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AGNI Associates

84890 78044
99445 48447

Plan Approval | Soil Testing | Structural Design | Elevation 3D | Estimate | Layout Drawing

Structural Stability Certificate

PROJECT NAME : Plan Showing the Proposed Construction of Stilt Floor + 3 Floors (Height- 14.00m) Residential Building With 15 Dwelling Units At Sai VIVA Lane, Thiruthani Nagar, Zamin Pallavaram, Chennai-600043. Comprised in Old S.No.130/3, T.S.No.3, Block No.20 Of Zamin Pallavaram Village, Within The limits of Tambaram Municipal Corporation.

Type of structure : R.C.C Framed Structure

- Material Used:
- For concrete M25 and for steel structure Fe500
- The loading is taken as per the requirements of Code of practice IS-875
- Wind forces as per the latest code IS-875 part III
- Seismic force as per the latest code IS 1893
- The design of the Structure is done as per the latest code IS-456.

Structure analysis & design:

The structure is analyzed as a space frame structure in STAAD Vi8. Footings, Columns, Lift lobby slabs, Staircase are designed as convential beam and slabs.

Accordingly , we hereby issue the structure is **'Sound and safe'**

Accordingly , we hereby issue the **'Structural Stability Certificate'**

P. DHIVAGAR
Registered Structural Engineer Grade-II
REG NO.SE/GR-II/19/08/147, CMDA
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No.21, Maheswari Avenue, Puzhuthivakkam,
Chennai - 91, Mob : 8489078044

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DESIGN CALCULATION

Plan Showing the Proposed Construction of Stilt Floor + 3 Floors (Height- 14.00m) Residential Building With 15 Dwelling Units At Sai VIVA Lane, Thiruthani Nagar, Zamin Pallavaram, Chennai-600043, Comprised in Old S.No.130/3, T.S.No.3, Block No.20 Of Zamin Pallavaram Village, Within The limits of Tambaram Municipal Corporation.

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1.0 DESIGN BRIEF:

This document furnishes the structural design calculation for proposed construction of Stilt +3 floors building in Zamin pallavaram Village, Chennai district.

2.0 GENERAL DESIGNCRITERIA

2.1. Description of thestructure

The Building consists of Stilt +3 Upper floors and the structure is designed as a RCC framed structure.

1. Size ofthe building : 28.48 x 27.49m
2. Height ofthebuilding : 14.00m
3. Number of storeysaboveGL : stilt +3 upperfloors
4. Floor to floor height ofthisbuilding :
   : Typical floor – 3.0m
5. Typeof foundation : Isolated footing as per geotechnicalreport

2.2. MaterialsUsed

Following materials are generally used in the design of the various components of the structure.
For Concrete Structure

- M25 grade concrete for all reinforced concrete parts of thestructure
- Fe500 grade Structural reinforcementsteel
- Masonry for allwalls : Brick /Block

2.3. Design Codes &Standards

Following codes and specifications have been generally used in the design of the members of the structure.

- IS 456 : 2000 Code of practice for Plain and Reinforcedconcrete
- SP: 16 Design Aids for Reinforcedconcrete
- IS 875 : 1987 Design Loads for building andstructures
- IS 1893 : 2002 Criteria for Earthquake Resistant design ofstructures
- IS 13920: 1993 Ductile Detailing of R.C structures subjected to Seismicforces
- SP: 34 Handbook on Concrete Reinforcement &Detailing
- IS 800 : 1984 Code of practice for general construction insteel
- IS 2062 : 1999 Steel for general structural purposesspecification
- IS 1786: 1985 Specification for high strength deformed bars and wires for concrete reinforcement

3.0 LOADING

Primary Load:

- Dead Load(DL)
- Live Load(LL)

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3.1. Dead load (DL)

Materialweight

- Densityof Concrete =25 kN/m^3
- D.L. due topartitions (Light Partition as perIS875) =1.50 kN/m^2
- D.L due to floor finish50mmthick = 0.05x25 = 1.25kN/m^2

3.2. Live load(LL)

Minimum Uniformly Distributed Live Loads:

Occupancy oruse	**Live Load(kn/m^2)**
All roomsand kitchens	2.00
Toilet and bathrooms	3.00
Corridors,passages, staircases	3.00
Balconies	3.00
TerraceFloor	1.50
Basic windspeed	=50m/sec
SeismicZone	=ZoneIII

3.5 LoadingCombinations

The following combinations of Loads as per IS 1893 is considered in the STAAD Analysis

- 1.5(DL+LL)
- 1.2(DL + LL)

The below load combinations are used to check the structure in serviceability condition.

- 1.0(DL+LL)

4.0 STRUCTURALMATERIAL:

4.1 Concrete MaterialSpecifications:

Concrete compressivecubestrength	- 25 N/mm^2
Minimum cementcontent	- Refer standard drawings for general & Legends
Cementtype	-OPC
Free watercementratio	- 0.5(Maximum)
Nominal maximum sizeofaggregate	- 20mmUNO

4.2 Reinforcement:

Steel reinforcement shall be deformed bars, the characteristic of reinforcement bars shall conform to the followingspecification:

Grade ofSteel	Actual Yield Strength(MPa)
GradeFe500	Minimum 500MPa,

4.4 Concretecover:

Cover for Reinforcement is considered as per Table 16A of NBC, for a Fire resistance of 2 hrs.

- RaftSlab = 50mm

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- Footing =50mm
- RCWall =30mm
- Columns =40mm
- Beams =30mm
- Slabs = 25mm

5.0 StructuralDescription

5.1. Method ofanalysis

Structure analysis & design:

The structure is analyzed as a Space frame structure in STADD Pro Vi8. Columns, Footing, Basement walls, slabs, Beams and Staircases are designed as reinforced concrete members.

5.2. Framing System, Analysis andDesign

Limit State concept of design will be used as per IS: 456-2000 & SP - 16. The detailing of reinforcement shall be done satisfying the requirements of IS: 456-2000, SP-16, IS: 13920, IS: 4326-1993 and SP-34.

The Slabs and beams are checked for deflection as per IS 456:2000. Cover for Reinforcement is considered as per Table 16A of NBC, for a Fire resistance of 2 hrs.

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APPENDIX

IISTAAD OUTPUT RESULTS

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```
*****************************************************
*                                                   *
*           STAAD.ProV8iSELECTseries5               *
*           Version20.07.10.65                      *
*           ProprietaryProgramof                    *
*           BentleySystems,Inc.                     *
*           Date=    FEB 18,2024                    *
*           Time=    05:19:00                       *
*                                                   *
*      USERID:                                      *
*****************************************************
```

```
 1. STAADSPACE
TFILE:zamin pallavaram.STD
 2. START JOBINFORMATION
 3. ENGINEER DATE01-JAN-24
 4. END JOBINFORMATION
 5. INPUT WIDTH79
 6. UNIT METERKN
 7. JOINTCOORDINATES
 8. 43 10.18 0 6.82001; 44 15.58 0 6.82001; 45 20.36 0 6.82001
 9. 63 9.83002 0 12.77; 67 15.58 0 13.64; 68 15.58 015.55
10. 69 9.83002 0 15.55; 70 13.26 0 15.55; 72 23.52 0 6.51001
11. 73 26.6801 0 6.51001; 75 30.3201 0 6.35001; 76 17.33 0 15.55
12. 77 22.1 0 15.55; 78 26.6801 0 15.55; 79 30.3201 015.55
13. 84 30.3201 0 11.7; 85 17.33 0 13.64; 86 22.1 013.64
14. 90 10.18 1.8 6.82001; 91 15.58 1.8 6.82001; 92 20.36 1.8 6.82001
15. 93 10.18 1.8 9.86002; 94 15.58 1.8 9.86002; 95 15.58 1.8 12.42
16.9620.361.812.42;9710.181.812.77;989.830021.812.77
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PERFORM ANALYSIS PRINT STATICSCHECK

P R O B LEM S T A T I S T I CS

NUMBER OF JOINTS	398	NUMBER OF MEMBERS	412
NUMBER OF PLATES	0	NUMBER OF SOLIDS	0
NUMBER OF SURFACES	0	NUMBER OF SUPPORTS	57

SOLVER USED IS THE OUT-OF-CORE BASIC SOLVER

ORIGINAL/FINALBAND-WIDTH= 31/ 23/ 138DOF
TAL PRIMARY LOADCASES= 2, TOTAL DEGREES OFFREEDOM= 984
TAL LOAD COMBINATIONCASES= 2 SOFAR.
SIZE OF STIFFNESSMATRIX= 136 DOUBLE KILO-WORDS
REQRD/AVAIL. DISKSPACE= 14.0/ 137375.1MB

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***TOTAL APPLIED LOAD (KN METE) SUMMARY (LOADING 2)
SUMMATION FORCE-X = 0.00
SUMMATION FORCE-Y = -1241.73
SUMMATION FORCE-Z = 0.00

SUMMATION OF MOMENTS AROUND THE ORIGIN-
MX= 13778.28MY= 0.00MZ= -26057.32

***TOTAL REACTION LOAD(KN METE) SUMMARY (LOADING 2)
SUMMATION FORCE-X = 0.00
SUMMATION FORCE-Y = 1241.73
SUMMATION FORCE-Z = 0.00

SUMMATION OF MOMENTS AROUND THE ORIGIN-
MX= -13778.28MY= 0.00MZ= 26057.32

MAXIMUM DISPLACEMENTS (CM/RADIANS)(LOADING 2)

	MAXIMUMS	ATNODE
X	=9.23911E-02	221
Y	= -3.06792E-01	221
Z	=3.35448E-01	214
RX	= -7.18108E-04	120
RY	=3.54576E-04	217
RZ	=2.75745E-04	240

********** END OF DATA FROM INTERNAL STORAGE **********

96.FINISH

********** END OF THE STAAD.Pro RUN **********

**** DATE=FEB 18,2025 TIME= 05:43:13****

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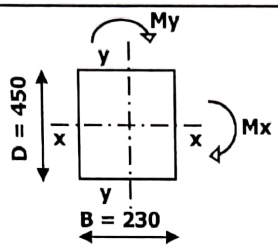
APPENDIX III

Design Calculations

Column Design

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PROJECT	ZAMIN PALLAVARAM VILLAGE, CHENNAI .	DOCUMENT. NO.	DATE	DESIGNED	DATE
TITLE	Design for a Short Column with Biaxial Bending	REVISION	DATE	CHECKED	DATE

CL. NO.	DESIGN CALCULATIONS	REFERENCES
	ColumnNo:  **CRITICAL LOADCASE:**	
1.0	**BasicData**	
1.1	**MaterialData**	
	GradeofConcrete = M25	
	GradeofSteel = Fe500	
1.2	**Codal Data**	
	NominalCover = 40mm	Cl 26.4.2.1,IS456:2000
	Diameter oftheBar = 25mm ≥ 12mm	
	d' = 52.5mm	
1.3	**Basic Dimensions**	
	Unsupported Length oftheColumn L_{ox} = 3000mm	
	L_{oy} = 3000 mm	
	L_{ex} = 3000mm	Table 28 ,
	L_{ey} = 3000mm	IS456:2000
	Size oftheColumn BXD = 230 x 450 mm	
1.4	**Analysis Results**	
	FactoredAxialLoad P_u = 450.0kN	STAAD
	FactoredMoment M_{ux} = 22.00kNm	OUTPUT
	FactoredMoment M_{uy} = 78.00kNm	
2.0	**Check for Slenderness**	
	Slenderness Ratio aboutMajorAxis L_{ex}/D = 6.667	
	Slenderness Ratio aboutMinorAxis L_{ey}/B = 13.043	
	Since Leff/LLD > 12 Designed as Slender Column; This sheet is not valid	Cl 25.1.2, IS456:2000
3.0	**Check for Eccentricity**	
	MinimumEccentricity $e_x = L_{ox}/500 + D/30$ = 21.0 mm>20	Cl 25.4
	$e_y = L_{oy}/500 + B/30$ = 13.7 mm<20	IS456:2000
3.1	**Moments Due to Minimum Eccentricity**	
	Me_x = 9.45kN.m	
	Me_y = 9.00kN.m	
4.0	**Design Moment**	
	Design Moment about Xaxis M_{ux} = 22.00kN.m	
	Design Moment about Yaxis M_{uy} = 78.00kN.m	

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PROJECT	ZAMIN PALLAVARAM VILLAGE, CHENNAI .	DOCUMENT. NO.	DATE	DESIGNED	DATE
TITLE	Design for a Short Column with Biaxial Bending	REVISION	DATE	CHECKED	DATE
CL. NO.	DESIGN CALCULATIONS				REFERENCES

5.0 Uniaxial Moment Carrying capacity of the Section about X & Y- axis

d' / D		=	0.117	
d' / B		=	0.2283	
Assume the Reinforcement Percentage	p	=	**3.50**	
p / f_{ck}		=	0.140	
$p_u / f_{ck}BD$		=	0.174	
Reinforcement distributed equally on four sides			**4**	
$M_{ux1} / f_{ck}BD^2$		=	0.206	Chart 43 - 46
$M_{uy1} / f_{ck}DB^2$		=	0.146	SP 16 : 1980
Moment carrying capacity about X axis	M_{ux1}	=	239.49 kN.m	
Moment carrying capacity about Y axis	M_{uy1}	=	87.01 kN.m	

6.0 Calculation of P_{uz}

$P_{uz} = 0.45 f_{ck} A_c + 0.75 f_y A_{sc}$		=	2482.06kN	Cl 39.6 , IS456:2000
P_u/P_{uz}		=	0.181	
α_n		=	1.000	Cl 39.6 , IS456:2000

7.0 Criteria for Biaxial Bending (Bresler's Formulation)

$(M_{ux}/M_{ux1})^{\alpha n}+(M_{uy}/M_{uy1})^{\alpha n}$ = **0.988** < 1 — Cl 39.6 , IS456:2000

Hence Safe

8.0 Longitudinal Reinforcement

Area ofcompressionSteel	$A_{sc,reqd}$	=	**3622.5**mm^2	
8 NosY20 + **0** NosY16	$A_{sc,pro}$	=	**2513**mm^2	

8.1 Check for Minimum & Maximum Area of Steel

Minimum Areaofsteel (0.8 % ofA_g,dir) = **254** mm^2 — Cl 26.5.3.1 a & b, IS 456 : 2000

(Based on the area of concrete reqd to resist directstress)

Maximum Areaofsteel (4 % ofA_g) = **4140**mm^2

254 < **2513** < **4140** mm^2

Area of Steel is with in the permissible limit ; Hence O.K

9.0 Transverse Reinforcement

9.1 Diameter ofTransverseReinforcement = **8** mm ≥ 6mm — Cl 26.5.3.2 c 2),

9.2 Spacing of Lateral Ties :

i)	Least Lateral Dimension ofthecolumn	=	230mm	Cl 26.5.3.2 c 1), IS 456 : 2000
ii)	16 times the Smallest dia ofLongitudinalSteel	=	320mm	
iii)		=	300mm	
	Reqd. Spacing of Ties (Minimum oftheabove)	=	230mm	

Provide 8 mm dia LateralTies@ **300** mmSpacing

Provide closer spacing on either side of the column above and below beam / slab.

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Footing Design

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ZAMIN PALLAVARAM VILLAGE, CHENNAI

Design ofIsolatedFooting **F3** **Node:** **38**

Basic Data:

Net SafeBearingCapacity	180kN/m^2
Unit wieghtofSoil	18kN/m^3
Unit wieghtofConcrete	25kN/m^3
GradeofConcrete	25N/mm^2
GradeofSteel	500N/mm^2
Clear CovertoReinforcement	50mm
Earth FillaboveFGL	0mm
Base AreaofFooting	3.70m^2
Ixx	1.23m^4
Izz	1.06m^4
WeightofFooting	69.38kN
Weightofsoil	87.39kN

Gross BearingPressureCalculation (kN/m^2)

Critical Load Combinations	Pmax	Pmin2
200	225.61	25.6135
0	42.37	42.37

Gross SBC (w/o increase) 149 kN/m^2

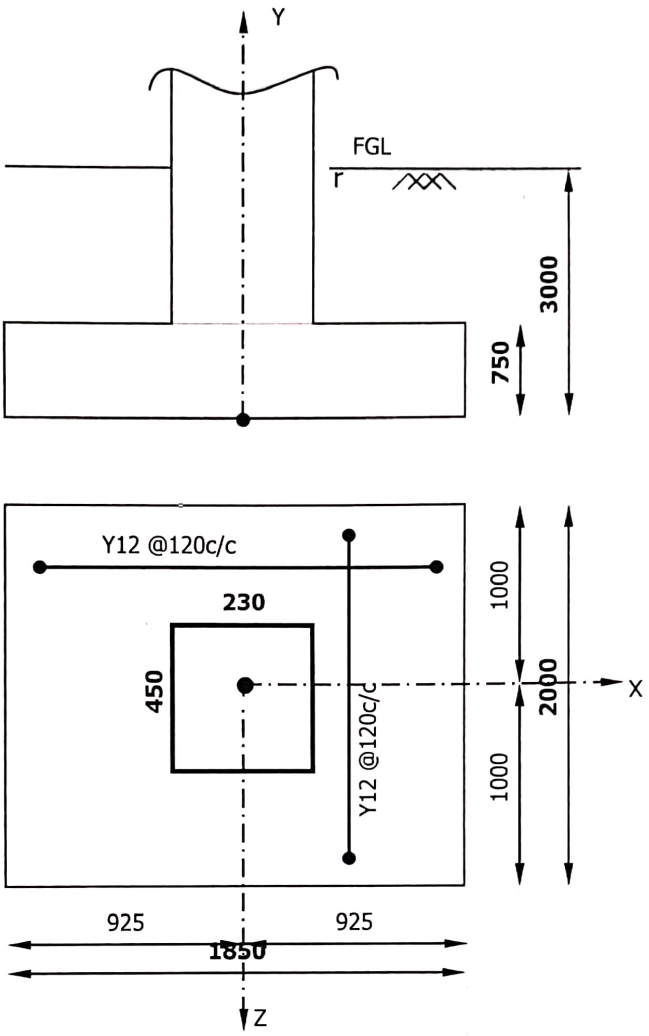
Hence **OK**

Factored Net Upward PressureCalculation

Load Factor for Design 1.5

Critical Load Combinations	Pmax	Pmin
200	274.86	274.8648649
0	0.00	0.0

Dsgn.(+ve) BM abt. X-axis Mux 82.55 kN.mDsgn.(+ve) BM abt. Z-axis Muz 90.17 kN.mDsgn.(-ve) BM abt. X-axis Mux 0.00 kN.mDsgn.(-ve) BM abt. Z-axis Muz 0.00kN.m



Provided Eff. depthforMux	682.00 mm
Provided Eff. depthforMuz	694.00 mm
Mu,lim	1547kN.m
Depthprovidedis	**OK**

Bottom Reinforcement

Ast RequiredforMux	280.5mm^2
Ast RequiredforMuz	301.3mm^2
Min.AstReqd.	900mm^2

BottomReinforcement						AstProvided	Ast Required		
Provide	12	@	120	C/C	along Z	942	900.0	mm^2	Hence
Provide	12	@	120	C/C	along X	942	900.0	mm^2	**OK**

Top Reinforcement

Ast RequiredforMux	0.00mm^2
Ast RequiredforMuz	0.00
mm^{2}Min.AstReqd.	Not Reqdmm^2

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ZAMIN PALLAVARAM VILLAGE, CHENNAI

Design of Isolated Footing **F3** **Node :** 36

Check For Flexural / Oneway Shear

	Actual	Allowable		
Shear Stress (Plane II to X)	0.037	0.280	N/mm^2	Hence OK
Shear Stress (Plane II to Z)	0.046	0.278	N/mm^2	OK

Check For Punching / Twoway Shear

Allowable Shear Stress = 1.25 N/mm^2

Actual Shear Stress = 0.35 N/mm^2 Hence OK

Check For Overturning

Co-efficient of friction = 0.57

Factor of safety for overturning, sliding = 1.4

Net Moments acting at Pad Level, M_{xx} = 0.00 kNm

Net Moments acting at Pad Level, M_{zz} = 0.00 kNm

Weight of pad = 69.38 kN

Weight of Over burden Earth = 87.39 kN

Total downward Load = 834.77 kN

Stabilizing moment along X-Dir = 834.77 x 0.93

= 772.16 kNm

Actuating moment, M_{zz} = 0.00 kNm

Factor of Safety (Along X-Dir) = 772.16 / 0.0

- > 1.40 Hence **OK**

Check For Sliding

Resistance against Sliding = 475.81887 kN

Max. Shear Load @ Pad level in X-Dir. = 2.5 kN

Max. Shear Load @ Pad level in Z-Dir. = 5.3 kN

Factor of Safety (Along X-Dir) = 475.8 / 2.5

187.33 > 1.40 Hence **OK**

Factor of Safety (Along Z-Dir) = 475.8 / 5.3

89.78 > 1.4 Hence **OK**

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Plinth Beam Design

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PROJECT	ZAMIN PALLAVARAM VILLAGE, CHENNAI .	DOCUMENT NO.	DATE	DESIGNED RMK	DATE
TITLE		REVISION	DATE	CHECKED RMK	DATE
CL. NO.	PLINTH BEAM DESIGN CALCULATIONS			REFERENCES	

1.1 **Geometry Data**

BeamNumber	=	PB1	
TypeofBeam	=	RectangularBeam	
SupportCondition	=	Continuous Beam	
Widthofbeam	b =	230 mm	
Overall DepthofBeam	D =	450 mm	
Diaofbar	Φ =	25 mm	
NominalCover	cc =	30 mm	IS 456:2000 Table 19
EffectiveDepth	d =	407.5 mm	IS 456:2000
EffectiveCover	=	42.5 mm	Cl 23.0
Effective Spanofbeam	l_{eff} =	4500 mm	
Concretegrade	=	M25	
SteelGrade	=	Fe500	
$p_{t,lim}$	=	0.911%	
$p_{t,min}$	=	0.170%	IS 456:2000
p_t&p_{cmax}	=	1.00%	Cl 26.5.1.1

1.2 **Force Input**

Leftnegativemoment	(Support1)	=	198 kNm
Mid spanpositivemoment		=	198 kNm
Rightnegativemoment	(Support2)	=	198 kNm
Shear @(Support1)		=	113 kN
Shear@(Span)		=	113 kN
Shear @(Support2)		=	113 kN

1.3 **Limiting Moment**

M_{ulim} = $0.133\ f_{ck}bd^2$ = 136.99 kNm

1.4 **Area of Steel**

Minimum Area ofStee= $0.17\%\ bd$ = 159.333mm²

Support 1

Negativemoment (Support1) = 198 kNmHence the Section is designed as Singly

ReinforcedSection

	M_u/bd^2	=	2.828
Percentage of tensionsteelreqd	p_t	=	0.917 %
Percentage of compressionsteelreqd	p_c	=	0 %
Required Area oftensionsteel	A_{streqd}	=	154.33mm²
Required Area ofcompressionsteel	A_{screqd}	=	0.00 mm²

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PROJECT	ZAMIN PALLAVARAM VILLAGE, CHENNAI .	DOCUMENT. NO.	DATE	DESIGNED RMK	DATE
TITLE		REVISION	DATE	CHECKED RMK	DATE
CL. NO.	PLINTH BEAM DESIGN CALCULATIONS				REFERENCES

Check for Shear

Shear		=	112	kN	
NominalShearStress	τ_v =		1.19	N/mm²	Cl 40.1, IS456:2000
PermissibleShearStress	τ_c =		0.92	N/mm²	β = 1.000
MaximumShearStress	$\tau_{c,max}$ =		2.5	N/mm²	Table 19, IS456:2000
Diameter of theStirrupbar		=	10	mm	Table 20, IS456:2000
NumberofLegs		=	2		
Spacing of ShearreinforcementRequired		=	1100.0		Cl 40.4, IS456:2000
Maximum Spacing ofShearReinforcement		=	300		Cl 26.5.1.5,IS456:2000

Provide 10 mm dia 2 legged stirrups @ 300mm c/c spacing

Check For Deflection

BasicValue		=	26		Cl.23.2, IS456:2000
Service StressinSteel	f_s	=	**76.60**	N/mm²	
ModificationFactor(TensionReinforcement)	F_1	=	2.00		
AllowableSpan/Depth		=	52.00		
ActualSpan/Depth		=	11.04	**Hence Safe**	

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Floor Beam Design

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PROJECT	ZAMIN PALLAVARAM VILLAGE, CHENNAI .	DOCUMENT. NO.	DATE	DESIGNED RMK	DATE
TITLE		REVISION	DATE	CHECKED RMK	DATE

CL. NO.	BEAM DESIGN CALCULATIONS	REFERENCES

1.1 **Geomentry Data**

BeamNumber	=	B1		
TypeofBeam	=	Rectangular Beam		
SupportCondition	=	Continuous Beam		
Widthofbeam	b =	230	mm	
Overall DepthofBeam	D =	450	mm	
Diaofbar	Φ =	25	mm	
NominalCover	cc =	30	mm	IS 456:2000 Table 19
EffectiveDepth	d =	407.5	mm	IS 456:2000
EffectiveCover	=	42.5	mm	Cl 23.0
Effective Spanofbeam	l_{eff}=		mm	
Concretegrade	=	M 25		
SteelGrade	=	Fe 500		
$p_{t,lim}$	=	0.944 %		
$p_{t,min}$	=	0.170 %		IS 456:2000
p_t & p_{cmax}	=	4.00%		Cl 26.5.1.1

1.2 **Force Input**

Leftnegativemoment	(Support1)	=	187	kNm
Mid spanpositivemoment		=	187	kNm
Rightnegativemoment	(Support2)	=	145	kNm
Shear @(Support1)		=	127	kN
Shear@(Span)		=	127	kN
Shear @(Support2)		=	127	kN

1.3 **Limiting Moment**

M_{ulim} = 0.133 $f_{ck} b d^2$ = 126.99 kNm

1.4 **Area of Steel**

Minimum Area of Steel = 0.17% bd = 159.3325mm^2

Support 1

Negativemoment	(Support1)	=	187	
HencetheSectionisdesignedasDoublyReinforcedSection		M_u/bd^2=		kNm
Percentage of tensionsteelreqd		p_t =	Required	
Percentage of compression steelreqd	p_c =		4.896	
Area oftensionsteel		A_{streqd} =	1.347 %	
Required Area of compression steel		A_{screqd} =	0.44 %	
			1262.48 mm^2	
			412.39 mm^2	

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PROJECT	ZAMIN PALLAVARAM VILLAGE, CHENNAI .	DOCUMENT. NO.	DATE	DESIGNED RMK	DATE
TITLE		REVISION	DATE	CHECKED RMK	DATE
CL. NO.	BEAM DESIGN CALCULATIONS			REFERENCES	

Detail of bars

	IstLayer		II ndLayer
	Nos	Dia	Nos
DiaTensionReinforcement	4	16	3
	16		

A_{st} provided = 1407.43 mm^2

	Nos	Dia	Nos
DiaCompressionReinforcemen	2	16	1
	16		

A_{sc} provided = 603.19 mm^2

Percentage of tensionsteelprovided p_t = 1.502 % **HenceO.K**

Percentage of compressionsteelprovide p_c = 0.644 % **HenceO.K**

Check for Shear

Shear = 127 kN

NominalShearStress	τ_v =	1.36	N/mm^2	Cl 40.1, IS456:2000
PermissibleShearStress	τ_c =	0.92	N/mm^2	β = 1.000
MaximumShearStress	$\tau_{c,max}$ =	2.5	N/mm^2	Table 19,IS456:2000
Diameter of theStirrupbar	=	8	mm	Table 20,IS456:2000
NumberofLegs	=	2		Cl 40.4, IS456:2000
Spacing of ShearreinforcementRequired	=	430.0		Cl 26.5.1.5,IS456:2000
Maximum Spacing ofShearReinforcement	=	300		

Provide 8 mm dia 2 legged stirrups @ 300mm c/c spacing

Support 2

Negativemoment = 145 kNm

Hence the Section is designed as Doubly Reinforced Section

	M_u/bd^2 =	3.797	
Percentage of tensionsteelreqd	p_t =	1.065 %	
Percentage of compressionsteelreqd	p_c =	0.132%	
Required Area oftensionsteel	A_{streqd} =	998.17	mm^2
Required Area ofcompressionsteel	A_{screqd} =	123.72	mm^2

Detail of bars

	IstLayer		II ndLayer
	Nos	Dia	Nos
DiaTensionReinforcement	3	16	3
	16		

A_{st} provided = 1206.372 mm^2

	Nos	Dia	Nos
DiaCompressionReinforcemen	3	16	2
	16		

A_{sc} provided = 1005.31 mm^2

Percentage of tensionsteelprovided p_t = 1.287 % **HenceO.K**

Percentage of compressionsteelprovide p_c = 1.073 % **HenceO.K**

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PROJECT	ZAMIN PALLAVARAM VILLAGE, CHENNAI .	DOCUMENT. NO.	DATE	DESIGNED RMK	DATE
TITLE		REVISION	DATE	CHECKED RMK	DATE
CL. NO.	BEAM DESIGN CALCULATIONS			REFERENCES	

Deck for Shear

Shear = 127 kN

NominalShearStress	τ_v =	1.36	N/mm^2	Cl 40.1, IS456:2000
PermissibleShearStress	τ_c =	0.92	N/mm^2	β = 1.000
MaximumShearStress	$\tau_{c,max}$ =	2.5	N/mm^2	Table 19, IS456:2000
Diameter of theStirrupbar	=	8	mm	Table 20, IS456:2000
NumberofLegs	=	2		
Spacing of ShearreinforcementRequired	=	430.0		Cl 40.4, IS456:2000
Maximum Spacing ofShearReinforcement	=	300		Cl 26.5.1.5,IS456:2000

Provide 8 mm dia 2 legged stirrups @ 300mm c/c spacing

Span

Positivemoment (Span) = 187 kNmHence the Section is designed as Doubly ReinforcedSection

	M_u/bd^2 =	3.325	
Percentage of tensionsteelreqd	p_t =	1.347	%
Percentage of compressionsteelreqd	p_c =	0.44	%
Required Area oftensionsteel	A_{streqd} =	1262.48	mm^2
Required Area ofcompressionsteel	A_{screqd} =	412.39	mm^2

Detail of bars

	IstLayer		II ndLayer	
	Nos	Dia	Nos	
DiaTensionReinforcement	4	16	4	16

A_{st} provided = 1608.50 mm^2

	Nos	Dia	Nos	
DiaCompressionReinforcemen	3	16	2	16

A_{sc} provided = 1005.31 mm^2

Percentage of tensionsteelprovided	p_t =	1.716	%	HenceO.K
Percentage of compressionsteelprovide	p_c =	1.073	%	HenceO.K

Deck for Shear

Shear = 127 kN

NominalShearStress	τ_v =	1.36	N/mm^2	Cl 40.1, IS456:2000
PermissibleShearStress	τ_c =	0.92	N/mm^2	β = 1.000
MaximumShearStress	$\tau_{c,max}$ =	2.5	N/mm^2	Table 19, IS456:2000
Diameter of theStirrupbar	=	10	mm	Table 20, IS456:2000
NumberofLegs	=	2		Cl 40.4, IS456:2000
Spacing of ShearreinforcementRequired	=	670.0		Cl 26.5.1.5,IS456:2000
Maximum Spacing ofShearReinforcement	=	300		

Provide 10 mm dia2 legged stirrups @ 300mm c/c spacing — Cl.23.2, IS456:2000

Check For Deflection

BasicValue	=	26	
Service StressinSteel	=	227.62	N/mm^2
ModificationFactor(TensionReinforcement)	=	0.91	
AllowableSpan/Depth	=	23.66	
ActualSpan/Depth	=	0.00	HenceSafe

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Floor Slab Design

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PROJECT	ZAMIN PALLAVARAM VILLAGE, CHENNAI .	DOCUMENT.NO.	DATE	DESIGNED	DATE
TITLE	TWO WAY SLAB DESIGN	REVISION	DATE	CHECKED	DATE

CL. NO.	DESIGN CALCULATIONS	REFERENCES
1.0	**Design of Two Way Slab S3**	
1.0.1	**Basic Input Data**	
	Gradeofconcrete = **M25**	
	Gradeofsteel = **Fe500**	
	Thicknessofslab D = **200** mm	
	Clearcover cc = **25** mm	Table 16 Cl.26.4.2 , IS 456 -2000
	Effective thickness of slab (d_{eff}) = 200 - 25 - 4 = 171 mm Unit weightofconcrete = 25 KN/m^{3}EffectiveShorterS pan	Cl 19.2.1, IS 456-2000
	EffectiveLongerSpan L_x= **4** m	
	Aspectratio L_y= **3.9** m	
	L_y/L_x = 0.98 < 2	Cl D-1.11, IS 456-2000
	Hence designed as Two way slab	
	Edge Condition : **One Long edge Discontinuous**	
1.0.2	**Load Data**	
	Self WeightofSlab = 0.200 x 25 = 5.000	
	KN/m^{2}Floorfinish = **1.000** KN/m^2	
	PartitionLoad = **1.000** KN/m^2	
	SunkenFilling = **0.000** KN/m^2	
	ImposedLoad = **2.000** KN/m^2	IS 875 (Part 2) -1987
	Extra Load,(ifAny) = **0.000**KN/m^2	
	Totalload = 9.000 KN/m^2	
	Design load (Wu) = 1.5x9 = **13.500**KN/m^2	Table 18 Cl 36.4.1 IS 456 -2000
1.0.3	**Moment and Shear Calculations**	
	Short Span Direction	
	a_x forpositivemoment 1 → 0.028	Table 26 Cl D-1.1, IS 456 -2000
	1.1 → 0.033	
	for 0.98 a_x = 0.027	
	PositivemomentM$_x$ 0.027 x 13.50x 4^2 = **5.78**KN-m	
	a_x fornegativemoment 1 → 0.037	Table 26 Cl D-1.1, IS 456 -2000
	1.1 → 0.044	
	for 0.98 a_x = 0.035	
	Negative moment M$_x$: 0.035 x 13.50x 4^2 = **7.61**KN-m	

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PROJECT	ZAMIN PALLAVARAM VILLAGE, CHENNAI .	DOCUMENT.NO.	DATE	DESIGNED	DATE
TITLE	TWO WAY SLAB DESIGN	REVISION	DATE	CHECKED	DATE
CL. NO.	DESIGN CALCULATIONS			REFERENCES	

Long Span Direction

Forpositivemoment moment M_y : 0.028 x13.50x a_y= 0.028 Positive 4^2 = **6.05** KN-m — Table 26 Cl D-1.1, IS 456 -2000

Fornegativemoment moment M_y : 0.037 x13.50x a_y= 0.037 Negative 4^2 = **7.99** KN-m — Table 26 Cl D-1.1, IS 456 -2000

Shear force V_u = 13.50 x 4 x 0.5 = **27.00**KN

1.0.4 **Check Effective Depth for Max.Bending Moment**

Depthrequired = $(M_x / (0.133 \times fck \times b))^{1/2}$ = 47.85mm — Table C,SP 16 :1980

Depthprovided = 200 - 25 -8/2 = 171 mm > 47.85mm — Cl 2.3

Hence the section is Safe against Bending

1.0.5 **Check Depth for Shear**

Nominal ShearStress: $t_v = V_u / bd$ = 0.16N/mm² — Cl.40.1, IS 456:2000

Design shear strength (t_c) = 0.33N/mm² — Table 19 , IS 456:2000

k = 1.20 — Cl.40.2.1.1, IS 456:2000

$k*t_c$ = 0.40N/mm²

t_v < $k*t_c$ **HencethesectionisSafeagainstShear**

1.0.6 **Check for Maximum Shear Stress:**

Nominal ShearStress: $t_v = V_u / bd$ = 0.16N/mm² — Cl.40.1, IS 456:2000

MaximumShearStress ($t_{c,max}$) = 3.1 N/mm² — Table 20 , IS 456:2000

0.5 $t_{c,max}$ = 1.55 N/mm²

t_v <0.5 $t_{c,max}$ **Hence the section is Safe against Max.ShearStress** — Cl.40.2.3.1, IS 456:20 0

1.0.7 **Reinforcement calculations**

Short Span Direction @ Support

$Mu/bd^2 = \frac{7.61 \times 10^6}{1000 \times 171 \times 171}$ **=0.260** — Table 2-4, SP16 :1980

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PROJECT	ZAMIN PALLAVARAM VILLAGE, CHENNAI .	DOCUMENT.NO.	DATE	DESIGNED	DATE
TITLE	TWO WAY SLAB DESIGN	REVISION	DATE	CHECKED	DATE

CL. NO.	DESIGN CALCULATIONS	REFERENCES
	Area of steel Ast= 0.0006 x 1000x 171 = 103.67 mm^2 Minimum area of steel 0.0012 x 1000x 200 = 240.00 mm^2 Spacing of Y **8** bars 50.27 x 1000/ 240.00 = 209.33mm	Cl:26.5.2.1 IS 456 -2000
	Check for Spacing Minimumof 1) 3d = 513 mm 2) = 300 mm 3) = 209.33 mm Thereforeprovide Y **8** @ **200** mmC/C	Cl:26.3.3.(b).1 IS 456 -2000
	Short Span Direction @ Mid Span Mu/bd^2 = 5.78 x 10^6 / 1000 x 171 x 171 = 0.198 Pt = 0.046%	SP16 :1980 Table 2-4
	Area of steel Ast= 0.0005 x 1000x 171 = 78.435 mm^2 Minimum area of steel 0.0012 x 1000x 200 = 240.00 mm^2 Spacing of Y **8** bars 50.27 x 1000/ 240.00 = 209.33mm	IS 456:2000 Cl:26.5.2.1
	Check for Spacing Minimumof 1) 3d = 513 mm 2) = 300 mm 3) = 209.33 mm Thereforeprovide Y **8** @ **150**mmC/C 150 Provided % of TensionReinforcement(pt) = **0.196**%	IS 456:2000 Cl:26.3.3.(b).1
	Long Span Direction @ Support Mu/bd^2 = 7.99 x 10^6 / 1000 x171x 171 = 0.273 Pt = 0.064%	SP16 :1980 Table 2-4
	Area of steel Ast= 0.0006 x 1000x 171 = 108.88 mm^2 Minimum area of steel 0.0012 x 1000x 200 = 240.00 mm^2 Spacing of Y **8** bars 50.27 x 1000/ 240.00 = 209.33mm	IS 456:2000 Cl:26.5.2.1

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PROJECT	ZAMIN PALLAVARAM VILLAGE, CHENNAI .	DOCUMENT.NO.	DATE	DESIGNED	DATE
TITLE	TWO WAY SLAB DESIGN	REVISION	DATE	CHECKED	DATE

CL. NO.	DESIGN CALCULATIONS	REFERENCES
	Check for Spacing	
	Minimumof 1) 3d = 513 mm 2) = 300 mm 3) = 209.33 mm Thereforeprovide Y **8** @ **200** mmC/C	IS 456:2000 Cl:26.3.3.(b).1
	Long Span Direction @ mid Span	
	Mu/bd^2 = 6.05 x 10^6 / 1000 x 171 x 171 = 0.207 Pt = 0.048%	SP16 :1980 Table 2-4
	Area of steel Ast= 0.0005 x 1000x 171 = 82.136 mm^2 Minimum area of steel 0.0012 x 1000x 200 = 240.00 mm^2 Spacing of Y **8** bars 50.27 x 1000/ 240.00 = 209.33mm	IS 456:2000 Cl:26.5.2.1
	Check for Spacing	
	Minimumof 1) 3d = 513 mm 2) = 300 mm 3) = 209.33 mm Thereforeprovide Y **8** @ **200** mmC/C	IS 456:2000 Cl:26.3.3.(b).1
1.0.8	**<u>Check for Deflection:</u> (Simplified Approach)**	
	BasicSpan/depthRatio = **26** % of Tension Reinforcement provided (p_t) = 0.196 % Service stress of steel (fs) 0.58 fy(Ast_R/Ast_P) = 67.88 N/mm^2Modification Factor for Tension Reinforcement (F_1= 2.00 Allowable Span / EffectiveDepthRatio = 52 Actual Span/Eff Depth Rati = 4 x 1000 /171 = 23.39 **Hence Safe against Deflection**	IS 456:2000 Cl:23.2.1 IS456:2000 Fig 4 Page 38 IS 456:2000 Cl:23.2.1

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