UNIVERSITY OF ASIA PACIFIC
Department of Civil Engineering

SPRING 2020

CE 412

Structural Engineering Sessional II

PROJECT

ON

Name : Usayed Islam

ID : 20105062

Section : B

Submitted to-
Md. Nazmul Alam
Lecturer, Department of CE

Date of Submission: 05/06/21

Introduction:

1.1 General:

A six-story residential structure in Barishal will be build as part of this project. The structure is made of reinforced concrete (RC) frames, The floor slabs are going to be built as beam-supported slabs. The site's original topography was generally level ground. Report on soil testing shallow foundation design has been included into the foundation.

A project information sheet (doc. file), an Autocad soft copy of the architectural design drawing, and PDF soft copy of the subsurface investigation report slabs that were judged suitable in terms of thickness and reinforcement are offered. Etabs file (soft copy of edb file), Project Report (soft copy of doc file), and Sample Drawing (soft copy of hand sketch) most therefore be submitted.

This building's analysis and design have been completed according to Bangladesh Nation Building Code (BNBC) 2017.

1.2 Project Information:

Project Information Sheet			
SL NO	Item Name	Item Description	
1.1	Client Information	Name:	Usayed Islam
		Address:	Bakerganj, Barishal
		Profession:	Student
		Contact No:	01718883980
		Email:	usaid463@gmail.com
1.2	Project Location	Plot Area	3250 sft
		Plot Number:	- - - - -
		Thana/Upazila:	Bakerganj
		District:	Barishal
		Division:	Barishal
1.3	Site Information	Adjacent (Utility Service Lines, Buildings walls of others property etc.)	North (front) side: Open Ground.
			East side: 6-storied animation building (under Construction)
			South side: Boundary wall
			West side: Open ground area
		Adjacent Road	- - -
		Road Level (±0)	0.0 Level
		EGL	(-) 1'-0"
		Plinth Level	(+) 2'-6"
1.4	Building Information	Occupancy Type	Residential
		No of story	6
		Story Height, Building Height Restriction. (Rajuk or any other Authorities)	10'
		No. of Unit Per Floor, Mezzanine Floor	Two units, No mezzanine floor
		Structure type	office Building
		Structural System	- - - -
		Building Foot Print Area	3256 sft.
		Floor Area	12,402 sft
		No of Basements	N/A
		Parking Facilities	8 Nos
		Ground floor facil.	Car parking
		Roof facilities	Over head water tank
		Lift Requirements and Measurement	8 persons lift, size 5'-6"X 6-2"
		USWT Requirement and Measurement	from Grid 2-2 to Grid 3-3 Southside area, Size 13'-1" X 24'-10"
		OHWT Req. and Location	Top of stair and Lift core area 12'6"X 24'1"
		Ramp Req. and Locat.	(±) 0.00 Level to (+) 2'6"
		Type of CA (Brick/Stone	Brick Chips

Structural Design Criteria:

2.1 Codes, Standards and References

Structural Analysis and design of this building have been reviewed according to Bangladesh National Building Code (BNBC) 2015.

ACI 318-08 ACI 318M-08: Building code requirement for Reinforced concrete, 2008,

ASCE 7-05 ASCE/SEI 7-05: 05: Minimum Design loads for Building and other Structures.

* Structural Analysis has been considered according to BNBC 2015.
* Loading criteria are considered according to BNBC 2015.
* Material Specification and properties have been considered according to BNBC 2015.
* Structural Design of RCC has been considered according to BNBC 2015.

2.2 Structural Geometry Specifications. (concrete)

The following concrete grades f'c (28 days cylinder strength) are adopted to design.

Column ———— 4550 psi
Shear wall ———— 4550 psi
Non-suspended slabs/slabs on grade, plain concrete ———— 4550 psi
Concrete young's modulus, Ec ———— 130812500 lb/in2
Poissions's ratio, u ———— 0.2
Weight per unit volume ———— 150 lb/ft3

(Steel)

The following steel grades fy are adopted in design:

Rebar ———————— 50000psi

Modulus of Elasticity ———— 29000000

Poisson's Ratio, u ———— 0.3

Weight Per Unit Volume ———— 490 lb./ft3

2.4 Loading Criteria

The building has been analyzed for possible load actions such as gravity and Lateral Loads.

a) Gravity Loads, such as dead and live loads applied at the floors or roofs of the building according to the provision of BNBC 2015 are as follows:

Dead Loads

Self-Weights of concrete = 150 pcf

Floor finish (FF) on floors = 25 psf

Fixed partition wall (RPW) = 432.5 psf

Live Loads

Live load on slab (without top story) = 42 psf

Roof Live load on slab = 20 psf

Stair and Lobby = 100 psf

Random Partition wall = 25 psf

Floor Live Load = 42 psf

(b) Lateral Loads, such as Wind Load and seismic Load applied at the building in accordance with provision of chapter 2, Part 6 of BNBC 2015 is as following.

Wind Load consideration parameters:

Basic Wind Speed, V_b : 132.35 mph (Barishal, Bangladesh
Structural Importance Co-efficient (CI) : 1
Occupancy Category : II
Importance Factor : 1
Gust Factor, G : 0.85
Topographic Factor, K_{zt} : 1
Wind Directionality Factor, K_d = 0.85
Exposure Category : B
Damping Ratio : 5%
Wind Pressure co-efficient:

C_{pw} : 0.8 (Windward-direction)
C_{pl} : 0.2725 (x-direction)
C_{pl} : 0.5 (Y-direction)

Seismic Load consideration parameters:

Seismic Zone: Zone-2 (Barishal, Bangladesh)
Zone factor : 0.12
Response Modification Co-efficient : 5
System Overstrength, Omega : 3
Deflection Amplification, C_d = 4.5
Occupancy Importance, I = 1
Site co-efficient (Fa) : 1.15

Site Co-efficient (Fv): 1.225

Occupancy category: II

Seismic Design category: SDC B

Fundamental Period of Vibration (T): 0.88 sec

Spectral Response Acceleration Parameter:

S_s : 0.5

S_1 : 0.2

2.5 Load Plan

Earth Quake Load:

In X direction: EX-1, EX-2, EX-3

In Y direction: EY-1, EY-2, EY-3

Wind Loads:

In X direction: WX-1, WX-2, WX-3, WX-4

In Y direction: WY-1, WY-2; WY-3, WY-4

2.6 Boundary Condition (Support Conditions)

Column base supports have been considered as fixed supports in 3D model of super structure Spring supports have been considered for shallow foundation

2.7 Design Method and Load Combinations:

USD/LRFD design method have been considered to design this structure.

U = LL

U = DL + LL

U = DL + 0.5LL + 0.7WX

2.8 Bearing Capacity of Shallow Foundation/Pile capacity

Bearing capacity of soil considered for this building is 4 ksf.

2.9 3D view and Typical Plan of Building

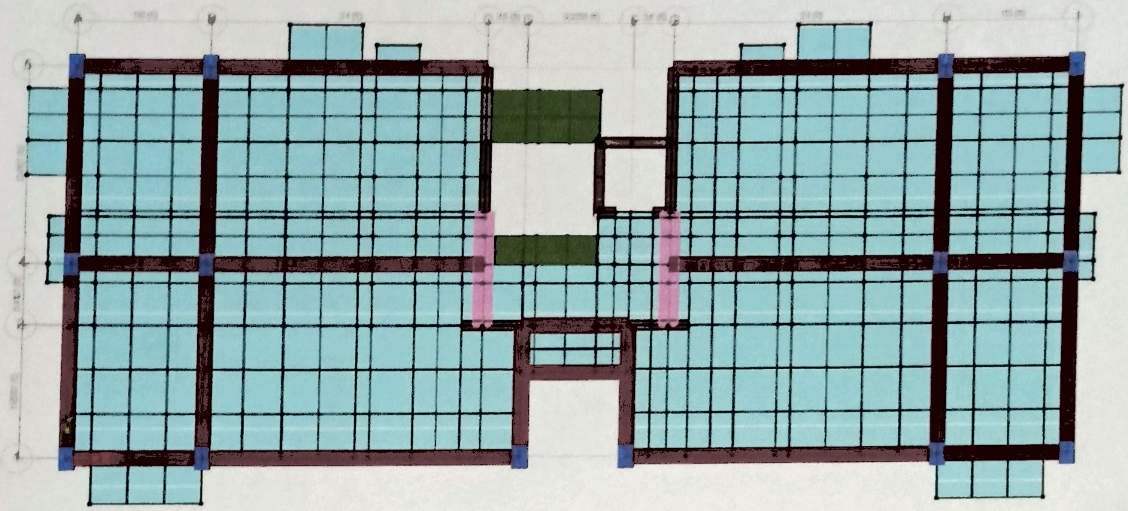

Fig. 2.1 Typical Plan of Building

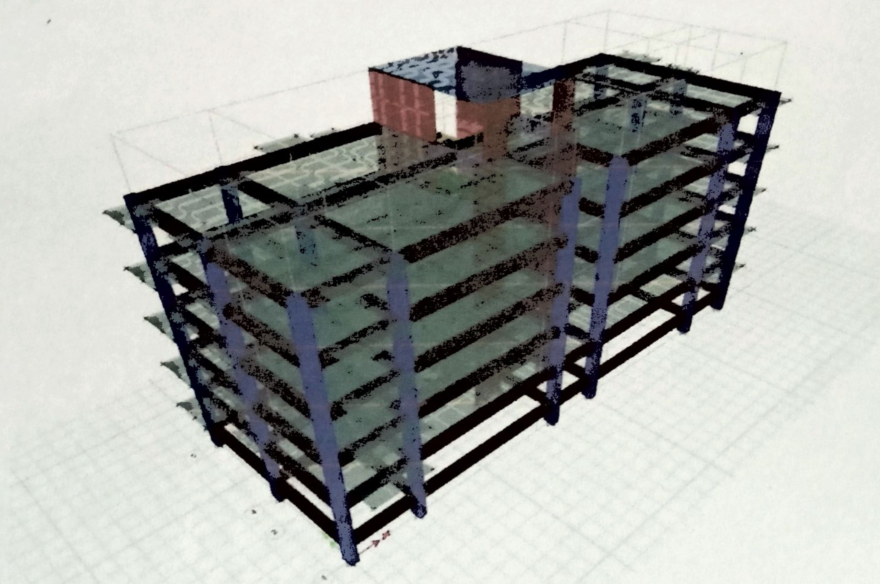

Fig. 2.2 3D view of Building

2.10 Building Irregularity

Sl No	Item Name	Yes/No
1	Torsional Irregularity	Yes
2	Re-entrant Corners	No
3	Diaphragm Discontinuity	NO
4	Out of Plane offsets	NO
5	Stiffness Irregularity - Soft Story	No
6	Mass Irregularity	No
7	Vertical Geometric Irregularity	No
8	Vertical In Plane Discontinuity	No
9	Discontinuity in Capacity - Weak story	No
10	Non-Parallel System	NO

2.11 Section of Analysis type

Structural analysis has been performed by ETABS 2020

3. Analysis And Design Software Features:

Ms Excel	Spread Sheet
ETABS 20	Extended 3D Analysis of Building System

4. Serviceability Criteria And Building Irregularities:

4.1 Serviceability Criteria

Column Size: 15"x24"

Beam Size: 15"x24"

4. SERVICEABILITY CRITERIA AND BUILDING IRREGULARITIES:

4.1 SERVICEABILITY CRITERIA

Column Size 15''X24''

Beam Size 24''X15''

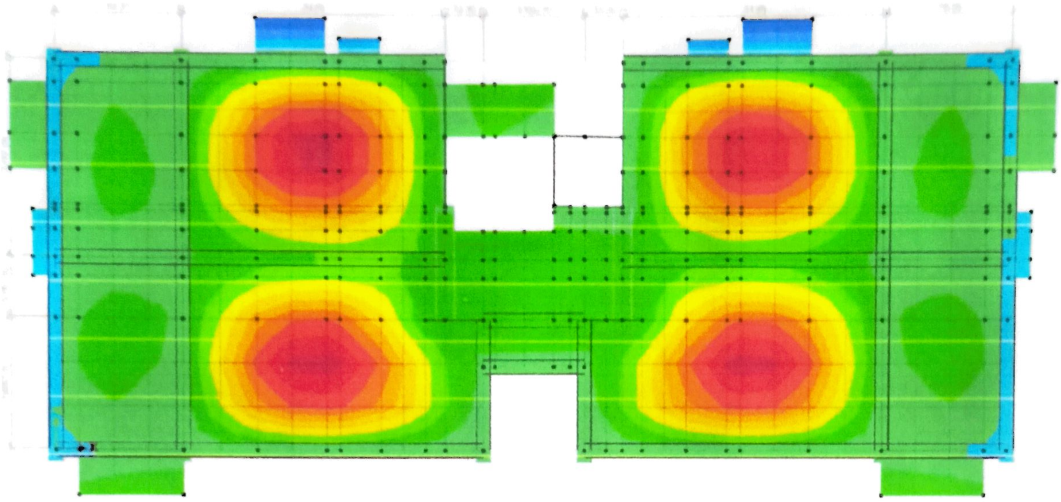

Fig. 4.1: Vertical Deflection Limits for Live Load

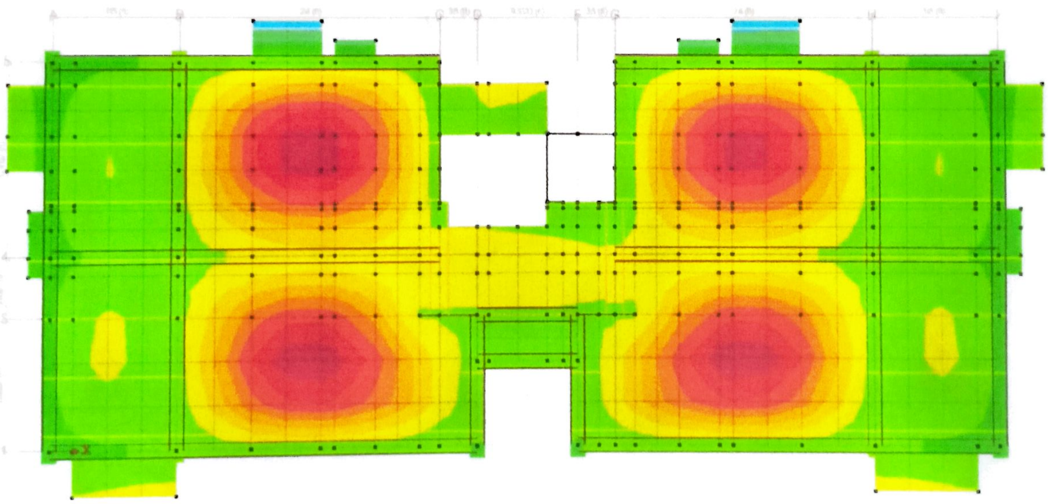

Fig. 4.1: Vertical Deflection Limits for DL+LL

[1] Vertical deflection limits (D+L and L)

Deflection limits (D+L) $= \frac{l}{240}$ [Table 6.1.2]

$= \frac{12.92 \times 12}{240}$

$= 0.821$ in

From Etabs

$U_z(D+L) = 0.001022 < 0.821''$

$\therefore$ ok

Deflection limits (L) $= \frac{l}{360}$

$= \frac{12.92 \times 12}{360}$

$= 0.5802$ in

From Etabs,

$U_z(L) = 0.02952 < 0.58''$

[2] Maximum Lateral displacement for wind load,

maximum Limits $= \frac{H}{500} = \frac{60 \times 12}{500}$

$= 1.44''$

For load Combination $(D + 0.5L + 0.7W \times 4)$ [Section 2.2.5]

Maximum story Displacement $= 0.007612 < 1.44$

$\therefore$ ok

[3] Story drift for wind Load [Section 1.5.6.1]

$T = C_t (h_n)^m$

$= 0.0466 \times \left(\frac{60}{3.28}\right)^{0.90}$

$= 0.637$ sec

$C_t = 0.0466$

$h_n = 60$ ft

$m = 0.90$

Here, $T < 0.2$ sec

$\therefore \Delta \leq 0.005h$

$\Rightarrow \frac{\Delta}{h} = 0.005$

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Maximum Story drifts from Etabs ($D+0.5L+0.9WX4$)

$$= 0.0001 \quad (3F)$$

$$\therefore 0.0041 > 0.0001$$

$$\therefore \text{OK}$$

$\boxed{4}$ Maximum Lateral Displacement for Earthquake Load,

for all structures [Table 6.2.21]

Allowable storey drift limit, $\Delta = 0.020\, h_{su}$

[Occupancy Category I and II]

$$\Rightarrow \Delta = 0.02 \times (60 \times 12)$$

$$= 14.4''$$

We know,

$$\delta_x = \frac{C_d\, \delta_{xe}}{I}$$

$$= 4.5 \times \delta_{xe}$$

From ETABS,

Maximum Story displacement for Earthquake

$\delta_{xe} = 2.03$ [For EQY2]

$$\therefore \delta_x = 4.5 \times 2.03$$

$$= 9.135 < 14.4$$

$$\therefore \text{OK}$$

$\boxed{5}$ Story Drift for Earthquake Load:

Allowable limit for story drift $= 0.02$

Story drift value $\times 4.5 \leq 0.02$

From ETABS,

Maximum value for drift = 0.0019591 [EQY2]

∴ 0.0019591 × 4.5 = 6.25×10⁻³ < 0.02"

∴ ok

4.2 Torsional Irregularities:

Story	Load case	Max Drift (in)	Avg Drift (in)	Ratio	Status
OHWT	EQX1	0.001231	0.00111	1.109	ok
OHWT	EQX2	0.001227	0.00107	1.117	ok
OHWT	EQX3	0.001228	0.00105	1.13	ok
OHWT	EQY1	0.000487	0.000201	2.428	ok
OHWT	EQY2	0.000758	0.000708	1.053	ok
OHWT	EQY3	0.000577	0.00205	1.096	ok
Roof	EQX1	0.001072	0.000766	1.13	ok
Roof	EQX2	0.0011	0.00753	1.12	ok
Roof	EQX3	0.00115	0.00772	1.17	ok
Roof	EQY1	0.000735	0.000656	1.407	ok
Roof	EQY2	0.000722	0.00651	1.51	ok
Roof	EQY3	0.00877	0.0072	1.32	ok
5F	EQX1	0.001202	0.00152	1.039	ok
5F	EQX2	0.0015	0.00143	1.025	ok
5F	EQX3	0.0022	0.003	1.012	ok
5F	EQY1	0.000782	0.00081	1.217	ok
5F	EQY2	0.00732	0.00022	1.3	ok
5F	EQY3	0.00735	0.007	1.5	ok
4F	EQX1	0.001377	0.001312	1.029	ok
4F	EQX2	0.0015	0.0072	1.003	ok
4F	EQX3	0.005	0.037	1.32	ok
4F	EQY1	0.00102	0.000828	1.162	ok
4F	EQY2	0.000587	0.0003	2.28	ok
4F	EQY3	0.00027	0.00059	2.47	ok
3F	EQX1	0.001405	0.001336	1.052	ok
3F	EQX2	0.00075	0.00036	2.17	ok
3F	EQX3	0.00735	0.007	1.5	

4.3 Stiffness Irregularity - soft story

Story	Load Case	Shear X (Kip)	Drift X (in)	Stiffness X (Kip/in)	Ke/Ka	Status	Ke/Kavg	Status
Roof	EQX1	7.601	0.001	6689.12	—	—	—	—
5F	EQX1	51.057	0.00077	51314.86	7.7	OK	—	—
4F	EQX1	88.055	0.0012	73697.98	1.43	OK	—	—
3F	EQX1	115.672	0.0013	86607.5	1.18	OK	—	—
2F	EQX1	137.455	0.0013	102943	1.18	OK	1.771	ok
1F	EQX1	145.084	0.0011	128751	1.26	OK	1.49	ok
GF	EQX1	68.168	0.00047	145620	1.13	OK	1.47	ok
							1.37	ok

Story	Load Case	Shear Y (Kip)	Drift Y (in)	Stiffness Y (Kip/in)	Ke/Ka	Status	Ke/Kavg	Status
Roof	EQY1	7.601	0.00071	8366.4	—	—	—	—
5F	EQY1	51.057	0.00067	76163	1.43	ok	—	—
4F	EQY1	88.055	0.00082	107085.5	1.41	OK	—	—
3F	EQY1	115.672	0.000828	137777.9	1.23	ok	—	—
2F	EQY1	137.455	0.000845	157078.9	1.21	OK	2.06	ok
1F	EQY1	145.084	0.000707	2045181	1.28	OK	1.51	ok
GF	EQY	97.227	0.000266	187063.95	0.71	OK	1.59	ok
							1.13	ok

P.T.O

4.2 Torsional Irregularities: (cont)

Story	Load case	Max Drift (in)	Avg Drift (in)	Ratio	Status
3F	EQY1	0.001405	0.001336	1.052	OK
3F	EQY2	0.000189	8.7×10^{-5}	2.108	ok
3F	EQY3	0.00025	0.00025	1.2	ok
2F	EQX1	0.001459	0.001263	1.151	ok
2F	EQX2	0.0028	0.0022	1.3	ok
2F	EQX3	0.0032	0.0022	1.02	ok
2F	EQY1	0.001023	0.000838	1.21	ok
2F	EQY2	0.00035	0.00032	1.02	ok
2F	EQY3	0.0001	0.0007	2.5	ok
1F	EQX1	0.0009	0.0003	2.5	ok
1F	EQX2	0.000213	0.00022	1.22	ok
1F	EQX3	0.00042	0.000266		ok

5. ADEQUACY OF STRUCTURAL MEMBERS:

5.1 Adequacy of Column

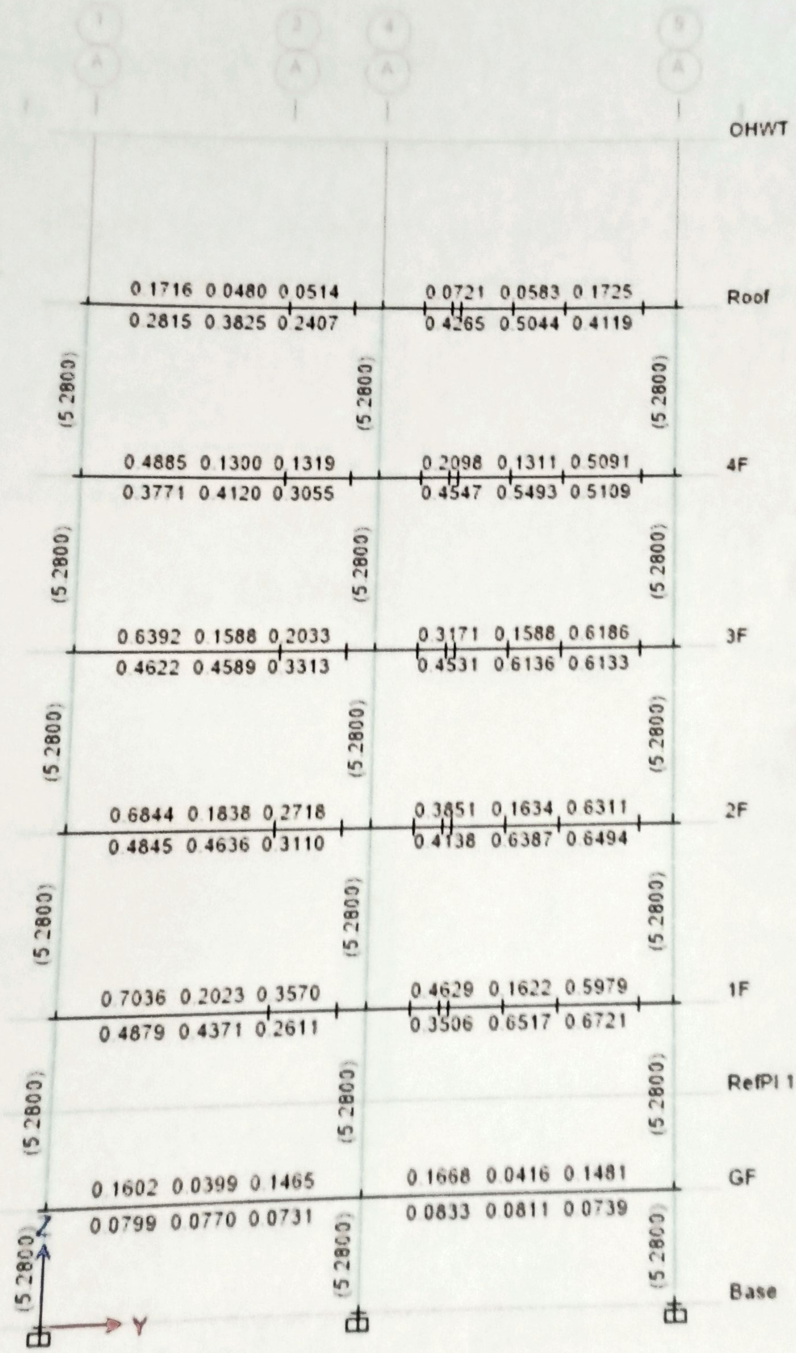


Fig. 5.1: Longitudinal Reinforcing of Column

5. Adequacy of Structural Members:

5.1 Adequacy of column

Here provided column section 18"×24". for this size maximum reinforcement showing 5.28 in^2.

The design done taking this value because by using this value structure might be resist against all kinds of load and shear.

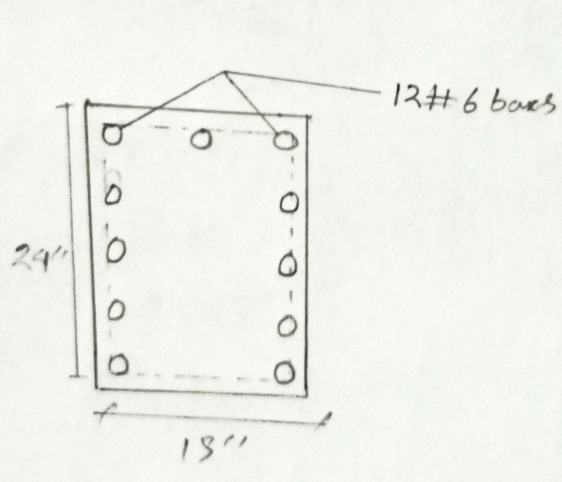
Using # 6 Rebar,

$$\therefore \text{No of bar} = \frac{5.28}{0.44} = 12 \text{ Nos}$$

$N = \frac{A_s}{A_s'}$

$A_s = 5.28 \, in^2$

$A_s' = 0.44 \, in^2$



Cross section of column

#6 use as a longitudinal reinforcement and 3# are as a tie.

This section will be use for all column at each and every section

Spacing of hoop within $L_o > c_2$, $h_{col}/6$, 18"

$c_2 = 24"$

$\frac{h_{col}}{6} = \frac{10\times12}{6} = 20"$

18"

$\therefore$ Spacing of hoop within $L_o = 24"$ c/c

End spacing $\leq \frac{b_c}{4} = \frac{20}{4} = 5"$

or, 4"

$\therefore$ End spacing $= 4"$ c/c

For special confinement,

Area of rectangular hoops $\geq 0.3 s_t d \left(\frac{f'_c}{f_y}\right)\left(\frac{A_g}{A_c} - 1\right)$

$\therefore$ Core area $A_c = 12\times21$
$= 252 \text{ in}^2$

$A_g = 24\times15 = 360 \text{ in}^2$

$\therefore$ Area of hoops $= 0.3\times4\times12.5\left(\frac{4.55}{50}\right) \times\left(\frac{360}{252} - 1\right)$

$= 1.958 \text{ in}^2$

$h' = 24 - 3"$
$= 21"$

$b = 15 - 3"$
$= 12"$

$d = 15 - 2.5$
$= 12.5"$

$\therefore$ Using at least 4-legged #6

Spacing through the colum $= \frac{b_c}{2} = \frac{15}{2} = 2.5"$
$\simeq 2"$ c/c

$S_p = \frac{L_c}{4} = \frac{10\times12}{4} = 30"$

Between this length provided spacing 4" c/c

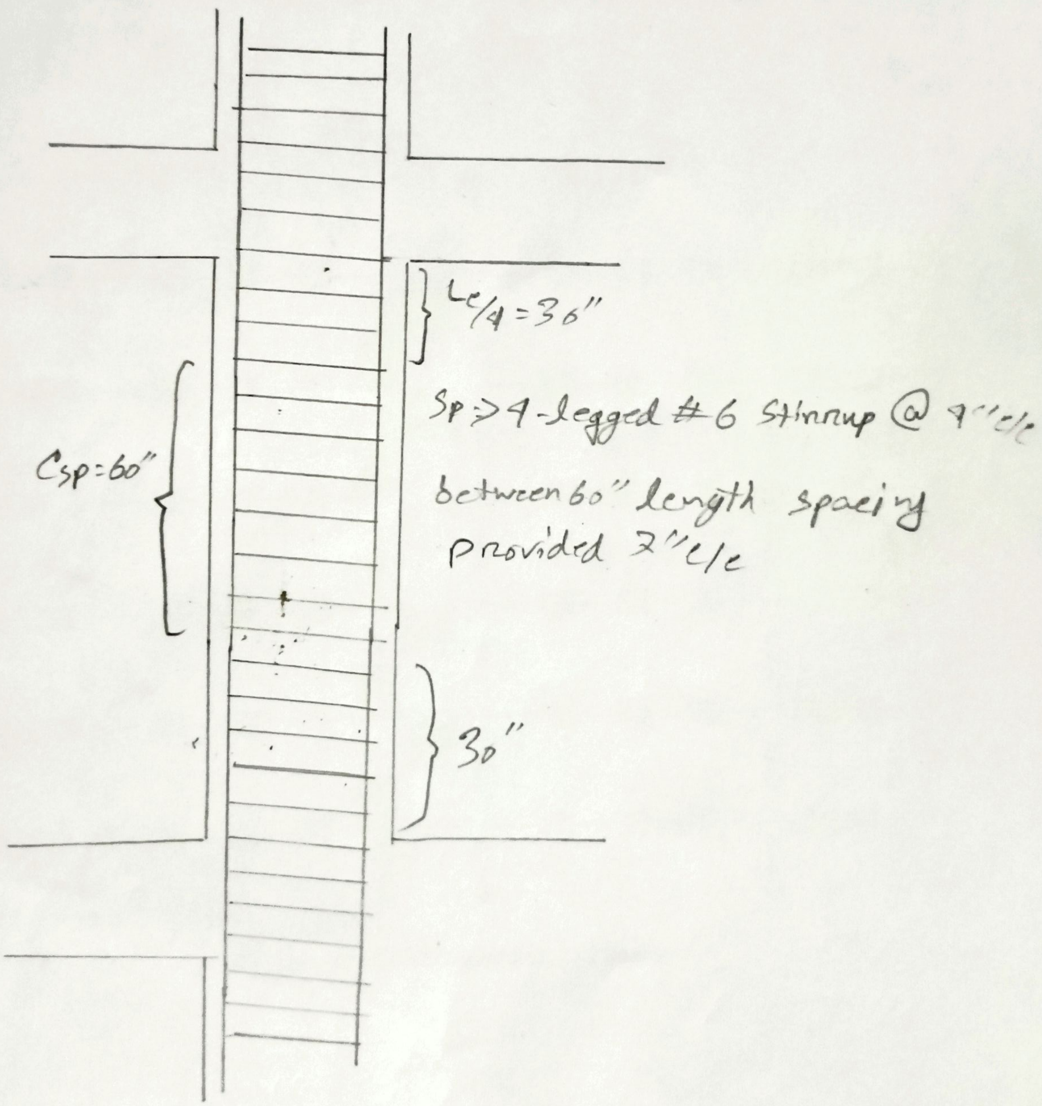
Anchoring at end joints, $L_{anch} = L_d + 10d_b$

L_d for #6 bar $= 0.04 \times A_s \times \dfrac{f_y}{\sqrt{f'_c}}$

$= 0.04 \times 0.44 \times \dfrac{50}{\sqrt{\dfrac{4.55}{1000}}}$

$= 13.046''$

$L_{anch} = 13.046 + 10 \times \frac{7}{8} = 21.79' \simeq 22''$



Long Section of Column

5.2 Adequacy of Beam

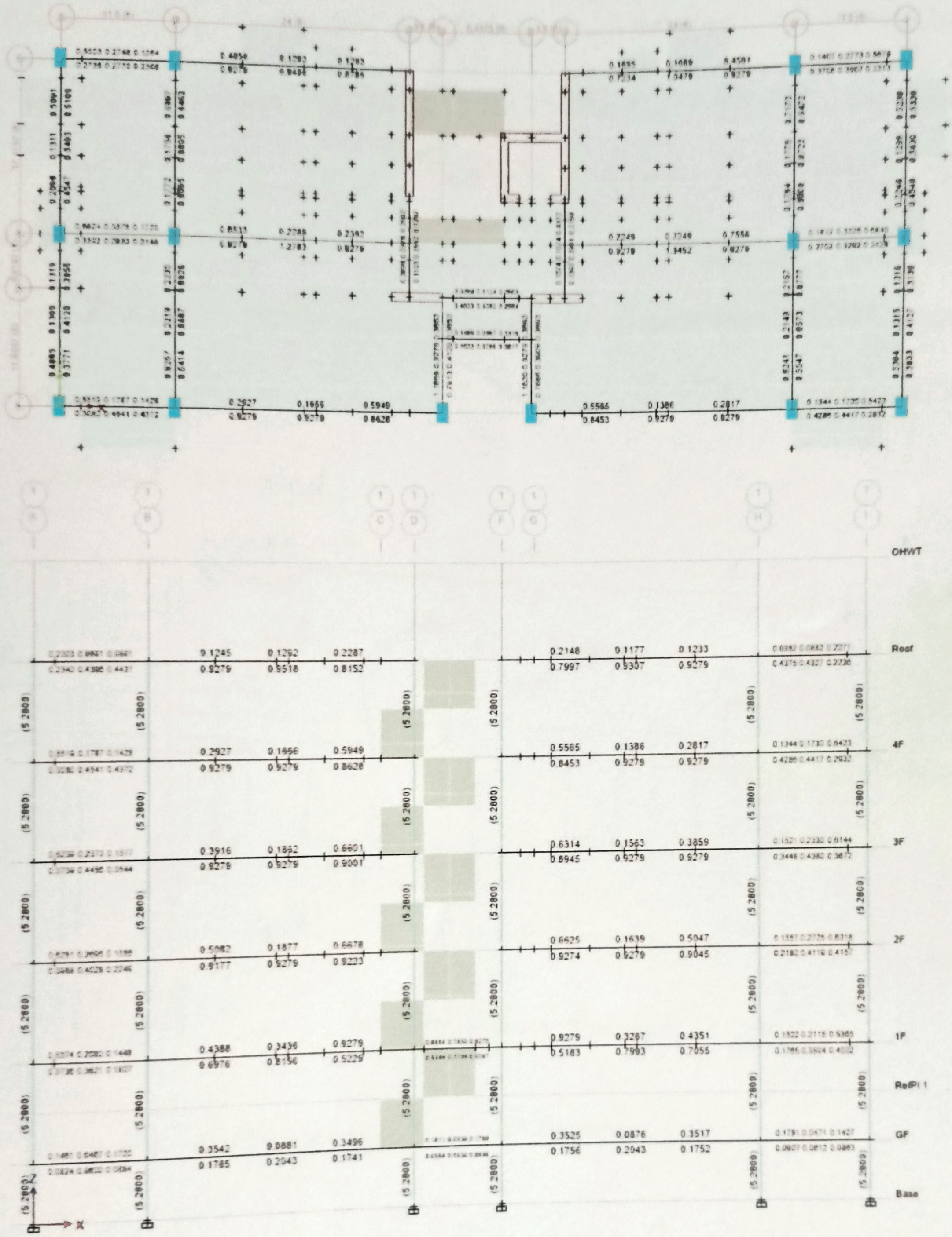
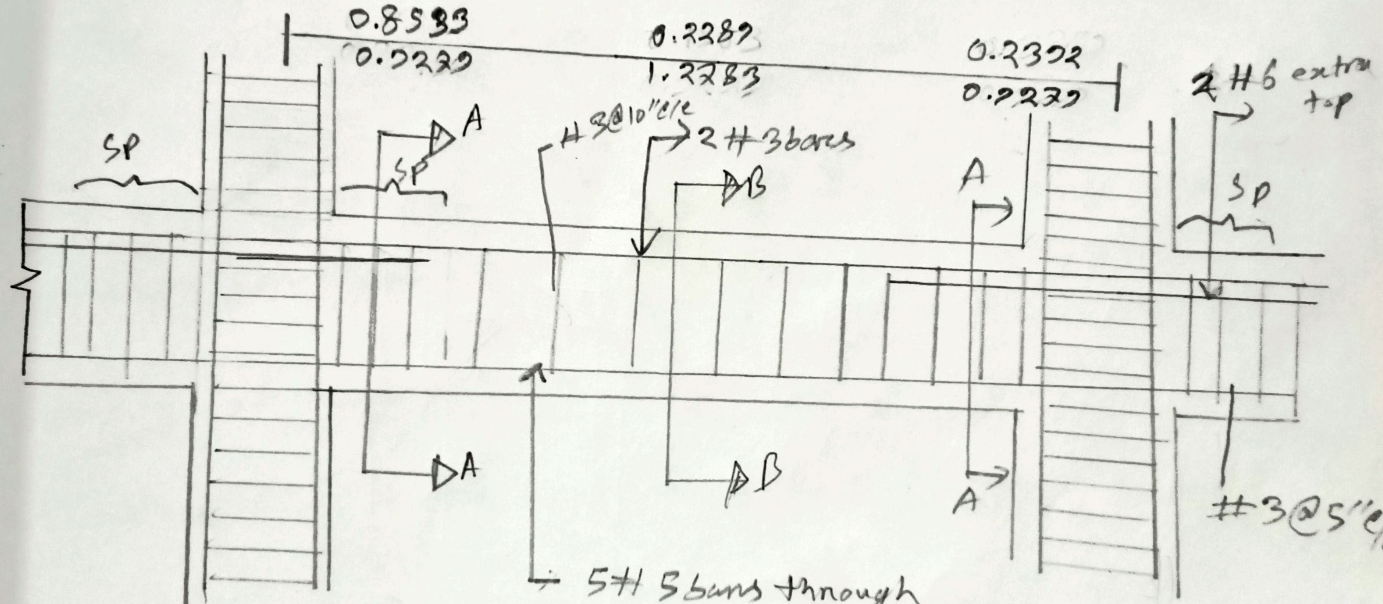


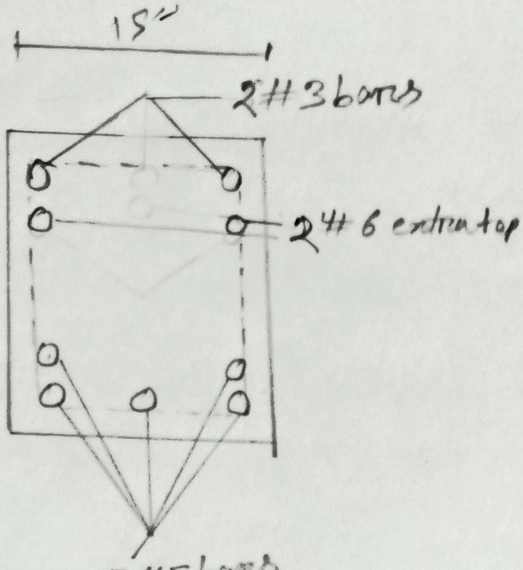
Fig. 5.4: Longitudinal Reinforcing of Beam

Provided beam section 15"X21". This beam were provided at each and every section without near between the shear wall. Near the shear wall beam section were increased because of shear failure. The shear failure occurred due to the lower length of the beam. In this location provided beam section 30"×30" and 30" X30'. Afterward No failure But we design 15"x 24" section because this section covered maximum floor. A section taken which have higher steel demand.

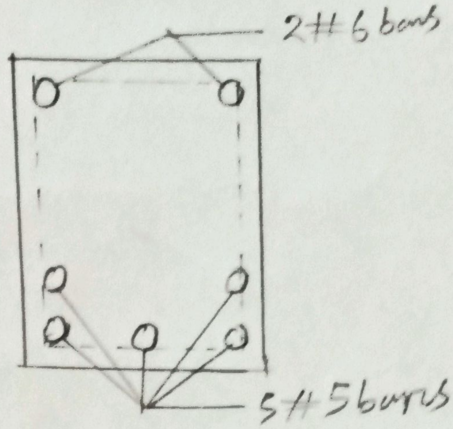


Long Section of Beam

#3 bar uses as a stirrup.



Section A-A



Section B-B

Cross Section of Beam

Total depth = 24"

$d = 24" - 3.5" = 20.5"$

Lap splices are allowed for $\leq 50\%$ of bars, only where stirrups are provided @ $\leq \frac{d}{4}$ (=5.13") or 4" c/c

Spacing of hoop within 2d (41"), beginning at $\leq 2"$, at either end of a beam must be $\leq \frac{d}{4} = 5.13"$, $8d_b = 8 \times \frac{5}{8} = 5"$

$\therefore$ Spacing 5" c/c

Elsewhere, $S_t = \frac{d}{2} = \frac{20.5}{2} = 10.25" \simeq 10"$ c/c

5.3 Adequacy of Shear Wall

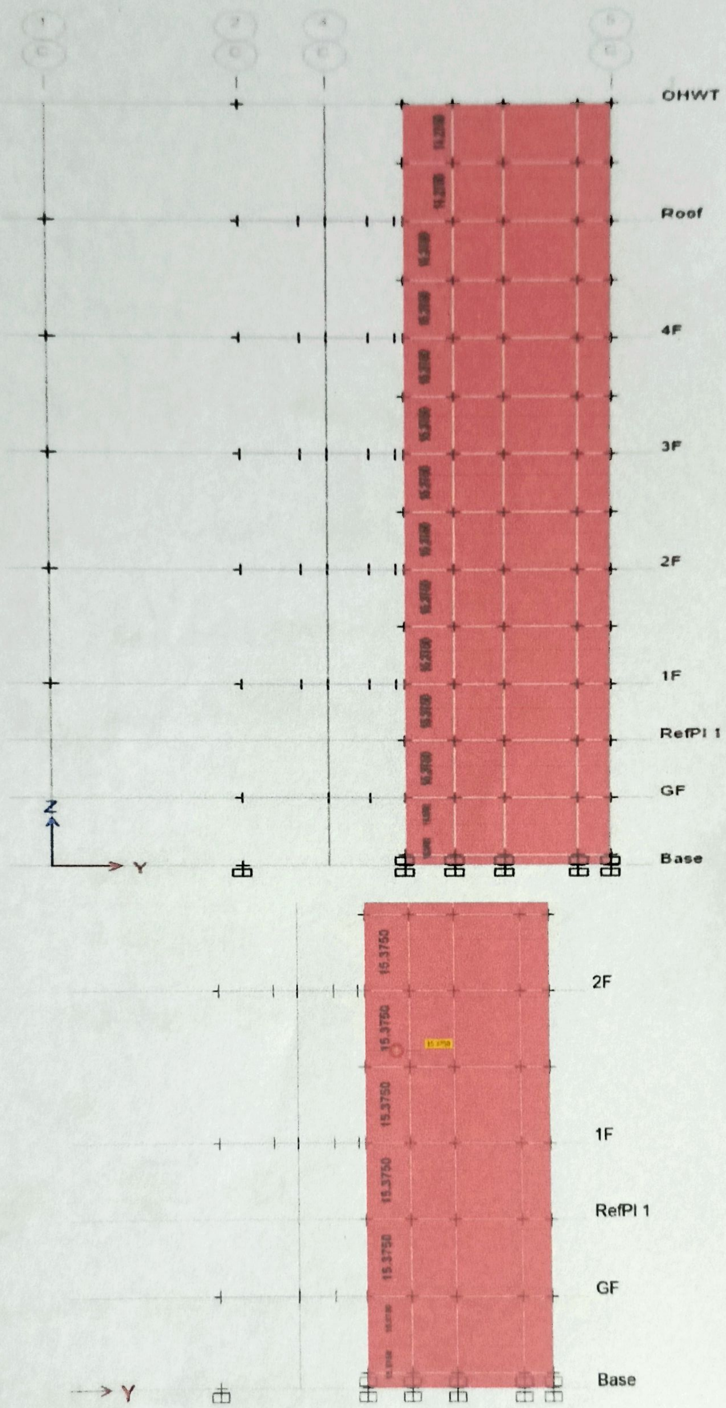


Fig. 5.7: Longitudinal Reinforcing of Shear Wall

From shear design flexural reinforcement found

$= 15.335\ in^2$

using #2 bars,

$\therefore N = \dfrac{15.335}{0.6}$

$= 25.625$

$\simeq 26$ nos

$\therefore$ At Every face $= \dfrac{26}{2} = 13$ Nos $\simeq 14$ Nos

$\therefore$ use 14 # 2 bars each side

for vertical reinforcement

using 2-legged #3 bars.

Spacing,

i) $s = \dfrac{A_{vh}}{P_{vh}} = \dfrac{0.11\times 2}{0.025\times 10} = 0.88 = 8.5''$ c/c

ii) $s = 3h = 3\times 10 = 30''$ c/c

iii) $s = 18''$ c/c

iv) $s = \dfrac{L_w}{3} = \dfrac{153}{3} = 51''$

$\therefore$ Minimum Spacing $= 8.8'' \simeq 8''$ c/c

use 2 legged #3 bars @ 8'' c/c

for horizontal reinforcement

Spacing,

$S = \frac{L_w}{5} = \frac{153}{5} = 30.6''$

$S = 3h = 3 \times 10 = 30''$

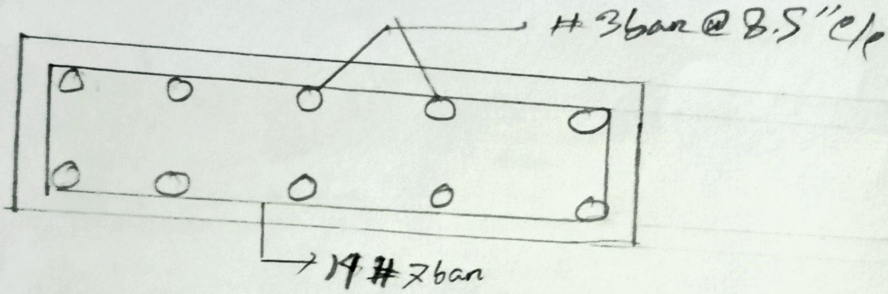
$S = 18'$

$S = \frac{A_{vh}}{0.0025h} = \frac{0.11 \times 2}{0.0025 \times 10}$

$= 8.8''$

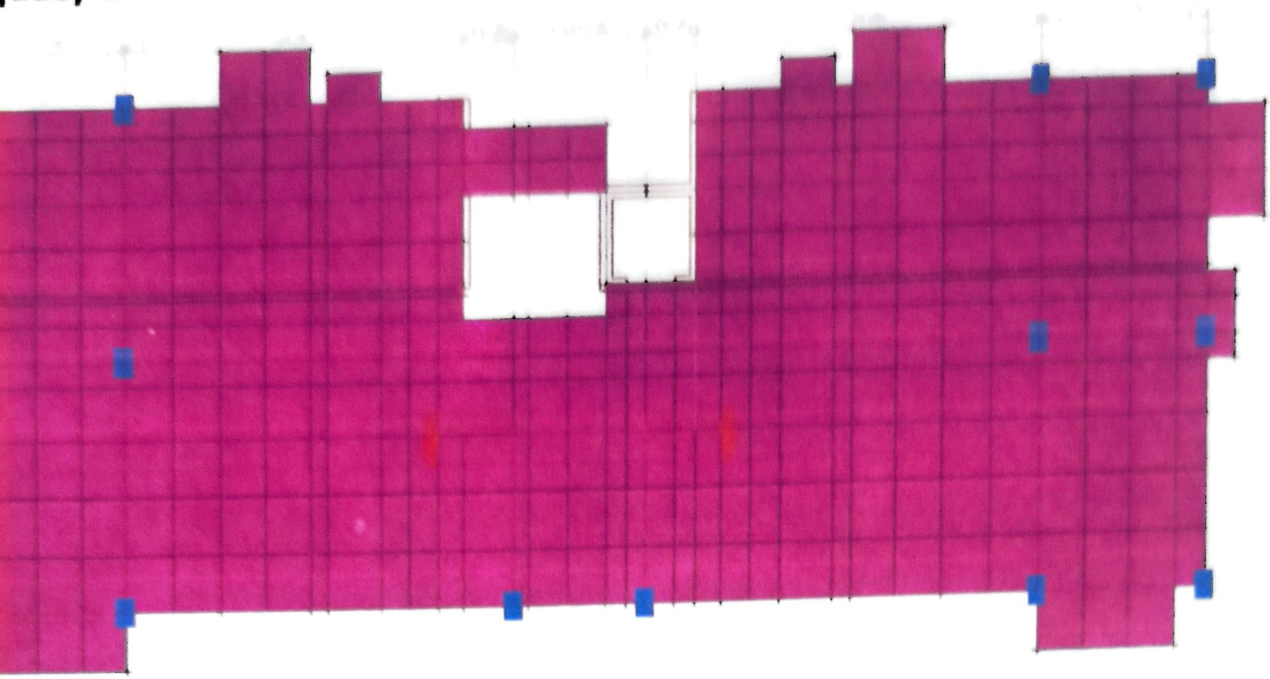
$\simeq 8.5$

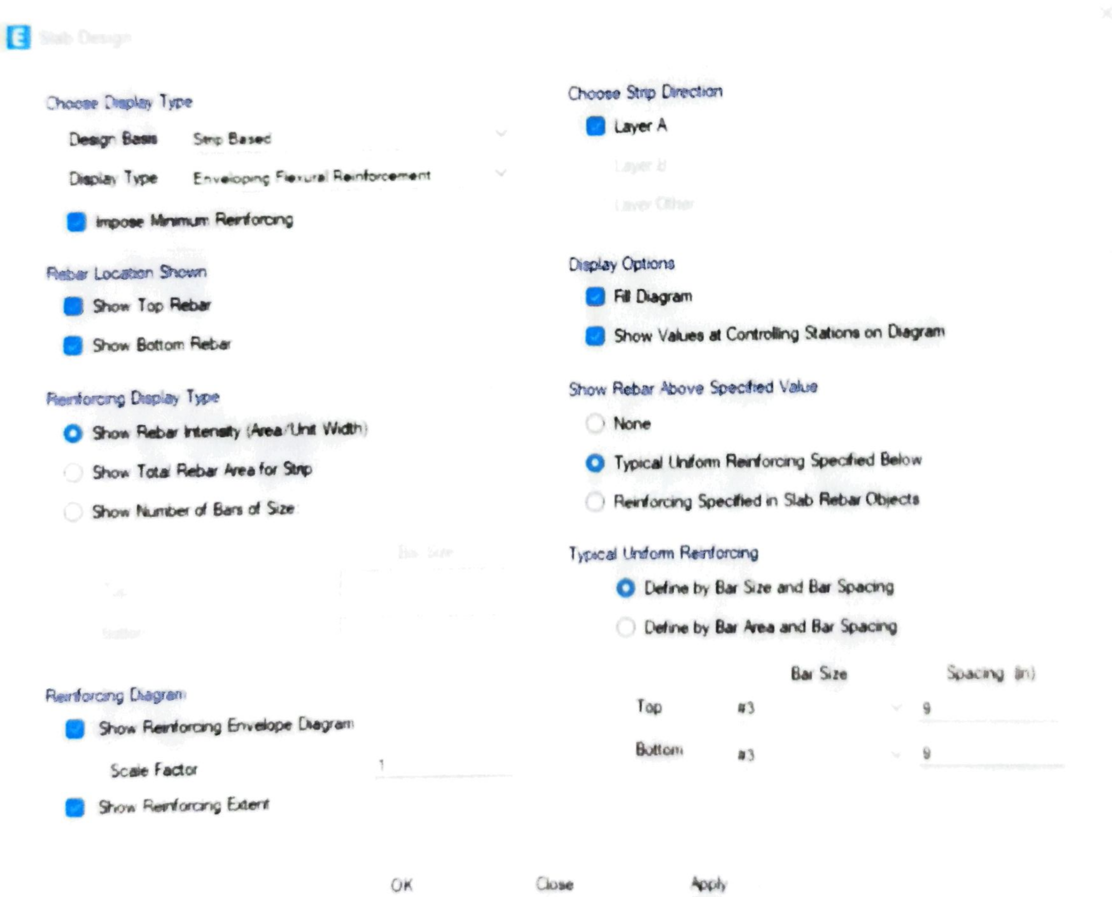
use 2-legged # 3bars @ 8.5c/c



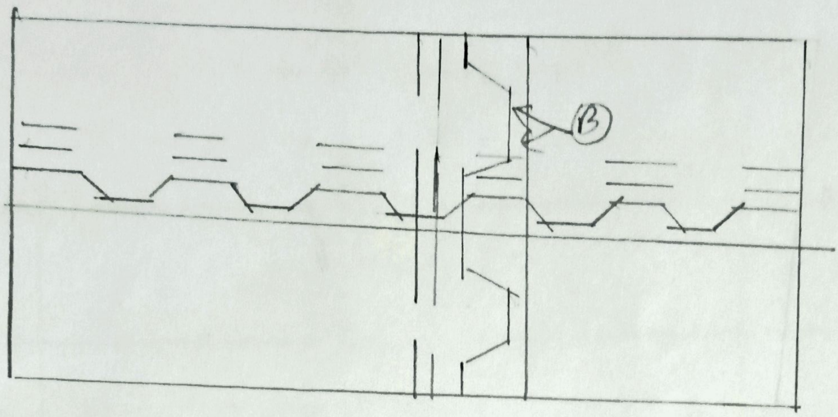
Cross section of shear wall

quacy of Slab





slab design is ok when define bar size #3 and bar spacing 7" c/c. But near the lift portion reinforcement was not ok. If 2#3 extra top is provided slab design is ok.



A = #3 @ 7" c/c alt. ckd + 2#3 extra top

B = #3 @ 6" c/c alt. ckd + 2#3 extra top

Slab reinforcement detailing for typical floor

5.5 Adequacy of Foundation

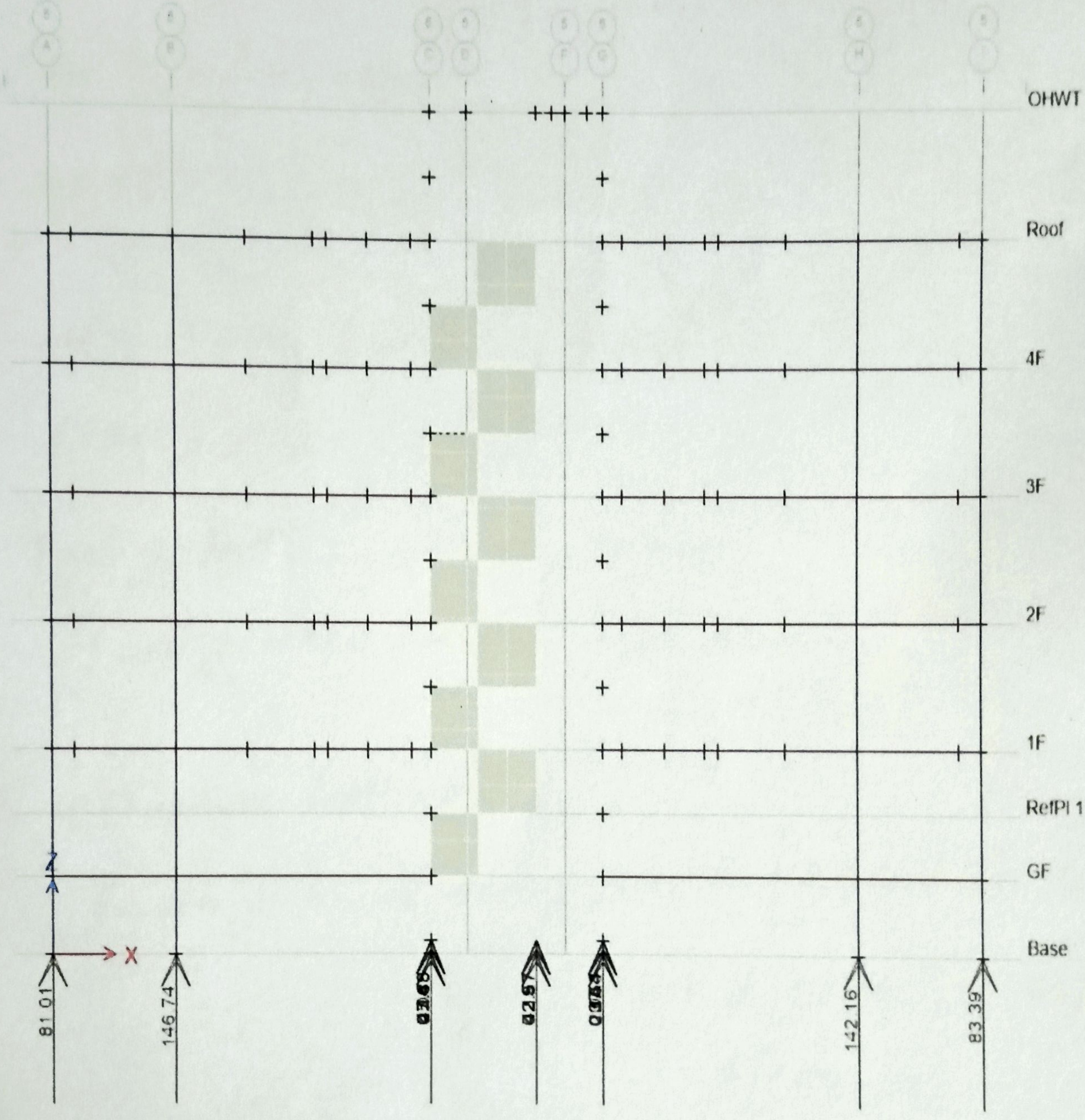
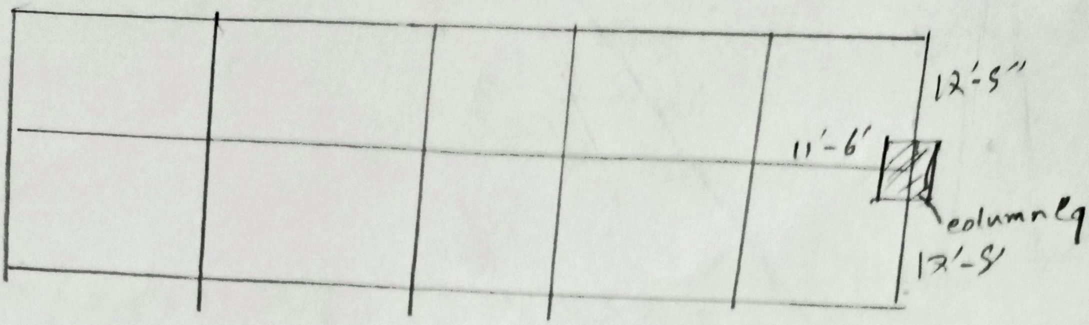


Fig. 5.11: Column load



Column Size = 15" × 24'

$f'c = 4.55$ Ksi

$Fy = 50$ Ksi

Bearing Capacity of soil = 4 ksf

$P(D+L) = 83.37$ Kip

Footing load $= 1.1 \times 83.37 = 91.7$ Kip

$\therefore$ Footing area $= \frac{91.7}{4} = 22.93 \; ft^2$

$= 6' \times 4'$

Effective depth = 24"

$\therefore$ Punching Shear area, $Ap = d\left[2(c_1 + \frac{d}{2}) + (c_2 + d)\right]$

$= d\left[2(15 + \frac{d}{2}) + (24 + d)\right]$

$= d\left[(54 + 2d)\right]$

$\therefore$ Punching Shear strength $= 4\phi\sqrt{f'c}$

$= 4 \times 0.85\sqrt{4550}$

$= 229.34$ Psi

$= 0.23$ Ksi

Effective bearing pressure = $\frac{83.37}{6\times 4}$

$= 3.47$

$\simeq 3.5 ksf$

$\therefore 0.23 \times \{d(54+2d)\} = 83.37 - 3.5 \times \frac{(15+\frac{d}{2})(24+d)}{(12)^2}$

$\therefore d = 5.36'' \simeq 5.5''$

Hence,

flexure shear strength = $2\phi\sqrt{f_c'}$

$= 2\times 0.85 \times \sqrt{4550}$

$= 114.67 psi$

$= 0.1147 ksi$

$= 16.51 ksf$

maximum flexural shear force = $3.5\{(\frac{4-\frac{15}{12}}{2})-d\}$

$\Rightarrow 16.51 \times 1 \times d = 3.5(1.375-d)$

$\therefore d = 0.241' = 2.87''$

footing thickness, $t = 3.36+4 = 7.36 > 2.87''$

[OK]

Total bending moment = $\frac{[3.5\times[\frac{4-15/12}{2}]^2}{2} \times 6$

$= 17.89$ K-ft

$f_c = 0.85 \times f_c'$

$= 0.85 \times 4550 = 3867.5 psi$

$= 3.87 ksi$

$\alpha = 0.68$

if $f_c' < 4550$ psi

$$\therefore \rho_{max} = \frac{0.85 \times 0.68 \times 3.87}{50} \times \frac{87}{87+50}$$

$$= 0.0251$$

Now,

$$R_u = \phi \rho_{max} f_y \left(1 - 0.59 \rho_{max} \times \frac{f_y}{f_c'}\right)$$

$$= 0.85 \times 0.0251 \times 50 \left(1 - 0.59 \times 0.0251 \times \frac{50}{4.55}\right)$$

$$= 2.11 \simeq 2.12$$

$\therefore$ Depth required by M is $= \sqrt{\frac{M}{R_u b}}$

$$= \sqrt{\frac{12.85}{2.12 \times 4}}$$

$$= 0.797 < 5.5''$$

$$\therefore A_s = \frac{f_c}{f_y}\left[1 - \sqrt{\left\{1 - 2M / \phi f_c b d^2\right\}}\right] bd$$

$$= \frac{3.87}{50}\left[1 - \sqrt{\left\{1 - \frac{2 \times 12.85}{0.7 \times 3.87 \times 4 \times 12 \times 5.5^2}\right\}}\right] 4 \times 12 \times 5.5$$

$$= 0.786\,in^2 \simeq 0.77\,in^2$$

Minimum Reinforcement $= \frac{0.2}{f_y} \times bd$

$$= \frac{0.2}{50} \times 4 \times 12 \times 5.5$$

$$= 1.056\,in^2 > A_s$$

$\therefore A_s$(Provided) $= 1.056\,in^2$

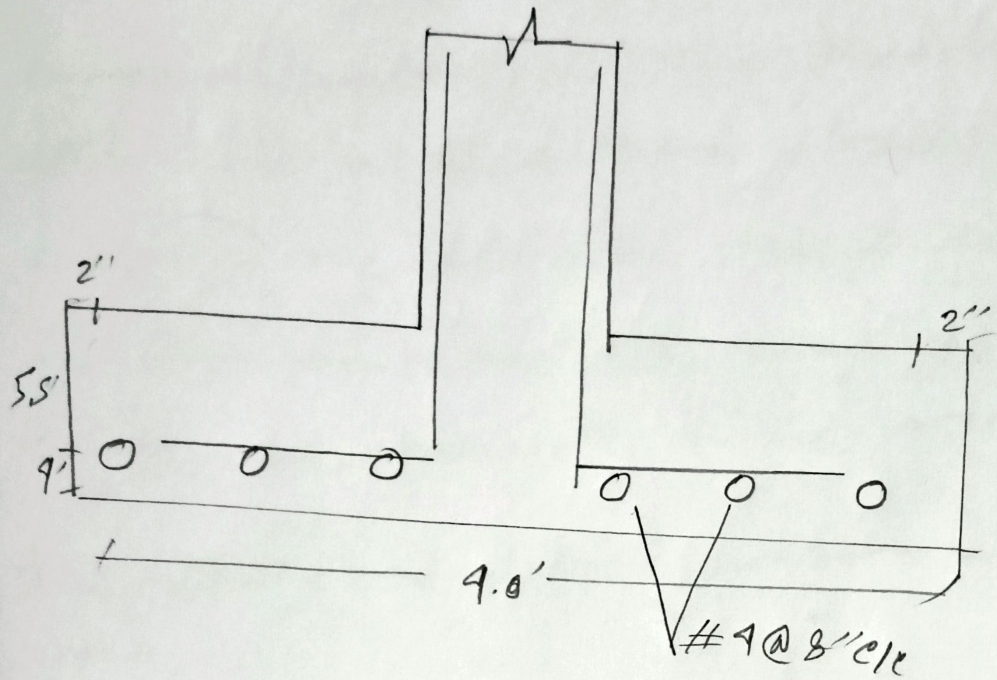
using # 4 bars

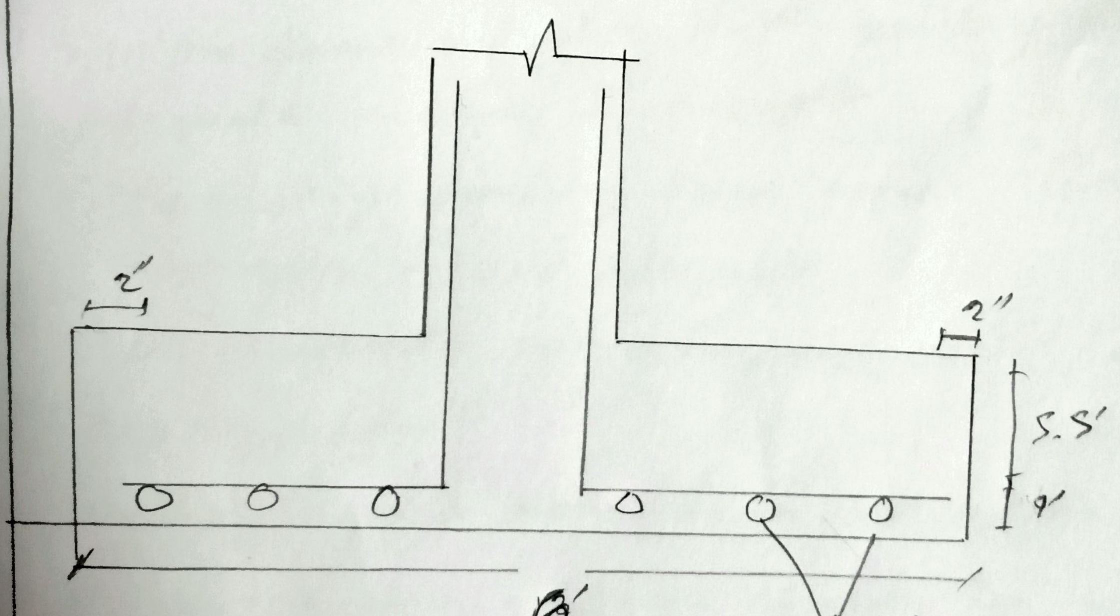
$A_s' = 0.44\,in^2$

$$N = \frac{A_s}{A_s'} = \frac{1.056}{0.2} = 5.28 \simeq 6 \text{ nos}$$

$\therefore$ Spacing $= \frac{4 \times 12}{6} = 8''$ c/c in short direction

$\therefore$ Spacing $= \frac{6 \times 12}{6} = 12''$ c/c in long direction





Detailling of footing

6. Conclusion and Recommendations:

Analyze and design of a 6 storied building as per BNBC 2020 was the project goal. Numerical analysis of these models was also done using software ETAB 2020. By analyzing the drift ratio, stress, displacement and other parameters like detailing of beam column, slab, shear wall, footing were determined.

The following calculations have been found from this work;

->All the columns and slabs of the building structurally Adequate in terms of strength.

-> Considering punching shear capacity foundation thickness found adequate

-> All shearwalls are adequate against load.

Recommendation!

Rather than a same beam and column section. Different section should be choosen. For economical design.