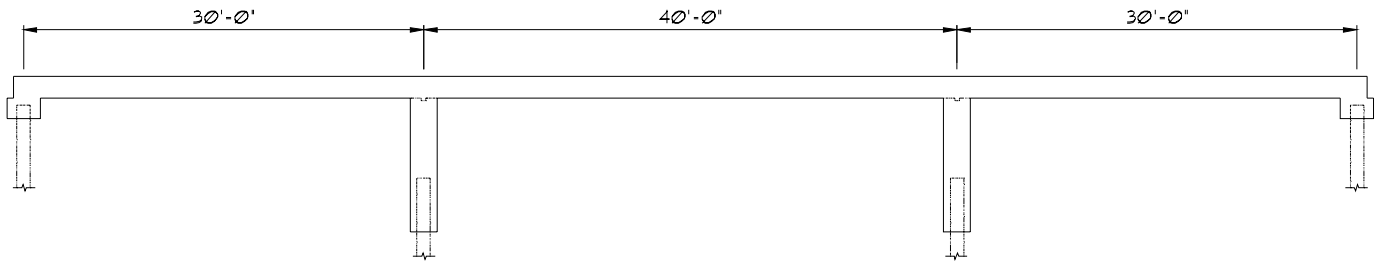


V Slab Bridge Design Software, Version 4.0

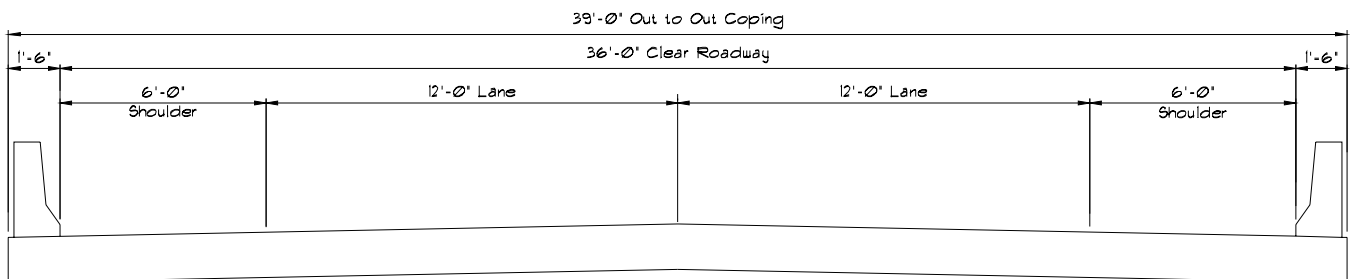
Superstructure Design Check

This superstructure design check is provided to assist the designer in understanding the key program functions and associated design calculations. This is intended to be a sample to guide the designer in understanding the methodology and in completing additional checks if desired. For this example, a three span (30', 40', 30') continuous flat slab was selected.



The bridge cross section consists of a two-lane roadway with shoulders and 18-inch barrier railing on each side. Based on the calculation Roadway/12, the code indicates a 3-lane bridge. However, we have overridden this calculation and specified a 2 lanes bridge.

For this example, the railing weighs 400 plf, and a future wearing surface of 35 psf was used. For simplicity of calculations, the bridge is not skewed. The other bridge properties and materials are presented in the printout.



DISTRIBUTION FACTORS

From [4.6.2.3], the interior strip width is calculated as:

$$E (\text{interior}) = 84 + 1.44 * \sqrt{(30 \times 39) / (12''/\text{ft.})} = 11.1 \text{ ft.} < 12 \times 39 / 2 / (12''/\text{ft.}) = 19.5 \text{ ft.}$$

$$E (\text{interior}) = 11.1 \text{ ft.}$$

From [4.6.2.1.4b], the edge beam strip width is calculated as:

$$E (\text{edge}) = 1.5 \text{ ft. (barrier)} + 1 \text{ ft.} + \frac{1}{4} \times 11.1 \text{ ft.} = 5.275 \text{ ft.} < \frac{1}{2} \times 11.1 = 5.55 \text{ ft. (6 ft. Max.)}$$

$$E (\text{edge}) = 5.275 \text{ ft.}$$

DEAD LOAD

The unfactored dead load moments and reactions are provided in the dead load and deflection summary table. These are for unfactored slab weight only, as described below the table. The maximum unfactored dead load negative moment at support 2 is -31.597 ft-k/ft. The slab weight is 250 psf which was determined by $150 \text{ pcf} \times 20'' / (12''/\text{ft})$.

The future wearing surface load is applied directly to the interior strip unit width (i.e. 35 psf load) for this case. For the edge beam strip width, the load is only applied to the roadway width. The railing width is equal to $(39' - 36') / 2 = 1.5$ feet. The edge beam strip load is a ratio of the tributary roadway width of the edge beam to the total strip width. The edge beam / exterior strip concepts are described later in this document.

$$\text{FWS (edge beam)} = 35 \text{ psf} \times (5.275 \text{ ft} - 1.5 \text{ ft}) / (5.275 \text{ ft}) = 25.05 \text{ psf}$$

The railing load is applied to the interior strip and edge beam according to the percentages specified. For this example, 50% was specified for distribution over the bridge width. This results in an equivalent interior strip load of:

$$W (\text{interior rail}) = 0.5 \times 2 \times 400 \text{ plf} / 39 \text{ ft} = 10.26 \text{ psf}$$

The edge beam rail load includes both this distributed portion and 50% of the line load distributed over the edge beam width.

$$W (\text{edge beam rail}) = 10.26 \text{ psf} + 0.50 \times 400 \text{ plf} / 5.275 \text{ ft} = 48.17 \text{ psf}$$

LIVE LOAD

Only standard HL-93 loading (no special vehicles) will be used to make the comparison easier for live loading. The Washington State Department of Transportation, Bridge and Structures Office, QConBridge Version 1.3 software package was used to compare the live load results. Qcon was programmed using the metric code version to analyze a bridge and then soft converts to the English equivalent. Therefore, since the metric and English versions use different load values and dimensions, the results do not match exactly. The metric equivalent axle load is 145KN (32.6 kips) which is about 2% higher than the English version, but the lane load is 9.3N/mm (637 plf) instead of 640 plf, which is 0.5% lower.

The V Slab maximum positive HL-93 moment, at the center of span 2, is 452.92 ft-k compared to -449.63 ft-k from Qcon, and the V Slab negative moment, at support 2, is -379.74 ft-k compared to -370.52 ft-k from Qcon. This difference is within 1% to 2%, which corresponds with the soft conversion difference.

Qcon HL-93 summary output table for a three span (30', 40' 30') continuous superstructure with pinned supports is provided below.

Live Load Envelopes (Per Lane)						
Span	Point	Min Shear(lbs)	Max Shear(lbs)	Min Moment(ft-lbs)	Max Moment(ft-lbs)	
1	0	-10.753e+03	71.762e+03	0.000e+00	0.000e+00	
1	1	-10.813e+03	63.018e+03	-23.042e+03	136.372e+03	
1	2	-10.993e+03	55.325e+03	-46.085e+03	241.934e+03	
1	3	-14.460e+03	48.676e+03	-69.127e+03	322.627e+03	
1	4	-20.479e+03	42.276e+03	-92.170e+03	377.599e+03	
1	5	-20.569e+03	36.398e+03	-115.212e+03	408.054e+03	
1	6	-32.640e+03	30.345e+03	-138.255e+03	415.485e+03	
1	7	-38.645e+03	24.874e+03	-161.297e+03	408.649e+03	
1	8	-44.549e+03	19.773e+03	-184.340e+03	387.228e+03	
1	9	-44.870e+03	15.120e+03	-207.383e+03	345.815e+03	
1	10	-50.703e+03	10.819e+03	-230.425e+03	286.658e+03	
1	11	-56.706e+03	6.975e+03	-253.468e+03	212.291e+03	
1	12	-70.596e+03	4.328e+03	-278.810e+03	127.721e+03	
1	13	-77.481e+03	2.148e+03	-313.409e+03	61.017e+03	
1	14	-83.951e+03	2.004e+03	-370.521e+03	60.133e+03	
2	0	-6.765e+03	88.722e+03	-370.521e+03	60.133e+03	
2	1	-6.809e+03	80.826e+03	-220.692e+03	68.988e+03	
2	2	-6.951e+03	72.162e+03	-178.023e+03	151.993e+03	
2	3	-10.108e+03	63.370e+03	-152.514e+03	251.152e+03	
2	4	-15.068e+03	54.781e+03	-135.871e+03	338.970e+03	
2	5	-20.630e+03	46.272e+03	-119.599e+03	403.027e+03	
2	6	-26.632e+03	39.568e+03	-103.327e+03	440.346e+03	
2	7	-26.803e+03	33.232e+03	-87.056e+03	449.631e+03	
2	8	-39.568e+03	26.632e+03	-103.327e+03	440.346e+03	
2	9	-39.909e+03	20.739e+03	-119.599e+03	403.027e+03	
2	10	-54.781e+03	15.068e+03	-135.871e+03	338.970e+03	
2	11	-63.370e+03	10.108e+03	-152.514e+03	251.152e+03	
2	12	-72.162e+03	6.951e+03	-178.023e+03	151.993e+03	
2	13	-80.826e+03	6.809e+03	-220.692e+03	68.988e+03	
2	14	-81.692e+03	6.765e+03	-370.521e+03	60.133e+03	
3	0	-2.004e+03	81.851e+03	-370.521e+03	60.133e+03	
3	1	-2.148e+03	77.481e+03	-313.409e+03	61.017e+03	
3	2	-4.328e+03	70.596e+03	-278.810e+03	127.721e+03	
3	3	-6.960e+03	63.357e+03	-253.468e+03	212.291e+03	
3	4	-10.788e+03	55.898e+03	-230.425e+03	286.658e+03	
3	5	-15.067e+03	50.313e+03	-207.383e+03	345.815e+03	
3	6	-19.773e+03	44.549e+03	-184.340e+03	387.228e+03	
3	7	-24.874e+03	38.645e+03	-161.297e+03	408.649e+03	
3	8	-30.345e+03	32.640e+03	-138.255e+03	415.485e+03	
3	9	-36.156e+03	26.572e+03	-115.212e+03	408.054e+03	
3	10	-42.276e+03	20.479e+03	-92.170e+03	377.599e+03	
3	11	-48.676e+03	14.460e+03	-69.127e+03	322.627e+03	
3	12	-55.325e+03	10.993e+03	-46.085e+03	241.934e+03	
3	13	-63.018e+03	10.813e+03	-23.042e+03	136.372e+03	
3	14	-71.762e+03	10.753e+03	0.000e+00	0.000e+00	

Live Load Envelopes (Per Lane)						
Pier	FxMin(lbs)	FxMax(lbs)	FyMin(lbs)	FyMax(lbs)	MzMin(ft-lbs)	MzMax(ft-lbs)
1	0.000e+00	0.000e+00	-10.753e+03	71.762e+03	0.000e+00	0.000e+00
2	0.000e+00	0.000e+00	-8.769e+03	112.974e+03	0.000e+00	0.000e+00
3	0.000e+00	0.000e+00	-8.769e+03	112.974e+03	0.000e+00	0.000e+00
4	0.000e+00	0.000e+00	-10.753e+03	71.762e+03	0.000e+00	0.000e+00

The V Slab HL-93 reaction at support 1 is 70.86 k compared to 71.76 k for Qcon, and 111.88 k at support 2 compared to 112.97 k for Qcon. The V Slab minimum live load reaction at support 1 is -10.65 k compared to -10.75 k for Qcon, and -8.67 k at support 2 compared to -8.77 k for Qcon. Again, these values are about 1% different due to the metric soft conversion.

INTERIOR STRIP DESIGN CHECK

The interior strip will be used for the superstructure design review. Only the negative moment condition will be verified as the positive moment checks are very similar to these and can be verified by the designer using the methodology provided in this check. The design moments are calculated below:

NEGATIVE MOMENT – SUPPORT #2 (TOP)

$$\begin{aligned} \text{Mu} &= 31.597 \times (1.25 + 1.25 \times 10.26 / 250 + 1.5 \times 35 / 250) + 1.75 \times 379.74 / 11.1 = 107.621 \text{ ft-k} \\ \text{Mu} &= 1,291,458 \text{ in - \# / ft width} \end{aligned}$$

$$\text{Mu} = 1,291,153 \text{ in - \# / ft width from report (Interior Strip Design Moments)}$$

$$\begin{aligned} \text{Ms} &= 31.597 \times (1 + 10.26 / 250 + 35 / 250) + 379.74 / 11.1 = 71.528 \text{ ft-k} \\ \text{Ms} &= 858,338 \text{ in - \# / ft width} \end{aligned}$$

$$\text{Ms} = 858,163 \text{ in - \# / ft width from report (Interior Strip Top Bar Section Checks)}$$

REQUIRED AREA OF STEEL

$$d = 20" - 2.5" \text{ (cover)} - 0.5" \text{ (Assume a \#8 bar diameter)} = 17 \text{ inches}$$

$$K_u = 1,291 \text{ in-k} / (0.9 \times 12" \times 4 \times 17^2) = 0.103406$$

$$\omega = 0.85 \times (1 - \sqrt{ 1 - 2.36 \times K_u }) = 0.110958$$

$$\rho = \omega \times f'_c / f_y = 0.007397$$

$$A_s = \rho \times b \times d = 1.51 \text{ in}^2 / \text{ft} \text{ (1.52 in}^2 / \text{ft from printout)}$$

TENSION / COMPRESSION CONTROL CHECK (STEEL STRAIN)

There is no longer a calculation to limit the maximum area of steel at a section. Instead, the strain at nominal strength is checked to determine if the section is tension or compression controlled. In accordance with 5.5.4.2 & 5.6.2.1, the strain limits for tensions and compression control are checked. These values are dependent on the grade of reinforcing provided. Tension controlled sections use a $\phi = 0.9$ and compression-controlled sections must use a $\phi = 0.75$. Between these limits, a transition equation is used.

For grade 60 steel, the tension-controlled strain is 0.005 and the compression-controlled strain is 0.002. This is completed in the program by finding the strain at each design section. The strain, in the extreme tension steel, is found by strain compatibility using the full factored load at nominal strength.

$$T = C \Rightarrow A_s F_y = .85 f'_c b a$$

$$a = A_s F_y / .85 f'_c b$$

$$c = a / \beta_1$$

$$\epsilon_s = 0.003 (d - c) / c = 0.003 (\beta_1 d / a - 1), \beta_1 = 0.85$$

$$\epsilon_s = 0.003 (.85 \beta_1 f'_c b d / A_s F_y - 1)$$

$$\epsilon_s = 0.003 (.85 \times .85 \times 4 \times 12 \times 17 / (1.51 \times 60) - 1) = 0.01659 > 0.005 \text{ (Tension Controlled)}$$

MINIMUM AREA OF STEEL

For the minimum steel requirement, the provided steel must be greater than that required to meet $1.2M_{cr}$, or at least 1.33 times the calculated steel if it is less than $1.2M_{cr}$. Temperature and shrinkage steel must also be satisfied.

The cracking moment per [5.6.3.3] is calculated. This utilizes variability factors that include reinforcing steel types. For grade 60 steel, the program used a variability factor of $0.75 \times 1.6 = 1.2$.

$$F_r = 0.24 \sqrt{f'_c} = 0.48 \text{ ksi}$$

$$S = b t^2 / 6 = 12 \times 20^2 / 6 = 800 \text{ in}^3$$

$$1.2M_{cr} = 1.2 M_{cr} * S * 1.2 = 1.2 \times 0.48 \times 800 \times 1.2 = 553 \text{ in-k/ft} < M_u = 1,291 \text{ in-k/ft (o.k.)}$$

CRACK CONTROL MAXIMUM SPACING

If the service moment is greater than 80% of the cracking moment, the maximum spacing in [5.7.3.4] must be checked. Per the previous section, a variability factor of 1.2 was used.

From report, Bar 1 is a #9 bar and Bar 2 is a #8 bar at a spacing of 6 inches
 A_s (provided) = $1.79 \text{ in}^2 / \text{ft}$

$$F_r = 0.24 \sqrt{f'_c} = 0.48 \text{ ksi}$$

$$0.8M_{cr} = 0.8 M_{cr} * S * 1.2 = 0.8 \times 0.48 \times 800 \times 1.2 = 369 \text{ in-k/ft} < M_s = 856 \text{ in-k/ft}$$

$$S_{max} < 700 \gamma_e / \beta_s f_{ss} - 2 d_c$$

$$\gamma_e = 0.75$$

$$\text{Average Bar Diameter} = (1.0 + 1.128) / 2 = 1.064''$$

$$d_c = 2.5'' \text{ (top cover)} + 1.064 / 2 = 3.032''$$

$$d = 20'' - 3.032'' = 16.968''$$

$T = C \Rightarrow F_s A_s = \frac{1}{2} f_c b c$ (c is the depth of the triangular concrete stress block)

$$E_s \varepsilon_s A_s = \frac{1}{2} \varepsilon_c E_c b c$$

$$\varepsilon_c = c \varepsilon_s / (d - c)$$

$$E_s \varepsilon_s A_s = \frac{1}{2} c \varepsilon_s E_c b c / (d - c)$$

$$A_s (d - c) E_s / E_c = \frac{1}{2} b c^2$$

$$n = E_s / E_c$$

$$E_c = 1,820 \sqrt{f'_c} = 3,640 \text{ ksi}, E_s = 29,000 \text{ ksi}$$

$$n = 29,000 / 3,640 = 7.97$$

$$n A_s d - n A_s c - \frac{1}{2} b c^2 = 0$$

$$\frac{1}{2} b c^2 + n A_s c - n A_s d = 0$$

$$A = 0.5 b = 0.5 \times 12 = 6$$

$$B = n A_s = 7.97 \times 1.79 = 14.266$$

$$C = -n A_s d = -7.97 \times 1.79 \times 16.968 = -242.07$$

$$c = (-B + \sqrt{B^2 - 4 A C}) / (2 A)$$

$$c = 5.273 \text{ inches}$$

The term β_s is the ratio of strain at the extreme tension fiber to the strain at the steel centroid. The equation below is a simplified method, provided in the code, to estimate the calculated value.

$$\beta_s = 1 + d_c / 0.7 (h - d_c)$$

$$\beta_s = 1 + 3.032 / 0.7 (20 - 3.032) = 1.188$$

Using similar triangles, the ratio of strain to the distance from the neutral axis is

$$(\text{Strain at Extreme Fiber}) / (h - c) = (\text{Strain at Steel Centroid}) / (h - c - dc)$$

$$(\text{Strain at Extreme Fiber}) / (\text{Strain at Steel Centroid}) = (h - c) / (h - c - dc)$$

$$\beta_s = (h - c) / (h - c - dc)$$

$$\beta_s = (20 - 5.273) / (20 - 5.273 - 3.032)$$

$$\beta_s = 1.259 \quad (\text{since this is the actual value, V Slab uses this calculation})$$

$$T = M_s / (d - c/3) = 858 / (16.968 - 5.273 / 3) = 56.409 \text{ kips}$$

$$F_{ss} = T / A_s = 56.409 / 1.79 = 31.513 \text{ ksi}$$

$$S_{\max} < 700 \times .75 / (1.259 \times 31.513 \text{ ksi}) - 2 \times 3.032 = 7.17 \text{ inches} \quad (7.14" \text{ from report})$$

This is reasonably close considering the number of calculations and the opportunity for roundoff errors to compound.

FATIGUE STRESS RANGE

When calculating the area of steel required at each section, the program checks the steel required for strength, then checks crack control and fatigue based on the selected toggle (No Fatigue, Fatigue I or Fatigue II) under the design envelope. If the strength reinforcing does not satisfy these requirements, the bar spacing and/or reinforcing steel selection is adjusted until the conditions are satisfied.

This check didn't control the required area of steel, for the negative moment steel at support 2, so values can't be compared with those in the report. However, a fatigue load rating was included in the report. This calculates fatigue based on the area of steel provided. For comparison purposes, the check is completed for this condition using the provided negative moment reinforcing.

$$M_f(\text{max}) = -770,723.3 \text{ in-#/ft}$$

$$M_f(\text{min}) = -409,787.0 \text{ in-#/ft}$$

$$A_s(\text{provided}) = 1.79 \text{ in}^2$$

$$c = 5.273 \text{ inches (See Crack Control Calculations)}$$

$$T_{\text{min}} = M_{f_{\text{min}}} / (d - c/3) = 409.8 / (16.968 - 5.273 / 3) = 26.94 \text{ kips}$$

$$f_{\text{min}} = T / A_s = 26.94 / 1.79 = 15.05 \text{ ksi (15.08 ksi from report)}$$

$$T_{\text{max}} = M_{f_{\text{max}}} / (d - c/3) = 770.7 / (16.968 - 5.273 / 3) = 50.67 \text{ kips}$$

$$f_{\text{max}} = T / A_s = 50.67 / 1.79 = 28.31 \text{ ksi (28.36 ksi from report)}$$

$$f_r = f_{\text{max}} - f_{\text{min}} < 28.31 - 15.05 = 13.26 \text{ ksi (13.28 ksi from report)}$$

$$f_r < 26 - 22 * f_{\text{min}} / F_y = 26 - 22 * 15.05 / 60 = 20.48 \text{ ksi (20.47 ksi from report)}$$

$$13.26 \text{ ksi} < 20.48 \text{ ksi (o.k.)}$$

These values agree reasonable well with the values included in the interior strip top bar fatigue I load rating table in the report.

INTERIOR STRIP NEGATIVE MOMENT – TOP BAR CUTOFF IN SPAN 2

Span 2 was selected to demonstrate the top steel bar cutoff because the span has symmetrical cutoff locations at support 2 & 3. Typically, Bar 2 is cut at the location where the Bar 1 area of steel, at twice the spacing, equals the required steel. The spacing limits are checked for the continuing reinforcing steel, Bar 1, at a spacing twice the typical spacing, since the cutoff bar no longer contributes. The cutoff bar is then extended by the greater of: $d(\text{neg})$, $15d_b$, or $\text{Span}/20$

$$\begin{aligned}d &= 17'' \text{ (approximately)} \\15d_b &= 15 \times 1'' = 15'' \\ \text{Span} / 20 &= 40' / 20 = 2.0' \text{ (controls)}\end{aligned}$$

V Slab calculated the Bar 2 cut location, in span 2, to end at 7 feet from the support. The location at support 3 was calculated by the program. The Bar 2 starting location at support 3 is 33 feet (measure from the left end of the span) which is 7 feet from support 3. For support 2, the ending location for Bar 2 was manually set to 6.75 feet, three inches shorter than provided by the program.

In the design section check table, following the top bar definition page, the location of the critical section for these cuts are $6.75' - 2' = 4.75'$ and $33' + 2' = 35'$ for the cutoff bars. As indicated in the table, both locations meet the area of steel requirements, but the section at 4.75' fails for spacing requirements. The section at 35 feet passes for spacing as the service moment appears to be less than 80% of the cracking moment. The spacing requirements at 4.75' will be verified by calculation.

$$\begin{aligned}M_s &= 372,400.1 \text{ IN-}\# \text{ (From Table)} \\d_b &= 1.128'' \text{ (Only the \#9 bar is effective)} \\d_c &= 2.5'' \text{ (top cover)} + 1.128'' / 2 = 3.064'' \\d &= 20'' - 3.064'' = 16.936''\end{aligned}$$

$$\begin{aligned}A_s &= 1.0 \text{ Sq. Inches (Only the \#9 bar is effective)} \\n &= 7.97 \text{ (defined earlier)}\end{aligned}$$

$$\begin{aligned}A &= 0.5 b = 0.5 \times 12 = 6 \\B &= n A_s = 7.97 \times 1.0 = 7.97 \\C &= -n A_s d = -7.97 \times 1.0 \times 16.936 = -134.98\end{aligned}$$

$$\begin{aligned}c &= (-B + \sqrt{B^2 - 4 A C}) / (2 A) \\c &= 4.125 \text{ inches}\end{aligned}$$

$$\begin{aligned}\beta_s &= (h - c) / (h - c - d_c) \\ \beta_s &= (20 - 4.125) / (20 - 4.125 - 3.064) \\ \beta_s &= 1.239\end{aligned}$$

$$T = M_s / (d - c/3) = 372.4 / (16.936 - 4.125 / 3) = 23.932 \text{ kips}$$

$$F_{ss} = T / A_s = 23.932 / 1.0 = 23.932 \text{ ksi}$$

$$S_{max} < 700 \times .75 / (1.239 \times 23.932 \text{ ksi}) - 2 \times 3.064 = 11.58 \text{ inches} \quad (11.58" \text{ from report})$$

The continuing #9 reinforcing bars are spaced at twice the typical spacing $2" \times 6" = 12"$ since the cut bar is no longer effective. Since this exceeds the maximum spacing, the spacing check, in the table, indicates a <FAIL> condition. Therefore, the initial location selected by the program was appropriate.

In addition to the area of steel and spacing requirements, the location of the cut bar termination must be beyond the development length of the cut bar from the support, since the bars selected at the maximum moment location are assumed to be fully engaged. This calculation is included to illustrate that the selected location is satisfactory. The basic development length is calculated in accordance with [5.10.8.2]

$$L_{db} = 2.4 d_b F_y / \sqrt{F'_c} = 2.4 \times 1.0 \times 60 / \sqrt{4} = 72.0 \text{ inches}, (5.10.8.2.1a-2)$$

The following equation and modification factors are applied to the basic development length to determine the actual length used in the program.

$$L_d = L_{db} \times \lambda_{rl} \times \lambda_{cf} \times \lambda_{rc} \times \lambda_{er} / \lambda \quad (5.10.8.2.1a-1)$$

$$\lambda_{rl} = 1.3 \quad (\text{more than } 12" \text{ concrete placed below reinforcing})$$

$$\lambda_{cf} = 1.5 \quad (\text{epoxy coated bar with } < 3d_b \text{ cover})$$

$$\lambda_{rl} \times \lambda_{cf} = 1.95 > 1.7 \quad (\text{need not be taken } > 1.7)$$

$$\lambda_{rc} = d_b / (C_b + K_{tr}) \quad (K_{tr} \text{ is assumed to be } 0 \text{ since transverse reinforcing is unknown})$$

$$C_b = \text{smaller of } (2.5" + 1" / 2 = 3") \text{ or } (6" \text{ spacing} / 2 = 3") = 3"$$

$$\lambda_{rc} = 1" / 3" = 0.333$$

$$0.4 < \lambda_{rc} = 1.0, \lambda_{rc} = 0.4$$

$$\lambda_{er} = 1.0 \quad (\text{Excess Reinforcing Ratio Taken as } 1.0)$$

$$\lambda = 1.0 \quad (\text{Normal Weight Concrete})$$

$$L_d = 72 \times 1.7 \times 1.0 \times 0.4 \times 1.0 / 1.0 = 48.96 \text{ Inches}$$

The cut bar must extend at least $48.96" / 12 + 2'$ extension = 6.08 feet from the support

Since the selected cut location is beyond the development length with extension, this condition is satisfied. V Slab will allow a cut location less than the development length and will calculate the reduced capacity at the critical sections. Section checks will indicate if the strength and spacing limits are satisfied.

EXTERIOR STRIP CALCULATIONS

The edge of the slab creates a discontinuity which must be designed as a beam [9.7.1.4]. The edge beam, defined as the exterior strip, design follows the same methodology as the interior strip. The live load is applied as ½ of the vehicle live load, and the dead load is that portion discussed in the dead load section. By code, the exterior strip reinforcing cannot be less than the interior strip.

Some agencies require the edge beam to be checked for shear. While superstructure shear design calculations are not required by the code [5.12.2.1] because the moment design is in accordance with [4.6.2.3], designers can obtain shear loads from the program. The calculated shear loads are provided for the interior and exterior beam strips. The shear summary table is printed if the designer checks the appropriate box on the loading page.

For the purposes of the design check, the exterior strip moment calculation at support 2 will be illustrated. The exterior strip distribution width is E (edge) = 5.275 ft. The future wearing surface and railing loads were calculated in the dead load section.

$$\begin{aligned} \text{Mu} &= 31.597 \times (1.25 + 1.25 \times 48.17/250 + 1.5 \times 25.05/250) + 1.75 \times 379.74 / (2 \times 5.275) \\ \text{Mu} &= 114.845 \text{ ft-k} = 1,378,140 \text{ in} - \# / \text{ft width} \end{aligned}$$

$$\text{Mu} = 1,333,889 \text{ in} - \# / \text{ft width from report (Exterior Strip Design Moments)}$$

The difference between these values is related to the live load calculation. For the design check, the maximum HL93 negative moment was divide by 2. However, the actual required loading is for one line of wheels and the prorated amount of the distributed lane load, based on the exterior tributary width (outside of the railing) divide by the 10 Ft. lane load width.

By dividing the total HL-93 moment by two, half of the distributed lane load is also applied to the exterior strip. Since the exterior strip roadway width (3.775 Ft. same as the future wearing surface width), is less than 5 Ft. (half of the lane load width), the live load used in the program will be overestimated in this calculation.

This difference can be calculated if desired. The user can select the "Print HL-93 Lane Load only Table," under the Loading Specification Tab, to obtain the information necessary to complete this calculation.

V SLAB OUTPUT
REPORT

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

GENERAL BRIDGE DATA

Code Check is based on the AASHTO LRFD Bridge Design Specification, 8th Edition

THE BRIDGE IS A 3 SPAN CONTINUOUS
FLAT SLAB BRIDGE

SPAN # 1 LENGTH OF SPAN = 30.00 Ft., SLAB DEPTH = 20.00 In.
SPAN # 2 LENGTH OF SPAN = 40.00 Ft., SLAB DEPTH = 20.00 In.
SPAN # 3 LENGTH OF SPAN = 30.00 Ft., SLAB DEPTH = 20.00 In.

GEOMETRICS

ROADWAY WIDTH = 36.00 ft.
OUT TO OUT BRIDGE WIDTH = 39.00 ft.
NUMBER OF TRAFFIC LANES = 2.50 In.
LOWER CLEAR COVER = 1.00 In.
TIRE WEAR DEPTH = 0.50 In.
BRIDGE SKEW = 0.00 Degrees
TOP EXPOSURE FACTOR = 0.750
BOTTOM EXPOSURE FACTOR = 0.750

MATERIAL PROPERTIES

Fy = 60.00 ksi
TOP REINFORCING IS EPOXY COATED
BOTTOM REINFORCING IS EPOXY COATED

F'c = 4.00 ksi
REINF. CONCRETE UNIT WEIGHT = 0.15 kcf
THE CALCULATED LIVE LOAD CONCRETE MODULUS WAS USED
THE CALCULATED DEAD LOAD CONCRETE MODULUS WAS USED

LOADING SPECIFICATION

RAILING LOAD / SIDE = 400.00 plf
50% RAILING LOAD TO BRIDGE & 50% To EDGE BEAM

FUTURE WEARING SURFACE = 35.00 psf
INTERIOR STRIP SPECIAL DISTRIBUTED LOAD = 0.00 Plf
EXTERIOR STRIP SPECIAL DISTRIBUTED LOAD = 0.00 Plf
ADDITIONAL EXTERIOR STRIP DEAD LOAD = 0.00 Plf

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

LOADING APPLICATION DETAILS

DISTRIBUTION WIDTH DEFINITION

FATIGUE WIDTH = 1.2 x Single LANE DISTR. = 16.00 ft./Lane

CALCULATED INTERIOR DISTRIBUTION WIDTH = 11.10 ft./Lane

CALCULATED EXTERIOR DISTRIBUTION WIDTH = 5.28 ft./Lane

DESIGN ENVELOPE LOADING DEFINITION

HL93 LOADING WAS INCLUDED
SPECIAL VEHICLE LOADING WAS EXCLUDED
FATIGUE I LOADING COMBINATION WAS INCLUDED

SPECIAL INTERIOR STRIP LINE LOAD WAS EXCLUDED
SPECIAL EXTERIOR STRIP LINE LOAD WAS EXCLUDED
ADDITIONAL EXTERIOR STRIP DEAD LOAD WAS EXCLUDED

MOMENTS WERE NOT REDUCED FOR SKEW CORRECTION

LOAD RATING DEFINITION

CONDITION RATING FACTOR x SYSTEM RATING FACTOR
COMBINED RATING FACTOR: $\Phi(c) \times \Phi(s) = 1.00$

SPECIAL INTERIOR STRIP LINE LOAD WAS INCLUDED
SPECIAL EXTERIOR STRIP LINE LOAD WAS INCLUDED
ADDITIONAL EXTERIOR STRIP DEAD LOAD WAS INCLUDED
FUTURE WEARING SURFACE WAS INCLUDED AS DEAD LOAD (DC)

MOMENTS WERE NOT REDUCED FOR SKEW CORRECTION

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

FATIGUE TRUCK ONLY
 Values Include 1.15 Dynamic Load Allowance

LOCATION (FT)	POSITIVE MOMENT (FT-K/LANE)	NEGATIVE MOMENT (FT-K/LANE)	POSITIVE SHEAR (K/LANE)	NEGATIVE SHEAR (K/LANE)	MAXIMUM REACTION (K/LANE)	MINIMUM REACTION (K/LANE)
Support # 1					40.93	-4.01
0.00	0.000	0.000	40.927	-4.012		
2.14	79.274	-8.597	36.994	-5.562		
4.29	141.927	-17.195	33.116	-9.772		
6.43	188.458	-25.792	29.316	-13.718		
8.57	219.566	-34.389	25.616	-17.391		
10.71	236.154	-42.986	22.041	-20.716		
12.86	239.323	-51.584	18.614	-23.788		
15.00	230.378	-60.181	15.359	-26.601		
17.14	213.719	-68.778	12.467	-29.867		
19.29	191.007	-77.375	9.904	-33.036		
21.43	160.933	-85.973	7.510	-35.940		
23.57	125.025	-94.570	5.304	-38.568		
25.71	84.973	-139.791	3.304	-40.906		
27.86	42.627	-190.391	1.530	-42.933		
30.00	28.967	-246.033	0.966	-44.666		
Support # 2					56.16	-4.22
0.00	28.967	-246.033	45.434	-3.259		
2.86	28.746	-168.197	41.250	-3.259		
5.71	95.557	-105.843	39.024	-3.259		
8.57	149.067	-73.451	36.396	-6.368		
11.43	185.499	-64.140	33.380	-10.699		
14.29	210.383	-54.830	30.039	-14.742		
17.14	224.255	-45.519	26.416	-18.438		
20.00	223.487	-36.208	22.503	-22.503		
22.86	224.255	-45.519	18.438	-26.416		
25.71	210.383	-54.830	14.742	-30.039		
28.57	185.499	-64.140	10.699	-33.380		
31.43	149.067	-73.451	6.368	-36.396		
34.29	95.557	-105.843	3.259	-39.024		
37.14	28.746	-168.197	3.259	-41.250		
40.00	28.967	-246.033	3.259	-45.434		
Support # 3					56.16	-4.22

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

LOCATION (FT)	POSITIVE MOMENT (FT-K/LANE)	NEGATIVE MOMENT (FT-K/LANE)	POSITIVE SHEAR (K/LANE)	NEGATIVE SHEAR (K/LANE)	MAXIMUM REACTION (K/LANE)	MINIMUM REACTION (K/LANE)
0.00	28.967	-246.033	44.666	-0.966		
2.14	42.627	-190.391	42.933	-1.530		
4.29	84.973	-139.791	40.906	-3.304		
6.43	125.025	-94.570	38.568	-5.304		
8.57	160.933	-85.973	35.940	-7.510		
10.71	191.007	-77.375	33.036	-9.904		
12.86	213.719	-68.778	29.867	-12.467		
15.00	230.378	-60.181	26.601	-15.359		
17.14	239.323	-51.584	23.788	-18.614		
19.29	236.154	-42.986	20.716	-22.041		
21.43	219.566	-34.389	17.391	-25.616		
23.57	188.458	-25.792	13.718	-29.316		
25.71	141.927	-17.195	9.772	-33.116		
27.86	79.274	-8.597	5.562	-36.994		
30.00	0.000	0.000	4.012	-40.927		
Support # 4					40.93	-4.01

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

HL-93 LIVE LOAD ENVELOPE SUMMARY

Values are Unfactored but Include Dynamic Load Allowance

LOCATION (FT)	POSITIVE MOMENT (FT-K/LANE)	NEGATIVE MOMENT (FT-K/LANE)	POSITIVE SHEAR (K/LANE)	NEGATIVE SHEAR (K/LANE)	MAXIMUM REACTION (K/LANE)	MINIMUM REACTION (K/LANE)
Support # 1					70.86	-10.65
0.00	0.000	0.000	70.864	-10.646		
2.14	135.772	-22.812	62.735	-10.706		
4.29	244.002	-45.624	55.803	-13.439		
6.43	325.330	-68.437	49.091	-18.302		
8.57	380.686	-91.249	42.630	-22.969		
10.71	411.293	-114.061	36.451	-27.347		
12.86	418.662	-136.873	30.585	-32.901		
15.00	411.754	-159.686	25.063	-38.969		
17.14	390.228	-182.498	19.914	-44.936		
19.29	348.487	-205.310	15.166	-50.761		
21.43	288.802	-228.122	10.847	-56.404		
23.57	213.732	-250.935	6.986	-62.601		
25.71	128.439	-276.061	4.259	-69.746		
27.86	60.047	-310.491	2.117	-76.534		
30.00	59.708	-379.739	1.990	-82.911		
Support # 2					111.88	-8.67
0.00	59.708	-379.739	88.096	-6.717		
2.86	50.531	-250.590	79.884	-6.760		
5.71	152.681	-176.821	71.312	-6.902		
8.57	252.818	-151.436	62.567	-10.168		
11.43	341.429	-134.953	54.080	-15.190		
14.29	406.034	-124.980	46.677	-20.786		
17.14	443.630	-120.944	39.907	-26.845		
20.00	452.921	-117.928	33.257	-33.257		
22.86	443.630	-120.944	26.845	-39.907		
25.71	406.034	-124.980	20.786	-46.677		
28.57	341.429	-134.953	15.190	-54.080		
31.43	252.818	-151.436	10.168	-62.567		
34.29	152.681	-176.821	6.902	-71.312		
37.14	50.531	-250.590	6.760	-79.884		
40.00	59.708	-379.739	6.717	-88.096		
Support # 3					111.88	-8.67

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

LOCATION (FT)	POSITIVE MOMENT (FT-K/LANE)	NEGATIVE MOMENT (FT-K/LANE)	POSITIVE SHEAR (K/LANE)	NEGATIVE SHEAR (K/LANE)	MAXIMUM REACTION (K/LANE)	MINIMUM REACTION (K/LANE)
0.00	59.708	-379.739	82.911	-1.990		
2.14	60.047	-310.491	76.534	-2.117		
4.29	128.439	-276.061	69.746	-4.259		
6.43	213.732	-250.935	62.601	-6.986		
8.57	288.802	-228.122	56.404	-10.847		
10.71	348.487	-205.310	50.761	-15.166		
12.86	390.228	-182.498	44.936	-19.914		
15.00	411.754	-159.686	38.969	-25.063		
17.14	418.661	-136.873	32.901	-30.585		
19.29	411.293	-114.061	27.347	-36.451		
21.43	380.686	-91.249	22.969	-42.630		
23.57	325.330	-68.437	18.302	-49.091		
25.71	244.002	-45.624	13.439	-55.803		
27.86	135.772	-22.812	10.706	-62.735		
30.00	0.000	0.000	10.646	-70.864		
Support # 4					70.86	-10.65

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

DEAD LOAD & DEFLECTION SUMMARY
 MODULUS OF ELASTICITY, E(dead)= 3,640 Ksi, E(live)= 3,640 Ksi

LOCATION (FT)	SLAB * MOMENT (FT-K/FT)	SLAB DEFLECTION (IN.)	LIVE LOAD DEFLECTION (IN.)	LIVE LOAD DEFLECTION L over
Support # 1, R(Slab)* = 2.70 K/Ft.				
0.00	0.000	0.000	0.000	0
2.14	5.205	-0.015	-0.019	19271
4.29	9.262	-0.029	-0.036	9966
6.43	12.170	-0.041	-0.051	7047
8.57	13.931	-0.049	-0.063	5729
10.71	14.544	-0.054	-0.071	5081
12.86	14.009	-0.054	-0.075	4804
15.00	12.326	-0.051	-0.075	4773
17.14	9.495	-0.044	-0.072	4976
19.29	5.517	-0.035	-0.066	5466
21.43	0.390	-0.025	-0.056	6420
23.57	-5.885	-0.014	-0.043	8311
25.71	-13.308	-0.005	-0.029	12455
27.86	-21.879	0.001	-0.014	25749
30.00	-31.597	0.000	0.000	0
Support # 2, R(Slab)* = 9.80 K/Ft.				
0.00	-31.597	0.000	0.000	0
2.86	-18.332	-0.012	-0.025	18863
5.71	-7.107	-0.034	-0.054	8954
8.57	2.076	-0.059	-0.081	5942
11.43	9.219	-0.083	-0.105	4573
14.29	14.321	-0.102	-0.123	3906
17.14	17.382	-0.115	-0.134	3589
20.00	18.403	-0.120	-0.137	3496
22.86	17.382	-0.115	-0.134	3589
25.71	14.321	-0.102	-0.123	3906
28.57	9.219	-0.083	-0.105	4573
31.43	2.076	-0.059	-0.081	5942
34.29	-7.107	-0.034	-0.054	8954
37.14	-18.332	-0.012	-0.025	18863
40.00	-31.597	0.000	0.000	0
Support # 3, R(Slab)* = 9.80 K/Ft.				
0.00	-31.597	0.000	0.000	0
2.14	-21.879	0.001	-0.014	25749

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

LOCATION (FT)	SLAB * MOMENT (FT-K/FT)	SLAB DEFLECTION (IN.)	LIVE LOAD DEFLECTION (IN.)	LIVE LOAD DEFLECTION L over
4.29	-13.308	-0.005	-0.029	12455
6.43	-5.885	-0.014	-0.043	8311
8.57	0.390	-0.025	-0.056	6420
10.71	5.517	-0.035	-0.066	5466
12.86	9.495	-0.044	-0.072	4976
15.00	12.326	-0.051	-0.075	4773
17.14	14.009	-0.054	-0.075	4804
19.29	14.544	-0.054	-0.071	5081
21.43	13.931	-0.049	-0.063	5729
23.57	12.170	-0.041	-0.051	7047
25.71	9.262	-0.029	-0.036	9966
27.86	5.205	-0.015	-0.019	19271
30.00	0.000	0.000	0.000	0
Support # 4, R(Slab)* = 2.70 K/Ft.				

* VALUES FOR UNFACTORED SLAB DEAD LOAD

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

SHEAR SUMMARY
All Shear Values are Factored

LOCATION (FT)	SLAB DEAD (K/FT)	INTERIOR STRIP MINIMUM (K/FT)	INTERIOR STRIP MAXIMUM (K/FT)	EXTERIOR STRIP MINIMUM (K/FT)	EXTERIOR STRIP MAXIMUM (K/FT)
Support # 1					
0.00	3.37	-1.67	11.17	-1.68	11.40
2.14	2.70	-1.68	9.89	-1.69	10.10
4.29	2.03	-2.12	8.80	-2.14	9.00
6.43	1.36	-2.88	7.74	-2.93	7.93
8.57	0.69	-3.62	6.72	-3.69	6.90
10.71	0.02	-4.31	5.74	-4.40	5.91
12.86	-0.65	-5.19	4.82	-5.29	4.96
15.00	-1.32	-6.14	3.95	-6.27	4.07
17.14	-1.99	-7.08	3.14	-7.23	3.24
19.29	-2.66	-8.00	2.39	-8.15	2.46
21.43	-3.33	-8.89	1.71	-9.05	1.76
23.57	-4.00	-9.87	1.10	-10.03	1.13
25.71	-4.66	-11.00	0.67	-11.17	0.68
27.86	-5.33	-12.07	0.33	-12.24	0.33
30.00	-6.00	-13.07	0.31	-13.25	0.31
Support # 2					
0.00	6.25	-1.05	13.89	-1.06	14.05
2.86	5.36	-1.06	12.60	-1.07	12.76
5.71	4.46	-1.08	11.24	-1.09	11.41
8.57	3.57	-1.60	9.86	-1.62	10.02
11.43	2.68	-2.39	8.53	-2.44	8.67
14.29	1.79	-3.27	7.36	-3.35	7.50
17.14	0.89	-4.23	6.29	-4.32	6.42
20.00	0.00	-5.24	5.24	-5.35	5.35
22.86	-0.89	-6.29	4.23	-6.42	4.32
25.71	-1.79	-7.36	3.27	-7.50	3.35
28.57	-2.68	-8.53	2.39	-8.67	2.44
31.43	-3.57	-9.86	1.60	-10.02	1.62
34.29	-4.46	-11.24	1.08	-11.41	1.09
37.14	-5.36	-12.60	1.06	-12.76	1.07
40.00	-6.25	-13.89	1.05	-14.05	1.06
Support # 3					
0.00	6.00	-0.31	13.07	-0.31	13.25
2.14	5.33	-0.33	12.07	-0.33	12.24

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

LOCATION (FT)	SLAB DEAD (K/FT)	INTERIOR STRIP MINIMUM (K/FT)	INTERIOR STRIP MAXIMUM (K/FT)	EXTERIOR STRIP MINIMUM (K/FT)	EXTERIOR STRIP MAXIMUM (K/FT)
4.29	4.66	-0.67	11.00	-0.68	11.17
6.43	4.00	-1.10	9.87	-1.13	10.03
8.57	3.33	-1.71	8.89	-1.76	9.05
10.71	2.66	-2.39	8.00	-2.46	8.15
12.86	1.99	-3.14	7.08	-3.24	7.23
15.00	1.32	-3.95	6.14	-4.07	6.27
17.14	0.65	-4.82	5.19	-4.96	5.29
19.29	-0.02	-5.74	4.31	-5.91	4.40
21.43	-0.69	-6.72	3.62	-6.90	3.69
23.57	-1.36	-7.74	2.88	-7.93	2.93
25.71	-2.03	-8.80	2.12	-9.00	2.14
27.86	-2.70	-9.89	1.68	-10.10	1.69
30.00	-3.37	-11.17	1.67	-11.40	1.68
Support # 4					

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

INTERIOR STRIP DESIGN MOMENTS AND REQ'D STEEL SUMMARY
 Values are Provided per Foot Width of Slab

LOCATION (FT)	FACTORED POSITIVE (# - IN)	FACTORED NEGATIVE (# - IN)	STEEL POSITIVE (SQ. IN.)	STEEL NEGATIVE (SQ. IN.)	FATIGUE MAXIMUM (# - IN)	FATIGUE MINIMUM (# - IN)
Support # 1						
0.00	0.0	0.0	0.21~	0.21~	0.0	0.0
2.14	351149.3	51250.6	0.49+	0.21~	177810.9	62480.0
4.29	629395.4	81682.5	0.67< T	0.21~	317537.4	108690.7
6.43	835948.5	91295.8	0.89< T	0.21~	419834.4	138632.2
8.57	972568.3	80090.4	1.04< T	0.21~	485620.8	152304.5
10.71	1041564.0	48066.2	1.12< T	0.21~	516079.2	149707.5
12.86	1045797.0	-4776.7	1.13< T	0.21~	512656.8	130841.3
15.00	1002214.0	-78438.1	1.08< T	0.21~	477064.3	95706.0
17.14	910164.1	-172918.3	0.97< T	0.25+	415078.8	44301.3
19.29	759070.8	-288217.1	0.81< T	0.43+	328879.8	-23372.6
21.43	553222.8	-424334.6	0.58< T	0.62=	216748.0	-107315.7
23.57	297460.3	-581270.8	0.41+	0.66<T	80690.1	-207528.0
25.71	1549.3	-763402.4	0.21~	0.87<T	-77076.1	-372078.2
27.86	-283220.0	-983945.9	0.21~	1.14<T	-254121.4	-559958.1
30.00	-460114.6	-1291153.0	0.21~	1.52<T	-409787.0	-770723.3
Support # 2						
0.00	-460114.6	-1291153.0	0.21~	1.52<T	-409787.0	-770723.3
2.86	-236896.8	-806348.5	0.21~	0.92<T	-222076.0	-480563.9
5.71	159839.2	-463283.3	0.22+	0.62=	24690.1	-239647.3
8.57	515758.9	-248728.2	0.58=	0.37+	225075.2	-66979.2
11.43	812868.9	-88017.3	0.87<T	0.21~	374122.7	46471.9
14.29	1027571.0	23369.1	1.11<T	0.21~	479091.8	130999.8
17.14	1154185.0	86518.8	1.26<T	0.21~	540682.6	186604.7
20.00	1190261.0	110728.3	1.30<T	0.21~	554136.2	213286.6
22.86	1154186.0	86518.9	1.26<T	0.21~	540682.6	186604.8
25.71	1027571.0	23369.1	1.11<T	0.21~	479091.8	130999.8
28.57	812869.0	-88017.3	0.87<T	0.21~	374122.8	46471.9
31.43	515758.9	-248728.2	0.58=	0.37+	225075.2	-66979.2
34.29	159839.2	-463283.3	0.22+	0.62=	24690.1	-239647.3
37.14	-236896.7	-806348.5	0.21~	0.92<T	-222075.9	-480563.9
40.00	-460114.5	-1291153.0	0.21~	1.52<T	-409786.9	-770723.2
Support # 3						
0.00	-460114.5	-1291153.0	0.21~	1.52<T	-409786.9	-770723.2
2.14	-283220.0	-983945.9	0.21~	1.14<T	-254121.4	-559958.1

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

LOCATION (FT)	FACTORED POSITIVE (# - IN)	FACTORED NEGATIVE (# - IN)	STEEL POSITIVE (SQ. IN.)	STEEL NEGATIVE (SQ. IN.)	FATIGUE MAXIMUM (# - IN)	FATIGUE MINIMUM (# - IN)
4.29	1549.4	-763402.3	0.21~	0.87<T	-77076.1	-372078.3
6.43	297460.3	-581270.8	0.41+	0.66<T	80690.1	-207528.0
8.57	553222.8	-424334.6	0.58<T	0.62=	216748.0	-107315.7
10.71	759070.6	-288217.1	0.81<T	0.43+	328879.8	-23372.6
12.86	910164.3	-172918.3	0.97<T	0.25+	415078.8	44301.3
15.00	1002214.0	-78438.2	1.08<T	0.21~	477064.3	95705.9
17.14	1045797.0	-4776.6	1.13<T	0.21~	512656.8	130841.4
19.29	1041564.0	48066.2	1.12<T	0.21~	516079.2	149707.5
21.43	972568.1	80090.3	1.04<T	0.21~	485620.8	152304.5
23.57	835948.5	91295.8	0.89<T	0.21~	419834.4	138632.2
25.71	629395.4	81682.5	0.67<T	0.21~	317537.4	108690.7
27.86	351149.3	51250.6	0.49+	0.21~	177810.9	62480.0
30.00	0.0	0.0	0.21~	0.21~	0.0	0.0
Support # 4						

(<) FACTORED MOMENT CONTROLS FATIGUE STRESS RANGE CONTROLS (>)
 (=) 1.2 X CRACKING MOMENT CONTROLS 1/3 MORE THAN FACTORED BUT < 1.2 MCR (+)
 (~) TEMPERATURE & SHRINKAGE STEEL CONTROLS
 (T) TENSION CONTROLLED (:) TRANSITION CONTROLLED (C) COMPRESSION CONTROLLED

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

INTERIOR STRIP BOTTOM BAR DEFINITION
All Distances are Measured from the Left End of the Span

REINFORCING IS SPACED AT 6.00 IN.

----- SPAN #1 -----
7 x 30.000 FT. MAIN BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 0.000 FT. AND ENDS AT 30.000 FT.

7 x 21.510 FT. CUT BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 1.495 FT. AND ENDS AT 23.005 FT.

BEGINNING BAR EXTENSION = 18.063 IN.
ENDING BAR EXTENSION = 18.063 IN.

----- SPAN #2 -----
8 x 40.000 FT. MAIN BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 0.000 FT. AND ENDS AT 40.000 FT.

7 x 23.750 FT. CUT BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 8.000 FT. AND ENDS AT 31.750 FT.

BEGINNING BAR EXTENSION = 24.000 IN.
ENDING BAR EXTENSION = 24.000 IN.

----- SPAN #3 -----
7 x 30.000 FT. MAIN BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 0.000 FT. AND ENDS AT 30.000 FT.

7 x 21.760 FT. CUT BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 6.495 FT. AND ENDS AT 28.255 FT.

BEGINNING BAR EXTENSION = 18.063 IN.
ENDING BAR EXTENSION = 18.063 IN.

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

INTERIOR STRIP BOTTOM BAR - DESIGN ENVELOPE SECTION CHECKS
All Distances are Measured from the Left End of the Span

LOCATION (FT)	SERVICE MOMENTS (#-IN/FT)	SPACING S(MAX.) (INCHES)	SPACING S(PROV.) (INCHES)	SPACING CHECK (P/F)	STEEL REQUIRED (SQ IN/FT)	STEEL PROVIDED (SQ IN/FT)	STEEL CHECK (P/F)
Support # 1							
3.00	290263.4	N/A	12.00	PASS	0.56	0.60	PASS
12.86	650963.0	11.62	6.00	PASS	1.13	1.20	PASS
21.50	311943.3	N/A	12.00	PASS	0.58	0.60	PASS
Support # 2							
10.00	401121.3	12.68	12.00	PASS	0.73	0.79	PASS
20.00	750249.6	11.43	6.00	PASS	1.30	1.39	PASS
29.75	418357.8	12.03	12.00	PASS	0.75	0.79	PASS
Support # 3							
8.00	272264.7	N/A	12.00	PASS	0.54	0.60	PASS
17.14	650963.0	11.62	6.00	PASS	1.13	1.20	PASS
26.75	310615.7	N/A	12.00	PASS	0.58	0.60	PASS
Support # 4							

S(MAX.) = N/A if Ms < 80% of Mcr

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

INTERIOR STRIP TOP BAR DEFINITION
All Distances are Measured from the Left End of the Span

REINFORCING IS SPACED AT 6.00 IN.

----- SUPPORT #2 -----
9 x 50.000 FT. MAIN BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 0.000 FT. SPAN #1 AND ENDS AT 20.000 FT. SPAN #2

8 x 14.500 FT. CUT BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 22.250 FT. SPAN #1 AND ENDS AT 6.750 FT. SPAN #2

BEGINNING BAR EXTENSION = 18.000 IN.
ENDING BAR EXTENSION = 24.000 IN.

----- SUPPORT #3 -----
9 x 50.000 FT. MAIN BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 20.000 FT. SPAN #2 AND ENDS AT 30.000 FT. SPAN #3

8 x 14.750 FT. CUT BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 33.000 FT. SPAN #2 AND ENDS AT 7.750 FT. SPAN #3

BEGINNING BAR EXTENSION = 24.000 IN.
ENDING BAR EXTENSION = 18.000 IN.

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

INTERIOR STRIP TOP BAR - DESIGN ENVELOPE SECTION CHECKS
All Distances are Measured from the Left End of the Span

LOCATION (FT)	SERVICE MOMENTS (#-IN/FT)	SPACING S(MAX.) (INCHES)	SPACING S(PROV.) (INCHES)	SPACING CHECK (P/F)	STEEL REQUIRED (SQ IN/FT)	STEEL PROVIDED (SQ IN/FT)	STEEL CHECK (P/F)
Support # 1							
23.75	-365601.8	N/A	12.00	PASS	0.67	1.00	PASS
30.00	-858162.8	7.14	6.00	PASS	1.52	1.79	PASS
Support # 2							
0.00	-858162.8	7.14	6.00	PASS	1.52	1.79	PASS
4.75	-372400.1	11.58	12.00	<FAIL>	0.72	1.00	PASS
35.00	-351505.4	N/A	12.00	PASS	0.70	1.00	PASS
40.00	-858162.6	7.14	6.00	PASS	1.52	1.79	PASS
Support # 3							
0.00	-858162.6	7.14	6.00	PASS	1.52	1.79	PASS
6.25	-365601.5	N/A	12.00	PASS	0.67	1.00	PASS
Support # 4							

S(MAX.) = N/A if Ms < 80% of Mcr

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

TRANSVERSE REINFORCING STEEL REQUIREMENTS

----- SPAN #1 -----
TOP TRANSVERSE TEMPERATURE & SHRINKAGE STEEL = 0.208 Sq. In./Ft.
BOTTOM TRANSVERSE DISTRIBUTION AREA OF STEEL = 0.208 Sq. In./Ft.

----- SPAN #2 -----
TOP TRANSVERSE TEMPERATURE & SHRINKAGE STEEL = 0.208 Sq. In./Ft.
BOTTOM TRANSVERSE DISTRIBUTION AREA OF STEEL = 0.208 Sq. In./Ft.

----- SPAN #3 -----
TOP TRANSVERSE TEMPERATURE & SHRINKAGE STEEL = 0.208 Sq. In./Ft.
BOTTOM TRANSVERSE DISTRIBUTION AREA OF STEEL = 0.208 Sq. In./Ft.

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

EXTERIOR STRIP DESIGN MOMENTS AND REQ'D STEEL SUMMARY
Values are Provided per Foot Width of Slab

LOCATION (FT)	FACTORED POSITIVE (# - IN)	FACTORED NEGATIVE (# - IN)	STEEL POSITIVE (SQ. IN.)	STEEL NEGATIVE (SQ. IN.)	FATIGUE MAXIMUM (# - IN)	FATIGUE MINIMUM (# - IN)
Support # 1						
0.00	0.0	0.0	0.21~	0.21~	0.0	0.0
2.14	364227.3	59080.8	0.51+	0.21~	184795.1	69464.2
4.29	652468.3	95554.4	0.69<T	0.21~	329965.4	121118.7
6.43	865996.5	109420.9	0.93<T	0.21~	436165.8	154963.6
8.57	1006664.0	100680.4	1.08<T	0.21~	504315.2	170998.9
10.71	1076901.0	69332.4	1.16<T	0.21~	535596.1	169224.4
12.86	1079717.0	15377.5	1.17<T	0.21~	531455.7	149640.3
15.00	1032947.0	-61184.6	1.11<T	0.21~	493604.9	112246.5
17.14	935907.2	-160353.9	1.00<T	0.24+	427820.5	57043.1
19.29	777465.7	-282130.2	0.83<T	0.42+	336282.3	-15969.9
21.43	562136.4	-426513.8	0.59<T	0.62=	217270.9	-106792.7
23.57	295012.8	-593504.4	0.41+	0.67<T	72793.0	-215425.1
25.71	-14755.3	-786580.5	0.21~	0.90<T	-94933.6	-389935.8
27.86	-316597.8	-1016246.0	0.21~	1.17<T	-283479.9	-589316.6
30.00	-508107.8	-1333889.0	0.21~	1.57<T	-452186.9	-813123.1
Support # 2						
0.00	-508107.8	-1333889.0	0.21~	1.57<T	-452186.9	-813123.1
2.86	-264906.3	-832401.9	0.21~	0.95<T	-246675.3	-505163.3
5.71	156347.2	-475463.9	0.22+	0.62=	15152.7	-249184.6
8.57	529554.3	-248608.4	0.58=	0.37+	227861.3	-64193.1
11.43	837840.2	-75321.6	0.90<T	0.21~	386493.7	58842.8
14.29	1060524.0	57207.0	1.15<T	0.21~	498309.1	150217.2
17.14	1191811.0	149545.1	1.30<T	0.21~	564007.8	209929.9
20.00	1229124.0	201692.8	1.34<T	0.21~	578830.6	237981.0
22.86	1191811.0	149545.1	1.30<T	0.21~	564007.8	209929.9
25.71	1060524.0	57207.0	1.15<T	0.21~	498309.1	150217.2
28.57	837840.4	-75321.5	0.90<T	0.21~	386493.8	58842.9
31.43	529554.2	-248608.4	0.58=	0.37+	227861.3	-64193.1
34.29	156347.3	-475463.9	0.22+	0.62=	15152.8	-249184.6
37.14	-264906.2	-832401.9	0.21~	0.95<T	-246675.2	-505163.3
40.00	-508107.8	-1333889.0	0.21~	1.57<T	-452186.8	-813123.0
Support # 3						
0.00	-508107.8	-1333889.0	0.21~	1.57<T	-452186.8	-813123.0
2.14	-316597.7	-1016246.0	0.21~	1.17<T	-283479.9	-589316.6

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

LOCATION (FT)	FACTORED POSITIVE (# - IN)	FACTORED NEGATIVE (# - IN)	STEEL POSITIVE (SQ. IN.)	STEEL NEGATIVE (SQ. IN.)	FATIGUE MAXIMUM (# - IN)	FATIGUE MINIMUM (# - IN)
4.29	-14755.3	-786580.5	0.21~	0.90<T	-94933.7	-389935.8
6.43	295012.8	-593504.4	0.41+	0.67<T	72793.0	-215425.1
8.57	562136.5	-426513.6	0.59<T	0.62=	217270.9	-106792.7
10.71	777465.6	-282130.2	0.83<T	0.42+	336282.3	-15970.0
12.86	935907.3	-160353.8	1.00<T	0.24+	427820.6	57043.1
15.00	1032947.0	-61184.6	1.11<T	0.21~	493604.9	112246.5
17.14	1079717.0	15377.6	1.17<T	0.21~	531455.8	149640.3
19.29	1076901.0	69332.5	1.16<T	0.21~	535596.1	169224.4
21.43	1006664.0	100680.3	1.08<T	0.21~	504315.1	170998.8
23.57	865996.5	109420.9	0.93<T	0.21~	436165.9	154963.6
25.71	652468.3	95554.4	0.69<T	0.21~	329965.4	121118.7
27.86	364227.3	59080.8	0.51+	0.21~	184795.1	69464.2
30.00	0.0	0.0	0.21~	0.21~	0.0	0.0
Support # 4						

(<) FACTORED MOMENT CONTROLS FATIGUE STRESS RANGE CONTROLS (>)
 (=) 1.2 X CRACKING MOMENT CONTROLS 1/3 MORE THAN FACTORED BUT < 1.2 MCR (+)
 (~) TEMPERATURE & SHRINKAGE STEEL CONTROLS
 (T) TENSION CONTROLLED (:) TRANSITION CONTROLLED (C) COMPRESSION CONTROLLED

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

EXTERIOR STRIP BOTTOM BAR DEFINITION
All Distances are Measured from the Left End of the Span

REINFORCING IS SPACED AT 6.00 IN.

----- SPAN #1 -----
7 x 30.000 FT. MAIN BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 0.000 FT. AND ENDS AT 30.000 FT.

7 x 21.510 FT. CUT BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 1.495 FT. AND ENDS AT 23.005 FT.

BEGINNING BAR EXTENSION = 18.063 IN.
ENDING BAR EXTENSION = 18.063 IN.

----- SPAN #2 -----
8 x 40.000 FT. MAIN BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 0.000 FT. AND ENDS AT 40.000 FT.

7 x 24.000 FT. CUT BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 8.000 FT. AND ENDS AT 32.000 FT.

BEGINNING BAR EXTENSION = 24.000 IN.
ENDING BAR EXTENSION = 24.000 IN.

----- SPAN #3 -----
7 x 30.000 FT. MAIN BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 0.000 FT. AND ENDS AT 30.000 FT.

7 x 22.010 FT. CUT BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 6.495 FT. AND ENDS AT 28.505 FT.

BEGINNING BAR EXTENSION = 18.063 IN.
ENDING BAR EXTENSION = 18.063 IN.

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

EXTERIOR STRIP BOTTOM BAR - DESIGN ENVELOPE SECTION CHECKS
All Distances are Measured from the Left End of the Span

LOCATION (FT)	SERVICE MOMENTS (#-IN/FT)	SPACING S(MAX.) (INCHES)	SPACING S(PROV.) (INCHES)	SPACING CHECK (P/F)	STEEL REQUIRED (SQ IN/FT)	STEEL PROVIDED (SQ IN/FT)	STEEL CHECK (P/F)
Support # 1							
3.00	303104.7	N/A	12.00	PASS	0.58	0.60	PASS
12.86	676672.8	11.07	6.00	PASS	1.17	1.20	PASS
21.50	316901.9	N/A	12.00	PASS	0.59	0.60	PASS
Support # 2							
10.00	414748.1	12.16	12.00	PASS	0.74	0.79	PASS
20.00	780768.0	10.87	6.00	PASS	1.34	1.39	PASS
30.00	414748.4	12.16	12.00	PASS	0.74	0.79	PASS
Support # 3							
8.00	275047.3	N/A	12.00	PASS	0.54	0.60	PASS
17.14	676672.8	11.07	6.00	PASS	1.17	1.20	PASS
27.00	303104.2	N/A	12.00	PASS	0.58	0.60	PASS
Support # 4							

S(MAX.) = N/A if Ms < 80% of Mcr

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

EXTERIOR STRIP TOP BAR DEFINITION
All Distances are Measured from the Left End of the Span

REINFORCING IS SPACED AT 6.00 IN.

----- SUPPORT #2 -----
9 x 50.000 FT. MAIN BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 0.000 FT. SPAN #1 AND ENDS AT 20.000 FT. SPAN #2

8 x 15.000 FT. CUT BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 22.000 FT. SPAN #1 AND ENDS AT 7.000 FT. SPAN #2

BEGINNING BAR EXTENSION = 18.000 IN.
ENDING BAR EXTENSION = 24.000 IN.

----- SUPPORT #3 -----
9 x 50.000 FT. MAIN BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 20.000 FT. SPAN #2 AND ENDS AT 30.000 FT. SPAN #3

8 x 15.000 FT. CUT BAR, 100% EFFECTIVE FOR LOAD RATING
BAR BEGINS AT 33.000 FT. SPAN #2 AND ENDS AT 8.000 FT. SPAN #3

BEGINNING BAR EXTENSION = 24.000 IN.
ENDING BAR EXTENSION = 18.000 IN.

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

EXTERIOR STRIP TOP BAR - DESIGN ENVELOPE SECTION CHECKS
All Distances are Measured from the Left End of the Span

LOCATION (FT)	SERVICE MOMENTS (#-IN/FT)	SPACING S(MAX.) (INCHES)	SPACING S(PROV.) (INCHES)	SPACING CHECK (P/F)	STEEL REQUIRED (SQ IN/FT)	STEEL PROVIDED (SQ IN/FT)	STEEL CHECK (P/F)
Support # 1							
23.50	-360149.0	N/A	12.00	PASS	0.67	1.00	PASS
30.00	-896853.5	6.57	6.00	PASS	1.57	1.79	PASS
Support # 2							
0.00	-896853.5	6.57	6.00	PASS	1.57	1.79	PASS
5.00	-364925.0	N/A	12.00	PASS	0.70	1.00	PASS
35.00	-364924.8	N/A	12.00	PASS	0.70	1.00	PASS
40.00	-896853.5	6.57	6.00	PASS	1.57	1.79	PASS
Support # 3							
0.00	-896853.5	6.57	6.00	PASS	1.57	1.79	PASS
6.50	-360148.8	N/A	12.00	PASS	0.67	1.00	PASS
Support # 4							

S(MAX.) = N/A if Ms < 80% of Mcr

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

INTERIOR STRIP BOTTOM BAR - FATIGUE I TRUCK LOAD RATING

LOCATION (FT)	EFF. STEEL (IN ² /FT)	MAX. MOMENT (#-IN/FT)	MIN. MOMENT (#-IN/FT)	MAX. STRESS (PSI)	MIN. STRESS (PSI)	STRESS RANGE (PSI)	THRESHOLD RANGE (PSI)	FATIGUE CHECK (P/F)
Support # 1								
0.00	0.60	0	0	0	0	0	26,000	PASS
2.14	0.60	177811	62480	17,511	6,153	11,358	23,744	PASS
3.00	0.60	233702	80964	23,015	7,973	15,042	23,076	PASS
4.29	0.76	317537	108691	24,844	8,504	16,340	22,882	PASS
6.43	1.03	419834	138632	24,547	8,106	16,442	23,028	PASS
8.57	1.20	485621	152305	24,496	7,683	16,814	23,183	PASS
10.71	1.20	516079	149708	26,033	7,552	18,481	23,231	PASS
12.86	1.20	512657	130841	25,860	6,600	19,260	23,580	PASS
15.00	1.20	477064	95706	24,065	4,828	19,237	24,230	PASS
17.14	1.15	415079	44301	21,896	2,337	19,559	25,143	PASS
19.29	0.88	328880	-23373	22,431	-290	22,720	26,106	PASS
21.43	0.61	216748	-107316	21,041	-1,917	22,959	26,703	PASS
21.50	0.60	212213	-110656	20,899	-2,007	22,905	26,736	PASS
23.57	0.60	80690	-207528	7,946	-3,763	11,710	27,380	PASS
25.71	0.60	-77076	-372078	0	0	0	26,000	PASS
27.86	0.60	-254121	-559958	0	0	0	26,000	PASS
30.00	0.60	-409787	-770723	0	0	0	26,000	PASS
Support # 2								
0.00	0.79	-409787	-770723	0	0	0	26,000	PASS
2.86	0.79	-222076	-480564	0	0	0	26,000	PASS
5.71	0.79	24690	-239647	1,870	-3,220	5,089	27,181	PASS
8.57	0.79	225075	-66979	17,044	-900	17,944	26,330	PASS
10.00	0.79	299599	-10254	22,687	-138	22,825	26,051	PASS
11.43	0.97	374123	46472	23,268	2,890	20,378	24,940	PASS
14.29	1.33	479092	131000	22,032	6,024	16,008	23,791	PASS
17.14	1.39	540683	186605	23,774	8,205	15,569	22,992	PASS
20.00	1.39	554136	213287	24,365	9,378	14,987	22,561	PASS
22.86	1.39	540683	186605	23,774	8,205	15,569	22,992	PASS
25.71	1.30	479092	131000	22,542	6,164	16,378	23,740	PASS
28.57	0.94	374123	46472	24,016	2,983	21,033	24,906	PASS
29.75	0.79	312641	-327	23,675	-4	23,679	26,002	PASS
31.43	0.79	225075	-66979	17,044	-900	17,944	26,330	PASS
34.29	0.79	24690	-239647	1,870	-3,220	5,089	27,181	PASS
37.14	0.79	-222076	-480564	0	0	0	26,000	PASS

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

LOCATION (FT)	EFF. STEEL (IN ² /FT)	MAX. MOMENT (#-IN/FT)	MIN. MOMENT (#-IN/FT)	MAX. STRESS (PSI)	MIN. STRESS (PSI)	STRESS RANGE (PSI)	THRESHOLD RANGE (PSI)	FATIGUE CHECK (P/F)
40.00	0.79	-409787	-770723	0	0	0	26,000	PASS
Support # 3								
0.00	0.60	-409787	-770723	0	0	0	26,000	PASS
2.14	0.60	-254121	-559958	0	0	0	26,000	PASS
4.29	0.60	-77076	-372078	0	0	0	26,000	PASS
6.43	0.60	80690	-207528	7,946	-3,763	11,710	27,380	PASS
8.00	0.60	180466	-134039	17,772	-2,431	20,203	26,891	PASS
8.57	0.67	216748	-107316	19,138	-1,739	20,877	26,638	PASS
10.71	0.94	328880	-23373	20,988	-271	21,259	26,099	PASS
12.86	1.20	415079	44301	20,938	2,235	18,703	25,181	PASS
15.00	1.20	477064	95706	24,065	4,828	19,237	24,230	PASS
17.14	1.20	512657	130841	25,860	6,600	19,260	23,580	PASS
19.29	1.20	516079	149708	26,033	7,552	18,481	23,231	PASS
21.43	1.20	485621	152305	24,496	7,683	16,814	23,183	PASS
23.57	1.00	419834	138632	25,288	8,350	16,938	22,938	PASS
25.71	0.73	317537	108691	25,873	8,856	17,017	22,753	PASS
26.75	0.60	250003	86355	24,620	8,504	16,116	22,882	PASS
27.86	0.60	177811	62480	17,511	6,153	11,358	23,744	PASS
30.00	0.60	0	0	0	0	0	26,000	PASS
Support # 4								

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

INTERIOR STRIP TOP BAR - FATIGUE I TRUCK LOAD RATING

LOCATION (FT)	EFF. STEEL (IN ² /FT)	MAX. MOMENT (#-IN/FT)	MIN. MOMENT (#-IN/FT)	MAX. STRESS (PSI)	MIN. STRESS (PSI)	STRESS RANGE (PSI)	THRESHOLD RANGE (PSI)	FATIGUE CHECK (P/F)
Support # 1								
0.00	1.00	0	0	0	0	0	26,000	PASS
2.14	1.00	177811	62480	0	0	0	26,000	PASS
4.29	1.00	317537	108691	0	0	0	26,000	PASS
6.43	1.00	419834	138632	0	0	0	26,000	PASS
8.57	1.00	485621	152305	0	0	0	26,000	PASS
10.71	1.00	516079	149708	0	0	0	26,000	PASS
12.86	1.00	512657	130841	0	0	0	26,000	PASS
15.00	1.00	477064	95706	0	0	0	26,000	PASS
17.14	1.00	415079	44301	0	0	0	26,000	PASS
19.29	1.00	328880	-23373	1,502	-1,369	2,871	26,502	PASS
21.43	1.00	216748	-107316	6,896	-321	7,218	26,118	PASS
23.57	1.00	80690	-207528	13,336	-112	13,448	26,041	PASS
23.75	1.00	67543	-221241	14,218	-94	14,311	26,034	PASS
25.71	1.38	-77076	-372078	17,550	3,635	13,914	24,667	PASS
27.86	1.79	-254121	-559958	20,607	9,352	11,255	22,571	PASS
30.00	1.79	-409787	-770723	28,363	15,081	13,283	20,470	PASS
Support # 2								
0.00	1.79	-409787	-770723	28,363	15,081	13,283	20,470	PASS
2.86	1.37	-222076	-480564	22,886	10,576	12,310	22,122	PASS
4.75	1.00	-58593	-320957	20,625	3,765	16,860	24,619	PASS
5.71	1.00	24690	-239647	15,400	-82	15,482	26,030	PASS
8.57	1.00	225075	-66979	4,304	-749	5,053	26,275	PASS
11.43	1.00	374123	46472	0	0	0	26,000	PASS
14.29	1.00	479092	131000	0	0	0	26,000	PASS
17.14	1.00	540683	186605	0	0	0	26,000	PASS
20.00	1.00	554136	213287	0	0	0	26,000	PASS
22.86	1.00	540683	186605	0	0	0	26,000	PASS
25.71	1.00	479092	131000	0	0	0	26,000	PASS
28.57	1.00	374123	46472	0	0	0	26,000	PASS
31.43	1.00	225075	-66979	4,304	-749	5,053	26,275	PASS
34.29	1.00	24690	-239647	15,400	-82	15,482	26,030	PASS
35.00	1.00	-37001	-299876	19,271	2,378	16,893	25,128	PASS
37.14	1.41	-222076	-480564	22,137	10,230	11,907	22,249	PASS
40.00	1.79	-409787	-770723	28,363	15,081	13,283	20,470	PASS

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

LOCATION (FT)	EFF. STEEL (IN ² /FT)	MAX. MOMENT (#-IN/FT)	MIN. MOMENT (#-IN/FT)	MAX. STRESS (PSI)	MIN. STRESS (PSI)	STRESS RANGE (PSI)	THRESHOLD RANGE (PSI)	FATIGUE CHECK (P/F)
Support # 3								
0.00	1.79	-409787	-770723	28,363	15,081	13,283	20,470	PASS
2.14	1.79	-254121	-559958	20,607	9,352	11,255	22,571	PASS
4.29	1.38	-77076	-372078	17,550	3,635	13,914	24,667	PASS
6.25	1.00	67543	-221241	14,217	-94	14,311	26,034	PASS
6.43	1.00	80690	-207528	13,336	-112	13,448	26,041	PASS
8.57	1.00	216748	-107316	6,896	-464	7,360	26,170	PASS
10.71	1.00	328880	-23373	1,502	-1,562	3,064	26,573	PASS
12.86	1.00	415079	44301	0	0	0	26,000	PASS
15.00	1.00	477064	95706	0	0	0	26,000	PASS
17.14	1.00	512657	130841	0	0	0	26,000	PASS
19.29	1.00	516079	149708	0	0	0	26,000	PASS
21.43	1.00	485621	152305	0	0	0	26,000	PASS
23.57	1.00	419834	138632	0	0	0	26,000	PASS
25.71	1.00	317537	108691	0	0	0	26,000	PASS
27.86	1.00	177811	62480	0	0	0	26,000	PASS
30.00	1.00	0	0	0	0	0	26,000	PASS
Support # 4								

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

EXTERIOR STRIP BOTTOM BAR - FATIGUE I TRUCK LOAD RATING

LOCATION (FT)	EFF. STEEL (IN ² /FT)	MAX. MOMENT (#-IN/FT)	MIN. MOMENT (#-IN/FT)	MAX. STRESS (PSI)	MIN. STRESS (PSI)	STRESS RANGE (PSI)	THRESHOLD RANGE (PSI)	FATIGUE CHECK (P/F)
Support # 1								
0.00	0.60	0	0	0	0	0	26,000	PASS
2.14	0.60	184795	69464	18,199	6,841	11,358	23,492	PASS
3.00	0.60	242863	90126	23,917	8,876	15,042	22,746	PASS
4.29	0.76	329965	121119	25,816	9,476	16,340	22,525	PASS
6.43	1.03	436166	154964	25,502	9,061	16,442	22,678	PASS
8.57	1.20	504315	170999	25,439	8,626	16,814	22,837	PASS
10.71	1.20	535596	169224	27,017	8,536	18,481	22,870	PASS
12.86	1.20	531456	149640	26,808	7,548	19,260	23,232	PASS
15.00	1.20	493605	112247	24,899	5,662	19,237	23,924	PASS
17.14	1.15	427821	57043	22,568	3,009	19,559	24,897	PASS
19.29	0.88	336282	-15970	22,935	-198	23,133	26,073	PASS
21.43	0.61	217271	-106793	21,092	-1,908	23,000	26,700	PASS
21.50	0.60	212455	-110414	20,923	-2,002	22,925	26,734	PASS
23.57	0.60	72793	-215425	7,169	-3,960	11,128	27,452	PASS
25.71	0.60	-94934	-389936	0	0	0	26,000	PASS
27.86	0.60	-283480	-589317	0	0	0	26,000	PASS
30.00	0.60	-452187	-813123	0	0	0	26,000	PASS
Support # 2								
0.00	0.79	-452187	-813123	0	0	0	26,000	PASS
2.86	0.79	-246675	-505163	0	0	0	26,000	PASS
5.71	0.79	15153	-249185	1,147	-3,348	4,495	27,228	PASS
8.57	0.79	227861	-64193	17,255	-862	18,117	26,316	PASS
10.00	0.79	307178	-2675	23,261	-36	23,297	26,013	PASS
11.43	0.97	386494	58843	24,038	3,660	20,378	24,658	PASS
14.29	1.33	498309	150217	22,915	6,908	16,008	23,467	PASS
17.14	1.39	564008	209930	24,799	9,231	15,569	22,615	PASS
20.00	1.39	578831	237981	25,451	10,464	14,987	22,163	PASS
22.86	1.39	564008	209930	24,799	9,231	15,569	22,615	PASS
25.71	1.33	498309	150217	22,915	6,908	16,008	23,467	PASS
28.57	0.97	386494	58843	24,038	3,660	20,378	24,658	PASS
30.00	0.79	307178	-2675	23,261	-36	23,297	26,013	PASS
31.43	0.79	227861	-64193	17,255	-862	18,117	26,316	PASS
34.29	0.79	15153	-249185	1,147	-3,348	4,495	27,228	PASS
37.14	0.79	-246675	-505163	0	0	0	26,000	PASS

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

LOCATION (FT)	EFF. STEEL (IN ² /FT)	MAX. MOMENT (#-IN/FT)	MIN. MOMENT (#-IN/FT)	MAX. STRESS (PSI)	MIN. STRESS (PSI)	STRESS RANGE (PSI)	THRESHOLD RANGE (PSI)	FATIGUE CHECK (P/F)
40.00	0.79	-452187	-813123	0	0	0	26,000	PASS
Support # 3								
0.00	0.60	-452187	-813123	0	0	0	26,000	PASS
2.14	0.60	-283480	-589317	0	0	0	26,000	PASS
4.29	0.60	-94934	-389936	0	0	0	26,000	PASS
6.43	0.60	72793	-215425	7,169	-3,960	11,128	27,452	PASS
8.00	0.60	178744	-135761	17,603	-2,462	20,065	26,903	PASS
8.57	0.67	217271	-106793	19,184	-1,730	20,915	26,634	PASS
10.71	0.94	336282	-15970	21,461	-185	21,646	26,068	PASS
12.86	1.20	427821	57043	21,581	2,877	18,703	24,945	PASS
15.00	1.20	493605	112247	24,899	5,662	19,237	23,924	PASS
17.14	1.20	531456	149640	26,808	7,548	19,260	23,232	PASS
19.29	1.20	535596	169224	27,017	8,536	18,481	22,870	PASS
21.43	1.20	504315	170999	25,439	8,626	16,814	22,837	PASS
23.57	1.03	436166	154964	25,502	9,061	16,442	22,678	PASS
25.71	0.76	329965	121119	25,816	9,476	16,340	22,525	PASS
27.00	0.60	242863	90126	23,917	8,876	15,042	22,746	PASS
27.86	0.60	184795	69464	18,199	6,841	11,358	23,492	PASS
30.00	0.60	0	0	0	0	0	26,000	PASS
Support # 4								

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

EXTERIOR STRIP TOP BAR - FATIGUE I TRUCK LOAD RATING

LOCATION (FT)	EFF. STEEL (IN ² /FT)	MAX. MOMENT (#-IN/FT)	MIN. MOMENT (#-IN/FT)	MAX. STRESS (PSI)	MIN. STRESS (PSI)	STRESS RANGE (PSI)	THRESHOLD RANGE (PSI)	FATIGUE CHECK (P/F)
Support # 1								
0.00	1.00	0	0	0	0	0	26,000	PASS
2.14	1.00	184795	69464	0	0	0	26,000	PASS
4.29	1.00	329965	121119	0	0	0	26,000	PASS
6.43	1.00	436166	154964	0	0	0	26,000	PASS
8.57	1.00	504315	170999	0	0	0	26,000	PASS
10.71	1.00	535596	169224	0	0	0	26,000	PASS
12.86	1.00	531456	149640	0	0	0	26,000	PASS
15.00	1.00	493605	112247	0	0	0	26,000	PASS
17.14	1.00	427821	57043	0	0	0	26,000	PASS
19.29	1.00	336282	-15970	1,026	-1,400	2,427	26,513	PASS
21.43	1.00	217271	-106793	6,863	-322	7,185	26,118	PASS
23.50	1.00	77609	-211804	13,611	-108	13,719	26,039	PASS
23.57	1.01	72793	-215425	13,662	-100	13,762	26,037	PASS
25.71	1.43	-94934	-389936	17,796	4,333	13,463	24,411	PASS
27.86	1.79	-283480	-589317	21,688	10,432	11,255	22,175	PASS
30.00	1.79	-452187	-813123	29,924	16,641	13,283	19,898	PASS
Support # 2								
0.00	1.79	-452187	-813123	29,924	16,641	13,283	19,898	PASS
2.86	1.41	-246675	-505163	23,270	11,363	11,907	21,834	PASS
5.00	1.00	-50304	-313179	20,126	3,233	16,893	24,815	PASS
5.71	1.00	15153	-249185	16,013	-50	16,064	26,018	PASS
8.57	1.00	227861	-64193	4,125	-758	4,883	26,278	PASS
11.43	1.00	386494	58843	0	0	0	26,000	PASS
14.29	1.00	498309	150217	0	0	0	26,000	PASS
17.14	1.00	564008	209930	0	0	0	26,000	PASS
20.00	1.00	578831	237981	0	0	0	26,000	PASS
22.86	1.00	564008	209930	0	0	0	26,000	PASS
25.71	1.00	498309	150217	0	0	0	26,000	PASS
28.57	1.00	386494	58843	0	0	0	26,000	PASS
31.43	1.00	227861	-64193	4,125	-758	4,883	26,278	PASS
34.29	1.00	15153	-249185	16,013	-50	16,064	26,018	PASS
35.00	1.00	-50304	-313179	20,126	3,233	16,893	24,815	PASS
37.14	1.41	-246675	-505163	23,270	11,363	11,907	21,834	PASS
40.00	1.79	-452187	-813123	29,924	16,641	13,283	19,898	PASS

V SLAB (v4.0) - VARIABLE DEPTH REINFORCED CONCRETE SLAB BRIDGE DESIGN PROGRAM

Copyright (c) KJH Consulting, LLC, 2018. All Rights Reserved.

KJH Consulting, LLC (Corp)

Superstructure Design Check

LOCATION (FT)	EFF. STEEL (IN ² /FT)	MAX. MOMENT (#-IN/FT)	MIN. MOMENT (#-IN/FT)	MAX. STRESS (PSI)	MIN. STRESS (PSI)	STRESS RANGE (PSI)	THRESHOLD RANGE (PSI)	FATIGUE CHECK (P/F)
Support # 3								
0.00	1.79	-452187	-813123	29,924	16,641	13,283	19,898	PASS
2.14	1.79	-283480	-589317	21,688	10,432	11,255	22,175	PASS
4.29	1.43	-94934	-389936	17,796	4,333	13,463	24,411	PASS
6.43	1.01	72793	-215425	13,662	-100	13,762	26,037	PASS
6.50	1.00	77609	-211804	13,611	-108	13,719	26,039	PASS
8.57	1.00	217271	-106793	6,863	-465	7,327	26,170	PASS
10.71	1.00	336282	-15970	1,026	-1,597	2,623	26,586	PASS
12.86	1.00	427821	57043	0	0	0	26,000	PASS
15.00	1.00	493605	112247	0	0	0	26,000	PASS
17.14	1.00	531456	149640	0	0	0	26,000	PASS
19.29	1.00	535596	169224	0	0	0	26,000	PASS
21.43	1.00	504315	170999	0	0	0	26,000	PASS
23.57	1.00	436166	154964	0	0	0	26,000	PASS
25.71	1.00	329965	121119	0	0	0	26,000	PASS
27.86	1.00	184795	69464	0	0	0	26,000	PASS
30.00	1.00	0	0	0	0	0	26,000	PASS
Support # 4								