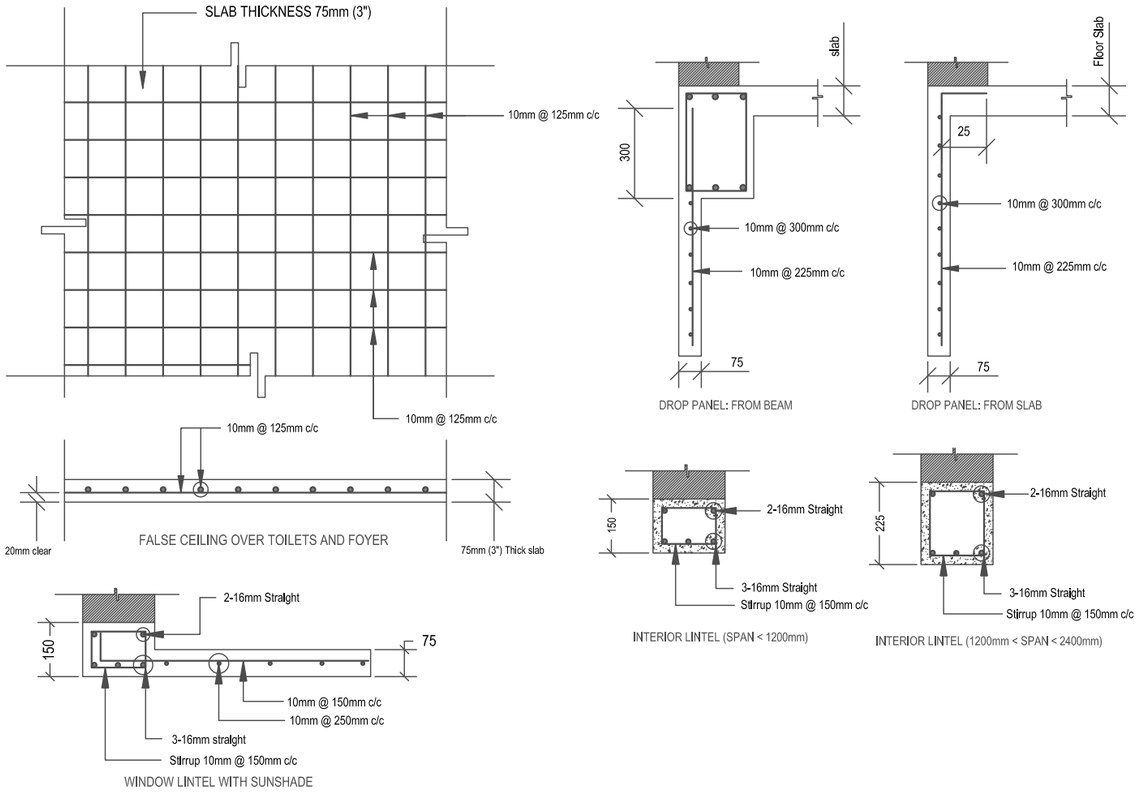


D = inside bend diameter = 6 d_b
where d_b is the dia. of rebar

Bar dia., d_b mm	Bend dia., D mm
10	60
12	72
16	96
20	120

18. MISCELLANEOUS STRUCTURAL DETAILS

The miscellaneous details shown below shall be followed wherever applicable unless otherwise mentioned elsewhere.



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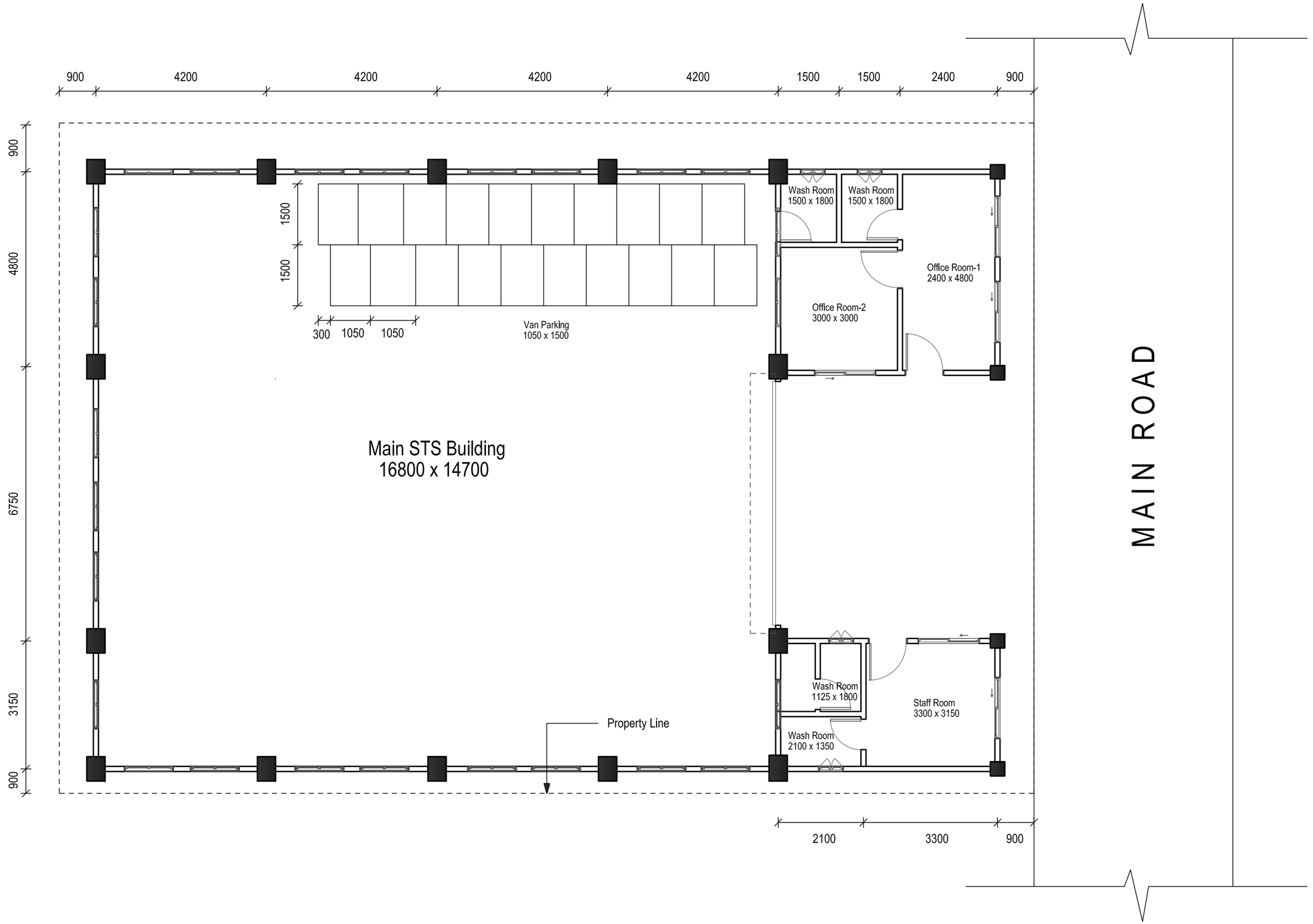
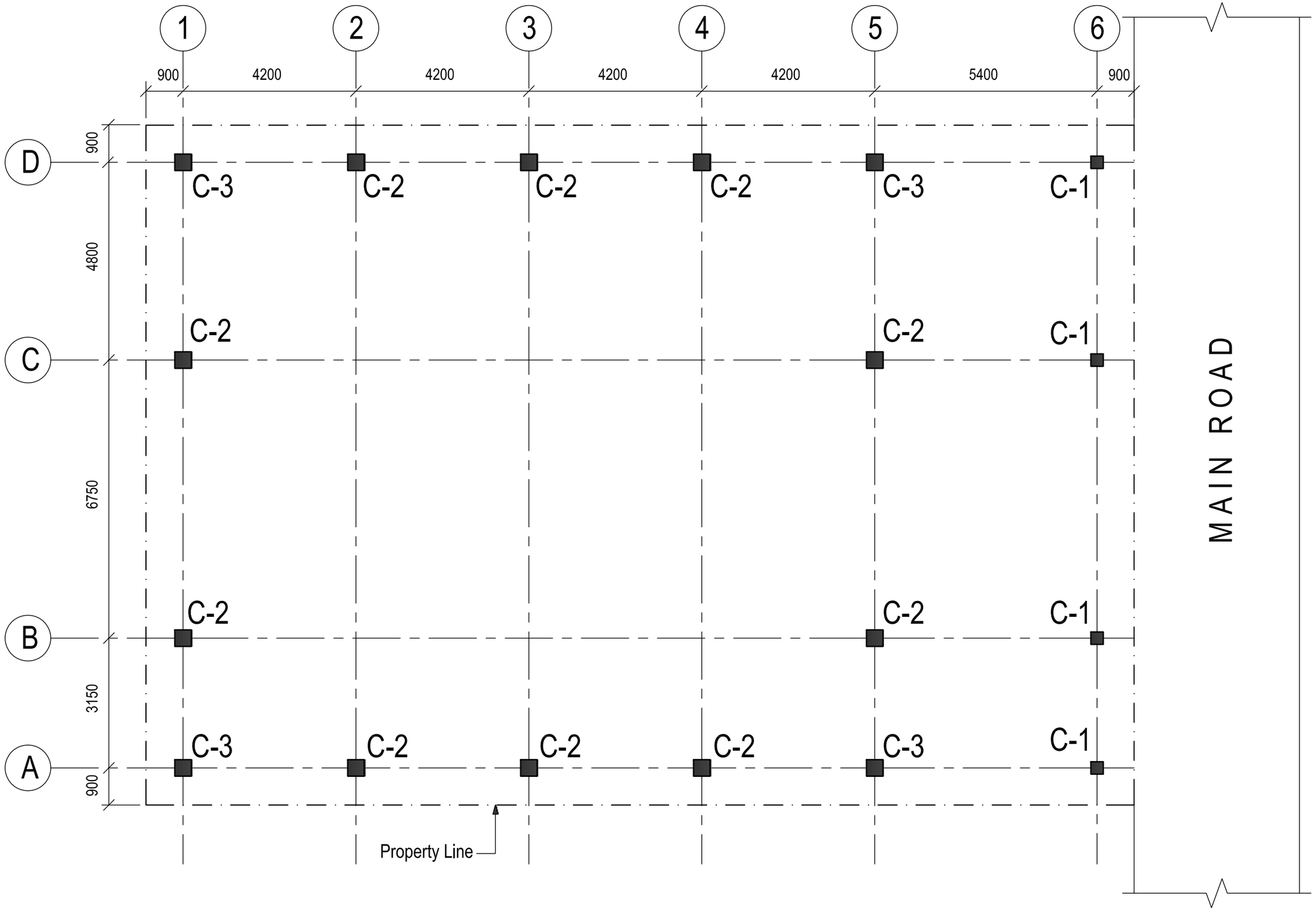


CE-404 CAPSTONE PROJECT Project Name: LALBAGH SECONDERY WASTE TRANSFER STATION NON-RESIDENTIAL BUILDING	Owner: DEPARTMENT OF CIVIL ENGINEERING, BUET	Drg. Title: GROUND FLOOR PLAN	DESIGN BY: 1904072(TL) CE-19, SEC-B1 GROUP - 04 Gr.Memb.: 1904070 (DTL), 1904075, 1904076, 1904080,1904082	Unit: mm Sheet No.: S-01 Date: 17-11-2024



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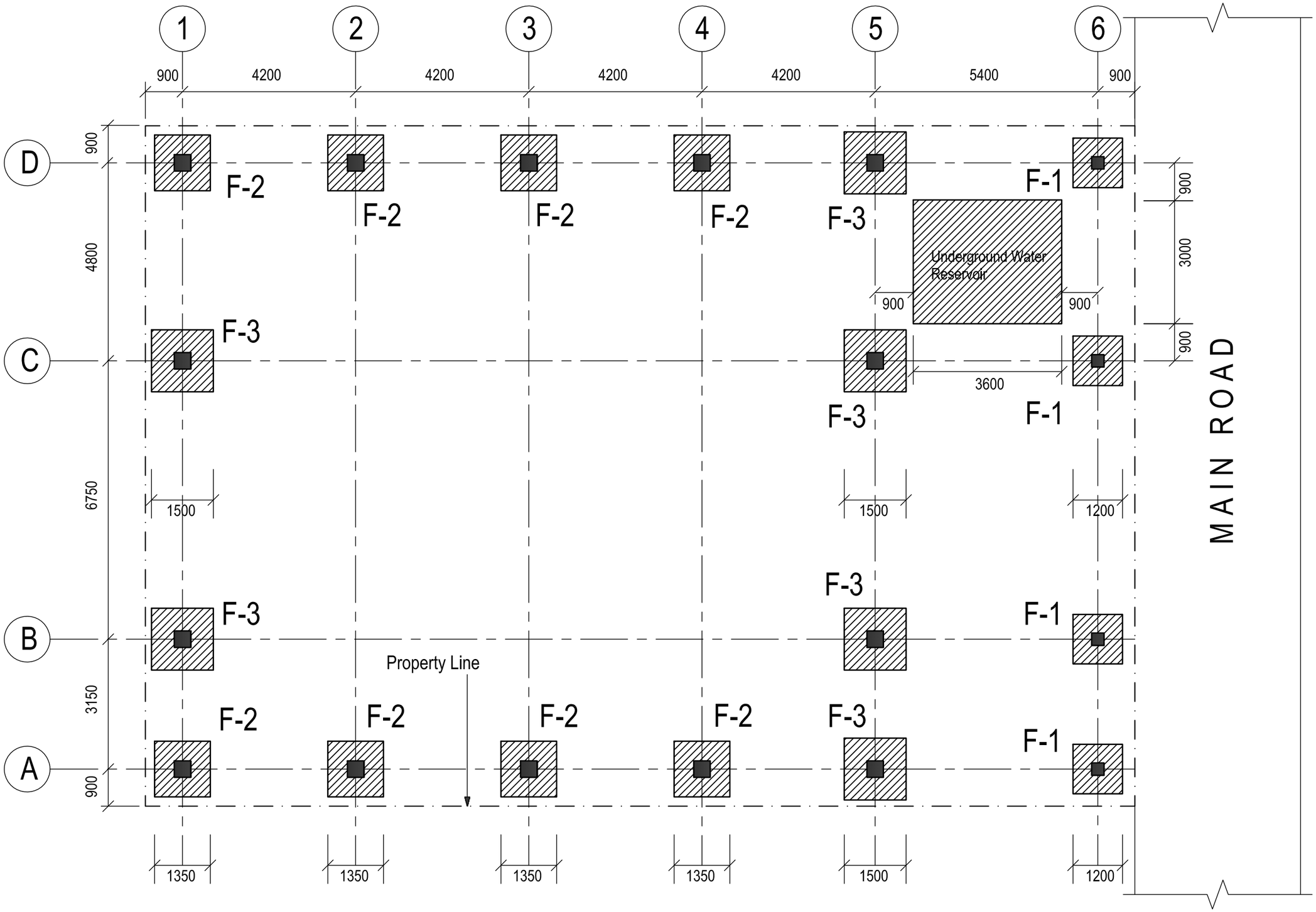

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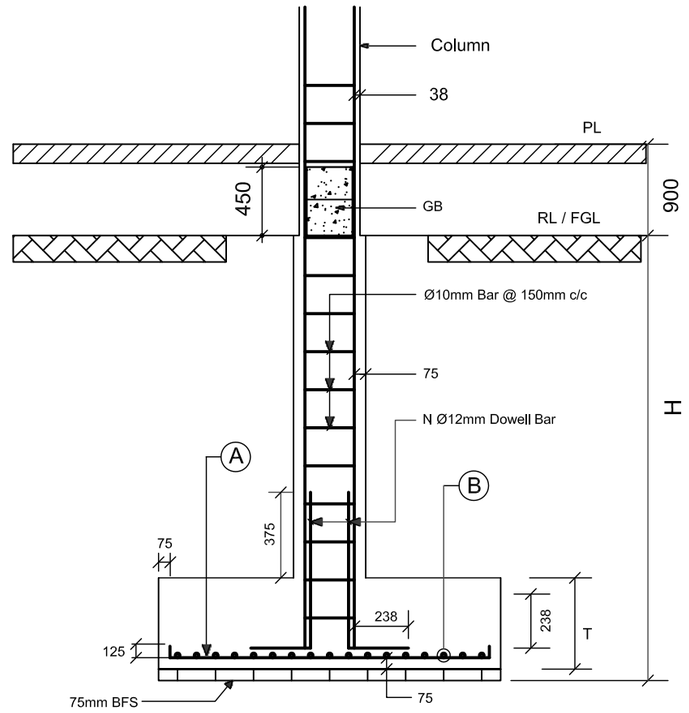
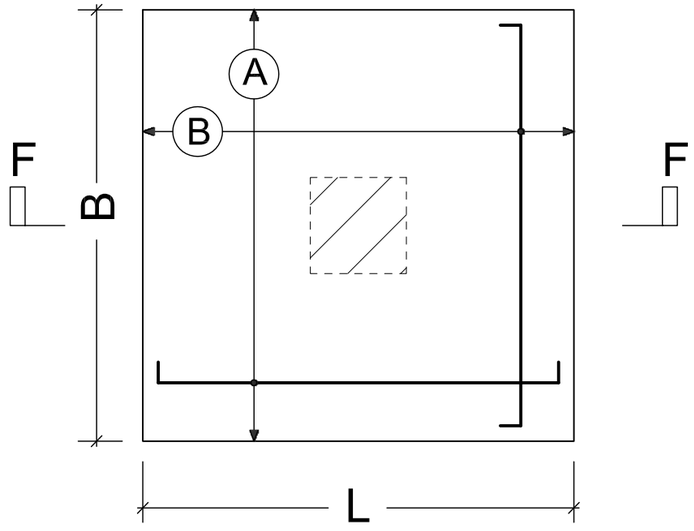


TYPICAL SECTION F-F OF FOOTING

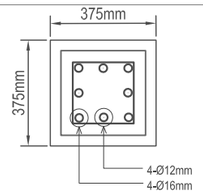
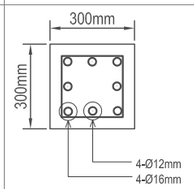
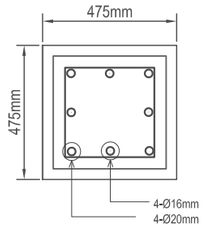
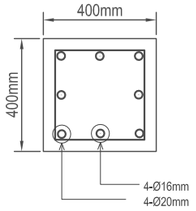
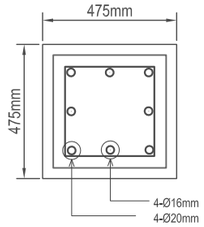
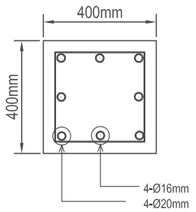
REINFORCEMENT SCHEDULE OF FOOTING							
FOOTING	FOOTING SIZE			T	N	FOOTING REINFORCEMENT	
	L	B	H			A (BOTTOM BAR)	B (TOP BAR)
F1	1200	1200	1500	350	4	Ø12mm @ 150mm c/c	Ø12mm @ 150mm c/c
F2	1350	1350	1500	375	8	Ø16mm @ 200mm c/c	Ø16mm @ 200mm c/c
F3	1500	1500	1500	425	8	Ø16mm @ 175mm c/c	Ø16mm @ 175mm c/c



TYPICAL PLAN OF FOOTING

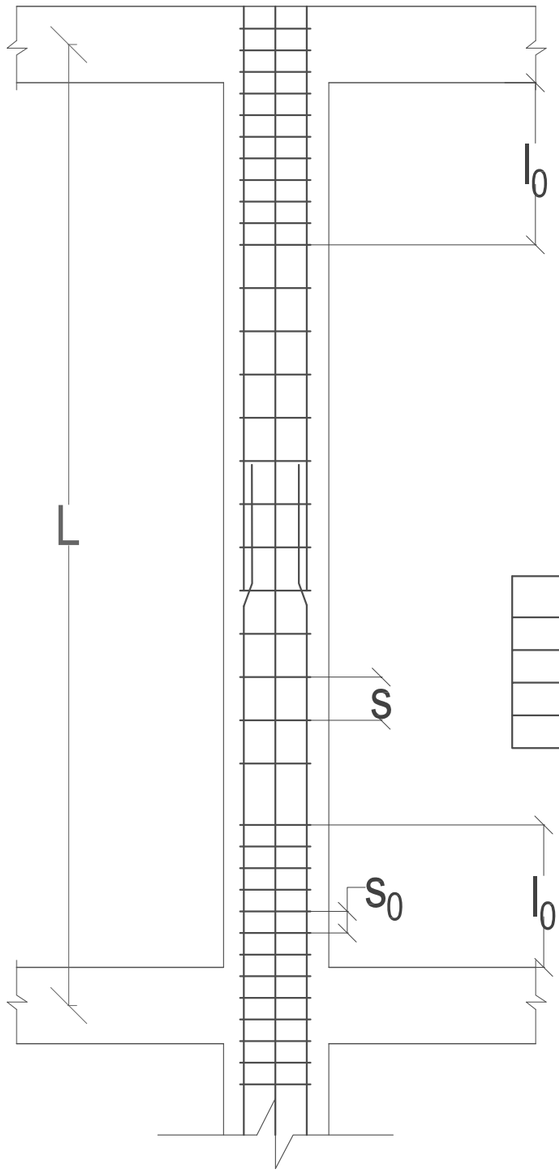
CE-404 CAPSTONE PROJECT Project Name: LALBAGH SECONDERY WASTE TRANSFER STATION NON-RESIDENTIAL BUILDING	Owner: DEPARTMENT OF CIVIL ENGINEERING, BUET	Drg. Title: FOOTING REINFORCEMENT DETAILS	DESIGN BY: 1904072(TL) CE-19, SEC-B1 GROUP - 4 Gr.Memb.: 1904070 (DTL), 1904075, 1904076, 1904080,1904082	Unit: mm Sheet No.: S-04 Date: 17-11-2024

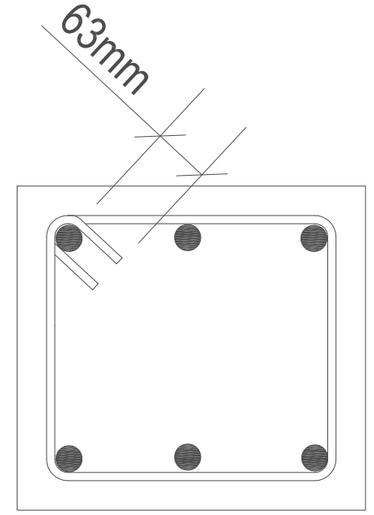
Column Reinforcement Schedule

C-1		
C-2		
C-3		

Column Tie Spacing:
Column ties shall be 10mmØ @ 125mm c/c at top and bottom for 925mm length. In the remaining middle portion ties shall be 10mmØ @ 250mm c/c for C-2 and C3.

For C-1, Column ties shall be 10mmØ @ 100mm c/c at top and bottom for 450mm length. In the remaining middle portion ties shall be 10mmØ @ 200mm c/c .





COLUMN TIE HOOK DETAILS

Column Tie Spacing

	So (mm)	S (mm)	lo (mm)	L (mm)
C1	100	200	450	3000
C2	125	250	925	6000
C3	125	250	925	6000

CE-404 CAPSTONE PROJECT
Project Name:
LALBAGH SECONDERY WASTE TRANSFER STATION NON-RESIDENTIAL BUILDING

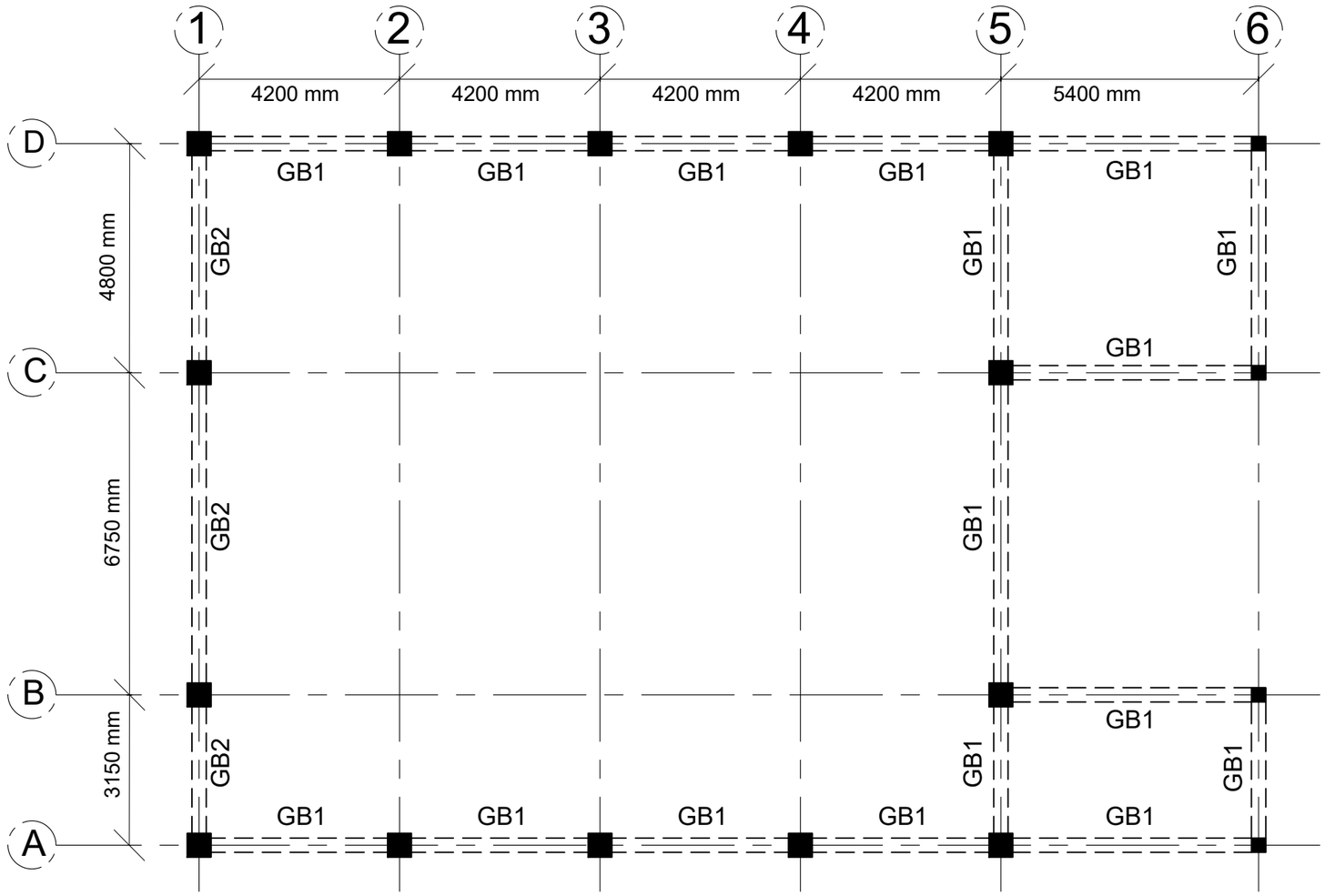
Owner:
DEPARTMENT OF CIVIL ENGINEERING, BUET

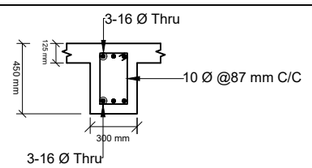
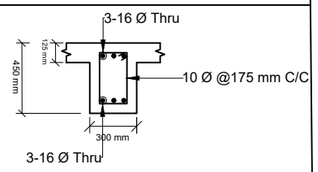
Drg. Title:
COLUMN REINFORCEMENT DETAILS

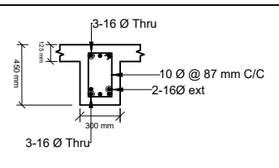
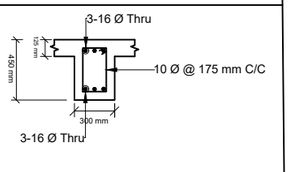
DESIGN BY: 1904075
CE-19, SEC-B1
GROUP - 04
Gr.Memb.: 1904072 (TL), 1904070 (DTL), 1904076, 1904080,1904082

Unit: mm
Sheet No.: S-05

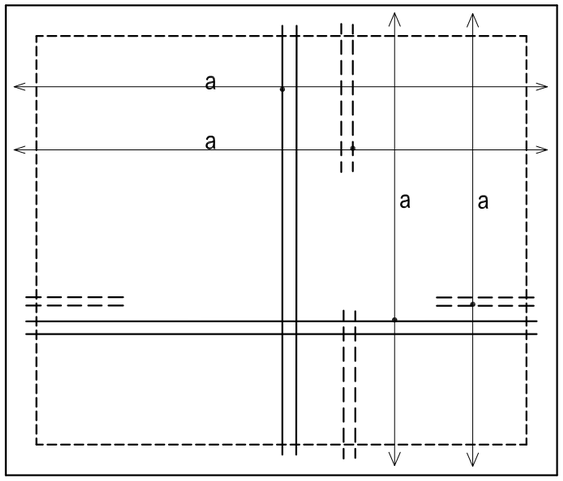
Date: 17-11-2024



	Section Near Comumn	Mid Span Section
G1		

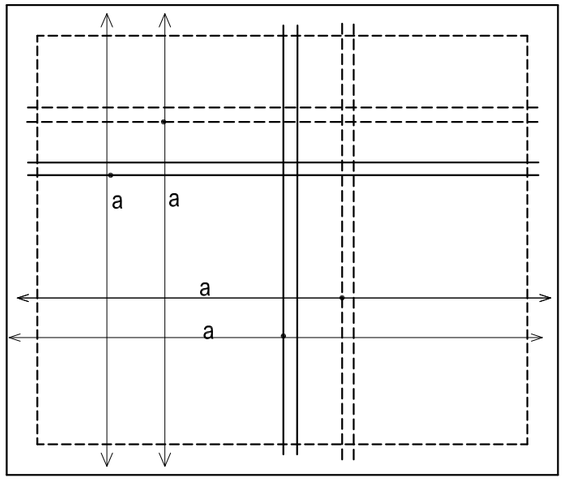
	Section Near Comumn	Mid Span Section
G2		

CE-404 CAPSTONE PROJECT Project Name: LALBAGH SECONDERY WASTE TRANSFER STATION NON-RESIDENTIAL BUILDING	Owner: DEPARTMENT OF CIVIL ENGINEERING, BUET	Drg. Title: GRADE BEAM LAYOUT AND REINFORCEMENT DETAILS	DESIGN BY: 1904080 CE-19, SEC-B1 GROUP - 4 Gr.Member: 1904072 (TL), 1904070 (DTL), 1904075, 1904076, 1904080,1904082	Unit: mm Sheet No.: S-06 Date: 17-11-2024



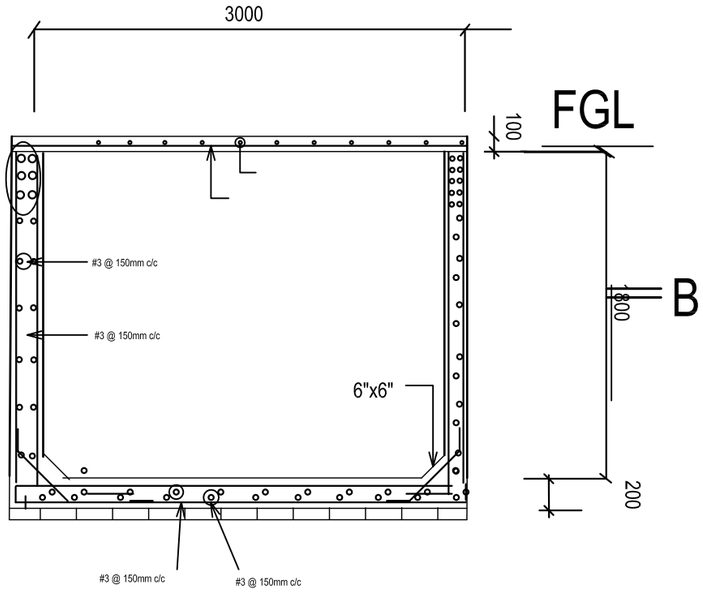
REINFORCEMENTS

A : #3 @ 380 mm C/C

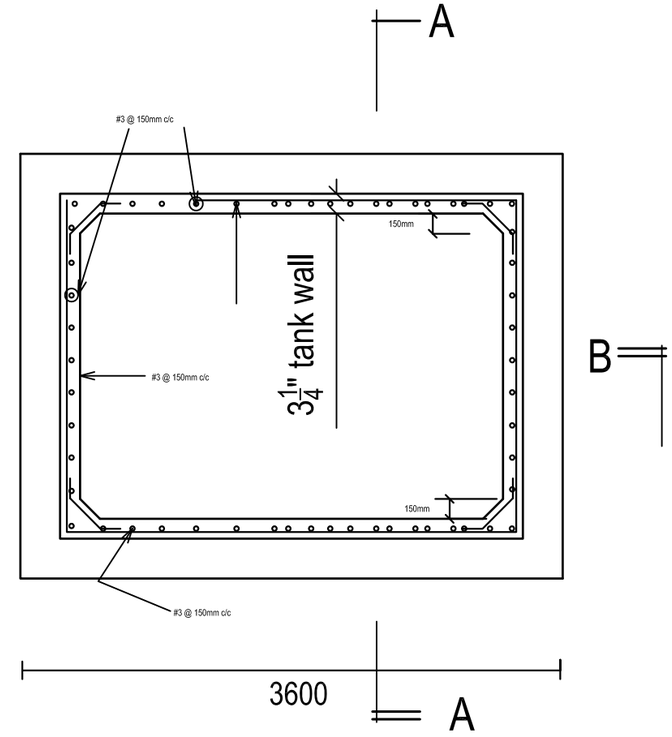


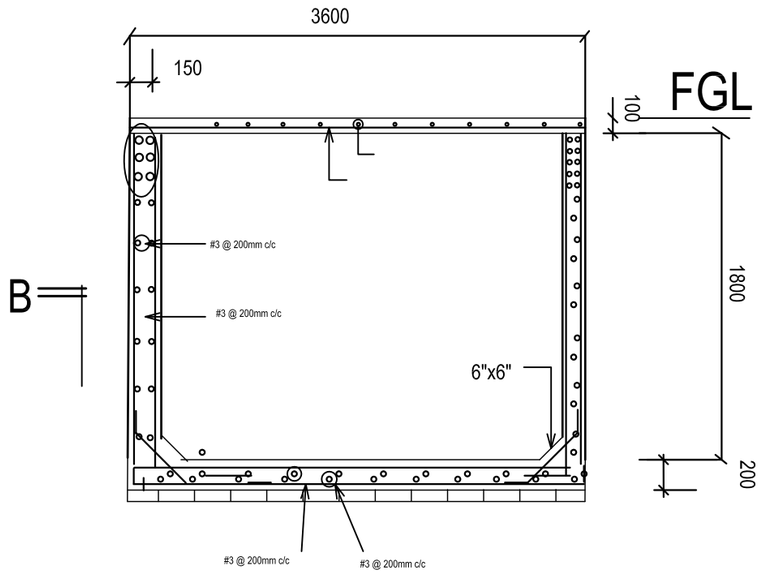
REINFORCEMENTS

A : #3 @ 380 mm C/C



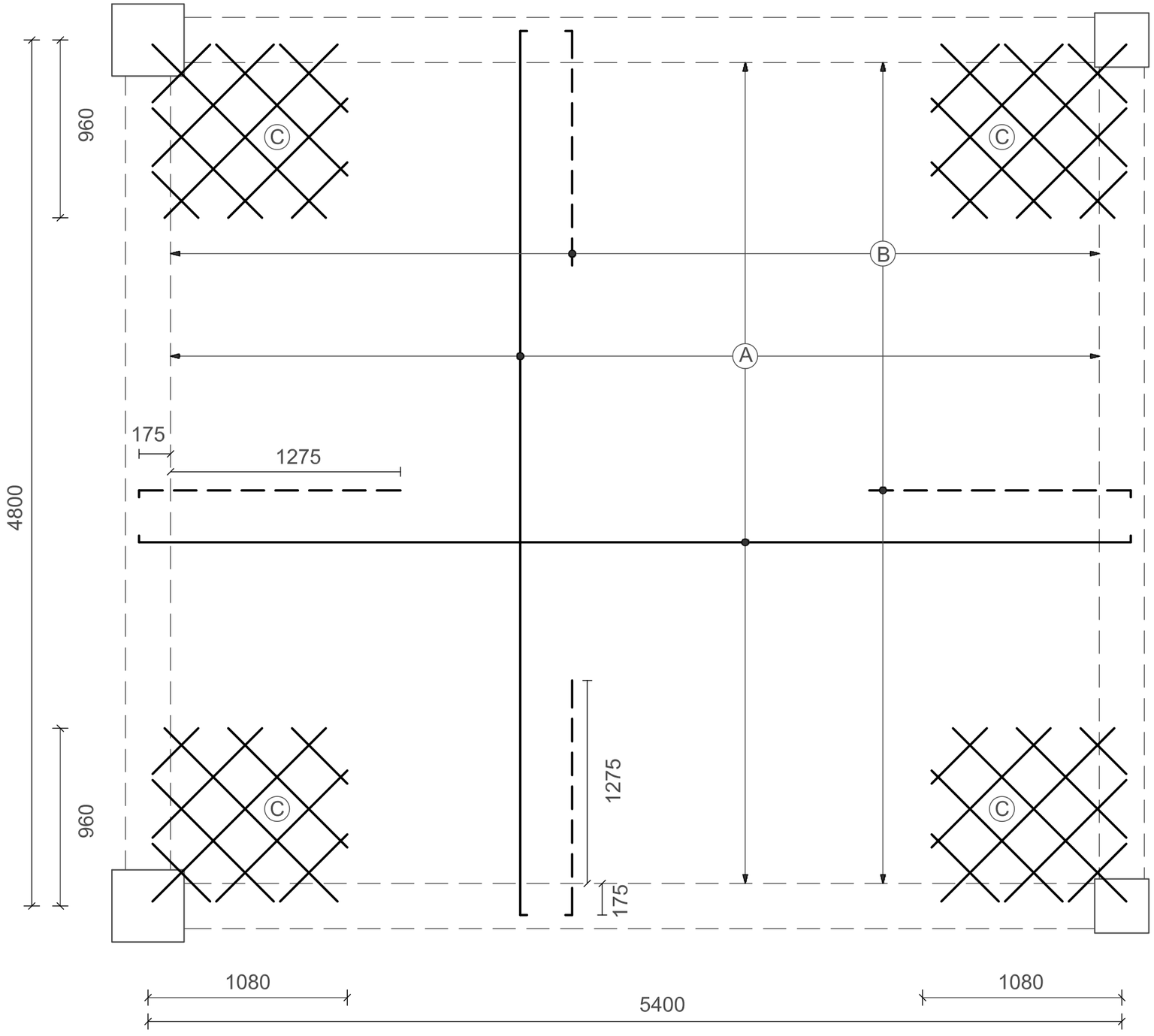
SECTION A-A





SECTION B-B

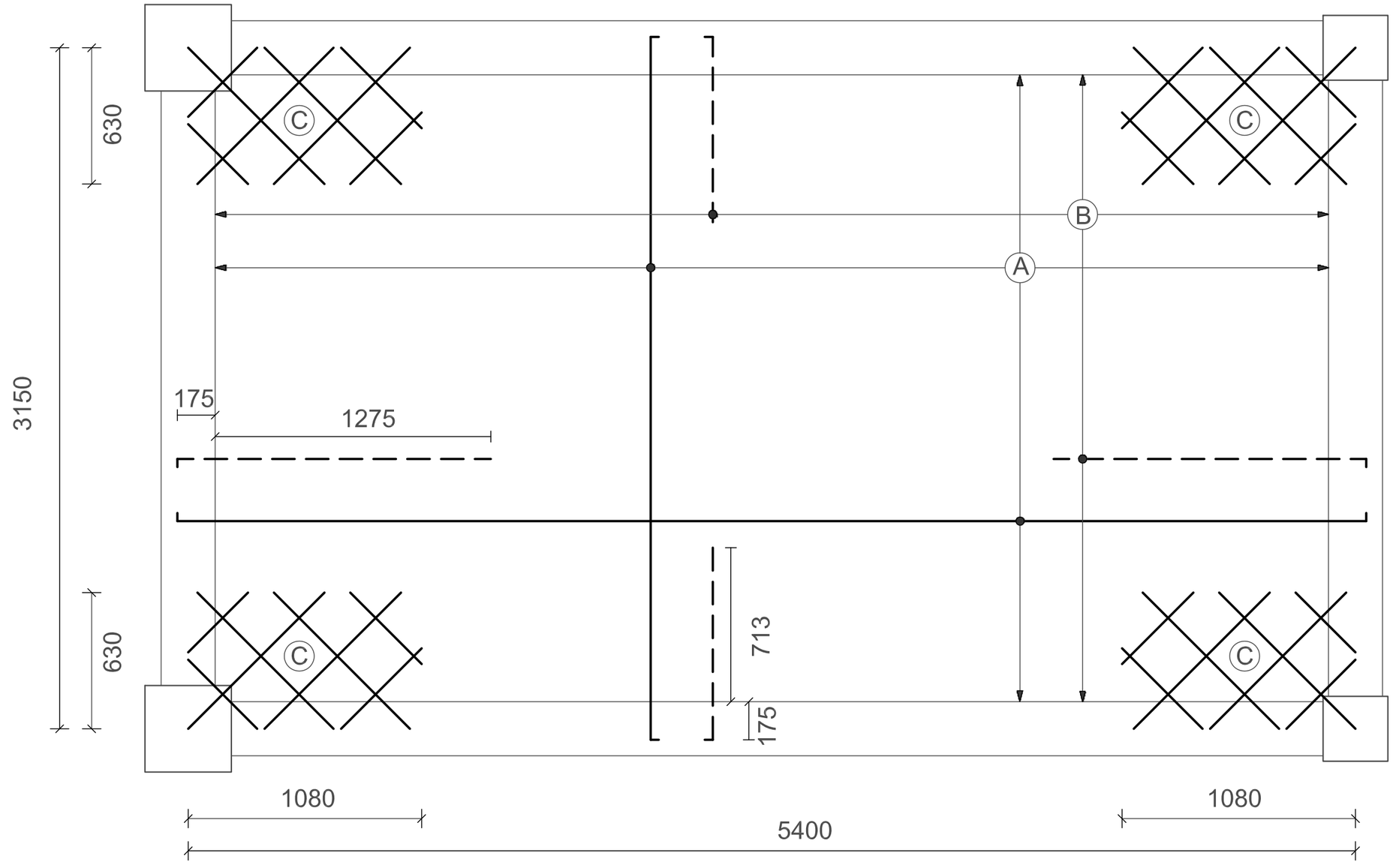
CE-404 CAPSTONE PROJECT Project Name: LALBAGH SECONDERY WASTE TRANSFER STATION NON-RESIDENTIAL BUILDING	Owner: DEPARTMENT OF CIVIL ENGINEERING, BUET	Drg. Title: UNDERGROUND WATER RESERVOIR DETAILS	DESIGN BY: 1904076 CE-19, SEC-B1 GROUP - 04 Gr.Memb.: 1904072 (TL), 1904070 (DTL), 1904075, 1904080,1904082	Unit: mm Sheet No.: S-07 Date: 17-11-2024



LEGENDS:

(A) Ø10 mm bar @ 225 mm c/c
(Straight Bottom)
(B) Ø10 mm bar @ 250 mm c/c
(Straight Top)
(C) Ø10 mm corner bar @ 250 mm c/c
diagonally to corner at top and
perpendicularly to corner at bottom

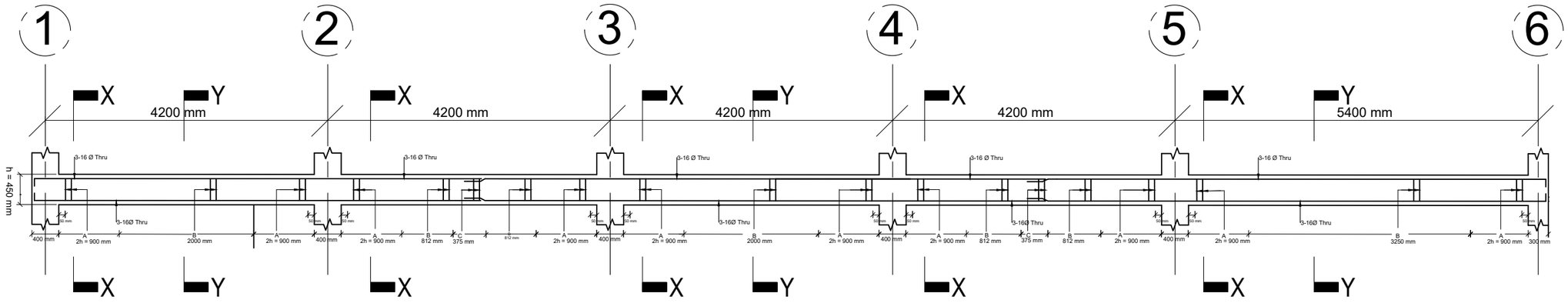
CE-404 CAPSTONE PROJECT Project Name: LALBAGH SECONDERY WASTE TRANSFER STATION NON-RESIDENTIAL BUILDING	Owner: DEPARTMENT OF CIVIL ENGINEERING, BUET	Drg. Title: OFFICE BUILDING FLOOR SLAB REINFORCEMENT DETAILING -01	DESIGN BY: 1904072(TL) CE-19, SEC-B1 GROUP - 04 Gr.Memb.: 1904070 (DTL), 1904075, 1904076, 1904080,1904082	Unit: mm Sheet No.: S-08 Date: 17-11-2024



LEGENDS:

(A) Ø10 mm bar @ 250 mm c/c (Straight Bottom)
(B) Ø10 mm bar @ 250 mm c/c (Straight Top)
(C) Ø10 mm corner bar @ 250 mm c/c diagonally to corner at top and perpendicularly to corner at bottom

CE-404 CAPSTONE PROJECT Project Name: LALBAGH SECONDERY WASTE TRANSFER STATION NON-RESIDENTIAL BUILDING	Owner: DEPARTMENT OF CIVIL ENGINEERING, BUET	Drg. Title: STAFF-ROMM BUILDING FLOOR SLAB REINFORCEMENT DETAILING -02	DESIGN BY: 1904072(TL) CE-19, SEC-B1 GROUP - 04 Gr.Memb.: 1904070 (DTL), 1904075, 1904076, 1904080,1904082	Unit: mm Sheet No.: S-09 Date: 17-11-2024

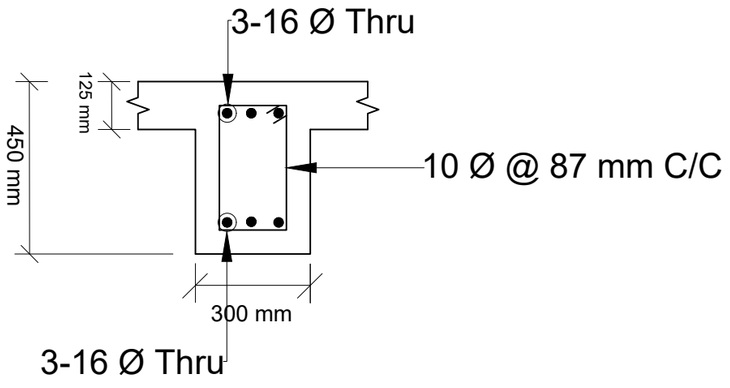


STIRRUPS LEGEND

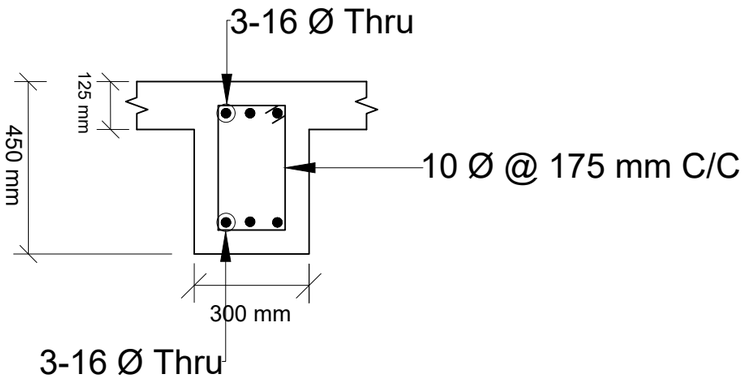
A : 10Ø @ 87 mm C/C

B : 10Ø @ 175 mm C/C

C : 10Ø @ 100 mm C/C

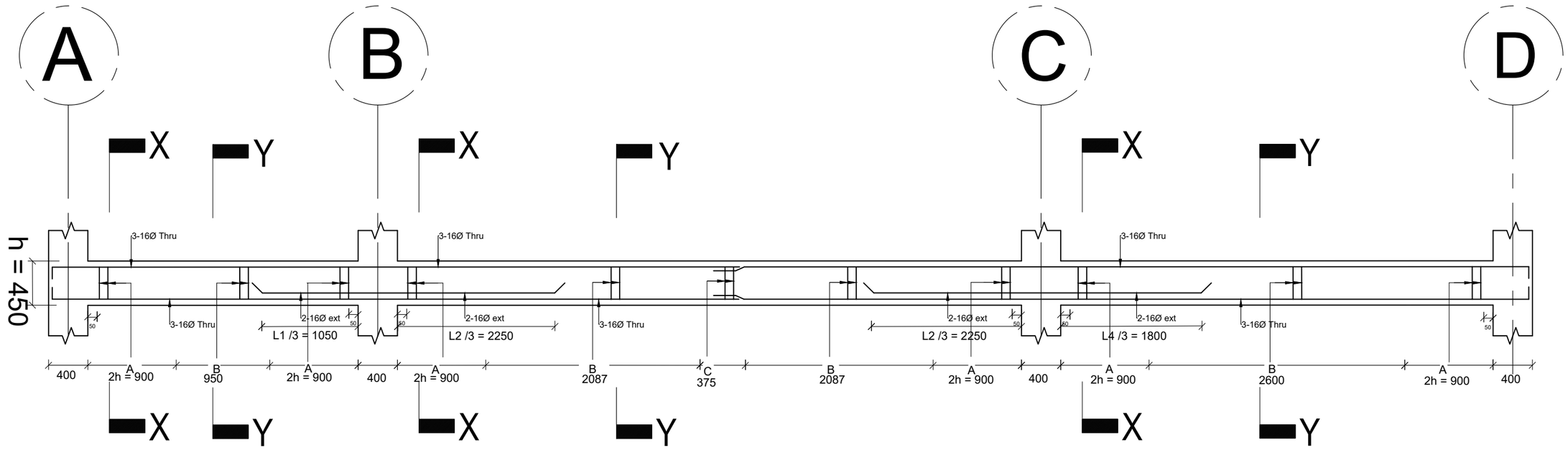


Section X-X



Section Y-Y

CE-404 CAPSTONE PROJECT Project Name: LALBAGH SECONDERY WASTE TRANSFER STATION NON-RESIDENTIAL BUILDING	Owner: DEPARTMENT OF CIVIL ENGINEERING, BUET	Drg. Title: STS BUILDING BEAM (LONGITUDINAL) REINFORCEMENT DETAILS 1 0F 3	DESIGN BY: 1904080 CE-19, SEC-B1 GROUP - 4 Gr.Member: 1904072 (TL), 1904070 (DTL), 1904075, 1904076, 1904080,1904082	Unit: mm Sheet No.: S-10 Date: 17-11-2024

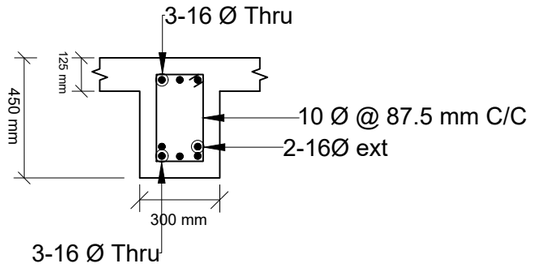


STIRRUPS LEGEND

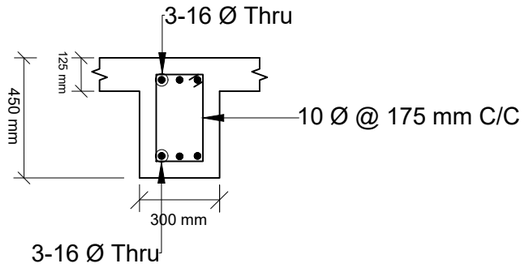
A : 10Ø @ 87 mm C/C

B : 10Ø @ 175mm C/C

C : 10Ø @ 100 mm C/C

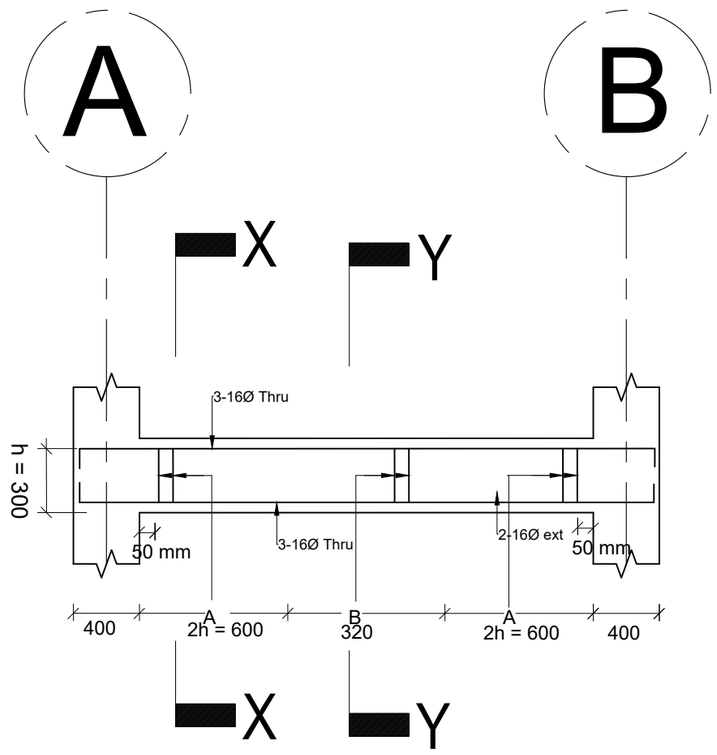


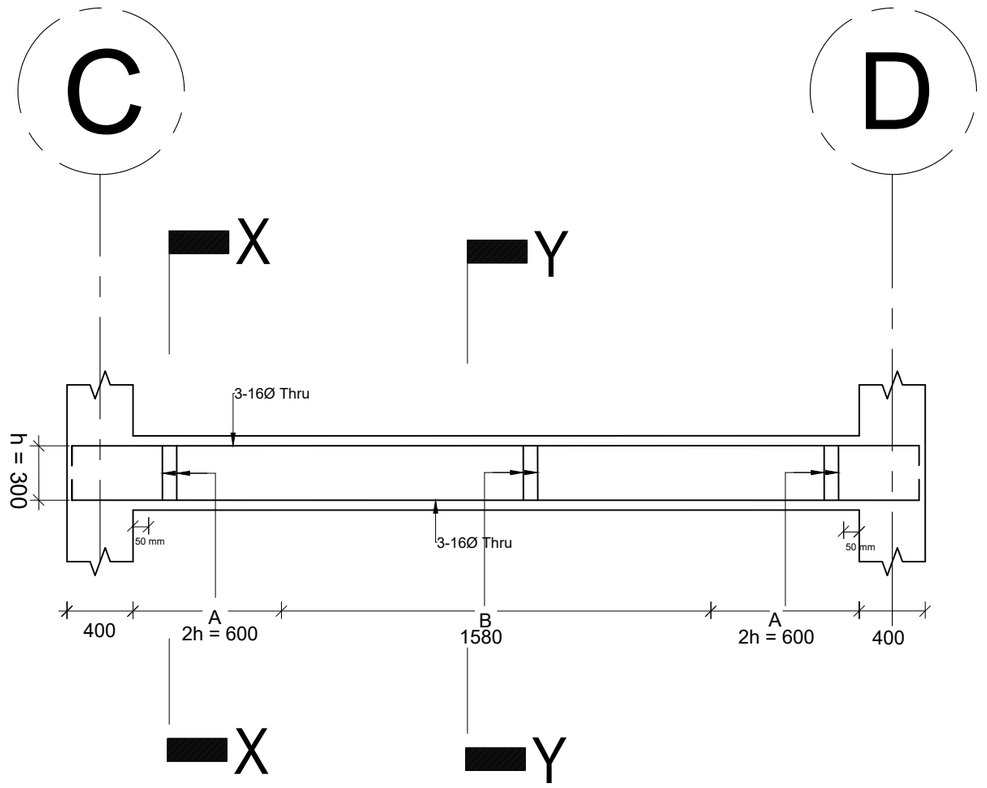
Section X-X



Section Y-Y

CE-404 CAPSTONE PROJECT Project Name: LALBAGH SECONDERY WASTE TRANSFER STATION NON-RESIDENTIAL BUILDING	Owner: DEPARTMENT OF CIVIL ENGINEERING, BUET	Drg. Title: STS BUILDING BEAM (TRANSVERSE) REINFORCEMENT DETAILS 2 0F 3	DESIGN BY: 1904080 CE-19, SEC-B1 GROUP - 4 Gr.Member: 1904072 (TL), 1904070 (DTL), 1904075, 1904076, 1904080,1904082	Unit: mm Sheet No.: S-11 Date: 17-11-2024

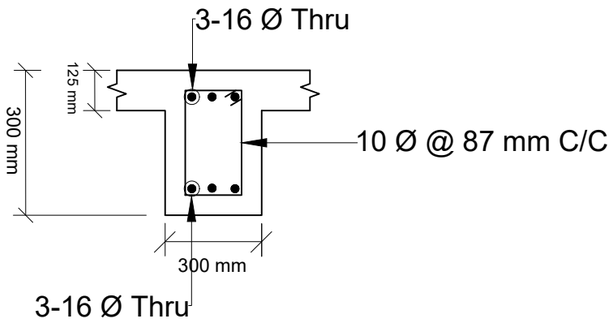




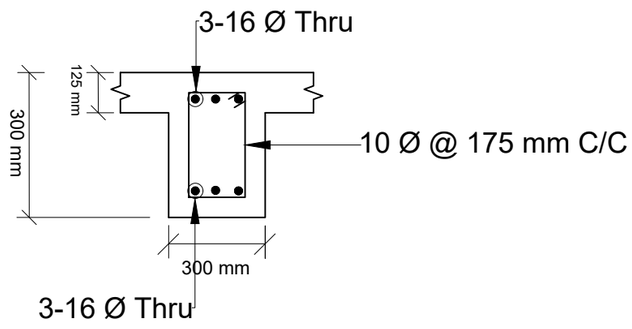
STIRRUPS LEGEND

A : 10Ø @ 87 mm C/C

B : 10Ø @ 175mm C/C



Section X-X



Section Y-Y

CE-404 CAPSTONE PROJECT Project Name: LALBAGH SECONDERY WASTE TRANSFER STATION NON-RESIDENTIAL BUILDING	Owner: DEPARTMENT OF CIVIL ENGINEERING, BUET	Drg. Title: OFFICE & STAFF BUILDING BEAM REINFORCEMENT DETAIL 3 0F 3	DESIGN BY: 1904080 CE-19, SEC-B1 GROUP - 4 Gr.Member: 1904072 (TL), 1904070 (DTL), 1904075, 1904076, 1904080,1904082	Unit: mm Sheet No.: S-12 Date: 17-11-2024