SLAB DESIGN

INPUT Girder Type (prestressed or steel): prestressed

Slab Thickness	7.25	In.	No. of Beams		4.00	
Top Bar Clearance	1.875	In.	Top Flange Width	=	1.33	Ft.
Bot. Bar Clearance	1.500	In.	Live Load	=	11	Kips
Future Wearing Surf.	0.00	Lbs./FT.^{2}	f'c	=	3.00	Ksi
Beam Spacing	8.000	Ft.	fy	=	40.00	Ksi

Effective Slab Span = 8.00 - 1.33 = 6.67 Ft.

Dead Load

Slab	=	(7.25 / 12.00) x 0.15	0.091	
FWS	=	(0.00 / 1000) x 1.00	0.000	
		W_{DL} =	0.091	Kips / Ft.

Moments

M_{DL}	=	0.091 x (6.67)^2 / 8.00 x 0.8	= 0.403	Ft. - Kips
M_{LL+I}	=	(6.67 + 2.00) / 32.00 x 11.0 x 0.8 x 1.3	= 3.098	Ft. - Kips
M_W	=	0.403 + 3.098	= 3.501	Ft. - Kips
M_U	=	(1.30 x (0.403 + (1.67 x 3.098))	= 7.250	Ft. - Kips

Top Slab Reinforcement

d	=	7.25 - 1.88 - 0.313	= 5.06	In.
R_U	=	(7.250 x 12.00) / (0.90 x 12.0 x (5.063)^2)	= 0.314	
ω	=	0.85 x (1.00 - {1.00 - (2.0 x 0.314 / 0.85 x 3.00)}^.5)	= 0.1122	
ρ Req.	=	0.112 x 3.00 / 40.00	= 0.0084	
β_1	=		= 0.85	
ρ Max	=	0.75 x (0.85 x 0.85 x 3000 / 40000) x {87000 / (87000 + 40000)}	= 0.0278	
A_S Req.	=	0.0084 x 12.00 x 5.06	= 0.51	Sq. In.

Bar Size 5 d_C = 2.188 In.

Spacing 6.50 in d_C' = 2.188 In.

A_S 0.57 Sq. In. d = 5.063 In.

A	=	2.00 x 6.50 x 2.19	= 28.44		
f_S Allow	=	130.00 / (28.44 x 2.19)^.33	= 32.81	Ksi	36 Max.
a	=	(0.57 x 40.00) / 0.85 x 3.00 x 12.00	= 0.740	In.	
jd	=	5.0625 - 0.74 / 2.00	= 4.69		
f_S Act	=	(3.50 x 12.00) / 0.57 x 4.69	= 15.81	Ksi	
θM_N	=	0.90 x 0.57 x 40.00 x 4.69 / 12	= 7.97	Ft. Kips	

f_S Act = 15.81 < 32.81 OK

θM_N = 7.97 > 7.25 OK

Bottom Slab Reinforcement

d	=	7.25 - 0.5 - 1.50 - 0.313	=	4.94	In.
R_U	=	(7.250 x 12.00) / 0.90 x 12.0 x (4.938)^2	=	0.330	
ω	=	0.85 x (1.00 - {1.00 - (2.0 x 0.330 / 0.85 x 3.00)}^.5)	=	0.1184	
ρ Req.	=	0.118 x 3.00 / 40.00	=	0.0089	
ρ Max	=		=	0.0278	
A_S Req.	=	0.0089 x 12.00 x 4.94	=	0.53	Sq. In.

Bar Size	5		d_C =	1.813	In.
Spacing	6.50	in	d_C' =	1.813	In.
A_S	**0.57**	Sq. In.	d =	4.938	In.

A	=	2.00 x 6.50 x 1.81	=	23.56		
f_S Allow	=	130.00 / (23.56 x 1.81)^.33	=	37.20	Ksi	36.0 Max
a	=	(0.57 x 40.00) / 0.85 x 3.00 x 12.00	=	0.740	In.	
jd	=	4.9375 - 0.74 / 2.00	=	4.57		
f_S Act	=	(3.50 x 12.00) / 0.57 x 4.57	=	16.24	Ksi	
θM_N	=	0.90 x 0.57 x 40.00 x 4.57 / 12	=	7.76	Ft. Kips	

f_S Act = 16.24 < 36.00 OK

θM_N = 7.76 > 7.25 OK

SLAB DESIGN

INPUT Girder Type (prestressed or steel): prestressed

Slab Thickness	5.75	In.	No. of Beams		4.00		
Top Bar Clearance	1.875	In.	Top Flange Width	=	1.33	Ft.	
Bot. Bar Clearance	0.000	In.	Live Load	=	11	Kips	
Future Wearing Surf.	0.00	Lbs./FT.^{2}	f'c	=	4.50	Ksi	
Beam Spacing	8.000	Ft.	fy	=	40.00	Ksi	

Effective Slab Span = 8.00 - 1.33 = 6.67 Ft.

Dead Load

Slab	=	(5.75 / 12.00) x 0.15	0.072	
FWS	=	(0.00 / 1000) x 1.00	0.000	
		W_{DL} =	0.072	Kips / Ft.

Moments

M_{DL}	=	0.072 x (6.67)^2 / 8.00 x 0.8	= 0.319	Ft. - Kips
M_{LL+I}	=	(6.67 + 2.00) / 32.00 x 11.0 x 0.8 x 1.3	= 3.098	Ft. - Kips
M_W	=	0.319 + 3.098	= 3.418	Ft. - Kips
M_U	=	(1.30 x (0.319 + (1.67 x 3.098))	= 7.142	Ft. - Kips

Top Slab Reinforcement

d	=	5.75 - 1.88 - 0.313	= 3.56	In.
R_U	=	(7.142 x 12.00) / (0.90 x 12.0 x (3.563)^2)	= 0.625	
ω	=	0.85 x (1.00 - {1.00 - (2.0 x 0.625 / 0.85 x 4.50)}^.5)	= 0.1527	
ρ Req.	=	0.153 x 4.50 / 40.00	= 0.0172	
β_1	=		= 0.83	
ρ Max	=	0.75 x (0.85 x 0.83 x 4500 / 40000) x {87000 / (87000 + 40000)}	= 0.0405	
A_S Req.	=	0.0172 x 12.00 x 3.56	= 0.73	Sq. In.

Bar Size	**5**		d_C =	2.188	In.
Spacing	**6.50**	in	d_C' =	2.188	In.
A_S	**0.57**	Sq. In.	d =	3.563	In.

A	=	2.00 x 6.50 x 2.19	=	28.44	
f_S Allow	=	130.00 / (28.44 x 2.19)^.33	=	32.81 Ksi	36 Max.
a	=	(0.57 x 40.00) / 0.85 x 4.50 x 12.00	=	0.494 In.	
jd	=	3.5625 - 0.49 / 2.00	=	3.32	
f_S Act	=	(3.42 x 12.00) / 0.57 x 3.32	=	21.84 Ksi	
θM_N	=	0.90 x 0.57 x 40.00 x 3.32 / 12	=	5.63 Ft. Kips	

f_S Act = 21.84 < 32.81 OK

θM_N = 5.63 < 7.14 27% OVERSTRESSED

Bottom Slab Reinforcement

d	=	5.75 - 0.5 - 0.00 - 0.313	=	4.94	In.
R_U	=	(7.142 x 12.00) / 0.90 x 12.0 x (4.938)^2	=	0.326	
ω	=	0.85 x (1.00 - {1.00 - (2.0 x 0.326 / 0.85 x 4.50)}^.5)	=	0.0757	
ρ Req.	=	0.076 x 4.50 / 40.00	=	0.0085	
ρ Max	=		=	0.0405	
A_S Req.	=	0.0085 x 12.00 x 4.94	=	0.50	Sq. In.

Bar Size	5		d_C =	0.313	In.
Spacing	6.50	in	d_C' =	0.313	In.
A_S	**0.57**	Sq. In.	d =	4.938	In.

A	=	2.00 x 6.50 x 0.31	=	4.06		
f_S Allow	=	130.00 / (4.06 x 0.31)^.33	=	120.06	Ksi	36.0 Max
a	=	(0.57 x 40.00) / 0.85 x 4.50 x 12.00	=	0.494	In.	
jd	=	4.9375 - 0.49 / 2.00	=	4.69		
f_S Act	=	(3.42 x 12.00) / 0.57 x 4.69	=	15.44	Ksi	
θM_N	=	0.90 x 0.57 x 40.00 x 4.69 / 12	=	7.97	Ft. Kips	

f_S Act = 15.44 < 36.00 OK

θM_N = 7.97 > 7.14 OK