PLANNING, ANALYSIS AND DESIGN OF A FOOD COURT

A PROJECT REPORT

Submitted by

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In partial fulfillment for the award of the degree of Bachelor of Engineering in Civil Engineering of Anna University

DEPARTMENT OF CIVIL ENGINEERING

KUMARAGURU COLLEGE OF TECHNOLOGY

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BONAFIDE CERTIFICATE

Certified that this project titled " **Planning, Analysis & Design Of a Food court for ESE – Larsen & Toubro**" is the bonafide work of **Aishwarya.K, Jayashree.V, Shenbagarani.S**" who carried out the project work under our supervision.

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We place on record our sincere thanks to our guide, **Mr.R.Elangovan**, Senior Lecturer, Department of Civil Engineering, for his valuable guidance, immense efforts and perennial encouragement in bringing out this meritorious volume amidst all his works.

We take this opportunity to thank all the **non-teaching staffs** and **lab staffs**, for their support to our project, with lively help in the laboratory.

Finally, we thank our **parents** for giving us the moral support and abundant blessing in all our activities and to all our **dear friends** who made us endure our difficult times with their unfailing humor and warm wishes.

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SYNOPSIS

SYNOPSIS

The objective of this project is to learn the planning, design and execution of the food court. The project is located at Larsen &Toubro campus, Malumichampatti Coimbatore. The food court is designed to accommodate 300 people at a time.

In this project, we have created a model of the food court using STAAD.Pro. The Structure is L shaped and is so designed to minimize land wastage in the site. The construction of this food court is carried out by using advanced technology and modern materials.

The structure has been raised and completed in a span of 3 months.The quantity estimation and programming of the execution of the design is done using MS Project. The structure is designed considering future expansion.

LIST OF SYMBOLS

The following symbols carrying the meanings noted against them are used in this volume.

A = Area

A_{st} = Area of steel reinforcement

A_g = Gross area of the section

BM = Bending Moment

A_{sv} = C/S area of stirrups

B = Breadth of beam, slab

D = Overall depth of beam or slab

D1 = Depth of footing at the end

D2 = Depth of the footing at the face of the column

B = breadth of column

d = Effective length of beam or slab

d' = Effective cover of beam or slab

f_y = Characteristics strength of steel

f_{ck} = Characteristics compressive strength of concrete

l = length of the beam

l_x = length of shorter span

l_y = length of longer span

l_{ey} = Effective length of slab along longer span

M_x, M_y = Moments on strips of unit width spanning lx & ly

M_{ux}, M_{uy} = Moments about x and y axes due to design loads

M_{ux1}, M_{uy1} = Maximum uniaxial moment capacity for an axial load of Pu

MR = moment of resistance

m = modular ratio

P_u = Axial load on compression member

S_v = Spacing of Stirrups

V = Shaer force

V_s = Design Shear force

W = Total load

α_x = BM co=efficient along shorter span

α_y = BM co=efficient along shorter span

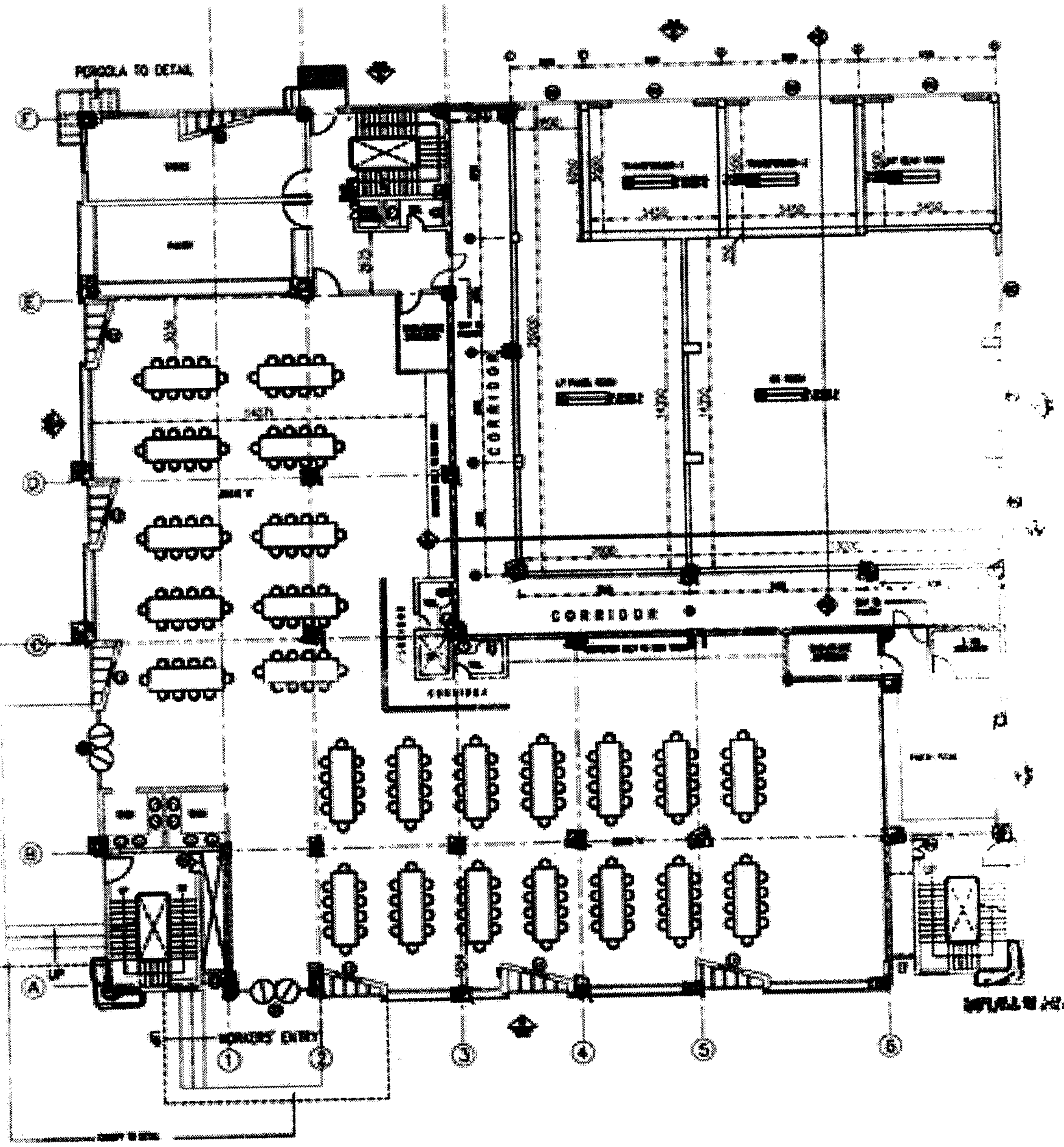
T_v = Shear stresses in concrete (permissible)

T_c = Shear stresses in concrete (maximum)

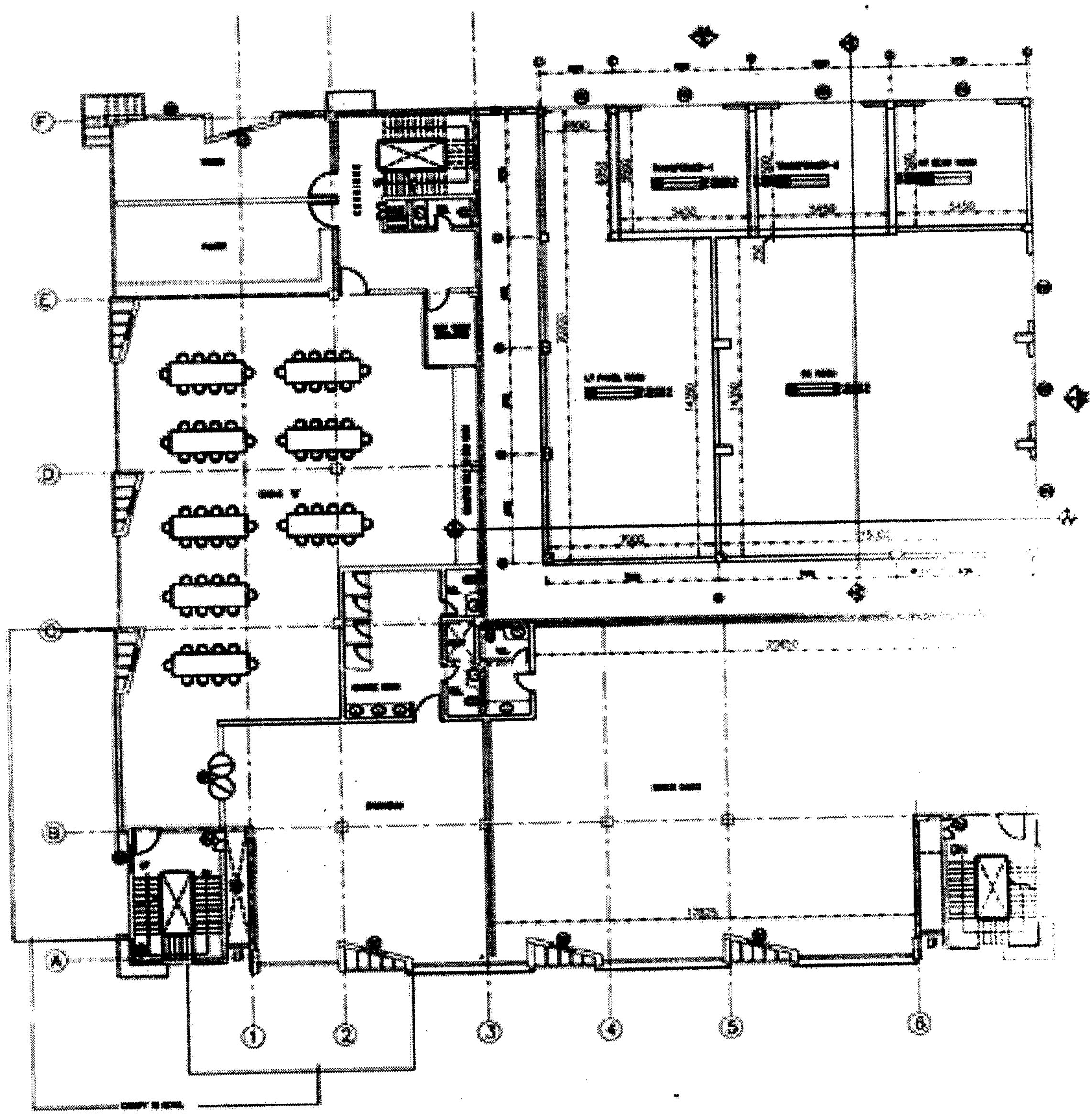
T_{cmax} = Nominal Shear stresses

Fe415= High Yield Strength deformed bars

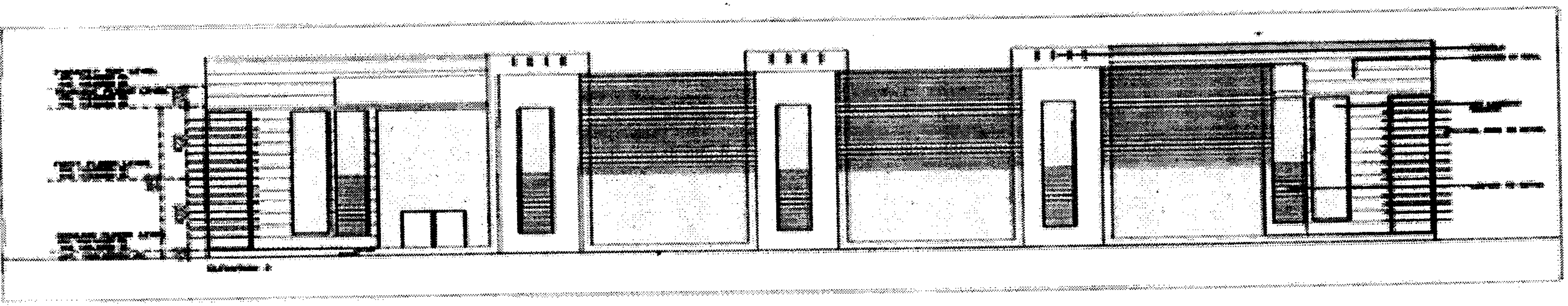
PLAN

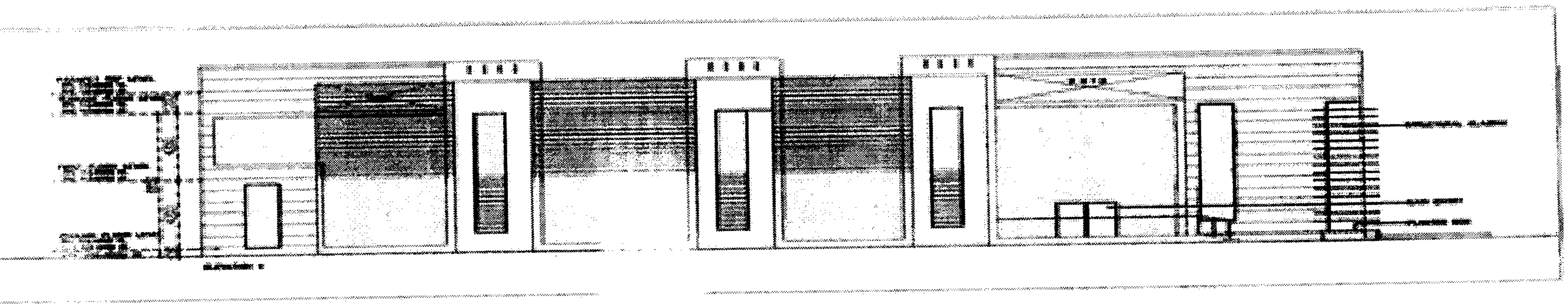


GROUND FLOOR PLAN

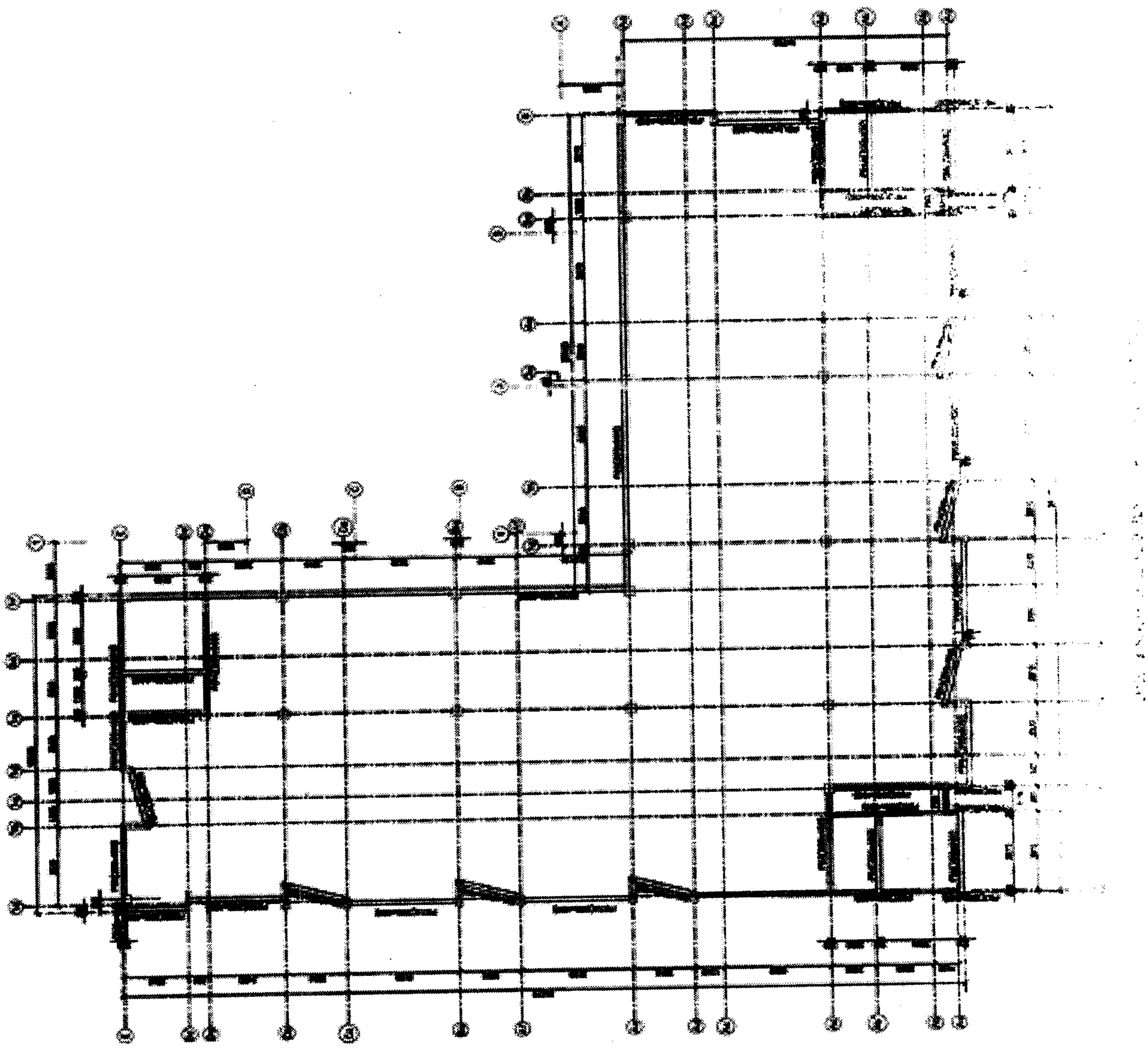


FIRST FLOOR PLAN





ELEVATION



INTRODUCTION

CHAPTER 1

INTRODUCTION

The main objective of this project is to gain knowledge on different phases in the construction of a building such as planning of the project, analysis and design of various structural members, preparation of detailed drawings for execution of the construction works.

Now-a-days food court has gained more popularity and is essential as such due to fast growing employment and unavailability of enough hotels in the city limit.

A food court of G+1 floor has been selected for this project and the complete planning, analysis and design works have been done. The proposed building is located at **Larsen & Toubro project campus, Malumichampatti, Coimbatore**. The food court is designed to accommodate 300 people at a time in both floors with plinth area of each floor as 9.6 billion sq.ft approximately.

The proposed building is a framed structure, which consists of one floor excluding ground. Each floor has dining cum washroom and a pantry with storeroom. The first accommodates gymnasium, indoor games and change room.

The design loads are adopted as per IS 875 – 1987 and the analysis of the

The limit state method of design and analysis has been followed for the components of the building. To implement the advanced technology in construction, the beams and columns have been designed as both RCC and composite sections.

The food court is provided with two staircases, one main staircase and two-fire staircase. The staircase, slabs and footings are designed manually.

SPECIFICATION

Earthwork Excavation:

- Depth of foundation is 1.5m below ground level
- The safe bearing capacity of soil is 200 KN/m^2

Footing:

- The footing with concrete mix M25 and Fe415 grade steel.

Column:

- The column with concrete mix M25 and Fe415 grade steel.

Beam:

- The beam with concrete mix M25 and Fe415 grade steel.

Flooring:

- Provide cement concrete of 1:4:8 mix for a depth of 150mm with cement mortar 1:4
- Floor to floor height = 3.05m

Roofing:

- The roofing slab for all rooms and passage 1:1.5:3 mix having 150mm thickness.

Brickwork:

- All the walls in superstructure will be of I class brick in cement of 1:5 above floor level height of roof is 3m.

- Thickness of partition wall is 140mm.

CHAPTER 2

LOAD CALCULATION

The following two loading conditions are considered

a). Dead Load

b). Live Load is taken in the analysis of the structure.

The loading specifications are taken as per the Indian code BIS 875 -1987

DEAD LOAD:

1. SELFWEIGHT:

   Self weight of slab = .15x25x1 = 3.75 KN/m^2

   Floor Finish = 1.00 KN/m^2

2. WALL LOAD:

   Each Floor = 0.23x1x3.05x22

   = 15.433 KN/m

LIVE LOAD:

As per the code of practice for design loads (other than earthquake) for buildings and structures IS 875 (part 2) – 1987 the imposed load for the food court is taken as 3 KN/m^2.

LOAD COMBINATIONS:

The load combination is taken as

CHAPTER 3

ANALYSIS OF FRAMES

3.1 INTRODUCTION

Analysis has been done for the building frame using STAAD.Pro software; to find out the bending moment, shear force and deflection produced on the members due to the applied loads.

The load combination used in the analysis is

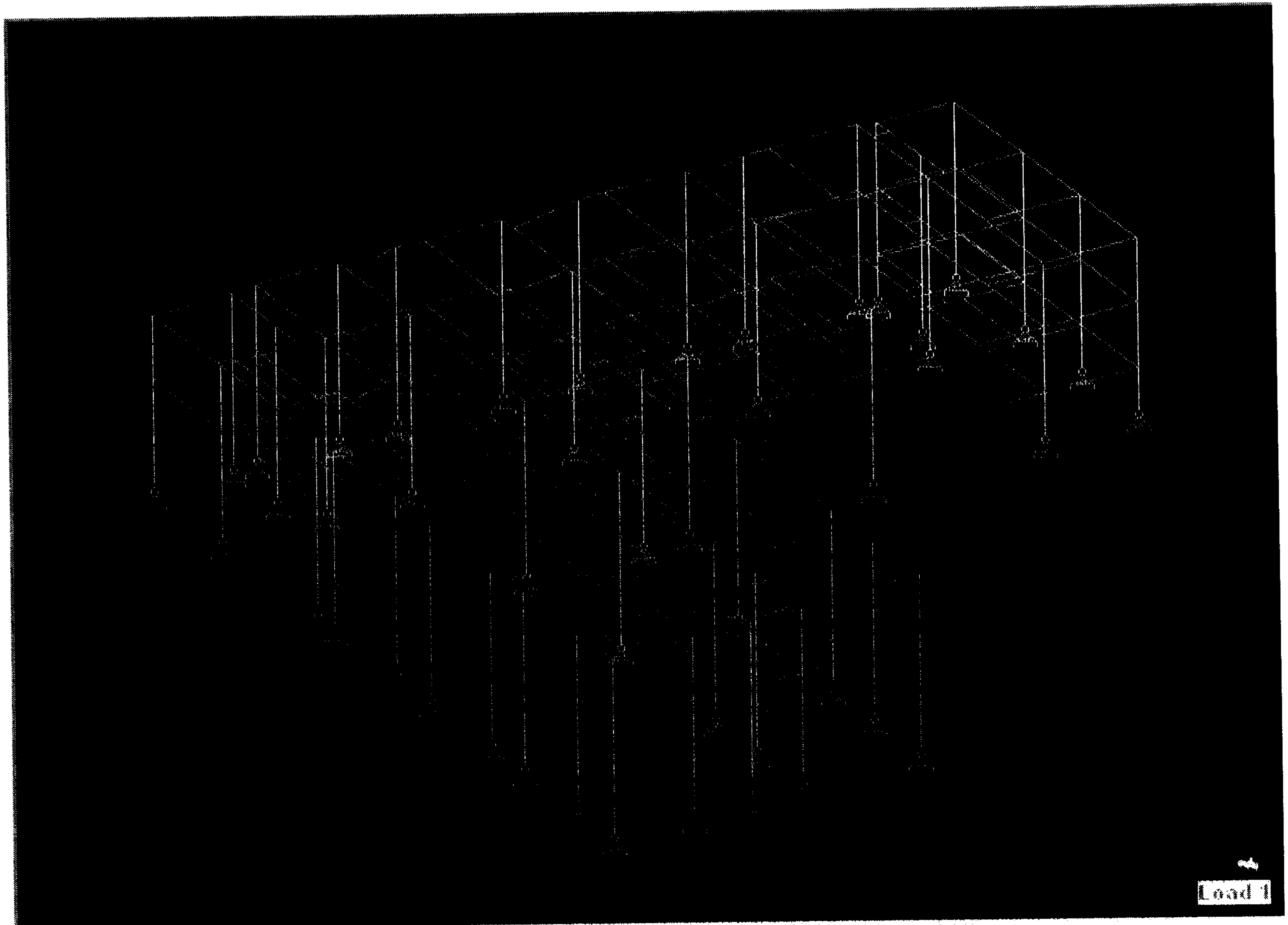
Dead Load + Live Load

The results obtained from the STAAD output have been used for the design of slabs, beams, columns and footings of the building.

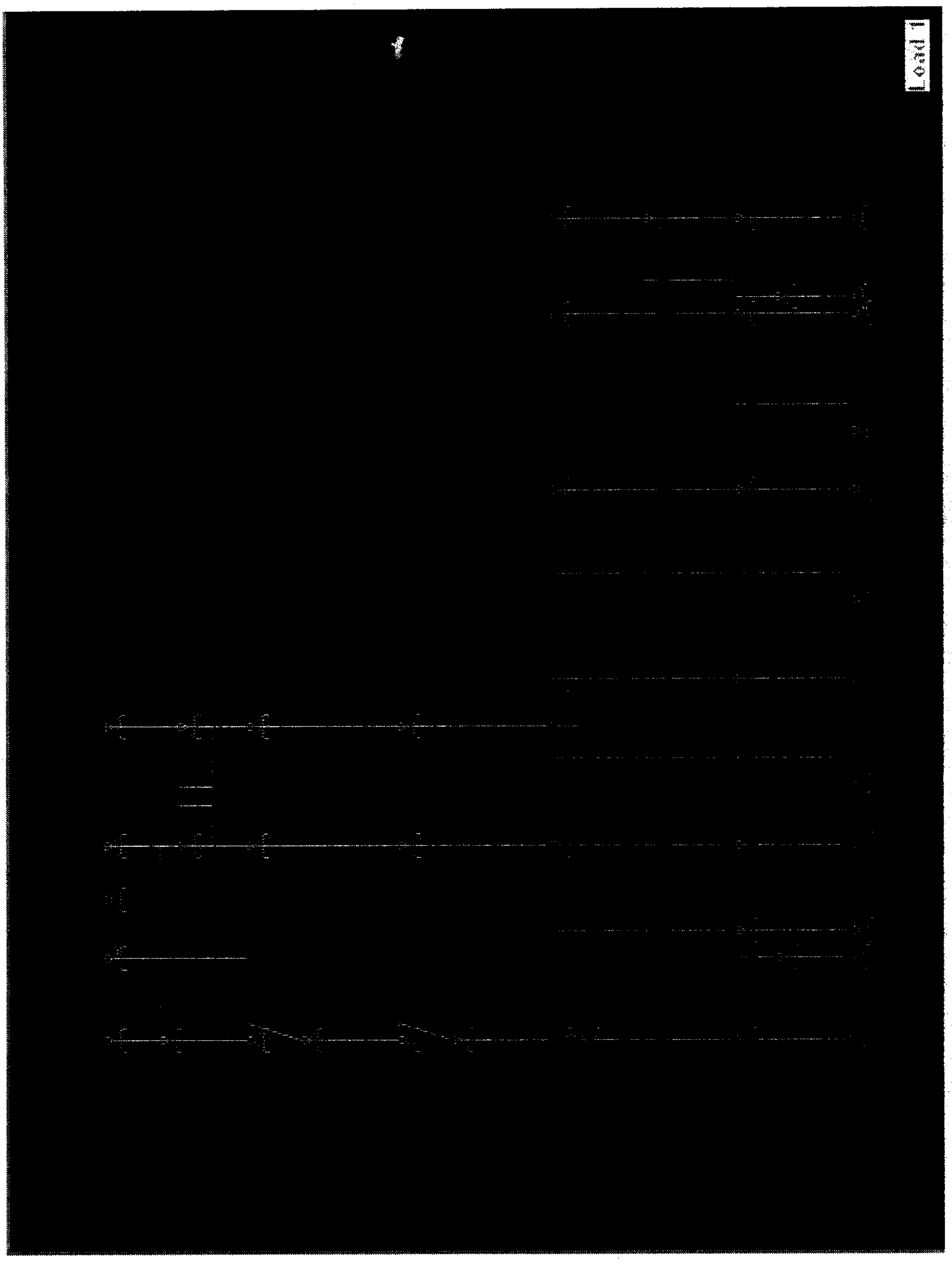
STIFFNESS ANALYSIS

The structure is analysed using the stiffness method. The stiffness analysis implemented in STAAD is based on the matrix displacement method. In matrix analysis of structures by the displacement method, the structure is first idealized into an assembly of discrete structural components. Each component has an assumed form of displacement in a manner, which satisfies the force equilibrium and displacement compact ability at the joints.

Structural systems such as slabs, plates spread footings, etc which transmit loads in two directions have to be discretized into a number of 3 or 4 noded finite elements connected to each other at their nodes. Loads may be applied in the form of uniformly distributed loads on the element surfaces or as concentrated loads at their joints. The plane stress effects as well as the plane



Load 1



CHAPTER 4

STRUCTURAL DESIGN

4.1 INTRODUCTION

The aim of the design is the achievement of an acceptable probability that structures being designed will perform satisfactorily during their intended life. With an appropriate degree of safety, the structure should sustain all the loads and have adequate durability and adequate resistance to the effects of misuse and fire.

4.2 METHOD OF DESIGN

The structures can be designed by the following methods

- Limit State Method
- Working Stress Method
- Load factor Method

In this project, Limit State Method designs all the structural members.

Design of footings is carried out using STAAD.

DESIGN OF SLAB

DESIGN OF SLAB

END CONDITION: Fixed

Rectangular slab: 9m×3.718m

Effective span L_Y=9000m; L_X=3.718m

Ly/Lx = 9.000/3.718 =2.420 > 2

Hence designed as **one-way slab.**

Assume the thickness of the slab as 150mm.

LOADS

Self weight =0.150*1*1*25000=3750 N/m^2

Superimposed load=3000 N/m^2

Finishes =1000 N/m^2

Total load calculated = 7750 N/m^2

Effective Span = 3.718m

Maximum Bending Moment = $wl^2/8$ = 7750*(3.718^2)/8 = 13391.539 N-m

Effective depth d = (M/Qb)^(0.5)

= ((13391.539 * 1000)/(1.11*1000))^(0.5)= 109mm

Depth assumed is safe so provide D= 150mm, d = 130mm

Provide 20mm effective cover to the centerline of steel.

AREA OF STEEL REQUIRED

$$A_{st} = \frac{M}{\sigma_{st} j d} = \frac{13391.539 * 1000}{230*0.904*130} = 495.44 mm^2$$

Assume 8mmϕ bars, Spacing =101.45 mm

So provide 8mm dia @ 100mm c/c.

Max shear force V = wl/2 = 7203.625 N

Nominal shear stress $\tau_v = V_s /bd = 0.0554\ N/mm^2$

$P_t = (A_{st}*100)/bd = 0.38\ N/mm^2$

Nominal shear stress < Permissible shear stress

DISTRIBUTORS:

0.12% C/S area = 156mm^2

Assume 6mmϕ bars,

Spacing = 181.24mm

So provide 6mm dia @ 180 mm c/c.

CHECK FOR DEFLECTION:

$L_{eff}/d = 3718/130 = 28.6$

Basic Value = 20

From fig 2 in IS 456 – 2000 Modification Factor = 1.62

So allowable deflection = 20*1.62 = 32.4 > 28.6

CHECK FOR END ANCHORAGE /DEVELOPMENT LENGTH:

$L_d = (\phi * \sigma_s) / (4 * \tau_{bd}) = 706.3$ mm

$(M_1/V) + L_0 = 876$mm

$L_d < (M_1/V) + L_0$

So it is safe.

DESIGN OF BEAM

DESIGN OF BEAM

Total load on the beam=3000N/m

Span of the beam= 9.255m

LOAD CALCULATIONS

Self weight of the slab=0.150*25000=3750 KN/m^2

Floor finish =1000 KN/m^2

Live load = 3000 KN/m^2

Weight of partitions =1000 KN/m^2

Total load = 8750 KN/m^2

Maximum bending Moment =$wl^2/8$=(8750*9.255^2)/8 =93685.184N-m

Taking width of the beam as b = 300mm

Assume the section to be balanced

Moment of resistance=Qbd^2

D=√ (M/bQ)=√(8750/(300*1.106))=513.5

Provide overall depth D = 750mm

Provide beams of size 300×750mm

For Fe415 $x_{u,max}/d = 0.48$

$M_{u,lim} = 0.36*0.48(1-0.42*0.48)*300*410^2*25$= 115.96 Kn – m

$$M_u < M_{u,lim}$$

AREA OF STEEL REQUIRED A_{st}:

$93.68*10^6 = 0.87*415* A_{st}*410[(1- A_{st}415)/(300*410*25)]$

$A_{st} = 573\ mm^2$

Provide 5 numbers of 12mm φ bars.

CHECK FOR SHEAR:

$V_u = 20$ KN

$\tau_v = 0.243\ N/mm^2$

$\tau_{c,max} = 3.1\ N/mm^2$

% Of steel = 0.63

$\tau_c = 0.51\ N/mm^2$

$\tau_v > \tau c$ so provide shear reinforcement.

$V_{us} = V_u - \tau_c bd$

= 19790.9 N

$S_v = (0.87*415*226*410)/19790.9$

= 117mm

Max Spacing = 0.75*d = 0.75*410 = 307.5mm

Provide 2 legged 12 mm φ stirrups from face of supports @ 150 mm c/c gradually increased to 200 mm c/c upto distance of 1m & thereafter 8 mm φ 2 legged stirrups @ 200 mm c/c.

CHECK FOR TORSION:

$T_u = 65KN - m$

Equivalent shear:

$V_e = V_u + 1.6\ T_u/b$

$= 600$ KN

Equivalent nominal shear stress:

$\tau_{ve} = V_e/bd$

$= 0.732\ N/mm^2$

$\tau_{c,max} = 3.1\ N/mm^2$

%st = 1

$\tau_c = 0.64\ N/mm^2$

$\tau_c < \tau_v$

Hence longitudinal and transverse reinforcement are to be designed.

$M_{el} = 17*10^6 + (5*10^6/1.7) *(1+450/200)$

$= 64$ KN – m

$M_{el}/bd^2 = 64*10^6/(200*410^2) = 1.67\ N/mm^2$

$P_t = 0.505\%$

$A_{st} = 0.505*300*410/100 = 622\ mm^2$

Provide 4 numbers of 16 mm φ on flexural tensile face.

TRANSVERSE REINFORCEMENT:

$A_{SV} = T_u S_v / b_1 d_1 0.87 f_y + V_u S_v / 2.5 d_1 0.87 f_y$

$A_{sv}(0.87 f_y)/S_v = 6*10^6/220*372 + 87*10^3/2.5*372$

$S_v = 340$ mm

CHECK FOR SPACING OF SHEAR STIRRUPS:

$x_1 = 246$ mm

$y_1 = 396$ mm

i) $x_1 = 246$ mm

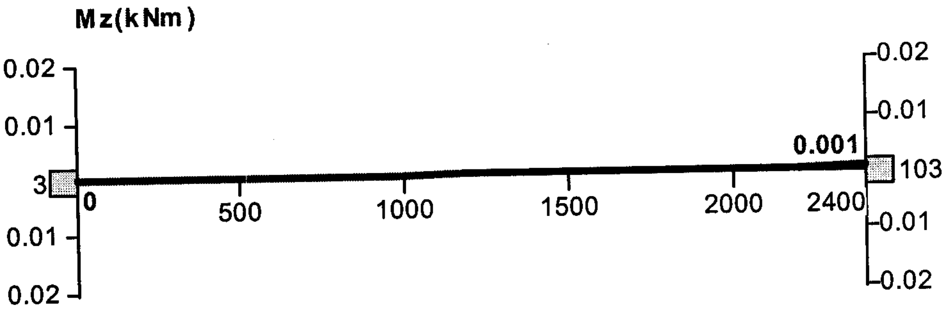
ii) (X1 + y1)/4= (246+396)/4 = 160.5 mm

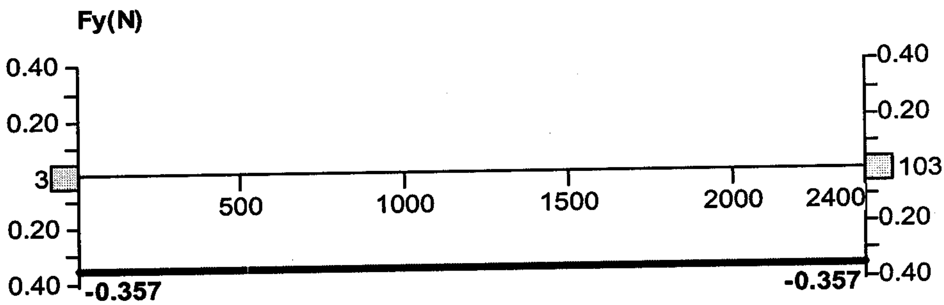
iii) 300 mm

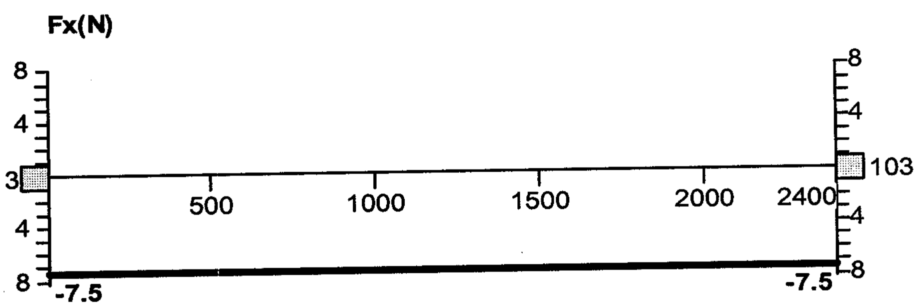
Hoop stirrups 2 legged 10 mm φ are provided @ 150 mm c/c throughout.

Hence safe

BEAM DESIGN STD – GRAPHS:







DESIGN OF COLUMN

DESIGN OF COLUMN

The column is designed with axial load and biaxial bending.

LOAD CALCULATION

Load from roof slab of top floor= 9*3.718*0.15*25=125.48KN

Live load+ weathering course on roof slab=(9*3.718)*(3+1)=133.848KN

Weight of wall in each storey = 0.23*3.05*(9*3.718)*25=586.83KN

Weight of beams in each storey = 0.23*0.45*(9*3.718)*25=86.583KN

Weight of floor slab in each storey =(DL +Floor finish+partitions +LL)

9*3.718*(0.15*25+1+1+3)=292.79 KN

Total load=1225.531KN

Assume 10% as self weight

Therefore total load =1348.0841KN

Factored load P_u=1.5*1348.0841=2022.12615KN

Assume area of steel=A_{st}=2% of Ag

Where A_g – gross area of column section

Therefore. Area of concrete =A_C =A_g –0.02A_g

A_C =0.98A_g

P_u= 0.4 f_{ck} A_c +0.67f_y Ast

$2022.1261*10^3$ =0.4*25*0.98Ag+0.67*415*0.02Ag

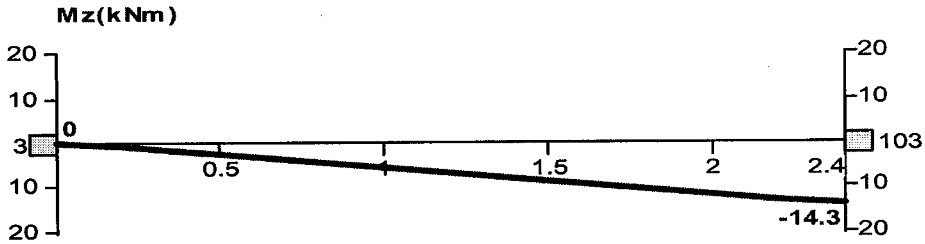
$Ag=131640.26mm^2$

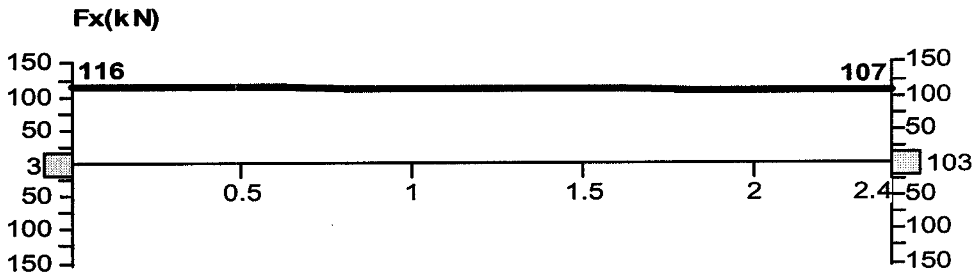
Assume B=300mm

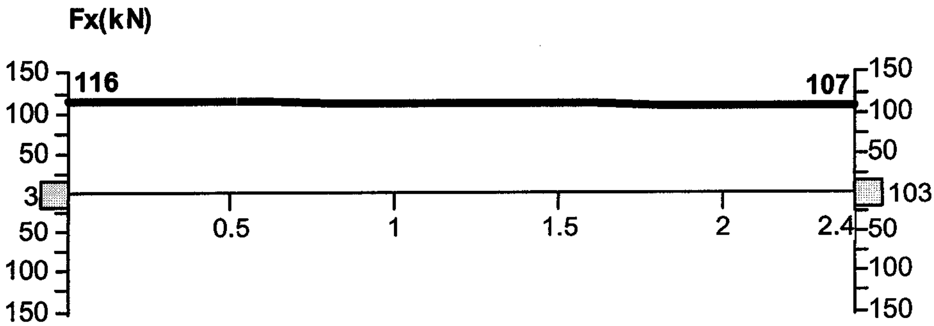
D=131640.26/300=438.80mm

Provide columns of size 450*450mm

COLUMN DESIGN STD – GRAPHS:







DESIGN OF STAIRCASE

DESIGN OF STAIRS

Assume the thickness of waist slab=200 mm

Rise of step=150mm

Tread =275mm

Width of stairs=1m

Self weight of slab / horizontal meter run $= \frac{1*0.2*25000}{\text{Cos}\theta} = 5696.1\ \text{N/m}^2$

Weight of steps/ horizontal meter run $= 0.5*0.275*\frac{0.15*1*25000}{0.275} = 1875\ \text{N/m}^2$

Weight of finishes $=1000\text{N/m}^2$

Total dead load $= 8571.1\ \text{N/m}^2$

Since the stairs are liable to overcrowding, Live load $=5000\text{N/m}^2$

Total load $=13571.1\ \text{N/m}^2$

Taking total load $= 14000\ \text{N/m}^2$

FLIGHT A

Flight A comprises of step 1 to 11. It starts from ground floor to landing.

Effective span =(10*0.275)+1 =3.75m

Maximum Bending moment $= \frac{w*l^2}{8}$

$$= \frac{14000*(3.75)^2}{8} = 24609.375\ \text{Nm}$$

$$D = \sqrt{\frac{(24609.375*1000)}{(0.87*1000)}} = 168.18\text{mm}$$

Therefore the assumed depth of 200 mm is 0.K.

Area of steel

$A_{st} = \frac{24609.375 * 1000}{140*0.87*180} = 1122.49 \text{ mm}^2$

Use 12mm Φ bars at spacing $\frac{(\pi / 4) * 12^2 * 1000}{1122.49}$ =100.76 say 100mm c/c

Minimum distribution steel

Minimum distribution steel = $\frac{0.15*1000*200}{100} = 300 \text{ mm}^2$

Use 8mm Φ bars at spacing $\frac{(\pi / 4) * 8^2 * 1000}{300}$ =167.55 say 160mm c/c

LANDING SLAB

Effective span= c/c of wall (or) clear span of landing +effective depth of slab.

whichever is less.

=1.3 m (or) 1.2625m

l_{ef}=1.2625m .

Assume thickness of landing slab=200mm.

Self weight of slab / horizontal meter run =1*0.2*25000 = 5000N/m^2

Weight of finishes =1000N/m^2

Live load =5000N/m^2

Total load =11000N/m^2

Maximum Bending moment = $\frac{w*l^2}{8}$

$= \frac{11000*(1.2625)^2}{8} = 2191.62 \text{Nm}$

D=$\sqrt{\frac{(2191.62*1000)}{(0.87*1000)}}$ =50.19mm

Therefore the assumed depth of 200 mm is 0.K.

Area of steel

$A_{st} = \frac{2191.62*1000}{140*0.87*180} = 134.57 mm^2$

Use 8mm Φ bars at spacing $\frac{(\pi / 4)* 8^2 *1000}{134.57}$ =373.53,say 300mm c/c

Minimum distribution steel

Minimum distribution steel of 6mmΦ at 150mm c/c may be provided on the upper face of landing to give support to the main bars.

FLIGHT B

Flight B comprises of step 12 to 17.

Effective span =(6*0.275)+1 =2.65m

Maximum Bending moment = $\frac{w*l^2}{8}$

$= \frac{14000*(2.65)^2}{8}$ =12289.375 Nm

$D = \sqrt{\frac{(12289.375)*1000)}{(0.87*1000)}}$ =118.85mm

Therefore the assumed depth of 200 mm is 0.K.

Area of steel

$A_{st} = \frac{12289.375*1000}{140*0.87*180} = 560.54 mm^2$

Use 10mm Φ bars at spacing $\frac{(\pi / 4)* 10^2 *1000}{560.54}$ =140.11,say 140mm c/c

Minimum distribution steel

Minimum distribution steel = $\frac{0.15*1000*200}{100}$ =300 mm^2

Use 8mm Φ bars at spacing $\frac{(\pi / 4)* 8^2 *1000}{300}$ =167.55 say 160mm c/c

LANDING SLAB

Effective span= c/c of wall (or) clear span of landing +effective depth of slab, whichever is less.

=1.2133 m

l_{ef}=1.213 5m .

Assume thickness of landing slab=200mm.

Self weight of slab / horizontal meter run =1*0.2*25000 = 5000N/m^2

Weight of finishes =1000N/m^2

Live load =5000N/m^2

Total load =11000N/m^2

Maximum Bending moment = $\frac{w*l^2}{8}$

$=\frac{11000*(1.213)^2}{8}$ =2023.13Nm

$D=\sqrt{\frac{(2191.62*1000)}{(0.87*1000)}}$ =48.22mm

Therefore the assumed depth of 200 mm is 0.K.

Area of steel

$A_{st}= \frac{2023.13*1000}{140*0.87*180}$ = 92.28mm^2

Use 8mm Φ bars at spacing $\frac{(\pi / 4)* 8^2 *1000}{134.57}$ =373.53,say 300mm c/c

Minimum distribution steel

Minimum distribution steel of 6mmΦ at 150mm c/c may be provided on the upper face of landing to give support to the main bars.

FLIGHT C

Flight C comprises of step 18 to 28.

Effective span =(10*0.275)+1 =3.75m

Maximum Bending moment = $\frac{w*l^2}{8}$

$=\frac{14000*(3.75)^2}{8}$ =24609.375 Nm

$D=\sqrt{\frac{(24609.375*1000)}{(0.87*1000)}}$ =168.18mm

Therefore the assumed depth of 200 mm is 0.K.

Area of steel

$A_{st}= \frac{24609.375 *1000}{140*0.87*180}$ =1122.49 mm^2

Use 12mm Φ bars at spacing $\frac{(\pi / 4)* 12^2 *1000}{1122.49}$ =100.76 say 100mm c/c

Minimum distribution steel

Minimum distribution steel = $\frac{0.15*1000*200}{100}$ =300 mm^2

Use 8mm Φ bars at spacing $(\pi / 4)* 8^2 *1000$ =167.55 say 160mm c/c

LANDING SLAB

Effective span= c/c of wall (or) clear span of landing +effective depth of slab, whichever is less.

=3875 mm

l_{ef}=3.875m .

Assume thickness of landing slab=200mm.

Self weight of slab / horizontal meter run =1*0.2*25000 = 5000N/m^2

Weight of finishes =1000N/m^2

Live load =5000N/m^2

Total load =11000N/m^2

$$\text{Maximum Bending moment} = \frac{w*l^2}{8}$$

$$= \frac{11000*(3.875)^2}{8} = 20646.48\text{Nm}$$

$$D = \sqrt{\frac{(20646.48*1000)}{(0.87*1000)}} = 154.05\text{mm}$$

Therefore the assumed depth of 200 mm is 0.K.

Area of steel

$$A_{st} = \frac{20646.48*1000}{140*0.87*180} = 941.73 \text{ mm}^2$$

Use 12mm Φ bars at spacing $\frac{(\pi / 4)* 12^2 *1000}{941.73}$ =120.10,say 120mm c/c

Minimum distribution steel

Minimum distribution steel of 6mmΦ at 150mm c/c may be provided on the upper face of landing to give support to the main bars.

DESIGN OF FOOTING

NUCLEAR POWER CORPORATION OF INDIA LTD.

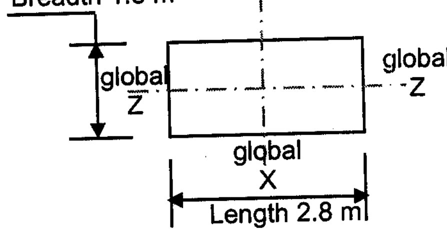
ESIGN OF BI-AXIAL ISOLATED RCC FOOTING (IS 456, 2000)

ilding Name
oting Number:
ode number

L	6	Ft
B	5	Ft
	1.5	Ft

OLUMN

ength (l, dim. || Z axis) =	1134	mm
readth (b, dim. || X axis) =	300	mm



Footing Dimensions

OOTING

oot length (L, dim. || Z axis) =	2.80	m
oot Breadth (B, dim. || X axis) =	1.80	m
hickness of footing (t) =	0	mm
lear cover of footing =	50	mm
lain bar dia of footing =	10	mm
ffective depth of footing =	400	mm
elfweight of the footing =	**0.00**	KN
rea of Footing(A) =	**5.04**	m^2
ect mod of foot about Z axis (Zz) =	**1.51**	m^3
ec mod of foot about X axis (Zx) =	**2.35**	m^3

IATERIALS OF CONSTRUCTION

rade of concrete f_{ck} =	20	N/mm^2
rade of steel f_y =	415	N/mm^2

CHECK FOR GROSS BEARING PRESSURE

Safe **NET** bearing pressure =	200	KN/m^2
Safe gross bearing pr. =	**238.00**	KN/m^3
Unfactored load case number =	1	
Axial load from output (P1) =	102	KN
Moment about Z axis (M_z) =	0	KN-m
Moment about X axis (M_x) =	0	KN-m
Depth of top of foot. from ground =	2	m
Unit wt of soil =	19	KN/m^3
Weight of soil retained above foot =	**178.59**	KN
P = (P1+soil+foot self wt) =	**280.59**	KN
Maximum bearing pressure =	**55.67**	KN/m^2
Minimum bearing pressure =	**55.67**	**KN/m^2**

(net pr. + depth of foot * soil unit wt

$$\frac{P}{A} \pm \frac{M_y}{Z_y} \pm \frac{M_x}{Z_x}$$

Hence footing is safe against max gross bearing pr.

DESIGN FORCES

Factored load comb. no.	1	
Axial load:(P_u) =	122	**KN**
Moment about Z axis (M_{uz}) =	0	**KN-m**
Moment about X axis (M_{ux}) =	0	**KN-m**

Maximum effective soil pressure $p_{e\,max}$

(Pu/Area+ Muz/Zz + Mux/Zx) = **24.21** **KN/m^2**

Minimum effective soil pressure $p_{e\,min}$

(Pu/Area - Muz/Zz - Mux/Zx) = **24.21** **KN/m^2**

Design of footing is done using above maximum effective soil pressure

ALCULATION FOR BOTTOM STEEL

u about X1 X1 = (pe max x length^2/2)= **8.40** KN-m per meter

Mulimit = **441.93** KN-m per meter

The section is singly reinforced

$$ {}_{st} = \frac{0.5 f_{ck}}{f_y}\left[1-\sqrt{1-\frac{4.6M_u}{f_{ck}bd^2}}\right]bd $$

ence, Ast = **58.357** mm^2

in Ast = **480.000** mm^2 (0.12 % for slab, cl 26.5.2.1)

pacing = **163.62** mm (considering max of above two calculated values of Ast)

: provided = **0.12** %

ence provide 10 mm dia bar @ 163 mm c/c parellel to length of footing (|| to Z)

u about N1 N1 = (pe max x length^2/2)= **6.81** KN-m per meter

The section is singly reinforced

alc. Ast = **47.280** mm^2

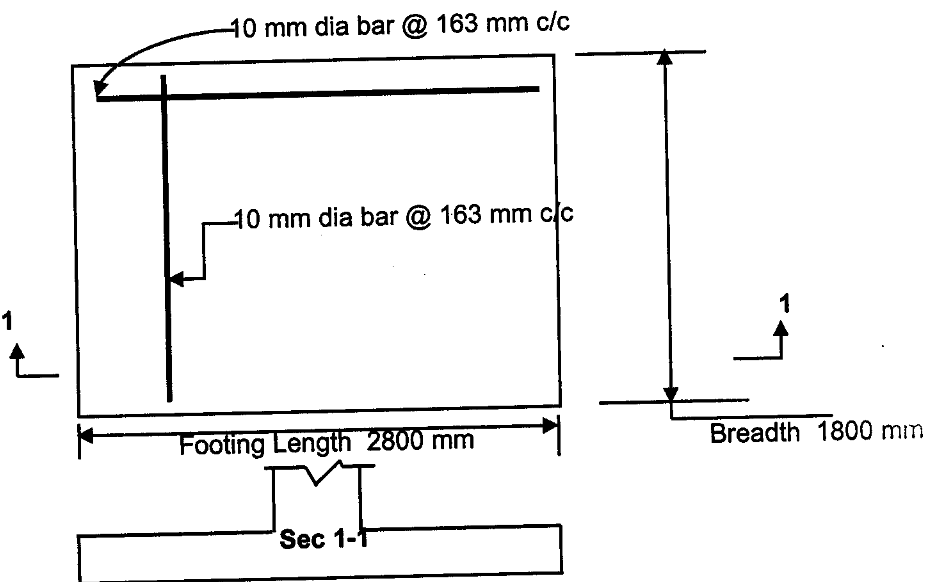
lin Ast = **480** mm^2 (0.12 % for slab, cl 26.5.2.1)

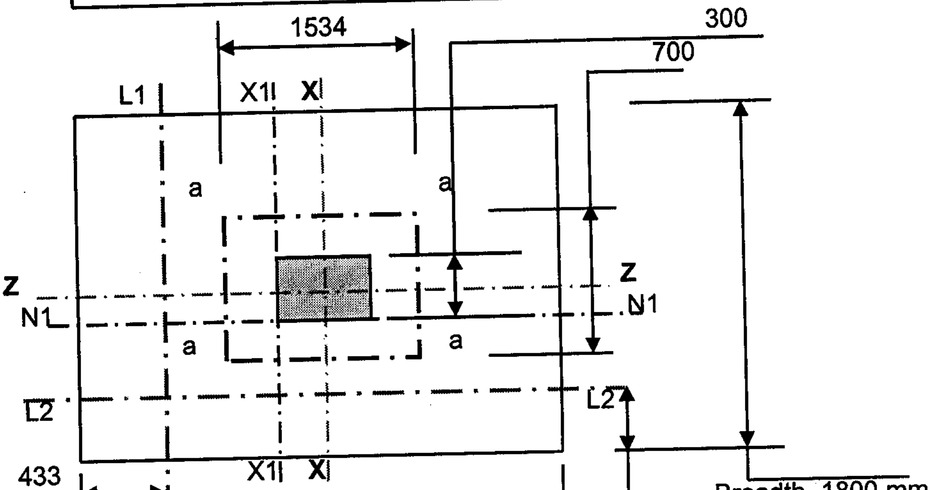
pacing = **163.62** mm (considering max of above two calculated values of Ast)

t provided = **0.12** %

lence provide 10 mm dia bar @ 163 mm c/c parellel to breadth of footing (|| to X)

rrangement of bottom reinforcement as per above design is shown below





IECK FOR ONE WAY SHEAR :

ne way shear at critical section L1- L1

stance of critical sec. from edge of footing = **0.433** m

ear force Vs =pe max x 0.433 x 1m width of footing = **10.481** KN

ear stress t_v = Vs/bd = **0.026** N/mm^2

= **0.26** N/mm^2

< tc hence O.K.

ne way shear at critical section L2- L2

stance of critical sec. from edge of footing = **0.35** m

near force Vs =pe max x 0.35 x 1m width of footing = **8.472** KN

near stress t_v = Vs/bd = **0.021** N/mm^2

= **0.26** N/mm^2

< tc hence O.K.

HECK FOR TWO WAY SHEAR

ef. cl 34.2.4 and cl.31.6.3 of IS 456 : 2000

llowable shear stress $t_{v\ allowable}$ = $k_s t_c$

$_s$ = (0.5 + bc) = **2.05556** >1

lence, k_s= **1**

$_c$ = 0.25 $(fck)^{0.5}$ = **1.11803** N/mm^2

$_{v\ allowable}$ = $k_s \times \tau_c$ = **1.11803** N/mm^2

Shear force Vs = 24.206 (2.8 x 1.8 - 1.534 x 0.7) = **96.01** KN

Length of critical section = 2 x (1534 + 700) = **4468** mm

Area of the critical section (length of critical sec x eff. d) = **1787200** mm^2

Hence shear stress τ_v = **0.054** N/mm^2

v < allowable hence O.K.

QUANTITY ESTIMATION

FOOD COURT - QUANTITY SERVEY

BILL NO :- RAB 15

Measurement period :- Upto 31.12.07

S No	DESCRIPTION		UNIT	DRG REF : NOS	LENGTH	BREADTH	DEPTH	d	QTY	TOTAL QTY
									PAGE	OF
1	Earthwork in ordinary soil	F1		7	3.800	3.000	1.000		79.80	
		F2		7	2.700	2.450	1.000		46.31	
		F3		4	3.800	3.800	1.000		57.76	
		F4		2	3.550	3.550	1.000		25.21	
		F5		2	3.200	3.200	1.000		20.48	
		F6		1	2.050	2.050	1.000		4.20	~~301.67~~
		F7		1	3.000	3.000	1.000		9.00	
		F8		2	2.950	2.950	1.000		17.41	373.52
		F9		5	3.200	3.000	1.000		48.00	
		F10		2	2.900	2.900	1.000		16.82	
		F11		2	3.600	2.700	1.000		19.44	
		F12		2	3.700	2.800	1.000		20.72	
		F13		1	2.900	2.900	1.000		8.41	
2	Earthwork in soft rock	F1		7	3.800	3.000	0.700		55.86	
		F2		7	2.700	2.450	0.700		32.41	
		F3		4	3.800	3.800	0.700		40.43	
		F4		2	3.550	3.550	0.700		17.64	
		F5		2	3.200	3.200	0.700		14.34	
		F6		1	2.050	2.050	0.700		2.94	231.47
		F7		1	3.000	3.000	0.700		6.30	
		F8		2	2.950	2.950	0.700		12.18	
		F9		5	3.200	3.000	0.700		33.60	
		F10		2	2.900	2.900	0.700		11.77	
		F11		2	3.600	2.700	0.700		13.61	
		F12		2	3.700	2.800	0.700		14.50	
		F13		1	2.900	2.900	0.700		5.89	
2	Earthwork in hard rock	F1		7	3.800	3.000	0.550		43.89	
		F2		7	2.700	3.000	0.550		31.19	
		F3		4	3.800	3.000	0.550		25.08	
		F4		2	3.550	3.000	0.550		11.72	
		F5		2	3.200	3.000	0.550		10.56	
		F6		1	2.050	3.000	0.550		3.38	
		F7		1	3.000	3.000	0.550		4.95	
		F8		2	2.950	3.000	0.550		9.74	285.48
		F9		5	3.200	3.000	0.550		26.40	
		F10		2	2.900	3.000	0.550		9.57	
		F11		2	3.600	3.000	0.550		11.88	
		F12		2	3.700	3.000	0.550		12.21	
		F13		1	2.900	3.000	0.550		4.79	

S No	DESCRIPTION		UNIT	NOS	LENGTH	BREADTH	DEPTH	d	QTY	TOTAL QTY
				MEASURMENTS						
4	FOOTNG IN PCC	F1		7	2.950	1.950	0.075		3.02	
		F2		7	1.650	1.350	0.075		1.17	
		F3		4	2.750	2.750	0.075		2.27	
		F4		2	2.500	2.500	0.075		0.94	
		F5		2	2.150	2.150	0.075		0.69	205.28
		F6		1	2.000	2.000	0.075		0.30	135.8
		F7		1	1.950	1.950	0.075		0.29	
		F8		2	1.900	1.900	0.075		0.54	
		F9		5	2.150	1.950	0.075		1.57	
		F10		2	2.850	2.850	0.075		1.22	
		F11		2	2.550	1.650	0.075		0.63	
		F12		2	2.650	1.750	0.075		0.70	
		F13		1	1.850	1.850	0.075		0.26	
5	FOOTNG IN RCC	F1		7	2.800	1.800	0.600		21.17	
		F2		7	1.500	1.250	0.400		5.25	
		F3		4	2.600	2.600	0.900	0.450	24.34	
		F4		2	2.350	2.350	0.800	0.350	8.84	
		F5		2	2.000	2.000	0.700	0.350	5.60	
		F6		1	1.850	1.850	0.600	0.350	2.05	13.58
		F7		1	1.800	1.800	0.600	0.300	1.94	99.33
		F8		2	1.757	1.750	0.600	0.300	3.69	
		F9		5	2.000	1.800	0.650	0.350	11.70	
		F10		2	1.700	1.700	0.550	0.300	3.18	
		F11		2	2.400	1.500	0.700	0.300	5.04	
		F12		2	2.500	1.600	0.600	0.300	4.80	
		F13		1	1.700	1.700	0.600	0.250	1.73	
6	PLINTH BEAM AT 108.55 M	PB1		1	3.910	0.200	0.450		0.35	
		PB1A		7	1.850	0.200	0.450		1.17	
		PB1B		1	2.535	0.200	0.450		0.23	
		PB1B		1	5.290	0.200	0.600		0.63	
		PB1C		1	5.690	0.200	0.600		0.68	
		PB2		1	23.225	0.200	0.600		2.79	
		PB3		1	4.960	0.200	0.450		0.45	
		PB3A		1	5.075	0.200	0.450		0.46	
		PB4		1	3.910	0.200	0.450		0.35	
		PB4A		1	3.875	0.200	0.450		0.35	
		PB5		1	1.170	0.200	0.450		0.11	
		PB6		1	3.875	0.200	0.600		0.47	
		PB6A		1	4.060	0.200	0.600		0.49	
		PB6B		1	5.115	0.200	0.450		0.46	99.33
		PB7		1	0.825	0.200	0.600		0.10	
		PB7		1	5.525	0.200	0.450		0.50	
		PB7		1	6.190	0.200	0.450		0.56	
		PB7A		2	5.120	0.200	0.450		0.92	

S No	DESCRIPTION		UNIT	MEASURMENTS NOS	LENGTH	BREADTH	DEPTH	d	QTY	TOTAL QTY
		PB7B		1	2.915	0.200	0.450		0.26	
		PB8		1	5.525	0.200	0.450		0.50	
		PB8		2	1.850	0.200	0.450		0.33	
		PB9		1	1.025	0.200	0.600		0.12	
		PB9		1	5.525	0.200	0.450		0.50	
		PB9A		1	3.275	0.200	0.450		0.29	
		PB9B		1	3.475	0.200	0.600		0.42	
		PB10		2	7.930	0.200	0.600		1.90	22.20
		PB10		1	7.165	0.200	0.600		0.86	
		PB11		1	0.825	0.200	0.600		0.10	
		PB11		1	5.525	0.200	0.450		0.50	
		PB12		1	1.025	0.200	0.600		0.12	
		PB12		2	1.850	0.200	0.450		0.33	
		PB13		1	0.825	0.200	0.600		0.10	
		PB13		1	5.525	0.200	0.450		0.50	
		PB13A		1	4.850	0.200	0.450		0.44	
		PB13B		1	3.950	0.200	0.450		0.36	
	1ST FLOOR BEAM AT 113.4 M	FFB1		1	3.465	0.200	0.600		0.42	
		FFB1B		1	2.160	0.200	0.600		0.26	
		FFB1B		1	5.465	0.200	0.600		0.66	
		FFB1A		1	2.599	0.200	0.600		0.31	
		FFB2		1	8.616	0.200	0.750		1.29	
		FFB2A		1	5.540	0.200	0.600		0.66	
		FFB3		1	8.332	0.300	0.750		1.87	
		FFB3A		1	5.315	0.300	0.750		1.20	
		FFB4		1	14.649	0.300	0.750		3.30	
		FFB5		1	8.252	0.300	0.750		1.86	
		FFB5		1	5.240	0.300	0.750		1.18	
		FFB6		1	8.809	0.300	0.750		1.98	
		FFB6A		1	5.540	0.300	0.750		1.25	
		FFB7		1	8.252	0.300	0.750		1.86	22.20
		FFB7A		1	5.390	0.300	0.750		1.21	
		FFB7B		1	1.785	0.200	0.750		0.27	
		FFB7B		1	5.585	0.200	0.750		0.84	
		FFB7B		1	7.480	0.200	0.750		1.12	
		FFB7B		1	4.300	0.200	0.750		0.65	
		FFB7C		1	4.995	0.200	0.600		0.60	
		FFB8		1	17.205	0.300	0.750		3.87	
		FFB8A		1	6.175	0.300	0.750		1.39	
		FFB9		1	3.610	0.300	0.750		0.81	
		FFB9		1	7.250	0.300	0.750		1.63	
		FFB9		1	7.585	0.300	0.750		1.71	
		FFB9		1	7.555	0.300	0.750		1.70	
		FFB9A		1	4.010	0.200	0.750		0.60	
		FFB9B		1	6.175	0.200	0.600		0.74	
		FFB10		1	1.170	0.200	0.450		0.11	
		FFB10A		1	1.570	0.200	0.450		0.14	
		FFB10B		1	1.570	0.200	0.300		0.09	
		FFB10B		1	1.000	0.200	0.450		0.09	

S NO	DESCRIPTION		UNIT	MEASURMENTS				d	QTY	TOTAL QTY
				NOS	LENGTH	BREADTH	DEPTH			
		FFB11		1	3.910	0.200	0.600		0.47	
		FFB11A		3	2.499	0.200	0.600		0.90	
		FFB11B		1	4.815	0.200	0.750		0.72	
		FFB11C		1	3.568	0.200	0.750		0.54	
		FFB11D		1	3.692	0.200	0.750		0.55	
		FFB12		1	1.000	0.200	0.600		0.12	
		FFB12		1	3.900	0.200	0.600		0.47	
		FFB12A		1	5.540	0.200	0.750		0.83	
		FFB12B		3	2.598	0.200	0.600		0.94	
		FFB12C		2	4.820	0.200	0.750		1.45	
		FFB12D		1	4.200	0.200	0.600		0.50	
		FFB12E		1	2.465	0.200	0.600		0.30	
		FFB13		1	1.000	0.200	0.600		0.12	
		FFB13		1	1.000	0.200	0.600		0.12	
		FFB13A		1	8.850	0.300	0.750		1.99	
		FFB13B		1	7.215	0.300	0.750		1.62	
		FFB13C		1	4.975	0.200	0.600		0.60	
		FFB14		1	4.425	0.300	0.750		1.00	
		FFB14		1	8.650	0.300	0.750		1.95	
		FFB14		2	7.480	0.300	0.750		3.37	79.93
		FFB14A		1	3.115	0.300	0.750		0.70	
		FFB14A		1	3.125	0.300	0.750		0.70	
		FFB16		1	11.017	0.300	0.750		2.48	
		FFB16A		1	3.850	0.200	0.400		0.31	
		FFB16B		2	7.480	0.200	0.750		2.24	
		FFB16B		1	6.840	0.200	0.750		1.03	
		FFB17		1	5.116	0.300	0.750		1.15	
		FFB17		1	8.550	0.300	0.750		1.92	
		FFB18		2	14.950	0.300	0.750		6.73	
		FFB19		1	5.116	0.300	0.750		1.15	
		FFB19		1	8.550	0.300	0.750		1.92	
		FFB20		1	5.300	0.200	0.750		0.80	
		FFB20A		1	8.425	0.300	0.750		1.90	
		FFB21		1	4.630	0.200	0.600		0.56	
		FFB21A		1	4.370	0.200	0.600		0.52	
		FFB22		1	4.730	0.200	0.600		0.57	
		FFB22A		1	4.470	0.200	0.600		0.54	
		FFB22B		1	4.025	0.200	0.600		0.48	
	ROOF BEAMS AT 117.6 M	RB1		1	3.465	0.200	0.600		0.42	
		RB2		1	8.616	0.200	0.750		1.29	
		RB3		1	8.332	0.300	0.750		1.87	
		RB3		1	5.314	0.300	0.750		1.20	
		RB4		2	14.649	0.300	0.750		6.59	
		RB5		1	8.252	0.300	0.750		1.86	
		RB5		1	5.240	0.300	0.750		1.18	
		RB6		1	8.252	0.300	0.750		1.86	

S No	DESCRIPTION	UNIT	MEASURMENTS				d	QTY	TOTAL QTY
			NOS	LENGTH	BREADTH	DEPTH			
	RB6A		1	5.390	0.300	0.750		1.21	
	RB6B		1	1.785	0.200	0.750		0.27	
	RB6B		1	5.585	0.200	0.750		0.84	
	RB6B		1	7.480	0.200	0.750		1.12	
	RB6B		1	4.300	0.200	0.750		0.65	
	RB7		1	4.110	0.200	0.600		0.49	
	RB8		1	5.445	0.200	0.600		0.65	
	RB9		1	4.010	0.300	0.750		0.90	
	RB9A		1	3.610	0.300	0.750		0.81	
	RB9A		1	7.250	0.300	0.750		1.63	
	RB9A		1	7.585	0.300	0.750		1.71	
	RB9A		1	7.555	0.300	0.750		1.70	
	RB9B		1	4.075	0.200	0.600		0.49	
	RB10		1	1.170	0.200	0.450		0.11	
	RB10		1	1.000	0.200	0.450		0.09	
	RB10A		1	1.370	0.200	0.300		0.08	
	RB10A		1	1.200	0.200	0.300		0.07	
	RB11		1	4.075	0.200	0.300		0.24	
	RB11A		1	3.910	0.200	0.600		0.47	
	RB11B		3	2.499	0.200	0.600		0.90	
	RB11C		1	4.815	0.200	0.750		0.72	
	RB11C		1	3.568	0.200	0.750		0.54	74.00
	RB11D		1	3.692	0.200	0.750		0.55	
	RB12		1	1.000	0.200	0.600		0.12	
	RB12		1	3.900	0.200	0.600		0.47	
	RB12A		1	5.540	0.200	0.750		0.83	
	RB12B		3	2.598	0.200	0.600		0.94	
	RB12C		2	4.820	0.200	0.750		1.45	
	RB12D		1	4.200	0.200	0.600		0.50	
	RB12E		1	2.465	0.200	0.300		0.15	
	RB13		1	1.000	0.200	0.600		0.12	
	RB13		1	1.000	0.200	0.600		0.12	
	RB13A		1	7.215	0.300	0.750		1.62	
	RB14		1	4.975	0.200	0.600		0.60	
	RB14A		1	8.850	0.300	0.750		1.99	
	RB15		1	4.425	0.300	0.750		1.00	
	RB15		1	8.650	0.300	0.750		1.95	
	RB15		2	7.480	0.300	0.750		3.37	
	RB15A		1	3.115	0.300	0.750		0.70	
	RB15A		1	3.125	0.300	0.750		0.70	
	RB16		1	15.167	0.300	0.750		3.41	
	RB16A		1	1.710	0.200	0.450		0.15	
	RB16B		2	7.480	0.200	0.750		2.24	
	RB16B		1	6.840	0.200	0.600		0.82	
	RB17		1	5.116	0.300	0.750		1.15	
	RB17		1	8.550	0.300	0.750		1.92	
	RB18		2	14.950	0.300	0.750		6.73	
	RB19		1	5.116	0.300	0.750		1.15	
	RB19		1	8.550	0.300	0.750		1.92	
	RB20		1	5.300	0.200	0.750		0.80	
	RB20A		1	8.425	0.300	0.750		1.90	
	RB21		1	4.630	0.200	0.600		0.56	
	RB21A		1	4.370	0.200	0.600		0.52	

			NOS	LENGTH	BREADTH	DEPTH	d		
		RB22	1	4.730	0.200	0.600		0.57	
		RB22A	1	4.470	0.200	0.600		0.54	
		RB22B	1	4.025	0.200	0.600		0.48	
6		S1	8	9.145	3.965	0.150		43.51	
	SLAB	S2	5	7.830	3.965	0.150		23.28	
		S3	1	5.370	5.790	0.150		4.66	
		S4	2	4.750	5.420	0.150		7.72	
		S5	8	4.875	2.073	0.150		12.13	
		S6	2	5.825	3.965	0.150		6.93	
		S7	1	4.275	5.025	0.150		3.22	
		S8	2	4.870	2.500	0.150		3.65	
		S9	3	4.750	4.165	0.150		8.90	
		S10	2	4.870	5.940	0.150		8.68	
		S11	1	4.115	2.765	0.150		1.71	
		S12	3	5.740	2.875	0.150		7.43	
		S13	1	5.740	4.225	0.150		3.64	
		S14	10	9.145	3.965	0.150		54.39	301.67
		S15	11	7.830	3.965	0.150		51.23	
		S16	2	2.880	1.575	0.150		1.36	
		S17	2	4.910	4.750	0.150		7.00	
		S18	1	5.075	4.150	0.150		3.16	
		S19	1	7.776	3.675	0.150		4.29	
		S20	1	4.165	2.765	0.150		1.73	
		S21	1	5.420	2.765	0.150		2.25	
		S22	1	4.450	4.165	0.150		2.78	
		S23	1	5.420	4.450	0.150		3.62	
		S24	2	4.870	2.500	0.150		3.65	
		S25	5	2.110	1.014	0.150		1.60	
		S26	8	6.000	3.910	0.150		28.15	
	Total Qty								1400.98

Sup port No	Grid	COLUMN SIZE	Axial Load - kN		Column Reinforcements		FOOTING SIZE			
			Unfactored	Factored	Below Plinth Beam	Lateral Ties	L	B	t	D
65	A-1	1134x300	102	122	#16-8	#8 @ 6" c/c	2.8	1.8	0	600
59	A-2	588x300	1004	1205	#16-10	#8 @ 6" c/c	1.5	1.25	0	400
68	A-3	450x450	1745	2094	#16-8	#8 @ 6" c/c	2.6	2.6	450	900
57	A-7	450x450	31	37	#16-12	#8 @ 6" c/c	2.35	2.35	350	800
39	B-1	450x450	24	28	#25-6 + #20-2	#8 @ 6" c/c	2	2	350	700
42	B-2	450x450	14	16	#20-8	#8 @ 6" c/c	1.85	1.85	350	600
46	B-3	450x450	23	27	#20-6 + #16-2	#8 @ 6" c/c	1.8	1.8	300	600
19	C-1	450x450	596	715	#20-8	#8 @ 6" c/c	1.75	1.75	300	600
86	C-2	300x600	364	760	#20-8	#8 @ 6" c/c	2	1.8	350	500
81	C-3	450x450	127	152	#20-8 + #16-2	#8 @ 6" c/c	1.7	1.7	300	400
1	D-6	200x900	274	280	#16-8	#8 @ 6" c/c	2.4	1.5	300	500
80	E-1	200x100	24	28	#20-4 + #16-4	#8 @ 6" c/c	2.5	1.6	300	400
74	E-2	450x450	566	679	#16-8	#8 @ 6" c/c	1.7	1.7	250	400

FOOTING REINFORCEMENTS in Bothways
#10 @ 150 c/c in both ways
#10 @ 110c/c in z and # 10 @ 150c/c in x dir
#12 @ 110 c/c in both ways
#10 @ 150 c/c in both ways
#10 @ 150 c/c in both ways
#10 @ 150 c/c in both ways
#10 @ 150 c/c in both ways
#12 @ 150 c/c in both ways
#10 @ 125 c/c in both ways
#10 @ 150 c/c in both ways
#10 @ 150 c/c in both ways
#10 @ 150 c/c in both ways
#10 @ 150 c/c in both ways

PROGRAMMING USING

MS PROJECT

CONCLUSION

CHAPTER 6

CONCLUSION

The plan for the proposed food court building has been prepared to suit the requirements of the employees

The space frames used in the building have been successfully analysed and the results were obtained using the STAAD.Pro software.

The design of the component members of the frame viz beams and columns have been designed using STAAD.Pro as well as by hand calculations.

Slabs and footings have been designed using STAAD.etc

The building plan and the detailed drawings showing the reinforcements in slabs, beams, columns and footings are presented in this project.

BIBLIOGRAPHY

CHAPTER 7

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