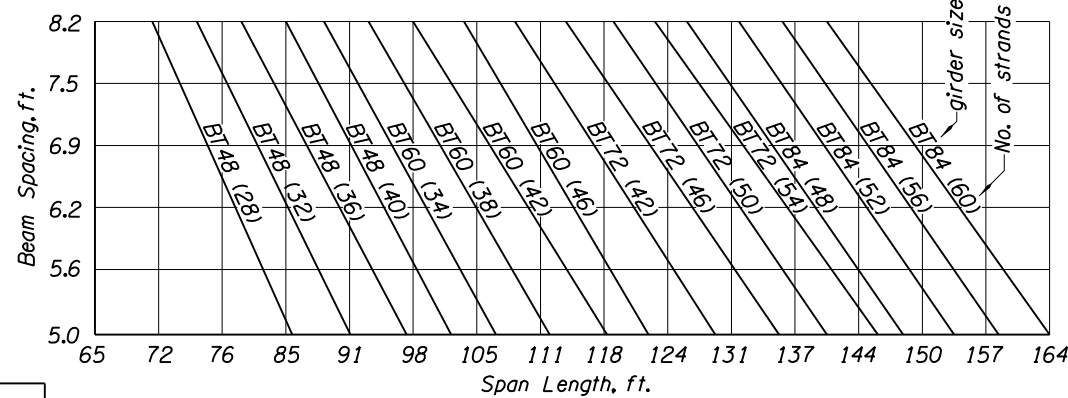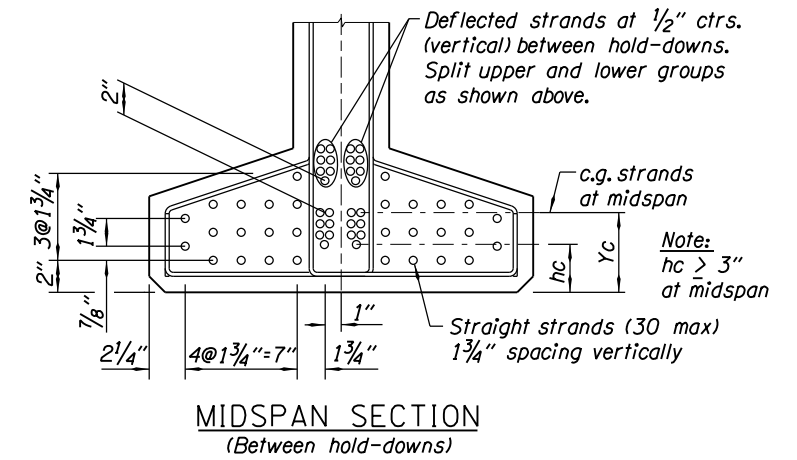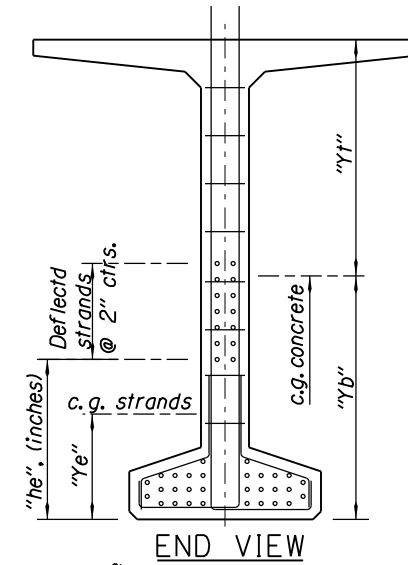**Assumptions for Estimating Strand Requirements:**
25 psf allowance for future wearing surface
100 psf allowance per girder for rails and utilities
HL-93 live loading with 0.095*sqrt (f'c) allowable final tension.
8" deck with 1" buildup on top of girder
0.5* (f'c) final allowable compressive stress.
he and Ye values provided for preliminary purposes only and are based on he ≈ 1/3 * girder depth. Adjust as needed to meet design requirements.

TOTAL STRANDS	N = 20	N = 22	N = 24	N = 26	N = 28	N = 30	N = 32	N = 34	N = 36	N = 38
STRANDS DEFLECTED	Ds = 10	Ds = 10	Ds = 12	Ds = 12	Ds = 14	Ds = 14	Ds = 16	Ds = 16	Ds = 18	Ds = 18
Yc (when hc = 3")	Yc = 2.98"	Yc = 3.05"	Yc = 3.04"	Yc = 3.10"	Yc = 3.30"	Yc = 3.33"	Yc = 3.69"	Yc = 3.64"	Yc = 3.83"	Yc = 3.91"

	N = 40	N = 42	N = 44	N = 46	N = 48	N = 50	N = 52	N = 54	N = 56	N = 58	N = 60
	Ds = 20	Ds = 20	Ds = 22	Ds = 22	Ds = 24	Ds = 24	Ds = 26	Ds = 26	Ds = 28	Ds = 28	Ds = 30
	Yc = 4.12"	Yc = 4.18"	Yc = 4.13"	Yc = 4.19"	Yc = 4.27"	Yc = 4.32"	Yc = 4.50"	Yc = 4.50"	Yc = 4.68"	Yc = 4.77"	Yc = 4.71"

STRAND CENTER OF GRAVITY AT GIRDER ENDS, INCHES (Ye)

No. Strands	Defl. Strands	BT48 he	BT48 Ye	BT60 he	BT60 Ye	BT72 he	BT72 Ye	BT84 he	BT84 Ye	BI51 he	BI51 Ye	BI63 he	BI63 Ye	BI75 he	BI75 Ye
20	10	18	12.17	20	13.17	24	15.17	48.23	17.17	18	12.17	22	14.17	26	16.17
22	10	18	11.41	20	12.32	24	14.14	28	15.95	18	11.41	22	13.23	26	15.05
24	12	18	12.79	20	13.79	24	15.79	28	17.79	18	12.79	22	14.79	26	16.79
26	12	18	12.10	20	13.02	24	14.87	28	16.71	18	12.10	22	13.94	26	15.79
28	14	18	13.37	20	14.37	24	16.37	28	18.37	18	13.37	22	15.37	26	17.37
30	14	18	12.73	20	13.67	24	15.53	28	17.40	18	12.73	22	14.60	26	16.47
32	16	18	13.94	20	14.94	24	16.94	28	18.94	18	13.94	22	15.94	26	17.94
34	16	18	13.29	20	14.23	24	16.11	28	17.99	18	13.29	22	15.17	26	17.05
36	18	18	14.44	20	15.44	24	17.44	28	19.44	18	14.44	22	16.44	26	18.44
38	18	18	13.97	20	14.91	24	16.81	28	18.70	18	13.97	22	15.86	26	17.76
40	20	18	15.07	20	16.07	24	18.07	28	20.07	18	15.07	22	17.07	26	19.07
42	20	---	---	20	15.57	24	17.47	28	19.37	---	---	22	16.52	26	18.42
44	22	---	---	20	16.68	24	18.68	28	20.68	---	---	22	17.68	26	19.68
46	22	---	---	20	16.19	24	18.10	28	20.02	---	---	22	17.15	26	19.06
48	24	---	---	20	17.27	24	19.27	28	21.27	---	---	22	18.27	26	20.27
50	24	---	---	---	---	24	18.71	28	20.63	---	---	---	---	26	19.67
52	26	---	---	---	---	24	19.84	28	21.84	---	---	---	---	26	20.84
54	26	---	---	---	---	24	19.28	28	21.20	---	---	---	---	26	20.24
56	28	---	---	---	---	24	20.37	28	22.37	---	---	---	---	26	21.37
58	28	---	---	---	---	---	---	28	21.85	---	---	---	---	---	---
60	30	---	---	---	---	---	---	28	22.99	---	---	---	---	---	---

Notes:

1. Allowable spans for Bulb-I girders are approximately 2'-0" greater than those shown for the companion Bulb-T girder in the Estimated Number of Strands chart.

2. Girder end blocks should be used at girder ends made continuous for live load or when girders are partially post tensioned.

3. Debonding strands to control compressive stresses at girder ends is permitted provided that the required development length for debonded strands is obtained. Do not debond any strands in the bottom row.

4. Ds = Deflected Strands.

5. Deflected strands may be bundled between hold-down points.

END VIEW

Deflectd strands @ 2" ctrs.
"he" (inches)
"Ye"
c.g. strands
c.g. concrete
"Yb"

MIDSPAN SECTION
(Between hold-downs)

Deflected strands at 1/2" ctrs. (vertical) between hold-downs. Split upper and lower groups as shown above.
c.g. strands at midspan
Note: hc > 3" at midspan
Straight strands (30 max) 1 3/4" spacing vertically
2"
1 3/4"
7/8"
2 1/4"
4@1 3/4"=7"
1 3/4"
1"
hc
Yc

STRAND PATTERN FOR CONCRETE INSERTS
Use a non-standard strand pattern if inserts need to be placed in lower bulb.

Concrete insert ℄
7/8"
1 3/4"
2 3/4"

ESTIMATED NO. OF STRANDS

Beam Spacing, ft.
Span Length, ft.
girder size / No. of strands
BT48 (28), BT48 (32), BT48 (36), BT48 (40), BT60 (34), BT60 (38), BT60 (42), BT60 (46), BT72 (42), BT72 (46), BT72 (50), BT72 (54), BI84 (48), BT84 (52), BT84 (56), BT84 (60)
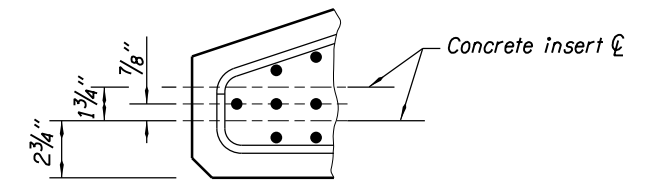
GIRDER PROPERTIES

Girder	Area, in²	Yb, in	I, in⁴	St, in³	Sb, in³	Wt, k/ft	V/S, in
BT48	556	24.51	177,200	7,540	7,230	0.598	2.58
BT60	628	30.45	307,800	10,420	10,110	0.676	2.62
BT72	700	36.41	483,700	13,590	13,290	0.753	2.65
BT84	772	42.37	710,000	17,050	16,760	0.831	2.68
BI51	565	25.22	190,800	7,400	7,570	0.608	3.21
BI63	637	31.16	326,600	10,260	10,480	0.685	3.18
BI75	709	37.12	508,200	13,420	13,690	0.763	3.16

Weight estimated at 155 lbs. per cubic foot

NOTE TO DESIGNER
Check limiting transport lengths before using long sections. Stability and route restrictions can be a problem.

OREGON DEPARTMENT OF TRANSPORTATION
TECHNICAL SERVICES
DETAILS

BULB-T and I
(PRECAST PRESTRESSED CONCRETE) GIRDERS
DESIGN SHEET

DETAIL NO.
DET3320

1:48 - det3320