



2LMN, INC.

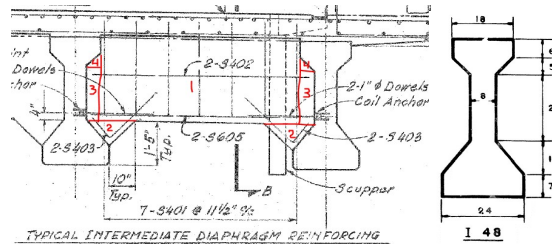
Calculated:	JBM	Date:	11/17/2021	Stage Review Submission:	FINAL
Checked:	HHH	Date:	11/19/2021	PID/Job No.:	114913
Concurred:	JBM	Date:	11/30/2021	Bridge No.:	FRA-00033-25.090L
Back Checked:	HHH	Date:	11/30/2021	SFN:	2501988
Released:	JBM	Date:	11/30/2021		
Project:	VAR-STW-BLR				
Subject:	Load Rating Dead Loads for BrR				

Diaphragm Weight - Concrete

Concrete Diaphragm Weight Calculator

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

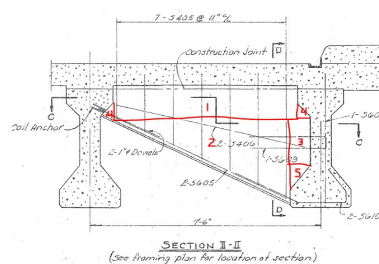
Reinforced Concrete Unit Weight	pcf	150.00
Beam		1.48
Spacing between beams	ft	7.50
Beam Height	in	48.00
Web Thickness	in	8.00
Top Flange Thickness	in	6.00
Top Flange Width	in	18.00
Top Flange Taper to Web Height	in	5.00
Bottom Flange Thickness	in	7.00
Bottom Flange Width	in	24.00
Bottom Flange Taper 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

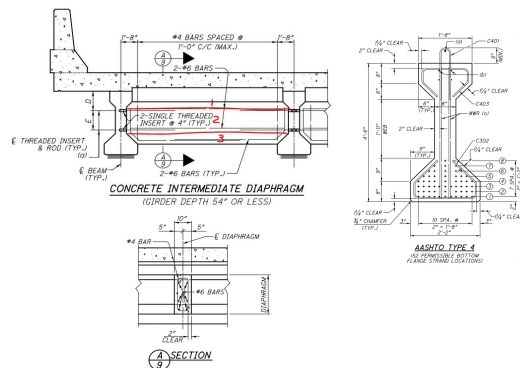
Beam		1.48
Spacing between beams	ft	7.50
Beam Height	in	48.00
Web Thickness	in	8.00
Top Flange Thickness	in	6.00
Top Flange Width	in	18.00
Top Flange Taper to Web Height	in	5.00
Bottom Flange Thickness	in	7.00
Bottom Flange Width	in	24.00
Bottom Flange Taper to Web Height	in	10.00
Diaphragm Thickness	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

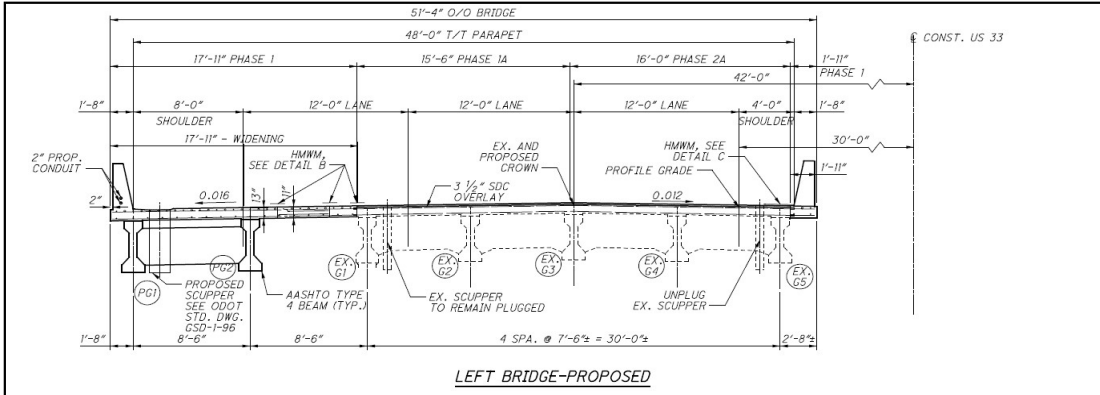
8'-6" Beam Spacing with Widening Diaphragm

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



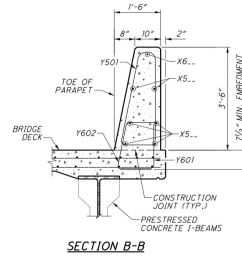
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Project:	VAR-STW-BLR				
Subject:	Load Rating Dead Loads for BrR				



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



2LMN, INC.

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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 PG1

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	6	71.0004	6	14.5
Bottom Long Bar	6	1.5	2.75	69.0004	6.5	71.0004	6.5	12.75
Bottom Trans Bar	7		Is Long bar above Trans? Yes	If Yes, then used in calculation above				

Deck Profile - Reinforcement - Beam PG2

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	8	102	8	14.5
Bottom Long Bar	6	1.5	2.75	98	8.5	102	9	12.75
Bottom Trans Bar	7		Is Long bar above Trans? Yes	If Yes, then used in calculation above				

Deck Profile - Reinforcement - Beam EX. G1

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	96	6.5	96	6.5	18
Bottom Long Bar	6	1.5	2.75	96	6.5	96	6.5	18
Bottom Trans Bar	7		Is Long bar above Trans? Yes	If Yes, then used in calculation above				

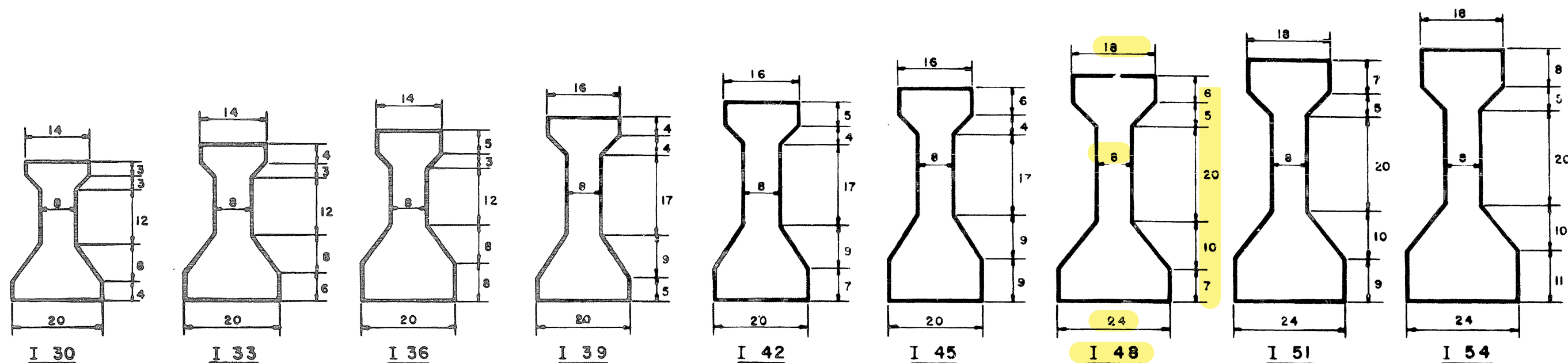
Deck Profile - Reinforcement - Beam EX. G2 - EX. G4

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 EX. G5

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	77.0004	5.5	77.0004	5.5	18
Bottom Long Bar	6	1.5	2.75	77.0004	5.5	77.0004	5.5	18
Bottom Trans Bar	7		Is Long bar above Trans? Yes	If Yes, then used in calculation above				

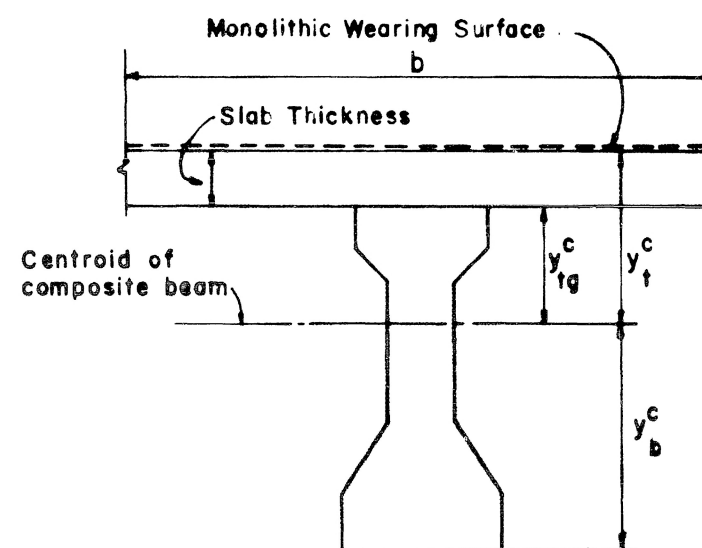
MICROFILMED
AUG 5, 1980



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

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			34	63			34	59			34
67			35	64			35	60			35
68			36	65			36	61			36
69			37	66			37	62			37
70		34	38	67		35	39	63		34	38
71		35	39	68		36	40	64		35	39
72		36	40	69		37	41	65		36	40
73		37	41	70		38	42	66		37	41
74		38	42	71		39	43	67		38	42
75	34	38	43	72	34	38	42	68	34	38	42
76	35	39	44	73	35	39	43	69	35	39	43
77	36	40	45	74	36	40	44	70	36	40	44
78	37	41	46	75	37	41	45	71	37	41	45
79	38	42	47	76	38	42	46	72	38	42	46
80	39	43	48	77	39	43	47	73	39	43	47
81	40	44	49	78	40	44	48	74	40	44	48
82	41	45	50	79	41	45	49	75	41	45	49
83	42	46	51	80	42	46	50	76	42	46	50
84	43	47	52	81	43	47	51	77	43	47	51
85	44	48	53	82	44	48	52	78	44	48	52
86	45	49	54	83	45	49	53	79	45	49	53
87	46	50	55	84	46	50	54	80	46	50	54
88	47	51	56	85	47	51	55	81	47	51	55
89	48	52	57	86	48	52	56	82	48	52	56
90	49	53	58	87	49	53	57	83	49	53	57
91	50	54	59	88	50	54	58	84	50	54	58
92	51	55	60	89	51	55	59	85	51	55	59
93				90				86			
				91				87			

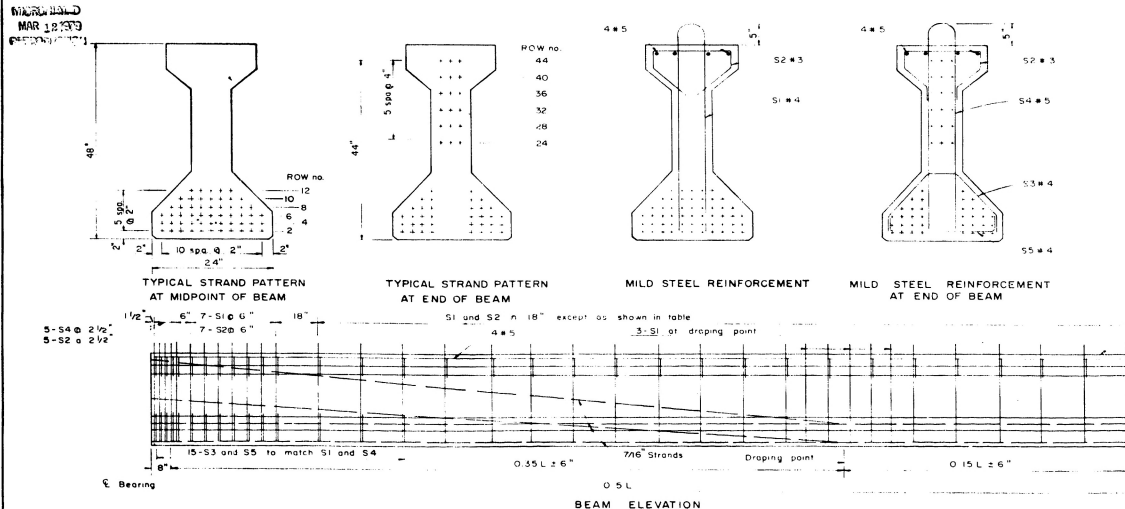
LOCATION OF STRANDS																	
(number of row indicates distance from bottom)																	
n	e ₁ in	n _d	e ₂ in	LOCATION AT MIDPOINT OF BEAMS								LOCATION OF DRAPED STRANDS AT END OF BEAMS					
				2	4	6	8	10	12	24	28	32	36	40	44		
34	17.28	10	8.93														
35	17.17	11	8.14														
36	17.07	12	7.40														
37	16.97	11	8.43														
38	16.87	12	7.72														
39	16.78	11	8.68														
40	16.70	12	8.00														
41	16.62	11	8.91														
42	16.54	12	8.26														
43	16.42	13	7.54														
44	16.31	14	6.85														
45	16.20	15	6.20														
46	16.10	14	7.05														
47	16.00	15	6.42														
48	15.90	14	7.23														
49	15.81	15	6.62														
50	15.68	16	7.24														
51	15.56	17	6.65														
52	15.44	18	6.09														
53	15.32	17	6.76														

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											
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89											
90											
91											
92											
93											

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:
- 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.



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	PREPARED BY	DRAWING NUMBER PSI-60
OHIO PRESTRESSED CONCRETE ASSN		REVIEWED	SHEET NO 17 OF 18 SHEETS

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"
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77	36	40	45	74	36	40	44	70	36	40	44
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80	39	43	48	77	39	43	47	73	39	43	47
81	40	44	49	78	40	44	48	74	40	44	48
82	41	45	50	79	41	45	49	75	41	45	49
83	42	46	51	80	42	46	50	76	42	46	50
84	43	47	52	81	43	47	51	77	43	47	51
85	44	48	53	82	44	48	52	78	44	48	52
86	45	49	54	83	45	49	53	79	45	49	53
87	46	50	55	84	46	50	54	80	46	50	54
88	47	51	56	85	47	51	55	81	47	51	55
89	48	52	57	86	48	52	56	82	48	52	56
90	49	53	58	87	49	53	57	83	49	53	57
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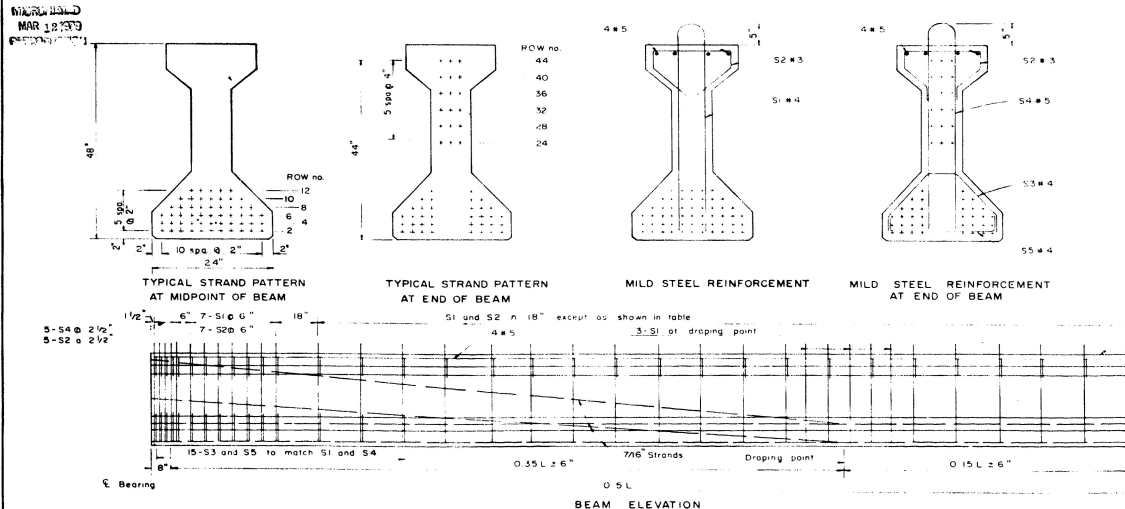
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43	16.42	13	7.54														
44	16.31	14	6.85														
45	16.20	15	6.20														
46	16.10	14	7.05														
47	16.00	15	6.42														
48	15.90	14	7.23														
49	15.81	15	6.62														
50	15.68	16	7.24														
51	15.56	17	6.65														
52	15.44	18	6.09														
53	15.32	17	6.76														

CAMBER AND DEFLECTION in											
BEAM SPACING											
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DESIGN CRITERIA

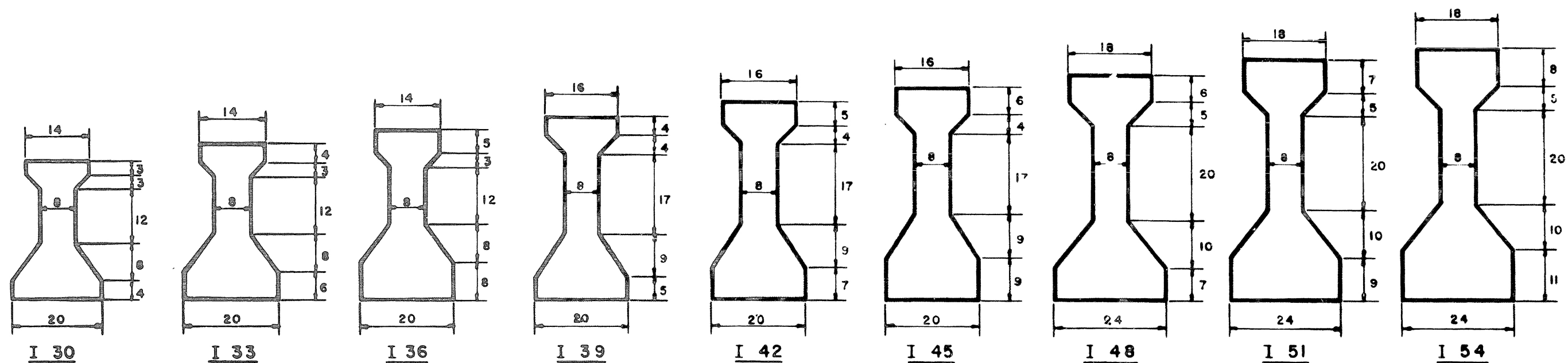
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- E_{slab} = 0.84
E_{beam}
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Loss of prestress at release is assumed to be 8% of the initial stress.



Top of beam to be artificially roughened

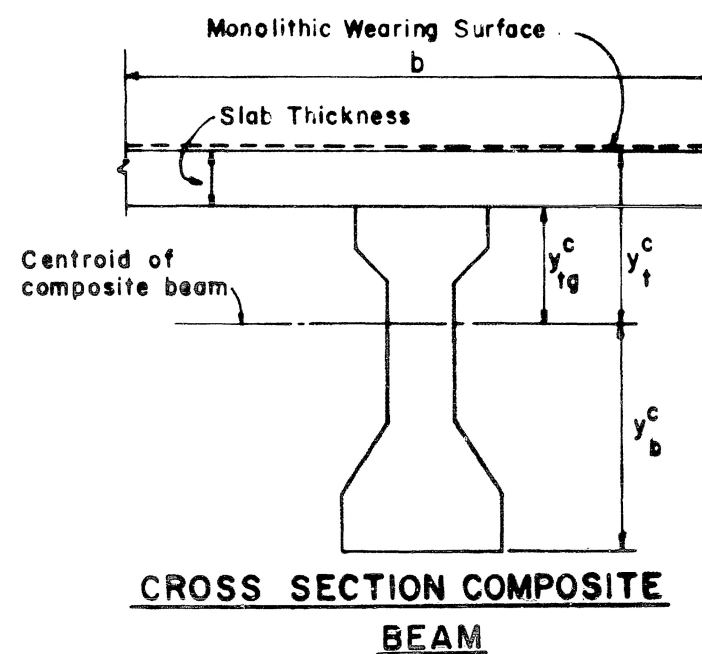
REVISIONS		STATE OF OHIO DEPARTMENT OF HIGHWAYS DIVISION OF DESIGN AND CONSTRUCTION BUREAU OF BRIDGES	
		DESIGN DATA FOR PRESTRESSED CONCRETE I-BEAM 1-48 WITH DRAPED STRANDS	
APPROVED	DATE 11-15-60	PREPARED BY	DRAWING NUMBER PSI-60
OHIO PRESTRESSED CONCRETE ASSN		REVIEWED	SHEET NO 17 OF 18 SHEETS

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	
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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	



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

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.

REVISIONS		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	DESIGNED BY	PSI-60
PREPARED BY	REVIEWED	SHEET NO 2	OF 19 SHEETS
OHIO PRESTRESSED CONCRETE ASS'N		FHR WJJ	