



Western Wood Structures, Inc.

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Structural Design Calculations

For:

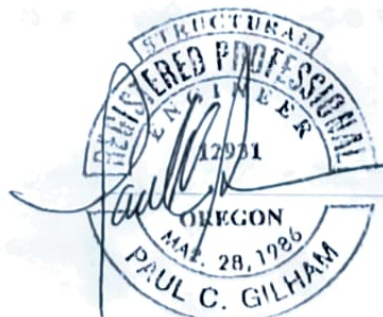
Bridge Load Rating

Designer: PCG

Walker Residence Bridge Analysis

Fall City, Oregon
WWSI Job No. 147008

March 2, 2015



EXPIRES: 6-30-15

3.2.15

The attached calculations (Sheets) show the span and loading conditions and product design/selection for the above referenced project.



WESTERN WOOD STRUCTURES, INC.

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PROJECT WALKER RESIDENCE BRIDGE

LOCATION FALL CITY, OREGON

JOB NO. 157008 BY PLG

DATE

2/27/15

SHEET

1 OF 3

EVALUATE EXISTING RESIDENCE BRIDGE

BRIDGE SPAN: 25'-0", 54'-0", 26'-0"

BRIDGE WIDTH 16'-6" @ ROAD, 12'-0" @ NORTH PIER

MAIN SPAN

(2) 11" x 39" GIRDERS W/ 4x12 DECKING

DEAD LOAD

$$\text{DECK } 3.5(6.5)(50)/12 = 94.79 \text{ PLF}$$

$$\text{CURB } 6^2\pi/4(50)/144 = 9.82 \text{ PLF}$$

$$\text{GIRDER } 11(39)(50)/144 = 148.96 \text{ PLF}$$

$$253.57 \text{ PLF}$$

$$M_{DL} = 253.57(54)^2/8 = 92,425.35 \text{ FT LBS}$$

$$\phi M_n = 0.85(2400)(0.8)(0.8)(0.75)(0.7492)(\frac{2.5}{0.85})(2.788.5)/12 = 501,394.61 \text{ FT LBS}$$

ϕ_b F_y C_m λ C_v C_{KF}/ϕ S
 NO TENSION LAMINATIONS

H20-44

$$M = SL + \frac{39.2}{L} - 28 = 5(54) + \frac{39.2}{54} - 28 = 242.73 \text{ FT KIPS}$$

$$RF = \frac{\phi M_n - 1.25(M_D)}{1.75 M_V} = \frac{501,394.61 - 1.25(92,425.35)}{1.75(242,730.00)} = 0.9084$$

$$\text{WEIGHT LIMIT} = 0.9084(40,000) = 36,335.53 \text{ LBS SAY 18 TONS}$$

AT CRACKED GIRDER



$$S = 2(11)(19.5)^2/6 = 1,394.25 \text{ IN}^3$$

$$C_v = 0.8030$$

$$\phi M_n = 0.85(2400)(0.8)(0.8)(0.75)(0.8030)(\frac{2.5}{0.85})(1394.25)/12 = 268,699.86 \text{ FT LBS}$$

$$RF = \frac{268,699.86 - 1.25(92,425.35)}{1.75(242,730)} = 0.36$$

$$\text{WEIGHT LIMIT} = 0.36(40,000) = 14,423 \text{ LBS SAY 7 TONS}$$



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PROJECT WALKER RESIDENCE BRIDGE

LOCATION _____

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BY _____

DATE _____

SHEET _____

OF _____

CHECK DEFLECTIONS

@ UNCRACKED BEAM:

$$\Delta_D = \frac{5(253.57)(54)^4(1728)}{384(1.6EG)(0.83)(54,375.75)} = 0.67 \text{ IN}$$

$$\Delta_V \approx \frac{ML^2}{10I(1.8/1.6)} = \frac{242.73(54)^2}{10(54,375.75)(1.6/1.8)} = 1.46 \text{ IN} = L/442$$

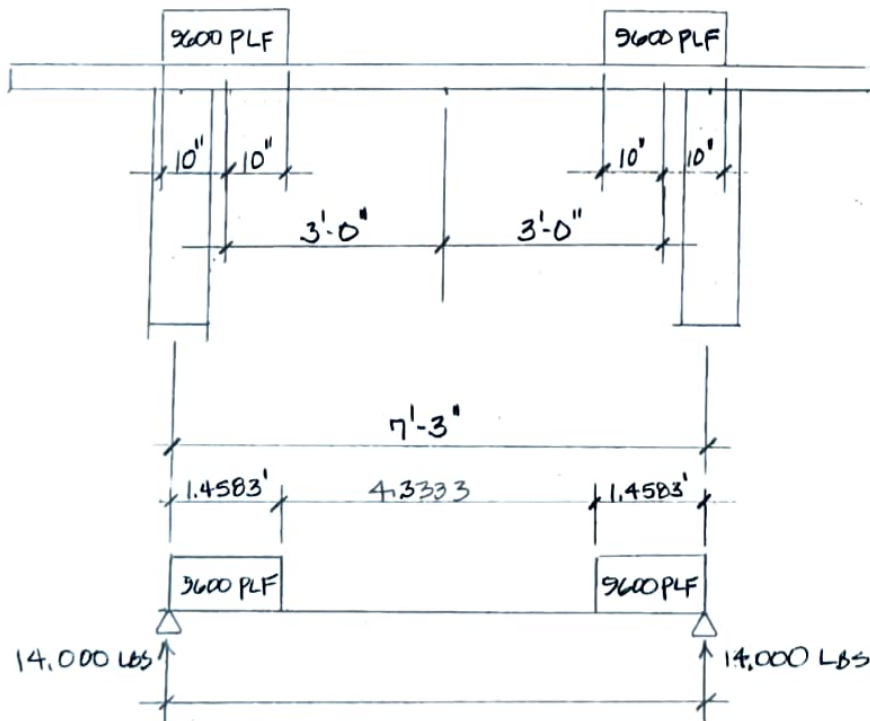
@ CRACKED BEAM

$$\Delta_D = \frac{5(253.57)(54)^4(1728)}{384(1.6EG)(0.83)(13,593.94)} = 2.69 \text{ IN}$$

$$\Delta_D + \text{LONG TERM CREEP} \approx 1.5 \Delta_D = 4.03 \text{ IN}$$

THIS IS CONSISTENT WITH SITE OBSERVATION.

CHECK 4x12 DECK W/ H20-44 TRUCK
ASSUME DF#1



$$M = 14,000(1.4583) - 9600(1.4583)^2/2 = 10,208.33 \text{ FT LBS}$$

$$\phi M_n = 0.85(1000)(1.1)(1.1)(0.8)(\frac{2.5}{0.85})(22.9688)/12 = 4,632.03 \text{ FT LBS}$$

$$M_D = 13.67(7.25)^2/8 = 89.82 \text{ FT LBS}$$

$$RF = \frac{4,632.03 - 1.25(89.82)}{(1.75)10,208.33} = 0.2530$$

$$\text{MAXIMUM AXLE LOAD} = 32,000(0.2530) = 8,096 \text{ LBS} \text{ GAY 4 TON}$$

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PROJECT _____

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DATE _____

SHEET _____

OF _____

CHECK SIDE SPANS W/ 6X22 GIRDERS @ 24" O/C

$$L = 26$$

$$M_{H2O} = 5(26) + \frac{39.2}{26} - 28 = 103.51 \text{ FT KIPS}$$

$$w_{DL} = 3.5(2 \times 50)/12 + 6(22 \times 50)/144 = 45.83 \text{ PLF}$$

$$M_{DL} = 45.83(26)^2/8 = 3,872.64 \text{ FT LBS}$$

$$\phi M_n = 0.85(1350 \times \frac{2.5}{0.85}) \left(\frac{12}{22} \right)^{1/2} (0.8 \times 484)/12 = 101,807.28 \text{ FT LBS}$$

$$DF = \frac{S}{4} = \frac{2.0}{4} = 0.5$$

$$RF = \frac{101,807.28 - 1.25(3,872.64)}{1.75(103,510)(0.5)} = 1.07$$

 $\Rightarrow$ SIDE SPANS DO NOT CONTROL CAPACITY