

Attachment Q.
Parametric Studies

NCHRP 18-15 LIGHTWEIGHT PRESTRESSED BRIDGE ELEMENTS

Parametric Study Summary

	6'-0" c-c girder spacing												Span Length	10'-0" c-c girder spacing												
	PCBT 45						PCBT 77							PCBT 45					PCBT 77							
	Lightweight		Lightweight		Normal Weight		Lightweight		Lightweight		Normal Weight			Lightweight		Lightweight		Normal Weight		Lightweight		Lightweight		Normal Weight		
Deck Concrete	Lightweight		Lightweight		Normal Weight		Lightweight		Lightweight		Normal Weight		Lightweight		Lightweight		Normal Weight		Lightweight		Lightweight		Normal Weight			
Girder Concrete	Lightweight		Normal Weight		Normal Weight		Lightweight		Normal Weight		Normal Weight		Lightweight		Normal Weight		Normal Weight		Lightweight		Normal Weight		Normal Weight			
f _c of Girder	8 ksi	10 ksi	8 ksi	10 ksi	8 ksi	10 ksi	8 ksi	10 ksi	8 ksi	10 ksi	8 ksi	10 ksi	8 ksi	10 ksi	8 ksi	10 ksi	8 ksi	10 ksi	8 ksi	10 ksi	8 ksi	10 ksi	8 ksi	10 ksi		
Span Length													Span Length													
90					30 (32)																					
95	32		34	32	36 (38)	34									14* (16)											
100	36	34	38	36	40 (44)	38									18* (16)		18*									
105	40	38	44	42	42										18*		18*		22*		24*					
110	42														20*		22*		24*							
115																										
120																										
125																										
130											38 (38)															
135							36				42 (42)		40													
140							40		38		44		42		46 (46)		44									
145							44		42		48		46		48											
150									46		52		50													
																			34*						34* (36)	
																	36		36*		38		38*		40 (44)	
																	40		38		42		40		42	
																			42		46		44			
# designs	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	

Notes

- * denotes the number of strands is controlled by ultimate flexural strength requirements
- Numbers in parentheses represent the number of strands from VDOT Preliminary Design Tables
- The reason for discrepancies between PESC and VDOT designs could be explained by the following:
 - In cases where the VDOT design requires more strands than the PESC design, the difference is likely due to the larger loads used by VDOT. VDOT includes dead load allowances for steel diaphragms, stay-in-place metal forms, and construction loads. The PESC design does not include these loads.
 - In cases where the PESC design requires more strands than the VDOT design, the difference is likely due to the minimum reinforcement requirement, which controls the PESC design in these cases. This requirement is controlled by either the cracking moment or the factored moment required by the applicable load combinations. Differences in applied loads as well as variations in how prestress losses are calculated can affect the minimum reinforcement requirement (VDOT uses the approximate estimate method to calculated prestress losses, while PESC uses the refined method).
- For runs with a lightweight concrete deck and a lightweight concrete girder, a phi (φ) of 0.85 for shear and a lambda (λ) of 1.0 was used.
- For runs with a lightweight concrete deck and a normal weight concrete girder, a phi (φ) of 0.90 for shear and a lambda (λ) of 1.0 was used.
- For runs with a normal weight concrete deck and a normal weight concrete girder, a phi (φ) of 0.90 for shear and a lambda (λ) of 1.0 was used.

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_LWC Slab_LWC Girder_8ksi_95' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 95.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 4,125 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.230 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.552 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 32
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.85 in
 e of Strands at Beam End: 18.85 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 15.93 ksi = 7.9%
 Total Prestress Loss at Service
 (including loss at transfer): 37.61 ksi = 19%

Deflections

Camber: 3.85 in ↑
 At Erection Before Deck: 4.43 in ↑
 After Deck: 3.18 in ↑
 Due to LL & Impact: 0.87 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.570	[-0.588]	2.978	[3.600]
Harp Point (N/A)		[3.600]		[3.600]
Midspan	0.314	[3.600]	2.114	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.139	[1.800]	1.350	[3.600]	--	--
Total Loads	0.767	[2.400]	1.852	[4.800]	-0.433	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 5,164 kip-ft
 Ultimate Moment, M_u: 4,710 kip-ft
 Strength for Min Reinf: 3,615 kip-ft

Nominal Shear Resistance:

Vertical Shear, V_c: 182.7 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 213.3 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (5) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 3.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 4.013 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_LWC Slab_LWC Girder_8ksi_100' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 100.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 4,125 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.230 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.545 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 36
 # Harped Strands: 6
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.56 in
 e of Strands at Beam End: 12.90 in
 Total Hold-Down Force: 15.4 kips

Prestress Losses

Prestress Loss at Transfer: 17.45 ksi = 8.6%
 Total Prestress Loss at Service
 (including loss at transfer): 39.73 ksi = 20%

Deflections

Camber: 4.38 in ↑
 At Erection Before Deck: 4.74 in ↑
 After Deck: 3.21 in ↑
 Due to LL & Impact: 1.01 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.016	[-0.588]	2.711	[3.600]
Harp Point (40.50 ft)	0.333	[3.600]	2.370	[3.600]
Midspan	0.376	[3.600]	2.329	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.154	[1.800]	1.523	[3.600]	--	--
Total Loads	0.821	[2.400]	2.056	[4.800]	-0.449	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 5,712 kip-ft
 Ultimate Moment, M_u: 5,101 kip-ft
 Strength for Min Reinf: 3,901 kip-ft

Nominal Shear Resistance:

Vertical Shear, V_c: 177.1 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 220.8 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 3.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 4.256 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_LWC Slab_LWC Girder_8ksi_105' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 105.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 4,125 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.230 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.537 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 40
 # Harped Strands: 6
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.33 in
 e of Strands at Beam End: 13.23 in
 Total Hold-Down Force: 14.6 kips

Prestress Losses

Prestress Loss at Transfer: 18.98 ksi = 9.4%
 Total Prestress Loss at Service
 (including loss at transfer): 41.84 ksi = 21%

Deflections

Camber: 5.29 in ↑
 At Erection Before Deck: 5.70 in ↑
 After Deck: 3.84 in ↑
 Due to LL & Impact: 1.16 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.058	[-0.588]	3.030	[3.600]
Harp Point (42.50 ft)	0.395	[3.600]	2.589	[3.600]
Midspan	0.442	[3.600]	2.543	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.170	[1.800]	1.706	[3.600]	--	--
Total Loads	0.874	[2.400]	2.269	[4.800]	-0.481	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 6,248 kip-ft
 Ultimate Moment, M_u: 5,498 kip-ft
 Strength for Min Reinf: 4,174 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 183.1 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 228.2 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (5) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 3.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 4.476 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_LWC Slab_LWC Girder_10ksi_100' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 100.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 4,612 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.230 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.550 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 34
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.70 in
 e of Strands at Beam End: 18.70 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 14.81 ksi = 7.3%
 Total Prestress Loss at Service
 (including loss at transfer): 32.95 ksi = 16%

Deflections

Camber: 4.05 in ↑
 At Erection Before Deck: 4.21 in ↑
 After Deck: 2.84 in ↑
 Due to LL & Impact: 0.95 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.593	[-0.657]	3.160	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	0.391	[4.500]	2.200	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.147	[1.800]	1.532	[4.500]	--	--
Total Loads	0.792	[2.400]	2.122	[6.000]	-0.520	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 5,440 kip-ft
 Ultimate Moment, M_u: 5,126 kip-ft
 Strength for Min Reinf: 3,906 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 201.0 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 220.8 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (4) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 3.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.891 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_LWC Slab_LWC Girder_10ksi_105' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 105.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 4,612 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.230 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.543 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 38
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.44 in
 e of Strands at Beam End: 18.44 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 16.22 ksi = 8.0%
 Total Prestress Loss at Service
 (including loss at transfer): 34.85 ksi = 17%

Deflections

Camber: 4.88 in ↑
 At Erection Before Deck: 5.03 in ↑
 After Deck: 3.37 in ↑
 Due to LL & Impact: 1.09 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.634	[-0.657]	3.484	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	0.456	[4.500]	2.421	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.163	[1.800]	1.712	[4.500]	--	--
Total Loads	0.845	[2.400]	2.336	[6.000]	-0.529	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 5,982 kip-ft
 Ultimate Moment, M_u: 5,530 kip-ft
 Strength for Min Reinf: 4,211 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 208.3 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 228.2 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (2) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 3.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 4.092 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_LWC Slab_LWC Girder_10ksi_110' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 110.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 4,612 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.230 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.537 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 42
 # Harped Strands: 6
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.13 in
 e of Strands at Beam End: 13.37 in
 Total Hold-Down Force: 13.2 kips

Prestress Losses

Prestress Loss at Transfer: 17.46 ksi = 8.6%
 Total Prestress Loss at Service
 (including loss at transfer): 36.48 ksi = 18%

Deflections

Camber: 5.45 in ↑
 At Erection Before Deck: 5.27 in ↑
 After Deck: 3.26 in ↑
 Due to LL & Impact: 1.24 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.074	[-0.657]	3.217	[4.500]
Harp Point (44.50 ft)	0.488	[4.500]	2.668	[4.500]
Midspan	0.539	[4.500]	2.618	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.178	[1.800]	1.919	[4.500]	--	--
Total Loads	0.898	[2.400]	2.578	[6.000]	-0.583	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 6,497 kip-ft
 Ultimate Moment, M_u: 5,951 kip-ft
 Strength for Min Reinf: 4,476 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 201.8 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 235.7 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (4) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (3) #6 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 4.298 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_LWC Slab_NWC Girder_8ksi_95' SPAN_φ = 0.90 λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 95.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.360 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.566 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 34
 # Harped Strands: 4
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.70 in
 e of Strands at Beam End: 14.58 in
 Total Hold-Down Force: 10.8 kips

Prestress Losses

Prestress Loss at Transfer: 12.40 ksi = 6.1%
 Total Prestress Loss at Service
 (including loss at transfer): 32.72 ksi = 16%

Deflections

Camber: 3.00 in ↑
 At Erection Before Deck: 3.03 in ↑
 After Deck: 2.08 in ↑
 Due to LL & Impact: 0.74 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.171	[-0.588]	2.784	[3.600]
Harp Point (38.50 ft)	0.427	[3.600]	2.200	[3.600]
Midspan	0.473	[3.600]	2.155	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.125	[1.800]	1.527	[3.600]	--	--
Total Loads	0.703	[2.400]	2.168	[4.800]	-0.451	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 5,440 kip-ft
 Ultimate Moment, M_u: 4,957 kip-ft
 Strength for Min Reinf: 4,403 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 170.1 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 220.3 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (5) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (3) #6 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.236 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_LWC Slab_NWC Girder_8ksi_100' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 100.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.360 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.558 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 38
 # Harped Strands: 6
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.44 in
 e of Strands at Beam End: 13.07 in
 Total Hold-Down Force: 15.4 kips

Prestress Losses

Prestress Loss at Transfer: 13.55 ksi = 6.7%
 Total Prestress Loss at Service
 (including loss at transfer): 34.35 ksi = 17%

Deflections

Camber: 3.58 in ↑
 At Erection Before Deck: 3.50 in ↑
 After Deck: 2.33 in ↑
 Due to LL & Impact: 0.86 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.023	[-0.588]	2.927	[3.600]
Harp Point (40.50 ft)	0.502	[3.600]	2.415	[3.600]
Midspan	0.554	[3.600]	2.365	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.138	[1.800]	1.723	[3.600]	--	--
Total Loads	0.750	[2.400]	2.402	[4.800]	-0.484	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 5,982 kip-ft
 Ultimate Moment, M_u: 5,368 kip-ft
 Strength for Min Reinf: 4,689 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 171.4 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 228.3 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (4) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (3) #6 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.413 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_LWC Slab_NWC Girder_8ksi_105' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 105.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.360 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.550 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 44
 # Harped Strands: 6
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 17.96 in
 e of Strands at Beam End: 13.50 in
 Total Hold-Down Force: 13.8 kips

Prestress Losses

Prestress Loss at Transfer: 15.34 ksi = 7.6%
 Total Prestress Loss at Service
 (including loss at transfer): 37.15 ksi = 18%

Deflections

Camber: 4.45 in ↑
 At Erection Before Deck: 4.45 in ↑
 After Deck: 3.03 in ↑
 Due to LL & Impact: 0.99 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.085	[-0.588]	3.413	[3.600]
Harp Point (42.50 ft)	0.586	[3.600]	2.758	[3.600]
Midspan	0.642	[3.600]	2.703	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.152	[1.800]	1.934	[3.600]	--	--
Total Loads	0.799	[2.400]	2.651	[4.800]	-0.414	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 6,744 kip-ft
 Ultimate Moment, M_u: 5,791 kip-ft
 Strength for Min Reinf: 5,115 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 177.7 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 236.4 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (1) #3 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #6 stirrups w/ 2 legs at 3.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.602 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_LWC Slab_NWC Girder_10ksi_95' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 95.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.360 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.571 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 32
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.85 in
 e of Strands at Beam End: 18.85 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 10.39 ksi = 5.1%
 Total Prestress Loss at Service
 (including loss at transfer): 27.04 ksi = 13%

Deflections

Camber: 2.70 in ↑
 At Erection Before Deck: 2.55 in ↑
 After Deck: 1.70 in ↑
 Due to LL & Impact: 0.70 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.569	[-0.657]	3.044	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	0.492	[4.500]	2.008	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.119	[1.800]	1.544	[4.500]	--	--
Total Loads	0.674	[2.400]	2.245	[6.000]	-0.557	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 5,164 kip-ft
 Ultimate Moment, M_u: 4,980 kip-ft
 Strength for Min Reinf: 4,426 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 188.3 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 220.3 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (3) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (3) #6 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.951 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_LWC Slab_NWC Girder_10ksi_100' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 100.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.360 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.563 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 36
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.56 in
 e of Strands at Beam End: 18.56 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 11.45 ksi = 5.7%
 Total Prestress Loss at Service
 (including loss at transfer): 28.53 ksi = 14%

Deflections

Camber: 3.29 in ↑
 At Erection Before Deck: 3.09 in ↑
 After Deck: 2.05 in ↑
 Due to LL & Impact: 0.81 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.610	[-0.657]	3.376	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	0.572	[4.500]	2.222	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.132	[1.800]	1.737	[4.500]	--	--
Total Loads	0.721	[2.400]	2.480	[6.000]	-0.568	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 5,712 kip-ft
 Ultimate Moment, M_u: 5,393 kip-ft
 Strength for Min Reinf: 4,740 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 192.7 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 228.3 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (1) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (3) #6 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.122 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_LWC Slab_NWC Girder_10ksi_105' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 105.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.360 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.556 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 42
 # Harped Strands: 6
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.13 in
 e of Strands at Beam End: 13.37 in
 Total Hold-Down Force: 13.8 kips

Prestress Losses

Prestress Loss at Transfer: 13.23 ksi = 6.5%
 Total Prestress Loss at Service
 (including loss at transfer): 31.21 ksi = 15%

Deflections

Camber: 3.87 in ↑
 At Erection Before Deck: 3.51 in ↑
 After Deck: 2.24 in ↑
 Due to LL & Impact: 0.93 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.064	[-0.657]	3.285	[4.500]
Harp Point (42.50 ft)	0.589	[4.500]	2.648	[4.500]
Midspan	0.645	[4.500]	2.593	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.145	[1.800]	1.936	[4.500]	--	--
Total Loads	0.768	[2.400]	2.723	[6.000]	-0.474	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 6,497 kip-ft
 Ultimate Moment, M_u: 5,823 kip-ft
 Strength for Min Reinf: 5,198 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 190.8 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 236.4 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (1) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (3) #6 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.294 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_NWC Slab_NWC Girder_8ksi_90' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 90.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.476 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.560 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 30
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.03 in
 e of Strands at Beam End: 19.03 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 11.20 ksi = 5.5%
 Total Prestress Loss at Service
 (including loss at transfer): 30.38 ksi = 15%

Deflections

Camber: 2.56 in ↑
 At Erection Before Deck: 2.71 in ↑
 After Deck: 1.79 in ↑
 Due to LL & Impact: 0.57 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.547	[-0.588]	2.860	[3.600]
Harp Point (N/A)		[3.600]		[3.600]
Midspan	0.401	[3.600]	1.935	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.125	[1.800]	1.477	[3.600]	--	--
Total Loads	0.715	[2.400]	1.949	[4.800]	-0.520	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 4,886 kip-ft
 Ultimate Moment, M_u: 4,645 kip-ft
 Strength for Min Reinf: 4,134 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 169.6 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 218.0 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (5) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (3) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.870 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_NWC Slab_NWC Girder_8ksi_95' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 95.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.476 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.552 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 36
 # Harped Strands: 4
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.56 in
 e of Strands at Beam End: 14.67 in
 Total Hold-Down Force: 10.8 kips

Prestress Losses

Prestress Loss at Transfer: 13.29 ksi = 6.6%
 Total Prestress Loss at Service
 (including loss at transfer): 33.76 ksi = 17%

Deflections

Camber: 3.14 in ↑
 At Erection Before Deck: 3.30 in ↑
 After Deck: 2.16 in ↑
 Due to LL & Impact: 0.67 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.194	[-0.588]	2.953	[3.600]
Harp Point (38.50 ft)	0.405	[3.600]	2.368	[3.600]
Midspan	0.451	[3.600]	2.323	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.139	[1.800]	1.655	[3.600]	--	--
Total Loads	0.767	[2.400]	2.157	[4.800]	-0.408	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 5,712 kip-ft
 Ultimate Moment, M_u: 5,057 kip-ft
 Strength for Min Reinf: 4,609 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 170.4 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 226.6 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (4) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 3.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.054 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_NWC Slab_NWC Girder_8ksi_100' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 100.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.476 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.545 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 40
 # Harped Strands: 6
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.33 in
 e of Strands at Beam End: 13.23 in
 Total Hold-Down Force: 15.4 kips

Prestress Losses

Prestress Loss at Transfer: 14.43 ksi = 7.1%
 Total Prestress Loss at Service
 (including loss at transfer): 35.32 ksi = 17%

Deflections

Camber: 3.75 in ↑
 At Erection Before Deck: 3.84 in ↑
 After Deck: 2.44 in ↑
 Due to LL & Impact: 0.77 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.048	[-0.588]	3.094	[3.600]
Harp Point (40.50 ft)	0.479	[3.600]	2.579	[3.600]
Midspan	0.531	[3.600]	2.529	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.154	[1.800]	1.864	[3.600]	--	--
Total Loads	0.821	[2.400]	2.397	[4.800]	-0.444	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 6,248 kip-ft
 Ultimate Moment, M_u: 5,485 kip-ft
 Strength for Min Reinf: 4,904 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 171.7 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 234.9 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (3) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 3.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.239 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_NWC Slab_NWC Girder_10ksi_95' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 95.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.476 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.558 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 34
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.70 in
 e of Strands at Beam End: 18.70 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 11.21 ksi = 5.5%
 Total Prestress Loss at Service
 (including loss at transfer): 27.97 ksi = 14%

Deflections

Camber: 2.84 in ↑
 At Erection Before Deck: 2.81 in ↑
 After Deck: 1.79 in ↑
 Due to LL & Impact: 0.62 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.592	[-0.657]	3.215	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	0.469	[4.500]	2.179	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.133	[1.800]	1.667	[4.500]	--	--
Total Loads	0.741	[2.400]	2.224	[6.000]	-0.496	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 5,440 kip-ft
 Ultimate Moment, M_u: 5,084 kip-ft
 Strength for Min Reinf: 4,657 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 190.5 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 226.6 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (4) #4 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 3.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.799 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_NWC Slab_NWC Girder_10ksi_100' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 100.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.476 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.550 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 38
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.44 in
 e of Strands at Beam End: 18.44 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 12.25 ksi = 6.0%
 Total Prestress Loss at Service
 (including loss at transfer): 29.38 ksi = 15%

Deflections

Camber: 3.44 in ↑
 At Erection Before Deck: 3.36 in ↑
 After Deck: 2.11 in ↑
 Due to LL & Impact: 0.72 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.634	[-0.657]	3.544	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	0.548	[4.500]	2.390	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.147	[1.800]	1.875	[4.500]	--	--
Total Loads	0.792	[2.400]	2.465	[6.000]	-0.521	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 5,982 kip-ft
 Ultimate Moment, M_u: 5,510 kip-ft
 Strength for Min Reinf: 4,967 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 193.3 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 234.9 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: No add'l reinforcement needed

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 3.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.960 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_6' SPACING_NWC Slab_NWC Girder_10ksi_105' SPAN_φ = 0.90 λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 105.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.476 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.543 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 42
 # Harped Strands: 6
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 18.13 in
 e of Strands at Beam End: 13.37 in
 Total Hold-Down Force: 13.8 kips

Prestress Losses

Prestress Loss at Transfer: 13.23 ksi = 6.5%
 Total Prestress Loss at Service
 (including loss at transfer): 30.70 ksi = 15%

Deflections

Camber: 3.87 in ↑
 At Erection Before Deck: 3.51 in ↑
 After Deck: 1.99 in ↑
 Due to LL & Impact: 0.83 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.064	[-0.657]	3.285	[4.500]
Harp Point (42.50 ft)	0.589	[4.500]	2.648	[4.500]
Midspan	0.645	[4.500]	2.593	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.163	[1.800]	2.109	[4.500]	--	--
Total Loads	0.845	[2.400]	2.733	[6.000]	-0.577	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 6,497 kip-ft
 Ultimate Moment, M_u: 5,953 kip-ft
 Strength for Min Reinf: 5,251 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 189.2 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 243.4 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (3) #4 bars

Anchorage Zone Reinforcement

Req'd Reinf: (3) #6 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.113 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_LWC Slab_LWC Girder_8ksi_135' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 135.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 4,125 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.425 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.559 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 36
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 34.00 in
 e of Strands at Beam End: 23.00 in
 Total Hold-Down Force: 21.5 kips

Prestress Losses

Prestress Loss at Transfer: 12.86 ksi = 6.4%
 Total Prestress Loss at Service
 (including loss at transfer): 32.20 ksi = 16%

Deflections

Camber: 3.90 in ↑
 At Erection Before Deck: 3.27 in ↑
 After Deck: 1.93 in ↑
 Due to LL & Impact: 0.80 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.065	[-0.588]	2.167	[3.600]
Harp Point (54.50 ft)	0.425	[3.600]	1.697	[3.600]
Midspan	0.471	[3.600]	1.653	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.137	[1.800]	1.459	[3.600]	--	--
Total Loads	0.648	[2.400]	1.984	[4.800]	-0.512	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 9,664 kip-ft
 Ultimate Moment, M_u: 9,171 kip-ft
 Strength for Min Reinf: 7,134 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 271.9 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 276.9 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #6 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.164 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_LWC Slab_LWC Girder_8ksi_140' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 140.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 4,125 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.425 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.555 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 40
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.77 in
 e of Strands at Beam End: 23.87 in
 Total Hold-Down Force: 20.8 kips

Prestress Losses

Prestress Loss at Transfer: 14.29 ksi = 7.1%
 Total Prestress Loss at Service
 (including loss at transfer): 34.34 ksi = 17%

Deflections

Camber: 4.63 in ↑
 At Erection Before Deck: 4.01 in ↑
 After Deck: 2.46 in ↑
 Due to LL & Impact: 0.89 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.124	[-0.588]	2.440	[3.600]
Harp Point (56.50 ft)	0.450	[3.600]	1.891	[3.600]
Midspan	0.500	[3.600]	1.843	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.147	[1.800]	1.568	[3.600]	--	--
Total Loads	0.681	[2.400]	2.117	[4.800]	-0.490	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 10,636 kip-ft
 Ultimate Moment, M_u: 9,737 kip-ft
 Strength for Min Reinf: 7,651 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 279.2 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 285.0 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (6) #6 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.273 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_LWC Slab_LWC Girder_8ksi_145' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 145.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 4,125 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.425 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.550 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 44
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.40 in
 e of Strands at Beam End: 24.58 in
 Total Hold-Down Force: 19.4 kips

Prestress Losses

Prestress Loss at Transfer: 15.56 ksi = 7.7%
 Total Prestress Loss at Service
 (including loss at transfer): 36.19 ksi = 18%

Deflections

Camber: 5.40 in ↑
 At Erection Before Deck: 4.76 in ↑
 After Deck: 2.98 in ↑
 Due to LL & Impact: 0.98 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.180	[-0.588]	2.709	[3.600]
Harp Point (58.50 ft)	0.491	[3.600]	2.066	[3.600]
Midspan	0.544	[3.600]	2.016	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.158	[1.800]	1.693	[3.600]	--	--
Total Loads	0.714	[2.400]	2.265	[4.800]	-0.478	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 11,566 kip-ft
 Ultimate Moment, M_u: 10,309 kip-ft
 Strength for Min Reinf: 8,149 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 287.1 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 293.2 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (6) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.380 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_LWC Slab_LWC Girder_10ksi_140' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 140.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 4,612 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.425 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.560 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 38
 # Harped Strands: 0
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.88 in
 e of Strands at Beam End: 33.88 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 12.08 ksi = 6.0%
 Total Prestress Loss at Service
 (including loss at transfer): 28.59 ksi = 14%

Deflections

Camber: 4.26 in ↑
 At Erection Before Deck: 3.58 in ↑
 After Deck: 2.20 in ↑
 Due to LL & Impact: 0.83 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.645	[-0.657]	2.855	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	0.522	[4.500]	1.738	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.140	[1.800]	1.585	[4.500]	--	--
Total Loads	0.653	[2.400]	2.181	[6.000]	-0.554	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 10,151 kip-ft
 Ultimate Moment, M_u: 9,777 kip-ft
 Strength for Min Reinf: 7,677 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 314.5 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 285.0 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (6) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.999 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_LWC Slab_LWC Girder_10ksi_145' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 145.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 4,612 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.425 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.555 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 42
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.57 in
 e of Strands at Beam End: 24.24 in
 Total Hold-Down Force: 19.4 kips

Prestress Losses

Prestress Loss at Transfer: 13.29 ksi = 6.6%
 Total Prestress Loss at Service
 (including loss at transfer): 30.32 ksi = 15%

Deflections

Camber: 4.67 in ↑
 At Erection Before Deck: 3.69 in ↑
 After Deck: 2.10 in ↑
 Due to LL & Impact: 0.91 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.153	[-0.657]	2.600	[4.500]
Harp Point (58.50 ft)	0.506	[4.500]	1.970	[4.500]
Midspan	0.559	[4.500]	1.920	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.150	[1.800]	1.705	[4.500]	--	--
Total Loads	0.685	[2.400]	2.327	[6.000]	-0.528	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 11,101 kip-ft
 Ultimate Moment, M_u: 10,351 kip-ft
 Strength for Min Reinf: 8,213 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 311.0 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 292.9 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (5) #6 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.087 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_LWC Slab_LWC Girder_10ksi_150' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 150.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 4,612 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.425 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.550 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 46
 # Harped Strands: 8
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.24 in
 e of Strands at Beam End: 22.19 in
 Total Hold-Down Force: 25.0 kips

Prestress Losses

Prestress Loss at Transfer: 14.42 ksi = 7.1%
 Total Prestress Loss at Service
 (including loss at transfer): 31.88 ksi = 16%

Deflections

Camber: 5.33 in ↑
 At Erection Before Deck: 4.19 in ↑
 After Deck: 2.37 in ↑
 Due to LL & Impact: 1.00 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.040	[-0.657]	2.708	[4.500]
Harp Point (60.50 ft)	0.549	[4.500]	2.144	[4.500]
Midspan	0.606	[4.500]	2.090	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.161	[1.800]	1.831	[4.500]	--	--
Total Loads	0.717	[2.400]	2.478	[6.000]	-0.508	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 12,016 kip-ft
 Ultimate Moment, M_u: 10,938 kip-ft
 Strength for Min Reinf: 8,748 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 314.4 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 300.5 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (6) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.191 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_LWC Slab_NWC Girder_8ksi_140' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 140.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.593 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.568 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 44
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.40 in
 e of Strands at Beam End: 24.58 in
 Total Hold-Down Force: 20.2 kips

Prestress Losses

Prestress Loss at Transfer: 11.42 ksi = 5.6%
 Total Prestress Loss at Service
 (including loss at transfer): 30.66 ksi = 15%

Deflections

Camber: 3.91 in ↑
 At Erection Before Deck: 3.05 in ↑
 After Deck: 1.87 in ↑
 Due to LL & Impact: 0.75 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.172	[-0.588]	2.756	[3.600]
Harp Point (56.50 ft)	0.627	[3.600]	1.990	[3.600]
Midspan	0.687	[3.600]	1.933	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.130	[1.800]	1.781	[3.600]	--	--
Total Loads	0.613	[2.400]	2.450	[4.800]	-0.465	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 11,566 kip-ft
 Ultimate Moment, M_u: 10,355 kip-ft
 Strength for Min Reinf: 9,521 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 274.7 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 298.4 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (4) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.627 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_LWC Slab_NWC Girder_8ksi_145' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 145.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.593 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.563 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 48
 # Harped Strands: 8
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.00 in
 e of Strands at Beam End: 22.59 in
 Total Hold-Down Force: 25.2 kips

Prestress Losses

Prestress Loss at Transfer: 12.34 ksi = 6.1%
 Total Prestress Loss at Service
 (including loss at transfer): 32.00 ksi = 16%

Deflections

Camber: 4.45 in ↑
 At Erection Before Deck: 3.42 in ↑
 After Deck: 2.07 in ↑
 Due to LL & Impact: 0.83 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.058	[-0.588]	2.872	[3.600]
Harp Point (58.50 ft)	0.688	[3.600]	2.158	[3.600]
Midspan	0.752	[3.600]	2.097	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.140	[1.800]	1.926	[3.600]	--	--
Total Loads	0.643	[2.400]	2.623	[4.800]	-0.464	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 12,343 kip-ft
 Ultimate Moment, M_u: 10,970 kip-ft
 Strength for Min Reinf: 10,030 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 271.5 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 307.3 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (5) #4 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.714 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_LWC Slab_NWC Girder_8ksi_150' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 150.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.593 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.558 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 52
 # Harped Strands: 8
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 32.36 in
 e of Strands at Beam End: 23.13 in
 Total Hold-Down Force: 22.8 kips

Prestress Losses

Prestress Loss at Transfer: 13.08 ksi = 6.5%
 Total Prestress Loss at Service
 (including loss at transfer): 33.09 ksi = 16%

Deflections

Camber: 5.08 in ↑
 At Erection Before Deck: 3.87 in ↑
 After Deck: 2.32 in ↑
 Due to LL & Impact: 0.91 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.104	[-0.588]	3.139	[3.600]
Harp Point (60.50 ft)	0.776	[3.600]	2.298	[3.600]
Midspan	0.844	[3.600]	2.232	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.149	[1.800]	2.102	[3.600]	--	--
Total Loads	0.672	[2.400]	2.827	[4.800]	-0.492	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 12,900 kip-ft
 Ultimate Moment, M_u: 11,599 kip-ft
 Strength for Min Reinf: 10,476 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 268.7 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 316.4 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (1) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #6 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.796 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_LWC Slab_NWC Girder_10ksi_140' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 140.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.593 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.574 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 42
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.57 in
 e of Strands at Beam End: 24.24 in
 Total Hold-Down Force: 20.2 kips

Prestress Losses

Prestress Loss at Transfer: 9.67 ksi = 4.8%
 Total Prestress Loss at Service
 (including loss at transfer): 25.67 ksi = 13%

Deflections

Camber: 3.38 in ↑
 At Erection Before Deck: 2.33 in ↑
 After Deck: 1.28 in ↑
 Due to LL & Impact: 0.70 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.143	[-0.657]	2.635	[4.500]
Harp Point (56.50 ft)	0.646	[4.500]	1.880	[4.500]
Midspan	0.706	[4.500]	1.823	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.123	[1.800]	1.795	[4.500]	--	--
Total Loads	0.585	[2.400]	2.516	[6.000]	-0.532	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 11,101 kip-ft
 Ultimate Moment, M_u: 10,403 kip-ft
 Strength for Min Reinf: 9,672 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 297.7 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 298.4 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (5) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.399 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_LWC Slab_NWC Girder_10ksi_145' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 145.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.593 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.568 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 46
 # Harped Strands: 8
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.24 in
 e of Strands at Beam End: 22.19 in
 Total Hold-Down Force: 25.9 kips

Prestress Losses

Prestress Loss at Transfer: 10.55 ksi = 5.2%
 Total Prestress Loss at Service
 (including loss at transfer): 26.94 ksi = 13%

Deflections

Camber: 3.87 in ↑
 At Erection Before Deck: 2.65 in ↑
 After Deck: 1.44 in ↑
 Due to LL & Impact: 0.77 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.029	[-0.657]	2.754	[4.500]
Harp Point (58.50 ft)	0.699	[4.500]	2.057	[4.500]
Midspan	0.763	[4.500]	1.996	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.132	[1.800]	1.934	[4.500]	--	--
Total Loads	0.612	[2.400]	2.684	[6.000]	-0.516	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 12,016 kip-ft
 Ultimate Moment, M_u: 11,012 kip-ft
 Strength for Min Reinf: 10,218 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 298.4 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 307.0 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (4) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.478 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_LWC Slab_NWC Girder_10ksi_150' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 150.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.593 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.563 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 50
 # Harped Strands: 8
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 32.71 in
 e of Strands at Beam End: 22.87 in
 Total Hold-Down Force: 23.6 kips

Prestress Losses

Prestress Loss at Transfer: 11.30 ksi = 5.6%
 Total Prestress Loss at Service
 (including loss at transfer): 27.97 ksi = 14%

Deflections

Camber: 4.44 in ↑
 At Erection Before Deck: 3.05 in ↑
 After Deck: 1.66 in ↑
 Due to LL & Impact: 0.85 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.080	[-0.657]	3.030	[4.500]
Harp Point (60.50 ft)	0.775	[4.500]	2.212	[4.500]
Midspan	0.843	[4.500]	2.146	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.141	[1.800]	2.099	[4.500]	--	--
Total Loads	0.641	[2.400]	2.879	[6.000]	-0.527	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 12,638 kip-ft
 Ultimate Moment, M_u: 11,643 kip-ft
 Strength for Min Reinf: 10,709 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 295.3 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 315.7 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (2) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.562 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_NWC Slab_NWC Girder_8ksi_130' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 130.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.709 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.566 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 38
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.88 in
 e of Strands at Beam End: 23.46 in
 Total Hold-Down Force: 22.3 kips

Prestress Losses

Prestress Loss at Transfer: 10.17 ksi = 5.0%
 Total Prestress Loss at Service
 (including loss at transfer): 28.48 ksi = 14%

Deflections

Camber: 2.95 in ↑
 At Erection Before Deck: 2.36 in ↑
 After Deck: 1.31 in ↑
 Due to LL & Impact: 0.55 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.087	[-0.588]	2.337	[3.600]
Harp Point (52.50 ft)	0.510	[3.600]	1.765	[3.600]
Midspan	0.561	[3.600]	1.716	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.127	[1.800]	1.624	[3.600]	--	--
Total Loads	0.617	[2.400]	2.128	[4.800]	-0.482	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 10,151 kip-ft
 Ultimate Moment, M_u: 9,390 kip-ft
 Strength for Min Reinf: 8,801 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 263.7 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 289.9 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (6) #6 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.321 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_NWC Slab_NWC Girder_8ksi_135' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 135.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.709 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.559 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 42
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.57 in
 e of Strands at Beam End: 24.24 in
 Total Hold-Down Force: 20.9 kips

Prestress Losses

Prestress Loss at Transfer: 11.22 ksi = 5.5%
 Total Prestress Loss at Service
 (including loss at transfer): 30.05 ksi = 15%

Deflections

Camber: 3.49 in ↑
 At Erection Before Deck: 2.85 in ↑
 After Deck: 1.63 in ↑
 Due to LL & Impact: 0.61 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.146	[-0.588]	2.620	[3.600]
Harp Point (54.50 ft)	0.551	[3.600]	1.953	[3.600]
Midspan	0.606	[3.600]	1.900	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.137	[1.800]	1.757	[3.600]	--	--
Total Loads	0.648	[2.400]	2.282	[4.800]	-0.457	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 11,101 kip-ft
 Ultimate Moment, M_u: 9,980 kip-ft
 Strength for Min Reinf: 9,358 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 270.7 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 298.9 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (6) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.406 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_NWC Slab_NWC Girder_8ksi_140' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 140.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.709 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.555 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 46
 # Harped Strands: 8
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.24 in
 e of Strands at Beam End: 22.19 in
 Total Hold-Down Force: 26.9 kips

Prestress Losses

Prestress Loss at Transfer: 12.14 ksi = 6.0%
 Total Prestress Loss at Service
 (including loss at transfer): 31.38 ksi = 15%

Deflections

Camber: 3.99 in ↑
 At Erection Before Deck: 3.21 in ↑
 After Deck: 1.80 in ↑
 Due to LL & Impact: 0.68 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.031	[-0.588]	2.730	[3.600]
Harp Point (56.50 ft)	0.604	[3.600]	2.121	[3.600]
Midspan	0.664	[3.600]	2.064	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.147	[1.800]	1.900	[3.600]	--	--
Total Loads	0.681	[2.400]	2.449	[4.800]	-0.452	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 12,016 kip-ft
 Ultimate Moment, M_u: 10,607 kip-ft
 Strength for Min Reinf: 9,888 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 271.3 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 307.8 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (5) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.490 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_NWC Slab_NWC Girder_10ksi_135' SPAN_φ = 0.90 λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 135.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.709 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.565 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 40
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.77 in
 e of Strands at Beam End: 23.87 in
 Total Hold-Down Force: 21.5 kips

Prestress Losses

Prestress Loss at Transfer: 9.44 ksi = 4.7%
 Total Prestress Loss at Service
 (including loss at transfer): 25.05 ksi = 12%

Deflections

Camber: 3.00 in ↑
 At Erection Before Deck: 2.17 in ↑
 After Deck: 1.08 in ↑
 Due to LL & Impact: 0.57 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.116	[-0.657]	2.490	[4.500]
Harp Point (54.50 ft)	0.572	[4.500]	1.831	[4.500]
Midspan	0.627	[4.500]	1.778	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.130	[1.800]	1.773	[4.500]	--	--
Total Loads	0.622	[2.400]	2.344	[6.000]	-0.536	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 10,636 kip-ft
 Ultimate Moment, M_u: 10,025 kip-ft
 Strength for Min Reinf: 9,479 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 293.8 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 298.7 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.198 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_NWC Slab_NWC Girder_10ksi_140' SPAN_φ = 0.90 λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 140.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.709 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.560 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 44
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.40 in
 e of Strands at Beam End: 24.58 in
 Total Hold-Down Force: 20.2 kips

Prestress Losses

Prestress Loss at Transfer: 10.33 ksi = 5.1%
 Total Prestress Loss at Service
 (including loss at transfer): 26.32 ksi = 13%

Deflections

Camber: 3.52 in ↑
 At Erection Before Deck: 2.59 in ↑
 After Deck: 1.33 in ↑
 Due to LL & Impact: 0.63 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.174	[-0.657]	2.775	[4.500]
Harp Point (56.50 ft)	0.621	[4.500]	2.013	[4.500]
Midspan	0.681	[4.500]	1.956	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.140	[1.800]	1.913	[4.500]	--	--
Total Loads	0.653	[2.400]	2.509	[6.000]	-0.512	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 11,566 kip-ft
 Ultimate Moment, M_u: 10,647 kip-ft
 Strength for Min Reinf: 10,060 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 299.4 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 307.6 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (5) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.282 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_6' SPACING_NWC Slab_NWC Girder_10ksi_145' SPAN_φ = 0.90 λ = 1.00**Bridge Cross Section**

Overall Deck Width: 36.0 ft
 Design Span: 145.0 ft
 Number of Beams: 6
 Beam Spacing: 6.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 72.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.709 kip/ft
 Composite DL: 0.284 kip/ft
 LLDF for Moment: 0.555 lanes/beam
 LLDF for Shear: 0.671 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 48
 # Harped Strands: 8
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.00 in
 e of Strands at Beam End: 22.59 in
 Total Hold-Down Force: 25.2 kips

Prestress Losses

Prestress Loss at Transfer: 11.16 ksi = 5.5%
 Total Prestress Loss at Service
 (including loss at transfer): 27.48 ksi = 14%

Deflections

Camber: 4.01 in ↑
 At Erection Before Deck: 2.90 in ↑
 After Deck: 1.45 in ↑
 Due to LL & Impact: 0.69 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.060	[-0.657]	2.892	[4.500]
Harp Point (58.50 ft)	0.682	[4.500]	2.182	[4.500]
Midspan	0.746	[4.500]	2.121	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.150	[1.800]	2.071	[4.500]	--	--
Total Loads	0.685	[2.400]	2.693	[6.000]	-0.512	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 12,343 kip-ft
 Ultimate Moment, M_u: 11,284 kip-ft
 Strength for Min Reinf: 10,586 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 298.1 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 317.0 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (4) #5 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.349 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_LWC Slab_LWC Girder_8ksi_45' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 45.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 4,125 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.563 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.972 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 12 (*see Note 1*)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 20.23 in
 e of Strands at Beam End: 20.23 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 7.92 ksi = 3.9%
 Total Prestress Loss at Service
 (including loss at transfer): 26.71 ksi = 13%

Deflections

Camber: 0.37 in ↑
 At Erection Before Deck: 0.57 in ↑
 After Deck: 0.47 in ↑
 Due to LL & Impact: 0.12 in ↓

*Note 1: Total number of strands controlled by strength***Stress Limits at Transfer**

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.270	[-0.588]	1.210	[3.600]
Harp Point (N/A)		[3.600]		[3.600]
Midspan	-0.090	[-0.588]	1.034	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.030	[1.800]	0.257	[3.600]	--	--
Total Loads	0.298	[2.400]	0.443	[4.800]	-0.041	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 2,128 kip-ft
 Ultimate Moment, M_u: 2,099 kip-ft
 Strength for Min Reinf: 2,124 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 129.6 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 175.5 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (2) #5 stirrups w/ 2 legs at 9.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 1.590 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_LWC Slab_LWC Girder_8ksi_50' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 50.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 4,125 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.563 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.945 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 14 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 20.23 in
 e of Strands at Beam End: 20.23 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 9.06 ksi = 4.5%
 Total Prestress Loss at Service
 (including loss at transfer): 28.35 ksi = 14%

Deflections

Camber: 0.53 in ↑
 At Erection Before Deck: 0.81 in ↑
 After Deck: 0.66 in ↑
 Due to LL & Impact: 0.16 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.314	[-0.588]	1.403	[3.600]
Harp Point (N/A)		[3.600]		[3.600]
Midspan	-0.088	[-0.588]	1.183	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.037	[1.800]	0.340	[3.600]	--	--
Total Loads	0.345	[2.400]	0.554	[4.800]	-0.091	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 2,475 kip-ft
 Ultimate Moment, M_u: 2,466 kip-ft
 Strength for Min Reinf: 2,312 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 156.9 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 189.1 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (8) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (2) #5 stirrups w/ 2 legs at 9.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.031 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_LWC Slab_LWC Girder_8ksi_55' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 55.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 4,125 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.563 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.920 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 18 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.79 in
 e of Strands at Beam End: 19.79 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 11.30 ksi = 5.6%
 Total Prestress Loss at Service
 (including loss at transfer): 32.03 ksi = 16%

Deflections

Camber: 0.80 in ↑
 At Erection Before Deck: 1.22 in ↑
 After Deck: 1.00 in ↑
 Due to LL & Impact: 0.22 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.382	[-0.588]	1.763	[3.600]
Harp Point (N/A)		[3.600]		[3.600]
Midspan	-0.104	[-0.588]	1.492	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.044	[1.800]	0.418	[3.600]	--	--
Total Loads	0.392	[2.400]	0.659	[4.800]	-0.010	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 3,134 kip-ft
 Ultimate Moment, M_u: 2,843 kip-ft
 Strength for Min Reinf: 2,694 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 161.0 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 202.3 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (2) #5 stirrups w/ 2 legs at 9.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.448 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_LWC Slab_LWC Girder_10ksi_50' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 50.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 4,612 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.563 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.955 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 16 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.98 in
 e of Strands at Beam End: 19.98 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 9.36 ksi = 4.6%
 Total Prestress Loss at Service
 (including loss at transfer): 26.51 ksi = 13%

Deflections

Camber: 0.54 in ↑
 At Erection Before Deck: 0.79 in ↑
 After Deck: 0.66 in ↑
 Due to LL & Impact: 0.15 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.353	[-0.657]	1.598	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	-0.127	[-0.657]	1.378	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.035	[1.800]	0.303	[4.500]	--	--
Total Loads	0.336	[2.400]	0.546	[6.000]	0.083	[6.000]

Flexural Strength at Midspan

Factored Resistance, M_r: 2,805 kip-ft
 Ultimate Moment, M_u: 2,484 kip-ft
 Strength for Min Reinf: 2,643 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 178.1 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 189.4 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (2) #5 stirrups w/ 2 legs at 9.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 1.856 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_LWC Slab_LWC Girder_10ksi_55' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 55.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 4,612 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.563 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.930 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 18 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.79 in
 e of Strands at Beam End: 19.79 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 10.19 ksi = 5.0%
 Total Prestress Loss at Service
 (including loss at transfer): 27.57 ksi = 14%

Deflections

Camber: 0.71 in ↑
 At Erection Before Deck: 1.01 in ↑
 After Deck: 0.81 in ↑
 Due to LL & Impact: 0.20 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.385	[-0.657]	1.775	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	-0.107	[-0.657]	1.504	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.043	[1.800]	0.410	[4.500]	--	--
Total Loads	0.382	[2.400]	0.684	[6.000]	0.014	[6.000]

Flexural Strength at Midspan

Factored Resistance, M_r: 3,134 kip-ft
 Ultimate Moment, M_u: 2,864 kip-ft
 Strength for Min Reinf: 2,821 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 180.0 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 202.3 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (2) #5 stirrups w/ 2 legs at 9.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.235 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_LWC Slab_LWC Girder_10ksi_60' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 60.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 4,612 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.563 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.907 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 20 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.63 in
 e of Strands at Beam End: 19.63 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 11.00 ksi = 5.4%
 Total Prestress Loss at Service
 (including loss at transfer): 28.58 ksi = 14%

Deflections

Camber: 0.93 in ↑
 At Erection Before Deck: 1.29 in ↑
 After Deck: 1.01 in ↑
 Due to LL & Impact: 0.26 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.418	[-0.657]	1.957	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	-0.083	[-0.657]	1.630	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.051	[1.800]	0.533	[4.500]	--	--
Total Loads	0.428	[2.400]	0.838	[6.000]	-0.077	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 3,460 kip-ft
 Ultimate Moment, M_u: 3,257 kip-ft
 Strength for Min Reinf: 2,979 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 180.5 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 214.7 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (2) #5 stirrups w/ 2 legs at 9.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.597 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_LWC Slab_NWC Girder_8ksi_50' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 50.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.693 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.969 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 20 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.63 in
 e of Strands at Beam End: 19.63 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 9.77 ksi = 4.8%
 Total Prestress Loss at Service
 (including loss at transfer): 30.45 ksi = 15%

Deflections

Camber: 0.56 in ↑
 At Erection Before Deck: 0.89 in ↑
 After Deck: 0.78 in ↑
 Due to LL & Impact: 0.14 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.420	[-0.588]	1.971	[3.600]
Harp Point (N/A)		[3.600]		[3.600]
Midspan	-0.149	[-0.588]	1.707	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.033	[1.800]	0.300	[3.600]	--	--
Total Loads	0.322	[2.400]	0.589	[4.800]	0.319	[4.800]

Flexural Strength at Midspan

Factored Resistance, M_r: 3,460 kip-ft
 Ultimate Moment, M_u: 2,559 kip-ft
 Strength for Min Reinf: 3,404 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 162.7 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 192.8 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #6 bars

Anchorage Zone Reinforcement

Req'd Reinf: (2) #5 stirrups w/ 2 legs at 9.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 1.631 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_LWC Slab_NWC Girder_8ksi_55' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 55.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.693 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.944 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 22 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.50 in
 e of Strands at Beam End: 19.50 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 10.44 ksi = 5.2%
 Total Prestress Loss at Service
 (including loss at transfer): 31.29 ksi = 15%

Deflections

Camber: 0.73 in ↑
 At Erection Before Deck: 1.12 in ↑
 After Deck: 0.95 in ↑
 Due to LL & Impact: 0.19 in ↓

*Note 1: Total number of strands controlled by strength***Stress Limits at Transfer**

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.450	[-0.588]	2.152	[3.600]
Harp Point (N/A)		[3.600]		[3.600]
Midspan	-0.117	[-0.588]	1.827	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.040	[1.800]	0.421	[3.600]	--	--
Total Loads	0.366	[2.400]	0.747	[4.800]	0.229	[4.800]

Flexural Strength at Midspan

Factored Resistance, M_r: 3,784 kip-ft
 Ultimate Moment, M_u: 2,955 kip-ft
 Strength for Min Reinf: 3,726 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 163.3 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 206.3 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #6 bars

Anchorage Zone Reinforcement

Req'd Reinf: (3) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 1.964 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_LWC Slab_NWC Girder_8ksi_60' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 60.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.693 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.921 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 22 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.50 in
 e of Strands at Beam End: 19.50 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 10.06 ksi = 5.0%
 Total Prestress Loss at Service
 (including loss at transfer): 30.16 ksi = 15%

Deflections

Camber: 0.87 in ↑
 At Erection Before Deck: 1.26 in ↑
 After Deck: 1.02 in ↑
 Due to LL & Impact: 0.24 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.444	[-0.588]	2.146	[3.600]
Harp Point (N/A)		[3.600]		[3.600]
Midspan	-0.042	[-0.588]	1.753	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.048	[1.800]	0.586	[3.600]	--	--
Total Loads	0.410	[2.400]	0.948	[4.800]	-0.024	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 3,784 kip-ft
 Ultimate Moment, M_u: 3,363 kip-ft
 Strength for Min Reinf: 3,683 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 162.0 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 219.0 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (6) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (3) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.276 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_LWC Slab_NWC Girder_10ksi_50' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 50.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.693 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.979 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 20 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.63 in
 e of Strands at Beam End: 19.63 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 8.81 ksi = 4.4%
 Total Prestress Loss at Service
 (including loss at transfer): 26.17 ksi = 13%

Deflections

Camber: 0.50 in ↑
 At Erection Before Deck: 0.73 in ↑
 After Deck: 0.63 in ↑
 Due to LL & Impact: 0.13 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.424	[-0.657]	1.984	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	-0.153	[-0.657]	1.720	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.032	[1.800]	0.293	[4.500]	--	--
Total Loads	0.312	[2.400]	0.616	[6.000]	0.349	[6.000]

Flexural Strength at Midspan

Factored Resistance, M_r: 3,460 kip-ft
 Ultimate Moment, M_u: 2,577 kip-ft
 Strength for Min Reinf: 3,428 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 180.5 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 192.8 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #6 bars

Anchorage Zone Reinforcement

Req'd Reinf: (2) #5 stirrups w/ 2 legs at 9.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 1.488 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_LWC Slab_NWC Girder_10ksi_55' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 55.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.693 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.953 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 24 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.40 in
 e of Strands at Beam End: 19.40 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 10.29 ksi = 5.1%
 Total Prestress Loss at Service
 (including loss at transfer): 28.41 ksi = 14%

Deflections

Camber: 0.71 in ↑
 At Erection Before Deck: 1.03 in ↑
 After Deck: 0.88 in ↑
 Due to LL & Impact: 0.17 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.490	[-0.657]	2.346	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	-0.157	[-0.657]	2.021	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.039	[1.800]	0.384	[4.500]	--	--
Total Loads	0.355	[2.400]	0.748	[6.000]	0.415	[6.000]

Flexural Strength at Midspan

Factored Resistance, M_r: 4,106 kip-ft
 Ultimate Moment, M_u: 2,973 kip-ft
 Strength for Min Reinf: 3,954 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 183.2 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 206.4 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (6) #6 bars

Anchorage Zone Reinforcement

Req'd Reinf: (3) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 1.794 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_LWC Slab_NWC Girder_10ksi_60' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 60.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.693 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.930 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 24 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.40 in
 e of Strands at Beam End: 19.40 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 9.99 ksi = 4.9%
 Total Prestress Loss at Service
 (including loss at transfer): 27.59 ksi = 14%

Deflections

Camber: 0.85 in ↑
 At Erection Before Deck: 1.18 in ↑
 After Deck: 0.97 in ↑
 Due to LL & Impact: 0.23 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.486	[-0.657]	2.348	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	-0.084	[-0.657]	1.955	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.046	[1.800]	0.547	[4.500]	--	--
Total Loads	0.398	[2.400]	0.952	[6.000]	0.159	[6.000]

Flexural Strength at Midspan

Factored Resistance, M_r: 4,106 kip-ft
 Ultimate Moment, M_u: 3,384 kip-ft
 Strength for Min Reinf: 4,081 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 183.2 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 219.0 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #6 bars

Anchorage Zone Reinforcement

Req'd Reinf: (3) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.082 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_NWC Slab_NWC Girder_8ksi_40' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 40.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.876 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 1.005 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 14 (*see Note 1*)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 20.23 in
 e of Strands at Beam End: 20.23 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 7.31 ksi = 3.6%
 Total Prestress Loss at Service
 (including loss at transfer): 26.18 ksi = 13%

Deflections

Camber: 0.26 in ↑
 At Erection Before Deck: 0.41 in ↑
 After Deck: 0.35 in ↑
 Due to LL & Impact: 0.06 in ↓

*Note 1: Total number of strands controlled by strength***Stress Limits at Transfer**

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.321	[-0.588]	1.420	[3.600]
Harp Point (N/A)		[3.600]		[3.600]
Midspan	-0.154	[-0.588]	1.258	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.023	[1.800]	0.177	[3.600]	--	--
Total Loads	0.251	[2.400]	0.335	[4.800]	0.283	[4.800]

Flexural Strength at Midspan

Factored Resistance, M_r: 2,475 kip-ft
 Ultimate Moment, M_u: 1,826 kip-ft
 Strength for Min Reinf: 2,429 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 157.8 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 166.7 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (8) #6 bars

Anchorage Zone Reinforcement

Req'd Reinf: (2) #5 stirrups w/ 2 legs at 9.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 0.848 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_NWC Slab_NWC Girder_8ksi_45' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 45.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.876 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.972 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 18 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.79 in
 e of Strands at Beam End: 19.79 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 9.07 ksi = 4.5%
 Total Prestress Loss at Service
 (including loss at transfer): 29.17 ksi = 14%

Deflections

Camber: 0.41 in ↑
 At Erection Before Deck: 0.67 in ↑
 After Deck: 0.58 in ↑
 Due to LL & Impact: 0.09 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.389	[-0.588]	1.790	[3.600]
Harp Point (N/A)		[3.600]		[3.600]
Midspan	-0.174	[-0.588]	1.579	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.030	[1.800]	0.249	[3.600]	--	--
Total Loads	0.298	[2.400]	0.435	[4.800]	0.376	[4.800]

Flexural Strength at Midspan

Factored Resistance, M_r: 3,134 kip-ft
 Ultimate Moment, M_u: 2,198 kip-ft
 Strength for Min Reinf: 2,924 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 161.0 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 183.1 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #6 bars

Anchorage Zone Reinforcement

Req'd Reinf: (2) #5 stirrups w/ 2 legs at 9.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 1.209 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_NWC Slab_NWC Girder_8ksi_50' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 50.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.876 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.945 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 20 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.63 in
 e of Strands at Beam End: 19.63 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 9.77 ksi = 4.8%
 Total Prestress Loss at Service
 (including loss at transfer): 30.09 ksi = 15%

Deflections

Camber: 0.56 in ↑
 At Erection Before Deck: 0.89 in ↑
 After Deck: 0.75 in ↑
 Due to LL & Impact: 0.12 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.420	[-0.588]	1.971	[3.600]
Harp Point (N/A)		[3.600]		[3.600]
Midspan	-0.149	[-0.588]	1.707	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.037	[1.800]	0.367	[3.600]	--	--
Total Loads	0.345	[2.400]	0.581	[4.800]	0.295	[4.800]

Flexural Strength at Midspan

Factored Resistance, M_r: 3,460 kip-ft
 Ultimate Moment, M_u: 2,588 kip-ft
 Strength for Min Reinf: 3,442 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 162.7 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 197.6 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (8) #6 bars

Anchorage Zone Reinforcement

Req'd Reinf: (2) #5 stirrups w/ 2 legs at 9.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 1.545 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_NWC Slab_NWC Girder_10ksi_45' SPAN_φ = 0.90 λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 45.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.876 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.982 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 18 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.79 in
 e of Strands at Beam End: 19.79 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 8.14 ksi = 4.0%
 Total Prestress Loss at Service
 (including loss at transfer): 25.01 ksi = 12%

Deflections

Camber: 0.37 in ↑
 At Erection Before Deck: 0.55 in ↑
 After Deck: 0.47 in ↑
 Due to LL & Impact: 0.08 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.390	[-0.657]	1.797	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	-0.175	[-0.657]	1.586	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.029	[1.800]	0.240	[4.500]	--	--
Total Loads	0.291	[2.400]	0.451	[6.000]	0.405	[6.000]

Flexural Strength at Midspan

Factored Resistance, M_r: 3,134 kip-ft
 Ultimate Moment, M_u: 2,214 kip-ft
 Strength for Min Reinf: 2,944 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 178.6 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 183.1 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #6 bars

Anchorage Zone Reinforcement

Req'd Reinf: (2) #5 stirrups w/ 2 legs at 9.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 1.104 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_NWC Slab_NWC Girder_10ksi_50' SPAN_φ = 0.90 λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 50.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.876 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.955 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 22 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.50 in
 e of Strands at Beam End: 19.50 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 9.69 ksi = 4.8%
 Total Prestress Loss at Service
 (including loss at transfer): 27.38 ksi = 14%

Deflections

Camber: 0.54 in ↑
 At Erection Before Deck: 0.81 in ↑
 After Deck: 0.69 in ↑
 Due to LL & Impact: 0.12 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.459	[-0.657]	2.165	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	-0.188	[-0.657]	1.901	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.035	[1.800]	0.327	[4.500]	--	--
Total Loads	0.336	[2.400]	0.570	[6.000]	0.482	[6.000]

Flexural Strength at Midspan

Factored Resistance, M_r: 3,784 kip-ft
 Ultimate Moment, M_u: 2,606 kip-ft
 Strength for Min Reinf: 3,466 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 182.6 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 198.2 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #6 bars

Anchorage Zone Reinforcement

Req'd Reinf: (3) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 1.412 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 45_10' SPACING_NWC Slab_NWC Girder_10ksi_55' SPAN_φ = 0.90 λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 55.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-45
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.876 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.930 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 24 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 42.0 in
 e of Strands at Midspan: 19.40 in
 e of Strands at Beam End: 19.40 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 10.29 ksi = 5.1%
 Total Prestress Loss at Service
 (including loss at transfer): 28.08 ksi = 14%

Deflections

Camber: 0.71 in ↑
 At Erection Before Deck: 1.03 in ↑
 After Deck: 0.85 in ↑
 Due to LL & Impact: 0.15 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.490	[-0.657]	2.346	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	-0.157	[-0.657]	2.021	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.043	[1.800]	0.461	[4.500]	--	--
Total Loads	0.382	[2.400]	0.735	[6.000]	0.383	[6.000]

Flexural Strength at Midspan

Factored Resistance, M_r: 4,106 kip-ft
 Ultimate Moment, M_u: 3,012 kip-ft
 Strength for Min Reinf: 4,006 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 183.2 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 211.8 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #6 bars

Anchorage Zone Reinforcement

Req'd Reinf: (3) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 1.700 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_LWC Slab_LWC Girder_8ksi_110' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 110.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 4,125 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.758 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.850 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 34 (see Note 1)
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 34.14 in
 e of Strands at Beam End: 22.49 in
 Total Hold-Down Force: 26.3 kips

Prestress Losses

Prestress Loss at Transfer: 14.31 ksi = 7.1%
 Total Prestress Loss at Service
 (including loss at transfer): 35.04 ksi = 17%

Deflections

Camber: 2.44 in ↑
 At Erection Before Deck: 2.85 in ↑
 After Deck: 1.92 in ↑
 Due to LL & Impact: 0.56 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.055	[-0.588]	2.026	[3.600]
Harp Point (44.50 ft)	0.087	[3.600]	1.890	[3.600]
Midspan	0.118	[3.600]	1.861	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.088	[1.800]	1.090	[3.600]	--	--
Total Loads	0.525	[2.400]	1.512	[4.800]	-0.369	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 9,384 kip-ft
 Ultimate Moment, M_u: 8,906 kip-ft
 Strength for Min Reinf: 7,053 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 263.6 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 318.2 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #8 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.366 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_LWC Slab_LWC Girder_8ksi_115' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 115.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 4,125 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.758 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.841 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 36
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 34.00 in
 e of Strands at Beam End: 23.00 in
 Total Hold-Down Force: 25.1 kips

Prestress Losses

Prestress Loss at Transfer: 14.82 ksi = 7.3%
 Total Prestress Loss at Service
 (including loss at transfer): 35.49 ksi = 18%

Deflections

Camber: 2.81 in ↑
 At Erection Before Deck: 3.21 in ↑
 After Deck: 2.10 in ↑
 Due to LL & Impact: 0.64 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.080	[-0.588]	2.160	[3.600]
Harp Point (46.50 ft)	0.127	[3.600]	1.961	[3.600]
Midspan	0.160	[3.600]	1.929	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.097	[1.800]	1.218	[3.600]	--	--
Total Loads	0.557	[2.400]	1.663	[4.800]	-0.451	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 9,898 kip-ft
 Ultimate Moment, M_u: 9,545 kip-ft
 Strength for Min Reinf: 7,319 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 264.6 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 328.8 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #8 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.525 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_LWC Slab_LWC Girder_8ksi_120' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 120.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 4,125 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.758 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.830 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 40
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.77 in
 e of Strands at Beam End: 23.87 in
 Total Hold-Down Force: 24.1 kips

Prestress Losses

Prestress Loss at Transfer: 16.30 ksi = 8.0%
 Total Prestress Loss at Service
 (including loss at transfer): 37.64 ksi = 19%

Deflections

Camber: 3.38 in ↑
 At Erection Before Deck: 3.89 in ↑
 After Deck: 2.58 in ↑
 Due to LL & Impact: 0.72 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.138	[-0.588]	2.431	[3.600]
Harp Point (48.50 ft)	0.141	[3.600]	2.164	[3.600]
Midspan	0.177	[3.600]	2.129	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.105	[1.800]	1.336	[3.600]	--	--
Total Loads	0.587	[2.400]	1.803	[4.800]	-0.451	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 10,923 kip-ft
 Ultimate Moment, M_u: 10,188 kip-ft
 Strength for Min Reinf: 7,828 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 271.6 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 339.5 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (6) #8 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.677 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_LWC Slab_LWC Girder_10ksi_115' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 115.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 4,612 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.758 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.849 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 36 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 34.00 in
 e of Strands at Beam End: 34.00 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 13.38 ksi = 6.6%
 Total Prestress Loss at Service
 (including loss at transfer): 30.83 ksi = 15%

Deflections

Camber: 2.72 in ↑
 At Erection Before Deck: 3.07 in ↑
 After Deck: 2.08 in ↑
 Due to LL & Impact: 0.60 in ↓

*Note 1: Total number of strands controlled by strength***Stress Limits at Transfer**

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.621	[-0.657]	2.692	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	0.155	[4.500]	1.948	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.093	[1.800]	1.211	[4.500]	--	--
Total Loads	0.539	[2.400]	1.703	[6.000]	-0.408	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 9,898 kip-ft
 Ultimate Moment, M_u: 9,593 kip-ft
 Strength for Min Reinf: 7,648 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 306.6 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 328.9 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (6) #8 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.215 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_LWC Slab_LWC Girder_10ksi_120' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 120.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 4,612 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.758 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.839 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 38
 # Harped Strands: 0
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.88 in
 e of Strands at Beam End: 33.88 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 13.89 ksi = 6.9%
 Total Prestress Loss at Service
 (including loss at transfer): 31.32 ksi = 15%

Deflections

Camber: 3.11 in ↑
 At Erection Before Deck: 3.42 in ↑
 After Deck: 2.25 in ↑
 Due to LL & Impact: 0.67 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.649	[-0.657]	2.836	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	0.199	[4.500]	2.024	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.101	[1.800]	1.348	[4.500]	--	--
Total Loads	0.570	[2.400]	1.864	[6.000]	-0.506	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 10,412 kip-ft
 Ultimate Moment, M_u: 10,245 kip-ft
 Strength for Min Reinf: 7,888 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 308.1 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 339.5 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.360 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_LWC Slab_LWC Girder_10ksi_125' SPAN_φ = 0.85_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 125.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: Sand-LWC
 Resist. Factor for Shear, φ: 0.85
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.125 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 4,612 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.758 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.829 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 42
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.57 in
 e of Strands at Beam End: 24.24 in
 Total Hold-Down Force: 22.5 kips

Prestress Losses

Prestress Loss at Transfer: 15.15 ksi = 7.5%
 Total Prestress Loss at Service
 (including loss at transfer): 33.06 ksi = 16%

Deflections

Camber: 3.45 in ↑
 At Erection Before Deck: 3.64 in ↑
 After Deck: 2.26 in ↑
 Due to LL & Impact: 0.75 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.166	[-0.657]	2.589	[4.500]
Harp Point (50.50 ft)	0.185	[4.500]	2.253	[4.500]
Midspan	0.224	[4.500]	2.215	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.110	[1.800]	1.475	[4.500]	--	--
Total Loads	0.601	[2.400]	2.015	[6.000]	-0.505	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 11,418 kip-ft
 Ultimate Moment, M_u: 10,912 kip-ft
 Strength for Min Reinf: 8,418 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 302.7 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 349.8 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (8) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.486 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_LWC Slab_NWC Girder_8ksi_115' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 115.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.926 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.862 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 38
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.88 in
 e of Strands at Beam End: 23.46 in
 Total Hold-Down Force: 25.1 kips

Prestress Losses

Prestress Loss at Transfer: 11.51 ksi = 5.7%
 Total Prestress Loss at Service
 (including loss at transfer): 30.94 ksi = 15%

Deflections

Camber: 2.30 in ↑
 At Erection Before Deck: 2.42 in ↑
 After Deck: 1.58 in ↑
 Due to LL & Impact: 0.54 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.101	[-0.588]	2.335	[3.600]
Harp Point (46.50 ft)	0.246	[3.600]	2.003	[3.600]
Midspan	0.286	[3.600]	1.964	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.087	[1.800]	1.364	[3.600]	--	--
Total Loads	0.514	[2.400]	1.929	[4.800]	-0.482	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 10,412 kip-ft
 Ultimate Moment, M_u: 10,018 kip-ft
 Strength for Min Reinf: 8,955 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 261.7 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 339.5 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.826 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_LWC Slab_NWC Girder_8ksi_120' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 120.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.926 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.851 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 42
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.57 in
 e of Strands at Beam End: 24.24 in
 Total Hold-Down Force: 23.4 kips

Prestress Losses

Prestress Loss at Transfer: 12.60 ksi = 6.2%
 Total Prestress Loss at Service
 (including loss at transfer): 32.55 ksi = 16%

Deflections

Camber: 2.75 in ↑
 At Erection Before Deck: 2.91 in ↑
 After Deck: 1.91 in ↑
 Due to LL & Impact: 0.61 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.158	[-0.588]	2.616	[3.600]
Harp Point (48.50 ft)	0.277	[3.600]	2.200	[3.600]
Midspan	0.320	[3.600]	2.159	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.095	[1.800]	1.498	[3.600]	--	--
Total Loads	0.542	[2.400]	2.090	[4.800]	-0.478	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 11,418 kip-ft
 Ultimate Moment, M_u: 10,700 kip-ft
 Strength for Min Reinf: 9,510 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 266.2 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 350.7 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.943 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_LWC Slab_NWC Girder_8ksi_125' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 125.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.926 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.842 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 46
 # Harped Strands: 8
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.24 in
 e of Strands at Beam End: 22.19 in
 Total Hold-Down Force: 30.0 kips

Prestress Losses

Prestress Loss at Transfer: 13.55 ksi = 6.7%
 Total Prestress Loss at Service
 (including loss at transfer): 33.88 ksi = 17%

Deflections

Camber: 3.17 in ↑
 At Erection Before Deck: 3.28 in ↑
 After Deck: 2.10 in ↑
 Due to LL & Impact: 0.68 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.047	[-0.588]	2.725	[3.600]
Harp Point (50.50 ft)	0.318	[3.600]	2.375	[3.600]
Midspan	0.366	[3.600]	2.330	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.103	[1.800]	1.643	[3.600]	--	--
Total Loads	0.572	[2.400]	2.264	[4.800]	-0.493	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 12,402 kip-ft
 Ultimate Moment, M_u: 11,410 kip-ft
 Strength for Min Reinf: 10,032 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 267.7 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 361.8 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (6) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 3.060 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_LWC Slab_NWC Girder_10ksi_115' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 115.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.926 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.871 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 38 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.88 in
 e of Strands at Beam End: 33.88 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 10.40 ksi = 5.1%
 Total Prestress Loss at Service
 (including loss at transfer): 26.92 ksi = 13%

Deflections

Camber: 2.21 in ↑
 At Erection Before Deck: 2.30 in ↑
 After Deck: 1.55 in ↑
 Due to LL & Impact: 0.51 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.651	[-0.657]	2.877	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	0.281	[4.500]	1.984	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.084	[1.800]	1.356	[4.500]	--	--
Total Loads	0.496	[2.400]	1.974	[6.000]	-0.438	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 10,412 kip-ft
 Ultimate Moment, M_u: 10,073 kip-ft
 Strength for Min Reinf: 9,421 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 297.9 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 339.5 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (6) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.579 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_LWC Slab_NWC Girder_10ksi_120' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 120.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.926 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.860 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 40
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.77 in
 e of Strands at Beam End: 23.87 in
 Total Hold-Down Force: 24.1 kips

Prestress Losses

Prestress Loss at Transfer: 10.68 ksi = 5.3%
 Total Prestress Loss at Service
 (including loss at transfer): 27.10 ksi = 13%

Deflections

Camber: 2.36 in ↑
 At Erection Before Deck: 2.24 in ↑
 After Deck: 1.35 in ↑
 Due to LL & Impact: 0.57 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.129	[-0.657]	2.487	[4.500]
Harp Point (48.50 ft)	0.297	[4.500]	2.078	[4.500]
Midspan	0.340	[4.500]	2.037	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.091	[1.800]	1.510	[4.500]	--	--
Total Loads	0.523	[2.400]	2.158	[6.000]	-0.549	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 10,923 kip-ft
 Ultimate Moment, M_u: 10,757 kip-ft
 Strength for Min Reinf: 9,662 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 291.7 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 350.6 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.691 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_LWC Slab_NWC Girder_10ksi_125' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 125.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: Sand-LWC
 Concrete Unit Weight: 0.125 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 1.926 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.850 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 44
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.40 in
 e of Strands at Beam End: 24.58 in
 Total Hold-Down Force: 22.5 kips

Prestress Losses

Prestress Loss at Transfer: 11.60 ksi = 5.7%
 Total Prestress Loss at Service
 (including loss at transfer): 28.39 ksi = 14%

Deflections

Camber: 2.79 in ↑
 At Erection Before Deck: 2.66 in ↑
 After Deck: 1.61 in ↑
 Due to LL & Impact: 0.64 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.187	[-0.657]	2.769	[4.500]
Harp Point (50.50 ft)	0.336	[4.500]	2.268	[4.500]
Midspan	0.384	[4.500]	2.223	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.099	[1.800]	1.655	[4.500]	--	--
Total Loads	0.552	[2.400]	2.334	[6.000]	-0.556	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 11,911 kip-ft
 Ultimate Moment, M_u: 11,465 kip-ft
 Strength for Min Reinf: 10,207 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 296.8 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 361.7 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (6) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.799 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_NWC Slab_NWC Girder_8ksi_105' SPAN_φ = 0.90 λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 105.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 2.109 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.862 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 34 (see Note 1)
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 34.14 in
 e of Strands at Beam End: 22.49 in
 Total Hold-Down Force: 27.5 kips

Prestress Losses

Prestress Loss at Transfer: 10.77 ksi = 5.3%
 Total Prestress Loss at Service
 (including loss at transfer): 29.74 ksi = 15%

Deflections

Camber: 1.72 in ↑
 At Erection Before Deck: 1.91 in ↑
 After Deck: 1.21 in ↑
 Due to LL & Impact: 0.38 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.049	[-0.588]	2.055	[3.600]
Harp Point (42.50 ft)	0.146	[3.600]	1.868	[3.600]
Midspan	0.180	[3.600]	1.836	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.080	[1.800]	1.213	[3.600]	--	--
Total Loads	0.495	[2.400]	1.614	[4.800]	-0.370	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 9,384 kip-ft
 Ultimate Moment, M_u: 8,903 kip-ft
 Strength for Min Reinf: 8,522 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 257.4 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 327.8 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (8) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.442 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_NWC Slab_NWC Girder_8ksi_110' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 110.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 2.109 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.850 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 36
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 34.00 in
 e of Strands at Beam End: 23.00 in
 Total Hold-Down Force: 26.3 kips

Prestress Losses

Prestress Loss at Transfer: 11.17 ksi = 5.5%
 Total Prestress Loss at Service
 (including loss at transfer): 30.10 ksi = 15%

Deflections

Camber: 2.00 in ↑
 At Erection Before Deck: 2.16 in ↑
 After Deck: 1.31 in ↑
 Due to LL & Impact: 0.43 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.075	[-0.588]	2.198	[3.600]
Harp Point (44.50 ft)	0.193	[3.600]	1.942	[3.600]
Midspan	0.230	[3.600]	1.907	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.088	[1.800]	1.362	[3.600]	--	--
Total Loads	0.525	[2.400]	1.784	[4.800]	-0.466	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 9,898 kip-ft
 Ultimate Moment, M_u: 9,569 kip-ft
 Strength for Min Reinf: 8,781 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 258.5 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 339.3 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (8) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.562 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_NWC Slab_NWC Girder_8ksi_115' SPAN_φ = 0.90 λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 115.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 6.0 ksi
 28-day Strength: 8.0 ksi
 Modulus of Elasticity, E_c: 5,422 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 2.109 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.841 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 40
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.77 in
 e of Strands at Beam End: 23.87 in
 Total Hold-Down Force: 25.1 kips

Prestress Losses

Prestress Loss at Transfer: 12.28 ksi = 6.1%
 Total Prestress Loss at Service
 (including loss at transfer): 31.69 ksi = 16%

Deflections

Camber: 2.41 in ↑
 At Erection Before Deck: 2.64 in ↑
 After Deck: 1.63 in ↑
 Due to LL & Impact: 0.49 in ↓

Stress Limits at Transfer

Compression: 3.600 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.588 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 3.600 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 4.800 ksi
 Tension: -0.537 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.132	[-0.588]	2.475	[3.600]
Harp Point (46.50 ft)	0.217	[3.600]	2.140	[3.600]
Midspan	0.257	[3.600]	2.101	[3.600]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.096	[1.800]	1.496	[3.600]	--	--
Total Loads	0.556	[2.400]	1.941	[4.800]	-0.470	[-0.537]

Flexural Strength at Midspan

Factored Resistance, M_r: 10,923 kip-ft
 Ultimate Moment, M_u: 10,270 kip-ft
 Strength for Min Reinf: 9,328 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 263.0 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 351.1 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.682 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_NWC Slab_NWC Girder_10ksi_110' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 110.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 2.109 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.859 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 36 (see Note 1)
 # Harped Strands: 0
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 34.00 in
 e of Strands at Beam End: 34.00 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 10.04 ksi = 5.0%
 Total Prestress Loss at Service
 (including loss at transfer): 26.10 ksi = 13%

Deflections

Camber: 1.93 in ↑
 At Erection Before Deck: 2.08 in ↑
 After Deck: 1.32 in ↑
 Due to LL & Impact: 0.40 in ↓

Note 1: Total number of strands controlled by strength

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.623	[-0.657]	2.730	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	0.227	[4.500]	1.917	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.085	[1.800]	1.355	[4.500]	--	--
Total Loads	0.509	[2.400]	1.822	[6.000]	-0.433	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 9,898 kip-ft
 Ultimate Moment, M_u: 9,620 kip-ft
 Strength for Min Reinf: 9,230 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 296.4 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 340.0 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.340 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_NWC Slab_NWC Girder_10ksi_115' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 115.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 2.109 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.849 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 38
 # Harped Strands: 0
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.88 in
 e of Strands at Beam End: 33.88 in
 Total Hold-Down Force: N/A

Prestress Losses

Prestress Loss at Transfer: 10.40 ksi = 5.1%
 Total Prestress Loss at Service
 (including loss at transfer): 26.40 ksi = 13%

Deflections

Camber: 2.21 in ↑
 At Erection Before Deck: 2.30 in ↑
 After Deck: 1.40 in ↑
 Due to LL & Impact: 0.45 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.651	[-0.657]	2.877	[4.500]
Harp Point (N/A)		[4.500]		[4.500]
Midspan	0.281	[4.500]	1.984	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.093	[1.800]	1.514	[4.500]	--	--
Total Loads	0.539	[2.400]	2.006	[6.000]	-0.546	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 10,412 kip-ft
 Ultimate Moment, M_u: 10,318 kip-ft
 Strength for Min Reinf: 9,468 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 297.9 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 351.1 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (6) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (4) #5 stirrups w/ 2 legs at 5.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.445 ksi
 Threshold Stress: 18.000 ksi

SUMMARY OF RESULTS**BEAM SATISFIES ALL DESIGN REQUIREMENTS****Project Name:** PCBT 77_10' SPACING_NWC Slab_NWC Girder_10ksi_120' SPAN_φ = 0.90_λ = 1.00**Bridge Cross Section**

Overall Deck Width: 56.0 ft
 Design Span: 120.0 ft
 Number of Beams: 6
 Beam Spacing: 10.00 ft
 Deck Slab Thickness: 8.00 in
 Relative Humidity: 70 %

Cast-in-Place Deck Slab

Concrete Type: NWC
 Concrete Unit Weight: 0.150 kcf
 28-day Strength: 4.0 ksi
 Effective Slab Width: 120.0 in

Prestressed Beams

VDOT PCBT-77
 Concrete Type: NWC
 Resist. Factor for Shear, φ: 0.90
 Modif. Factor for LWC, λ: 1.00
 Concrete Unit Weight: 0.150 kcf
 Strength at Transfer: 7.5 ksi
 28-day Strength: 10.0 ksi
 Modulus of Elasticity, E_c: 6,062 ksi
 Effective Haunch Depth: 2.00 in

Loads

Non-Composite DL: 2.109 kip/ft
 Composite DL: 0.367 kip/ft
 LLDF for Moment: 0.839 lanes/beam
 LLDF for Shear: 0.951 lanes/beam

Prestressing Strands 1/2 in. dia. 7-wire low-relaxation

Total Number of Strands: 42
 # Harped Strands: 6
 Top Row of Harp Strands: 74.0 in
 e of Strands at Midspan: 33.57 in
 e of Strands at Beam End: 24.24 in
 Total Hold-Down Force: 23.4 kips

Prestress Losses

Prestress Loss at Transfer: 11.32 ksi = 5.6%
 Total Prestress Loss at Service
 (including loss at transfer): 27.67 ksi = 14%

Deflections

Camber: 2.46 in ↑
 At Erection Before Deck: 2.42 in ↑
 After Deck: 1.35 in ↑
 Due to LL & Impact: 0.51 in ↓

Stress Limits at Transfer

Compression: 4.500 ksi
 Tension (w/o bonded reinf): -0.200 ksi
 Tension (w/ bonded reinf): -0.657 ksi

Stress Limits at Service

Compression - Permanent Loads (deck): 1.800 ksi
 Compression - Permanent Loads (beam): 4.500 ksi
 Compression - Total Loads (deck): 2.400 ksi
 Compression - Total Loads (beam): 6.000 ksi
 Tension: -0.601 ksi

Calculated Stresses at Transfer

	Top of Beam f _t (ksi)		Bottom of Beam f _b (ksi)	
	Stress	Limit	Stress	Limit
Transfer Length (2.50 ft)	-0.159	[-0.657]	2.625	[4.500]
Harp Point (48.50 ft)	0.274	[4.500]	2.210	[4.500]
Midspan	0.317	[4.500]	2.169	[4.500]

Calculated Stresses at Service (at midspan)

	Top of Deck Service I (ksi)		Top of Beam Service I (ksi)		Bottom of Beam Service III (ksi)	
	Stress	Limit	Stress	Limit	Stress	Limit
Permanent Loads	0.101	[1.800]	1.661	[4.500]	--	--
Total Loads	0.570	[2.400]	2.177	[6.000]	-0.551	[-0.601]

Flexural Strength at Midspan

Factored Resistance, M_r: 11,418 kip-ft
 Ultimate Moment, M_u: 11,035 kip-ft
 Strength for Min Reinf: 10,032 kip-ft

Nominal Shear Resistance

Vertical Shear, V_c: 293.1 kips
 Interface Shear, V_{ni}: 169.9 kips/ft
 Fact'd Vert Shear, V_u: 363.0 kips

Required Shear Reinforcement

Vertical Shear: #4 stirrups w/ 2 legs at 24.0"
 Interface Shear: #4 stirrups w/ 2 legs at 24.0"

Longitudinal Reinforcement Req'd at Face of Bearing

Add'l Reinf Req'd: (7) #7 bars

Anchorage Zone Reinforcement

Req'd Reinf: (5) #5 stirrups w/ 2 legs at 4.0"

Fatigue of Reinforcement

Fact'd Fatigue Stress: 2.556 ksi
 Threshold Stress: 18.000 ksi