



BRIDGE LOAD RATING SUMMARY REPORT

OFFICE OF STRUCTURAL ENGINEERING

OHIO DEPARTMENT OF TRANSPORTATION

SFN	BRIDGE NUMBER	DISTRICT	GPS COORDINATES	
2502011	FRA-00033-25.090R	6	LATITUDE:	LONGITUDE:
			39.89844722	-82.89394444
ORIGINAL CONSTRUCTION YEAR	REHABILITATION YEAR	OVERALL STRUCTURE LENGTH	FEATURE INTERSECTED	
1963	2021	303 ft	Big Walnut Cr	

SPECIAL ASSUMPTIONS & COMMENTS	Four Span (73'-7"±; 74'-5"±; 74'-5"±; 73'-7"± C/C Brgs.) Composite Prestressed Concrete I-Beam (5 - 48" Deep PSC I-Beams, PSI-60 Dated 11/15/60 on Original Construction, and 4 - AASHTO Type 4, PSID-1-13 Dated 7/15/16 on Widened Section) Bridge on Reinforced Concrete Substructures. Composite Deck is 7.5" Thick with 3.5" SDC Overlay (Date of Wearing Surface 2021), 63'-4"± O/O Bridge Deck. Roadway 60'-0"± T/T Parapets (SBR-1-13 Dated 1/17/14). Alignment is Tangent with 40°00'00"± L.F. Skew. Assumptions: Added 3% additional self-load to beams to account for any misc. loads not included in calculations. Added 2" minimum haunch over original beams. Pulled original beam information from PSI-60 (Dated 11/15/60) Sheets 2 and 7 as specified in the Original Plans. Applied EV2 rLL = 1.3 and EV3 rLL = 1.1 (LRFR Factors).
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	PLEASE SELECT ON RIGHT, WHERE APPROPRIATE, BY USING THE DROP DOWN ARROW BUTTON
LOAD RATING PURPOSE :	8 - Update Analysis Model and Software
GENERAL APPRAISAL (0-9) :	8
(708) LOAD RATING SOFTWARE :	3 - AASHTO BrR (VIRTIS)
SOFTWARE VERSION :	6.8.4.3002
(709) RATING SOURCE :	1 - Plan information available for load rating analysis
(63)(65) RATING METHOD :	8 - Load & Resistance Factor Rating (LRFR) reported by rating factor (RF)
(31) ORIGINAL DESIGN LOADING :	6 - HS20-44 & Alternate Military Loading

STRUCTURE RATING SUMMARY

OHIO LEGAL VEHICLES				DESIGN VEHICLE		
Loading Type	GVW (Tons)	Operating Rating RF	Legal Weight (Tons)	Loading Type	Rating by RF	
					Operating	Inventory
2F1	15	2.753	15.00	HL93 Loading	1.050	0.810
3F1	23	1.837	23.00			
4F1	27	1.620	27.00			
5C1	40	1.783	40.00	Overall Legal Posting Rating 120%		
				Posting Recommendation No Load Posting is Recommended		
SPECIALIZED HAULING VEHICLES (SHV)				Sign Posting Recommendation:		
SU4	27	1.608	27.00			
SU5	31	1.455	31.00			
SU6	34.75	1.303	34.75			
SU7	38.75	1.192	38.75			
EMERGENCY VEHICLES (EV)						
Check box if this is an NBI bridge ☒						
EV2	28.75	1.699	28.75			
EV3	43	1.315	43.00			

AGENCY/FIRM/OFFICE	2LMN, Inc	Report Date	11/30/2021
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	Rated By	Reviewed By	
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2LMN, INC.

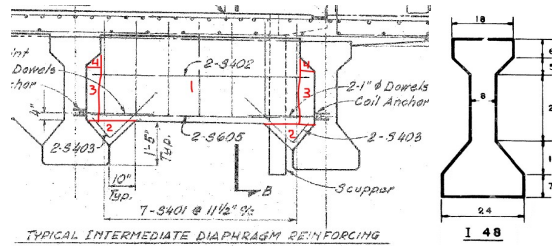
Calculated:	JBM	Date:	11/24/2021	Stage Review Submission:	FINAL
Checked:	HHH	Date:	11/25/2021	PID/Job No.:	114913
Concurred:	JBM	Date:	11/30/2021	Bridge No.:	FRA-00033-25.090L
Back Checked:	HHH	Date:	11/30/2021	SFN:	2501988
Released:	JBM	Date:	11/30/2021		
Project:	VAR-STW-BLR				
Subject:	Load Rating Dead Loads for BrR				

Diaphragm Weight - Concrete

Concrete Diaphragm Weight Calculator

7'-6" Beam Spacing with Original Typ. Intermediate Diaphragm

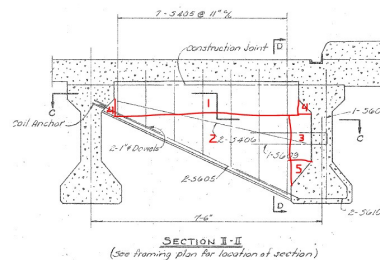
Reinforced Concrete Unit Weight	pcf	150.00
Beam		1.48
Spacing between beams	ft	7.50
Beam Height	in	48.00
Web Thickness	in	8.00
Top Flange Thickness	in	6.00
Top Flange Width	in	18.00
Top Flange Taper to Web Height	in	5.00
Bottom Flange Thickness	in	7.00
Bottom Flange Width	in	24.00
Bottom Flange Taper to Web Height	in	10.00
Diaphragm Thickness	in	12.00
Area 1	sf	15.50
Area 2	sf	0.63
Area 3	sf	0.69
Area 4	sf	0.09
Total Area (Area1 + 2*Area2 + 2*Area3 + 2*Area4)	sf	18.313
Diaphragm Volume	cf	18.313
Diaphragm Weight	kips	2.747



Concrete Diaphragm Weight Calculator

7'-6" Beam Spacing with Original Diaphragm

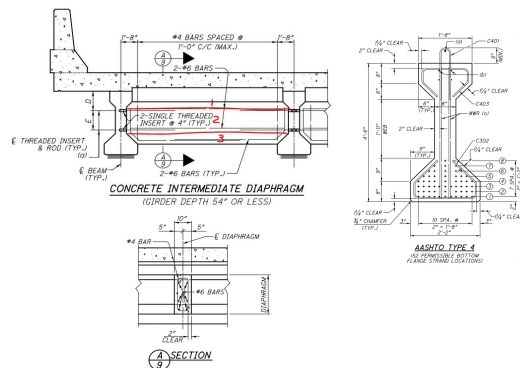
Beam		1.48
Spacing between beams	ft	7.50
Beam Height	in	48.00
Web Thickness	in	8.00
Top Flange Thickness	in	6.00
Top Flange Width	in	18.00
Top Flange Taper to Web Height	in	5.00
Bottom Flange Thickness	in	7.00
Bottom Flange Width	in	24.00
Bottom Flange Taper to Web Height	in	10.00
Diaphragm Thickness	in	12.00
Area 1	sf	5.50
Area 2	sf	6.17
Area 3	sf	1.11
Area 4	sf	0.09
Area 5	sf	0.28
Total Area (Area1 + Area2 + Area3 + 2*Area4 + Area5)	sf	13.229
Diaphragm Volume	cf	13.229
Diaphragm Weight	kips	1.984



Concrete Diaphragm Weight Calculator

8'-6" Beam Spacing with Widening Diaphragm

Beam		AASHTO Type 4
Spacing between beams	ft	8.50
Beam Height	in	54.00
Web Thickness	in	8.00
Top Flange Thickness	in	8.00
Top Flange Width	in	20.00
Top Flange Taper to Web Height	in	6.00
Bottom Flange Thickness	in	8.00
Bottom Flange Width	in	26.00
Bottom Flange Taper to Web Height	in	9.00
Diaphragm Thickness	in	10.00
Area 1	sf	3.67
Area 2	sf	15.01
Area 3	sf	5.31
Total Area (Area1 + Area2 + Area3)	sf	23.993
Diaphragm Volume	cf	19.994
Diaphragm Weight	kips	2.999



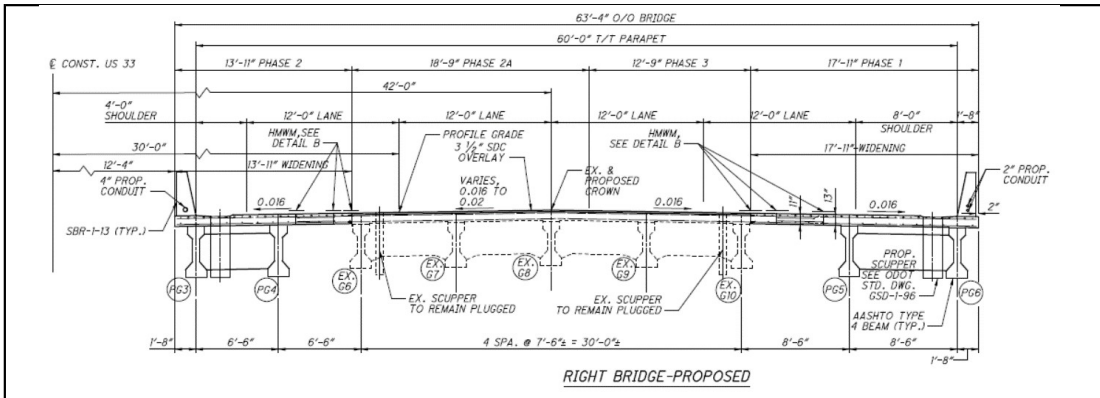
2LMN, INC.

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Concurred:	JBM	Date:	11/30/2021	Bridge No.:	FRA-00033-25.090L
Back Checked:	HHH	Date:	11/30/2021	SFN:	2501988
Released:	JBM	Date:	11/30/2021		
Project:	VAR-STW-BLR				
Subject:	Load Rating Dead Loads for BrR				

Concrete Diaphragm Weight Calculator

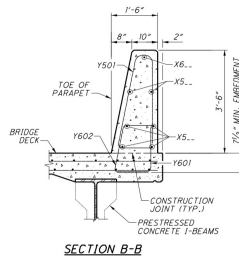
6'-6" Beam Spacing with Widening Diaphragm

Beam	ft	AASHTO Type 4	
Spacing between beams	ft	6.50	
Beam Height	in	54.00	66.54005277
Web Thickness	in	8.00	
Top Flange Thickness	in	8.00	
Top Flange Width	in	20.00	
Top Flange Taper to Web Height	in	6.00	6.293247
Bottom Flange Thickness	in	8.00	
Bottom Flange Width	in	26.00	24.458333
Bottom Flange Taper to Web Height	in	9.00	17.6875
Diaphragm Thickness	in	10.00	
Area 1	sf	2.67	
Area 2	sf	11.18	
Area 3	sf	3.81	
Total Area (Area1 + Area2 + Area3)	sf	17.660	
Diaphragm Volume	cf	14.716	
Diaphragm Weight	kips	2.207	



Parapet Weight

Concrete Unit Weight	pcf	150
42" Parapet		
Top Width	in	10.00
Bottom Width	in	18.00
Height	in	42.00
Total Area	sf	4.08
Total Weight / ft	kips/ft	0.613



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Back Checked:	HHH	Date:	11/30/2021	SFN:	2501988
Released:	JBM	Date:	11/30/2021		
Project:	VAR-STW-BLR				
Subject:	Load Rating Rebar Inputs for BrR				

Deck Profile - Reinforcement - Beam PG3

Location	Size	Cover (in)	BrR Distance (in)	STD - Eff. Flange Width (in)	STD Bar Count	LRFD - Eff. Flange Width (in)	LRFD Bar Count	Bar Spacing (in)
Top Long Bar	6	2.5	2.875	59.0004	5	59.0004	5	14.5
Bottom Long Bar	6	1.5	2.75	59.0004	5.5	59.0004	5.5	12.75
Bottom Trans Bar	7		Is Long bar above Trans? Yes	If Yes, then used in calculation above				

Deck Profile - Reinforcement - Beam PG4

Location	Size	Cover (in)	BrR Distance (in)	STD - Eff. Flange Width (in)	STD Bar Count	LRFD - Eff. Flange Width (in)	LRFD Bar Count	Bar Spacing (in)
Top Long Bar	6	2.5	2.875	78	6.5	78	6.5	14.5
Bottom Long Bar	6	1.5	2.75	78	7	78	7	12.75
Bottom Trans Bar	7		Is Long bar above Trans? Yes	If Yes, then used in calculation above				

Deck Profile - Reinforcement - Beam EX. G6

Location	Size	Cover (in)	BrR Distance (in)	STD - Eff. Flange Width (in)	STD Bar Count	LRFD - Eff. Flange Width (in)	LRFD Bar Count	Bar Spacing (in)
Top Long Bar	6	2.5	2.875	84	5.5	84	5.5	18
Bottom Long Bar	6	1.5	2.75	84	5.5	84	5.5	18
Bottom Trans Bar	7		Is Long bar above Trans? Yes	If Yes, then used in calculation above				

Deck Profile - Reinforcement - Beam EX. G7 - EX. G9

Location	Size	Cover (in)	BrR Distance (in)	STD - Eff. Flange Width (in)	STD Bar Count	LRFD - Eff. Flange Width (in)	LRFD Bar Count	Bar Spacing (in)
Top Long Bar	6	2.5	2.875	90	6	90	6	18
Bottom Long Bar	6	1.5	2.75	90	6	90	6	18
Bottom Trans Bar	7		Is Long bar above Trans? Yes	If Yes, then used in calculation above				

Deck Profile - Reinforcement - Beam PG5

Location	Size	Cover (in)	BrR Distance (in)	STD - Eff. Flange Width (in)	STD Bar Count	LRFD - Eff. Flange Width (in)	LRFD Bar Count	Bar Spacing (in)
Top Long Bar	6	2.5	2.875	98	6.5	98	6.5	18
Bottom Long Bar	6	1.5	2.75	98	6.5	98	6.5	18
Bottom Trans Bar	7		Is Long bar above Trans? Yes	If Yes, then used in calculation above				

Deck Profile - Reinforcement - Beam PG6

Location	Size	Cover (in)	BrR Distance (in)	STD - Eff. Flange Width (in)	STD Bar Count	LRFD - Eff. Flange Width (in)	LRFD Bar Count	Bar Spacing (in)
Top Long Bar	6	2.5	2.875	69.0004	5	69.0004	5	18
Bottom Long Bar	6	1.5	2.75	69.0004	5	69.0004	5	18
Bottom Trans Bar	7		Is Long bar above Trans? Yes	If Yes, then used in calculation above				

NUMBER OF 7/16" STRANDS PER BEAM											
LOADING S12-60				LOADING S15-60				LOADING S20-60			
SPAN	BEAM SPACING			SPAN	BEAM SPACING			SPAN	BEAM SPACING		
FT.	5'-0"	6'-0"	7'-0"	FT.	5'-0"	6'-0"	7'-0"	FT.	5'-0"	6'-0"	7'-0"
66				63				59			
67				64				60			
68				65				61			
69				66				62			
70				67				63			
71				68				64			
72				69				65			
73				70				66			
74				71				67			
75				72				68			
76				73				69			
77				74				70			
78				75				71			
79				76				72			
80				77				73			
81				78				74			
82				79				75			
83				80				76			
84				81				77			
85				82				78			
86				83				79			
87				84				80			
88				85				81			
89				86				82			
90				87				83			
91				88				84			
92				89				85			
93				90				86			
				91				87			

LOCATION OF STRANDS											
(number of row indicates distance from bottom)											
LOCATION AT MIDPOINT OF BEAMS				LOCATION OF DRAPED STRANDS AT END OF BEAMS							
n	e ₁	n _d	e ₂	2	4	6	8	10	12	24	28
34	17.28	10	8.93							3	3
35	17.17	11	8.14							3	3
36	17.07	12	7.40							3	3
37	16.97	11	8.43							3	3
38	16.87	12	7.72							3	3
39	16.78	11	8.68							3	3
40	16.70	12	8.00							3	3
41	16.62	11	8.91							3	3
42	16.54	12	8.26							3	3
43	16.42	13	7.54							3	3
44	16.31	14	6.85							3	3
45	16.20	15	6.20							3	3
46	16.10	14	7.05							3	3
47	16.00	15	6.42							3	3
48	15.90	14	7.23							3	3
49	15.81	15	6.62							3	3
50	15.68	16	7.24							3	3
51	15.56	17	6.65							3	3
52	15.44	18	6.09							3	3
53	15.32	17	6.76							3	3

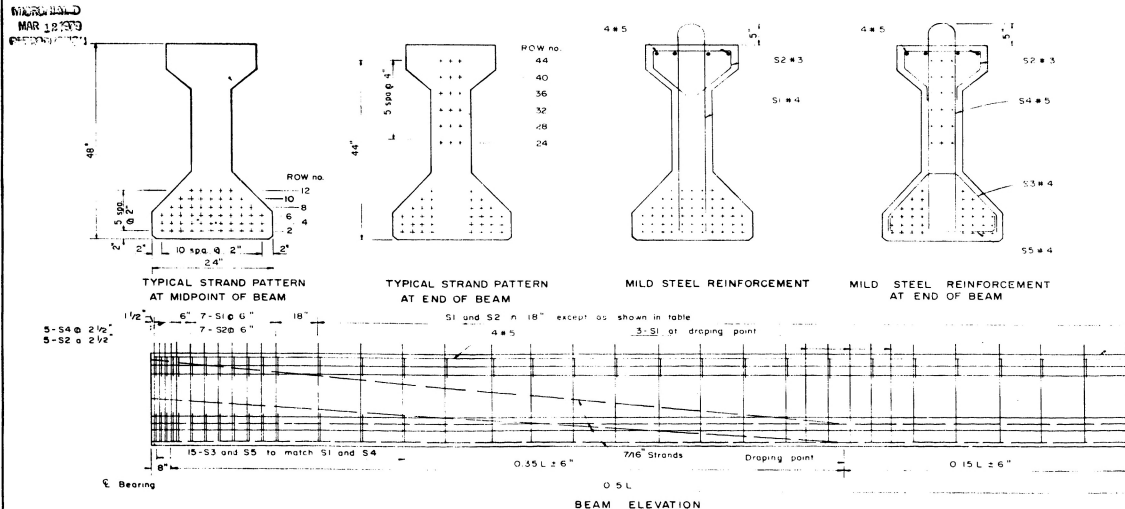
CAMBER AND DEFLECTION in											
BEAM SPACING											
SPAN	5'-0"	6'-0"	7'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	13'-0"	14'-0"	15'-0"
66											
67											
68											
69											
70											
71											
72											
73											
74											
75											
76											
77											
78											
79											
80											
81											
82											
83											
84											
85											
86											
87											
88											
89											
90											

SPACING OF STIRRUPS S1 AND S2			
LOADING	BEAM SPACING	SPAN	STIRRUP SPACING
S12-60	8'-0"	63'-70"	16"

n = total number of strands
n_d = total number of draped strands
e₁ = eccentricity of strands at midspan
e₂ = eccentricity of strands at end of beam
Δ₁ = camber at release of prestress computed with an assumed modulus of elasticity of 3,800,000 psi
Δ₂ = deflection due to dead load at slab computed with an assumed modulus of elasticity of 4,550,000 psi

DESIGN CRITERIA

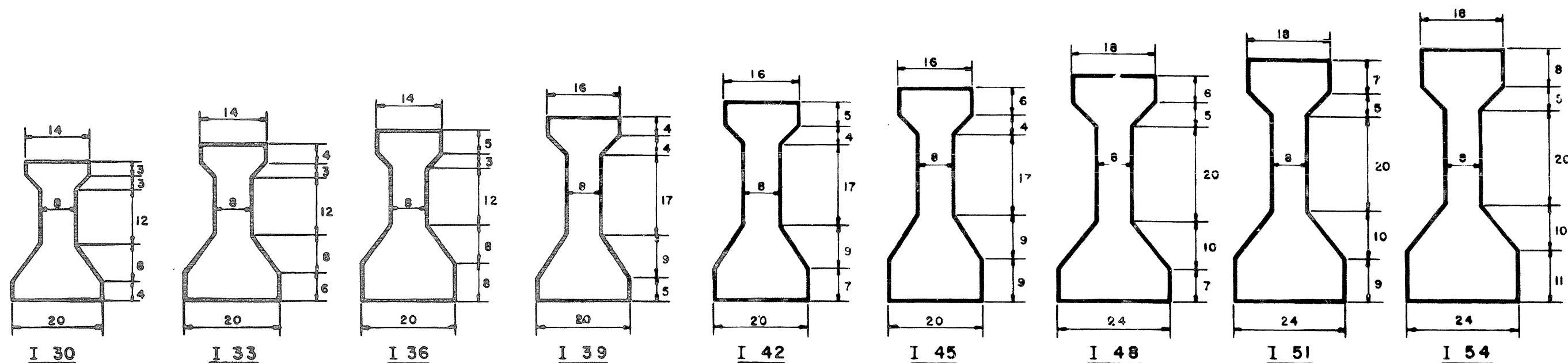
- This drawing conforms to the requirements of "Design Specifications for Highway Structures" of the State of Ohio, Department of Highways, dated 9-1-1957 together with revisions dated 2-21-1958 and 2-15-1961.
 - Properties for composite sections are computed with slab thicknesses and beam spacings as shown below:
- | LOADING | 5'-0" | 6'-0" | 7'-0" | 8'-0" |
|---------|--------|--------|--------|--------|
| S12-60 | 6 1/2" | 6 1/2" | 6 1/2" | 6 3/4" |
| S15-60 | 6 3/4" | 6 3/4" | 7" | 7 1/4" |
| S20-60 | 7 1/2" | 7 3/4" | 7 3/4" | 7 3/4" |
- E slab = 0.84
E beam
 - A monolithic wearing surface of 3/4" for loading S12-60 and 1" for loadings S15-60 and S20-60 is added to the weight of the slab
 - Provision is made for a future wearing surface of 30 pounds per square foot
 - Number of intermediate diaphragms are as follows:
40' ≤ L < 40' no diaphragm
40' ≤ L < 60' one diaphragm
60' ≤ L < 90' two diaphragms
90' ≤ L three diaphragms
 - Min concrete strength at 28 days = 5,500 psi
 - Min concrete strength at release of prestress = 4,000 psi
 - Prestressing strands are 7/16" uncoated seven wire stress-relieved strand with an initial tension of 18,900 per strand.
 - The total loss of prestress is assumed to be 20% of the initial stress.
Loss of prestress at release is assumed to be 8% of the initial stress.



Top of beam to be artificially roughened

REVISIONS		STATE OF OHIO DEPARTMENT OF HIGHWAYS DIVISION OF DESIGN AND CONSTRUCTION BUREAU OF BRIDGES	
		DESIGN DATA FOR PRESTRESSED CONCRETE I-BEAM 1-48 WITH DRAPED STRANDS	
APPROVED	DATE 11-15-60	DESIGNED BY	DRAWING NUMBER PSI-60
OHIO PRESTRESSED CONCRETE ASSN		REVIEWED	SHEET NO 17 OF 18 SHEETS

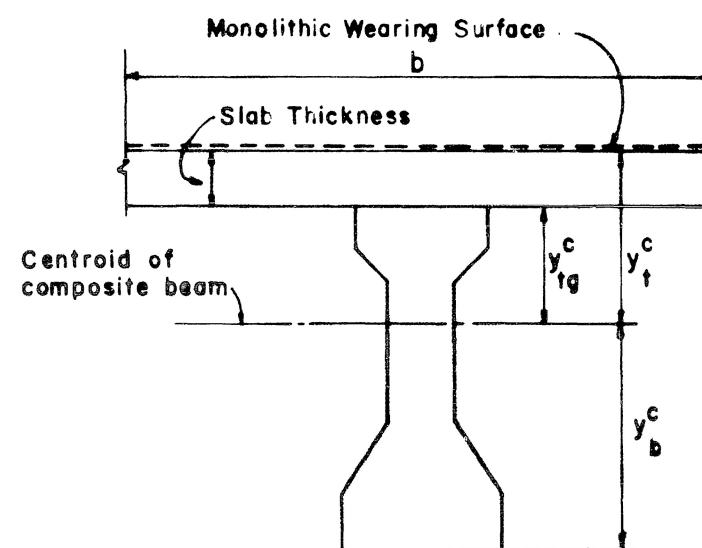
MICROFILMED
AUG 5, 1980



CROSS SECTIONS PRESTRESSED CONCRETE I-BEAMS

All dim. in inches

SECTION PROPERTIES								
BEAM NUMBER	WEIGHT lb./ft.	A in ²	y _t in	y _b in	I in ⁴	Z _t in ³	Z _b in ³	
I 30	378	363	16.88	13.12	32786	1942	2499	
I 33	434	417	18.65	14.35	44802	2400	3119	
I 36	490	471	20.38	15.62	59077	2899	3782	
I 39	494	474	21.30	17.70	75923	3564	4289	
I 42	552	530	23.06	18.94	97227	4216	5133	
I 45	610	586	24.77	20.23	121731	4914	6017	
I 48	689	661	26.60	21.40	165503	6222	7734	
I 51	757	727	28.41	22.59	202346	7122	8957	
I 54	826	793	30.18	23.82	243646	8073	10229	



CROSS SECTION COMPOSITE
BEAM

$$\frac{E_{\text{slab}}}{E_{\text{beam}}} = 0.84$$

A^c = area of beam plus area of cast in place slab taken 0.84 times its value.

b = beam spacing or effective flange width.

STATE OF OHIO DEPARTMENT OF HIGHWAYS DIVISION OF DESIGN AND CONSTRUCTION BUREAU OF BRIDGES	
DESIGN DATA FOR PRESTRESSED CONCRETE BRIDGE I-BEAM PROPERTIES OF I	
APPROVED DATE 11-15-60	DRAWING NUMBER PSI-60
PREPARED BY FHR WJJ	SHEET NO 2 OF 19 SHEETS