

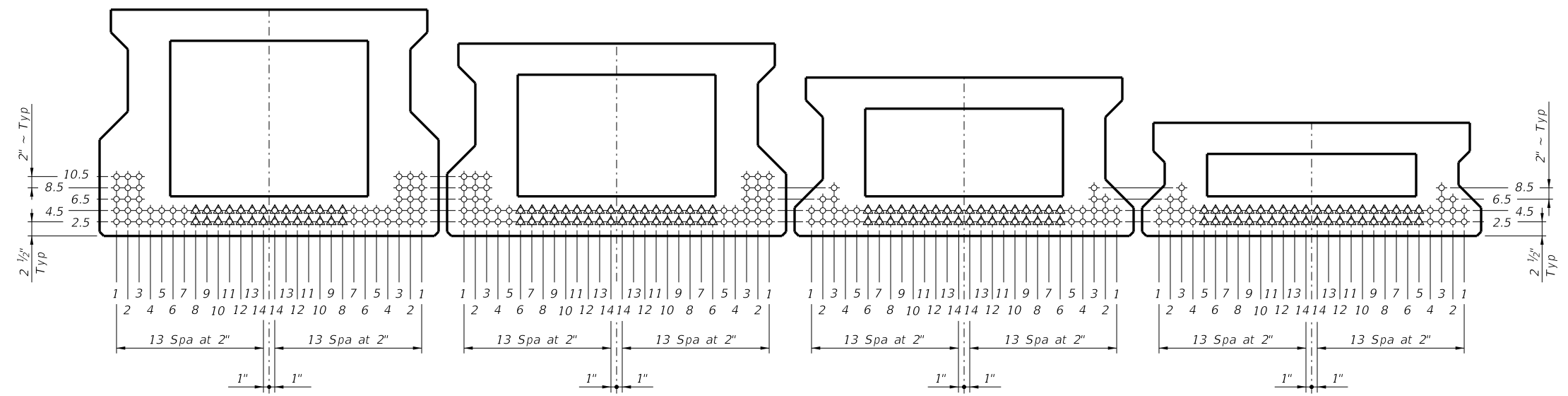
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STRUCTURE	DESIGNED BEAMS (STRAIGHT STRANDS)																			OPTIONAL DESIGN					LOAD RATING FACTORS						
	SPAN LENGTH (ft)	BEAM NO.	BEAM TYPE	PRESTRESSING STRANDS							DEBONDED STRAND PATTERN PER ROW					CONCRETE		DESIGN LOAD COMP STRESS (TOP $\epsilon$ ) (SERVICE I)	DESIGN LOAD TENSILE STRESS (BOTT $\epsilon$ ) (SERVICE III)	REQUIRED MINIMUM ULTIMATE MOMENT CAPACITY (STRENGTH I)	LIVE LOAD DISTRIBUTION FACTOR		STRENGTH I			SERVICE III					
				NON-STD STRAND PATTERN	TOTAL NO.	SIZE (in)	STRGTH (ksi)	"e" $\epsilon$ (in)	"e" END (in)	TOT NO. DEB	DIST FROM BOTTOM (in)	NO. OF STRANDS		NUMBER OF STRANDS DEBONDED TO (ft from end)							RELEASE STRENGTH $f'_{ci}$ (ksi)	MINIMUM 28 DAY COMP STRGTH $f'_c$ (ksi)	②		Inv		Opr		Inv		
												TOTAL	DE-BONDED	3	6	9	12						15	Moment	Shear	Inv	Opr	Inv	Opr	Inv	
Type 5XB20 X-BEAMS 40' Roadway 8.5" Slab	40	ALL	5XB20		12	0.6	270	7.03	7.03	0	2.50	12	0	0	0	0	0	0	4.000	5.000	1.326	-1.696	1280	0.679	0.891	1.24	1.60	1.20			
	45	ALL	5XB20		16	0.6	270	7.03	7.03	0	2.50	16	0	0	0	0	0	0	4.000	5.000	1.662	-2.079	1523	0.658	0.885	1.43	1.85	1.22			
	50	ALL	5XB20		20	0.6	270	7.03	7.03	0	2.50	20	0	0	0	0	0	0	4.000	5.000	2.035	-2.514	1811	0.640	0.879	1.51	1.96	1.13			
	55	ALL	5XB20		26	0.6	270	7.03	7.03	6	2.50	26	6	4	0	2	0	0	4.000	5.000	2.474	-3.009	2122	0.624	0.875	1.65	2.18	1.15			
	60	ALL	5XB20		32	0.6	270	6.78	6.72	6	2.50	28	6	2	2	2	0	0	4.700	5.000	2.935	-3.526	2442	0.610	0.871	1.55	2.05	1.14			
65	ALL	5XB20		38	0.6	270	6.51	6.41	6	2.50	28	6	2	0	2	2	0	5.200	5.500	3.472	-4.115	2792	0.598	0.867	1.51	2.00	1.05				
Type 5XB28 X-BEAMS 40' Roadway 8.5" Slab	40	ALL	5XB28		12	0.6	270	10.63	10.63	0	2.50	12	0	0	0	0	0	0	4.000	5.000	0.846	-1.059	1772	0.709	0.935	1.72	2.23	2.39			
	45	ALL	5XB28		12	0.6	270	10.63	10.63	0	2.50	12	0	0	0	0	0	0	4.000	5.000	1.066	-1.302	1797	0.687	0.930	1.35	1.75	1.70			
	50	ALL	5XB28		14	0.6	270	10.63	10.63	0	2.50	14	0	0	0	0	0	0	4.000	5.000	1.317	-1.585	1921	0.669	0.925	1.31	1.70	1.43			
	55	ALL	5XB28		16	0.6	270	10.63	10.63	0	2.50	16	0	0	0	0	0	0	4.000	5.000	1.592	-1.888	2228	0.652	0.920	1.26	1.63	1.19			
	60	ALL	5XB28		20	0.6	270	10.63	10.63	0	2.50	20	0	0	0	0	0	0	4.000	5.000	1.872	-2.198	2559	0.638	0.917	1.42	1.84	1.22			
	65	ALL	5XB28		24	0.6	270	10.63	10.63	2	2.50	24	2	2	0	0	0	0	4.000	5.000	2.193	-2.545	2916	0.625	0.914	1.51	1.97	1.16			
	70	ALL	5XB28		28	0.6	270	10.63	10.63	4	2.50	28	4	2	2	0	0	0	4.000	5.000	2.528	-2.904	3282	0.613	0.911	1.57	2.04	1.10			
	80	ALL	5XB28		34	0.6	270	10.28	10.20	6	2.50	28	6	2	0	2	2	0	4.200	5.000	2.903	-3.300	3675	0.602	0.909	1.61	2.13	1.11			
80	ALL	5XB28		40	0.6	270	10.03	9.88	8	2.50	28	8	2	2	2	0	2	4.800	5.100	3.305	-3.721	4086	0.592	0.907	1.47	1.98	1.13				
Type 5XB34 X-BEAMS 40' Roadway 8.5" Slab	40	ALL	5XB34		12	0.6	270	13.11	13.11	0	2.50	12	0	0	0	0	0	0	4.000	5.000	0.673	-0.798	1844	0.726	0.963	2.05	2.65	3.24			
	45	ALL	5XB34		12	0.6	270	13.11	13.11	0	2.50	12	0	0	0	0	0	0	4.000	5.000	0.870	-0.990	2207	0.704	0.958	1.62	2.10	2.38			
	50	ALL	5XB34		14	0.6	270	13.11	13.11	0	2.50	14	0	0	0	0	0	0	4.000	5.000	1.072	-1.204	2493	0.685	0.953	1.59	2.06	2.08			
	55	ALL	5XB34		14	0.6	270	13.11	13.11	0	2.50	14	0	0	0	0	0	0	4.000	5.000	1.294	-1.435	2430	0.668	0.949	1.26	1.63	1.47			
	60	ALL	5XB34		16	0.6	270	13.11	13.11	0	2.50	16	0	0	0	0	0	0	4.000	5.000	1.535	-1.683	2683	0.653	0.946	1.24	1.61	1.27			
	65	ALL	5XB34		18	0.6	270	13.11	13.11	0	2.50	18	0	0	0	0	0	0	4.000	5.000	1.797	-1.949	3061	0.640	0.943	1.20	1.56	1.07			
	70	ALL	5XB34		22	0.6	270	13.11	13.11	0	2.50	22	0	0	0	0	0	0	4.000	5.000	2.058	-2.215	3439	0.628	0.941	1.37	1.78	1.12			
	75	ALL	5XB34		26	0.6	270	13.11	13.11	2	2.50	26	2	2	0	0	0	0	4.000	5.000	2.356	-2.513	3849	0.617	0.939	1.49	1.93	1.09			
	80	ALL	5XB34		30	0.6	270	12.97	12.95	4	2.50	28	4	2	2	0	0	0	4.000	5.000	2.647	-2.806	4256	0.607	0.937	1.56	2.03	1.06			
	85	ALL	5XB34		36	0.6	270	12.66	12.54	8	2.50	28	8	2	4	0	2	0	4.000	5.000	3.016	-3.166	4730	0.597	0.935	1.62	2.16	1.06			
	90	ALL	5XB34		42	0.6	270	12.44	12.23	10	2.50	28	10	2	4	2	0	2	4.400	5.000	3.348	-3.495	5177	0.589	0.934	1.51	2.01	1.12			
95	ALL	5XB34		46	0.6	270	12.32	12.11	10	2.50	28	10	2	4	0	2	2	4.800	5.700	3.722	-3.861	5660	0.581	0.933	1.47	1.97	1.06				
Type 5XB40 X-BEAMS 40' Roadway 8.5" Slab	40	ALL	5XB40		12	0.6	270	15.70	15.70	0	2.50	12	0	0	0	0	0	0	4.000	5.000	0.576	-0.650	1919	0.741	0.988	2.36	3.06	4.02			
	45	ALL	5XB40		12	0.6	270	15.70	15.70	0	2.50	12	0	0	0	0	0	0	4.000	5.000	0.743	-0.807	2299	0.718	0.982	1.89	2.44	3.02			
	50	ALL	5XB40		14	0.6	270	15.70	15.70	0	2.50	14	0	0	0	0	0	0	4.000	5.000	0.915	-0.982	2753	0.699	0.978	1.85	2.40	2.68			
	55	ALL	5XB40		16	0.6	270	15.70	15.70	0	2.50	16	0	0	0	0	0	0	4.000	5.000	1.104	-1.171	3229	0.682	0.975	1.80	2.33	2.37			
	60	ALL	5XB40		16	0.6	270	15.70	15.70	0	2.50	16	0	0	0	0	0	0	4.000	5.000	1.298	-1.365	3199	0.667	0.972	1.47	1.91	1.78			
	65	ALL	5XB40		16	0.6	270	15.70	15.70	0	2.50	16	0	0	0	0	0	0	4.000	5.000	1.517	-1.580	3186	0.653	0.969	1.19	1.54	1.26			
	70	ALL	5XB40		18	0.6	270	15.70	15.70	0	2.50	18	0	0	0	0	0	0	4.000	5.000	1.753	-1.811	3600	0.641	0.967	1.18	1.53	1.08			
	75	ALL	5XB40		22	0.6	270	15.70	15.70	0	2.50	22	0	0	0	0	0	0	4.000	5.000	2.005	-2.054	4031	0.629	0.965	1.37	1.77	1.15			
	80	ALL	5XB40		26	0.6	270	15.70	15.70	2	2.50	26	2	2	0	0	0	0	4.000	5.000	2.253	-2.296	4462	0.619	0.964	1.52	1.97	1.17			
	85	ALL	5XB40		30	0.6	270	15.57	15.54	6	2.50	28	6	4	2	0	0	0	4.000	5.000	2.536	-2.567	4933	0.610	0.963	1.62	2.09	1.14			
	90	ALL	5XB40		34	0.6	270	15.35	15.24	8	2.50	28	8	4	4	0	0	0	4.000	5.000	2.809	-2.830	5394	0.601	0.962	1.68	2.18	1.09			
95	ALL	5XB40		40	0.6	270	15.10	14.90	10	2.50	28	10	2	6	0	2	0	4.000	5.000	3.156	-3.155	5936	0.592	0.961	1.63	2.17	1.10				
100	ALL	5XB40		44	0.6	270	14.98	14.70	12	2.50	28	12	2	6	2	0	2	4.300	5.100	3.476	-3.460	6455	0.585	0.960	1.53	2.04	1.04				
105	ALL	5XB40		50	0.6	270	14.82	14.48	14	2.50	28	14	2	6	2	2	2	4.700	5.700	3.845	-3.805	7030	0.578	0.959	1.51	2.01	1.09				

- ① Based on the following allowable stresses (ksi):  
Compression = 0.65  $f'_{ci}$   
Tension = 0.24  $\sqrt{f'_{ci}}$   
Optional designs must likewise conform.
- ② Portion of full HL93.

**DESIGN NOTES:**  
Designed in accordance with AASHTO LRFD Bridge Design Specifications.  
Load rated using Load and Resistance Factor Rating according to AASHTO Manual for Bridge Evaluation.  
Prestress losses for the designed beams have been calculated for a relative humidity of 60 percent. Optional designs must likewise conform.  
Beam designs are applicable for 8 1/2" concrete slabs without overlay and 0 through 30 degree skews.

**FABRICATION NOTES:**  
Provide Class H concrete.  
Provide Grade 60 reinforcing steel bars.  
Use low relaxation strands, each pretensioned to 75 percent of fpu.  
When shown on this sheet, the Fabricator has the option of furnishing either the designed beam or an approved optional beam design. All optional design submittals and shop drawings must be signed, sealed and dated by a Professional Engineer registered in the State of Texas.  
Locate strands for the designed beam as low as possible on the 2" grid system unless a non-standard strand pattern is indicated. Fill row "2.5", then row "4.5", then row "6.5", etc. Place strands within a row as follows:  
1) Locate a strand in each "1" position.  
2) Place strand symmetrically about vertical centerline of box.  
3) Space strands as equally as possible across the entire width.  
Strand debonding must comply with Item 424.4.2.2.4. Do not debond strands in position "1". Distribute debonded strands equally about the vertical centerline. Decrease debonded lengths working inward, with debonding staggered in each row.  
Full-length debonded strands are only permitted in positions marked  $\Delta$ . Double wrap full-length debonded strands.



HL93 LOADING

Texas Department of Transportation  
Bridge Division Standard

## PRESTRESSED CONCRETE X-BEAM STANDARD DESIGNS 40' ROADWAY

### XBSD-40

FILE: XB-XBSD40-22.dgn	DN: TAR	CK: EFC	DW: JER	CK: TAR
©TxDOT August 2022	CONT	SECT	JOB	HIGHWAY
REVISIONS				
DIST		COUNTY		SHEET NO.

DATE:  
FILE: