

LOCHNER

SHEET

PROJECT: **BONNER BRIDGE - OREGON INLET NORTH CAROLINA**

JMJ Aug-06

SUBJECT: **SLAB ANALYSIS**

WDB Aug-06

SUBJECT: **STEEL GIRDER SECTIONS - BASED ON PLAN DIMENSIONS**

SLAB DESIGN

INPUT

Girder Type (prestressed or steel): **steel**

Slab Thickness	7.25	In.	No. of Beams	4.00
Top Bar Clearance	1.875	In.	Top Flange Width	= 1.50 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.	f _y	= 40.00 Ksi
Effective Slab Span	=	8.00 - 1.50 * .5		= 7.25 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 (7.25) ² / 8.00 x 0.8	= 0.476 Ft. - Kips
M _{LL+I}	=	(7.25 + 2.00) / 32.00 x 11.0 x 0.8 x 1.3	= 3.307 Ft. - Kips
M _W	=	0.476 + 3.307	= 3.783 Ft. - Kips
M _U	=	(1.30 x (0.476 + (1.67 x 3.307)))	= 7.798 Ft. - Kips

Top Slab Reinforcement

d	=	7.25 - 1.88 - 0.313	= 5.06 In.
R _U	=	(7.798 x 12.00) / (0.90 x 12.0 x (5.063) ²)	= 0.338
ω	=	0.85 x (1.00 - {1.00 - (2.0 x 0.338 / 0.85 x 3.00)} ^{.5})	= 0.1214
ρ Req.	=	0.121 x 3.00 / 40.00	= 0.0091
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.	=	0.0091 x 12.00 x 5.06	= 0.55 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	=	(3.78 x 12.00) / 0.57 x 4.69	=	17.08 Ksi	
θM _N	=	0.90 x 0.57 x 40.00 x 4.69 / 12	=	7.97 Ft. Kips	

f_S Act = 17.08 < 32.81 OK

θM_N = 7.97 > 7.80 OK

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Bottom Slab Reinforcement

d	=	7.25 - 0.5 - 1.50 - 0.313	=	4.94 In.
R _U	=	(7.798 x 12.00) / 0.90 x 12.0 x (4.938) ²	=	0.355
ω	=	0.85 x (1.00 - {1.00 - (2.0 x 0.355 / 0.85 x 3.00)} ^{0.5})	=	0.1281
ρ Req.	=	0.128 x 3.00 / 40.00	=	0.0096
ρ Max	=		=	0.0278
A _S Req.	=	0.0096 x 12.00 x 4.94	=	0.57 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) ^{0.33}	=	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	=	(3.78 x 12.00) / 0.57 x 4.57	=	17.55 Ksi
θM _N	=	0.90 x 0.57 x 40.00 x 4.57 / 12	=	7.76 Ft. Kips

f_S Act =	17.55	<	36.00	OK	
θM_N =	7.76	<	7.80	0%	OVERSTRESSED - OK

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SUBJECT: **STEEL GIRDER SECTIONS - BASED ON FIELD DATA, ASSUME NO BOTTOM COVER**

SLAB DESIGN

INPUT

Girder Type (prestressed or steel): **steel**

Slab Thickness	5.75	In.	No. of Beams	=	4.00
Top Bar Clearance	1.875	In.	Top Flange Width	=	1.50 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.	f _y	=	40.00 Ksi
Effective Slab Span	=	8.00 - 1.50 * .5		=	7.25 Ft.

Dead Load

Slab	=	(5.75 / 12.00) x 0.15		=	0.072
FWS	=	(0.00 / 1000) x 1.00		=	<u>0.000</u>
			W _{DL}	=	0.072 Kips / Ft.

Moments

M _{DL}	=	0.072 x (7.25) ² / 8.00 x 0.8		=	0.378 Ft. - Kips
M _{LL+I}	=	(7.25 + 2.00) / 32.00 x 11.0 x 0.8 x 1.3		=	3.307 Ft. - Kips
M _W	=	0.378 + 3.307		=	3.685 Ft. - Kips
M _U	=	(1.30 x (0.378 + (1.67 x 3.307)))		=	7.670 Ft. - Kips

Top Slab Reinforcement

d	=	5.75 - 1.88 - 0.313		=	3.56 In.
R _U	=	(7.670 x 12.00) / (0.90 x 12.0 x (3.563) ²)		=	0.672
ω	=	0.85 x (1.00 - {1.00 - (2.0 x 0.672 / 0.85 x 4.50)} ^{.5})		=	0.1653
ρ Req.	=	0.165 x 4.50 / 40.00		=	0.0186
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.	=	0.0186 x 12.00 x 3.56		=	0.79 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	=	(3.68 x 12.00) / 0.57 x 3.32		=	23.54 Ksi
θM _N	=	0.90 x 0.57 x 40.00 x 3.32 / 12		=	5.63 Ft. Kips

f_S Act = 23.54 < 32.81 OK

θM_N = 5.63 < 7.67 36% OVERSTRESSED

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Bottom Slab Reinforcement

d	=	5.75 - 0.5 - 0.00 - 0.313	=	4.94 In.
R _U	=	(7.670 x 12.00) / 0.90 x 12.0 x (4.938)^2	=	0.350
ω	=	0.85 x (1.00 - {1.00 - (2.0 x 0.350 / 0.85 x 4.50)}^0.5)	=	0.0816
ρ Req.	=	0.082 x 4.50 / 40.00	=	0.0092
ρ Max	=		=	0.0405
A _S Req.	=	0.0092 x 12.00 x 4.94	=	0.54 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)^0.33	=	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	=	(3.68 x 12.00) / 0.57 x 4.69	=	16.64 Ksi
θM _N	=	0.90 x 0.57 x 40.00 x 4.69 / 12	=	7.97 Ft. Kips

f_S Act = 16.64 < 36.00 OK

θM_N = 7.97 > 7.67 OK