
NAVAL TECHNOLOGIES
We Support Your Construction Needs

WHO WE ARE...

- Located at Chennai and Karur, Tamil Nadu, India. We provide complex Engineering services in Civil Engineering for Our clients.

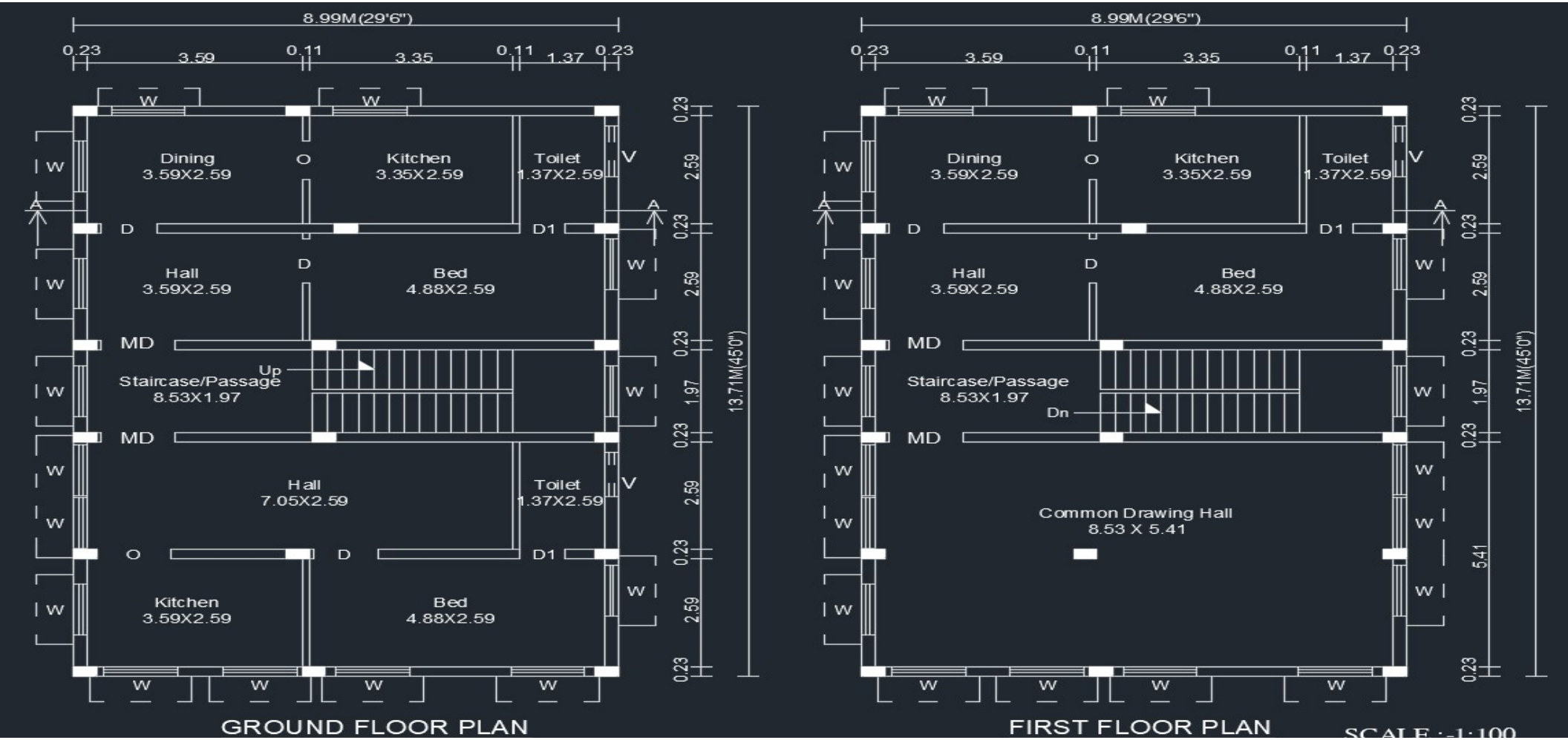
- More than 12 years of experience in engineering and detailing services

- A strong team of 10 engineers with expertise in diverse designing and detailing services.

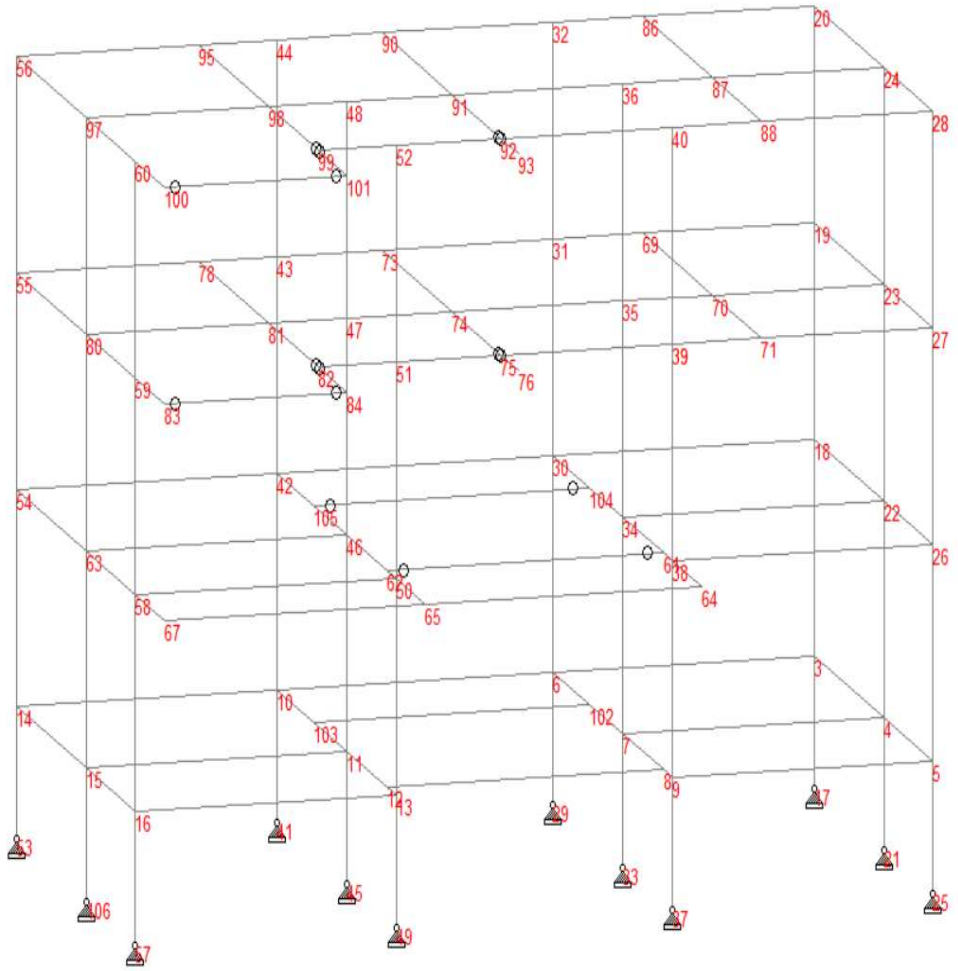
WE DO... DESIGN AND DETAILING SERVICE FOR ...

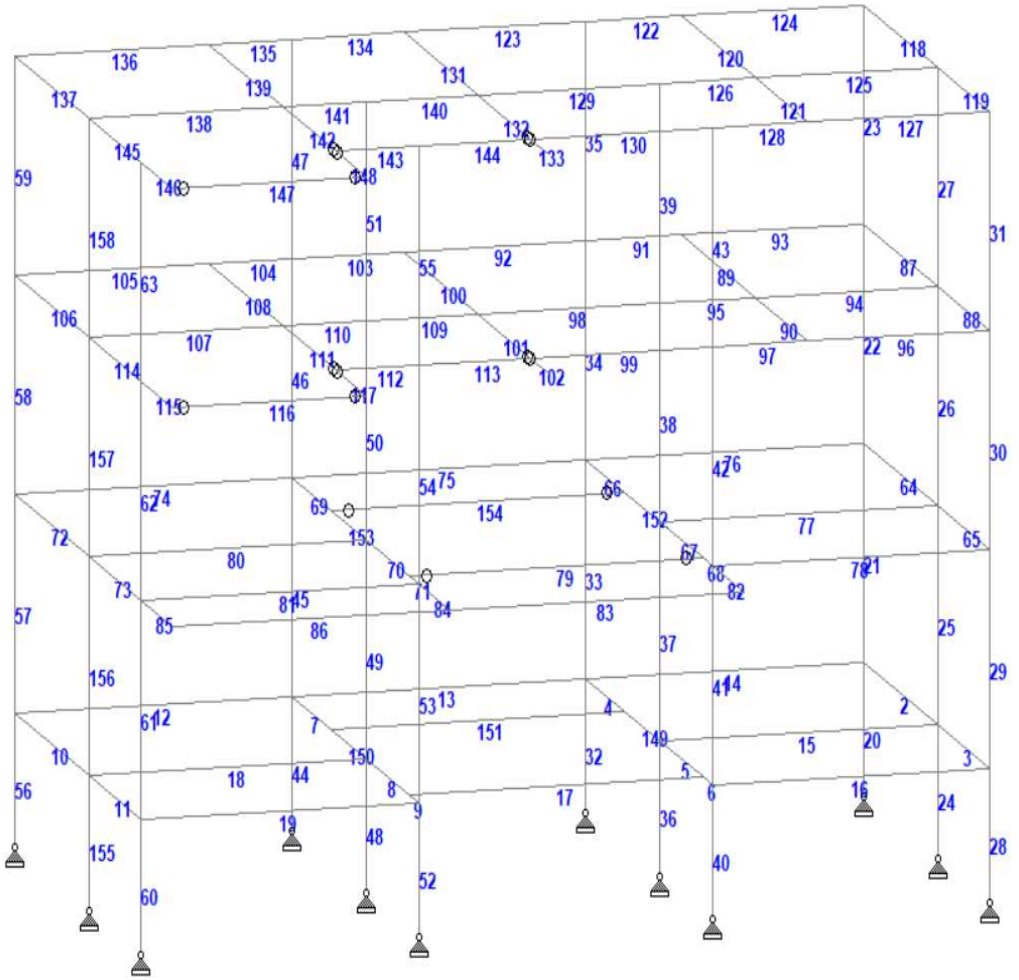
- R.C.C Multi-Story residential buildings
- Commercial buildings
- Individual Houses
- Factory buildings
- Other R.C.C Structures
- Design of steel structures
- Telecom towers
- Substation Structures

ARCHITECTURAL PLAN AND COLUMN PLACEMENT

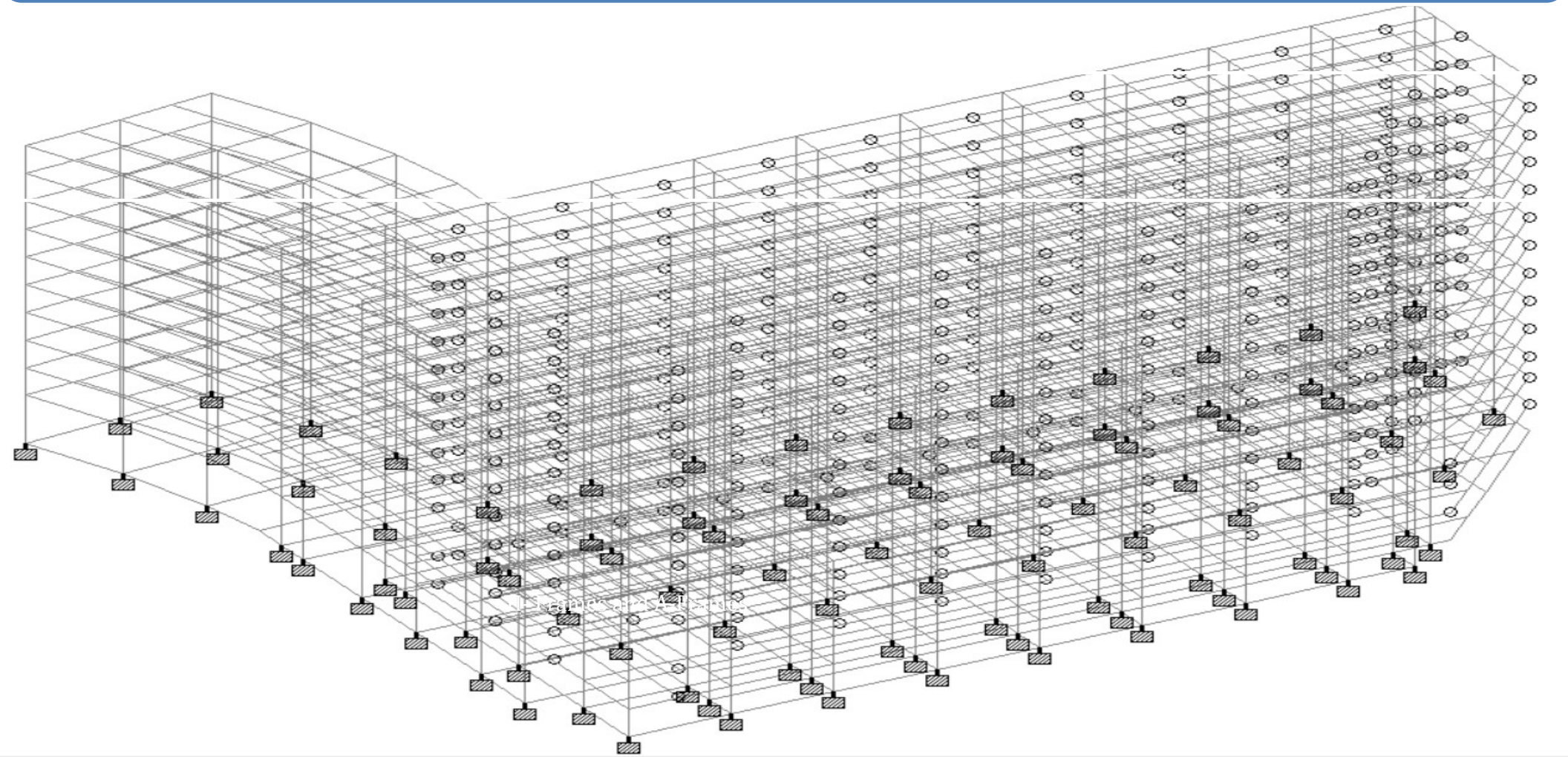


PREPARING STAAD MODEL

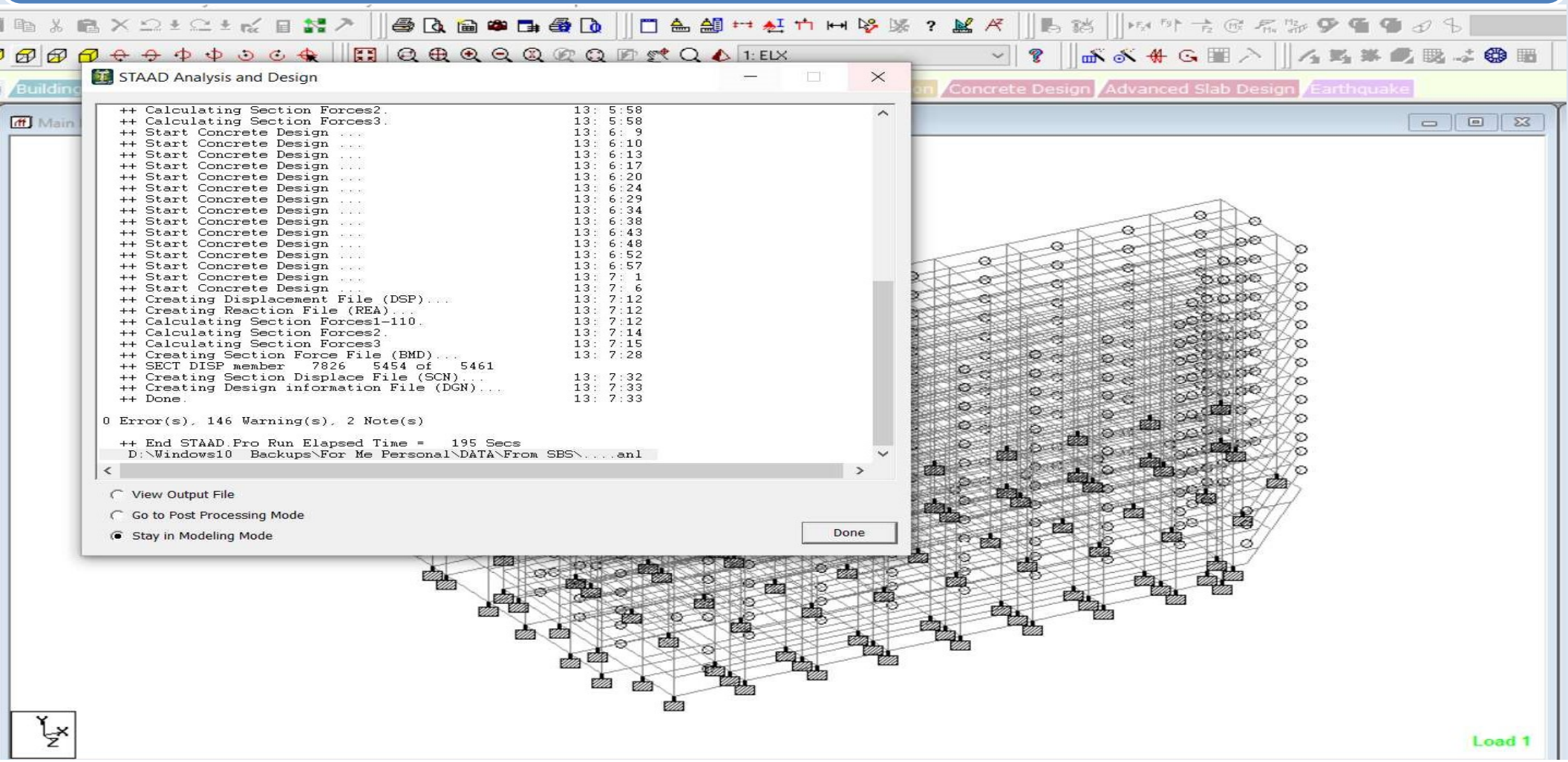




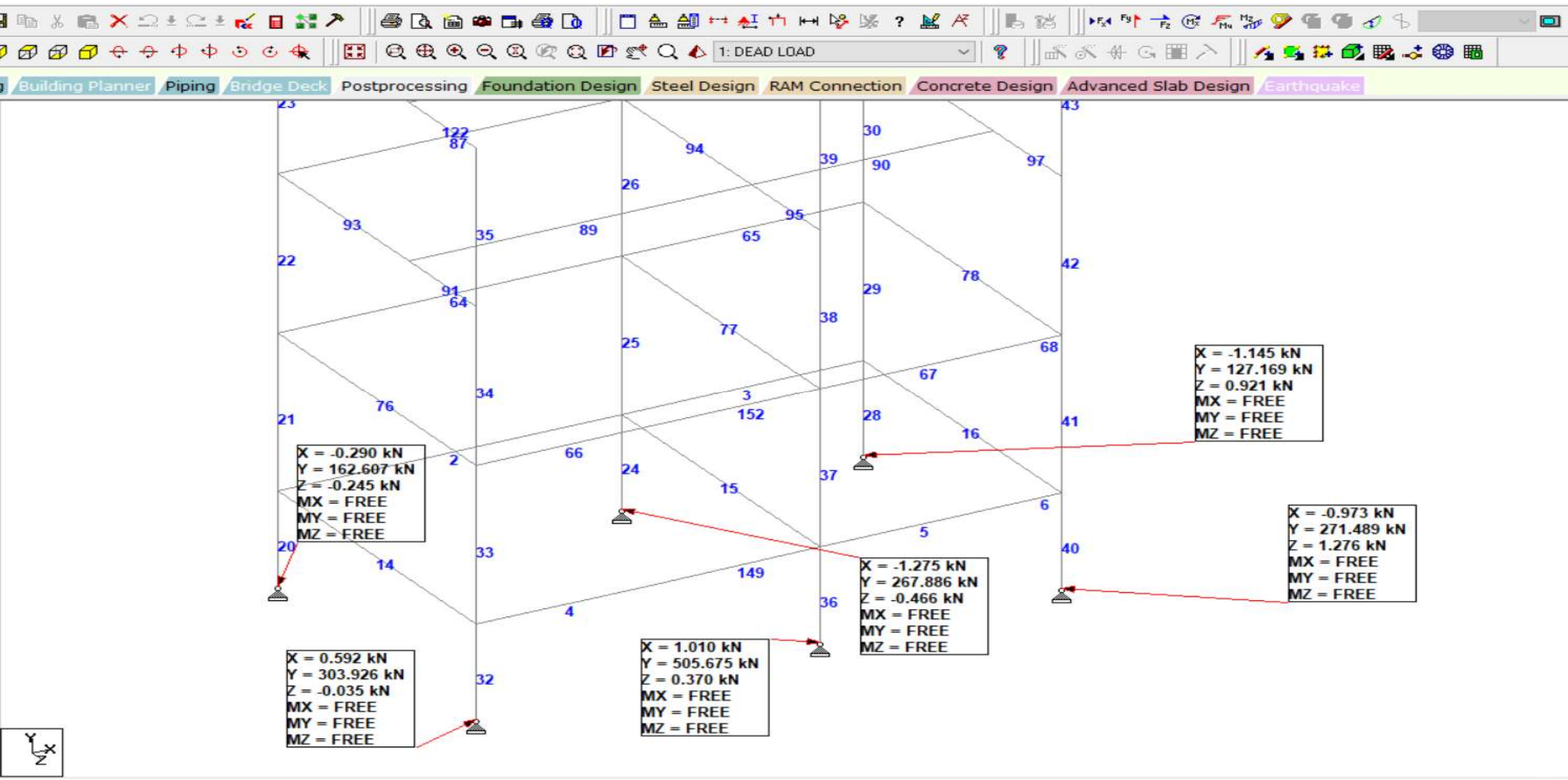
PREPARING STAAD MODEL



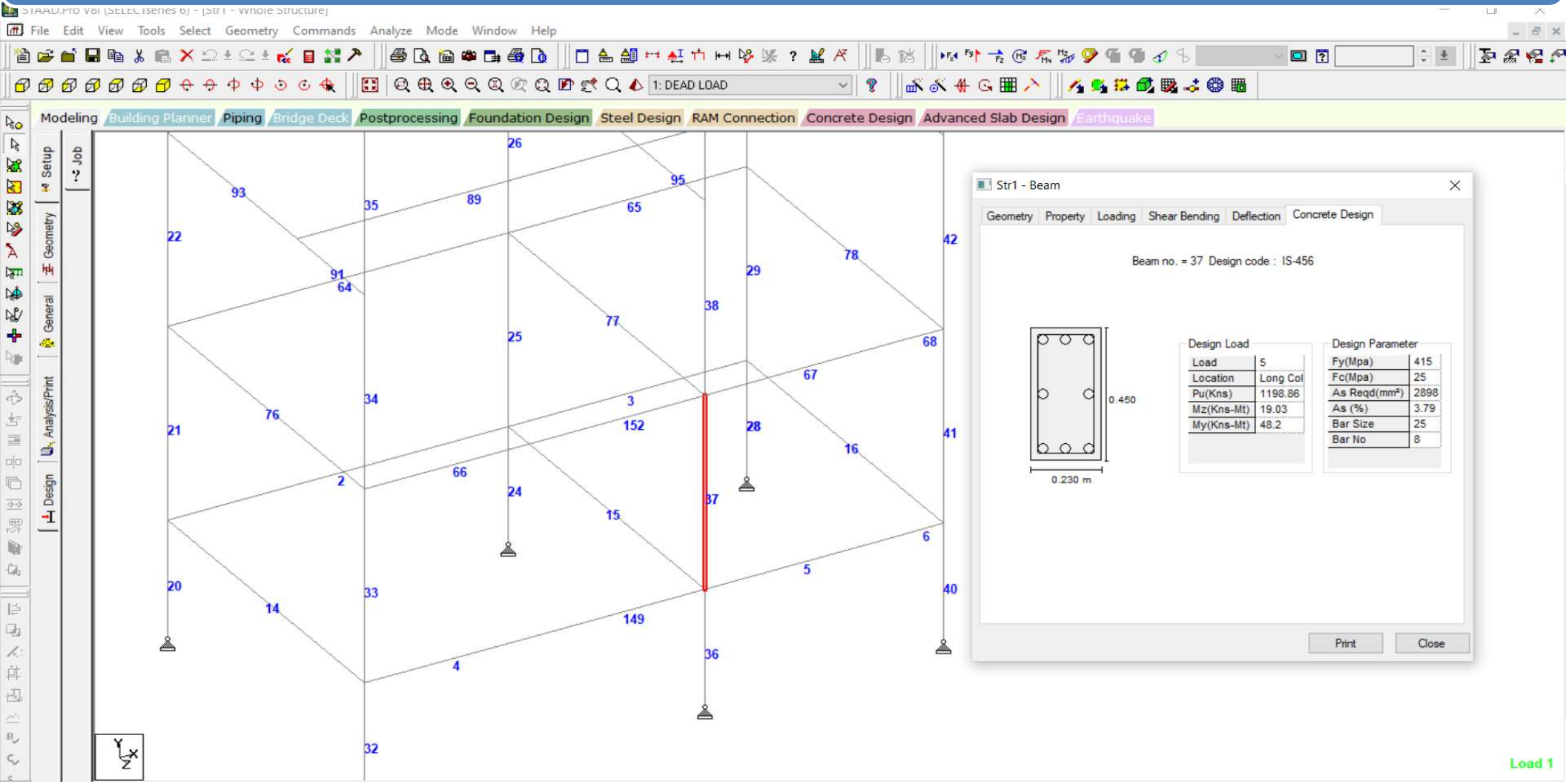
STAAD MODEL ANALYSIS



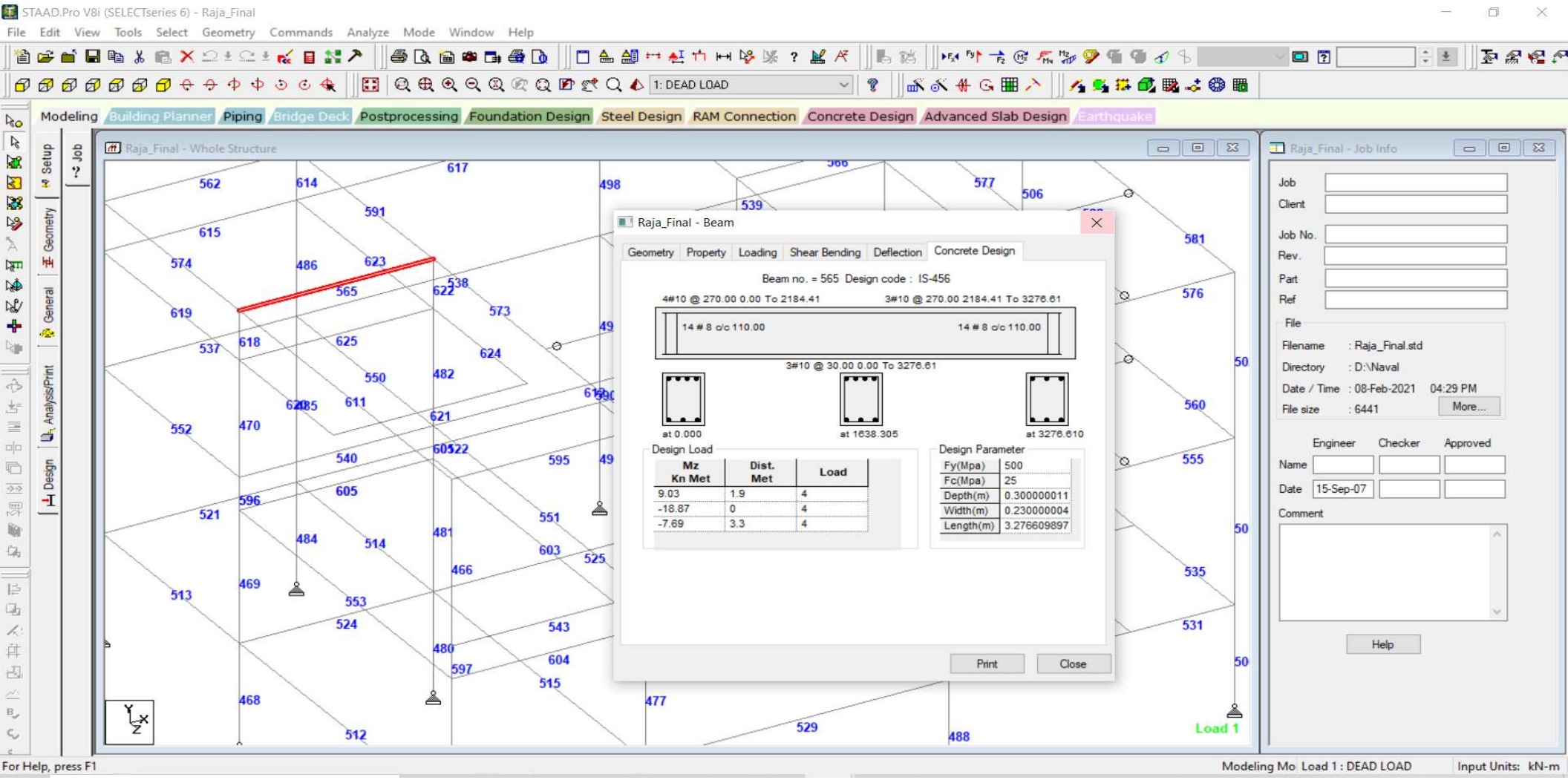
CALCULATION OF FOUNDATION LOADS



DESIGNING COLUMN SIZES AND REINFORCEMENT



DESIGNING BEAM SIZES AND REINFORCEMENT



FOUNDATION SIZE MANUAL CALCULATION

Geometry Of Foundation

Length of Foundation	(l)	=	5.0	m
Width of Foundation	(b)	=	2.8	m
Distance between two pedestal along length	(lp)	=	5.9	m
Distance between two pedestal along width	(bp)	=	0.0	m
Thickness Of slab	(h)	=	0.40	m
Wt Density of soil below fdn. Base		=	18.0	kN/m^3
Net SBC (With Out Wind/Seismic)		=	150.0	kN/m^2
Net SBC (With Wind/Seismic)		=	187.5	kN/m^2
Gross SBC (With Out Wind/Seismic)		=	196.8	kN/m^2
Gross SBC (With Wind/Seismic)		=	234.3	kN/m^2

Length of Pedestal (lc)	=	0.50	m	
Width of Pedestal (bc)	=	0.50	m	
Depth of Fdn. (d)	=	3.0	m	
Ht. of Pedestal above FGL	=	0.3	m	
Wt Density of Concrete	=	25.0	kN/m^3	
Wt Density of soil above fdn.	=	18.0	kN/m^3	

	Node 1 (A1)			Node 2 (B1)		
LOAD COMBINATION	FX (Ton)	FY (Ton)	FZ (Ton)	FX (Ton)	FY (Ton)	FZ (Ton)
101 DL+LL+WLX	4.5	-84.0	0.0	4.5	178.0	0.0
103 DL+WLX	4.0	-50.0	0.0	4.0	78.0	0.0

Foundation area	=	14	m^2
Section Modulus Zxx	=	6.53	m^3
Section Modulus Zzz	=	11.67	m^3
Foundation Wt	=	140	kN

FOUNDATION SIZE MANUAL CALCULATION

Design for bottom reignforcement

$\frac{Mu}{bd^2}$ = 0.00 N/mm^2 Pt required = 0.08 Ast required = 5.41 cm^2

Therefore provide = 6 number of 16 dia bars

Area of steel provided = 12.07 cm^2

CHECK FOR SHEAR

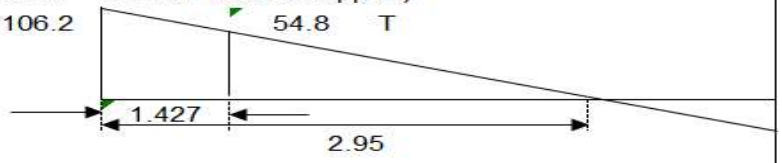
V_{max} = 118.8 - 36 x (0.35 + 1.127 + 0.3) = 54.8 T (at d = 1.127 m from face of support)

$\tau_v = \frac{Vu}{bd}$ = 1.22 N/mm^2

τ_c = 0.33 N/mm^2 (Percentage of steel provided = 0.18)

V_{us} = (V_{umax} - τ_c x bd) = 599 KN

$\frac{V_{us}}{d}$ = 5.3 KN/cm

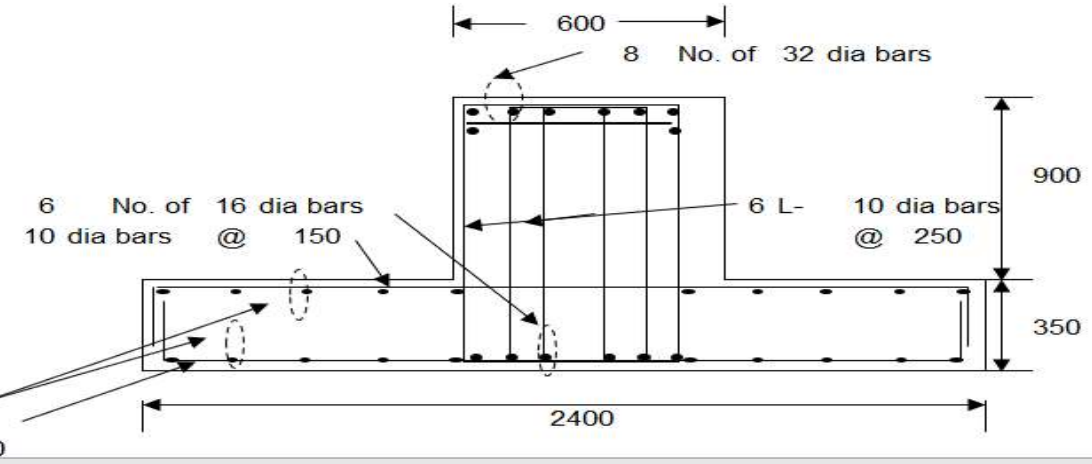


Therefore provide = **10 dia 6 L stirrups @ 250 mm c/c spacing**

V capacity = 0.87 x 415 x $A_{sv\,x}$ d / s_v = 0.87 x 415 x 471 x 1127 / 250 = 767 KN > 599 KN

OK

Therefore provide at top of beam			
Diameter of bar	=	32	mm
Number of bar	=	8	
Therefore provide at bottom of beam			
Diameter of bar	=	16	mm
Number of bar	=	6	
Provid 6 Legged stirrups			
Diameter of stirrups	=	10	mm
Spacing of bar	=	250	mm



COLUMN SIZE MANUAL CALCULATION

Design of Column - C1 (Member No.155. L/C - 103-SL+SELF+DL+LL)

Size of Colum

Breadth b	=	350	mm	
Depth D	=	350	mm	
Unsupported Length of column = lx	=	4.5	m	
Unsupported Length of column = ly	=	4.5	m	
Grade of concerte fck	=	25	N/mm^2	
Grade of Steel fy	=	500	N/mm^2	
Factor of safety	=	1.50		
Axial load Pu	=	13.00	t	
Moment My	=	1.05	t-m	
Moment Mz	=	1.02	t-m	
Factored load Pu	=	1.5 x 13		
	=	**19.50**	t	
Factored moment Muy	=	1.5 x 1.05		
	=	**1.58**	t-m	
Factored moment Muz	=	1.5x1.02		
	=	**1.53**	t-m	

Lex/D	=	4.5/0.35	
	=	12.857	So column is slender column in this axis
eax/D	=	0.083	[Refer Table 1 (Clause 3.4),page- 106 : SP – 16)]
Ley/b	=	4.5/0.35	
	=	12.857	So column is slender column in this axis
eay/b	=	0.083	[Refer Table 1 (Clause 3.4),page- 106 : SP – 16)]

So Additional Moment My	=	19.5x0.083x0.35	
	=	0.57	t-m
So Additional Moment Mz	=	19.5x0.083x0.35	
	=	0.57	t-m

Net moment :	=	1.58+0.57		
Muy	=	2.15	t-m	
	=	1.53+0.566		
Muz	=	2.10	t-m	
	=	4	Nos	20 mm dia Ba (Area= 12.57 cm^2)
Percentage of reinf Provided	=	1.03	%	
Provided Reinforcement is Enough				
Puz/A	=	**16**	N/mm^2	
		(Refer Chart 63 after knowing reinforcement % and Fy)		
Puz	=	16x350x350/1000		
	=	1960	t	
Pu / Puz	=	19.5/1960		
	=	0.01		
pt / fck	=	1.03/25		
	=	**0.041**		
Pu / fckbD	=	19.5x10000/(25x350x350)		
	=	**0.064**		
$Mux1/FckbD^2$	=	**0.07**		
	=	0.14		

(Refer Chart 49 depending upon d'/D ratio), d'/D

Mux1	=	0.07x25x350x350x350/1000000	
	=	75.03125	kN-m
$Muz1/FckbD^2$	=	**0.07**	
	=	0.14	

(Refer chart 49 depending upon d'/D ratio), d'/b

Muz1	=	0.07x25x350x350x350/1000000	
	=	75.03125	kN-m
Mux/Mux1 + Muy / Muy1	=	2.15/75.03125 + 2.096/75.03125	
		0.566 < **1**	
		THE DESIGN IS SAFE	

BEAM SIZE MANUAL CALCULATION

Design of Beam - RB3

Datas From Staad output file: Member No :	16		
Worst Load case considered for design :	103		
Bredth of beam	=	250	mm
Depth of beam	=	500	mm
Max.Support B.M (At Top)	=	5.16	t-m
Max.B.M (At Bottom)	=	10.86	t-m
Shear	=	7.65	t
Load factor	=	1.2	
Assume Dia of Bar	=	16	mm
Clear cover	=	50	mm
Effective Depth = d	=	442	mm
fck	=	25	N/mm^2
fy	=	500	N/mm^2

For Support Moment At Top :

Mu	=	6.192	t-m
Mu / bxd^2	=	1.268	
(From SP-16) Pt	=	0.311	%
Ast Required (Pt/100)x(bxD)	=	388.75	mm^2
Ast Required	=	3.89	cm^2
Provide	**3**	**Nos**	**16** mm
Area of reinforcement provided at top	=	6.04	Cm^2

Provided Reinforcement is Enough

For Moment At Bottom :

Mu	=	13.032	t-m
Mu / bxd^2	=	2.669	
(From SP-16) Pt	=	0.717	%
Ast Required (Pt/100)x(bxD)	=	896.25	mm^2
Ast Required	=	8.96	cm^2
Provide	**5**	**Nos**	**16** mm
Area of reinforcement provided at top	=	10.06	Cm^2

Provided Reinforcement is Enough

Check for Shear :

Actual maximum Shear = Vu	=	9.18	t
Assuming to provide 2 10 mm Dia stirrups @		200	mm c/c
Vus/d	=	2.836	kN/cm

[Refer table 62 , SP 16] For fe = 415 N/mm^2

Shear Strength Taken by Vertical Stirrups	=	125.352	kN
Vus	=	12.536	t
Percentage of tension Reinforcement	=	0.717	
Shear Strength taken by concrete = Tc	=	0.45	%

[Refer table 61 , SP 16] For fck = 25 N/mm^2

Tc= Vu/bd

Vu = 0.45x b xd	49725	N
Vuc	4.9725	t
Total Allowable Shear	17.5085	t

All. Stress is > Act. Stress so Safe

SLAB DESIGN CALCULATION

Design of Two Way Slab :

Slab Size:

Slab End condition :		Interior Panels	
Size of slab :			
Ly	=	6	m
Lx	=	5	m
		Ly/Lx =	1.20
Designing as a		Two way slab	

Materials :

Grade of Concrete = fck	=	25	N/mm^2
Grade of steel = fy	=	415	N/mm^2
Overall depth of slab = D	=	140	mm
Clear cover to reinforcement	=	20	mm
Bar diameter considered = ø	=	12	mm
Effective depth = d	=	114	mm

Loads :

Slab Dead Load	=	3.5	kN/m^2
Floor Finishes + Plastering	=	1	kN/m^2
Live load	=	2	kN/m^2
Total Load = W	=	6.5	kN/m^2
Factor of Safty	=	1.5	
Design Load (W*1.5) = Wu	=	9.75	kN/m^2
Moment Wu*Lx^2 = Mux	=	243.8	kN-m

Short Span (lx) :	άx	άx*Mu (kn-m	άx*Mu/b*d'	pt(%)	Ast req.(mm^2)
Support (-ve Mu)	0.043	10.481	0.806	0.232	265
Span (+ve Mu)	0.032	7.800	0.600	0.171	195

In Support Provide	8	mm Dia bar @	200	mm c/c	251 mm^2
In Span Provide	8	mm Dia bar @	200	mm c/c	251 mm^2

Provided Reinforcement is Not Enough

Long Span (ly) :	άy	άy*Mu (kn	άy*Mu/b*	pt(%)	Ast req.(mm^2)
Support (-ve Mu)	0.032	7.800	0.600	0.171	195
Span (+ve Mu)	0.024	5.850	0.450	0.127	145

In Support Provide	8	mm Dia bar	200	mm c/c	251 mm^2
in Span Provide	8	mm Dia bar	200	mm c/c	251 mm^2

Provided Reinforcement is Enough

Checks :

1) For Deflection

Actual Lx/d	=	43.86	mm	
Percentage of tension reinforcement Pt	=	0.23	And fck =	25 N/mm^2
Allowable L/d	=	25		(From SP:16, Chart -22)
Fs =(0.58*fy*Ast Req/Ast. Prv.) Fs	=	179.087	N/mm^2	
Modification Factor =M.F	=	2		(From IS:456-2000,Fig:4)
Permissible L/d = (M.F x Allowable L/d)	=	50	mm	Safe in Deflection

2) Effective depth required for bending =

3) For Craking

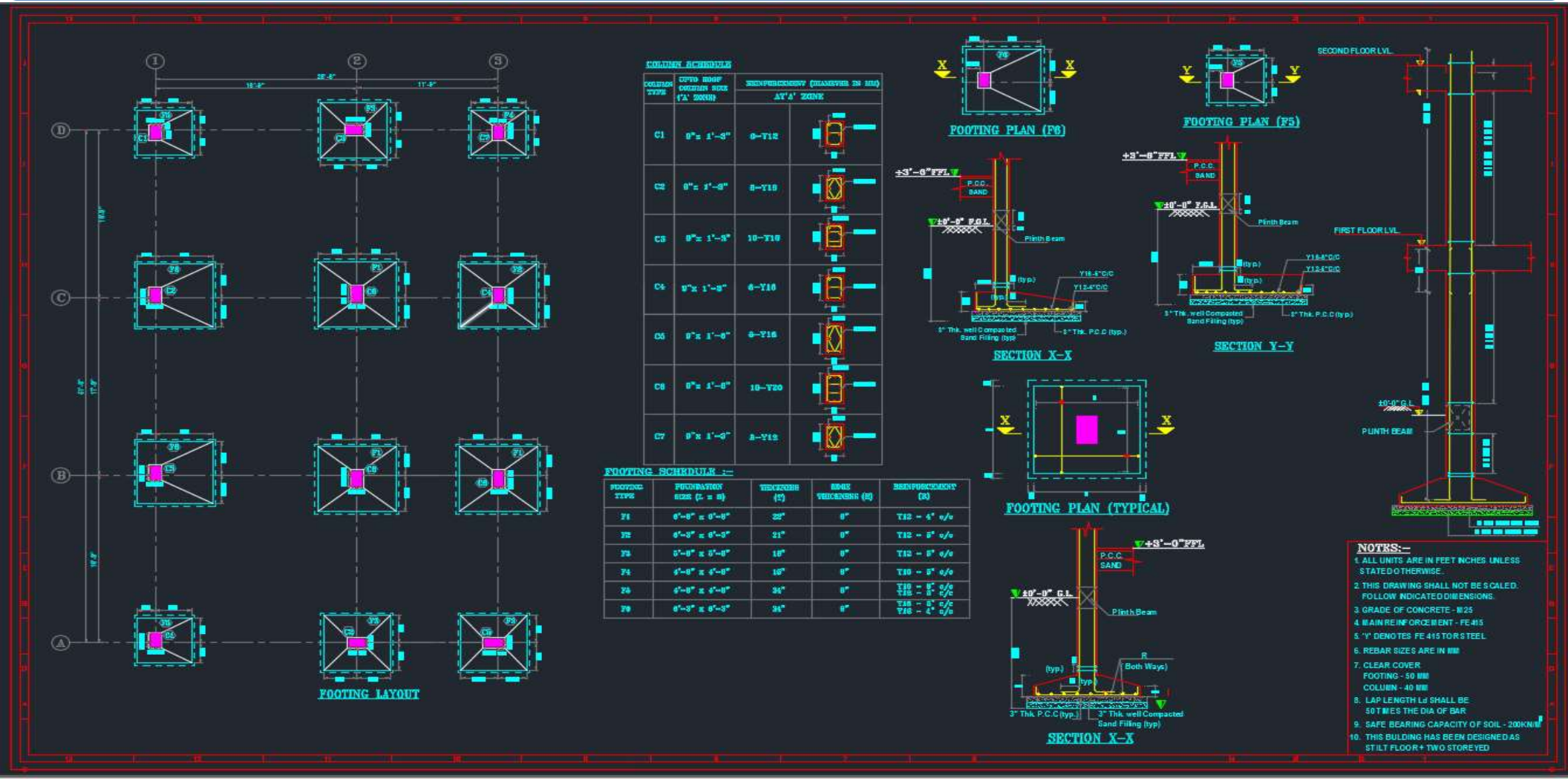
Ast Provided	=	0.299	%	Ast prov. is > 0.12% So Safe

Spacing of Steel

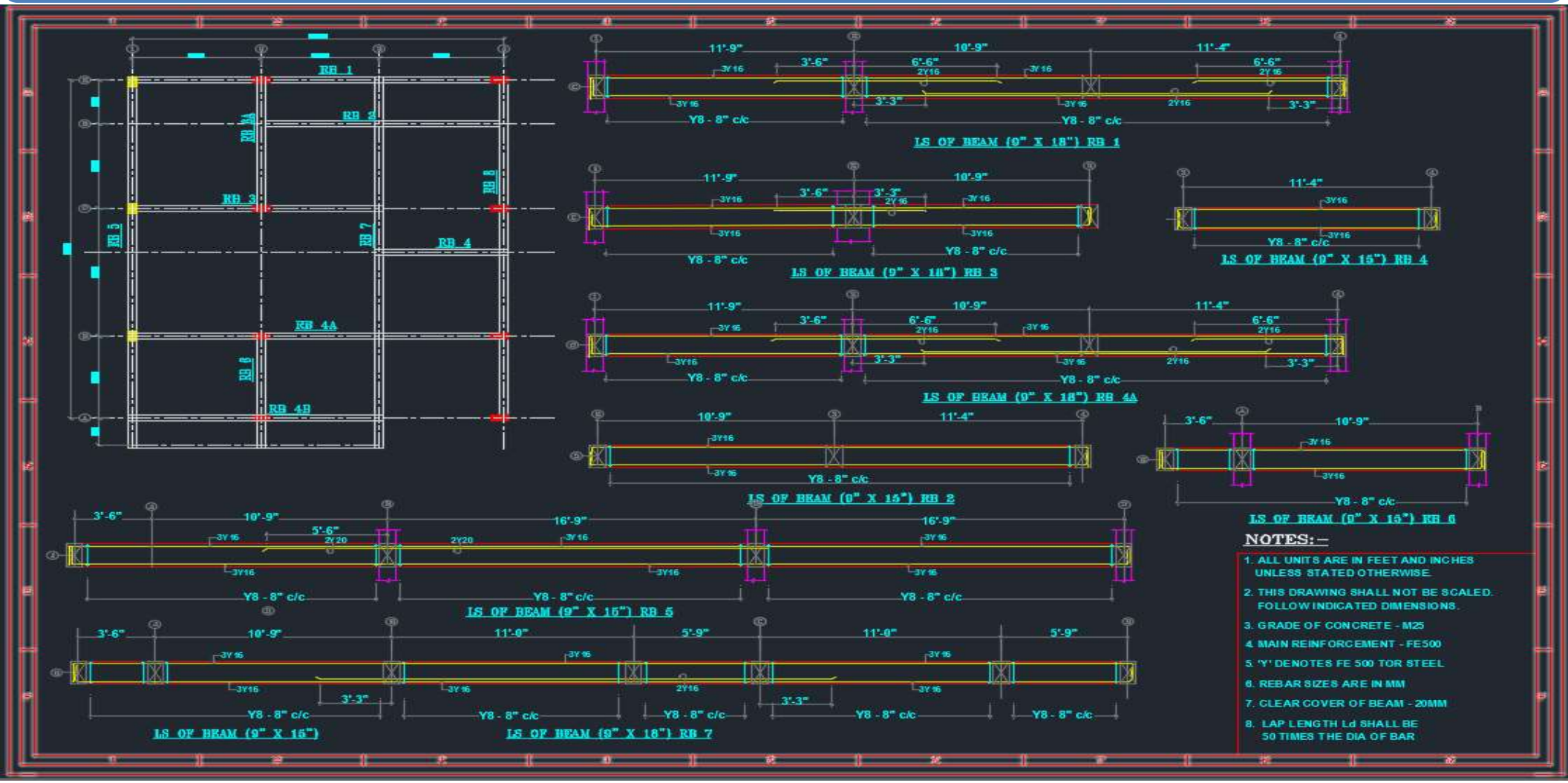
Reinforcement in lx	=	200	mm	<= (3*d or 300, Safe)
Reinforcement in ly	=	200	mm	<= (5*d or 450, Safe)
Dia of Steel	=	12	mm	< D/8, Safe

F1 | Com-(-ve) (2) | Footing | Column | Beam | 2 Way Slab | 1 Way Slab

SAMPLE R.C. DRAWING FOR FOOTING AND COLUMN



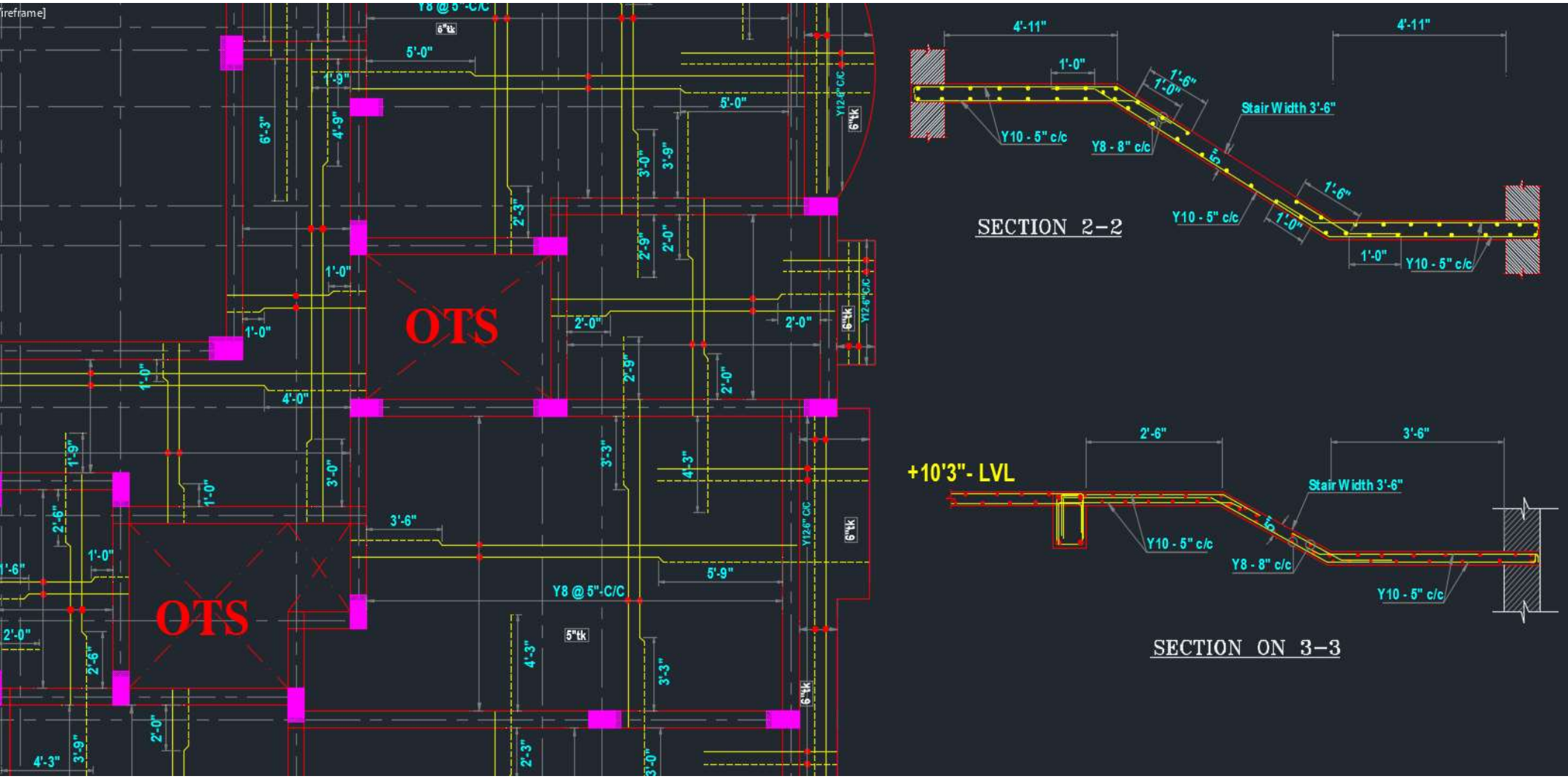
SAMPLE R.C. DRAWING FOR BEAM



NOTES:–

1. ALL UNITS ARE IN FEET AND INCHES UNLESS STATED OTHERWISE.
2. THIS DRAWING SHALL NOT BE SCALED. FOLLOW INDICATED DIMENSIONS.
3. GRADE OF CONCRETE - M25
4. MAIN REINFORCEMENT - FE500
5. 'Y' DENOTES FE 500 TOR STEEL
6. REBAR SIZES ARE IN MM
7. CLEAR COVER OF BEAM - 20MM
8. LAP LENGTH Ld SHALL BE 50 TIMES THE DIA OF BAR

SAMPLE R.C. DRAWING FOR ROOF SLAB



Thank You

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