Designer Notes - Web Crippling

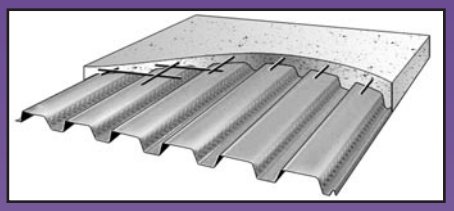
Specified Deck Web Crippling Data (per foot of width):

CD-36

Base Steel Thickness (in.)	P_{e1} (lb)	P_{e2} (lb)	P_{i1} (lb)	P_{i2} (lb)
0.030	182	45.4	344	58.5
0.036	269	67.1	508	86.4
0.048	495	124	935	159

CD75-150

Base Steel Thickness (in.)	P_{e1} (lb)	P_{e2} (lb)	P_{i1} (lb)	P_{i2} (lb)
0.030	174	43.4	356	60.6
0.036	259	64.7	527	89.5
0.048	483	121	970	165



CD75-200

Base Steel Thickness (in.)	P_{e1} (lb)	P_{e2} (lb)	P_{i1} (lb)	P_{i2} (lb)
0.030	130	32.5	267	45.4
0.036	194	48.5	395	67.1
0.048	362	90.6	728	124

CD75-300

Base Steel Thickness (in.)	P_{e1} (lb)	P_{e2} (lb)	P_{i1} (lb)	P_{i2} (lb)
0.030	79.8	20.0	153	26.0
0.036	120	29.9	228	38.8
0.048	224	56.0	428	72.7

$P_e=P_{e1}+P_{e2}\sqrt{n/t}$; $P_i=P_{i1}+P_{i2}\sqrt{n/t}$; n = bearing length (in.); t = deck thickness (in.)

Composite Slab Deflection Parameter, DP (lb•ft):

	Overall Slab Depth, D (in.)	4.0	4.5	5.0	5.5	6.0	6.5	7.0
CD36 Normal	Base Steel (in.) 0.030	63.4	89.9	123	163	211		
	0.036	67.8	96.0	131	174	225		
	0.048	75.7	107	146	193	249		
CD75-150 Normal	Base Steel (in.) 0.030			122	160	206	260	323
	0.036			130	171	220	277	344
	0.048			145	190	244	307	381
CD75-150 Inverted	Base Steel (in.) 0.030			137	179	229	289	357
	0.036			146	190	244	306	379
	0.048			162	211	270	339	418
CD75-200 Normal	Base Steel (in.) 0.030			102	134	174	220	275
	0.036			108	143	185	234	293
	0.048			121	159	206	261	325
CD75-200 Inverted	Base Steel (in.) 0.030			146	191	243	305	376
	0.036			155	202	258	323	397
	0.048			172	224	284	356	437
CD75-300 Normal	Base Steel (in.) 0.030			126	165	212	266	330
	0.036			134	175	224	281	348
	0.048			148	193	246	309	382

$w_d = \frac{DP(10)^6}{DC(L)^3}$; DC = deflection constant such as 360; L = span length (ft)

Shoring was established based on CSSBI 12M-2008 and web crippling was based on an assumed end bearing length, n, of 3 in. and an interior bearing length of 6 in. for the CD75 decks and 1.5 in. and 4 in., respectively for the CD36 deck. If the bearing lengths are less than these values, the Engineer of Record must verify the web crippling strength during the construction stage (see example).

The information contained on this data sheet was prepared by Dr. R.M. Schuster P.Eng.
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Designer Notes - Web Crippling

EXAMPLE
CD75-200 (A25) NORMAL - IMPERIAL UNITS
Given the following information, check the adequacy of the CD75-200 composite slab system:

GIVEN:
Steel deck - Design thickness = 0.036 in.; yield strength = 33 ksi
Concrete - Normal density = 150 lb/ft^3
Overall slab depth = 5.0 in.
Triple span deck length = 11.0 ft (132 in.)

Specified Loads:
Superimposed dead load
a) floor finish = 10 psf
b) partitions = 20 psf
DL = 30 psf
Live load LL = 100 psf
Total load = {1.25/1.5(DL) + LL} = {0.833(30) + 100} = *125 psf*

USE OF LOAD TABLE:
From the appropriate table, the maximum specified load is *155 psf*
Since 155 > 125 ∴ ***OK***
NOTE: The self-weight of the steel deck and the concrete have already been accounted for in the load tables for strength requirements.

DEFLECTION CHECK:
See Additional Technical Data Tables for value of DP = 108 and assume DC = 480. Typically this value is 360.

$$w_d = \frac{DP(10)^6}{DC(L)^3} = \frac{108(10)^6}{480(11)^3} = 169 \text{ psf}, > 100 \text{ psf} \quad \therefore \text{ OK}$$

SHORING CHECK:
Based on CSSBI 12M-2008, flexure and deflection during the construction stage have already been accounted for in the composite load tables by the use of the shaded areas. Web crippling was based on an assumed end bearing length of 3 in. and an interior bearing length of 6 in. See Additional Technical Data Tables for web crippling information. The slab weight can be obtained from the composite load table, which is 40.7 psf for the 5.0 in. slab depth. As per CSSBI 12M-2008, the uniform construction live load is 20 psf, resulting in a total specified load during construction of
[0.833(40.7) + 20] = 53.9 psf;

End Web Crippling
a) Specified end reaction
0.4(53.9)11.0 = ***237 lb/ft***
b) Maximum specified end reaction
$P_e = P_{e1} + P_{e2}\sqrt{n/t}$
n/t = 3/0.036 = 83.3
P_{e1} = 194; P_{e2} = 48.5
$P_e = 194 + 48.5\sqrt{83.3}$ = ***637 lb/ft***, which is greater than ***237 lb/ft***, ∴ OK
Or, the maximum unshored span, L_{max} = 637/0.4/53.9 = ***29.5 ft***, which is > ***11.0 ft***, ∴ OK

Interior Web Crippling
a) Specified interior reaction
1.10(53.9)11.0 = ***652 lb/ft***
b) Maximum specified interior reaction
$P_i = P_{i1} + P_{i2}\sqrt{n/t}$
n/t = 6.0/0.036 = 167
P_{i1} = 395; P_{i2} = 67.1
$P_i = 395 + 67.1\sqrt{167}$ = ***1262 lb/ft***, which is greater than ***652 lb/ft***, ∴ OK
Or, the maximum unshored span, L_{max} = 1262/1.1/53.9 = ***21.3 ft***, which is > ***11.0 ft***, ∴ OK

Designer Notes - Web Crippling

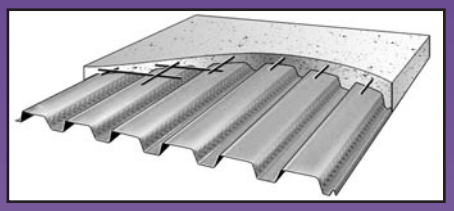
Specified Deck Web Crippling Data (per metre of width):

CD-36

Base Steel Thickness (mm)	P_{e1} (kN)	P_{e2} (kN)	P_{i1} (kN)	P_{i2} (kN)
0.762	2.68	0.670	5.08	0.863
0.914	3.96	0.989	7.49	1.27
1.22	7.29	1.82	13.8	2.34

CD75-150

Base Steel Thickness (mm)	P_{e1} (kN)	P_{e2} (kN)	P_{i1} (kN)	P_{i2} (kN)
0.762	2.56	0.640	5.26	0.893
0.914	3.82	0.954	7.76	1.32
1.22	7.13	1.78	14.3	2.43



CD75-200

Base Steel Thickness (mm)	P_{e1} (kN)	P_{e2} (kN)	P_{i1} (kN)	P_{i2} (kN)
0.762	1.92	0.480	3.94	0.383
0.914	2.86	0.715	5.82	0.990
1.22	5.34	1.34	10.7	1.83

CD75-300

Base Steel Thickness (mm)	P_{e1} (kN)	P_{e2} (kN)	P_{i1} (kN)	P_{i2} (kN)
0.762	1.18	0.294	2.25	0.383
0.914	1.76	0.441	3.37	0.573
1.22	3.31	0.826	6.31	1.07

$P_e=P_{e1}+P_{e2}\sqrt{n/t}$; $P_i=P_{i1}+P_{i2}\sqrt{n/t}$; n = bearing length (mm); t = deck thickness (mm)

Composite Slab Deflection Parameter, DP (kN•m):

Overall Slab Depth, D (mm)		100	110	120	130	140	150	160	170
CD36 Normal	Base Steel (mm) 0.762	80.8	107	139	176	220			
	0.914	86.4	115	148	188	234			
	1.220	96.7	128	165	209	260			
CD75-150 Normal	Base Steel (mm) 0.762				174	216	263	317	379
	0.914				186	230	280	338	403
	1.220				207	256	312	376	448
CD75-150 Inverted	Base Steel (mm) 0.762				195	241	293	352	419
	0.914				208	256	311	374	445
	1.220				231	284	345	415	493
CD75-200 Normal	Base Steel (mm) 0.762				145	180	221	268	321
	0.914				155	192	236	285	342
	1.220				173	215	263	318	380
CD75-200 Inverted	Base Steel (mm) 0.762				208	256	311	373	442
	0.914				221	272	329	395	468
	1.220				245	301	364	436	516
CD75-300 Normal	Base Steel (mm) 0.762				181	224	272	328	390
	0.914				192	237	288	346	412
	1.220				212	261	317	381	453

$w_d = \frac{DP(10)^3}{DC(L)^3}$; DC = deflection constant such as 360; L = span length (m)

Shoring was established based on CSSBI 12M-2008 and web crippling was based on an assumed end bearing length, n, of 76 mm and an interior bearing length of 152 mm for the CD75 decks and 40 mm and 102 mm, respectively, for the CD36 deck. If the bearing lengths are less than these values, the Engineer of Record must verify the web crippling strength during the construction stage (see example).

The information contained on this data sheet was prepared by Dr. R.M. Schuster P.Eng.
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Designer Notes - Web Crippling

EXAMPLE
CD75-300 (ZF75) - SI UNITS
Given the following information, check the adequacy of the CD75-300 composite slab system:

GIVEN:
Steel deck - Design thickness = 0.914 mm; yield strength = 230 MPa
Concrete - Normal density = 2400 kg/m^3
Overall slab depth = 130 mm
Triple span deck length = 3.0 m

Specified Loads:
Superimposed dead load
a) floor finish = 0.5 kPa
b) partitions = 1.0 kPa
DL = 1.5 kPa
Live load LL = 4.8 kPa
Total load = {1.25/1.5(DL) + LL} = {0.833(1.5) + 4.8} = *6.05 kPa*

USE OF LOAD TABLE:
From the appropriate table, the maximum specified load is *10.8 kPa*
Since 10.8 > 6.05 ∴ ***OK***
NOTE: The self-weight of the steel deck and the concrete have already been accounted for in the load tables for strength requirements.

DEFLECTION CHECK:
See Additional Technical Data Tables for value of DP = 192 and assume DC = 480. Typically this value is 360.

$$w_d = \frac{DP(10)^3}{DC(L)^3} = \frac{192(10)^3}{480(3.0)^3} = 14.8\text{kPa}, > 4.8\text{ kPa} \quad \therefore \text{ OK}$$

SHORING CHECK:
Based on CSSBI 12M-2008, flexure and deflection during the construction stage have already been accounted for in the composite load tables by the use of the shaded areas. Web crippling was based on an assumed end bearing length of 76 mm and an interior bearing length of 152 mm. See Additional Technical Data Tables for web crippling information. The slab weight can be obtained from the composite load table, which is 2.32 kPa for the 130 mm slab depth. As per CSSBI 12M-2008, the uniform construction live load is 1 kPa, resulting in a total specified load during construction of
[0.833(2.32) + 1] = 2.93 kPa;

End Web Crippling
a) Specified end reaction
0.4(2.93)3.0 = ***3.52 kN/m***
b) Maximum specified end reaction
$P_e = P_{e1} + P_{e2}\sqrt{n/t}$
n/t = 76/0.914 = 83.2
P_{e1} = 1.76; P_{e2} = 0.441
$P_e = 1.76 + 0.441\sqrt{83.2}$ = ***5.78 kN/m***, which is greater than ***3.52 kN/m***, ∴ OK
Or, the maximum unshored span, L_{max} = 5.78(1000)/0.4/2.93 = ***4932 mm***, which is > ***3000 mm***, ∴ OK

Interior Web Crippling
a) Specified interior reaction
1.10(2.93)3.0 = ***9.67 kN/m***
b) Maximum specified interior reaction
$P_i = P_{i1} + P_{i2}\sqrt{n/t}$
n/t = 152/0.914 = 166
P_{i1} = 3.37; P_{i2} = 0.573
$P_i = 3.37 + 0.573\sqrt{166}$ = ***10.8 kN/m***, which is greater than ***9.67 kN/m***, ∴ OK
Or, the maximum unshored span, L_{max} = 10.8(1000)/1.1/2.93 = ***3351 mm***, which is > ***3000 mm***, ∴ OK