

Prestress Girder Detailed Calculation Report

PROJECT

Generic Prestressed Girder Sample

GIRDER DESIGNATION

Sample Exterior Girder

DATE

Sample Report

Design Parameters

Material

Deck Concrete Compressive Strength	(fc)deck =	4500	psi
Prestressed Beam Concrete Compressive Strength At Release	fci =	6000	psi
Prestressed Beam Concrete Compressive Strength	fc =	8500	psi
Mild Steel Yielding Strength	fy =	60000	psi
Prestressed Strands Ultimate Strength	fpu =	270	ksi
Modulus of Elasticity of Prestressed Strands	Ep =	28500	ksi
Concrete Density (For Dead Load Calc's)	yc =	160	pcf
Concrete Density (For Modulus of Elasticity Calc's)	yc =	150	pcf

Bridge Geometry

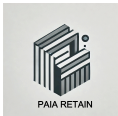
Bridge Width	W =	21	ft
Number of Girder	Nb =	6	-
Bridge Skew	θ =	45	degree
Girder Total Length	L' =	79	ft
Bridge Span	L =	77.5	ft
Girder Position	Position =	exterior	-
Exterior barrier distance	de =	-1.88	ft
Exterior wheel-load distance	di =	1	ft

Girder

Type of Girder	Type =	Custom Box Section	-
Girder Height	H =	30	in
Girder Width	b =	40	in
Top Slab Effective Width	be =	40	in
Top Slab Thickness	ts =	6	in
Top Slab average Thickness (for Dead Load Calculation)	(ts)ave =	6	in

Strands

Strands Diameter	db =	0.5	in
Eccentricity of Strands	e =	11.75	in
Area of one Strand	Aps1 =	0.15	in ²
Number of Strands	No Str =	32	-
Total Area of Strands	APS =	4.9	in ²
Number of Masked Strands	NoMask =	12	-
Masked Strands Length	Mask Length =	8.5	ft
Total Area of Masked Strands	Mask Aps =	-	in ²
Bottom Mild Steel Area (tension reinforcement)	As =	0.27	in ²
ds = distance from girder top compression fiber to centroid of As	ds =	4	in
Top Mild Steel Area (compression reinforcement)	As' =	0	in ²
ds' = distance from girder top compression fiber to centroid of As'	ds' =	4	in
Girders Release Time	t =	1	days



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Humidity	H =	70	%
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Loads

Barrier Dead Load Input (per girder)	Bw =	0.18	klf
Utility Dead Load Input (per girder)	Util =	0.15	klf
Future Wearing Surface	Fww =	0.02	ksf

1. Gross Section Properties (Composite)

1-1) CUSTOM-BOX Section

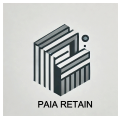
Description	Parameter	Value	Unit
Girder Area	Ag	663	in ²
Girder Moment of Inertia	Ig	75344.3	in ⁴
Centroid	Cg	15	in
Height	h	30	in
Width	b	40	in
Bottom Centroid	Cb	15	in
Top Centroid	Ct	$h - Cb = 30 - 15 = 15$	in
Bottom Section Modulus	Sb	$I / Cb = 75344.3 / 15 = 5022.95$	in ³
Top Section Modulus	St	$I / Ct = 75344.3 / 15 = 5022.95$	in ³

1-2) Concrete Properties

Description	Parameter	Value	Unit
Deck concrete compressive strength	(fc)deck	4500	psi
Girder concrete compressive strength at release	fci	6000	psi
Girder concrete compressive strength	fc	8500	psi
Concrete density for section property	gamma2	150	pcf
$Ec(\text{deck}) = 120000 * K1 * \text{gamma}2^2 * (fc \text{ deck} / 1000)^{0.33}$	Ec(deck)	$120000 \times 1 \times 0.15^2 \times (4.5)^{0.33} = 4435309.12$	psi
$Ec(i) = 120000 * K1 * \text{gamma}2^2 * (fci / 1000)^{0.33}$	Ec(i)	$120000 \times 1 \times 0.15^2 \times (6)^{0.33} = 4877010.34$	psi
$Ec(p) = 120000 * K1 * \text{gamma}2^2 * (fc / 1000)^{0.33}$	Ec(p)	$120000 \times 1 \times 0.15^2 \times (8.5)^{0.33} = 5471066.7$	psi

1-3) Composite Section

Description	Parameter	Value	Unit
Top Slab Thickness	ts	6	in
Effective Slab Width	be	40	in
Modular Ratio	n	$E_{\text{deck}} / E_{\text{girder}} = 4435309.12 / 5471066.7 = 0.81$	-
n × be	n × be	$0.81 \times 40 = 32.43$	in
Composite Area	A_total	$Ag + As = 663 + 194.56 = 857.56$	in ²
Composite Centroid	Yc	$\Sigma Ay / A = 16365.62 / 857.56 = 19.08$	in



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Description	Parameter	Value	Unit
Composite Inertia	Ic	$I_o - A \times Y_c^2 = 436983.5$ $- 857.56 \times 19.08^2 =$ 124664.56	in ⁴
Sbc	Sbc	$I_c / Y_c = 124664.56 /$ $19.08 = 6532.47$	in ³
Stc	Stc	$I_c / (H + t_s - Y_c) =$ $124664.56 / (36 - 19.08)$ $= 7369.56$	in ³
St slab	St slab	$I_c / (n \times (H + t_s - Y_c))$ $= 124664.56 / (0.81 \times (36$ $- 19.08)) = 9090.53$	in ³

This section uses the transformed composite properties already computed by the prestress module.

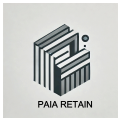
2. Live Loads Distribution Factors

2-1) Input Summary

Variable	Equation	Substitution	Result	Unit
Girder type	box	exterior box girder routine	-	
Exterior de	de	-1.88	ft	
Exterior di	di	-	ft	
Width	b	40	in	
Span	L	77.5	ft	
Number of Beams	Nb	6	-	
Depth	d	30	in	
Moment of Inertia	I	75344.3	in ⁴	
Skew Angle	theta	45	deg	
Top flange thickness	t_ft	5.5	in	
Bottom flange thickness	t_fb	6	in	
Web thickness	t_w	5	in	
Centerline width	$b_0 = b - t_w$	35	in	
Centerline height	$h_0 = d - (t_{ft} + t_{fb}) / 2$	24.25	in	
Enclosed centerline area	$A_k = b_0 \times h_0$	848.75	in ²	
Wall path integral	$\oint ds/t$	21.9	1/in	
J	$J = 4A_k^2 / \oint (ds/t)$	$4(848.75)^2$ $/ 21.9 =$ 131593.84	in ⁴	
I / J	I / J	$75344.3 /$ $131593.84 =$ 0.57	-	

2-2) Distribution Factors For Moment

Variable	Equation	Substitution	Result	Unit
k raw	$k = 2.5 \times Nb^{-0.2}$	$2.5 \times$ $6^{-0.2}$	1.75	-
k	$k = \max(k_{raw}, 1.5)$	$\max(1.75,$ $1.50)$	1.75	-
DFM , 1 lane	$k \times (b / (33.3L+))^0.5 \times (I /$ $J)^0.25$	$1.75 \times (40$ $/ (33.3 \times$ $77.5))^0.5$	0.19	-



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Variable	Equation	Substitution	Result	Unit
		$*$ $(0.57)^{0.25}$		
DFM pos, multi-lane	$k * (b / 305)^{0.6} * (b / (12L))^0.2 * (I / J)^{0.06}$	$1.75 * (40 / 305)^{0.6} * (40 / (12 * 77.5))^0.2 * (0.57)^{0.06}$	0.27	-
Interior DFM pos	$\max(1 \text{ lane}, \text{ multi-lane})$	$\max(0.19, 0.27)$	0.27	-
Exterior e, 1 lane	$e = \max(1.125 + de / 30, 1.0)$	$\max(1.125 + -1.88 / 30, 1.0)$	1.06	-
Exterior DFM pos, 1 lane	$e * \text{DFM pos, 1 lane}$	$1.06 * 0.19$	0.2	-
Exterior e, multi-lane	$e = \max(1.04 + de / 25, 1.0)$	$\max(1.04 + -1.88 / 25, 1.0)$	1	-
Exterior DFM pos, multi-lane	$e * \text{DFM pos, multi-lane}$	$1 * 0.27$	0.27	-
DFM pos	$\max(\text{exterior 1 lane}, \text{exterior multi-lane})$	$\max(0.2, 0.27)$	0.27	-

Provided that the ranges are met:

$$35 \leq b \leq 60$$

b = 40 inches (OK)

$$20 \leq L \leq 120$$

L = 77.5 feet (OK)

$$5 \leq Nb \leq 20$$

Nb = 6 (OK)

2-4) Distribution Factors For Shear

Variable	Equation	Substitution	Result	Unit
J check	J applicability	$25000 \leq J \leq 610000$	ok	-
I check	I applicability	$40000 \leq I \leq 610000$	ok	-
ko	$ko = 1 + 12L \tan(\theta)^{0.5} / (90d)$	$1 + (12 * 77.5 * \tan(45)^{0.5}) / (90 * 30)$	1.34	-
DFV, 1 lane	$(b / (130L))^{0.15} * (I / J)^{0.05} * ko$	$(40 / (130 * 77.5))^{0.15} * (0.57)^{0.05} * 1.34$	0.57	-
DFV, multi-lane	$(b / 156)^{0.4} * (b / (12L))^{0.1} * (I / J)^{0.05} * ko$	$(40 / 156)^{0.4} * (40 / (12 * 77.5))^{0.1} * (0.57)^{0.05} * 1.34$	0.55	-
DFV	$\max(1 \text{ lane}, \text{ multi-lane})$	$\max(0.57, 0.55)$	0.57	-



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2-6) Governing Distribution Factors

Moment	Shear
0.27	0.57

3. Load Effects Tables

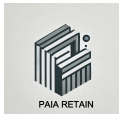
Tandem and Truck Shear and Moment

Station	Truck M	Tandem M	Truck V	Tandem V
Bearing (0.00L)	0	0	77.16	64.57
H/2 from left support (0.02L)	95.07	79.64	75.78	63.5
60db from left support (0.03L)	186.71	156.6	74.41	62.42
0.1L (0.10L)	534.13	450.54	68.65	57.92
0.2L (0.20L)	949.09	798	59.89	51.27
0.3L (0.30L)	1275.47	1042.39	50.32	44.62
0.4L (0.40L)	1453.42	1183.7	40.74	37.97
0.45L (0.45L)	1485.48	1215.29	36.11	34.75
Midspan (0.50L)	1482.95	1221.94	31.16	31.32
0.6L (0.60L)	1423.63	1183.7	21.59	24.67
0.7L (0.70L)	1290.37	1042.39	12.01	18.02
0.8L (0.80L)	1008.67	798	2.78	11.37
0.9L (0.90L)	578.55	450.54	1.03	4.72
60db from right support (0.97L)	202.85	156.6	0.31	0.97
H/2 from right support (0.98L)	103.35	79.64	0.14	0.43
1.0L (1.00L)	0	0	0	0

Live Load

Dist/Span (X/L)	Location (ft)	Shear (kip)	Moment (kip-ft)
Bearing (0.00L)	0	101.96	0
H/2 from left support (0.02L)	1.25	99.79	125.57
60db from left support (0.03L)	2.5	97.64	246.71
0.1L (0.10L)	7.75	88.73	707.11
0.2L (0.20L)	15.5	75.76	1256.61
0.3L (0.30L)	23.25	62.47	1679.09
0.4L (0.40L)	31	49.67	1914.7
0.45L (0.45L)	34.88	43.61	1961.17
Midspan (0.50L)	38.75	42.55	1963.45
0.6L (0.60L)	46.5	54.85	1884.91
0.7L (0.70L)	54.25	67.65	1693.99
0.8L (0.80L)	62	80.95	1316.19
0.9L (0.90L)	69.75	94.74	751.53
60db from right support (0.97L)	75	104.36	262.85
H/2 from right support (0.98L)	76.25	106.69	133.85
1.0L (1.00L)	77.5	109.03	0

Governing positive moment = 1963.45 kip-ft at x = 38.75 ft.

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Governing shear = 109.03 kip (maximum absolute shear).

Live load moments are reported from the HL-93 envelope, showing the governing positive moment plus lane load.

Girder Dead Load After Fabrication

Dist/Span (X/L)	Location (ft)	Shear (kip)	Moment (kip-ft)
Bearing (0.00L)	0	29.1	0
H/2 from left support (0.02L)	1.25	28.18	35.8
60db from left support (0.03L)	2.5	27.26	70.44
0.1L (0.10L)	7.9	23.28	206.89
0.2L (0.20L)	15.8	17.46	367.8
0.3L (0.30L)	23.7	11.64	482.74
0.4L (0.40L)	31.6	5.82	551.7
Midspan (0.50L)	39.5	0	574.69
0.6L (0.60L)	47.4	5.82	551.7
0.7L (0.70L)	55.3	11.64	482.74
0.8L (0.80L)	63.2	17.46	367.8
0.9L (0.90L)	71.1	23.28	206.89
60db from right support (0.95L)	75	26.15	110.5
H/2 from right support (0.97L)	76.25	27.07	77.23
1.0L (1.00L)	79	29.1	0

Governing positive moment = 574.69 kip-ft at x = 39.5 ft.

Governing shear = 29.1 kip (maximum absolute shear).

This row uses the as-fabricated girder self-weight envelope.

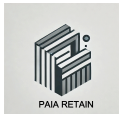
Installed Girder Dead Load

Dist/Span (X/L)	Location (ft)	Shear (kip)	Moment (kip-ft)
Bearing (0.00L)	0	28.55	0
H/2 from left support (0.02L)	1.25	27.63	35.11
60db from left support (0.03L)	2.5	26.7	69.06
0.1L (0.10L)	7.75	22.84	199.11
0.2L (0.20L)	15.5	17.13	353.97
0.3L (0.30L)	23.25	11.42	464.58
0.4L (0.40L)	31	5.71	530.95
Midspan (0.50L)	38.75	0	553.08
0.6L (0.60L)	46.5	5.71	530.95
0.7L (0.70L)	54.25	11.42	464.58
0.8L (0.80L)	62	17.13	353.97
0.9L (0.90L)	69.75	22.84	199.11
60db from right support (0.97L)	75	26.7	69.06
H/2 from right support (0.98L)	76.25	27.63	35.11
1.0L (1.00L)	77.5	28.55	0

Governing positive moment = 553.08 kip-ft at x = 38.75 ft.

Governing shear = 28.55 kip (maximum absolute shear).

This row uses the installed girder dead-load envelope before the composite slab is added.



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Top Slab Dead Load

Dist/Span (X/L)	Location (ft)	Shear (kip)	Moment (kip-ft)
Bearing (0.00L)	0	10.33	0
H/2 from left support (0.02L)	1.25	10	12.71
60db from left support (0.03L)	2.5	9.67	25
0.1L (0.10L)	7.75	8.27	72.08
0.2L (0.20L)	15.5	6.2	128.13
0.3L (0.30L)	23.25	4.13	168.18
0.4L (0.40L)	31	2.07	192.2
Midspan (0.50L)	38.75	0	200.21
0.6L (0.60L)	46.5	2.07	192.2
0.7L (0.70L)	54.25	4.13	168.18
0.8L (0.80L)	62	6.2	128.13
0.9L (0.90L)	69.75	8.27	72.08
60db from right support (0.97L)	75	9.67	25
H/2 from right support (0.98L)	76.25	10	12.71
1.0L (1.00L)	77.5	10.33	0

Governing positive moment = 200.21 kip-ft at x = 38.75 ft.
Governing shear = 10.33 kip (maximum absolute shear).
This row uses the composite top slab dead-load envelope.

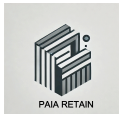
Barrier Wall Dead Load

Dist/Span (X/L)	Location (ft)	Shear (kip)	Moment (kip-ft)
Bearing (0.00L)	0	6.97	0
H/2 from left support (0.02L)	1.25	6.75	8.58
60db from left support (0.03L)	2.5	6.52	16.88
0.1L (0.10L)	7.75	5.58	48.65
0.2L (0.20L)	15.5	4.18	86.49
0.3L (0.30L)	23.25	2.79	113.52
0.4L (0.40L)	31	1.39	129.74
Midspan (0.50L)	38.75	0	135.14
0.6L (0.60L)	46.5	1.39	129.73
0.7L (0.70L)	54.25	2.79	113.52
0.8L (0.80L)	62	4.19	86.49
0.9L (0.90L)	69.75	5.58	48.65
60db from right support (0.97L)	75	6.53	16.88
H/2 from right support (0.98L)	76.25	6.75	8.58
1.0L (1.00L)	77.5	6.97	0

Governing positive moment = 135.14 kip-ft at x = 38.75 ft.
Governing shear = 6.97 kip (maximum absolute shear).
This row uses the barrier wall dead-load envelope.

Future Wearing Surface Dead Load

Dist/Span (X/L)	Location (ft)	Shear (kip)	Moment (kip-ft)
Bearing (0.00L)	0	2.26	0
H/2 from left support (0.02L)	1.25	2.19	2.78



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Dist/Span (X/L)	Location (ft)	Shear (kip)	Moment (kip-ft)
60db from left support (0.03L)	2.5	2.11	5.47
0.1L (0.10L)	7.75	1.81	15.77
0.2L (0.20L)	15.5	1.36	28.03
0.3L (0.30L)	23.25	0.9	36.79
0.4L (0.40L)	31	0.45	42.04
Midspan (0.50L)	38.75	0	43.8
0.6L (0.60L)	46.5	0.45	42.04
0.7L (0.70L)	54.25	0.9	36.79
0.8L (0.80L)	62	1.36	28.03
0.9L (0.90L)	69.75	1.81	15.77
60db from right support (0.97L)	75	2.11	5.47
H/2 from right support (0.98L)	76.25	2.19	2.78
1.0L (1.00L)	77.5	2.26	0

Governing positive moment = 43.8 kip-ft at $x = 38.75$ ft.

Governing shear = 2.26 kip (maximum absolute shear).

This row uses the future wearing surface dead-load envelope.

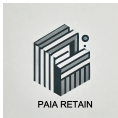
Utility Dead Load

Dist/Span (X/L)	Location (ft)	Shear (kip)	Moment (kip-ft)
Bearing (0.00L)	0	5.81	0
H/2 from left support (0.02L)	1.25	5.63	7.15
60db from left support (0.03L)	2.5	5.44	14.06
0.1L (0.10L)	7.75	4.65	40.54
0.2L (0.20L)	15.5	3.49	72.08
0.3L (0.30L)	23.25	2.33	94.6
0.4L (0.40L)	31	1.16	108.11
Midspan (0.50L)	38.75	0	112.62
0.6L (0.60L)	46.5	1.16	108.11
0.7L (0.70L)	54.25	2.32	94.6
0.8L (0.80L)	62	3.49	72.07
0.9L (0.90L)	69.75	4.65	40.54
60db from right support (0.97L)	75	5.44	14.06
H/2 from right support (0.98L)	76.25	5.63	7.15
1.0L (1.00L)	77.5	5.81	0

Governing positive moment = 112.62 kip-ft at $x = 38.75$ ft.

Governing shear = 5.81 kip (maximum absolute shear).

This row uses the utility dead-load envelope.



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4. Prestress Losses Calculations

A) Elastic Shortening Loss

EQUATION	VALUES	RESULT
$\Delta f_{pES} = [Aps \times f_{pbt} \times (Ig + e_m^2 \times Ag) - e_m \times Mg \times Ag] / [Aps \times (Ig + e_m^2 \times Ag) + Ag \times Ig \times Eci / Ep]$	$Aps = 4.9 \text{ in}^2$ $Ag = 663 \text{ in}^2$ $Ig = 75344.3 \text{ in}^4$ $f_{pbt} = 0.75 \times 270 = 202.5 \text{ ksi}$ $Eci = 4877.01 \text{ ksi}$ $Ep = 28500 \text{ ksi}$ $e_m = 11.75 \text{ in}$ $Mg = 553.08 \text{ kip-ft} = 6636.91 \text{ kip-in}$ $e_m^2 = 138.06 \text{ in}^2$	$\Delta f_{pES} = 12.15 \text{ ksi}$
Common term = $Ig + e_m^2 \times Ag$	$75344.3 + 138.06 \times 663$	166879.74
Numerator = $Aps \times f_{pbt} \times \text{Common term} - e_m \times Mg \times Ag$	$4.9 \times 202.5 \times 166879.74 - 11.75 \times 6636.91 \times 663$	113748088.03
Denominator = $Aps \times \text{Common term} + Ag \times Ig \times Eci / Ep$	$4.9 \times 166879.74 + 663 \times 75344.3 \times 4877.01 / 28500$	9365205.26
$Pi = f_{pbt} - \Delta f_{pES}$	$202.5 - 12.15$	$Pi = 190.35 \text{ ksi}$

Mg is the midspan dead-load moment from the installed girder envelope, converted to kip-in.

B) Long-Term Losses

EQUATION	VALUES	RESULT
$\Delta f_{pCR} = 10.0 \times (f_{pi} \times Aps / Ag) \times y_h \times y_{st}$	$f_{pi} = 202.5 \text{ ksi}$ $Aps = 4.9 \text{ in}^2$ $Ag = 663 \text{ in}^2$ $H = 70 \%$ $y_h = 1.7 - 0.01H = 1.7 - 0.01(70) = 1$ $f'_{ci} = 6 \text{ ksi}$ $y_{st} = 5 / (1 + f'_{ci}) = 5 / (1 + 6) = 0.71$ $\Delta f_{pCR} = 10.0 \times (202.5 \times 4.9 / 663) \times 1 \times 0.71$	$\Delta f_{pCR} = 10.68 \text{ ksi}$
$\Delta f_{pSH} = 12.0 \times y_h \times y_{st}$	$y_h = 1$ $y_{st} = 0.71$ $\Delta f_{pSH} = 12.0 \times 1 \times 0.71$	$\Delta f_{pSH} = 8.57 \text{ ksi}$
$\Delta f_{pR} = \text{relaxation loss}$	$\Delta f_{pR} = 2.4 \text{ ksi}$	$\Delta f_{pR} = 2.4 \text{ ksi}$
$\Delta f_{pLT} = \Delta f_{pCR} + \Delta f_{pSH} + \Delta f_{pR}$	$\Delta f_{pLT} = 10.68 + 8.57 + 2.4$	$\Delta f_{pLT} = 21.65 \text{ ksi}$

Method: AASHTO 5.9.3.3 approximate method for time-dependent prestress losses.

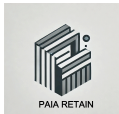
Approximate method selected for time-dependent prestress losses. Normal-weight concrete, moist/steam curing, low-relaxation strand, and average exposure conditions are assumed acceptable for this check. Prestress release time input = 1.0 days (captured for reporting; not used in the AASHTO 5.9.3.3 approximate equation).

5. Strand Tension and Section Stress

Strand Tension

$f_{pu} = 270.0000 \text{ ksi}$

$f_{py} = 243.0000 \text{ ksi}$



Prestress Girder Detailed Calculation Report

$$f_{pbt} = 0.75 * f_{pu} = 0.75 * 270.0000 = 202.5000 \text{ ksi}$$

$$\Delta f_{pes} = 12.1458 \text{ ksi}$$

$$\Delta f_{pr1} = 2.4000 \text{ ksi}$$

$$\Delta f_{pt} = \Delta f_{pes} + \Delta f_{pLT} = 12.1458 + 21.6527 = 33.7986 \text{ ksi}$$

$$Pt1 \text{ base stress} = f_{pbt} - (\Delta f_{pes} + \Delta f_{pr1}) = 202.5000 - (12.1458 + 2.4000) = 187.9542 \text{ ksi}$$

$$A_{ps} = 4.8960 \text{ in}^2$$

$$\text{Mask } A_{ps} = 1.8360 \text{ in}^2$$

$$Pt1 = \text{base stress} \times A_{ps} = 187.9542 \times 4.8960 = 920.2237 \text{ kip}$$

$$Pt2 = \text{base stress} \times (A_{ps} - \text{Mask } A_{ps}) = 187.9542 \times (4.8960 - 1.8360) = 575.1398 \text{ kip}$$

$$Pe = (f_{pbt} - \Delta f_{pt}) \times A_{ps} = (202.5000 - 33.7986) \times 4.8960 = 825.9622 \text{ kip}$$

$$Pt1 = 920.2237 \text{ kip}, Pt2 = 575.1398 \text{ kip}, Pe = 825.9622 \text{ kip}$$

This section tension block uses f_{pbt} , elastic shortening loss, relaxation loss, and the masked strand area from the current inputs.

6. Section Stress at Critical Sections

60db

$$x = 2.5 \text{ ft}$$

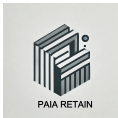
$$\text{Mask length} = 8.5 \text{ ft}$$

$$\text{Mask status} = \text{Inside mask length: } Pt2 \text{ used}$$

$$Pt1 = 920.22 \text{ kip}; Pt2 = 575.14 \text{ kip}; Pe = 825.96 \text{ kip}$$

Description	Symbol	Formula
Initial Stress Top of Girder	fit	$P/A - P^*e/St + Mdp_fab/St$
Initial Stress Bottom of Girder	fib	$P/A + P^*e/Sb - Mdp_fab/Sb$
Stress at Final Stage Top of Girder	fft	$Pe/A - Pe^*e/St + (Mdp_inst+Mds)/St + (Mub+Mfw+DFM^*MLL)/Stc$
Stress at Final Stage Bottom of Girder	ffb	$Pe/A + Pe^*e/Sb - (Mdp_inst+Mds)/Sb - (Mub+Mfw+0.8^*DFM^*MLL)/Sbc$
Stress at Sustained Service Top of Girder	fsc	$Pe/A - Pe^*e/St + (Mdp_inst+Mds)/St + (Mub+Mfw)/Stc$
Stress at Top of Girder, Live Load + 1/2 Dead Load	f2t	$1/2(Pe/A - Pe^*e/St + (Mdp_inst+Mds)/St + (Mub+Mfw)/Stc) + DFM^*$
Stress at Top of Deck Fiber	fdt	$(Mub+Mfw+DFM^*MLL)/St_slab$
Stress at Transfer Length	fbtr	$P/A + P^*e/Sb - Mdtr/Sb$
Mask Length		Pt2 used inside mask; partial masked-strand transfer after mas transfer length

Location	X	Stress	Substitution	Mdp_fab (kip-ft)	Mdp_inst (kip-ft)	Mds Top Slab	Mub Barrier+Utility	Mfw (kip- ft)	DFM*MLL (kip-ft)	P (kip)	Actual (ksi)
60db	2.5	fit	$575.14/663 - 575.14*11.75/5022.95 + (70.44*12)/5022.95$	70.44	69.06	25	30.94	5.47	65.67	575.14	-0.31
60db	2.5	fib	$575.14/663 + 575.14*11.75/5022.95 - (70.44*12)/5022.95$	70.44	69.06	25	30.94	5.47	65.67	575.14	2.04
60db	2.5	fft	$825.96/663 - 825.96*11.75/5022.95 + (69.06+25)*12/5022.95 + (30.94+5.47+65.67)*12/7369.56$	70.44	69.06	25	30.94	5.47	65.67	825.96	-0.3
60db	2.5	ffb	$825.96/663 + 825.96*11.75/5022.95 - (69.06+25)*12/5022.95 -$	70.44	69.06	25	30.94	5.47	65.67	825.96	2.79



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Location	X	Stress	Substitution	Mdp_fab (kip-ft)	Mdp_inst (kip-ft)	Mds Top Slab	Mub Barrier+Utility	Mfw (kip-ft)	DFM*MLL (kip-ft)	P (kip)	Actual (ksi)
			$(30.94+5.47+0.8*65.67)*12/6532.47$								
60db	2.5	fsc	$825.96/663 - 825.96*11.75/5022.95 + (69.06+25)*12/5022.95 + (30.94+5.47)*12/7369.56$	70.44	69.06	25	30.94	5.47	65.67	825.96	-0.4
60db	2.5	f2t	$0.5*(825.96/663 - 825.96*11.75/5022.95 + (69.06+25)*12/5022.95 + (30.94+5.47)*12/7369.56) + (65.67*12)/7369.56$	70.44	69.06	25	30.94	5.47	65.67	825.96	-0.09
60db	2.5	fdt	$(30.94+5.47+65.67)*12/9090.53$	70.44	69.06	25	30.94	5.47	65.67	-	0.13
60db	2.5	fbtr	$575.14/663 + 575.14*11.75/5022.95 - (69.06*12)/5022.95$	70.44	69.06	25	30.94	5.47	65.67	575.14	2.05

0.1L

x = 7.9 ft

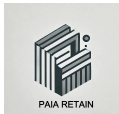
Mask length = 8.5 ft

Mask status = Inside mask length: Pt2 used

Pt1 = 920.22 kip; Pt2 = 575.14 kip; Pe = 825.96 kip

Description	Symbol	Formula
Initial Stress Top of Girder	fit	$P/A - P*e/St + Mdp_fab/St$
Initial Stress Bottom of Girder	fib	$P/A + P*e/Sb - Mdp_fab/Sb$
Stress at Final Stage Top of Girder	fft	$Pe/A - Pe*e/St + (Mdp_inst+Mds)/St + (Mub+Mfw+DFM*MLL)/Stc$
Stress at Final Stage Bottom of Girder	ffb	$Pe/A + Pe*e/Sb - (Mdp_inst+Mds)/Sb - (Mub+Mfw+0.8*DFM*MLL)/Sbc$
Stress at Sustained Service Top of Girder	fsc	$Pe/A - Pe*e/St + (Mdp_inst+Mds)/St + (Mub+Mfw)/Stc$
Stress at Top of Girder, Live Load + 1/2 Dead Load	f2t	$1/2(Pe/A - Pe*e/St + (Mdp_inst+Mds)/St + (Mub+Mfw)/Stc) + DFM*$
Stress at Top of Deck Fiber	fdt	$(Mub+Mfw+DFM*MLL)/St_slab$
Stress at Transfer Length	fbtr	$P/A + P*e/Sb - Mdtr/Sb$
Mask Length		Pt2 used inside mask; partial masked-strand transfer after mas transfer length

Location	X	Stress	Substitution	Mdp_fab (kip-ft)	Mdp_inst (kip-ft)	Mds Top Slab	Mub Barrier+Utility	Mfw (kip-ft)	DFM*MLL (kip-ft)	P (kip)	Actual (ksi)
0.1L	7.9	fit	$575.14/663 - 575.14*11.75/5022.95 + (206.89*12)/5022.95$	206.89	202.52	73.31	90.72	16.04	191.17	575.14	0.02
0.1L	7.9	fib	$575.14/663 + 575.14*11.75/5022.95 - (206.89*12)/5022.95$	206.89	202.52	73.31	90.72	16.04	191.17	575.14	1.72
0.1L	7.9	fft	$825.96/663 - 825.96*11.75/5022.95 + (202.52+73.31)*12/5022.95 + (90.72+16.04+191.17)*12/7369.56$	206.89	202.52	73.31	90.72	16.04	191.17	825.96	0.46
0.1L	7.9	ffb	$825.96/663 + 825.96*11.75/5022.95 - (202.52+73.31)*12/5022.95 - (90.72+16.04+0.8*191.17)*12/6532.47$	206.89	202.52	73.31	90.72	16.04	191.17	825.96	2.04
0.1L	7.9	fsc	$825.96/663 - 825.96*11.75/5022.95 + (202.52+73.31)*12/5022.95 + (90.72+16.04)*12/7369.56$	206.89	202.52	73.31	90.72	16.04	191.17	825.96	0.15



Prestress Girder Detailed Calculation Report

Location	X	Stress	Substitution	Mdp_fab (kip-ft)	Mdp_inst (kip-ft)	Mds Top Slab	Mub Barrier+Utility	Mfw (kip- ft)	DFM*MLL (kip-ft)	P (kip)	Actual (ksi)
0.1L	7.9	f2t	$0.5 * (825.96/663 - 825.96 * 11.75/5022.95 + (202.52 + 73.31) * 12/5022.95 + (90.72 + 16.04) * 12/7369.56) + (191.17 * 12)/7369.56$	206.89	202.52	73.31	90.72	16.04	191.17	825.96	0.38
0.1L	7.9	fdt	$(90.72 + 16.04 + 191.17) * 12/9090.53$	206.89	202.52	73.31	90.72	16.04	191.17	-	0.39
0.1L	7.9	fbtr	$575.14/663 + 575.14 * 11.75/5022.95 - (202.52 * 12)/5022.95$	206.89	202.52	73.31	90.72	16.04	191.17	575.14	1.73

0.2L

x = 15.8 ft

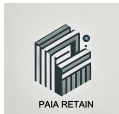
Mask length = 8.5 ft

Mask status = Fully developed: Pt1 used

Pt1 = 920.22 kip; Pt2 = 575.14 kip; Pe = 825.96 kip

Description	Symbol	Formula
Initial Stress Top of Girder	fit	$P/A - P * e / St + Mdp_fab / St$
Initial Stress Bottom of Girder	fib	$P/A + P * e / Sb - Mdp_fab / Sb$
Stress at Final Stage Top of Girder	fft	$Pe/A - Pe * e / St + (Mdp_inst + Mds) / St + (Mub + Mfw + DFM * MLL) / Stc$
Stress at Final Stage Bottom of Girder	ffb	$Pe/A + Pe * e / Sb - (Mdp_inst + Mds) / Sb - (Mub + Mfw + 0.8 * DFM * MLL) / Sbc$
Stress at Sustained Service Top of Girder	fsc	$Pe/A - Pe * e / St + (Mdp_inst + Mds) / St + (Mub + Mfw) / Stc$
Stress at Top of Girder, Live Load + 1/2 Dead Load	f2t	$1/2 (Pe/A - Pe * e / St + (Mdp_inst + Mds) / St + (Mub + Mfw) / Stc) + DFM *$
Stress at Top of Deck Fiber	fdt	$(Mub + Mfw + DFM * MLL) / St_slab$
Stress at Transfer Length	fbtr	$P/A + P * e / Sb - Mdtr / Sb$
Mask Length		Pt2 used inside mask; partial masked-strand transfer after mas transfer length

Location	X	Stress	Substitution	Mdp_fab (kip-ft)	Mdp_inst (kip-ft)	Mds Top Slab	Mub Barrier+Utility	Mfw (kip- ft)	DFM*MLL (kip-ft)	P (kip)	Actual (ksi)
0.2L	15.8	fit	$920.22/663 - 920.22 * 11.75/5022.95 + (367.8 * 12)/5022.95$	367.8	359.07	129.98	160.85	28.43	339.29	920.22	0.11
0.2L	15.8	fib	$920.22/663 + 920.22 * 11.75/5022.95 - (367.8 * 12)/5022.95$	367.8	359.07	129.98	160.85	28.43	339.29	920.22	2.66
0.2L	15.8	fft	$825.96/663 - 825.96 * 11.75/5022.95 + (359.07 + 129.98) * 12/5022.95 + (160.85 + 28.43 + 339.29) * 12/7369.56$	367.8	359.07	129.98	160.85	28.43	339.29	825.96	1.34
0.2L	15.8	ffb	$825.96/663 + 825.96 * 11.75/5022.95 - (359.07 + 129.98) * 12/5022.95 - (160.85 + 28.43 + 0.8 * 339.29) * 12/6532.47$	367.8	359.07	129.98	160.85	28.43	339.29	825.96	1.16
0.2L	15.8	fsc	$825.96/663 - 825.96 * 11.75/5022.95 + (359.07 + 129.98) * 12/5022.95 + (160.85 + 28.43) * 12/7369.56$	367.8	359.07	129.98	160.85	28.43	339.29	825.96	0.79
0.2L	15.8	f2t	$0.5 * (825.96/663 - 825.96 * 11.75/5022.95 + (359.07 + 129.98) * 12/5022.95 + (160.85 + 28.43) * 12/7369.56) + (339.29 * 12)/7369.56$	367.8	359.07	129.98	160.85	28.43	339.29	825.96	0.95



Prestress Girder Detailed Calculation Report

Location	X	Stress	Substitution	Mdp_fab (kip-ft)	Mdp_inst (kip-ft)	Mds Top Slab	Mub Barrier+Utility	Mfw (kip- ft)	DFM*MLL (kip-ft)	P (kip)	Actual (ksi)
0.2L	15.8	fdt	$(160.85+28.43+339.29)*12/9090.53$	367.8	359.07	129.98	160.85	28.43	339.29	-	0.7
0.2L	15.8	fbtr	$920.22/663 + 920.22*11.75/5022.95 - (359.07*12)/5022.95$	367.8	359.07	129.98	160.85	28.43	339.29	920.22	2.68

0.3L

x = 23.7 ft

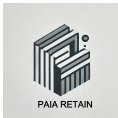
Mask length = 8.5 ft

Mask status = Fully developed: Pt1 used

Pt1 = 920.22 kip; Pt2 = 575.14 kip; Pe = 825.96 kip

Description	Symbol	Formula
Initial Stress Top of Girder	fit	$P/A - P*e/St + Mdp_fab/St$
Initial Stress Bottom of Girder	fib	$P/A + P*e/Sb - Mdp_fab/Sb$
Stress at Final Stage Top of Girder	fft	$Pe/A - Pe*e/St + (Mdp_inst+Mds)/St + (Mub+Mfw+DFM*MLL)/Stc$
Stress at Final Stage Bottom of Girder	ffb	$Pe/A + Pe*e/Sb - (Mdp_inst+Mds)/Sb - (Mub+Mfw+0.8*DFM*MLL)/Sbc$
Stress at Sustained Service Top of Girder	fsc	$Pe/A - Pe*e/St + (Mdp_inst+Mds)/St + (Mub+Mfw)/Stc$
Stress at Top of Girder, Live Load + 1/2 Dead Load	f2t	$1/2(Pe/A - Pe*e/St + (Mdp_inst+Mds)/St + (Mub+Mfw)/Stc) + DFM*$
Stress at Top of Deck Fiber	fdt	$(Mub+Mfw+DFM*MLL)/St_slab$
Stress at Transfer Length	fbtr	$P/A + P*e/Sb - Mdtr/Sb$
Mask Length		Pt2 used inside mask; partial masked-strand transfer after mas transfer length

Location	X	Stress	Substitution	Mdp_fab (kip-ft)	Mdp_inst (kip-ft)	Mds Top Slab	Mub Barrier+Utility	Mfw (kip- ft)	DFM*MLL (kip-ft)	P (kip)	Actual (ksi)
0.3L	23.7	fit	$920.22/663 - 920.22*11.75/5022.95 + (482.74*12)/5022.95$	482.74	469.65	170.01	210.38	37.19	451.67	920.22	0.39
0.3L	23.7	fib	$920.22/663 + 920.22*11.75/5022.95 - (482.74*12)/5022.95$	482.74	469.65	170.01	210.38	37.19	451.67	920.22	2.39
0.3L	23.7	fft	$825.96/663 - 825.96*11.75/5022.95 + (469.65+170.01)*12/5022.95 + (210.38+37.19+451.67)*12/7369.56$	482.74	469.65	170.01	210.38	37.19	451.67	825.96	1.98
0.3L	23.7	ffb	$825.96/663 + 825.96*11.75/5022.95 - (469.65+170.01)*12/5022.95 - (210.38+37.19+0.8*451.67)*12/6532.47$	482.74	469.65	170.01	210.38	37.19	451.67	825.96	0.53
0.3L	23.7	fsc	$825.96/663 - 825.96*11.75/5022.95 + (469.65+170.01)*12/5022.95 + (210.38+37.19)*12/7369.56$	482.74	469.65	170.01	210.38	37.19	451.67	825.96	1.24
0.3L	23.7	f2t	$0.5*(825.96/663 - 825.96*11.75/5022.95 + (469.65+170.01)*12/5022.95 + (210.38+37.19)*12/7369.56) + (451.67*12)/7369.56$	482.74	469.65	170.01	210.38	37.19	451.67	825.96	1.36
0.3L	23.7	fdt	$(210.38+37.19+451.67)*12/9090.53$	482.74	469.65	170.01	210.38	37.19	451.67	-	0.92



Prestress Girder Detailed Calculation Report

Location	X	Stress	Substitution	Mdp_fab (kip-ft)	Mdp_inst (kip-ft)	Mds Top Slab	Mub Barrier+Utility	Mfw (kip- ft)	DFM*MLL (kip-ft)	P (kip)	Actual (ksi)
0.3L	23.7	fbtr	$920.22/663 + 920.22*11.75/5022.95 - (469.65*12)/5022.95$	482.74	469.65	170.01	210.38	37.19	451.67	920.22	2.42

0.4L

x = 31.6 ft

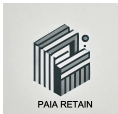
Mask length = 8.5 ft

Mask status = Fully developed: Pt1 used

Pt1 = 920.22 kip; Pt2 = 575.14 kip; Pe = 825.96 kip

Description	Symbol	Formula
Initial Stress Top of Girder	fit	$P/A - P*e/St + Mdp_fab/St$
Initial Stress Bottom of Girder	fib	$P/A + P*e/Sb - Mdp_fab/Sb$
Stress at Final Stage Top of Girder	fft	$Pe/A - Pe*e/St + (Mdp_inst+Mds)/St + (Mub+Mfw+DFM*MLL)/Stc$
Stress at Final Stage Bottom of Girder	ffb	$Pe/A + Pe*e/Sb - (Mdp_inst+Mds)/Sb - (Mub+Mfw+0.8*DFM*MLL)/Sbc$
Stress at Sustained Service Top of Girder	fsc	$Pe/A - Pe*e/St + (Mdp_inst+Mds)/St + (Mub+Mfw)/Stc$
Stress at Top of Girder, Live Load + 1/2 Dead Load	f2t	$1/2(Pe/A - Pe*e/St + (Mdp_inst+Mds)/St + (Mub+Mfw)/Stc) + DFM*$
Stress at Top of Deck Fiber	fdt	$(Mub+Mfw+DFM*MLL)/St_slab$
Stress at Transfer Length	fbtr	$P/A + P*e/Sb - Mdtr/Sb$
Mask Length		Pt2 used inside mask; partial masked-strand transfer after mas transfer length

Location	X	Stress	Substitution	Mdp_fab (kip-ft)	Mdp_inst (kip-ft)	Mds Top Slab	Mub Barrier+Utility	Mfw (kip- ft)	DFM*MLL (kip-ft)	P (kip)	Actual (ksi)
0.4L	31.6	fit	$920.22/663 - 920.22*11.75/5022.95 + (551.7*12)/5022.95$	551.7	534.25	193.39	239.32	42.3	512.03	920.22	0.55
0.4L	31.6	fib	$920.22/663 + 920.22*11.75/5022.95 - (551.7*12)/5022.95$	551.7	534.25	193.39	239.32	42.3	512.03	920.22	2.22
0.4L	31.6	fft	$825.96/663 - 825.96*11.75/5022.95 + (534.25+193.39)*12/5022.95 + (239.32+42.3+512.03)*12/7369.56$	551.7	534.25	193.39	239.32	42.3	512.03	825.96	2.34
0.4L	31.6	ffb	$825.96/663 + 825.96*11.75/5022.95 - (534.25+193.39)*12/5022.95 - (239.32+42.3+0.8*512.03)*12/6532.47$	551.7	534.25	193.39	239.32	42.3	512.03	825.96	0.17
0.4L	31.6	fsc	$825.96/663 - 825.96*11.75/5022.95 + (534.25+193.39)*12/5022.95 + (239.32+42.3)*12/7369.56$	551.7	534.25	193.39	239.32	42.3	512.03	825.96	1.51
0.4L	31.6	f2t	$0.5*(825.96/663 - 825.96*11.75/5022.95 + (534.25+193.39)*12/5022.95 + (239.32+42.3)*12/7369.56) + (512.03*12)/7369.56$	551.7	534.25	193.39	239.32	42.3	512.03	825.96	1.59
0.4L	31.6	fdt	$(239.32+42.3+512.03)*12/9090.53$	551.7	534.25	193.39	239.32	42.3	512.03	-	1.05
0.4L	31.6	fbtr	$920.22/663 + 920.22*11.75/5022.95 - (534.25*12)/5022.95$	551.7	534.25	193.39	239.32	42.3	512.03	920.22	2.26



Prestress Girder Detailed Calculation Report

0.5L

x = 39.5 ft

Mask length = 8.5 ft

Mask status = Fully developed: Pt1 used

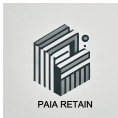
Pt1 = 920.22 kip; Pt2 = 575.14 kip; Pe = 825.96 kip

Description	Symbol	Formula
Initial Stress Top of Girder	fit	$P/A - P^*e/St + Mdp_fab/St$
Initial Stress Bottom of Girder	fib	$P/A + P^*e/Sb - Mdp_fab/Sb$
Stress at Final Stage Top of Girder	fft	$Pe/A - Pe^*e/St + (Mdp_inst+Mds)/St + (Mub+Mfw+DFM^*MLL)/Stc$
Stress at Final Stage Bottom of Girder	ffb	$Pe/A + Pe^*e/Sb - (Mdp_inst+Mds)/Sb - (Mub+Mfw+0.8^*DFM^*MLL)/Sbc$
Stress at Sustained Service Top of Girder	fsc	$Pe/A - Pe^*e/St + (Mdp_inst+Mds)/St + (Mub+Mfw)/Stc$
Stress at Top of Girder, Live Load + 1/2 Dead Load	f2t	$1/2(Pe/A - Pe^*e/St + (Mdp_inst+Mds)/St + (Mub+Mfw)/Stc) + DFM^*$
Stress at Top of Deck Fiber	fdt	$(Mub+Mfw+DFM^*MLL)/St_slab$
Stress at Transfer Length	fbtr	$P/A + P^*e/Sb - Mdtr/Sb$
Mask Length		Pt2 used inside mask; partial masked-strand transfer after mas transfer length

Location	X	Stress	Substitution	Mdp_fab (kip-ft)	Mdp_inst (kip-ft)	Mds Top Slab	Mub Barrier+Utility	Mfw (kip- ft)	DFM^*MLL (kip-ft)	P (kip)	Actual (ksi)
0.5L	39.5	fit	$920.22/663 - 920.22^*11.75/5022.95 + (574.69^*12)/5022.95$	574.69	552.87	200.13	247.67	43.78	521.22	920.22	0.61
0.5L	39.5	fib	$920.22/663 + 920.22^*11.75/5022.95 - (574.69^*12)/5022.95$	574.69	552.87	200.13	247.67	43.78	521.22	920.22	2.17
0.5L	39.5	fft	$825.96/663 - 825.96^*11.75/5022.95 + (552.87+200.13)^*12/5022.95 + (247.67+43.78+521.22)^*12/7369.56$	574.69	552.87	200.13	247.67	43.78	521.22	825.96	2.44
0.5L	39.5	ffb	$825.96/663 + 825.96^*11.75/5022.95 - (552.87+200.13)^*12/5022.95 - (247.67+43.78+0.8^*521.22)^*12/6532.47$	574.69	552.87	200.13	247.67	43.78	521.22	825.96	0.08
0.5L	39.5	fsc	$825.96/663 - 825.96^*11.75/5022.95 + (552.87+200.13)^*12/5022.95 + (247.67+43.78)^*12/7369.56$	574.69	552.87	200.13	247.67	43.78	521.22	825.96	1.59
0.5L	39.5	f2t	$0.5^*(825.96/663 - 825.96^*11.75/5022.95 + (552.87+200.13)^*12/5022.95 + (247.67+43.78)^*12/7369.56) + (521.22^*12)/7369.56$	574.69	552.87	200.13	247.67	43.78	521.22	825.96	1.64
0.5L	39.5	fdt	$(247.67+43.78+521.22)^*12/9090.53$	574.69	552.87	200.13	247.67	43.78	521.22	-	1.07
0.5L	39.5	fbtr	$920.22/663 + 920.22^*11.75/5022.95 - (552.87^*12)/5022.95$	574.69	552.87	200.13	247.67	43.78	521.22	920.22	2.22

7. Moment Design

EQUATION	VALUES	RESULT
Initial Depth	H = 30 in	dp = 32.75 in
	ts = 6 in	
dp = H / 2 + ts + e	e = 11.75 in	



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EQUATION	VALUES	RESULT
	$dp = 30 / 2 + 6 + 11.75$	
Beta 1 and k $\beta 1 = \max(0.65, 0.85 - 0.05(f'c - 4))$ $k = 2(1.04 - f_{py} / f_{pu})$	$f'c$ used for moment = 4.5 ksi Strength source = deck concrete strength because $t_s > 0$ $f_{py} = 243$ ksi $f_{pu} = 270$ ksi $\beta 1 = \max(0.65, 0.85 - 0.05(4.5 - 4))$ $k = 2(1.04 - 243 / 270)$	$\beta 1 = 0.82$ $k = 0.28$
Neutral Axis Depth $c = (A_{ps} f_{pu} + A_s f_s - A_s' f_s') / (\alpha 1 f'c \beta 1 b + k A_{ps} f_{pu} / dp)$	$A_{ps} = 4.9$ in ² $A_s = 0.27$ in ² $A_s' = 0$ in ² $f_{pu} = 270$ ksi $f_s = 60$ ksi $f_s' = 60$ ksi $\alpha 1 = 0.85$ $f'c = 4.5$ ksi $\beta 1 = 0.82$ $b = 40$ in $dp = 32.75$ in Numerator = 1338.12 Denominator = 137.53	$c = 9.73$ in NG
Prestressing Steel Stress $f_{ps} = f_{pu}(1 - k c / dp)$	$f_{pu} = 270$ ksi $k = 0.28$ $c = 9.73$ in $dp = 32.75$ in $f_{ps} = 270(1 - 0.28 \times 9.73 / 32.75)$	$f_{ps} = 247.54$ ksi
Moment Resistance $a = \beta 1 \times c$ $M_n = A_{ps} \times f_{ps} \times (dp - a / 2) + A_s \times f_s \times (ds - a / 2) - A_s' \times f_s' \times (a / 2 - ds')$ $M_r = \phi M_n$	$a = 0.82 \times 9.73 = 8.03$ in $f_{ps} = 270 \times (1 - 0.28 \times 9.73 / 32.75) = 247.54$ ksi $ds = 4$ in; $ds' = 4$ in from section datum $M_n = 4.9 \times 247.54 \times (32.75 - 8.03 / 2) + 0.27 \times 60 \times (4 - 8.03 / 2) - 0 \times 60 \times (8.03 / 2 - 4)$ $M_n = 35292.53$ kip-in $M_n = 2941.04$ kip-ft $M_r = 1 \times 2941.04$	$M_r = 2941.04$ kip-ft
Strain Limit Check $\epsilon_t = \epsilon_{cu} \times (dp - c) / c$ Compression-controlled if $\epsilon_t \leq \epsilon_{cl}$ Tension-controlled if $\epsilon_t \geq \epsilon_{tl}$ Transition zone if $\epsilon_{cl} < \epsilon_t < \epsilon_{tl}$	$\epsilon_{cu} = 0.003$ $dp = 32.75$ in $c = 9.73$ in $\epsilon_t = 0.003 \times (32.75 - 9.73) / 9.73 = 0.0071$ $\epsilon_{cl} = 0.002$ $\epsilon_{tl} = 0.005$	Tension-controlled $\epsilon_t \geq \epsilon_{tl}$
Minimum Flexural Reinforcement Required = min(1.33Mu, Mcr)	$f_r = 0.51$ ksi $f_{cpe} = 3.18$ ksi $M_{cr} = 1804.21$ kip-ft $1.33M_u = 2967.96$ kip-ft Required = 1804.21 kip-ft $M_r = 2941.04$ kip-ft	OK - Minimum Flexural Reinforcement Satisfied
Strength Demand $M_u = 1.25(M_{dp_inst} + M_{ds} + M_{ub}) + 1.5M_{fw} + 1.75(DFM \times MLL)$ $V_u = 1.25(V_{dp_inst} + V_{ds} + V_{ub}) + 1.5V_{fw} + 1.75(DFV \times VLL)$	Moment row = 0.5L $M_{dp_inst} = 553.08$ kip-ft $M_{ds} = 200.21$ kip-ft $M_{ub} = 247.76$ kip-ft $M_{fw} = 43.8$ kip-ft $DFM \times MLL = 522.6$ kip-ft	$M_u = 2231.55$ kip-ft $V_u = 165.41$ kip

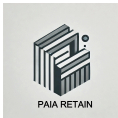


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EQUATION			VALUES										RESULT	
			Shear row = H/2 Vdp_inst = 27.63 kip Vds = 10 kip Vub = 12.38 kip Vfw = 2.19 kip DFV*VLL = 56.93 kip											
Flexural Strength Check			Mr = 2941.04 kip-ft Mu = 2231.55 kip-ft										2941.04 - 2231.55 = 709.5 kip-ft	
Mr ≥ Mu			Margin = Mr - Mu										PASS ✓	
Location	x (ft)	x/L	Mdp_inst	Mds	Mub	Mfw	DFM*MLL	Mu	Vdp_inst	Vds	Vub	Vfw	DFV*VLL	Vu
H/2	1.25	0.02	35.11	12.71	15.73	2.78	33.42	142.09	27.63	10	12.38	2.19	56.93	165.41
0.1L	7.75	0.1	199.11	72.08	89.19	15.77	188.21	803.48	22.84	8.27	10.23	1.81	50.62	142.97
0.2L	15.5	0.2	353.97	128.13	158.56	28.03	334.46	1428.19	17.13	6.2	7.67	1.36	43.22	116.43
0.3L	23.25	0.3	464.58	168.18	208.12	36.79	446.91	1888.38	11.42	4.13	5.12	0.9	35.64	89.56
0.4L	31	0.4	530.95	192.2	237.85	42.04	509.63	2156.16	5.71	2.07	2.56	0.45	28.34	63.18
0.45L	34.88	0.45	542.01	196.2	242.8	42.92	521.99	2204.15	2.85	1.03	1.28	0.23	24.88	50.34
0.5L	38.75	0.5	553.08	200.21	247.76	43.8	522.6	2231.55	0	0	0	0	24.27	42.48

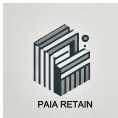
8. Shear Design

EQUATION			VALUES										RESULT	
8-1) Critical Section for Shear Design			H = 30 in ts = 6 in e = 11.75 in a = 8.03 in hc = 30 + 6 = 36 in ybts = 30 / 2 - 11.75 = 3.25 in de = 36 - 3.25 = 32.75 in dv(calc) = 32.75 - 8.03 / 2 = 28.74 in 0.9de = 0.9 × 32.75 = 29.48 in 0.72hc = 0.72 × 36 = 25.92 in										dv = 29.48 in dv = 2.46 ft	
hc = H + ts ybts = H / 2 - e de = hc - ybts dv = de - a / 2 dv shall not be less than max(0.9de, 0.72hc)														
8-2) Factored Shear and Moment			Vdc1 = 26.74 kip Vdc2 = 11.98 kip Vdw = 2.12 kip Vll (undistributed) = 104.45 kip DFV × Vll = 59.59 kip Strength I Vu = 1.25(26.74 + 11.98) + 1.50(2.12) + 1.75(DFV × Vll = 59.59) = 155.84 kip Strength II Vu = 1.25(26.74 + 11.98) + 1.50(2.12) + 1.35(DFV × Vll = 59.59) = 132.01 kip Mdc1 = 67.87 kip-ft Mdc2 = 24.57 kip-ft Mdw = 35.78 kip-ft Mll = 258.33 kip-ft										Controlling = Strength I Vu = 155.84 kip Mu = 289.55 kip-ft	
Strength I: Vu = 1.25(Vdc1 + Vdc2) + 1.50Vdw + 1.75Vll Mu = 1.25(Mdc1 + Mdc2) + 1.50Mdw + 1.75Mll Strength II: Vu = 1.25(Vdc1 + Vdc2) + 1.50Vdw + 1.35Vll Mu = 1.25(Mdc1 + Mdc2) + 1.50Mdw + 1.35Mll														
8-3) Longitudinal Strain εx			Mu used = 382.79 kip-ft dv = 2.46 ft Nu = 0 kip Vu = 155.84 kip Vp = 0 kip θ = 26.6° cotθ (converged) = 2.5 Aps = 4.9 in² fpo = 189 ksi										εx = -0.000020 AASHTO B5.2-5 compression case	
εx = [Mu / dv + 0.5Nu + (Vu - Vp)cotθ - Aps fpo] / [2(Es As + Ep Aps)]														



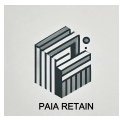
Prestress Girder Detailed Calculation Report

EQUATION	VALUES	RESULT
	Es = 29000 ksi As = 0.27 in ² Ep = 28500 ksi Numerator = -379.86 Denominator = 294732	
8-4) Concrete Shear Resistance vu = Vu - φVp / (φ bv dv) vu / f'c = vu / f'c Vc = 0.0316 β λ √f'c bv dv	Vu = 155.84 kip φ = 0.9 Vp = 0 kip bv = 10 in dv = 29.48 in f'c = 8.5 ksi Concrete strength used = girder concrete f'c λ = 1 β = 3.75 vu = 155.84 - 0.9(0) / (0.9 × 10 × 29.48) = 0.59 ksi vu / f'c = 0.59 / 8.5 = 0.07 Vc = 0.0316 × 3.75 × 1 × √8.5 × 10 × 29.48	Vc = 101.83 kip
Lookup for θ and β Use AASHTO shear table based on: vu / f'c and εx × 1000	vu / f'c actual = 0.07 Selected row = 0.07 εx = -0.000020 εx × 1000 = -0.01979 Selected column = 0	θ = 21.8° β = 3.75
8-5) Transverse Reinforcement Requirement Transverse reinforcement required if: Vu > 0.5φ(Vc + Vp) Vs,req = Vu / φ - Vc - Vp	Vu = 155.84 kip φ = 0.9 Vc = 101.83 kip Vp = 0 kip Limit = 0.5 × 0.9 × (101.83 + 0) = 45.82 kip Vs,req = 155.84 / 0.9 - 101.83 - 0	Vs,req = 71.33 kip Strength reinforcement demand governs Minimum transverse reinforcement is required by detailing rules
8-6) Stirrups and Shear Capacity Av = bar area × number of legs Av / s = Av / s Vs = (Av / s) fy dv (cotθ + cotα) sinα Vn = Vc + Vs + Vp φVn = φVn	Stirrup legs = 2 Area of one bar = 0.2 in ² s = 12 in Av = 0.2 × 2 = 0.4 in ² Av / s = 0.4 / 12 = 0.03 in ² /in fy = 60 ksi dv = 29.48 in cotθ (converged) = 2.5 cotα = 0 sinα = 1 Vs = 147.39 kip Vn = 101.83 + 147.39 + 0 = 249.22 kip φVn = 0.9 × 249.22	φVn = 224.3 kip Vu = 155.84 kip Concrete + prestress shear strength: PASS Strength reinforcement demand: Vs,req = 71.33 kip Minimum transverse reinforcement: REQUIRED Maximum spacing: 18 in Preliminary detail: 2-leg #4 @ 18 in o.c.
8-7) Additional Spacing Check If vu < 0.125f'c: smax = lesser of 0.8dv and 18 in Otherwise: smax = lesser of 0.4dv and 12 in	vu = 0.59 ksi 0.125f'c = 0.125 × 8.5 = 1.06 ksi vu < 0.125f'c, therefore smax = lesser of 0.8dv and 18 in 0.8dv = 0.8 × 29.48 = 23.58 in s provided = 12 in	smax = 18 in Code spacing limit = 18 in Preliminary recommended spacing = 18 in o.c.



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EQUATION	VALUES	RESULT
8-8) Minimum Transverse Reinforcement $A_{v,min} = 0.0316 \lambda \sqrt{f'_c} b_v s / f_y$	$\lambda = 1$ $f'_c = 8.5 \text{ ksi}$ $b_v = 10 \text{ in}$ $s = 12 \text{ in}$ $f_y = 60 \text{ ksi}$ $A_{v,min} = 0.0316 \times 1 \times \sqrt{8.5} \times 10 \times 12 / 60$	$A_{v,min}/s = 0.02 \text{ in}^2/\text{in}$ $A_{v,min}$ at selected spacing = 0.18 in^2 A_v/s required for design = $0.02 \text{ in}^2/\text{in}$ Preliminary detail if no stirrup input is supplied: 2-leg #4, $A_v = 0.4 \text{ in}^2$ @ 18 in o.c. Minimum transverse reinforcement governs; select bars and spacing to satisfy both A_v/s and spacing limits.
8-9) Maximum Nominal Shear Resistance $V_n \leq 0.25f'_c b_v d_v + V_p$	$V_n = 249.22 \text{ kip}$ Limit 1 = $V_c + V_s + V_p = 249.22 \text{ kip}$ Limit 2 = $0.25 \times 8.5 \times 10 \times 29.48 + 0 = 626.34 \text{ kip}$	$V_{n,max} = 249.22 \text{ kip}$ Maximum V_n OK
8-10) Longitudinal Reinforcement Requirement $A_{ps} f_{ps} + A_s f_y \geq M_u / (d_v \phi_c) + 0.5N_u / \phi_c + (V_u / \phi - V_p - 0.5V_s) \cot \theta$	$M_u = 289.55 \text{ kip-ft}$ $d_v = 29.48 \text{ in}$ $\phi_c = 1$ $N_u = 0 \text{ kip}$ $V_u = 155.84 \text{ kip}$ $\phi = 0.9$ $V_p = 0 \text{ kip}$ $V_s \text{ provided} = 147.39 \text{ kip}$ $V_s \text{ cap} = V_u / \phi = 173.16 \text{ kip}$ $V_s \text{ credited} = \min(V_s \text{ provided}, V_u / \phi) = 147.39 \text{ kip}$ Cap not controlling. $\cot \theta = 2.5$ Required = 366.57 kip Transfer length = $60d_b = 60(0.5) = 30 \text{ in}$ $f_{ps, \text{effective}} = 243.21 \text{ ksi}$ Provided = $A_{ps} f_{ps, \text{effective}} + A_s f_y$ Provided = $4.9 \times 243.21 + 0.27 \times 60$	Provided = 1206.94 kip Required = 366.57 kip Longitudinal reinforcement OK
8-11) Pretensioned Anchorage Zone Reinforcement $P_r = 0.04P_i$ $A_{s, \text{req}} = P_r / f_s$	$P_i = 0.75 \text{ fpu } A_{ps}$ $P_i = 0.75 \times 270 \times 4.9 = 991.44 \text{ kip}$ $P_r = 0.04 \times 991.44 = 39.66 \text{ kip}$ $f_s = 20 \text{ ksi}$ $A_{s, \text{req}} = 39.66 / 20 = 1.98 \text{ in}^2$ Bar area = 0.31 in^2 Faces = 2 $h / 4 = 7.5 \text{ in}$	Bars required = 3.2 Use 4 #5 stirrups within $h/4 = 7.50 \text{ in}$ from the end of girder.
8-12) Interface Shear Transfer $V_h = V_u / d_e$ $V_n = V_h / \phi$ Limit 1 = $K_1 \times f'_c(\text{deck}) \times A_{cv}$ Limit 2 = $K_2 \times A_{cv}$ Limit 3 = $\text{coh} \times b + \mu(A_{vf} \times f_y / 1000 + P_c)$ $A_{vf}/s = A_{vf} / s$ $A_{vf, \text{min}} = 0.05b / f_y$	$V_u = 155.84 \text{ kip}$ $d_e = 32.75 \text{ in}$ $\phi = 0.9$ $f'_c(\text{deck}) = 4.5 \text{ ksi}$ $K_1 = 0.3$ $K_2 = 1.8$ $\text{coh} = 0.24 \text{ ksi}$ $\mu = 1$ $V_h = 155.84 / 32.75 = 4.76 \text{ k/in}$	$\phi V_n = 0.9 \times 5.29 = 4.76 \text{ k/in}$ Governing limit = 33.6 k/in Provided $A_{vf}/s = 0.04 \text{ in}^2/\text{in}$ Required $A_{vf, \text{min}} = 0 \text{ in}^2/\text{in}$



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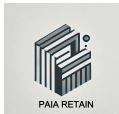
EQUATION	VALUES	RESULT
	$V_n = 4.76 / 0.9 = 5.29 \text{ k/in}$	Status = ok
	$Ac_v = b \times 1 \text{ in} = 40 \times 1 = 40 \text{ in}^2$	
	$\text{Limit 1} = 0.3 \times 4.5 \times 40 = 54 \text{ k/in}$	
	$\text{Limit 2} = 1.8 \times 40 = 72 \text{ k/in}$	
	$\text{Limit 3} = 0.24 \times 40 + 1 \times (0.4 \times 60000 / 1000 + 0) = 33.6 \text{ k/in}$	
	$Av_f/s = 0.4 / 10 = 0.04 \text{ in}^2/\text{in}$	
	$Av_{f,min} = 0.05 \times 40 / 60000 = 0 \text{ in}^2/\text{in}$	

Shear Iteration Table

Iteration	θ in	cot θ	ϵx	Actual v_u/f_c	Selected Row	$\epsilon x \times 1000$ Col	θ out	β
1	26.6	2	-2.388e-5	0.069	0.075	0	21.8	3.75
2	21.8	2.5	-1.979e-5	0.069	0.075	0	21.8	3.75

9. Deflection and Camber

EQUATION	VALUES	RESULT
9-1) Input Summary Summary of values used for deflection and camber calculations	$Pt1 = 920.22 \text{ kip}$ $e = 11.75 \text{ in}$ $L' = 948 \text{ in}$ $L = 930 \text{ in}$ $E_{ci} = 4877.01 \text{ ksi}$ $E_{cp} = 5471.07 \text{ ksi}$ $I = 75344.3 \text{ in}^4$ $I_c = 124664.56 \text{ in}^4$ $W_{dp} = 0.74 \text{ kip/ft}$ $W_{deck} = 0.27 \text{ kip/ft}$ $W_{bw} = 0.18 \text{ kip/ft}$ $W_{ut} = 0.15 \text{ kip/ft}$ $W_{fw} = 0.06 \text{ kip/ft}$	Inputs listed
9-2) Transfer Deflection Components $d1 = -Pt1 \times L'^2 \times e / (8 \times E_{ci} \times I)$ $d2 = 5 \times (W_{dp} / 12) \times L'^4 / (384 \times E_{ci} \times I)$	$d1 = -920.22 \times 948^2 \times 11.75 / (8 \times 4877.01 \times 75344.3)$ $d2 = 5 \times (0.74 / 12) \times 948^4 / (384 \times 4877.01 \times 75344.3)$	d1 = -3.31 in d2 = 1.76 in
9-3) Deck and Superimposed Dead Load Deflection $d3 = 5 \times (W_{deck} / 12) \times L^4 / (384 \times E_{cp} \times I)$ $d4 = 5 \times ((W_{ut} + W_{fw} + W_{bw}) / 12) \times L^4 / (384 \times E_{cp} \times I_c)$	$W_{deck} = 0.27 \text{ kip/ft}$ $W_{ut} + W_{fw} + W_{bw} = 0.15 + 0.06 + 0.18 = 0.39 \text{ kip/ft}$ $d3 = 5 \times (0.27 / 12) \times 930^4 / (384 \times 5471.07 \times 75344.3)$ $d4 = 5 \times (0.39 / 12) \times 930^4 / (384 \times 5471.07 \times 124664.56)$	d3 = 0.53 in d4 = 0.46 in
9-4) Prestress Loss Deflection $f_{ptr} = 0.75f_{pu} - \Delta f_{pes} - \Delta f_{pr1}$ $d5 = [(\Delta f_{pt} - (\Delta f_{pes} + \Delta f_{pr1})) / f_{ptr}] \times d1 $	$f_{ptr} = 0.75(270) - 12.15 - 2.4 = 187.95 \text{ ksi}$ $\Delta f_{pt} = 33.8 \text{ ksi}$ $\Delta f_{pes} = 12.15 \text{ ksi}$ $\Delta f_{pr1} = 2.4 \text{ ksi}$ $d1 = -3.31 \text{ in}$ $d5 = [(33.8 - (12.15 + 2.4)) / 187.95] \times -3.31 $	d5 = 0.34 in

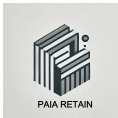


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EQUATION	VALUES	RESULT
9-5) Release / Erection Deflection Summary Release camber = initial prestress camber + beam self-weight deflection	Initial prestress camber: d1 = -3.31 in PCI multiplier = 1.8 After multiplier = -5.95 in Beam self-weight deflection: d2 = 1.76 in PCI multiplier = 1.85 After multiplier = 3.25 in Total release / erection camber = -5.95 + 3.25	Release camber = -2.7 in
9-6) Final / Total Deflection Summary Final deflection = initial camber + prestress loss deflection + beam self-weight + slab deflection + superimposed dead-load deflection	Initial prestress camber: d1 = -3.31 in × 2.2 = -7.27 in Prestress loss deflection: d5 = 0.34 in × 2.2 = 0.74 in Beam self-weight deflection: d2 = 1.76 in × 2.4 = 4.22 in Deck / slab deflection: d3 = 0.53 in × 2.3 = 1.21 in Utility + FWS + barrier deflection: d4 = 0.46 in × 3 = 1.39 in	Total final deflection = 0.28 in
9-7) Live Load Deflection Check Optional AASHTO live-load deflection check uses the design vehicle with impact and DFM; lane load is excluded. Truck vehicle = truck vehicle deflection × impact factor Tandem vehicle = tandem vehicle deflection × impact factor Governing live-load deflection = max(truck vehicle, tandem vehicle) Optional AASHTO live-load deflection criterion = L / 800	Span length L = 77.5 ft = 930 in Composite inertia I _c = 124664.56 in ⁴ Distribution factor DFM = 0.27 Impact factor = 1.33 Truck vehicle per lane = 1.63 in Tandem vehicle per lane = 1.22 in Lane load per lane = 0.76 in Truck vehicle with impact per lane = 1.63 × 1.33 = 2.17 in Tandem vehicle with impact per lane = 1.22 × 1.33 = 1.63 in Truck vehicle after DFM = 0.27 × 2.17 = 0.58 in Tandem vehicle after DFM = 0.27 × 1.63 = 0.43 in Optional AASHTO live-load criterion limit = 930 / 800 = 1.16 in	Live load deflection = 0.58 in Optional criterion limit = 1.16 in Live load deflection OK

10. Development Length

EQUATION	VALUES	RESULT
f _{pe} = 0.75f _{pu} - Δf _{pt} 60db = 60 × db l _d = k × (f _{ps} - 2/3 f _{pe}) × db	db = 0.5 in C = 7.98 in f _{pu} = 270 ksi f _{ps} = 247.54 ksi Δf _{pt} = 33.8 ksi f _{pe} = 0.75 × 270 - 33.8 = 168.7 ksi 60db = 60 × 0.5 = 30 in l _d bonded = 1.6 × (247.54 - 2/3 × 168.7) × 0.5 l _d partially bonded = 2 × (247.54 - 2/3 × 168.7) × 0.5	l_d bonded = 108.06 in l_d partially bonded = 135.07 in



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11. Beam Top Reinforcement Check

EQUATION	VALUES	RESULT
$x = f'ci \text{ top} \times H / (f'ci \text{ bot} + f'ci \text{ top})$	fit = -0.31 ksi (initial top stress at governing section)	As' req = 0.81 in ²
$As' \text{ req} = f'ci \text{ top} \times x \times b_{top} / (2 \times f_s)$	fib = 2.04 ksi (initial bottom stress at governing section) governing section = 60db top stress limit = -0.2 ksi fit over limit = true	As' provided = 0 in ² NG
	f'ci top = 0.31 ksi f'ci bot = 2.04 ksi H = 30 in btop = 40 in fs = 0.5 × fy = 29.99 ksi	
	$x = (0.31 \times 30) / (2.04 + 0.31) = 3.95 \text{ in}$	
	$As' \text{ req} = 0.31 \times 3.95 \times 40 / (2 \times 29.99)$	

12. Calculation Trail

1) Live Load Calculation

L = 77.5000 ft

dx_move = 0.2500 ft

Impact factor = 1.3300

Lane load w = 0.6400 kip/ft

Stations = 0.0L, H/2 from left support, 60db from left support, 0.1L, 0.2L, 0.3L, 0.4L, 0.45L, 0.5L, 0.6L, 0.7L, 0.8L, 0.9L, 60db from right support, H/2 from right support, 1.0L

Vehicle search = HL-93 truck rear spacing 14 to 30 ft, tandem spacing 4 ft, move step 0.25 ft

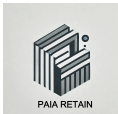
0.0L | x = 0.0000 ft (0.0000L) | M_lane = 0.6400 * 0.0000 * (77.5000 - 0.0000) / 2 = 0.0000 kip-ft | M_truck = 0.0000 kip-ft | M_tandem = 0.0000 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(0.0000 + 0.0000, 0.0000 + 0.0000) = 0.0000 kip-ft | V_truck = 77.1572 kip | V_tandem = 64.5694 kip | V+ = max(77.1572 + 24.8000, 64.5694 + 24.8000) = 101.9572 kip | V- = min(0.0000 + -0.0000, 0.0000 + -0.0000) = 0.0000 kip

H/2 from left support | x = 1.2500 ft (0.0161L) | M_lane = 0.6400 * 1.2500 * (77.5000 - 1.2500) / 2 = 30.5000 kip-ft | M_truck = 95.0735 kip-ft | M_tandem = 79.6391 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(95.0735 + 30.5000, 79.6391 + 30.5000) = 125.5735 kip-ft | V_truck = 75.7843 kip | V_tandem = 63.4968 kip | V+ = max(75.7843 + 24.0065, 63.4968 + 24.0065) = 99.7907 kip | V- = min(-0.6865 + -0.0065, -0.5363 + -0.0065) = -0.6929 kip

60db from left support | x = 2.5000 ft (0.0323L) | M_lane = 0.6400 * 2.5000 * (77.5000 - 2.5000) / 2 = 60.0000 kip-ft | M_truck = 186.7148 kip-ft | M_tandem = 156.5968 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(186.7148 + 60.0000, 156.5968 + 60.0000) = 246.7148 kip-ft | V_truck = 74.4114 kip | V_tandem = 62.4242 kip | V+ = max(74.4114 + 23.2258, 62.4242 + 23.2258) = 97.6372 kip | V- = min(-1.3729 + -0.0258, -1.0726 + -0.0258) = -1.3987 kip

0.1L | x = 7.7500 ft (0.1000L) | M_lane = 0.6400 * 7.7500 * (77.5000 - 7.7500) / 2 = 172.9800 kip-ft | M_truck = 534.1280 kip-ft | M_tandem = 450.5375 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(534.1280 + 172.9800, 450.5375 + 172.9800) = 707.1080 kip-ft | V_truck = 68.6452 kip | V_tandem = 57.9194 kip | V+ = max(68.6452 + 20.0880, 57.9194 + 20.0880) = 88.7332 kip | V- = min(-4.2560 + -0.2480, -4.9339 + -0.2480) = -5.1819 kip

0.2L | x = 15.5000 ft (0.2000L) | M_lane = 0.6400 * 15.5000 * (77.5000 - 15.5000) / 2 = 307.5200 kip-ft | M_truck = 949.0880 kip-ft | M_tandem = 798.0000 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(949.0880 + 307.5200, 798.0000 + 307.5200) = 1256.6080 kip-ft | V_truck = 59.8929 kip | V_tandem = 51.2694 kip | V+ = max(59.8929 + 15.8720, 51.2694 + 15.8720) = 75.7649 kip | V- = min(-9.3357 + -0.9920, -11.5839 + -0.9920) = -12.5759 kip



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0.3L | x = 23.2500 ft (0.3000L) | M_lane = 0.6400 * 23.2500 * (77.5000 - 23.2500) / 2 = 403.6200 kip-ft | M_truck = 1275.4700 kip-ft | M_tandem = 1042.3875 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(1275.4700 + 403.6200, 1042.3875 + 403.6200) = 1679.0900 kip-ft | V_truck = 50.3169 kip | V_tandem = 44.6194 kip | V+ = max(50.3169 + 12.1520, 44.6194 + 12.1520) = 62.4689 kip | V- = min(-17.8477 + -2.2320, -18.2339 + -2.2320) = -20.4659 kip

0.4L | x = 31.0000 ft (0.4000L) | M_lane = 0.6400 * 31.0000 * (77.5000 - 31.0000) / 2 = 461.2800 kip-ft | M_truck = 1453.4240 kip-ft | M_tandem = 1183.7000 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(1453.4240 + 461.2800, 1183.7000 + 461.2800) = 1914.7040 kip-ft | V_truck = 40.7409 kip | V_tandem = 37.9694 kip | V+ = max(40.7409 + 8.9280, 37.9694 + 8.9280) = 49.6689 kip | V- = min(-26.7716 + -3.9680, -24.8839 + -3.9680) = -30.7396 kip

0.45L | x = 34.8750 ft (0.4500L) | M_lane = 0.6400 * 34.8750 * (77.5000 - 34.8750) / 2 = 475.6950 kip-ft | M_truck = 1485.4770 kip-ft | M_tandem = 1215.2875 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(1485.4770 + 475.6950, 1215.2875 + 475.6950) = 1961.1720 kip-ft | V_truck = 36.1074 kip | V_tandem = 34.7516 kip | V+ = max(36.1074 + 7.5020, 34.7516 + 7.5020) = 43.6094 kip | V- = min(-31.4052 + -5.0220, -28.1016 + -5.0220) = -36.4272 kip

0.5L | x = 38.7500 ft (0.5000L) | M_lane = 0.6400 * 38.7500 * (77.5000 - 38.7500) / 2 = 480.5000 kip-ft | M_truck = 1482.9500 kip-ft | M_tandem = 1221.9375 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(1482.9500 + 480.5000, 1221.9375 + 480.5000) = 1963.4500 kip-ft | V_truck = 31.1649 kip | V_tandem = 31.3194 kip | V+ = max(31.1649 + 6.2000, 31.3194 + 6.2000) = 37.5194 kip | V- = min(-36.3476 + -6.2000, -31.5339 + -6.2000) = -42.5476 kip

0.6L | x = 46.5000 ft (0.6000L) | M_lane = 0.6400 * 46.5000 * (77.5000 - 46.5000) / 2 = 461.2800 kip-ft | M_truck = 1423.6320 kip-ft | M_tandem = 1183.7000 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(1423.6320 + 461.2800, 1183.7000 + 461.2800) = 1884.9120 kip-ft | V_truck = 21.5889 kip | V_tandem = 24.6694 kip | V+ = max(21.5889 + 3.9680, 24.6694 + 3.9680) = 28.6374 kip | V- = min(-45.9236 + -8.9280, -38.1839 + -8.9280) = -54.8516 kip

0.7L | x = 54.2500 ft (0.7000L) | M_lane = 0.6400 * 54.2500 * (77.5000 - 54.2500) / 2 = 403.6200 kip-ft | M_truck = 1290.3660 kip-ft | M_tandem = 1042.3875 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(1290.3660 + 403.6200, 1042.3875 + 403.6200) = 1693.9860 kip-ft | V_truck = 12.0129 kip | V_tandem = 18.0194 kip | V+ = max(12.0129 + 2.2320, 18.0194 + 2.2320) = 20.2514 kip | V- = min(-55.4996 + -12.1520, -44.8339 + -12.1520) = -67.6516 kip

0.8L | x = 62.0000 ft (0.8000L) | M_lane = 0.6400 * 62.0000 * (77.5000 - 62.0000) / 2 = 307.5200 kip-ft | M_truck = 1008.6720 kip-ft | M_tandem = 798.0000 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(1008.6720 + 307.5200, 798.0000 + 307.5200) = 1316.1920 kip-ft | V_truck = 2.7801 kip | V_tandem = 11.3694 kip | V+ = max(2.7801 + 0.9920, 11.3694 + 0.9920) = 12.3614 kip | V- = min(-65.0756 + -15.8720, -51.4839 + -15.8720) = -80.9476 kip

0.9L | x = 69.7500 ft (0.9000L) | M_lane = 0.6400 * 69.7500 * (77.5000 - 69.7500) / 2 = 172.9800 kip-ft | M_truck = 578.5500 kip-ft | M_tandem = 450.5375 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(578.5500 + 172.9800, 450.5375 + 172.9800) = 751.5300 kip-ft | V_truck = 1.0297 kip | V_tandem = 4.7194 kip | V+ = max(1.0297 + 0.2480, 4.7194 + 0.2480) = 4.9674 kip | V- = min(-74.6516 + -20.0880, -58.1339 + -20.0880) = -94.7396 kip

60db from right support | x = 75.0000 ft (0.9677L) | M_lane = 0.6400 * 75.0000 * (77.5000 - 75.0000) / 2 = 60.0000 kip-ft | M_truck = 202.8465 kip-ft | M_tandem = 156.5968 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(202.8465 + 60.0000, 156.5968 + 60.0000) = 262.8465 kip-ft | V_truck = 0.3089 kip | V_tandem = 0.9653 kip | V+ = max(0.3089 + 0.0258, 0.9653 + 0.0258) = 0.9911 kip | V- = min(-81.1386 + -23.2258, -62.6387 + -23.2258) = -104.3644 kip

H/2 from right support | x = 76.2500 ft (0.9839L) | M_lane = 0.6400 * 76.2500 * (77.5000 - 76.2500) / 2 = 30.5000 kip-ft | M_truck = 103.3539 kip-ft | M_tandem = 79.6391 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(103.3539 + 30.5000, 79.6391 + 30.5000) = 133.8539 kip-ft | V_truck = 0.1373 kip | V_tandem = 0.4290 kip | V+ = max(0.1373 + 0.0065, 0.4290 + 0.0065) = 0.4355 kip | V- = min(-82.6831 + -24.0065, -63.7113 + -24.0065) = -106.6895 kip

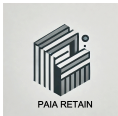
1.0L | x = 77.5000 ft (1.0000L) | M_lane = 0.6400 * 77.5000 * (77.5000 - 77.5000) / 2 = 0.0000 kip-ft | M_truck = 0.0000 kip-ft | M_tandem = 0.0000 kip-ft | M_HL93 = max(M_truck + M_lane, M_tandem + M_lane) = max(0.0000 + 0.0000, 0.0000 + 0.0000) = 0.0000 kip-ft | V_truck = 0.0000 kip | V_tandem = 0.0000 kip | V+ = max(0.0000 + 0.0000, 0.0000 + 0.0000) = 0.0000 kip | V- = min(-84.2276 + -24.8000, -64.7839 + -24.8000) = -109.0276 kip

Governing moment = 1963.4500 kip-ft at x = 38.7500 ft

Governing shear = max(|V+|, |V-|) = 109.0276 kip

Governing shear location = x = 77.5000 ft

HL-93 envelope computed at 16 stations; max moment = 1963.4500 kip-ft, max positive shear = 101.9572 kip, max negative shear = -109.0276 kip

**Prestress Girder Detailed Calculation Report**

This block computes the HL-93 simple-span live-load envelope at 0.1L stations.

2) Girder Dead Load After Fabrication

$L = 79.0000 \text{ ft}$

$\gamma_{a1} = 0.1600 \rightarrow 0.1600 \text{ kcf}$

$A = 663.0000 \text{ in}^2$

$w_{DL} = \gamma_{a1} * A / 144 = 0.1600 * 663.0000 / 144 = 0.7367 \text{ kip/ft}$

Stations = 0.0L, H/2 from left support, 60db from left support, 0.1L, 0.2L, 0.3L, 0.4L, 0.5L, 0.6L, 0.7L, 0.8L, 0.9L, 60db from right support, H/2 from right support, 1.0L

0.0L | $x = 0.0000 \text{ ft (0.0000L)}$ | $M_{DL} = w_{DL} * x * (L - x) / 2 = 0.7367 * 0.0000 * (79.0000 - 0.0000) / 2 = 0.0000 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.7367 * (79.0000 / 2 - 0.0000) = 29.0983 \text{ kip}$

H/2 from left support | $x = 1.2500 \text{ ft (0.0158L)}$ | $M_{DL} = w_{DL} * x * (L - x) / 2 = 0.7367 * 1.2500 * (79.0000 - 1.2500) / 2 = 35.7974 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.7367 * (79.0000 / 2 - 1.2500) = 28.1775 \text{ kip}$

60db from left support | $x = 2.5000 \text{ ft (0.0316L)}$ | $M_{DL} = w_{DL} * x * (L - x) / 2 = 0.7367 * 2.5000 * (79.0000 - 2.5000) / 2 = 70.4438 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.7367 * (79.0000 / 2 - 2.5000) = 27.2567 \text{ kip}$

0.1L | $x = 7.9000 \text{ ft (0.1000L)}$ | $M_{DL} = w_{DL} * x * (L - x) / 2 = 0.7367 * 7.9000 * (79.0000 - 7.9000) / 2 = 206.8892 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.7367 * (79.0000 / 2 - 7.9000) = 23.2787 \text{ kip}$

0.2L | $x = 15.8000 \text{ ft (0.2000L)}$ | $M_{DL} = w_{DL} * x * (L - x) / 2 = 0.7367 * 15.8000 * (79.0000 - 15.8000) / 2 = 367.8029 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.7367 * (79.0000 / 2 - 15.8000) = 17.4590 \text{ kip}$

0.3L | $x = 23.7000 \text{ ft (0.3000L)}$ | $M_{DL} = w_{DL} * x * (L - x) / 2 = 0.7367 * 23.7000 * (79.0000 - 23.7000) / 2 = 482.7414 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.7367 * (79.0000 / 2 - 23.7000) = 11.6393 \text{ kip}$

0.4L | $x = 31.6000 \text{ ft (0.4000L)}$ | $M_{DL} = w_{DL} * x * (L - x) / 2 = 0.7367 * 31.6000 * (79.0000 - 31.6000) / 2 = 551.7044 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.7367 * (79.0000 / 2 - 31.6000) = 5.8197 \text{ kip}$

0.5L | $x = 39.5000 \text{ ft (0.5000L)}$ | $M_{DL} = w_{DL} * x * (L - x) / 2 = 0.7367 * 39.5000 * (79.0000 - 39.5000) / 2 = 574.6921 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.7367 * (79.0000 / 2 - 39.5000) = 0.0000 \text{ kip}$

0.6L | $x = 47.4000 \text{ ft (0.6000L)}$ | $M_{DL} = w_{DL} * x * (L - x) / 2 = 0.7367 * 47.4000 * (79.0000 - 47.4000) / 2 = 551.7044 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.7367 * (79.0000 / 2 - 47.4000) = -5.8197 \text{ kip}$

0.7L | $x = 55.3000 \text{ ft (0.7000L)}$ | $M_{DL} = w_{DL} * x * (L - x) / 2 = 0.7367 * 55.3000 * (79.0000 - 55.3000) / 2 = 482.7414 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.7367 * (79.0000 / 2 - 55.3000) = -11.6393 \text{ kip}$

0.8L | $x = 63.2000 \text{ ft (0.8000L)}$ | $M_{DL} = w_{DL} * x * (L - x) / 2 = 0.7367 * 63.2000 * (79.0000 - 63.2000) / 2 = 367.8029 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.7367 * (79.0000 / 2 - 63.2000) = -17.4590 \text{ kip}$

0.9L | $x = 71.1000 \text{ ft (0.9000L)}$ | $M_{DL} = w_{DL} * x * (L - x) / 2 = 0.7367 * 71.1000 * (79.0000 - 71.1000) / 2 = 206.8891 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.7367 * (79.0000 / 2 - 71.1000) = -23.2787 \text{ kip}$

60db from right support | $x = 75.0000 \text{ ft (0.9494L)}$ | $M_{DL} = w_{DL} * x * (L - x) / 2 = 0.7367 * 75.0000 * (79.0000 - 75.0000) / 2 = 110.5000 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.7367 * (79.0000 / 2 - 75.0000) = -26.1517 \text{ kip}$

H/2 from right support | $x = 76.2500 \text{ ft (0.9652L)}$ | $M_{DL} = w_{DL} * x * (L - x) / 2 = 0.7367 * 76.2500 * (79.0000 - 76.2500) / 2 = 77.2349 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.7367 * (79.0000 / 2 - 76.2500) = -27.0725 \text{ kip}$

1.0L | $x = 79.0000 \text{ ft (1.0000L)}$ | $M_{DL} = w_{DL} * x * (L - x) / 2 = 0.7367 * 79.0000 * (79.0000 - 79.0000) / 2 = 0.0000 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.7367 * (79.0000 / 2 - 79.0000) = -29.0983 \text{ kip}$

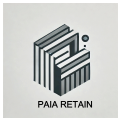
Governing moment = 574.6921 kip-ft at $x = 39.5000 \text{ ft}$

Governing positive shear = 29.0983 kip at $x = 0.0000 \text{ ft}$

Governing negative shear = -29.0983 kip at $x = 79.0000 \text{ ft}$

Girder dead load envelope computed at 15 stations; $w_{DL} = 0.7367 \text{ kip/ft}$, max moment = 574.6921 kip-ft, max positive shear = 29.0983 kip, max negative shear = -29.0983 kip

This block computes the girder dead load after fabrication at 0.1L stations.

**Prestress Girder Detailed Calculation Report****3) Installed Girder Dead Load**

L = 77.5000 ft

gamma1 = 0.1600 -> 0.1600 kcf

A = 663.0000 in²

wDL = gamma1 * A / 144 = 0.1600 * 663.0000 / 144 = 0.7367 kip/ft

Stations = 0.0L, H/2 from left support, 60db from left support, 0.1L, 0.2L, 0.3L, 0.4L, 0.5L, 0.6L, 0.7L, 0.8L, 0.9L, 60db from right support, H/2 from right support, 1.0L

0.0L | x = 0.0000 ft (0.0000L) | M_DL = wDL*x*(L-x)/2 = 0.7367 * 0.0000 * (77.5000 - 0.0000) / 2 = 0.0000 kip-ft
| V_DL = wDL*(L/2 - x) = 0.7367 * (77.5000 / 2 - 0.0000) = 28.5458 kip

H/2 from left support | x = 1.2500 ft (0.0161L) | M_DL = wDL*x*(L-x)/2 = 0.7367 * 1.2500 * (77.5000 - 1.2500) / 2 = 35.1068 kip-ft | V_DL = wDL*(L/2 - x) = 0.7367 * (77.5000 / 2 - 1.2500) = 27.6250 kip

60db from left support | x = 2.5000 ft (0.0323L) | M_DL = wDL*x*(L-x)/2 = 0.7367 * 2.5000 * (77.5000 - 2.5000) / 2 = 69.0625 kip-ft | V_DL = wDL*(L/2 - x) = 0.7367 * (77.5000 / 2 - 2.5000) = 26.7042 kip

0.1L | x = 7.7500 ft (0.1000L) | M_DL = wDL*x*(L-x)/2 = 0.7367 * 7.7500 * (77.5000 - 7.7500) / 2 = 199.1072 kip-ft | V_DL = wDL*(L/2 - x) = 0.7367 * (77.5000 / 2 - 7.7500) = 22.8367 kip

0.2L | x = 15.5000 ft (0.2000L) | M_DL = wDL*x*(L-x)/2 = 0.7367 * 15.5000 * (77.5000 - 15.5000) / 2 = 353.9683 kip-ft | V_DL = wDL*(L/2 - x) = 0.7367 * (77.5000 / 2 - 15.5000) = 17.1275 kip

0.3L | x = 23.2500 ft (0.3000L) | M_DL = wDL*x*(L-x)/2 = 0.7367 * 23.2500 * (77.5000 - 23.2500) / 2 = 464.5834 kip-ft | V_DL = wDL*(L/2 - x) = 0.7367 * (77.5000 / 2 - 23.2500) = 11.4183 kip

0.4L | x = 31.0000 ft (0.4000L) | M_DL = wDL*x*(L-x)/2 = 0.7367 * 31.0000 * (77.5000 - 31.0000) / 2 = 530.9525 kip-ft | V_DL = wDL*(L/2 - x) = 0.7367 * (77.5000 / 2 - 31.0000) = 5.7092 kip

0.5L | x = 38.7500 ft (0.5000L) | M_DL = wDL*x*(L-x)/2 = 0.7367 * 38.7500 * (77.5000 - 38.7500) / 2 = 553.0755 kip-ft | V_DL = wDL*(L/2 - x) = 0.7367 * (77.5000 / 2 - 38.7500) = 0.0000 kip

0.6L | x = 46.5000 ft (0.6000L) | M_DL = wDL*x*(L-x)/2 = 0.7367 * 46.5000 * (77.5000 - 46.5000) / 2 = 530.9525 kip-ft | V_DL = wDL*(L/2 - x) = 0.7367 * (77.5000 / 2 - 46.5000) = -5.7092 kip

0.7L | x = 54.2500 ft (0.7000L) | M_DL = wDL*x*(L-x)/2 = 0.7367 * 54.2500 * (77.5000 - 54.2500) / 2 = 464.5834 kip-ft | V_DL = wDL*(L/2 - x) = 0.7367 * (77.5000 / 2 - 54.2500) = -11.4183 kip

0.8L | x = 62.0000 ft (0.8000L) | M_DL = wDL*x*(L-x)/2 = 0.7367 * 62.0000 * (77.5000 - 62.0000) / 2 = 353.9683 kip-ft | V_DL = wDL*(L/2 - x) = 0.7367 * (77.5000 / 2 - 62.0000) = -17.1275 kip

0.9L | x = 69.7500 ft (0.9000L) | M_DL = wDL*x*(L-x)/2 = 0.7367 * 69.7500 * (77.5000 - 69.7500) / 2 = 199.1072 kip-ft | V_DL = wDL*(L/2 - x) = 0.7367 * (77.5000 / 2 - 69.7500) = -22.8367 kip

60db from right support | x = 75.0000 ft (0.9677L) | M_DL = wDL*x*(L-x)/2 = 0.7367 * 75.0000 * (77.5000 - 75.0000) / 2 = 69.0625 kip-ft | V_DL = wDL*(L/2 - x) = 0.7367 * (77.5000 / 2 - 75.0000) = -26.7042 kip

H/2 from right support | x = 76.2500 ft (0.9839L) | M_DL = wDL*x*(L-x)/2 = 0.7367 * 76.2500 * (77.5000 - 76.2500) / 2 = 35.1068 kip-ft | V_DL = wDL*(L/2 - x) = 0.7367 * (77.5000 / 2 - 76.2500) = -27.6250 kip

1.0L | x = 77.5000 ft (1.0000L) | M_DL = wDL*x*(L-x)/2 = 0.7367 * 77.5000 * (77.5000 - 77.5000) / 2 = 0.0000 kip-ft | V_DL = wDL*(L/2 - x) = 0.7367 * (77.5000 / 2 - 77.5000) = -28.5458 kip

Governing moment = 553.0755 kip-ft at x = 38.7500 ft

Governing positive shear = 28.5458 kip at x = 0.0000 ft

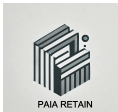
Governing negative shear = -28.5458 kip at x = 77.5000 ft

Installed girder dead load envelope computed at 15 stations; wDL = 0.7367 kip/ft, max moment = 553.0755 kip-ft, max positive shear = 28.5458 kip, max negative shear = -28.5458 kip

This block computes the installed girder dead load using the span length, gamma 1, and girder area.

4) Top Slab Dead Load

L = 77.5000 ft

**Prestress Girder Detailed Calculation Report**

$\gamma_{a1} = 0.1600 \rightarrow 0.1600 \text{ kcf}$

$t_s(\text{ave}) = 6.0000 \text{ in}$

$\text{width} = b_e = 40.0000 \text{ in}$

$w_{DL} = \gamma_{a1} * t_s(\text{ave}) * \text{width} / 144 = 0.1600 * 6.0000 * 40.0000 / 144 = 0.2667 \text{ kip/ft}$

Stations = 0.0L, H/2 from left support, 60db from left support, 0.1L, 0.2L, 0.3L, 0.4L, 0.5L, 0.6L, 0.7L, 0.8L, 0.9L, 60db from right support, H/2 from right support, 1.0L

0.0L | $x = 0.0000 \text{ ft (0.0000L)}$ | $M_{DL} = w_{DL} * x * (L-x)/2 = 0.2667 * 0.0000 * (77.5000 - 0.0000) / 2 = 0.0000 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.2667 * (77.5000 / 2 - 0.0000) = 10.3333 \text{ kip}$

H/2 from left support | $x = 1.2500 \text{ ft (0.0161L)}$ | $M_{DL} = w_{DL} * x * (L-x)/2 = 0.2667 * 1.2500 * (77.5000 - 1.2500) / 2 = 12.7083 \text{ kip-ft}$ | $V_{DL} = w_{DL} * (L/2 - x) = 0.2667 * (77.5000 / 2 - 1.2500) = 10.0000 \text{ kip}$

60db from left support | $x = 2.5000 \text{ ft (0.0323L)}$ | $M_{DL} = w_{DL} * x * (L-x)/2 = 0.2667 * 2.5000 * (77.5000 - 2.5000) / 2 = 25.0000 \text{ kip-ft}$ | $V_{DL} = w_{DL} * (L/2 - x) = 0.2667 * (77.5000 / 2 - 2.5000) = 9.6667 \text{ kip}$

0.1L | $x = 7.7500 \text{ ft (0.1000L)}$ | $M_{DL} = w_{DL} * x * (L-x)/2 = 0.2667 * 7.7500 * (77.5000 - 7.7500) / 2 = 72.0750 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.2667 * (77.5000 / 2 - 7.7500) = 8.2667 \text{ kip}$

0.2L | $x = 15.5000 \text{ ft (0.2000L)}$ | $M_{DL} = w_{DL} * x * (L-x)/2 = 0.2667 * 15.5000 * (77.5000 - 15.5000) / 2 = 128.1333 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.2667 * (77.5000 / 2 - 15.5000) = 6.2000 \text{ kip}$

0.3L | $x = 23.2500 \text{ ft (0.3000L)}$ | $M_{DL} = w_{DL} * x * (L-x)/2 = 0.2667 * 23.2500 * (77.5000 - 23.2500) / 2 = 168.1750 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.2667 * (77.5000 / 2 - 23.2500) = 4.1333 \text{ kip}$

0.4L | $x = 31.0000 \text{ ft (0.4000L)}$ | $M_{DL} = w_{DL} * x * (L-x)/2 = 0.2667 * 31.0000 * (77.5000 - 31.0000) / 2 = 192.2000 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.2667 * (77.5000 / 2 - 31.0000) = 2.0667 \text{ kip}$

0.5L | $x = 38.7500 \text{ ft (0.5000L)}$ | $M_{DL} = w_{DL} * x * (L-x)/2 = 0.2667 * 38.7500 * (77.5000 - 38.7500) / 2 = 200.2083 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.2667 * (77.5000 / 2 - 38.7500) = 0.0000 \text{ kip}$

0.6L | $x = 46.5000 \text{ ft (0.6000L)}$ | $M_{DL} = w_{DL} * x * (L-x)/2 = 0.2667 * 46.5000 * (77.5000 - 46.5000) / 2 = 192.2000 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.2667 * (77.5000 / 2 - 46.5000) = -2.0667 \text{ kip}$

0.7L | $x = 54.2500 \text{ ft (0.7000L)}$ | $M_{DL} = w_{DL} * x * (L-x)/2 = 0.2667 * 54.2500 * (77.5000 - 54.2500) / 2 = 168.1750 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.2667 * (77.5000 / 2 - 54.2500) = -4.1333 \text{ kip}$

0.8L | $x = 62.0000 \text{ ft (0.8000L)}$ | $M_{DL} = w_{DL} * x * (L-x)/2 = 0.2667 * 62.0000 * (77.5000 - 62.0000) / 2 = 128.1333 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.2667 * (77.5000 / 2 - 62.0000) = -6.2000 \text{ kip}$

0.9L | $x = 69.7500 \text{ ft (0.9000L)}$ | $M_{DL} = w_{DL} * x * (L-x)/2 = 0.2667 * 69.7500 * (77.5000 - 69.7500) / 2 = 72.0750 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.2667 * (77.5000 / 2 - 69.7500) = -8.2667 \text{ kip}$

60db from right support | $x = 75.0000 \text{ ft (0.9677L)}$ | $M_{DL} = w_{DL} * x * (L-x)/2 = 0.2667 * 75.0000 * (77.5000 - 75.0000) / 2 = 25.0000 \text{ kip-ft}$ | $V_{DL} = w_{DL} * (L/2 - x) = 0.2667 * (77.5000 / 2 - 75.0000) = -9.6667 \text{ kip}$

H/2 from right support | $x = 76.2500 \text{ ft (0.9839L)}$ | $M_{DL} = w_{DL} * x * (L-x)/2 = 0.2667 * 76.2500 * (77.5000 - 76.2500) / 2 = 12.7083 \text{ kip-ft}$ | $V_{DL} = w_{DL} * (L/2 - x) = 0.2667 * (77.5000 / 2 - 76.2500) = -10.0000 \text{ kip}$

1.0L | $x = 77.5000 \text{ ft (1.0000L)}$ | $M_{DL} = w_{DL} * x * (L-x)/2 = 0.2667 * 77.5000 * (77.5000 - 77.5000) / 2 = 0.0000 \text{ kip-ft}$
| $V_{DL} = w_{DL} * (L/2 - x) = 0.2667 * (77.5000 / 2 - 77.5000) = -10.3333 \text{ kip}$

Governing moment = 200.2083 kip-ft at $x = 38.7500 \text{ ft}$

Governing positive shear = 10.3333 kip at $x = 0.0000 \text{ ft}$

Governing negative shear = -10.3333 kip at $x = 77.5000 \text{ ft}$

Top slab dead load envelope computed at 15 stations; $w_{DL} = 0.2667 \text{ kip/ft}$, max moment = 200.2083 kip-ft, max positive shear = 10.3333 kip, max negative shear = -10.3333 kip

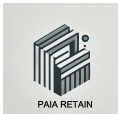
This block computes the top slab dead load using t_s average and the effective width or girder width.

5) Barrier Wall Dead Load

$L = 77.5000 \text{ ft}$

Bw input = 0.1800 klf (per_girder)

Load basis: Input treated as load on this girder

**Prestress Girder Detailed Calculation Report**

wDL = Bw = 0.1800 kip/ft

Stations = 0.0L, H/2 from left support, 60db from left support, 0.1L, 0.2L, 0.3L, 0.4L, 0.5L, 0.6L, 0.7L, 0.8L, 0.9L, 60db from right support, H/2 from right support, 1.0L

0.0L | x = 0.0000 ft (0.0000L) | M_DL = wDL*x*(L-x)/2 = 0.1800 * 0.0000 * (77.5000 - 0.0000) / 2 = 0.0000 kip-ft
| V_DL = wDL*(L/2 - x) = 0.1800 * (77.5000 / 2 - 0.0000) = 6.9750 kip

H/2 from left support | x = 1.2500 ft (0.0161L) | M_DL = wDL*x*(L-x)/2 = 0.1800 * 1.2500 * (77.5000 - 1.2500) / 2 = 8.5781 kip-ft | V_DL = wDL*(L/2 - x) = 0.1800 * (77.5000 / 2 - 1.2500) = 6.7500 kip

60db from left support | x = 2.5000 ft (0.0323L) | M_DL = wDL*x*(L-x)/2 = 0.1800 * 2.5000 * (77.5000 - 2.5000) / 2 = 16.8750 kip-ft | V_DL = wDL*(L/2 - x) = 0.1800 * (77.5000 / 2 - 2.5000) = 6.5250 kip

0.1L | x = 7.7500 ft (0.1000L) | M_DL = wDL*x*(L-x)/2 = 0.1800 * 7.7500 * (77.5000 - 7.7500) / 2 = 48.6506 kip-ft
| V_DL = wDL*(L/2 - x) = 0.1800 * (77.5000 / 2 - 7.7500) = 5.5800 kip

0.2L | x = 15.5000 ft (0.2000L) | M_DL = wDL*x*(L-x)/2 = 0.1800 * 15.5000 * (77.5000 - 15.5000) / 2 = 86.4900 kip-ft
| V_DL = wDL*(L/2 - x) = 0.1800 * (77.5000 / 2 - 15.5000) = 4.1850 kip

0.3L | x = 23.2500 ft (0.3000L) | M_DL = wDL*x*(L-x)/2 = 0.1800 * 23.2500 * (77.5000 - 23.2500) / 2 = 113.5181 kip-ft
| V_DL = wDL*(L/2 - x) = 0.1800 * (77.5000 / 2 - 23.2500) = 2.7900 kip

0.4L | x = 31.0000 ft (0.4000L) | M_DL = wDL*x*(L-x)/2 = 0.1800 * 31.0000 * (77.5000 - 31.0000) / 2 = 129.7350 kip-ft
| V_DL = wDL*(L/2 - x) = 0.1800 * (77.5000 / 2 - 31.0000) = 1.3950 kip

0.5L | x = 38.7500 ft (0.5000L) | M_DL = wDL*x*(L-x)/2 = 0.1800 * 38.7500 * (77.5000 - 38.7500) / 2 = 135.1406 kip-ft
| V_DL = wDL*(L/2 - x) = 0.1800 * (77.5000 / 2 - 38.7500) = 0.0000 kip

0.6L | x = 46.5000 ft (0.6000L) | M_DL = wDL*x*(L-x)/2 = 0.1800 * 46.5000 * (77.5000 - 46.5000) / 2 = 129.7350 kip-ft
| V_DL = wDL*(L/2 - x) = 0.1800 * (77.5000 / 2 - 46.5000) = -1.3950 kip

0.7L | x = 54.2500 ft (0.7000L) | M_DL = wDL*x*(L-x)/2 = 0.1800 * 54.2500 * (77.5000 - 54.2500) / 2 = 113.5181 kip-ft
| V_DL = wDL*(L/2 - x) = 0.1800 * (77.5000 / 2 - 54.2500) = -2.7900 kip

0.8L | x = 62.0000 ft (0.8000L) | M_DL = wDL*x*(L-x)/2 = 0.1800 * 62.0000 * (77.5000 - 62.0000) / 2 = 86.4900 kip-ft
| V_DL = wDL*(L/2 - x) = 0.1800 * (77.5000 / 2 - 62.0000) = -4.1850 kip

0.9L | x = 69.7500 ft (0.9000L) | M_DL = wDL*x*(L-x)/2 = 0.1800 * 69.7500 * (77.5000 - 69.7500) / 2 = 48.6506 kip-ft
| V_DL = wDL*(L/2 - x) = 0.1800 * (77.5000 / 2 - 69.7500) = -5.5800 kip

60db from right support | x = 75.0000 ft (0.9677L) | M_DL = wDL*x*(L-x)/2 = 0.1800 * 75.0000 * (77.5000 - 75.0000) / 2 = 16.8750 kip-ft
| V_DL = wDL*(L/2 - x) = 0.1800 * (77.5000 / 2 - 75.0000) = -6.5250 kip

H/2 from right support | x = 76.2500 ft (0.9839L) | M_DL = wDL*x*(L-x)/2 = 0.1800 * 76.2500 * (77.5000 - 76.2500) / 2 = 8.5781 kip-ft
| V_DL = wDL*(L/2 - x) = 0.1800 * (77.5000 / 2 - 76.2500) = -6.7500 kip

1.0L | x = 77.5000 ft (1.0000L) | M_DL = wDL*x*(L-x)/2 = 0.1800 * 77.5000 * (77.5000 - 77.5000) / 2 = 0.0000 kip-ft
| V_DL = wDL*(L/2 - x) = 0.1800 * (77.5000 / 2 - 77.5000) = -6.9750 kip

Governing moment = 135.1406 kip-ft at x = 38.7500 ft

Governing positive shear = 6.9750 kip at x = 0.0000 ft

Governing negative shear = -6.9750 kip at x = 77.5000 ft

Barrier wall dead load envelope computed at 15 stations; wDL = 0.1800 kip/ft, max moment = 135.1406 kip-ft, max positive shear = 6.9750 kip, max negative shear = -6.9750 kip

This block computes the barrier wall dead load using the Bw input as a uniform line load.

6) Future Wearing Surface Dead Load

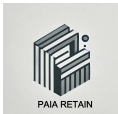
L = 77.5000 ft

fww = 0.0175 ksf

width = be = 40.0000 in = 3.3333 ft

wDL = fww * width = 0.0175 * 3.3333 = 0.0583 kip/ft

Stations = 0.0L, H/2 from left support, 60db from left support, 0.1L, 0.2L, 0.3L, 0.4L, 0.5L, 0.6L, 0.7L, 0.8L, 0.9L, 60db from right support, H/2 from right support, 1.0L

**Prestress Girder Detailed Calculation Report**

0.0L | $x = 0.0000$ ft (0.0000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.0583 \cdot 0.0000 \cdot (77.5000 - 0.0000) / 2 = 0.0000$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.0583 \cdot (77.5000 / 2 - 0.0000) = 2.2604$ kip

H/2 from left support | $x = 1.2500$ ft (0.0161L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.0583 \cdot 1.2500 \cdot (77.5000 - 1.2500) / 2 = 2.7799$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.0583 \cdot (77.5000 / 2 - 1.2500) = 2.1875$ kip

60db from left support | $x = 2.5000$ ft (0.0323L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.0583 \cdot 2.5000 \cdot (77.5000 - 2.5000) / 2 = 5.4688$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.0583 \cdot (77.5000 / 2 - 2.5000) = 2.1146$ kip

0.1L | $x = 7.7500$ ft (0.1000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.0583 \cdot 7.7500 \cdot (77.5000 - 7.7500) / 2 = 15.7664$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.0583 \cdot (77.5000 / 2 - 7.7500) = 1.8083$ kip

0.2L | $x = 15.5000$ ft (0.2000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.0583 \cdot 15.5000 \cdot (77.5000 - 15.5000) / 2 = 28.0292$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.0583 \cdot (77.5000 / 2 - 15.5000) = 1.3563$ kip

0.3L | $x = 23.2500$ ft (0.3000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.0583 \cdot 23.2500 \cdot (77.5000 - 23.2500) / 2 = 36.7883$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.0583 \cdot (77.5000 / 2 - 23.2500) = 0.9042$ kip

0.4L | $x = 31.0000$ ft (0.4000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.0583 \cdot 31.0000 \cdot (77.5000 - 31.0000) / 2 = 42.0438$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.0583 \cdot (77.5000 / 2 - 31.0000) = 0.4521$ kip

0.5L | $x = 38.7500$ ft (0.5000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.0583 \cdot 38.7500 \cdot (77.5000 - 38.7500) / 2 = 43.7956$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.0583 \cdot (77.5000 / 2 - 38.7500) = 0.0000$ kip

0.6L | $x = 46.5000$ ft (0.6000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.0583 \cdot 46.5000 \cdot (77.5000 - 46.5000) / 2 = 42.0438$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.0583 \cdot (77.5000 / 2 - 46.5000) = -0.4521$ kip

0.7L | $x = 54.2500$ ft (0.7000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.0583 \cdot 54.2500 \cdot (77.5000 - 54.2500) / 2 = 36.7883$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.0583 \cdot (77.5000 / 2 - 54.2500) = -0.9042$ kip

0.8L | $x = 62.0000$ ft (0.8000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.0583 \cdot 62.0000 \cdot (77.5000 - 62.0000) / 2 = 28.0292$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.0583 \cdot (77.5000 / 2 - 62.0000) = -1.3563$ kip

0.9L | $x = 69.7500$ ft (0.9000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.0583 \cdot 69.7500 \cdot (77.5000 - 69.7500) / 2 = 15.7664$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.0583 \cdot (77.5000 / 2 - 69.7500) = -1.8083$ kip

60db from right support | $x = 75.0000$ ft (0.9677L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.0583 \cdot 75.0000 \cdot (77.5000 - 75.0000) / 2 = 5.4688$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.0583 \cdot (77.5000 / 2 - 75.0000) = -2.1146$ kip

H/2 from right support | $x = 76.2500$ ft (0.9839L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.0583 \cdot 76.2500 \cdot (77.5000 - 76.2500) / 2 = 2.7799$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.0583 \cdot (77.5000 / 2 - 76.2500) = -2.1875$ kip

1.0L | $x = 77.5000$ ft (1.0000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.0583 \cdot 77.5000 \cdot (77.5000 - 77.5000) / 2 = 0.0000$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.0583 \cdot (77.5000 / 2 - 77.5000) = -2.2604$ kip

Governing moment = 43.7956 kip-ft at $x = 38.7500$ ft

Governing positive shear = 2.2604 kip at $x = 0.0000$ ft

Governing negative shear = -2.2604 kip at $x = 77.5000$ ft

Future wearing surface dead load envelope computed at 15 stations; $wDL = 0.0583$ kip/ft, max moment = 43.7956 kip-ft, max positive shear = 2.2604 kip, max negative shear = -2.2604 kip

This block computes the future wearing surface dead load using fww and the effective width or girder width.

7) Utility Dead Load

$L = 77.5000$ ft

Wut input = 0.1500 klf (per_girder)

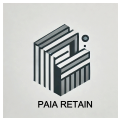
Load basis: Input treated as load on this girder

$wDL = Wut = 0.1500$ kip/ft

Stations = 0.0L, H/2 from left support, 60db from left support, 0.1L, 0.2L, 0.3L, 0.4L, 0.5L, 0.6L, 0.7L, 0.8L, 0.9L, 60db from right support, H/2 from right support, 1.0L

0.0L | $x = 0.0000$ ft (0.0000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.1500 \cdot 0.0000 \cdot (77.5000 - 0.0000) / 2 = 0.0000$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.1500 \cdot (77.5000 / 2 - 0.0000) = 5.8125$ kip

H/2 from left support | $x = 1.2500$ ft (0.0161L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.1500 \cdot 1.2500 \cdot (77.5000 - 1.2500) / 2 = 7.1484$ kip-ft
| $V_{DL} = wDL \cdot (L/2 - x) = 0.1500 \cdot (77.5000 / 2 - 1.2500) = 5.6250$ kip



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60db from left support | $x = 2.5000$ ft (0.0323L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.1500 \cdot 2.5000 \cdot (77.5000 - 2.5000) / 2 = 14.0625$ kip-ft | $V_{DL} = wDL \cdot (L/2 - x) = 0.1500 \cdot (77.5000 / 2 - 2.5000) = 5.4375$ kip

0.1L | $x = 7.7500$ ft (0.1000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.1500 \cdot 7.7500 \cdot (77.5000 - 7.7500) / 2 = 40.5422$ kip-ft | $V_{DL} = wDL \cdot (L/2 - x) = 0.1500 \cdot (77.5000 / 2 - 7.7500) = 4.6500$ kip

0.2L | $x = 15.5000$ ft (0.2000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.1500 \cdot 15.5000 \cdot (77.5000 - 15.5000) / 2 = 72.0750$ kip-ft | $V_{DL} = wDL \cdot (L/2 - x) = 0.1500 \cdot (77.5000 / 2 - 15.5000) = 3.4875$ kip

0.3L | $x = 23.2500$ ft (0.3000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.1500 \cdot 23.2500 \cdot (77.5000 - 23.2500) / 2 = 94.5984$ kip-ft | $V_{DL} = wDL \cdot (L/2 - x) = 0.1500 \cdot (77.5000 / 2 - 23.2500) = 2.3250$ kip

0.4L | $x = 31.0000$ ft (0.4000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.1500 \cdot 31.0000 \cdot (77.5000 - 31.0000) / 2 = 108.1125$ kip-ft | $V_{DL} = wDL \cdot (L/2 - x) = 0.1500 \cdot (77.5000 / 2 - 31.0000) = 1.1625$ kip

0.5L | $x = 38.7500$ ft (0.5000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.1500 \cdot 38.7500 \cdot (77.5000 - 38.7500) / 2 = 112.6172$ kip-ft | $V_{DL} = wDL \cdot (L/2 - x) = 0.1500 \cdot (77.5000 / 2 - 38.7500) = 0.0000$ kip

0.6L | $x = 46.5000$ ft (0.6000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.1500 \cdot 46.5000 \cdot (77.5000 - 46.5000) / 2 = 108.1125$ kip-ft | $V_{DL} = wDL \cdot (L/2 - x) = 0.1500 \cdot (77.5000 / 2 - 46.5000) = -1.1625$ kip

0.7L | $x = 54.2500$ ft (0.7000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.1500 \cdot 54.2500 \cdot (77.5000 - 54.2500) / 2 = 94.5984$ kip-ft | $V_{DL} = wDL \cdot (L/2 - x) = 0.1500 \cdot (77.5000 / 2 - 54.2500) = -2.3250$ kip

0.8L | $x = 62.0000$ ft (0.8000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.1500 \cdot 62.0000 \cdot (77.5000 - 62.0000) / 2 = 72.0750$ kip-ft | $V_{DL} = wDL \cdot (L/2 - x) = 0.1500 \cdot (77.5000 / 2 - 62.0000) = -3.4875$ kip

0.9L | $x = 69.7500$ ft (0.9000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.1500 \cdot 69.7500 \cdot (77.5000 - 69.7500) / 2 = 40.5422$ kip-ft | $V_{DL} = wDL \cdot (L/2 - x) = 0.1500 \cdot (77.5000 / 2 - 69.7500) = -4.6500$ kip

60db from right support | $x = 75.0000$ ft (0.9677L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.1500 \cdot 75.0000 \cdot (77.5000 - 75.0000) / 2 = 14.0625$ kip-ft | $V_{DL} = wDL \cdot (L/2 - x) = 0.1500 \cdot (77.5000 / 2 - 75.0000) = -5.4375$ kip

H/2 from right support | $x = 76.2500$ ft (0.9839L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.1500 \cdot 76.2500 \cdot (77.5000 - 76.2500) / 2 = 7.1484$ kip-ft | $V_{DL} = wDL \cdot (L/2 - x) = 0.1500 \cdot (77.5000 / 2 - 76.2500) = -5.6250$ kip

1.0L | $x = 77.5000$ ft (1.0000L) | $M_{DL} = wDL \cdot x \cdot (L-x)/2 = 0.1500 \cdot 77.5000 \cdot (77.5000 - 77.5000) / 2 = 0.0000$ kip-ft | $V_{DL} = wDL \cdot (L/2 - x) = 0.1500 \cdot (77.5000 / 2 - 77.5000) = -5.8125$ kip

Governing moment = 112.6172 kip-ft at $x = 38.7500$ ft

Governing positive shear = 5.8125 kip at $x = 0.0000$ ft

Governing negative shear = -5.8125 kip at $x = 77.5000$ ft

Utility dead load envelope computed at 15 stations; $wDL = 0.1500$ kip/ft, max moment = 112.6172 kip-ft, max positive shear = 5.8125 kip, max negative shear = -5.8125 kip

This block computes the utility dead load using the submitted utility load input.