

**HAM-50-0376 RATING ANALYSIS
PROCEDURE**

HAM-50-0376 TRUSS ANALYSIS(A) DEAD LOADS →(I) TRUSS →(1) DETAIL Factor calculations for

⊗ Vertical / Diagonal members

⊗ Lower chord members

⊗ Upper chord members.

(2) Section Properties of members(3) Weight of truss

⊗ Length of each member

⊗ Horizontal sway bracing is divided between two bays.

(II) RAILING, SLAB and Haunch Loads →(1) Railing load (applied compositely to each beam) — includes

⊗ 2W beams

⊗ Type I post

⊗ bolts and plates.

(2) Slab loads (applied compositely to each beam) — includes wt. of slab, haunch and curb.(III) DIAPHRAGM LOADS → applied non compositely(IV) Stringer Weights.(V) Model railing, slabs, diaphragm loads on the stringer using STAAD to get Dead Load reactions on floor Beams at the stringer

HAM-50-0576 TRUSS ANALYSIS

locations and calculate panel point reactions (Dead load reactions from floor beams onto truss).

(B) DEAD LOADS FOR LARS INPUT →

(I) TRUSS INPUT → ① Truss weight (as uniform load)

② Panel point reactions at floor beam locations

(II) Stringer INPUT → ① Railing, Slab and Haunch Load (uniform load)

② Diaphragm load

NOTE: Stringer size is input in LARS and LARS computes self weight of stringer based on the input member size.

(III) FLOOR BEAM INPUT → ① Floor Beam reactions from STAAD includes

(i) Slab loads

(ii) Diaphragm loads

② Haunch and/or Slab loads.

③ Stringer Dead Load

NOTE: Floor beam size is input in LARS and LARS computes self weight of floor beams based on the input member size.

(C) DISTRIBUTION FACTORS → LARS takes no. of wheels as the

input for Distribution factor:—

(I) D.F. for stringers

(II) D.F. due to two trucks placed close to one truss

(III) ① D.F. due to one truck placed in lane closer to the truss

② D.F. due to one truck placed in the other lane.

HAM-50-0376 TRUSS ANALYSIS

① LIVE LOAD VEHICLES →

(I) INVENTORY → AASHTO HS-20-44 (Truck and Lane)

(II) OPERATING → ① AASHTO HS-20-44 (Truck and Lane)

② 2FI

③ 3FI

④ 4FI

⑤ SCI

⑥ BDM article 911.2.2.2 states that place as many no. of SCI trucks (36' apart) as the span can accommodate fully in right lane and place a single SCI truck in the left lane so as to maximize the force in the member under consideration. (This applies to spans of 200' or more. However, we have used this for 191' truss as well)

⑤ LARS RUNS →

(I) MAIN RUN → For Inv. level (HS20), Opt. level (HS20, 2FI, 3FI, 4FI, SCI)

(II) Right lane Run — $\left[\begin{array}{l} 250' \text{ truss} - 3(\text{SCI trucks}) \text{ separated by } 36' \\ \text{(SCIT1)} \\ 191' \text{ truss} - 2(\text{SCI trucks}) \text{ separated by } 36' \\ \text{(SCIT2 in LARS)} \end{array} \right]$ ④

(III) Left lane Run — Single SCI Truck in the right lane

* Results from (II) and (III) are combined to get Operating level loading of BDM 911.2.2.2

**SPANS 1 AND 4
(191'-4" TRUSS)**

WEIGHT OF TRUSS

1. SPANS 1 AND 4

HAM-50-0376L

SELFWEIGHT OF TRUSS SPANS 1 AND 3

CALCULATION OF TRUSS MEMBER WEIGHT							
Member	Description	Area (in ²)	Nominal Wt. plf	Number	Length ft.	Detail Factor	Weight (pounds)
L0 U1	2-C15x50 1 PL 21x9/16	41.233	140	2	36.8240	1.23	12710
U1 U2	2-C15x40 1 PL 21x1/2	33.900	115	2	24.4861	1.23	6950
U2 U3	2-C15x40 1 PL 21x11/16	37.838	129	2	23.9806	1.23	7600
U3 U4	2-C15x50 1 PL 21x9/16	41.233	140	2	23.9167	1.23	8260
L0 L2	2 PL 15x3/4	22.500	77	2	47.8333	1.42	10410
L2 L3	2 PL 15x11/16 2 PL 15x3/8	31.875	108	2	23.9167	1.42	7370
L3 L4	2 PL 15x11/16 2 PL 15x9/16	37.50	128	2	23.9167	1.42	8670
U1 L2	12WF58		58	2	36.8240	1.11	4750
U2 L3	12WF53		53	2	40.9582	1.11	4820
U3 L4	12WF36		36	4	42.3911	1.11	6780
U1 L1	12WF40		40	2	28.0000	1.11	2490
U2 L2	12WF65		65	2	33.2500	1.11	4800
U3 L3	12WF36		36	2	35.0000	1.11	2800
U4 L4	12WF36		36	1	35.0000	1.11	1400
SUBSTRUTS	12WF36		36	2	23.9167	1.11	1920
							0
SUBTOTAL 1 TRUSS =							91730
TOTAL 2 TRUSSES = x2							183460

CALCULATION OF SWAY BRACING WEIGHT						
Member	Description	Nominal Wt. plf	Number	Length ft.	Detail Factor	Weight (pounds)
U1 & U7	8WF28	28	4	38.8333	1.22	5310
U2 & U6	8WF28	28	4	38.8333	1.22	5310
U3 & U5	8WF28	28	4	38.8333	1.22	5310
U4	8WF28	28	2	38.8333	1.22	2660
U1 & U7	8WF17	17	12	10.2000	1.22	2540
U2 & U6	8WF17	17	8	22.8180	1.22	3790
U3 & U5	8WF17	17	8	23.7217	1.22	3940
U4	8WF17	17	4	23.7217	1.22	1970
PANEL 2&7	ST8WF18	18	4	45.9057	1.22	4040
PANEL 3&6	ST8WF19	18	4	45.6381	1.22	4010
PANEL 4&5	ST8WF20	18	4	45.6046	1.22	4010
TOTAL =						42890

TOTAL WEIGHT OF TRUSSES 226350 pounds
 SPAN LENGTH 191.33 ft.
 TRUSS WEIGHT PER FOOT 1183.1 plf
 LOAD APPLIED TO EA TRUSS 591.55 plf ← Input into LARS

See 250' truss calculations for detail factors

RAILING, SLAB AND HAUNCH LOADS

- 1. RAILING LOAD**
- 2. SLAB LOAD**
- 3. DIAPHRAGM LOAD**

Load Rating of Stringers 19'-4" truss

WF 21 x 62 - Non-composite (5 @ 7'-0"±)

Width - 33'-4"

Spacing - 7'-0"

Railing - DBR-2-73

Overhang - 2'-8"

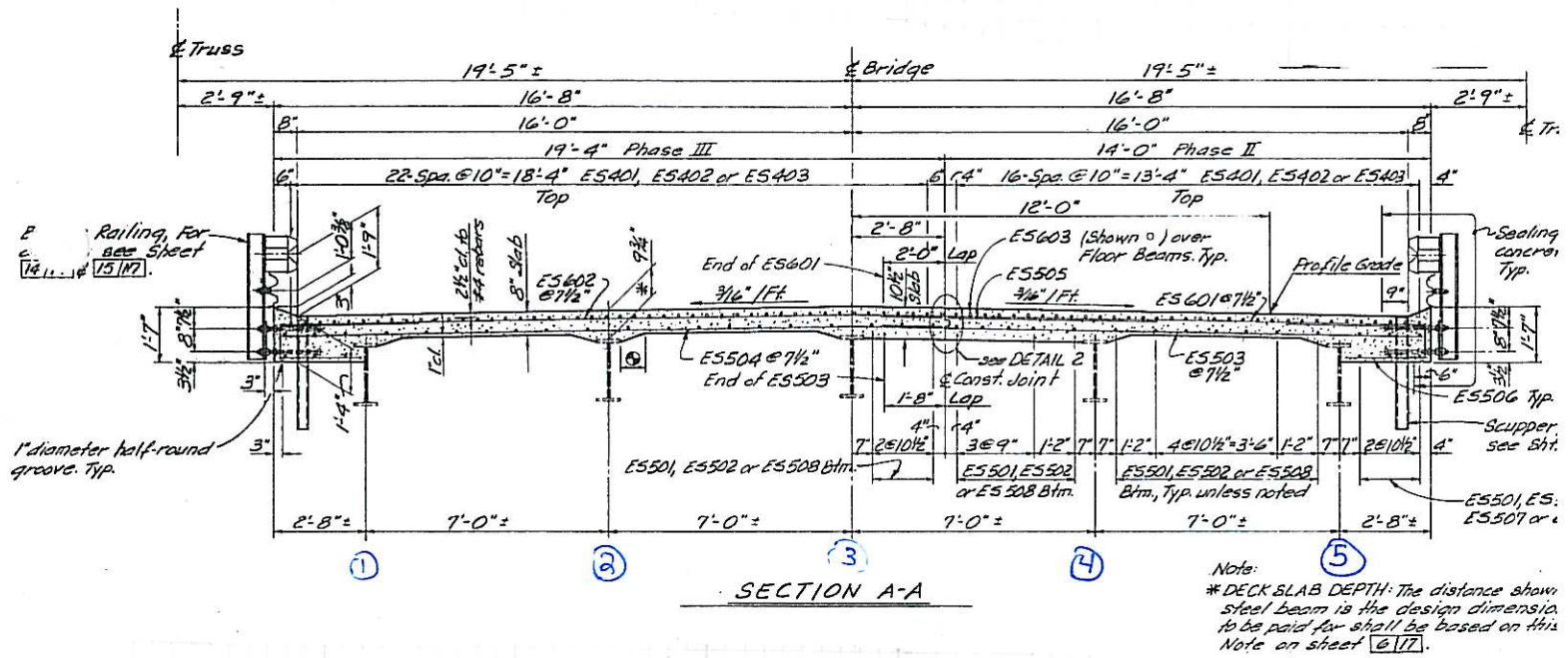
Slab - 8" nominal (see section)

Lightweight conc. (120 pcf per LFRD Tbl. 3.5.1-1)

Loads - HS-20 (Lane 1 Truck)

8 spans @ 23'-11"

- 2F1
- 3F1
- 4F1
- 5C1



Dead Loads

Railing - rail is similar to DBR-2-73

AASHTO M180 Type 2 Class A

2 w-beams @ 7.25 p/f x 2 = 14.5 p/f

TS 8' x 4' x 3/16" = 14.54 p/f

29.04 p/f

Posts - W6 x 25 x 3'-7 3/4" = 91.2 pounds ea

TS 8' x 4' x 3/16" x 1' x 14.54 p/f = 14.54 #

PL 1/2 x 7 1/2 x 14 1/2" = 15.5 #

Anchors & Bolts: 0.75 # + 1.06 # + 34.63 # = 36.44 # = 25.23 #/ft

TOTAL = 25.23 #/ft + 29.04 p/f = 54.27 sq ft 55-p/f

Slab loadsExterior stringers ① & ⑤

$$\text{Slab} - \frac{8''}{12} \times (3.5' + 2.67') \times 0.120 \text{ kcf} = 0.50 \text{ klf}$$

$$\text{Haunch} - \left[1.75'' \times 8\frac{1}{4}'' + \frac{1}{2} (2.375'' \times 9'') \right] \times \frac{1}{144} \times 0.120 \text{ kcf} = 0.021 \text{ klf}$$

$$\text{5/8 + 1 3/4} \times 1.1 = 0.023 \text{ klf}$$

$$\text{Overhang} - \frac{8''}{12} \times 2.67' \times 0.120 \text{ kcf} = 0.21 \text{ klf}$$

$$\text{Curb} - \frac{1}{2} (3'' \times 8'') \times \frac{1}{144} \times 0.120 \text{ kcf} = 0.01 \text{ klf}$$

$$\text{Total} = 0.50 + 0.023 + 0.21 + 0.01 = \boxed{0.743 \text{ klf}}$$

Stringer ②

$$\text{Slab} - \frac{8''}{12} \times 7'-0'' \times 0.120 \text{ kcf} = 0.56 \text{ kcf}$$

$$\text{Haunch} - \left[\frac{8\frac{1}{4}'' \times 1.75''}{144} + \frac{9'' \times 2.375''}{144} \right] \times 0.120 \text{ kcf} \times 1.1 = 0.033 \text{ klf}$$

$$\text{Total} = 0.56 \text{ klf} + 0.033 \text{ klf} = \boxed{0.593 \text{ klf}}$$

Stringer ③ & ④ (thickened slab)

$$\text{Slab} - \left[\frac{8''}{12} \times 3.5' + \frac{10.5''}{12} \times 3.5' \right] \times 0.120 \text{ kcf} = 0.65 \text{ klf}$$

$$\text{Haunch} = \left[\frac{1}{2} \times 9'' \times 2.375'' + 4'' \times 1.75'' \right] \times \frac{1}{144} \times 0.12 \text{ kcf} \times 1.1 = 0.016 \text{ klf}$$

$$\text{Total} = 0.65 + 0.016 \text{ klf} = \boxed{0.666 \text{ klf}}$$

Diaphragm Loads

$$L 3 \times 3 \times 5/16 = 6.10 \text{ \#/ft}$$

$$\text{Lower L} - 7'-0'' \times 6.10 \text{ \#/ft} = 42.7 \text{ \#}$$

$$\text{Diagonals} - 14' \times \frac{x}{7'} \quad x = 7.14' \quad \text{weight} = 2 \times 7.14' \times 6.10 = 87.11 \text{ \#}$$

$$\text{Total} = 42.7 + 87.11 = 129.81 \text{ say } 0.13 \text{ k int}$$

$$/2 \text{ ext} = 0.065 \text{ k ext}$$

STRINGER INPUT

Calculate Load on Stringers

Exterior Stringers ① & ⑤

Rail - Dist equally to all beams

$$\frac{55 \text{ plf} \times 2 \text{ sides}}{5} = 22 \text{ plf each stringer}$$

$$\text{Slab} = 0.743 \text{ k/ft}$$

Haunch

$$\text{Total} = 0.022 \text{ k/ft} + 0.853 \text{ k/ft} = 0.765 \text{ k/ft}$$

Diaphragm - 0.065 k @ mid panel each panel

Stringer ②

Rail - 22 plf

Diaphragm - 0.13 k @ mid panel

$$\text{Slab} \text{ \& Haunch} = 0.593 \text{ k/ft}$$

$$\text{Total} = 0.593 \text{ k/ft} + 0.022 \text{ k/ft} = 0.615 \text{ k/ft}$$

Stringers ③ & ④

Rail - 22 plf

$$\text{Slab} \text{ \& Haunch} = 0.666 \text{ k/ft}$$

$$\text{Total} = 0.688 \text{ k/ft}$$

TRUSS AND FLOOR BEAM INPUT

- 1. STAAD ANALYSIS FOR SLAB, HAUNCH AND DIAPHRAGM LOADS (FOR PANEL POINT REACTION ON THE TRUSS)**
- 2. STRINGER WEIGHT AND HAUNCH WEIGHT FOR FLOOR BEAM INPUT**

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*****
*
*          STAAD.Pro
*          Version  2007    Build 04
*          Proprietary Program of
*          Research Engineers, Intl.
*          Date=    AUG 11, 2009
*          Time=    13:47:55
*
*          USER ID: TranSystems
*****

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1. STAAD SPACE

INPUT FILE: FLOOR BEAM REACTIONS 02(Spans 1 and 3) MSL2009-08-11.STD

2. START JOB INFORMATION

3. ENGINEER DATE 09-30-08

4. JOB NAME HAM-50-0367L

5. JOB CLIENT ODOT D-8

6. JOB NO P402080073

7. JOB REV REV 0

8. JOB REF 191'-4" STRINGER DEAD LOADS

9. ENGINEER NAME PJP

10. JOB COMMENT DL FOR 8 SPAN CONT STRINGER

11. END JOB INFORMATION

12. INPUT WIDTH 79

13. UNIT FEET KIP

14. JOINT COORDINATES

15. 10 0 0 1; 11 23.92 0 1; 12 47.83 0 1; 13 71.75 0 1; 14 95.67 0 1

16. 15 119.58 0 1; 16 143.5 0 1; 17 167.42 0 1; 18 191.33 0 1; 20 0 0 2

17. 21 23.92 0 2; 22 47.83 0 2; 23 71.75 0 2; 24 95.67 0 2; 25 119.58 0 2

18. 26 143.5 0 2; 27 167.42 0 2; 28 191.33 0 2; 30 0 0 3; 31 23.92 0 3

19. 32 47.83 0 3; 33 71.75 0 3; 34 95.67 0 3; 35 119.58 0 3; 36 143.5 0 3

20. 37 167.42 0 3; 38 191.33 0 3; 40 0 0 4; 41 23.92 0 4; 42 47.83 0 4

21. 43 71.75 0 4; 44 95.67 0 4; 45 119.58 0 4; 46 143.5 0 4; 47 167.42 0 4

22. 48 191.33 0 4; 50 0 0 5; 51 23.92 0 5; 52 47.83 0 5; 53 71.75 0 5

23. 54 95.67 0 5; 55 119.58 0 5; 56 143.5 0 5; 57 167.42 0 5; 58 191.33 0 5

24. MEMBER INCIDENCES

25. 10 10 11; 11 11 12; 12 12 13; 13 13 14; 14 14 15; 15 15 16; 16 16 17; 17 17 18

26. 20 20 21; 21 21 22; 22 22 23; 23 23 24; 24 24 25; 25 25 26; 26 26 27; 27 27 28

27. 30 30 31; 31 31 32; 32 32 33; 33 33 34; 34 34 35; 35 35 36; 36 36 37; 37 37 38

28. 40 40 41; 41 41 42; 42 42 43; 43 43 44; 44 44 45; 45 45 46; 46 46 47; 47 47 48

29. 50 50 51; 51 51 52; 52 52 53; 53 53 54; 54 54 55; 55 55 56; 56 56 57; 57 57 58

30. DEFINE MATERIAL START

31. ISOTROPIC STEEL

32. E 4.176E+006

33. POISSON 0.3

34. DENSITY 0.489024

35. ALPHA 6.5E-006

36. DAMP 0.03

37. END DEFINE MATERIAL

38. MEMBER PROPERTY AMERICAN

39. 10 TO 17 20 TO 27 30 TO 37 40 TO 47 50 TO 57 TABLE ST W21X62

40. CONSTANTS

STAAD SPACE

-- PAGE NO. 2

41. MATERIAL STEEL ALL
 42. SUPPORTS
 43. 10 TO 17 20 TO 27 30 TO 37 40 TO 47 50 TO 57 PINNED
 44. 18 28 38 48 58 FIXED BUT FX MZ
 45. LOAD 1 LOADTYPE DEAD TITLE DEAD LOAD
 **WARNING- THIS STRUCTURE IS DISJOINTED. IGNORE IF
 MASTER/SLAVE OR IF UNCONNECTED JOINTS.
 46. MEMBER LOAD
 47. 10 TO 17 50 TO 57 UNI GY -0.765 0 23.92
 48. 20 TO 27 UNI GY -0.615 0 23.92
 49. 30 TO 37 40 TO 47 UNI GY -0.688 0 23.92
 50. 20 TO 27 30 TO 37 40 TO 47 CON GY -0.13 11.96 0
 51. 10 TO 17 50 TO 57 CON GY -0.065 11.96 0
 52. LOAD 2 STRINGER SELFWEIGHT
 53. SELFWEIGHT Y -1.1
 54. PERFORM ANALYSIS

P R O B L E M S T A T I S T I C S

NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS = 45/ 40/ 45

SOLVER USED IS THE OUT-OF-CORE BASIC SOLVER

ORIGINAL/FINAL BAND-WIDTH= 1/ 1/ 6 DOF
 TOTAL PRIMARY LOAD CASES = 2, TOTAL DEGREES OF FREEDOM = 130
 SIZE OF STIFFNESS MATRIX = 1 DOUBLE KILO-WORDS
 REQD/AVAIL. DISK SPACE = 12.1/ 642574.7 MB

55. PRINT SUPPORT REACTION LIST 10 TO 18

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
10	1	0.00	7.26	0.00	0.00	0.00	0.00
	2	0.00	0.65	0.00	0.00	0.00	0.00
11	1	0.00	20.77	0.00	0.00	0.00	0.00
	2	0.00	1.85	0.00	0.00	0.00	0.00
12	1	0.00	17.74	0.00	0.00	0.00	0.00
	2	0.00	1.58	0.00	0.00	0.00	0.00
13	1	0.00	18.53	0.00	0.00	0.00	0.00
	2	0.00	1.65	0.00	0.00	0.00	0.00
14	1	0.00	18.28	0.00	0.00	0.00	0.00
	2	0.00	1.63	0.00	0.00	0.00	0.00
15	1	0.00	18.52	0.00	0.00	0.00	0.00
	2	0.00	1.65	0.00	0.00	0.00	0.00
16	1	0.00	17.75	0.00	0.00	0.00	0.00
	2	0.00	1.58	0.00	0.00	0.00	0.00
17	1	0.00	20.77	0.00	0.00	0.00	0.00
	2	0.00	1.85	0.00	0.00	0.00	0.00
18	1	0.00	7.26	0.00	0.00	0.00	0.00
	2	0.00	0.65	0.00	0.00	0.00	0.00

***** END OF LATEST ANALYSIS RESULT *****

56. *DL REACTIONS FROM STRINGER 1 ABOVE
 57. PRINT SUPPORT REACTION LIST 20 TO 28

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
20	1	0.00	5.86	0.00	0.00	0.00	0.00
	2	0.00	0.65	0.00	0.00	0.00	0.00
21	1	0.00	16.79	0.00	0.00	0.00	0.00
	2	0.00	1.85	0.00	0.00	0.00	0.00
22	1	0.00	14.34	0.00	0.00	0.00	0.00
	2	0.00	1.58	0.00	0.00	0.00	0.00
23	1	0.00	14.98	0.00	0.00	0.00	0.00
	2	0.00	1.65	0.00	0.00	0.00	0.00
24	1	0.00	14.77	0.00	0.00	0.00	0.00
	2	0.00	1.63	0.00	0.00	0.00	0.00
25	1	0.00	14.97	0.00	0.00	0.00	0.00
	2	0.00	1.65	0.00	0.00	0.00	0.00
26	1	0.00	14.34	0.00	0.00	0.00	0.00
	2	0.00	1.58	0.00	0.00	0.00	0.00
27	1	0.00	16.79	0.00	0.00	0.00	0.00
	2	0.00	1.85	0.00	0.00	0.00	0.00
28	1	0.00	5.86	0.00	0.00	0.00	0.00
	2	0.00	0.65	0.00	0.00	0.00	0.00

***** END OF LATEST ANALYSIS RESULT *****

58. *DL REACTIONS FROM STRINGER 2 ABOVE
 59. PRINT SUPPORT REACTION LIST 30 TO 38

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
30	1	0.00	6.55	0.00	0.00	0.00	0.00
	2	0.00	0.65	0.00	0.00	0.00	0.00
31	1	0.00	18.77	0.00	0.00	0.00	0.00
	2	0.00	1.85	0.00	0.00	0.00	0.00
32	1	0.00	16.02	0.00	0.00	0.00	0.00
	2	0.00	1.58	0.00	0.00	0.00	0.00
33	1	0.00	16.74	0.00	0.00	0.00	0.00
	2	0.00	1.65	0.00	0.00	0.00	0.00
34	1	0.00	16.51	0.00	0.00	0.00	0.00
	2	0.00	1.63	0.00	0.00	0.00	0.00
35	1	0.00	16.73	0.00	0.00	0.00	0.00
	2	0.00	1.65	0.00	0.00	0.00	0.00
36	1	0.00	16.03	0.00	0.00	0.00	0.00
	2	0.00	1.58	0.00	0.00	0.00	0.00
37	1	0.00	18.77	0.00	0.00	0.00	0.00
	2	0.00	1.85	0.00	0.00	0.00	0.00
38	1	0.00	6.55	0.00	0.00	0.00	0.00
	2	0.00	0.65	0.00	0.00	0.00	0.00

***** END OF LATEST ANALYSIS RESULT *****

60. *DL REACTIONS FROM STRINGER 3 ABOVE
 61. PRINT SUPPORT REACTION LIST 40 TO 48

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
40	1	0.00	6.55	0.00	0.00	0.00	0.00
	2	0.00	0.65	0.00	0.00	0.00	0.00
41	1	0.00	18.77	0.00	0.00	0.00	0.00
	2	0.00	1.85	0.00	0.00	0.00	0.00
42	1	0.00	16.02	0.00	0.00	0.00	0.00
	2	0.00	1.58	0.00	0.00	0.00	0.00
43	1	0.00	16.74	0.00	0.00	0.00	0.00
	2	0.00	1.65	0.00	0.00	0.00	0.00
44	1	0.00	16.51	0.00	0.00	0.00	0.00
	2	0.00	1.63	0.00	0.00	0.00	0.00
45	1	0.00	16.73	0.00	0.00	0.00	0.00
	2	0.00	1.65	0.00	0.00	0.00	0.00
46	1	0.00	16.03	0.00	0.00	0.00	0.00
	2	0.00	1.58	0.00	0.00	0.00	0.00
47	1	0.00	18.77	0.00	0.00	0.00	0.00
	2	0.00	1.85	0.00	0.00	0.00	0.00
48	1	0.00	6.55	0.00	0.00	0.00	0.00
	2	0.00	0.65	0.00	0.00	0.00	0.00

***** END OF LATEST ANALYSIS RESULT *****

62. *DL REACTIONS FROM STRINGER 4 ABOVE
 63. PRINT SUPPORT REACTION LIST 50 TO 58

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
50	1	0.00	7.26	0.00	0.00	0.00	0.00
	2	0.00	0.65	0.00	0.00	0.00	0.00
51	1	0.00	20.77	0.00	0.00	0.00	0.00
	2	0.00	1.85	0.00	0.00	0.00	0.00
52	1	0.00	17.74	0.00	0.00	0.00	0.00
	2	0.00	1.58	0.00	0.00	0.00	0.00
53	1	0.00	18.53	0.00	0.00	0.00	0.00
	2	0.00	1.65	0.00	0.00	0.00	0.00
54	1	0.00	18.28	0.00	0.00	0.00	0.00
	2	0.00	1.63	0.00	0.00	0.00	0.00
55	1	0.00	18.52	0.00	0.00	0.00	0.00
	2	0.00	1.65	0.00	0.00	0.00	0.00
56	1	0.00	17.75	0.00	0.00	0.00	0.00
	2	0.00	1.58	0.00	0.00	0.00	0.00
57	1	0.00	20.77	0.00	0.00	0.00	0.00
	2	0.00	1.85	0.00	0.00	0.00	0.00
58	1	0.00	7.26	0.00	0.00	0.00	0.00
	2	0.00	0.65	0.00	0.00	0.00	0.00

***** END OF LATEST ANALYSIS RESULT *****

64. *DL REACTIONS FROM STRINGER 5 ABOVE

65. FINISH

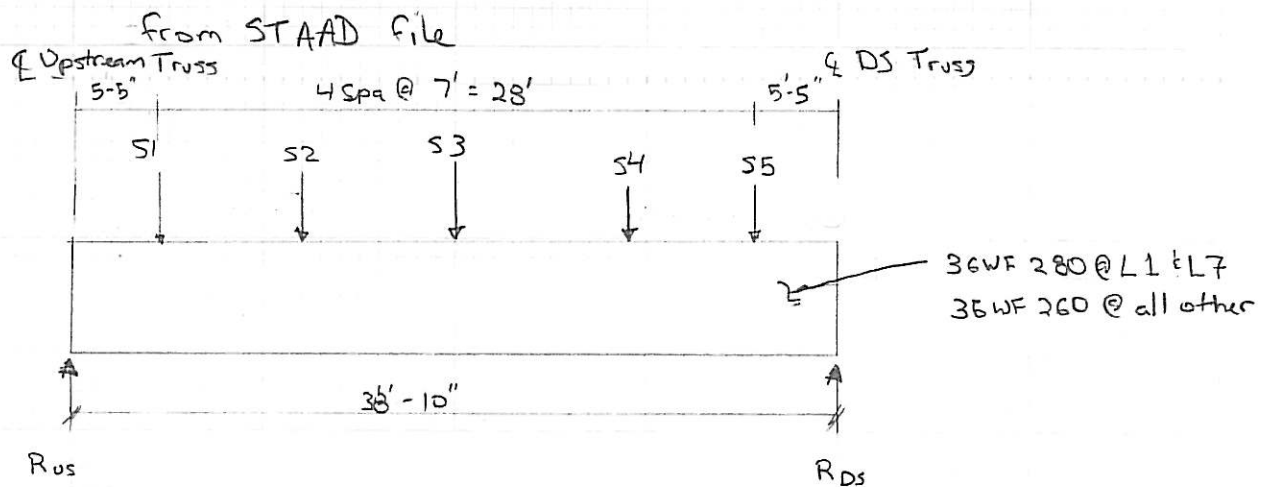
***** END OF THE STAAD.Pro RUN *****

**** DATE= AUG 11,2009 TIME= 13:47:56 ****

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*****
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*****
```


Calculate floor beam reactions to Panel Pts.

		Stringer Reactions (k)				
		Floor beam				
Stringer		L0 & L8	L1 & L7	L2 & L6	L3 & L5	L4
	S1 & S5	7.91	22.62	19.33	20.18	19.91
	S2	6.51	18.64	15.92	16.63	16.40
	S3 & S4	7.20	20.62	17.61	18.39	18.14



Self weight & Deck Haunch

S.W. L1 & L7 = $38'-10" \times 280 \text{ #/ft} \times 1.1 = 11.96 \text{ k total weight}$

others $38'-10" \times 260 \text{ #/ft} \times 1.1 = 11.11 \text{ k total weight}$

Haunch & Deck Include 1'-3" of additional slab @ end floor beams (conservative @ abuts) and estimated haunch over each floor beam.

End Floor beams

Haunch Depth $\approx 1.75" \text{ min to cross slope } 14' \times \frac{3}{16} \text{ #/ft} + 1.75" = 4.375"$

avg = $\frac{1.75" + 4.375"}{2} = 3.0625" + \text{flange} = 1\frac{1}{2}" = 4.5625"$

Haunch weight = $35' \times \frac{4.5625"}{12} \times 2.5' \times 0.12 \text{ kcf} \times 1.1 = 4.39 \text{ k}$

L H x W

Floor Bm. Reactions (cont)

Add slab @ end FB

$$1'-3" \times 35' \times \frac{8"}{12} \times 0.12 \text{ kcf} \times 1.1 = 3.85 \text{ k}$$

Interior Floor Beams

Haunch - avg depth 4.5625"

length = 33'-4"

width = 16.5" + 12" taper on each side = 28.5" = 2.375'

$$\text{weight} = \frac{4.5625"}{12} \times 33.33' \times 2.375' \times 0.12 \text{ kcf} \times 1.1 = 3.97 \text{ k}$$

Total Self Weight & Deck Weight on FB

$$\text{End FB L0 \& L8} = 11.11 \text{ k} + 3.85 \text{ k} + 4.39 \text{ k} = 19.35 \text{ k}$$

$$\text{L1 \& L7} = 11.96 \text{ k} + 3.97 \text{ k} = 15.93 \text{ k}$$

$$\text{L2-L6} = 11.11 \text{ k} + 3.97 \text{ k} = 15.08 \text{ k}$$

Reactions to Panel Points

• End FB U.S. L0 & L8 $\Sigma M = 0$

$$= \frac{19.35 \text{ k}}{2} + \frac{7.91 \text{ k}(38.83')}{38.83'} + \frac{7.20 \text{ k}(31.84')}{38.83'} + \frac{6.51 \text{ k}(26.42')}{38.33'}$$

$$R_{us} = 27.92 \text{ k}$$

$$R_{Ds} = 28.16 \text{ k}$$

small difference less than 0.5% say average = 28.04 k = $R_{us} = R_{Ds}$

• L1 & L7 U.S.

$$= \frac{15.93 \text{ k}}{2} + \frac{22.62 \text{ k}(38.83')}{38.83'} + \frac{20.62 \text{ k}(31.84')}{38.83'} + \frac{18.64 \text{ k}(26.42')}{38.33'}$$

$$R_{us} = 58.26 \text{ k}$$

$$R_{Ds} = 62.79 \text{ k}$$

small difference less than 0.5% use average

$$60.53 \text{ k}$$

• L2 & L6

$$R_{us} = R_{DS} = \frac{15.08k + 2(19.33k) + 15.92k + 2(17.61k)}{2}$$
$$= 52.44k$$

• L3 & L5

$$R_{us} = R_{DS} = \frac{15.08k + 2(20.18k) + 16.63k + 2(18.39k)}{2}$$
$$= 54.97k$$

• L4

$$R_{us} = R_{DS} = \frac{15.08k + 2(19.91k) + 16.4k + 2(18.14k)}{2}$$
$$= 53.79k$$

TRUSS DISTRIBUTION FACTORS

- 1. DUE TO TWO TRUCK LOADS**
- 2. DUE TO A SINGLE TRUCK LOAD:**
 - a. IN RIGHT LANE**
 - b. IN LEFT LANE**

DISTRIBUTION FACTORS

(I) STRINGERS — S01 → External stringer 1; S02, S03 → Interior stringers

① MAIN ANALYSIS → $\frac{S}{5.5} = 1.2727$ for stringers ~~S02~~ S02, S03.
 $= 1.143$ for S01

② Right Lane Analysis → For 501 train of trucks:

Ⓐ Stringer S01 → Page 2, Case I

Ⓑ Stringer S02 → Page 3, Case I

Ⓒ Stringer S03 → Page 4, Case I

③ Left Lane Analysis → For single 501 truck:

Ⓐ Stringer S01 → Page 2, Case II

Ⓑ Stringer S02 → Page 3, Case II

Ⓒ Stringer S03 → Page 4, Case III

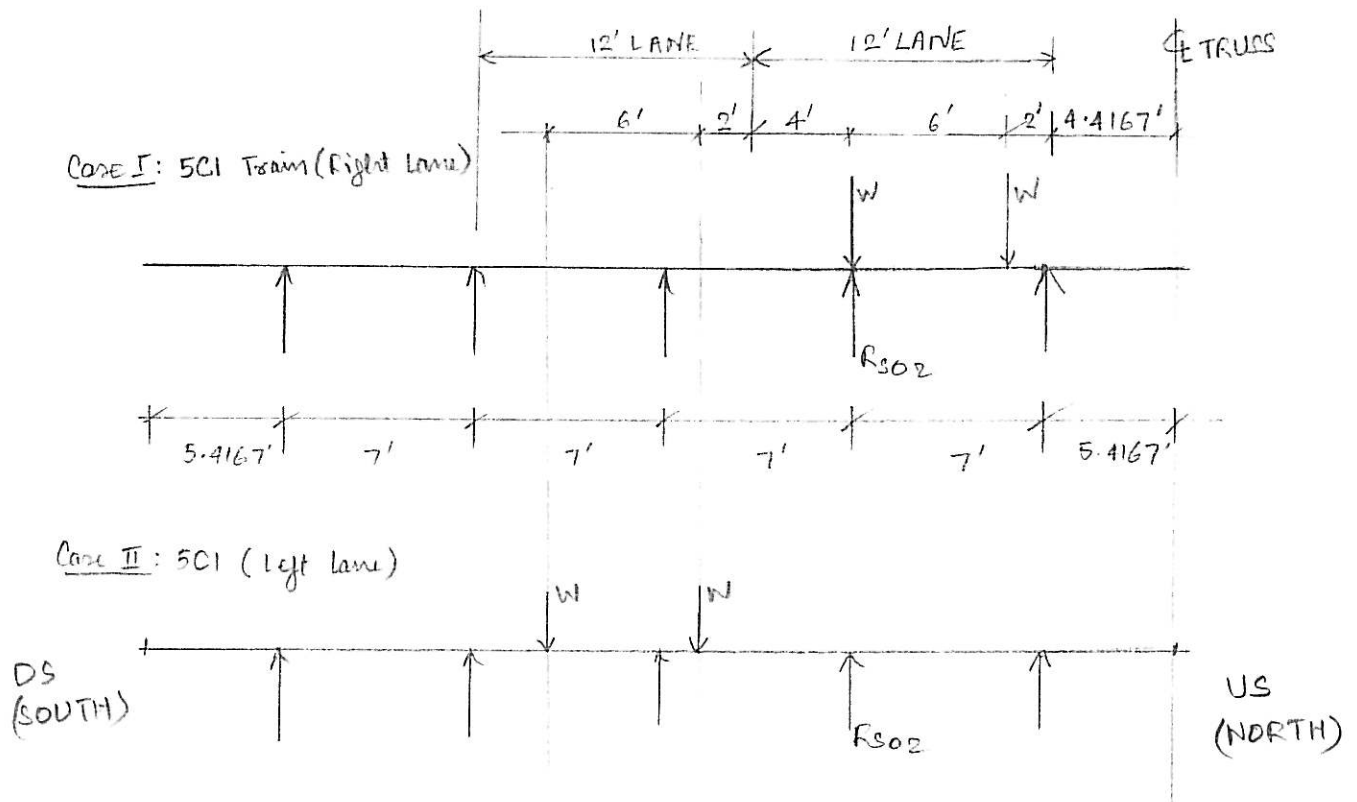
(II) TRUSS — T01 → Downstream Truss

① Main Analysis → Page 5

② Right Lane Analysis → Page 6

③ Left Lane Analysis → Page 6

DISTRIBUTION FACTOR FOR S02



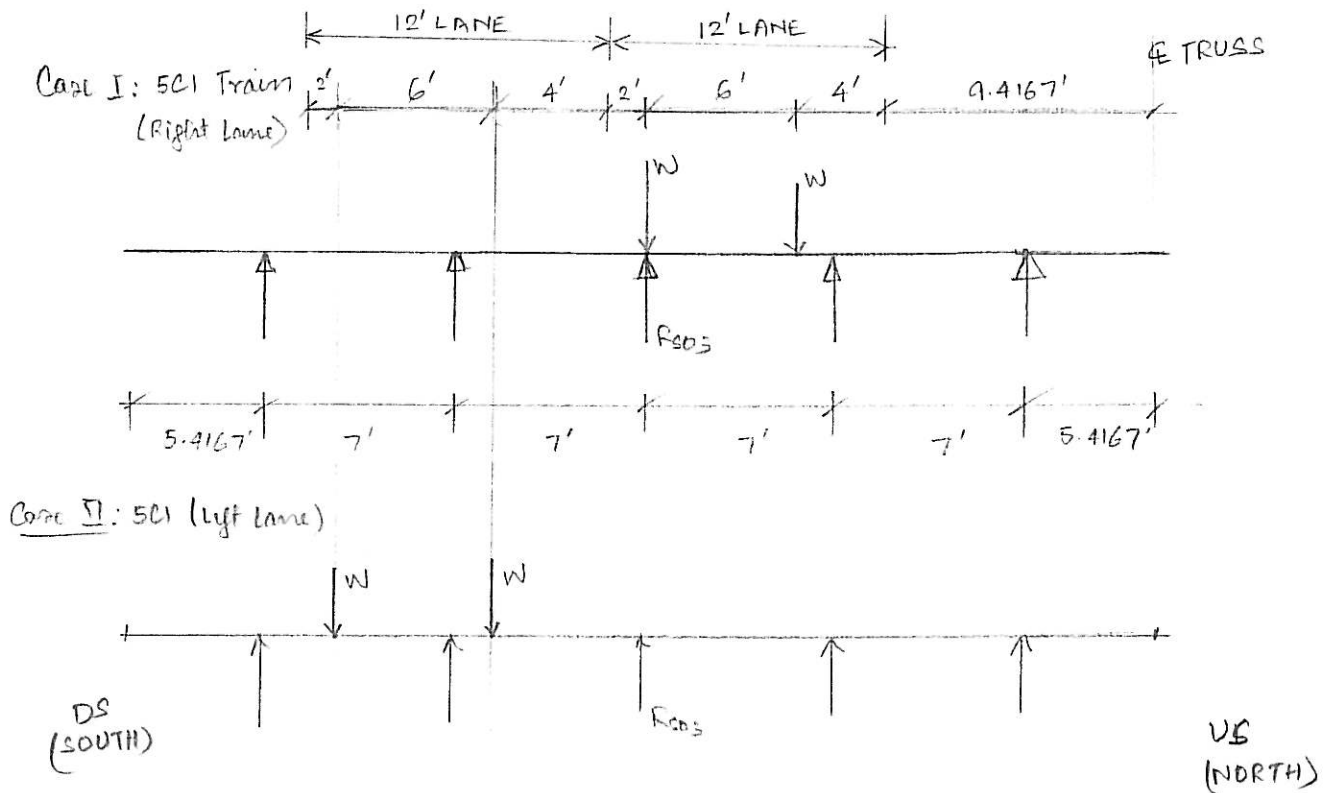
Case I:

$$R_{S02} = W + \frac{W}{7} = \frac{8}{7} W = 1.143W$$

Case II:

$$R_{S02} = \frac{W}{7} = 0.143W$$

DISTRIBUTION FACTOR FOR SDS



Case I:

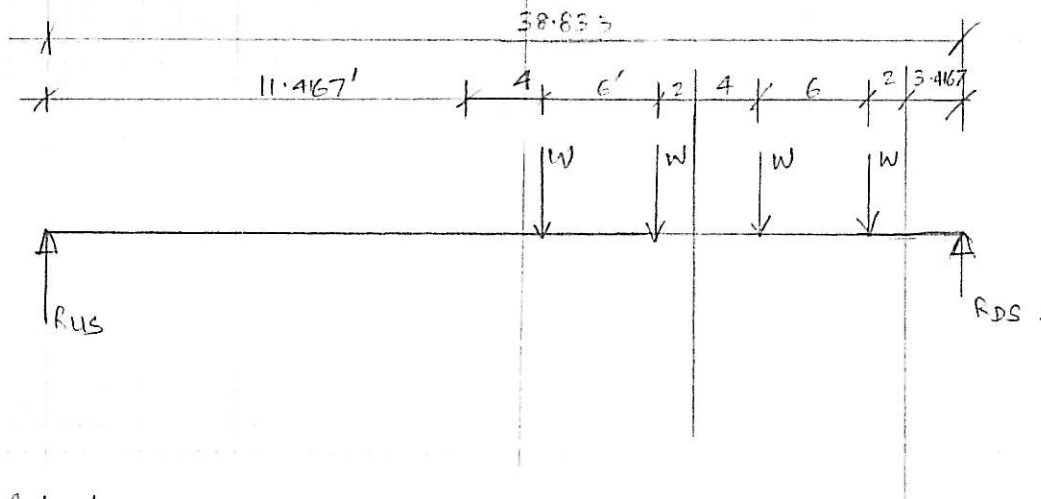
Case I:

$$R_{SD3} = W + \frac{W}{7} = \frac{8}{7} W = 1.143 W$$

Case II:

$$R_{SD3} = \frac{W}{7} = 0.143 W$$

DISTRIBUTION FACTOR DUE TO TWO TRUCK LOADS.


 Wheel loads $\rightarrow$

$$R_{DS} = \left[\frac{33.4167}{38.4167} + \frac{(27.4167')}{(38.4167')} + \frac{(21.4167)}{(32.4167)} + \frac{15.4167}{38.4167} \right] W$$

$$= 2.54 W$$

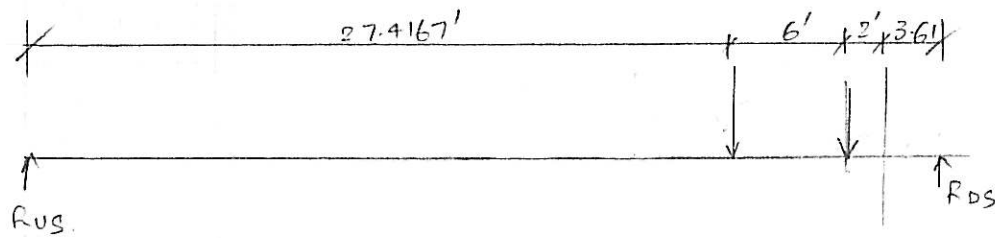
$$R_{US} = 1.46 W$$

 Distribution factor $\rightarrow$

$$\text{Trucks DS} = \frac{2.54 W}{4 W} = 0.635$$

$$\text{Trucks US} = \frac{1.46 W}{4 W} = 0.365$$

Right Truss Distribution factor due to a single truck load →

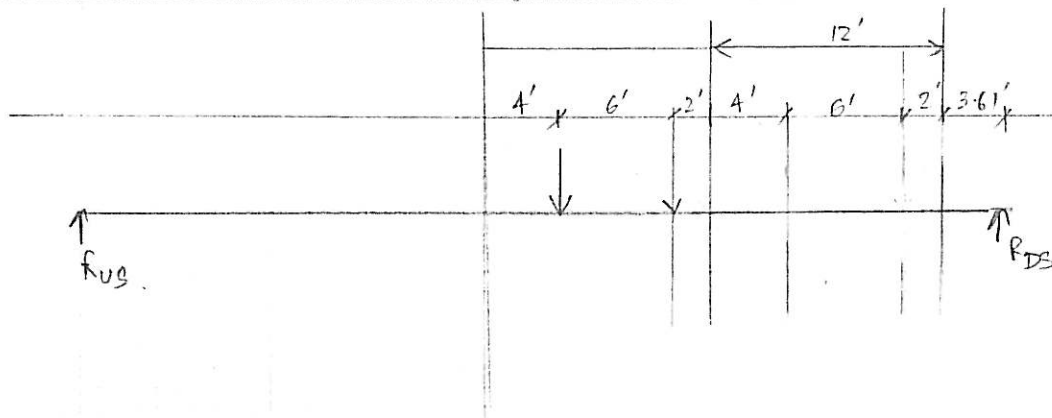


Wheel Loads →

$$R_{DS} = \left[\frac{35.4167}{38.4167} + \frac{27.4167}{38.4167} \right] W = 1.584 W$$

$$R_{UG} = 0.416 W$$

Wheel Load distribution on Right Truss due to truck in left lane: →



Wheel Loads →

$$R_{DS} = \left[\frac{21.225}{38.855} + \frac{15.225}{38.855} \right] W = 0.937 W$$

**SPANS 2 AND 3
(250' TRUSS)**

TRUSS DETAIL FACTOR

- 1. SPAN 2 VERTICAL MEMBER L1U1**
- 2. SPAN 2 LOWER CHORD MEMBER L2L3**
- 3. SPAN 2 UPPER CHORD MEMBER L2L3**

Member L1U, exact wt.

Length, $L = 28'$

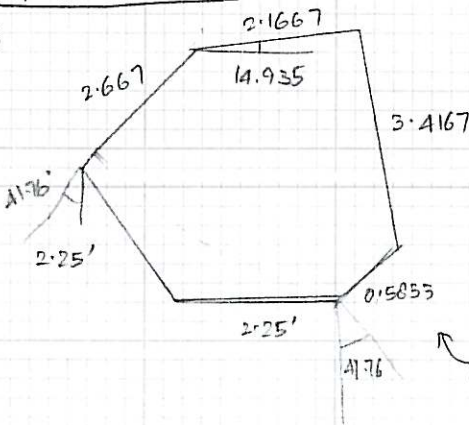
WF 12 x 40 = 25.5'

~~1/4" wide~~

Wt. = $(400 \text{ lbs/ft}) (25.5') = 1020 \text{ lbs}$

GUSSET PLATE →

①



②

Area of gusset at bottom

Chord = 3.3 ft^2

Thickness = $\frac{9}{16}"$

Volume = $(3.3 \text{ ft}^2) \left(\frac{9}{16 \times 12} \right)$
 $= 0.1547 \text{ ft}^3$

Wt. = $\frac{(490 \text{ lbs/ft}^3) (0.1547 \text{ ft}^3)}{4} \times 2$
 $= (37.9) \times 2 (\#)$
 $= 75.8 \text{ lbs}$

Area = 12.865 ft^2

Thickness = $\left(\frac{9}{16} \right)"$

Volume = $\left(\frac{12.865}{12} \times \frac{9}{16} \right) = 0.603 \text{ ft}^3$

Wt. on U1L1 = $\frac{(490 \text{ lbs/ft}^3) (0.603 \text{ ft}^3)}{4} = 73.87 \text{ lbs}$ $\times 2 = 147.74 \text{ lbs}$

BOLTS WT.

Wt. of $\left(\frac{7}{8} \right)"$ rivets, 1.29" long $\approx \frac{60}{100} \text{ lbs}$

Wt. of 35 bolts = $\frac{60}{100} \times 35 = 21 \text{ lbs}$ $\times 2 = 42 \text{ lbs}$

Wt. of Dia. @ panel ft.

Plate → $\left(\frac{1}{2} \right) (10") (17") = 85 \text{ in}^2$

Wt. of Plate = $\left(\frac{85 \text{ in}^2}{1728 \text{ in}^3/\text{ft}^3} \right) \left(\frac{9}{4} \right) (490 \text{ lbs/ft}^3) = 12.1 \text{ lbs/ft}$

Angles → 4 Ls $(4" \times 3.5" \times 0.575")$ 17" long.

Wt. of angles = $\frac{4 \times (9.1 \text{ lbs/ft}) (1.4167)}{2} = 25.783 \text{ lbs}$

Total wt. =	1020 lbs +
	147.74 lbs +
	75.8 lbs +
	42 lbs +
	12.1 lbs +
	25.783 lbs
	= 1247.64
Total wt/ft =	$\frac{1247.64 \text{ lbs}}{28 \text{ ft}}$
	= 44.56 lbs/ft

Det. factor = $\frac{44.56 \text{ lbs/ft}}{40 \text{ lbs/ft}}$

= 1.11

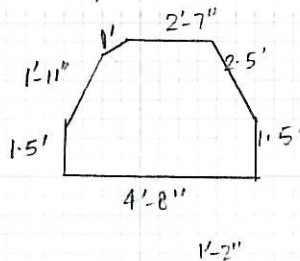
MEMBER L₂-L₃ exact weight

Member length = 25'

$$2 \text{ Plates } 18" \times \frac{5}{4} = 2 \times (490 \text{ lbs/ft}^2) \times \left(\frac{18 \times 0.75 \text{ in}^2}{144 \text{ in}^2/\text{ft}^2} \right) (25') = \boxed{2297 \text{ lbs.}}$$

$$2 \text{ Plates } 18" \times \frac{3}{8} = 2 \times (490 \text{ lbs/ft}^2) \times \left(\frac{18 \times 0.375 \text{ in}^2}{144 \text{ in}^2/\text{ft}^2} \right) (25') = \boxed{1149 \text{ lbs.}}$$

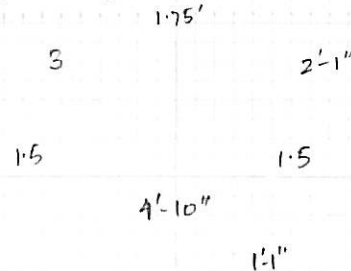
GUSSET PLATE

 ①. At panel pt. L₂


$$\text{Area} = 16.19 \text{ ft}^2$$

$$\text{Thickness} = \frac{9}{16} = 0.0468 \text{ ft.}$$

$$\begin{aligned} \text{Wt.} &= (16.19 \text{ ft}^2)(0.0468 \text{ ft})(490 \text{ lbs/ft}^3) \\ &= 364.922 \text{ lbs} \times 2\# \end{aligned}$$

 ②. At panel pt. L₃


$$\text{Area} = 12.51 \text{ ft}^2$$

$$\text{Thickness} = \left(\frac{9}{16} \right) = 0.0468 \text{ ft.}$$

$$\begin{aligned} \text{Wt.} &= (12.51 \text{ ft}^2)(0.0468 \text{ ft})(490 \text{ lbs/ft}^3) \\ &= 286.88 \text{ lbs.} \times 2\# \end{aligned}$$

$$\text{Total wt. due to gusset on L₂L₃} = \frac{1}{4} (364.922 + 286.88) = 162.95 \text{ lbs.} \times 2\# = \boxed{325.9 \text{ lbs.}}$$

Wt. of Dia.

 ①. At panel pt. L₂

4 angles 4" x 3.5" x 0.375" (17" long)

$$\text{Wt.} = \frac{4 \times (9.1 \text{ lbs/ft})(1.4167)}{4} = \boxed{12.92 \text{ lbs.}}$$

$$\text{Wt. of } 10" \text{ plate} = \frac{0.5 \times 10' \times 17' \times 490}{17 \times 8 \times 4}$$

$$= \boxed{6.03 \text{ lbs.}}$$

 ②. At panel pt. L₃

$$4 \text{ angles } 4" \times 3.5" \times 0.375" (17" \text{ long}) \Rightarrow \text{Wt.} = \frac{4 \times (9.1 \text{ lbs/ft})}{4} = 12.89 \text{ lbs.}$$

$$\boxed{\text{Wt. of plate} = 6.03 \text{ lbs.}}$$

③. Diaphragm @ splice pl. and intermediate @ 3' o c/c.

$$4 \text{ angles } 3.5" \times 3.5" \times 0.375" \rightarrow 4 \times (2.5 \text{ lbs/ft}) (1.5') = \boxed{15 \text{ lbs.}}$$

$$\text{Diaphragm plate} \rightarrow \left[\frac{(0.5") (18") (10")}{1728 \text{ in}^3/\text{ft}^3} \right] (490 \text{ lbs/ft}^3) = \boxed{25.5 \text{ lbs.}}$$

Wt. of splice plates & fill plates

$$\begin{array}{l} \text{Fill plate} \rightarrow \text{length} = 3.17' \\ \text{ht.} = 1.5' \\ \text{Thickness} = \frac{0.25"}{12} = \end{array} \left. \vphantom{\begin{array}{l} \text{Fill plate} \rightarrow \text{length} = 3.17' \\ \text{ht.} = 1.5' \\ \text{Thickness} = \frac{0.25"}{12} = \end{array}} \right\} \begin{array}{l} \text{Wt.} = 2(3.17' \times 1.5' \times 0.0208') (490 \text{ lbs/ft}^3) \\ = \boxed{47.1 \text{ lbs.}} \end{array}$$

$$\begin{array}{l} \text{Splice plate} \rightarrow \text{length} = 4'-9" \\ \text{ht.} = 1.5' \\ \text{Thickness} = 0.03125' = \end{array} \left. \vphantom{\begin{array}{l} \text{Splice plate} \rightarrow \text{length} = 4'-9" \\ \text{ht.} = 1.5' \\ \text{Thickness} = 0.03125' = \end{array}} \right\} \begin{array}{l} \text{Wt.} = 2(4.75') (1.5') (0.03125') (490 \text{ lbs/ft}^3) \\ = \boxed{118.2 \text{ lbs.}} \end{array}$$

Wt. of bolts

$$\text{No. of rivets} = 134 \times 2 \\ (7/8")$$

$$\text{Av. bolt length} = 1.4" (\text{avg})$$

$$\text{Wt.} = \frac{65 \text{ lbs}}{100 \text{ bolts}} \times 2 \times 134 \text{ bolts} = \boxed{174.2 \text{ lbs.}}$$

$$\begin{aligned} \text{Total Wt.} &= (2797 + 1149 + 325.9 + 12.92 + 6.03 + 12.92 + 6.03 + \\ &\quad 8(510 \text{ lbs} + 25.5 \text{ lbs}) + 97.1 \text{ lbs} + 118.2 \text{ lbs} + 174.2 \text{ lbs}) \\ &= \frac{4911.5 \text{ lbs.}}{25'} = 196.45 \text{ lbs/ft.} \end{aligned}$$

Calculate detail factor for upper chord members

Use member $U_4 - U_5$ as a representative top chord member.

Basic member weight

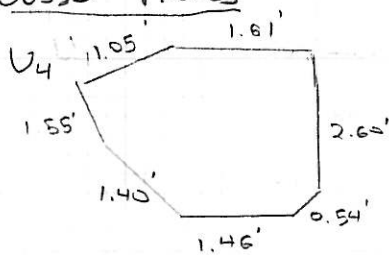
$$A = 55.36 \text{ in}^2$$

$$\text{weight} = \frac{55.36 \text{ in}^2}{144} \times 490 \text{ pcf} \times 25' = 4709.4 \#$$

Detailed Weight

$$\text{Basic member weight} = 4709.4 \#$$

Gusset Plates



scaled
from sheet
281 of
orig. plans.

$$\text{area} = 6.95 \text{ ft}^2$$

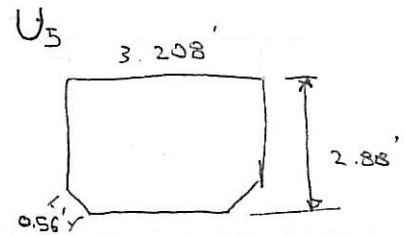
$$\text{weight} = 6.95 \text{ ft}^2 \times \frac{1/2}{12} \times 490 \text{ pcf} = 141.90 \#$$

$$\times 2 = 283.8 \#$$

(each side)

Divide the plate into quarters and assign the weight to the members in each quadrant

$$\frac{283.8 \#}{4} = 70.95 \#$$



$$\text{area} = 9.12 \text{ sf}$$

$$= 9.12 \text{ sf} \times \frac{1/2}{12} \times 490 \text{ pcf} = 186.2$$

$$= \times 2 = 372.4 \# \text{ each}$$

$$\frac{372.4 \#}{4} = 93.1 \#$$

Gusset Bolts - divide up similar to PL weight

$$54 \text{ bolts in elevation} \times 2 \text{ PL} = 108 \text{ bolts}$$

$$/4 = 27 \text{ bolts per quad.}$$

$$\text{weight} = (30 + 27) \frac{74.4 \#}{100} = 42.4 \#$$

$$60 \text{ bolts} \times 2 = 120 \text{ bolts}$$

$$/4 = 30 \text{ each quad}$$

Weight of Diaphragm @ Panel ft.

$$4 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \frac{3}{8} \times 18 \text{ lb}$$

$$\text{weight} = 1.5' \times 8.5 \frac{\#}{\text{ft}} \times 4 = 51 \#$$

$$\frac{1}{2} \text{ P} \times 11.5' \times 18" \text{ tall}$$

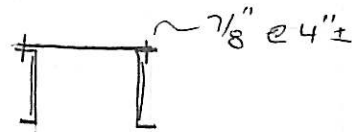
$$\text{Weight} = \frac{\frac{1}{2} \times 11.5 \times 18}{1728 \frac{\text{in}^3}{\text{ft}^3}} \times 490 \frac{\text{pcf}}{\text{ft}^3} = 29.35 \#$$

$$\text{Total weight} = 51 \# + 29.35 \# = 80.35 \#$$

80.35 # each location
there is one @ each panel
point say $\frac{1}{2}$ weight is
accounted for in each
member. 80.35 #

Connection Bolts/Rivets

Top P bolts to each channel
spacing scales as 4"



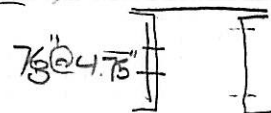
$\frac{7}{8}$ " rivets - assume weight similar to min length $\frac{7}{8}$ " bolt

$$\# \text{ of bolts per foot} = 8$$

$$\text{weight/ft} = \frac{74.4 \#}{100} \times \frac{8 \text{ bolts}}{\text{ft}} = \boxed{5.95 \#/\text{ft}}$$

Web Plate Stitch rivets

Spacing scales @ 4.75"

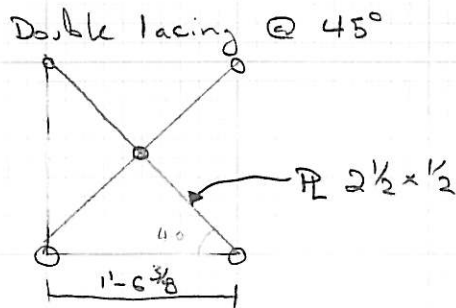


$$\# \text{ of spaces per foot} = 2.526$$

$$\# \text{ of bolts per foot} = (2.526 + 1) \times 2 \text{ per space} \times 2 \text{ sides} = 14.105$$

$$\text{weight/ft} = \frac{74.4 \#}{100} \times 14.105 = \boxed{10.50 \#/\text{ft}}$$

Lacing Weight



$$\text{Length of lacing bars} = \frac{1.53125'}{\cos 45} = 2.166'$$

$$\begin{aligned} \text{weight} &= 2.166' \times \frac{2.5}{12} \times \frac{0.5}{12} \times 490 \text{ pcf} = 9.21 \# \\ &\times 2 \text{ bars} = 18.42 \# \end{aligned}$$

$$3 - 7/8" \text{ rivets} = 3 \times \frac{74.4}{100} = 2.23 \#$$

$$\text{Total Weight of one lacing panel} = 18.42\# + 2.23\# = 20.65\#$$

$$\text{Weight/ft} = 20.65\# / 1.53125 = \boxed{13.49 \#/\text{ft}}$$

Top plates

$$\text{Weight/ft} = \frac{3/8" \times 22"}{144} \times 490 \text{ pcf} = 28.07 \#/\text{ft}$$

bolts/rivets are at the same spacing as the top PL connection

$$w = 5.95 \#/\text{ft}$$

Total Detailed weight

$$\text{Gusset Pl. Connect.} - 70.95 + 93.1 + 42.4 = 206.45 \#$$

$$\text{Diaphragm @ Panel Pt.} - 80.35 \#$$

$$\text{Built up member connections} - 25'(5.95 \#/\text{ft} + 10.5) = 411.25 \#$$

$$\text{Lacing on bot} - 13.49 \#/\text{ft} \times 18.375' = 247.88 \#$$

$$\text{Tie plate} - 4' \times (28.07 + 5.95 \#/\text{ft}) = 136.08 \#$$

$$\text{Basic Section Wt} - 4709.4 \#$$

$$\text{TOTAL} = 5791.41 \#$$

$$\text{Detail Factor} = \frac{5791.41}{4709.4} = 1.23$$

WEIGHT OF TRUSS

1. SPANS 2 AND 3

Span 2,3 TRUSS (250' TRUSS)

	Members	Area (in ²)	Wt. including bolts, gusset plates & splices	Nominal Wt.	Detail factor	Wt (lbs)	L _{eff}
U	L ₀ U ₁	55.36		188.39 lb/ft	1.23	8698	37.557'
	U ₁ U ₂	44.98		153 lb/ft		4870	25.874'
	U ₂ -U ₃	51.76		176.13 lb/ft		5485	25.318'
	U ₃ -U ₄	55.36		188.39 lb/ft		5802	25.036'
	U ₄ -U ₅	55.36		188.39 lb/ft		5793	25'
L	L ₀ -L ₁	29.25		99.53 lb/ft.	1.42	3534	25'
	L ₂ -L ₃	40.5	196.45 lb/ft	137.81 lbs/ft.		4893	25'
	L ₃ -L ₄	44.5		168.4375 lb/ft		5980	25'
	L ₄ L ₅	54.0		183.75 lb/ft		6524	25'
D	U ₁ L ₂	19.11		65.027 lb/ft.	1.11	2710	37.557'
	U ₂ L ₃	15.59		53.05 lb/ft.		2517	42.74'
	U ₃ L ₄	13.24		45.05 lb/ft		2303	46.045'
	U ₄ L ₅	13.24		45.05 lb/ft		2359	47.17' X2(U ₅ L ₄)
V	U ₁ L ₁	11.77	44.56 lbs/ft.	40.11 lbs/ft.	1.42	1248	28.667'
	U ₂ L ₂	19.11		65.03		2502	34.667'
	U ₃ L ₃	11.77		40 lb/ft		1717	38.667'
	U ₄ L ₄	11.77		40 lb/ft.		1776	40'
L	L ₁ L ₂	29.25		99.53 lb/ft.	1.42	3533	25'
	(Substrut 1)			36 lb/ft.	1.11	999	25'
	(Substrut 2)			36 lb/ft.	1.11	999	25'

Calculations for 1/10 US Grid

$$4 \times (76601 \text{ lbs}) = 306404 \text{ lbs}$$

(2 symm x 2(U₅,D₅))

SPAN 2/3

Sway Bracing Hor. Member	Area (in ²)	Length	Member	Nominal wt (lbs/ft)	Detail factor	Wt.
U ₀ U ₀ '				28		1327
U ₁ U ₁ '				28		1327
U ₂ U ₂ '		38.833'	WF 8x28	28	1.22	1327
U ₃ U ₃ '				28		1327
U ₄ U ₄ '				28		1327
U ₀ U ₁ ' U ₁ U ₀ '		(10.34)(6) = 62.04	WF 8x17 WF 8x17	17	1.22	1287
U ₁ U ₂ '		46.67'		18		1025
U ₂ U ₁ '		46.67'		18		1025
U ₂ U ₃ '		46.56'		18		1018
U ₃ U ₂ '		46.56'	WF 8x18	18		1018
U ₃ U ₄ '		46.21'		18	1.22	1015
U ₄ U ₃ '		46.21'		18		1015
U ₄ U ₅ '		46.19'		18		1015
U ₅ U ₄ '		46.19'		18		1015
M ₂ M ₂ '		38.833'		28		1327
M ₃ M ₃ '		38.833'	WF 8x28	28	1.22	1327
M ₄ M ₄ '		38.833'		28		1327

$$2 \times (20049) = 40098 \text{ lbs}$$

SPAN 2/3

Survey Bracing Vertical Member	Area	Length	Member	Nominal Wt (lbs/ft)	Detail factor	Wt. (lbs)
$U_2 - M_{2m}$		23.19'		17		481
$M_2 - U_{2m}$		23.19'		17		481
$U_3 - M_{3m}$		25.17'	WF 8x17	17	1.22	522
$M_3 - U_{3m}$		25.17'		17		522
$U_4 - M_{4m}$		26.49'		17		550
$M_4 - U_{4m}$		26.49'		17		550

$$4 (3106) = 12424 \text{ lbs}$$

Member 5	Area	Length	Member	Nominal Wt. (lbs/ft)	Detail factor	Wt.
$U_5 L_5$		40'	WF 12x40	40		1952 (2#)
$U_5 U_5'$		38.833'	WF 8x28	28		1327
$M_5 M_5'$		38.833'	WF 8x28	28	1.22	1327
$U_5 M_{5m}$		26.49'	WF 8x17	17		550 (2#)
$M_5 U_{5m}$		26.49'	WF 8x17	17		550 (2#)

$$8758 \text{ lbs.}$$

$$\begin{aligned} \text{Total wt. of two trusses} &= (306404 + 40098 + 12424 + 8758) \text{ lbs.} \\ &= 367684 \text{ lbs.} \end{aligned}$$

$$\text{Wt. of individual truss} = \frac{367684 \text{ lbs}}{2} = \frac{183842 \text{ lbs}}{250 \text{ ft}} = \boxed{735.37 \text{ lbs/ft}}$$

Weight of floor beams. (SPAN 2/3)

Panel Point	Area	Length (ft)	Member	Nominal wt.	Detail factor	Wt.
L ₀ L ₀ '		38.83	36 WF 280	280	1.10	11960
L ₁ L ₁ '		38.83	36 WF 500	500	1.10	12814
L ₂ L ₂ '		38.83	36 WF 280	280	1.10	11960
L ₃ L ₃ '		38.83	36 WF 280	280	1.10	11960
L ₄ L ₄ '		38.83	36 WF 280	280	1.10	11960
L ₅ L ₅ '		38.83	36 WF 280	280	1.10	11960

RAILING, SLAB AND HAUNCH LOADS

- 1. RAILING LOAD**
- 2. SLAB LOAD**
- 3. DIAPHRAGM LOAD**

STRINGER LOAD RATING FOR 250'-0" TRUSS

WF 21 x 75 - Outside Panel Points

WF 21 x 62 - Interior Panel Points

Non composite - 5 stringers @ 7'±

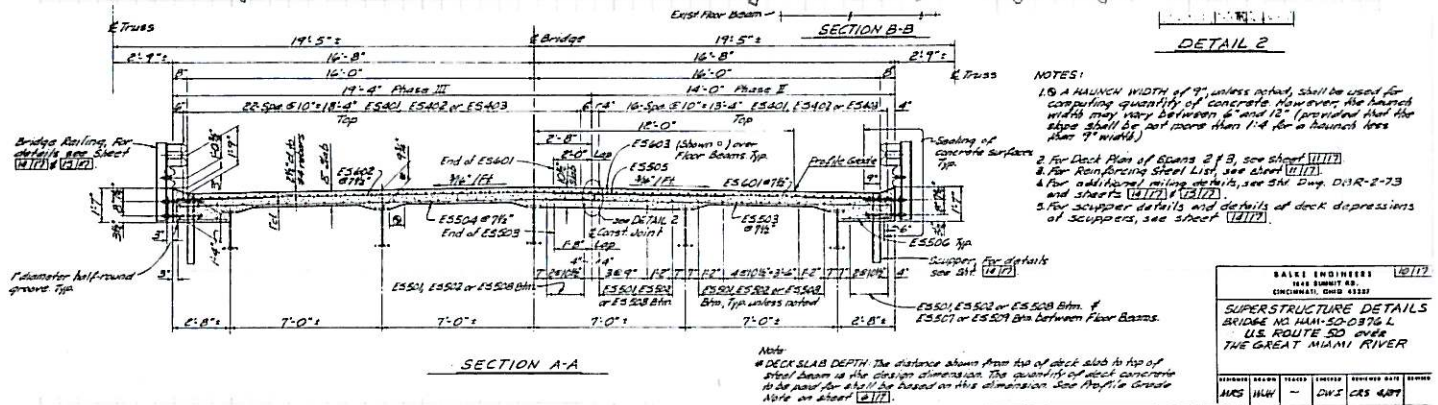
Deck width - 33'-4"

Deck thickness = 8" (nominal); 10.95" (thickened)

Railing - DGR-2-73

Overhang - 2'-8"

Light weight structural concrete



DEAD LOADS

① RAILING LOADS →

RAIL → DGR-2-73.

$$i) TS \ 8 \times 4 \times \frac{3}{16} = 14.5 \text{ plf}$$

$$ii) 2 \text{ W Beams} = 7.25 \text{ plf} \times 2 = 14.5 \text{ plf}$$

$$\left(\frac{19" \text{ wide} \times 0.11" \text{ thick}}{144 \text{ in}^2/\text{ft}^2} \times 490 \text{ lbs/ft}^3 = 7.11 \approx 7.25 \text{ plf} \right)$$

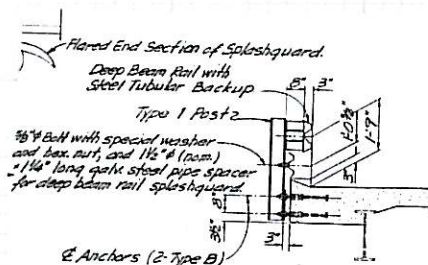
AASHTO M180 Type 2 Class A.

iii) Type 1 Post →

$$(W6 \times 25) \times 3' - 7\frac{3}{4}" = 91.2 \text{ pounds each.}$$

$$2 \left(TS \ 8" \times 4" \times \frac{3}{16} \right) \text{ section} \times 6" \text{ long} = 2 \times 14.5 \text{ plf} \times 0.5' = 14.5 \text{ lb/each}$$

$$R \ 1\frac{1}{2} \times 7\frac{1}{2} \times 14\frac{1}{2} = 15.5 \text{ lbs/each}$$



SECTION B-B

$$\begin{aligned}
 \text{iv) } & \left\{ \begin{array}{l} 2 \text{ Type B Anchors } (1\frac{1}{4}" \times 8") \\ 2 \frac{5}{8}" \phi \times 1" \text{ long bolt} \\ 1 \frac{5}{8}" \phi \times 10" \text{ long bolt} \\ 1 \frac{5}{8}" \phi \times 2" \text{ long bolt with } (1\frac{1}{2}" \text{ and } 1\frac{1}{4}" \text{ long steel pipe spacer}) \end{array} \right. \\
 & = 2 \left[\frac{(689 + (20.75 - 9)49.7)}{100} \right] + 5 = 30.46 \text{ lbs} \\
 & \quad 2 \times \frac{29.4}{100} = 0.588 \text{ lbs.} \\
 & \quad \frac{106.4}{100} = 1.064 \\
 & \quad = \frac{37.4}{100} = 0.374 \\
 & \quad \approx 33 \text{ lbs / each.}
 \end{aligned}$$

$$\text{Total wt.} = (14.5 \text{ plf} + 14.5 \text{ plf}) + \frac{91.2 \text{ lbs} + 14.5 \text{ lbs} + 15.5 \text{ lbs} + 33 \text{ lbs}}{6.25'}$$

$$= 53.67 \text{ plf} \approx \boxed{54 \text{ plf.}} \checkmark \text{ say } 55 \text{ plf}$$

SLAB LOADS

EXTERIOR STRINGERS ① & ⑤

$$\text{Slab} \rightarrow (3.5') (0.667') (0.12 \text{ K/ft}^2) = 0.28 \text{ Krf.}$$

$$\text{Overhang} \rightarrow (2.667') (1.33') (0.12 \text{ K/ft}^2) = 0.43 \text{ Krf}$$

$$\begin{aligned}
 \text{Haunch} \rightarrow & \left[\frac{1}{2} \times 9" \times (1.75" + 0.625") + 1.75" \times 8.25" \right] \frac{1}{144 \text{ in}^2/\text{ft}^2} \times \frac{120}{1000} = 0.021 \text{ Krf} \\
 & \times 1.1 = 0.023 \text{ Krf}
 \end{aligned}$$

$$\text{Curb} \rightarrow \left(\frac{1}{2} \times 3" \times 8" \right) \frac{1}{144 \text{ in}^2/\text{ft}^2} \times \frac{120 \text{ lbs/ft}^2}{1000} = 0.01 \text{ Krf}$$

$$\text{Total} = (0.28 + 0.43 + 0.023 + 0.01) \text{ Krf} = 0.743 \text{ Krf}$$

STRINGER - 2

$$\text{Slab} - (7') (0.667') (0.12 \text{ K/ft}^2) = 0.56 \text{ Klf.}$$

$$\text{Haunch} - \left[8.25" \times 1.75" + (1.75' + 0.625") (9" \times 9") \right] \frac{1}{144 \text{ in}^2/\text{ft}^2} \times \frac{120 \text{ lbs/ft}^2}{1000} \times 1.1 = 0.033 \text{ Klf}$$

$$\text{Total} = 0.56 \text{ Klf} + 0.03 = 0.593$$

STRINGER ③ and ④ (Thickend slab)

$$\text{Slab} - \left[(3.5' \times 0.667') + (3.5' \times 0.875') \right] (0.12 \text{ K/ft}^2) = 0.648 \text{ Klf}$$

$$\text{Haunch} - \left[\frac{1}{2} \times 9" \times (1.75 + 0.625) + 1.75" \times 4" \right] \frac{1}{144 \text{ in}^2/\text{ft}^2} \times \frac{120}{1000} \times 1.1 = 0.016 \text{ Klf}$$

$$\text{Total} = 0.648 \text{ Klf} + 0.016 \text{ Klf} = 0.664 \text{ Klf.}$$

DIAPHRAGM LOADS

$$L \ 3 \times 3 \times \frac{5}{16} = 6.04 \text{ lbs/ft.}$$

$$\text{Lower angle} = 7' \times 6.04 \text{ lbs/ft} = 42.28 \text{ lbs}$$

$$\text{Diagonal angles} = (\sqrt{1.4^2 + 7^2}) \text{ ft} \times 2 (6.1 \text{ lbs/ft}) = 87.1 \text{ lbs}$$

$$\text{Total} = 42.28 \text{ lbs} + 87.1 \text{ lbs} = 129.4 \text{ lbs} = 0.129 \text{ Kips} \approx 0.13 \text{ Kips}$$

$$\text{Interior stringer wt.} = 0.13 \text{ Kips}$$

$$\text{Exterior stringer wt} = 0.065 \text{ Kips.}$$

STRINGER INPUT

Calculate loads on stringers.

Exterior Stringers ① and ⑤ →

$$\text{Railing load} = \frac{(54 \text{ plf}) \times (2 \text{ rails})}{5} = 21.6 \text{ plf each stringer.}$$

$$\text{Slab and Haunch} = 0.743 \text{ klf}$$

$$\text{Total} = 0.743 \text{ klf} + 0.022 \text{ klf} = \boxed{0.765 \text{ klf}}$$

$$\text{Diaphragm load} = \boxed{0.065 \text{ kips}}$$

Interior Stringer ② →

$$\text{Railing load} = 0.0216 \text{ klf.}$$

$$\text{Slab and Haunch} = 0.593 \text{ klf.}$$

$$\text{Total} = \boxed{0.615 \text{ klf}}$$

$$\text{Diaphragm load} = \boxed{0.13 \text{ kips}}$$

Interior stringer ③ & ④ →

$$\text{Railing load} = 0.022 \text{ klf.}$$

$$\text{Slab & Haunch} = 0.666 \text{ klf.}$$

$$\text{Total} = \boxed{0.688 \text{ klf}}$$

$$\text{Diaphragm load} = \boxed{0.13 \text{ kips}}$$

TRUSS AND FLOOR BEAM INPUT

- 1. STAAD ANALYSIS FOR SLAB, HAUNCH AND DIAPHRAGM LOADS (FOR PANEL POINT REACTION ON THE TRUSS)**
- 2. STRINGER WEIGHT AND HAUNCH WEIGHT FOR FLOOR BEAM INPUT**

```

*****
*
*          STAAD.Pro
*          Version  2007    Build 04
*          Proprietary Program of
*          Research Engineers, Intl.
*          Date=    AUG 11, 2009
*          Time=    9:43: 6
*
*          USER ID: TranSystems
*****

```

1. STAAD PLANE

INPUT FILE: FLOOR BEAM REACTIONS MSL2009-08-11.STD

2. START JOB INFORMATION

3. ENGINEER DATE 03-OCT-08

4. JOB NAME HAM-50-0376L

5. JOB CLIENT ODOT D-8

6. JOB NO P402080073

7. JOB REV 0

8. JOB REF 250' STRINGER REACTIONS

9. ENGINEER NAME SSM

10. CHECKER NAME PJP

11. CHECKER DATE 10-OCT-08

12. JOB COMMENT 250' DL STRINGER REACTIONS

13. END JOB INFORMATION

14. INPUT WIDTH 79

15. UNIT FEET KIP

16. JOINT COORDINATES

17. 1 0 0 0; 2 25 0 0; 3 50 0 0; 4 75 0 0; 5 100 0 0; 6 125 0 0; 7 150 0 0

18. 8 175 0 0; 9 200 0 0; 10 225 0 0; 11 250 0 0

19. MEMBER INCIDENCES

20. 1 1 2; 2 2 3; 3 3 4; 4 4 5; 5 5 6; 6 6 7; 7 7 8; 8 8 9; 9 9 10; 10 10 11

21. DEFINE MATERIAL START

22. ISOTROPIC STEEL

23. E 4.176E+006

24. POISSON 0.3

25. DENSITY 0.489024

26. ALPHA 6.5E-006

27. DAMP 0.03

28. END DEFINE MATERIAL

29. MEMBER PROPERTY AMERICAN

30. 1 10 TABLE ST W21X73

31. 2 TO 9 TABLE ST W21X62

32. CONSTANTS

33. MATERIAL STEEL ALL

34. SUPPORTS

35. 1 TO 10 PINNED

36. 11 FIXED BUT FX MZ

37. LOAD 1 LOADTYPE DEAD TITLE S 1 _5

38. MEMBER LOAD

39. 1 TO 10 CON GY -0.065 12.5

40. 1 TO 10 UNI GY -0.765

STAAD PLANE

-- PAGE NO. 2

41. LOAD 2 LOADTYPE DEAD TITLE S 2
 42. MEMBER LOAD
 43. 1 TO 10 UNI GY -0.615
 44. 1 TO 10 CON GY -0.13 12.5
 45. LOAD 3 LOADTYPE DEAD TITLE S 3 _4
 46. MEMBER LOAD
 47. 1 TO 10 UNI GY -0.688
 48. 1 TO 10 CON GY -0.13 12.5
 49. LOAD 4 STRINGER SELFWEIGHT
 50. SELFWEIGHT Y -1.1
 51. PERFORM ANALYSIS

P R O B L E M S T A T I S T I C S

NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS = 11/ 10/ 11

SOLVER USED IS THE OUT-OF-CORE BASIC SOLVER

ORIGINAL/FINAL BAND-WIDTH= 1/ 1/ 3 DOF
 TOTAL PRIMARY LOAD CASES = 4, TOTAL DEGREES OF FREEDOM = 12
 SIZE OF STIFFNESS MATRIX = 1 DOUBLE KILO-WORDS
 REQ'D/AVAIL. DISK SPACE = 12.0/ 642585.1 MB

52. PRINT SUPPORT REACTION ALL

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	1	0.00	7.62	0.00	0.00	0.00	0.00
	2	0.00	6.15	0.00	0.00	0.00	0.00
	3	0.00	6.88	0.00	0.00	0.00	0.00
	4	0.00	0.81	0.00	0.00	0.00	0.00
2	1	0.00	21.63	0.00	0.00	0.00	0.00
	2	0.00	17.48	0.00	0.00	0.00	0.00
	3	0.00	19.54	0.00	0.00	0.00	0.00
	4	0.00	2.12	0.00	0.00	0.00	0.00
3	1	0.00	18.60	0.00	0.00	0.00	0.00
	2	0.00	15.03	0.00	0.00	0.00	0.00
	3	0.00	16.80	0.00	0.00	0.00	0.00
	4	0.00	1.63	0.00	0.00	0.00	0.00
4	1	0.00	19.34	0.00	0.00	0.00	0.00
	2	0.00	15.63	0.00	0.00	0.00	0.00
	3	0.00	17.47	0.00	0.00	0.00	0.00
	4	0.00	1.73	0.00	0.00	0.00	0.00
5	1	0.00	19.15	0.00	0.00	0.00	0.00
	2	0.00	15.47	0.00	0.00	0.00	0.00
	3	0.00	17.29	0.00	0.00	0.00	0.00
	4	0.00	1.70	0.00	0.00	0.00	0.00
6	1	0.00	19.21	0.00	0.00	0.00	0.00
	2	0.00	15.52	0.00	0.00	0.00	0.00
	3	0.00	17.35	0.00	0.00	0.00	0.00
	4	0.00	1.71	0.00	0.00	0.00	0.00
7	1	0.00	19.15	0.00	0.00	0.00	0.00
	2	0.00	15.47	0.00	0.00	0.00	0.00
	3	0.00	17.29	0.00	0.00	0.00	0.00
	4	0.00	1.70	0.00	0.00	0.00	0.00
8	1	0.00	19.34	0.00	0.00	0.00	0.00
	2	0.00	15.63	0.00	0.00	0.00	0.00
	3	0.00	17.47	0.00	0.00	0.00	0.00
	4	0.00	1.73	0.00	0.00	0.00	0.00
9	1	0.00	18.60	0.00	0.00	0.00	0.00
	2	0.00	15.03	0.00	0.00	0.00	0.00
	3	0.00	16.80	0.00	0.00	0.00	0.00
	4	0.00	1.63	0.00	0.00	0.00	0.00
10	1	0.00	21.63	0.00	0.00	0.00	0.00
	2	0.00	17.48	0.00	0.00	0.00	0.00
	3	0.00	19.54	0.00	0.00	0.00	0.00
	4	0.00	2.12	0.00	0.00	0.00	0.00
11	1	0.00	7.62	0.00	0.00	0.00	0.00
	2	0.00	6.15	0.00	0.00	0.00	0.00
	3	0.00	6.88	0.00	0.00	0.00	0.00
	4	0.00	0.81	0.00	0.00	0.00	0.00

***** END OF LATEST ANALYSIS RESULT *****

53. FINISH

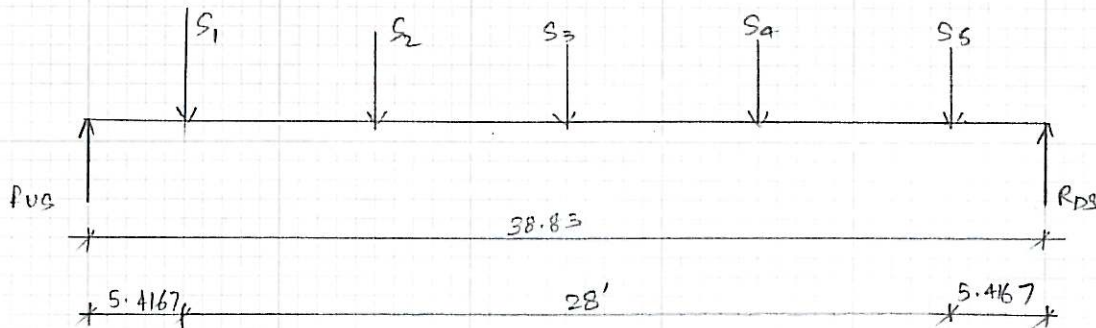
***** END OF THE STAAD.Pro RUN *****

**** DATE= AUG 11,2009 TIME= 9:43: 8 ****

*	For questions on STAAD.Pro, please contact		*
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*			*
	Telephone	Email	
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*	UK +44(1454)207-000	support@bentley.com	*
*	NORWAY +47 67 57 21 30	staad@edr.no	*
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*			*
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*	Asia	support@bentley.com	*

FLOOR BEAM REACTIONS $\rightarrow$ from STAAD

	L_0-L_{10}	L_1/L_9	L_2/L_8	L_3/L_7	L_4/L_6	L_5
$S_1 \& S_5$	7.02	21.63	18.60	19.34	19.15	19.21
S_2	6.15	17.48	15.03	15.63	15.47	15.52
$S_3 \& S_4$	6.88	19.54	16.80	17.47	17.29	17.35



Floor Beam Weight = Beam wt + Haunch wt, + Slab wt. $\leftarrow$ only for L_0 & L_{10}

END FLOOR BEAMS L_0 and $L_{10} \rightarrow$

$$\text{Beam wt.} = (280 \text{ lbs/ft}) (38.83') (1.1) = 11.96 \text{ kips}$$

Haunch wt $\rightarrow$

$$\begin{aligned} \text{Depth} &= 1.75'' \text{ min. to } 1.75'' + \left(\frac{3}{16} \times 14 \right)'' = 4.375'' \\ &= \frac{1.75'' + 4.375''}{2} = 3.0625'' + 1\frac{1}{2}'' \text{ flange} = 4.5625'' \end{aligned}$$

$$\text{Wt.} = (35') \left(\frac{4.5625}{12} \right) (2.5') (0.12) (1.1) = 4.391 \text{ K}$$

Slab wt. $\rightarrow$ Applicable only to end floorbeams @ pts. L_0 and L_{10}

$$\left(\frac{15''}{12} \right) \times 35' \times \left(\frac{8}{12} \right) (0.12) (1.1) = 3.85 \text{ K}$$

$$\text{Total} \rightarrow 11.96 \text{ K} + 4.391 \text{ K} + 3.85 \text{ K} = 20.2 \text{ K}$$

Floor Beam Reactions →

Floor Beam L_1 and L_9 →

$$\text{Beam wt.} = (500 \text{ lbs/ft}) (38.83') (1.1) = 12.82 \text{ Kips.}$$

$$\text{Haunch wt.} \rightarrow \text{length} = 33.33'$$

$$\text{width} = 29''$$

$$\text{wt.} = \frac{4.5625''}{12} \times 33.33' \times \left(\frac{29''}{12}\right) (0.12 \text{ Kcf}) \times 1.1$$

$$= 4.04 \text{ Kips.}$$

$$\text{Total} \rightarrow \underline{16.86 \text{ Kips.}}$$

Floor Beam $L_2 - L_8$ →

$$\text{Beam wt.} = (280 \text{ lbs/ft}) (38.83') (1.1) = 11.96 \text{ Kips.}$$

$$\text{Haunch wt.} = 4.39 \text{ K.}$$

$$\text{Total} = \underline{16.35 \text{ Kips.}}$$

REACTIONS TO PANEL PTS. →

Floor beams L_0 and L_{10} →

$$\begin{aligned} R_{US} &= \frac{20.2^K}{2} + \frac{7.62^K (38.83')}{(38.83)} + \frac{6.15^K (26.413')}{38.83} + \frac{6.88^K (19.41' + 12.4167')}{38.83'} \\ &= 27.54^K \end{aligned}$$

$$R_{DS} = (55.35^K - 27.54^K) = 27.81^K$$

Floor Beams L_1 and L_9

$$R_{US} = \frac{16.86^K}{2} + \frac{21.63^K(38.83')}{38.83'} + \frac{(17.48^K)(26.415')}{38.83'} + \frac{(19.54^K)(31.83')}{38.83'}$$

$$= 57.96^K$$

$$R_{DS} = (116.68 - 57.96^K) = 58.72^K$$

Floor Beams L_3 and L_7

$$R_{US} = \frac{16.35^K}{2} + \frac{(19.34^K)(38.83')}{38.83'} + \frac{(15.63^K)(26.415')}{38.83'} + \frac{(17.47^K)(31.83')}{38.83'}$$

$$= 52.47^K$$

$$R_{DS} = 105.60^K - 52.47^K = 53.13^K$$

Floor Beams L_2 and L_8

$$R_{US} = \frac{16.35^K}{2} + \frac{(18.60^K)(38.83')}{38.83'} + \frac{(15.03^K)(26.415')}{38.83'} + \frac{(16.8^K)(31.83')}{38.83'}$$

$$= 50.77^K$$

$$R_{DS} = 102.18^K - 50.77^K = 51.41^K$$

Floor Beam L_4 and L_6

$$R_{US} = \frac{16.35^K}{2} + \frac{(19.15^K)(38.83')}{38.83'} + \frac{(15.47^K)(26.415')}{38.83'} + \frac{(17.29^K)(31.83')}{38.83'}$$

$$= 52.021^K$$

$$R_{DS} = 104.7^K - 52.021^K = 52.68^K$$

(L5) $\rightarrow R_{US} = \frac{16.35}{2} + \frac{19.21^K(38.83')}{38.83'} + \frac{(5.52^K)(26.415')}{38.83'} + \frac{(17.35^K)(31.83')}{38.83'} = 52.16^K$

$$R_{DS} = 104.99^K - 52.16^K = 52.83^K$$

TRUSS DISTRIBUTION FACTORS

- 1. DUE TO TWO TRUCK LOADS**
- 2. DUE TO A SINGLE TRUCK LOAD:**
 - a. IN RIGHT LANE**
 - b. IN LEFT LANE**

DISTRIBUTION FACTORS

(I) STRINGERS — S01 → External stringer 1; S02, S03 → Interior stringers

① MAIN ANALYSIS → $\frac{S}{S+5} = 1.2727$ for stringers S02, S03

$\Delta = 1.143$ for stringer S01 (Ext stringer)

② Right Lane analysis → For 501 train of trucks; Live load

① Stringer S01 → Page 2 Case I

② Stringer S02 → Page 3, Case I

③ Stringer S03 → Page 4, Case I

③ Left Lane Analysis → For single 501 truck :

① Stringer S01 → Page 2, Case II

② Stringer S02 → Page 3, Case II

③ Stringer S03 → Page 4, Case III

(II) TRUSS — T01 → Downstream Truss

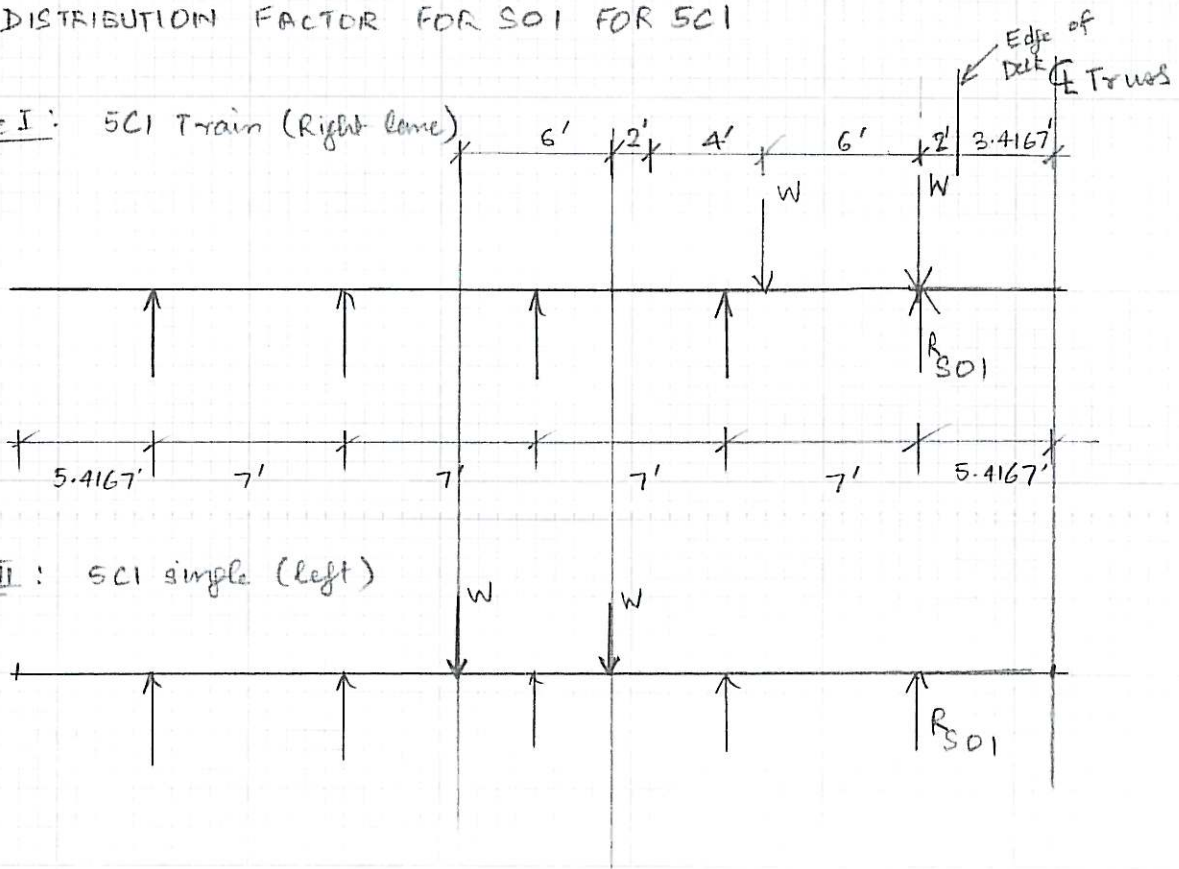
① Main Analysis → Page 5

② Right Lane Analysis → Page 6

③ Left Lane Analysis → Page 6

DISTRIBUTION FACTOR FOR SOI FOR SCI

Case I: SCI Train (Right Lane)



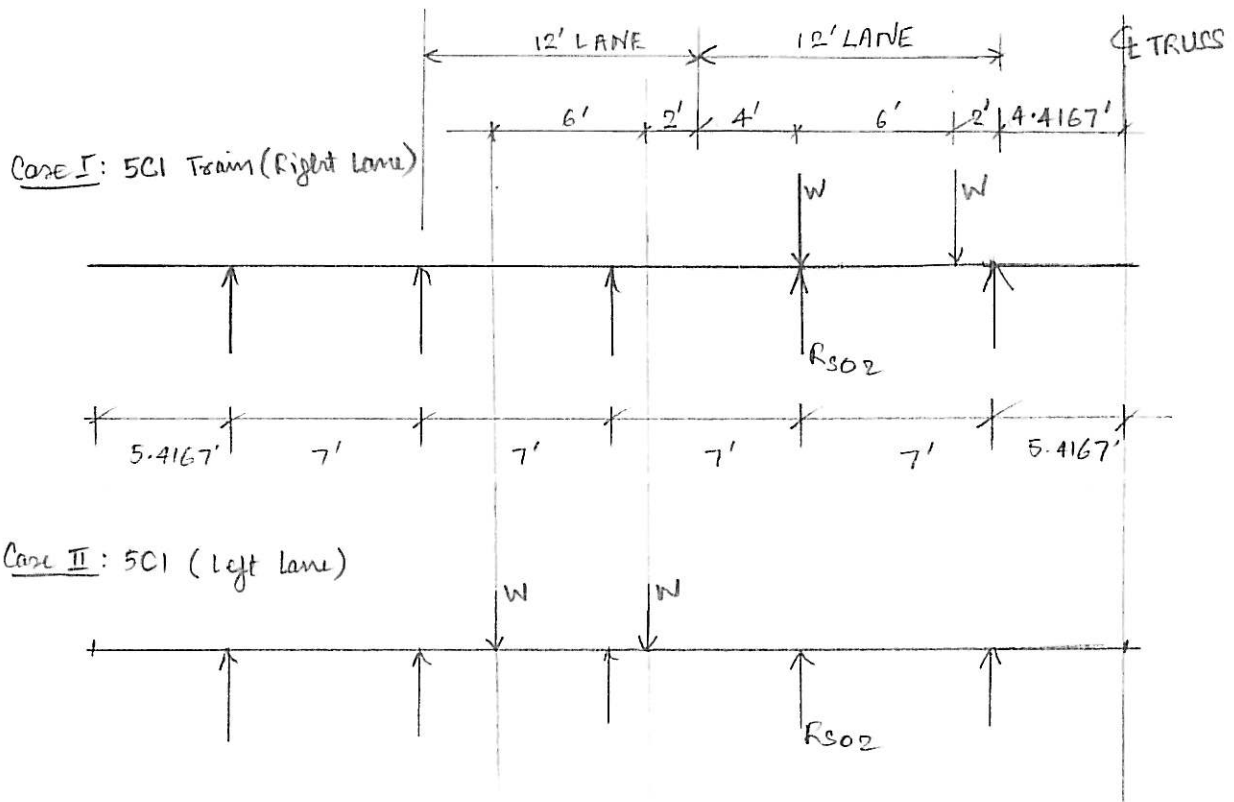
Case II: SCI single (left)

Case I:

$$R_{SOI} = W + \frac{W}{7} = \frac{8}{7}W = 1.143W$$

Case II:

$$R_{SOI} = 0$$

DISTRIBUTION FACTOR FOR S02 FOR SC1


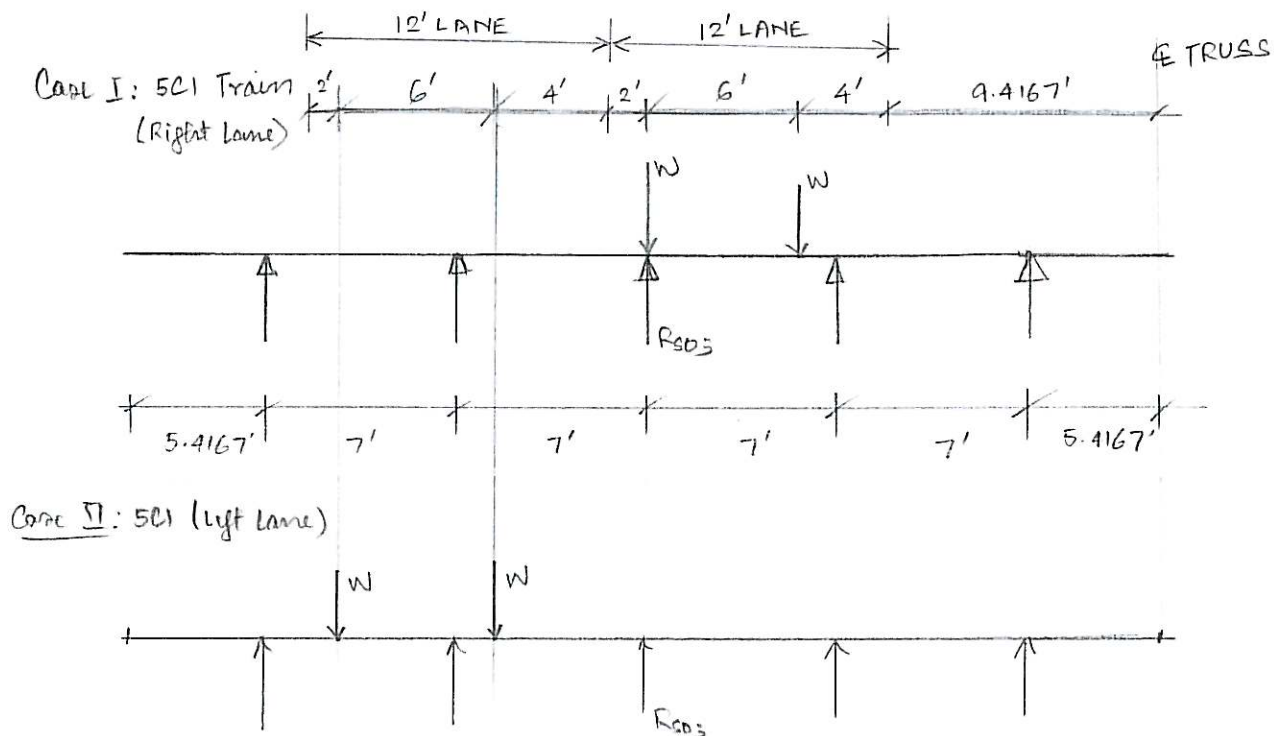
Case I:

$$R_{S02} = W + \frac{W}{7} = \frac{8}{7}W = 1.143W$$

Case II:

$$R_{S02} = \frac{W}{7} = 0.143W$$

DISTRIBUTION FACTOR FOR SCS FOR SCI



Case I:

Case I:

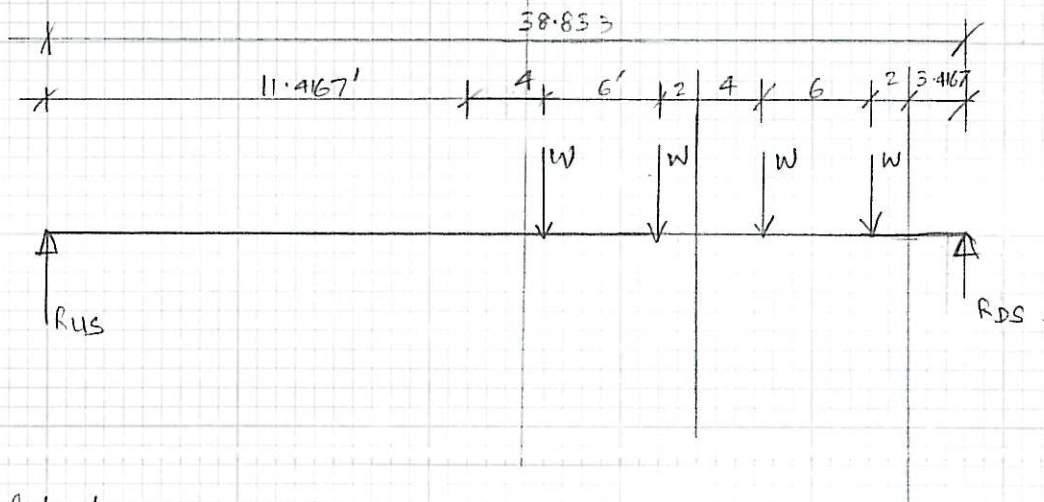
$$DF = \frac{9}{5.5} = \frac{7}{5.5} = 1.272 \text{ for Interior Stringers}$$

$$R_{SD3} = W + \frac{W}{7} = \frac{8}{7} W = 1.143 W$$

Case II:

$$R_{SD3} = \frac{W}{7} = 0.143 W$$

DISTRIBUTION FACTOR DUE TO TWO TRUCK LOADS.



Wheel loads $\rightarrow$

$$R_{DS} = \left[\frac{33.4167}{38.8333} + \frac{(27.4167')}{(38.8333')} + \frac{(21.4167')}{(38.8333')} + \frac{15.4167}{38.8333} \right] W$$

38.8333'

$$= 2.54 W$$

2.515 W but say OK (conservative)

$$R_{US} = 1.46 W$$

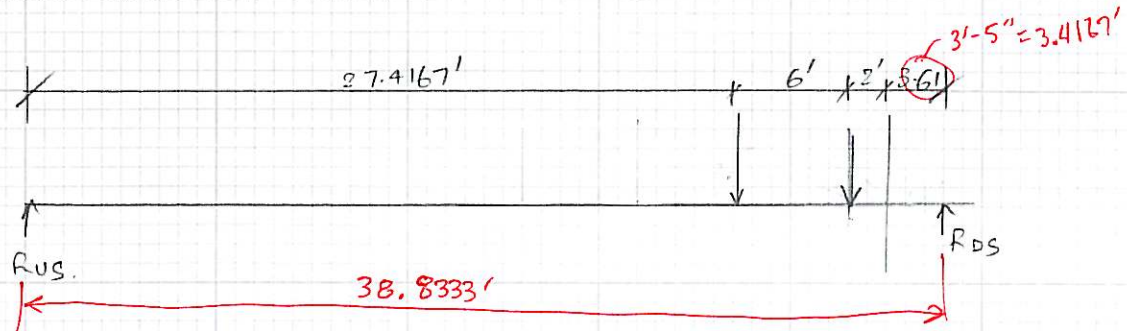
1.485 W, but say OK

Distribution factor $\rightarrow$

$$\text{Truck DS} = \frac{2.54 W}{4 W} = 0.635$$

$$\text{Truck US} = \frac{1.46 W}{4 W} = 0.365$$

Right Truss Distribution factor due to a single truck load →



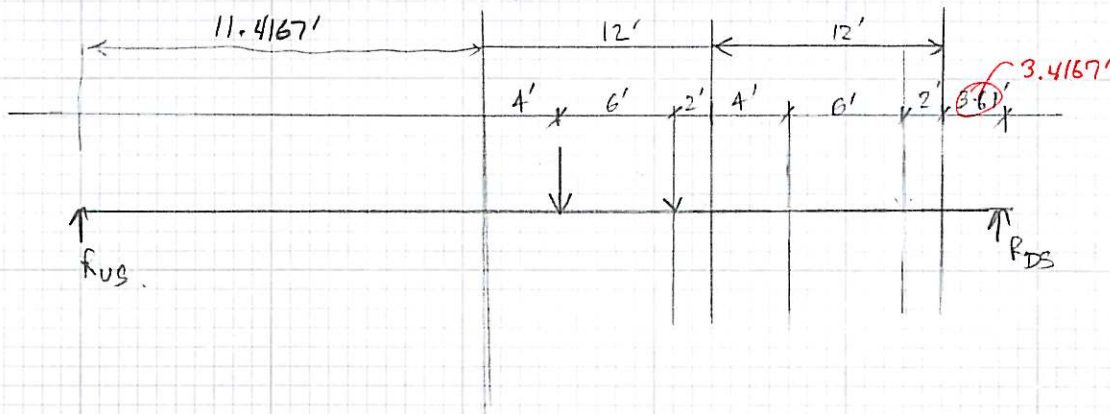
Wheel Loads →

$$R_{DS} = \left[\frac{33.4167}{38.8333} + \frac{27.4167}{38.8333} \right] W = 1.584 W$$

(1.567W but say OK (Conservative))

$$R_{US} = 0.416 W$$

Wheel Load distribution on Right Truss due to truck in left lane: →



Wheel Loads →

$$R_{DS} = \left[\frac{21.225}{38.8333} + \frac{15.225}{38.8333} \right] W = 0.937 W$$

(0.974 W)