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CMDA BLOCK-2(MAGNUS)		
Along Grid :(7-10/A-D)		slab Reff. S3

INPUT DATA

Slab				Loads			
Shorter Span	Lx =	3.600	m	Dead Load	DL =	3.13	kN/m²
Longer Span	Ly =	5.750	m	Live load	LL =	2.00	kN/m²
Thickness of Slab	D =	125	mm	Floor Finishes	FF =	1.50	kN/m²
Clear Cover	d' =	20	mm	False Ceilling Load	=	0.25	kN/m²
Ly/Lx ratio	k =	1.60	Two-Way Slab	Total Load	w =	6.88	kN/m²

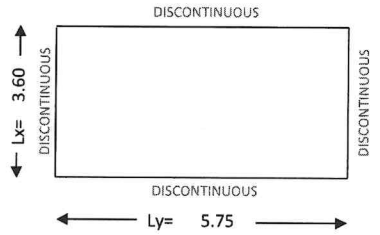
Panel Type			Materials			
Basic L/d ratio	=	26	Grade of Concrete	=	25	N/mm²
Edge Condition:	=	9	Grade of Reinf. Steel	=	550	N/mm²
Four Edges Discontinuous			Young's Modulus E		2.50E+04	N/mm²

DESIGN

Direction	BM Coefficients (IS:456-2000)		Flexural Design			dia & Required Spacing				Provided Reinforcement			
			Mu	Ast_{req}	Ast_{pro}	8	10	12	16				
			kNm	mm²	mm²	mm	mm	mm	mm				
Shorter Span	αx (-) =	0.0000	0.000	121	452	300	300	297	291	8	@	125	Safe
	αx (+) =	0.0933	12.467	274	452	183	286	297	291	8	@	125	Safe
Longer Span	αy (-) =	0.0000	0.000	121	302	279	270	261	243	8	@	200	Safe
	αy (+) =	0.0560	7.484	161	302	279	270	261	243	8	@	200	Safe

CHECK FOR DEFLECTION

Area of Steel required = 274 mm²
Area of Steel Provided = 452 mm²
Steel stress of service load = 193.53 N/mm²
Provided reinforcement (%) = 0.45%
Modification ratio MF = 1.587
Effective depth required for deflection point of view
d_{req} = 87.25999 mm
Eff. depth provided d = 101 mm Safe



SLAB SUMMARY

Shorter Span: Provide T 8 @ 125 mm c/c + 1 T 10 Extra between the two cranked bars
Longer Span : Provide T 8 @ 200 mm c/c + 1 T 10 Extra between the two cranked bars

CHECK FOR SHEAR

Max Shear Force = 19 KN
Actual Shear stress τv = 0.184 N/mm2
P_t of A_{st} = 0.45%
Design Shear Stress τc = 0.46 N/mm²
Shear is less than Design Shear Stress, Hence Safe against shear

NOTES

1. Crank alternate bars at 0.3 times the respective span.
2. Provide 12mm dia chairs at 1000mm c/c in both directions.
3. Provide 6 mm thick cover blocks at 600mm c/c in both directions.

Reinforcement Summary:
Along Shorter Span
Provided T8@ 125mm c/c
Along Longer Span
Provided T8@ 200mm c/c

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BEAM DESIGN:

BEAM NO: 207/ (9" x 18")

ALONG GRID: (5/N-Q)

M25 Fe550 (Main) Fe550 (Sec.)

LENGTH: 3700.0 mm SIZE: 230.0 mm X 450.0 mm COVER: 25.0 mm

SUMMARY OF REINF. AREA (Sq.mm)

SECTION	0.0 mm	925.0 mm	1850.0 mm	2775.0 mm	3700.0 mm
TOP REINF.	577.14 (Sq. mm)	221.97 (Sq. mm)	147.16 (Sq. mm)	161.21 (Sq. mm)	532.01 (Sq. mm)
BOTTOM REINF.	397.92 (Sq. mm)	297.61 (Sq. mm)	157.88 (Sq. mm)	207.06 (Sq. mm)	298.84 (Sq. mm)

_ STAAD SPACE -- PAGE NO. 1823

SUMMARY OF PROVIDED REINF. AREA

SECTION	0.0 mm	925.0 mm	1850.0 mm	2775.0 mm	3700.0 mm

	Left	Midspan	Right
TOP REINF.	2-16d+1-20d 1 layer(s)	2-16d 1 layer(s)	2-16d+1-20d 1 layer(s)

	Left	Midspan	Right
BOTTOM REINF.	2-16d+1-20d 1 layer(s)	2-16d 1 layer(s)	2-16d+1-20d 1 layer(s)

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	Left	Midspan	Right
SHEAR REINF.	2 legged 8d @ 100 mm c/c	2 legged 8d @ 200 mm c/c	2 legged 8d @ 100 mm c/c

---

SHEAR DESIGN RESULTS AT DISTANCE d (EFFECTIVE DEPTH) FROM FACE OF THE SUPPORT

SHEAR DESIGN RESULTS AT 637.0 mm AWAY FROM START SUPPORT

VY = 64.63 MX = 3.84 LD= 401

Provide 2 Legged 8d @ 140 mm c/c

SHEAR DESIGN RESULTS AT 562.0 mm AWAY FROM END SUPPORT

VY = -67.02 MX = 2.14 LD= 404

Provide 2 Legged 8d @ 100 mm c/c

==========

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COLUMN DESIGN:

COLUMN NO: C9

ALONG GRID:(5/N)

M25 **Fe550 (Main)** **Fe550 (Sec.)**

LENGTH: 3000.0 mm CROSS SECTION: 300.0 mm X 450.0 mm COVER: 40.0 mm

LOAD CASE: 408 END JOINT: (1.5DL-1.5RSZ-0.45RSX)

REQD. STEEL AREA : 3135.55 Sq.mm.

REQD. CONCRETE AREA: 131864.45 Sq.mm.

MAIN REINFORCEMENT: Provide 8 - 25 dia. (2.9%, 3920 Sq.mm.)

(Equally distributed)

TIE REINFORCEMENT: Provide 8 mm dia. rectangular ties @ 150 mm c/c

SECTION CAPACITY BASED ON REINFORCEMENT REQUIRED (KNS-MET)

Puz: 2776.89 Muz1: 203.72 Muy1: 119.05

INTERACTION RATIO: 0.98 (as per Cl. 39.6, IS456:2000)

SECTION CAPACITY BASED ON REINFORCEMENT PROVIDED (KNS-MET)

WORST LOAD CASE: 408

END JOINT: 106 Puz: 2809.57 Muz: 207.67 Muy: 120.87 IR: 0.96

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PILE CAP DESIGN:

Design Code	:	**IS 456 + IS 13920 - 2016**	
Pilecap No	:	**PC2**	
Column No	:	**C9**	(300mm X 450mm)
GRID		**(5/N)**	

Concrete Grade	:	M25	
Steel Grade	:	Fe550	
Clear Cover	:	50	mm
Top of pile-cap below ground	:	0.25	m

Density of Soil	=	18	kN/cum
Founding Depth	=	1	m
Pile Capacity in Compression	=	900	kN
Pile Capacity in Tension	=	310	kN
Pile Capacity in Shear	=	40	kN
Pile Capacity Reduction	=	0	%
Pile Overloading	=	10	%
Pile Group Overloading	=	10	%
Pile Capacity Increase for EQ	=	25	%
Pile Capacity Increase for Wind	=	25	%
Live Load Reduction	=	0	%

Consider Capacity Design	:	No	
Consider Overburden Pressure	:	Yes	

No. of Piles	=	2	
Pile Diameter	=	550	mm
Pilecap Offset	=	150	mm
Pile Spacing	=	2.5	x Ø
Pilecap Size	=	2225 X 850	mm
Pilecap Depth	=	750	mm
Soil Wt. + Pile-cap Wt.	=	43.972	kN

For design, moments along shorter direction of pile cap has been ignored

Check for Maximum Load on One Pile:

Critical Analysis Load Combination	:	110	
Critical Load Combination	:	[10] : (LOAD 3: DL) +0.8 (LOAD 4: LL) +0.8 (LOAD 1: EQX) +0.24 (LOAD 2: EQZ)	
Pcomb	=	1449.92	kN
Ptotal	=	Pcomb + Soil Wt. + Pilecap Wt.	
	=	1493.89	kN

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Mx	=	31.34	kNm
My	=	6.84	kNm
P	=	Ptotal/ No. of Piles	
	=	746.94	kN
Pmx	=	22.79	kN
Pmy	=	0	kN
Maximum load on pile	=	769.74	kN
Allowable load on pile	=	900 x 1.25	
	=	1125	kN

Check for Maximum Load on Pile Group:

Critical Analysis Load Combination	:	101	
Critical Load Combination	:	[1] ; (LOAD 3: DL) +(LOAD 4: LL)	
Pcomb	=	1382.2	kN
Ptotal	=	Pcomb + Soil Wt. + Pilecap Wt.	
	=	1426.17	kN
Mx	=	1.86	kNm
My	=	-0.59	kNm
Maximum load on pile group	=	1426.18	kN
Allowable load on pile group	=	2 x 900 x 1.1	
	=	1980	kN

Check for Maximum shear on Pile Group:

Critical Analysis Load Combination	:	102	
Critical Load Combination	:	[2] : (LOAD 3: DL) +(LOAD 1: EQX) +0.3 (LOAD 2: EQZ)	
Pcomb	=	1299.63	kN
Ptotal	=	Pcomb + Soil Wt. + Pilecap Wt.	
	=	1343.6	kN
Mx	=	38.29	kNm
My	=	8.13	kNm
Vx	=	13.51	kNm
Vy	=	26.93	kNm
Maximum shear on pile group	=	$\sqrt{13.51^2 + 26.93^2}$	
	=	30.13	kN
Shear capacity of pile group	=	2 x 40 x 1 x 1.25	
	=	100	kN

Check for Uplift Load on Pile:

No uplift in any pile

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Design for Bending:

Bottom Reinforcement Along Column-D

Critical Analysis Load Combination	:	201	
Critical Load Combination	:	[60] : 1.5 (LOAD 3: DL) +1.5 (LOAD 4: LL)	
Pcomb	=	2073.31	kN
Ptotal	=	Pcomb + Soil Wt. + Pilecap Wt.	
	=	2139.267	kN
Mx	=	2.79	kNm
My	=	-0.88	kNm
Ppile	=	Max Load on pile	
	=	1071.66	kN
Deff	=	690	mm
Beff	=	850	mm
DfCol	=	0.46	m
BMux	=	Ppile X DfCol	
	=	495.64	kNm
PtReq	=	0.27	%
AstReq (BM)	=	1879	sqmm/m
AstPrv	=	T16 @ 105 C/C	
	=	1914.86	sqmm/m

Top Reinforcement Along Column-D

D	=	750	mm
	<=	1000	mm, Hence
AstReq (BM)	=	Min Pt for Top Reinforcement X D X 1000	
	=	0.12% X 750 X 1000	
	=	900	sqmm/m
AstPrv	=	T12 @ 125 C/C	
	=	904.8	sqmm/m

Bottom Reinforcement Along Column-B

AstReq (BM)	=	0.2 x (D/2) x 1000/100	
	=	0.2 x 375 x 1000/100	
	=	750	sqmm/m
AstPrv	=	T10 @ 100 C/C	
	=	785.4	sqmm/m

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Top Reinforcement Along Column-B

D	=	750	mm
	<=	1000	mm, Hence
AstReq (BM)	=	Min Pt for Top Reinforcement X D X 1000	
	=	0.12% X 750 X 1000	
	=	900	sqmm/m
AstPrv	=	T12 @ 125 C/C	
	=	904.8	sqmm/m

Design for One Way Shear:

Along Column-D

Critical Analysis Load Combination	:	201	
Critical Load Combination	:	[60] : 1.5 (LOAD 3: DL) +1.5 (LOAD 4: LL)	
Pcomb	=	2073.31	kN
Ptotal	=	Pcomb + Soil Wt. + Pilecap Wt.	
	=	2139.27	kN
Mx	=	2.79	kNm
My	=	-0.88	kNm
Ppile	=	Max Load on pile	
	=	1071.66	kN

Location of critical section is at d/2 from face of column

Section Location from column center = 570 mm

Data for Piles

Pile No	Load (kN)	% covered	Shear (kN)
P1	1067.6	28.64	761.88
P2	1071.66	28.64	764.78

Design Shear Force (Vu)	=	Max. of (Shear due to P1, P2)	
	=	764.78	kN
Deff	=	690	mm
Beff	=	850	mm
Tv	=	Vu/(Beff x Deff)	
	=	1.3	N/sqmm
Tc	=	0.38	N/sqmm
Av	=	117.5	mm
Shear enhancement factor	=	2 X Deff / Av	
	=	11.74	
Enhanced shear strength (Tce)	=	3.1	N/sqmm
Tv	<	Tce, Hence Shear Reinforcement is not required	

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Along Column-B

One way shear check do not applicable for 2 pile pile-cap design

Design of Face Reinforcement:

AsfrReq	=	SFR % X D X Beffsfr	
	=	0.05 X 750 X 500 / 100	
	=	188	sqmm
Asfr Prv	=	3-T10	
	=	236	sqmm

Check for Load Transfer from Column to PileCap

Critical Analysis Load Combination	=	201	
Critical Load Combination	:	[60] : 1.5 (LOAD 3: DL) +1.5 (LOAD 4: LL)	
P	=	2073.31	kN
A2	=	0.14	sqm
A1	=	1.89	sqm
Base Area	=	1.89	sqm
A1	<	Base Area	
Modification Factor	=	SquareRoot(A1/A2) < = 2	
SquareRoot(A1/A2)	=	3.74	
Thus, Modification Factor	=	2	
Concrete Bearing Capacity	=	0.45 X Fck X Modication Factor X Column Area	
	=	3037.5	kN
Concrete Bearing Capacity	>	P, Hence Safe.	

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