Bridge Grid Flooring Systems

Rehabilitation of Queensboro Bridge, New York City, N.Y.

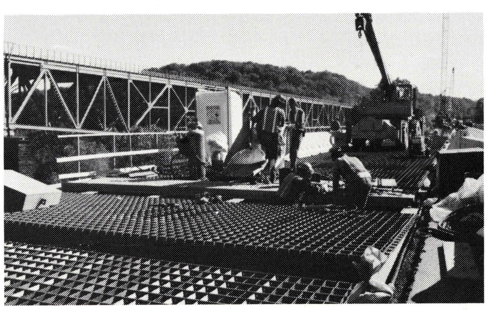
BRIDGE GRID FLOORING SYSTEMS

Tenth Street Bridge, Pittsburgh, PA, 3″ Full Depth Grid Installed 1932

Design and Specification Data According To The

Bridge Grid Flooring Manufacturers Association

231 South Church St., Mt. Pleasant, PA 15666



Rehabilitation of Pennsylvania Turnpike Allegheny River Bridge

NOTE: The information contained herein has been prepared in accordance with generally accepted engineering principles. However, the Bridge Grid Flooring Manufacturers Association is not responsible for any errors that may be contained herein. The user of the information provided herein should check the information supplied and make an independent determination as to its applicability to any particular project or application.

The Bridge Grid Flooring Manufacturers Association

The Bridge Grid Flooring Manufacturers Association was formed to promote the use of Concrete Filled Steel Grid Floor Systems, and to provide the bridge community with engineering information pertaining to them. This catalog is intended to provide that information.

Bridge Grid Flooring Systems

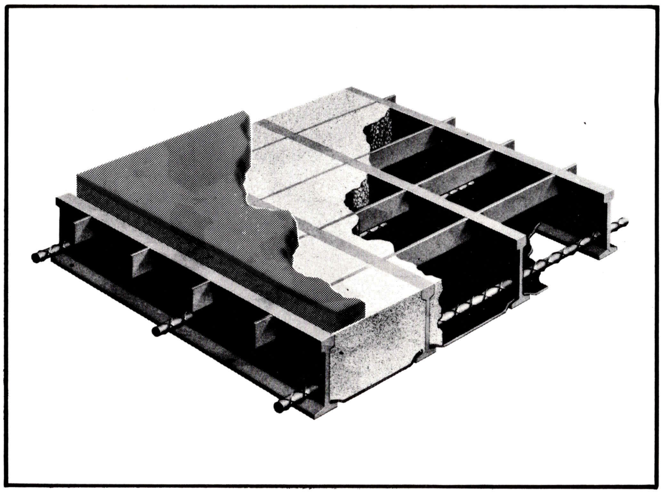
Concrete Filled Steel Grid Bridge Floors and Exodermic Systems are the most sophisticated type of reinforced concrete decks. Offering composite action, light weight with low cost and durability. . . many bridge engineers regard them as the best answer to deck rehabilitation.

Description

Bridge Grid Flooring Systems is a method of producing a reinforced concrete deck, utilizing interlocking steel grid members. This configuration yields a strong, lightweight floor with a wide range of design choices. By altering the spacing between steel members of the grid and the location of the concrete, a bridge designer can choose a system which most economically matches design parameters of a particular bridge. The three primary categories of grid systems are described below.

Full Depth Concrete Grid Floors

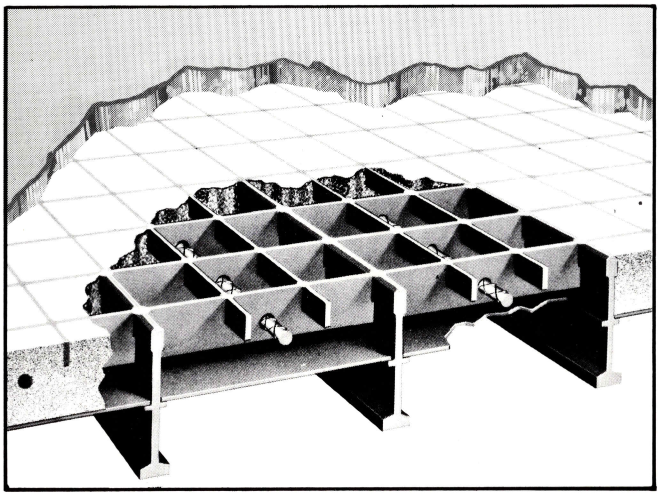
In this configuration, the entire profile of the Grid System is filled with concrete by the placement of a concrete-retaining pan at the bottom of the system. Full Depth Grids are available in 4-1/4″ and 5″ depths, weigh between 60-80# psf, with span capabilities up to 16′-0″. (Depth and weight do not include wearing surface.)



Full-Depth Concrete-Grid Floor

Half Depth Concrete Grid Floors

This category of Grids is available only in 5″ depth (not including wearing surface). Only the top half of the floor (2-1/2″) is filled with concrete, achieved by placement of a concrete retaining pan at mid point of the steel grid network. These floors weigh between 45-51# psf, with span capabilities to 10′-6″.

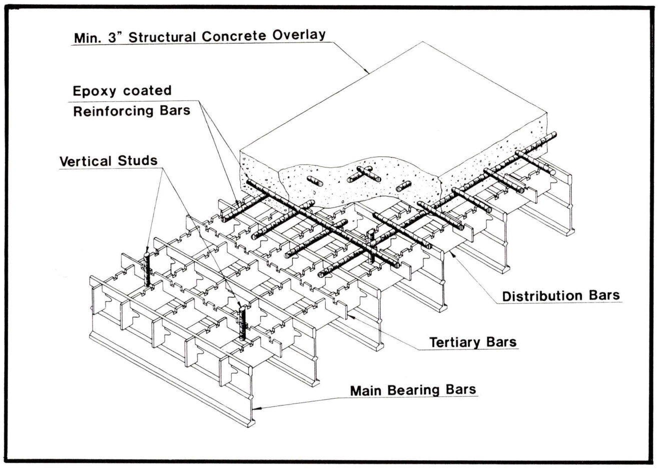


Half-Depth Concrete-Grid Floor

Exodermic Bridge Deck Systems

Exodermic is a patented* design concept that combines steel grid and reinforced concrete in a unique way; the concrete slab is placed on top of, and made composite with, a Steel Grid. This maximizes the use of the compressive strength of concrete and the tensile strength of steel. Horizontal shear transfer is developed through the partial embedment in the concrete of one of the steel grid components, in addition to vertical studs which extend from the grid into the slab. Overall thickness of the system (grid plus concrete) ranges from 7″ to 9″; weights range between 50 and 70# psf, with span capabilities to 17′-0″ and beyond.

*Members of BGFMA are licensed manufacturers of Exodermic Bridge Decks.



Exodermic Deck System

Quality Assurance

Members of the Bridge Grid Flooring Manufacturers Association manufactures its products in accordance with an approved American Institute of Steel Construction (AISC) Quality Certification Program. This is considered part of the specification when specifying from this manual.

Design Criteria and Assumptions

- AASHTO 1985 Interim
- Transformed Area (3.27.2.2)
- f'_c = 4000 psi   n = 8 (10.38.1.3)
- A36 f_y = 20 ksi
- A588 (or A572 gd. 50) f_y = 27 ksi (10.32.1)
- Continuity 0.8 positive and negative dead and live load (3.24.3.1)
- Impact 30% (3.8.2.1)
- Concrete weight = 144 lb./cu.ft.
- Steel weight-490 lb./cu.ft.
- Live load composite positive and negative moment.
- Dead load steel alone positive and negative moment.
- Wearing surface considered in design examples only.
- Span Length - S equals distance beween edges of stringer flanges plus ½ flange width (3.24.1.2.b)
- Transverse Distribution - full depth
  $M_{LL} = \left(\frac{S+2}{32}\right)P$ (3.24.3.1)
- Longitudinal Distribution - full depth
  $M_{LL} = 900S$ (3.24.3.2)
- Transverse and Longitudinal Distribution - half depth
  E = 4 ft.
  $M_{LL} = \frac{16000xS}{4} \times \frac{1}{E} = 1000S$ (3.24.3.2)
- Spans shown = Clear Span + ½ Flange (Assuming Flange = 12″)

Design Examples - Full and Half-Depth Systems

As an example, let us design a 4¼″ full depth floor, using A36 steel for the case of traffic transverse to the main members. Stringer spacing is 7′-6″ cc, with a flange width of 12″ and a 1¾″ overlay for a wearing surface.

The design span length is S = (7.50 - 0.50) = 7.00 ft. Select a 4¼″ Full Depth Floor with a 6″ spacing of main reinforcement, which has an allowable design span of 7.48 ft., and n = 8.

The net section properties in $(in)^3$ per ft. are:

Top Steel = 2.924   Bot Steel = 3.348

The composite section properties in $(in)^3$ per ft. with n = 8 are:

Positive : S_t = 50.275(conc) S_b = 3.568(st)
Negative: S_t = 3.055(st) S_b = 50.095(conc)

The theoretical dead load weight of concrete and steel is 61.8# psf plus a 1¾″ overlay wearing surface = 21# psf.

The grid floor is continuous over three or more supports, so the design moments are calculated using a continuity factor of 0.8. An impact factor of 0.3 is used. Thus,

$M_{LL+I} = \frac{(7.00 + 2)}{32} 16 \times 1.3 \times 0.8 = 4.680$ k-ft./ft.

$M_{DL} = (0.062 \times 7.00^2/8)\ 0.8 = 0.304$ k-ft./ft.

$M_{WS} = (0.021 \times 7.00^2/8)\ 0.8 = 0.103$ k-ft./ft.

The stresses are calculated as follows:

Positive:

Steel:
f_{LL+I} = 4.680 x 12/3.568 = 15.740
f_{DL} = 0.304 x 12/3.348 = 1.090
f_{WS} = 0.103 x 12/3.568 = 0.346
f_{st} = 17.176 ksi

Concrete:
f_{LL+I} = 4.680 x 12/50.275 = 1.117
f_{WS} = 0.103 x 12/50.275 = 0.025
f_{conc} = 1.142 ksi

Negative:

Steel:
f_{LL+I} = 4.680 x 12/3.055 = 18.383
f_{DL} = 0.304 x 12/2.924 = 1.248
f_{WS} = 0.103 x 12/3.055 = 0.405
f_{st} = 20.036 ksi

Concrete:
f_{LL+I} = 4.680 x 12/50.095 = 1.121
f_{WS} = 0.103 x 12/50.095 = 0.025
f_{conc} = 1.146 ksi

All stresses meet the allowable limits of 1.600 ksi for concrete and 20 ksi for A36 steel. The design is therefore satisfactory.

As a second example, let us design a 5″ Half Depth grid floor, using A36 steel for the traffic either parallel or transverse to the main members. Beam spacing is 7′0″cc with a flange width of 12″ and a 1¾″ overlay for a wearing surface.

The design span length is S = (7.00 - 0.50) = 6.50 ft. Select a 5″ Half Depth grid, with a 6″ spacing of main reinforcement and one supplementary bearing bar, which has an allowable design span of 7.59 ft. and use n = 8.

The net section properties in $(in)^3$ per ft. are:

Top Steel = 4.678 (Neg.)   Bot Steel = 4.795 (Pos.)

The composite section properties in $(in)^3$ per ft. with n = 8 are:

Positive : S_t = 74.383(conc) S_b = 5.182(st)
Negative: S_t = 4.678(st only) S_b = 5.280(st)

The theoretical dead load weight of concrete and steel is 48.6# psf plus a 1 13/16″ wearing surface = 21# psf.

The grid floor is continuous over three or more supports, so the design moments are calculated using a continuity factor of 0.8. An impact factor of 0.3 is used. Thus,

$M_{LL+I} = (1.000 \times 6.5)\ 1.3 \times 0.8 = 6.760$ k-ft./ft.

$M_{DL} = (0.049 \times 6.5^2/8)\ 0.8 = 0.207$ k-ft./ft.

$M_{WS} = (0.021 \times 6.5^2/8)\ 0.8 = 0.089$ k-ft./ft.

The stresses are calculated as follows:

Positive:

Steel:
f_{LL+I} = 6.760 x 12/5.182 = 15.654
f_{DL} = 0.207 x 12/4.795 = 0.518
f_{WS} = 0.089 x 12/5.182 = 0.206
f_{st} = 16.378 ksi

Concrete:
f_{LL+I} = 6.760 x 12/74.383 = 1.091
f_{WS} = 0.089 x 12/74.383 = 0.014
f_{conc} = 1.105 ksi

Negative:

Steel: (TOP)
f_{LL+I} = 6.760 x 12/4.678 = 17.341
f_{DL} = 0.207 x 12/4.678 = 0.531
f_{WS} = 0.089 x 12/4.678 = 0.228
f_{st} = 18.100 ksi

Steel: (BOTTOM)
f_{LL+I} = 6.760 x 12/5.280 = 15.364
f_{DL} = 0.207 x 12/5.28 = 0.470
f_{WS} = 0.089 x 12/5.280 = 0.202
f_{st} = 16.036 ksi

All stresses meet the allowable limits of 1.600 ksi for concrete and 20 ksi for A36 steel. The design is therefore satisfactory.

NOTE: FURTHER REDUCTION OF DEAD LOAD CAN BE ACHIEVED THROUGH THE USE OF LIGHTWEIGHT CONCRETE.

Design Examples — Exodermic Deck Systems

The design criteria and assumptions show on page 3 of this catalog apply to the following design examples, except that allowable grid material stresses shall be reduced by 20%. Computation of section properties of Exodermic Bridge Deck was made on an IBM-PC using software developed by the Exodermic Bridge Deck Institute, P.O. Box 374, Westwood, New Jersey 07675, and is available from them. This computer program produces all of the physical property data for exodermic deck installations, including the data when the deck is composite with bridge floor system members.

Example #1

As an example, let us design an Exodermic Deck using the 5-3/16″ deep I-Beam weighing 6.09#/sf, A588 steel, spaced 8″ center to center, with a 4″ thick reinforced concrete slab composite with the grid. Reinforcement of the slab is #5 and #3 rebar, spaced 4″ on center, both ways; 4000# concrete. Stringer spacing is 16′-0″. Deck weight is 65#/sf (53# lightweight).

$$M_{LL+I} = \left(\frac{15.5+2}{32}\right) 16 \times 1.3 \times 0.8 = 9.1\text{K-Ft./Ft.}$$

$$M_{DL} \left(\frac{0.065 \times 15.5^2}{8}\right) \times 0.8 = 1.56$$

$$\text{Total} = 10.66 \text{ K-Ft./Ft.}$$

Positive Bending:

$$\text{fc. top of concrete} = \frac{10.66 \times 12}{155.68} = 822 \text{ psi}$$

$$\text{ft. bott. of main grid bar} = \frac{10.66 \times 12}{10.75} = 11{,}900 \text{ psi}$$

Negative Bending:

$$\text{ft. top reinf. bar} = \frac{10.66 \times 12}{8.21} = 15{,}581 \text{ psi}$$

$$\text{fc. bott. of main grid bar} = \frac{10.66 \times 12}{6.94} = 18{,}432 \text{ psi}$$

Example #2

As a second example, let us design an Exodermic Deck using a 4-1/4″ I-Beam weighing 5.0#/sf, A36 steel, spaced 10″ on center, with a 3″ concrete slab, composite with the grid. Reinforcement of the slab is #3 and #2 rebar, spaced 4″ on center, both ways; 4000# concrete. Stringer spacing is 8′-0″. Deck weight is 49#/sf (40# lightweight).

$$M_{LL+I} = \left(\frac{7.5+2}{32}\right) 16 \times 1.3 \times 0.8 = 4.94 \text{ K-Ft./Ft.}$$

$$M_{DL} = \left(\frac{0.049 \times 7.5^2}{8}\right) \times 0.8 = \underline{.28}$$

$$\text{Total} = 5.22 \text{ K-Ft./Ft.}$$

Positive Bending:

$$\text{fc. top of concrete} = \frac{5.22 \times 12}{86.12} = 727 \text{ psi}$$

$$\text{ft. bott. of main grid bar} = \frac{62.64}{5.20} = 12{,}046 \text{ psi}$$

Negative Bending:

$$\text{ft. top reinf. bar} = \frac{62.64}{3.77} = 16{,}615 \text{ psi}$$

$$\text{fc. bott. of main grid bar} = \frac{62.64}{3.27} = 19{,}156 \text{ psi}$$

Design Options

Exodermic bridge deck may be made using any steel grid and any configuration of reinforced concrete upper component.

The reinforced concrete component may be left exposed as the traffic surface, or it may be overlaid with any material compatible with concrete. Main bearing bars (I-beams) regularly available are 4¼″ (5.0#/ft.) and 5³⁄₁₆″ (5.58# and 6.09#/ft.) Spacings are standard for 6″, 8″, 10″ and 12″ center to center.

Distribution bars are slotted half depth to permit assembly of the grid. Tertiary bars are not slotted.

Bar reinforcement is entirely at the design engineer's option except that all reinforcement should be fusion bonded epoxy coated. The upper layer of reinforcement is most effective in negative moment areas of the deck.

Concrete selection is also at the design engineer's option. The use of very low water/cement ratio mix design using ⅜″ maximum size coarse aggregate is recommended.

Suggested Specifications

Bridge flooring shall be of Exodermic composite concrete unfilled grid type as manufactured by a licensed producer.

Design: Current AASHTO design specifications shall be adhered to (and current specifications for concrete filled grid shall apply), except that the Working Stress Method only shall be used and reduction of allowable grid material stresses by 20% is recommended.

The reinforced concrete slab shall be at least 2¾″ thick, reinforced with #3 bars @ 6″ E.W., minimum, and shall have ⅜″ maximum size coarse aggregate.

The concrete slab shall not embed more than ⅛″ of the top of the main bars or distribution bars.

Vertical studs spaced at least one per square foot shall be fillet welded to the tertiary bars midway between the grid distribution bars. These studs shall be #4 bars and shall extend from the bottom of the tertiary bars to 1″ below the top surface of the concrete.

Headed studs shall be attached to the structural framing supporting the Exodermic Deck after placement of the deck modules and shall be spaced to assure full horizontal shear transfer between the Exodermic Bridge Deck (including a future wearing surface) and the structural framing.

Fabrication: Specifications currently in force as published by AASHTO, AISC, ASTM, and AWS shall apply as selected by the engineer.

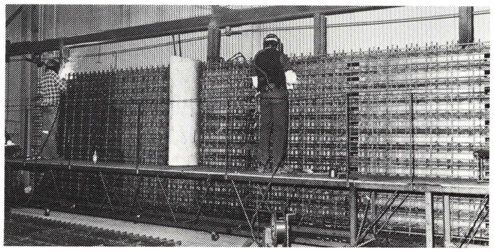
All embedded concrete reinforcing steel shall be cleaned to white metal and epoxy coated as specified by the engineer.

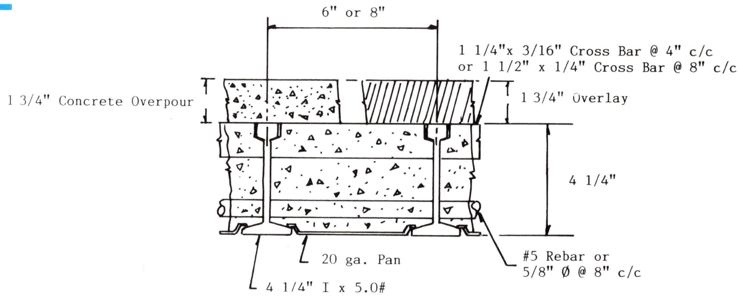
Material: The grid material, grid configuration and properties, shear connectors, reinforcing steel, concrete top surface treatment or material, and joint details shall be as shown on the drawings (as selected by the engineer), and as described above.

Installation: Field welded studs installed after module placement which have ceramic ferrules shall have all such ferrules shattered before placement of grout to assure full horizontal shear transfer without displacement.

Grout Material: Shall be as specified by engineer.

4¼″ FULL DEPTH CONCRETE

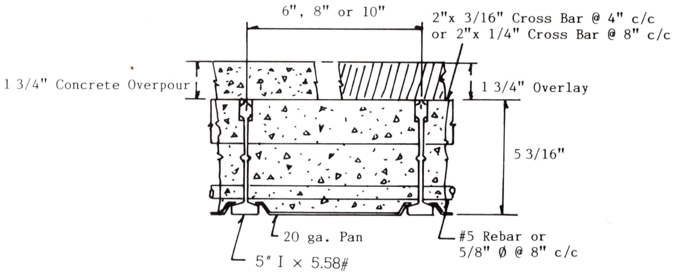




N=8 Main Bar Spacing	SECTIONAL PROPERTIES (in³/ft)						CONTINUOUS SPAN IN FEET FOR HS20 LOADING				APPROX. WEIGHT	
	STEEL ONLY		COMPOSITE SECTION				TRANSVERSE		PARALLEL		STEEL ONLY* #psf	STEEL & CONCRETE #psf
	TOP STEEL	BOTTOM STEEL	POSITIVE Sc	POSITIVE Sst	NEGATIVE Sc	NEGATIVE Sst	A36	A588	A36	A588		
N=8			50.275	3.568	50.095	3.055	7.48	10.05	5.58	7.15		61.8
4¼″ I @6″	2.924	3.348									15.3	
N=8			42.820	2.719	42.145	2.322	5.45	7.70	4.35	5.71		60.0
4¼″ I @8″	2.193	2.511									12.8	

*Weights shown are for 1¼ x $^3/_{16}$ cross bar spaced 4″o.c. For 1½ x ¼ cross bar spaced 8″o.c., deduct .48#/SF.

5″ FULL DEPTH CONCRETE

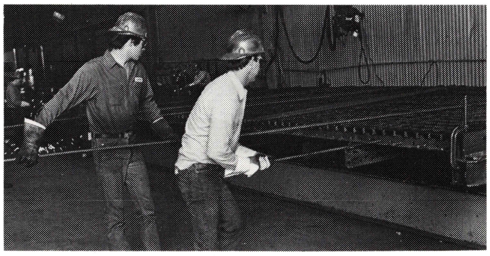


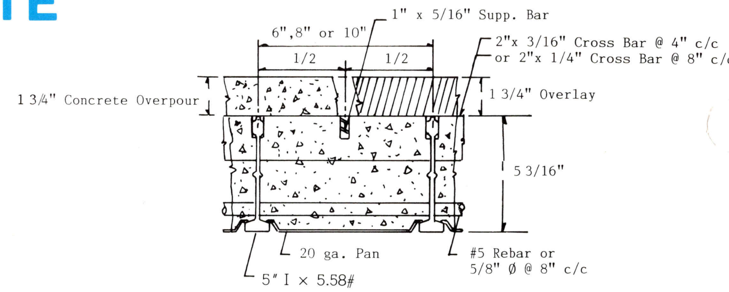
ZERO SUPPLEMENTARY BARS

N=8 Main Bar Spacing	SECTIONAL PROPERTIES (in³/ft)						CONTINUOUS SPAN IN FEET FOR HS20 LOADING				APPROX. WEIGHT	
	STEEL ONLY		COMPOSITE SECTION				TRANSVERSE		PARALLEL		STEEL ONLY* #psf	STEEL & CONCRETE #psf
	TOP STEEL	BOTTOM STEEL	POSITIVE Sc	POSITIVE Sst	NEGATIVE Sc	NEGATIVE Sst	A36	A588	A36	A588		
N=8 5″ I @6″			64.936	5.031	60.370	2.935	7.05	9.70	5.34	7.01		75.0
	2.761	4.319									18.2	
N=8 5″ I @8″			56.379	3.868	50.525	2.236	5.14	7.28	4.18	5.48		73.1
	2.071	3.239									15.6	
N=8 5″ I @10″			50.729	3.154	44.280	1.182	3.94	5.73	3.47	4.53		72.0
	1.657	2.592									14.0	

*Weights shown are for 2 x $^3/_{16}$ cross bar spaced 4″o.c. For 2 x ¼ cross bar spaced 8″o.c., deduct 1.28#psf.

5″ FULL DEPTH CONCRETE



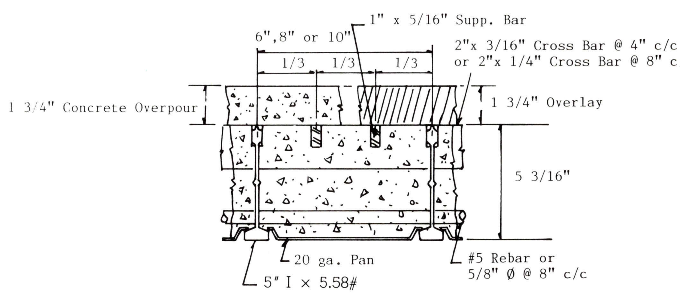


ONE SUPPLEMENTARY BAR

N=8 Main Bar Spacing	SECTIONAL PROPERTIES (in³/ft)						CONTINUOUS SPAN IN FEET FOR HS20 LOADING				APPROX. WEIGHT	
	STEEL ONLY		COMPOSITE SECTION				TRANSVERSE		PARALLEL		STEEL ONLY* #psf	STEEL & CONCRETE #psf
	TOP STEEL	BOTTOM STEEL	POSITIVE Sc	POSITIVE Sst	NEGATIVE Sc	NEGATIVE Sst	A36	A588	A36	A588		
N=8 5″ I @6″			74.383	5.182	74.579	4.976	12.09	14.44	8.59	10.13		76.5
	4.678	4.795									20.3	
N=8 5″ I @8″			63.058	3.957	63.071	3.793	9.24	12.39	6.72	8.74		74.3
	3.508	3.596									17.2	
N=8 5″ I @10″			55.808	3.212	55.714	3.075	7.40	10.14	5.56	7.30		73.0
	2.807	2.877									15.3	

*Weights shown are for $2 \times \frac{3}{16}$ cross bar spaced 4″o.c. For $2 \times \frac{1}{4}$ cross bar spaced 8″o.c., deduct 1.28#psf.

5″ FULL DEPTH CONCRETE

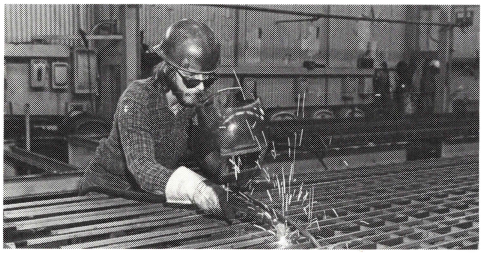


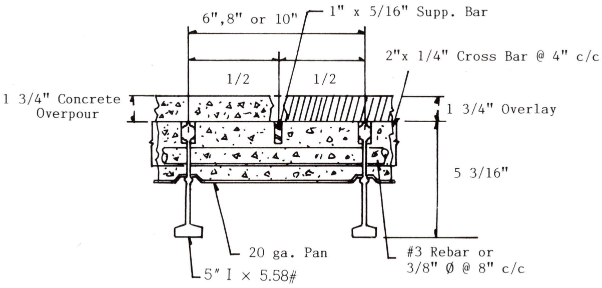
TWO SUPPLEMENTARY BARS

N=8 Main Bar Spacing	SECTIONAL PROPERTIES (in³/ft)						CONTINUOUS SPAN IN FEET FOR HS20 LOADING				APPROX. WEIGHT	
	STEEL ONLY		COMPOSITE SECTION				TRANSVERSE		PARALLEL		STEEL ONLY* #psf	STEEL & CONCRETE #psf
	TOP STEEL	BOTTOM STEEL	POSITIVE Sc	POSITIVE Sst	NEGATIVE Sc	NEGATIVE Sst	A36	A588	A36	A588		
N=8 5″ I @6″			83.556	5.295	83.448	6.926	12.82	16.00	9.08	11.22		78.5
	6.480	5.056									22.4	
N=8 5″ I @8″			69.560	4.027	71.108	5.286	9.83	13.18	7.10	9.31		75.8
	4.860	3.792									18.8	
N=8 5″ I @10″			60.760	3.259	63.180	4.289	7.89	10.75	5.87	7.69		74.2
	3.889	3.034									16.6	

*Weights shown are for $2 \times \frac{3}{16}$ cross bar spaced 4″o.c. For $2 \times \frac{1}{4}$ cross bar spaced 8″o.c., deduct 1.28#psf.

5″ HALF DEPTH CONCRETE

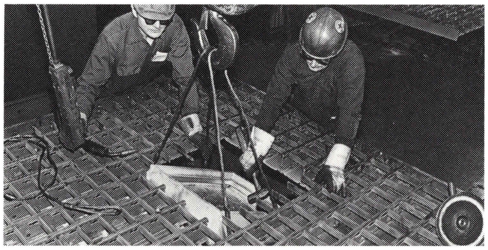


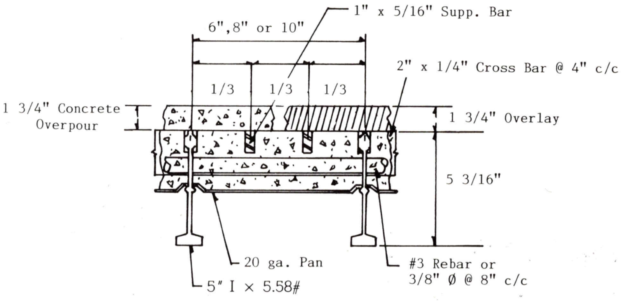


ONE SUPPLEMENTARY BAR

N=8 Main Bar Spacing	SECTIONAL PROPERTIES (in³/ft)						CONTINUOUS SPAN IN FEET FOR HS20 LOADING		APPROX. WEIGHT	
	STEEL ONLY		COMPOSITE SECTION				TRANSVERSE OR PARALLEL			
	TOP STEEL	BOTTOM STEEL	POSITIVE		NEGATIVE				STEEL ONLY #psf	STEEL & CONCRETE #psf
			Sc	Sst	S_{top}	S_{bot}	A36	A588		
N=8 5″ I @6″			74.383	5.182		5.280	7.59	9.49		48.6
	4.678	4.795			4.678				20.5	
N=8 5″ I @8″			63.058	3.957		3.960	5.82	7.69		46.0
	3.508	3.596			3.508				17.5	
N=8 5″ I @10″			55.808	3.212		3.168	4.74	6.25		44.4
	2.807	2.877			2.807				15.6	

5″ HALF DEPTH CONCRETE





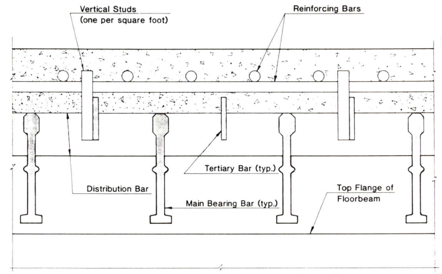
TWO SUPPLEMENTARY BARS

N=8 Main Bar Spacing	SECTIONAL PROPERTIES (in³/ft)						CONTINUOUS SPAN IN FEET FOR HS20 LOADING		APPROX. WEIGHT	
	STEEL ONLY		COMPOSITE SECTION				TRANSVERSE OR PARALLEL			
	TOP STEEL	BOTTOM STEEL	POSITIVE		NEGATIVE				STEEL ONLY #psf	STEEL & CONCRETE #psf
			Sc	Sst	S_{top}	S_{bot}	A36	A588		
N=8 5″ I @6″			83.556	5.296		5.612	8.49	10.56		50.6
	6.480	5.056			6.480				22.6	
N=8 5″ I @8″			69.590	4.027		4.209	6.60	8.71		47.5
	4.860	3.792			4.860				19.0	
N=8 5″ I @10″			60.760	3.259		3.367	5.43	7.17		45.5
	3.889	3.034			3.889				16.8	

EXODERMIC BRIDGE DECK TYPE DESIGNATION SYSTEM

EBD 6.09/8/4/3.5

- Reinforced Concrete Component Thickness
- Distribution Bar Spacing
- Grid Main Bar Spacing
- Grid Main Bar Weight per Linear Foot

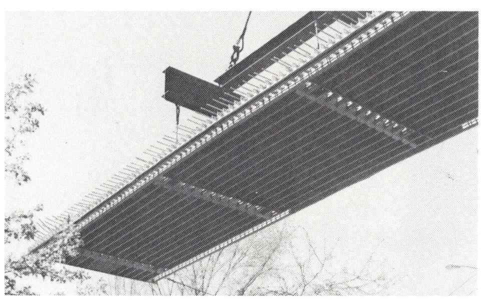


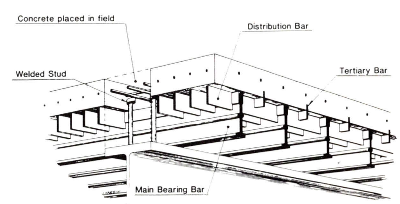
TYPICAL SECTION–EXODERMIC DECK

7¼″ EXODERMIC

Main Grid Bar Spacing	EBD Deck Type	COMPOSITE SECTIONAL PROPERTIES (in³/Ft) POSITIVE Conc Top	POSITIVE Steel Bottom Grid	NEGATIVE Steel Reinf.	NEGATIVE Steel Bottom Grid	CONTINUOUS SPAN IN FEET FOR HS20 LOADING TRANSVERSE OR PARALLEL A36	A588	APPROX. WEIGHT #/SF
4 1/4″ I @ 6″	5.0/6/4/3	117.89	8.27	8.69	6.46	14′-0	15′-0	56
4 1/4″ I @ 8″	5.0/8/4/3	105.73	6.46	7.84	5.09	10′-3	13′-6	53
4 1/4″ I @ 10″	5.0/10/4/3	97.02	5.32	7.33	4.22	9′-0	10′-6	50
4 1/4″ I @ 12″	5.0/12/4/3	90.29	4.54	7.00	3.61	7′-0	8′-6	47

All Properties shown for 7¼″ Exodermic based on 3″ thick slab on top of 4¼″ grid, #5 top, #3 Bott. reinf.





EXODERMIC BRIDGE DECK SYSTEM

9³⁄₁₆″ EXODERMIC

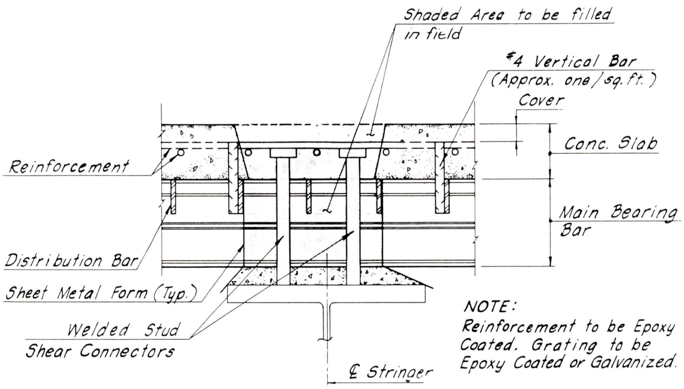
Main Grid Bar Spacing	EBD Deck Type	COMPOSITE SECTIONAL PROPERTIES (in³/Ft) POSITIVE Conc Top	POSITIVE Steel Bottom Grid	NEGATIVE Steel Reinf.	NEGATIVE Steel Bottom Grid	CONTINUOUS SPAN IN FEET FOR HS20 LOADING TRANSVERSE OR PARALLEL A36	A588	APPROX. WEIGHT #/SF
5 3/16″ I @ 6″	6.09/6/4/4	182.52	13.72	13.35	9.97	17′-0	17′-0	69
5 3/16″ I @ 8″	6.09/8/4/4	160.18	10.72	10.01	7.47	14′-6	17′-0	65
5 3/16″ I @ 10″	6.09/10/4/4	145.35	8.85	8.00	5.98	11′-6	14′-6	62
5 3/16″ I @ 12″	6.09/12/4/4	134.51	7.56	6.67	4.98	9′-0	12′-0	60

All Properties shown for 9³⁄₁₆″ Exodermic based on 4″ thick slab above 5³⁄₁₆″ grid, #6 top, #3 Bott. reinf.

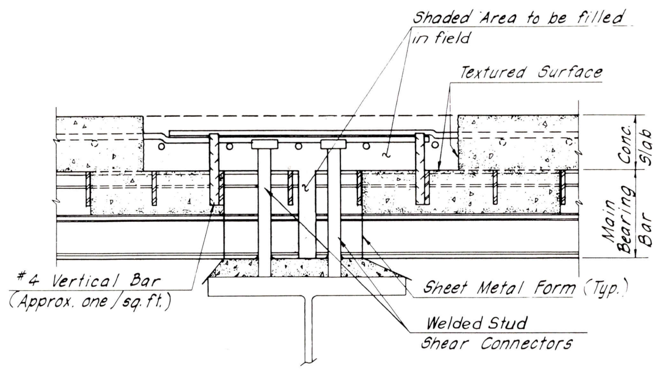
NOTE: Exodermic Deck design is not limited to the alternates shown in the tables above.

TYPICAL JOINT AND CONNECTION DETAILS

EXODERMIC BRIDGE DECK

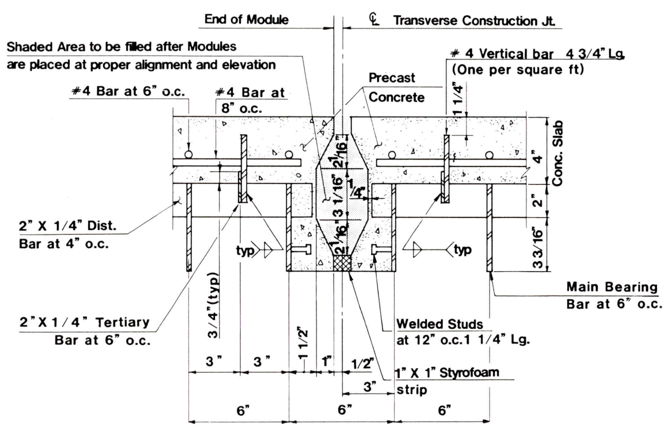


TYPICAL CONNECTION to STRINGER



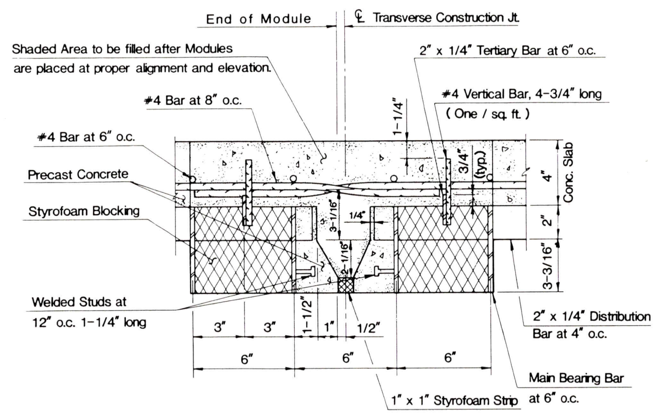
JOINT BETWEEN MODULES

(Perpendicular to MAIN BEARING BARS)



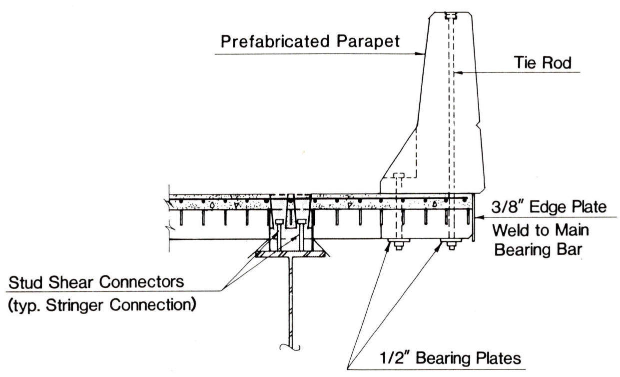
TRANSVERSE JOINT DETAIL

POSITIVE MOMENT AREAS OF COMPOSITE STRINGER

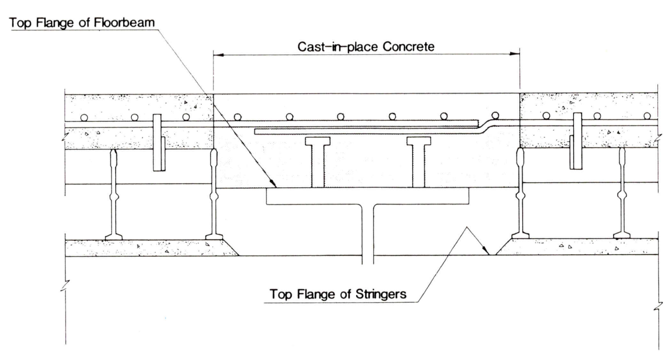


TRANSVERSE JOINT DETAIL

NEGATIVE MOMENT AREAS OF COMPOSITE STRINGER



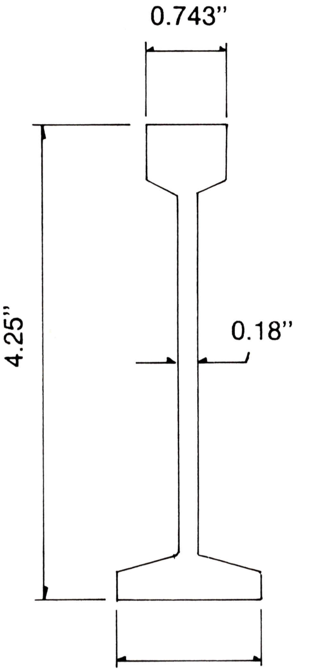
TYPICAL FASCIA DETAIL



GENERAL ARRANGEMENT of EXODERMIC BRIDGE DECK

(when Floorbeam Flange is above top of Stringer Flange.)

SPECIAL SECTION I-BEAMS



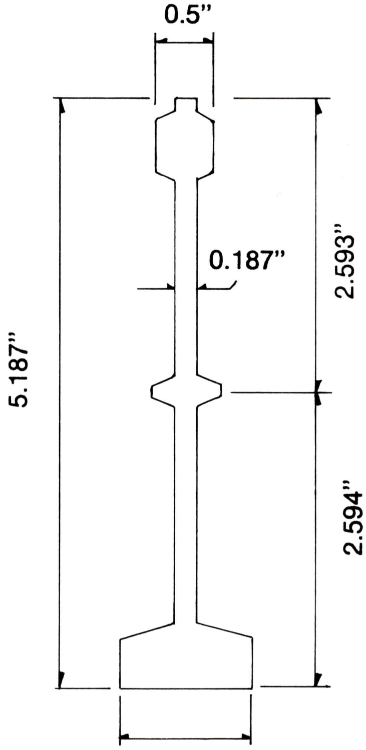
SPECIAL SECTION - 4¼" I BEAM

Total Weight: 5.0 #/ft.

I = Value of 3.691 in.^{4}

S_T = Value of 1.643 in.^{3}

S_b = Value of 1.842 in.^{3}



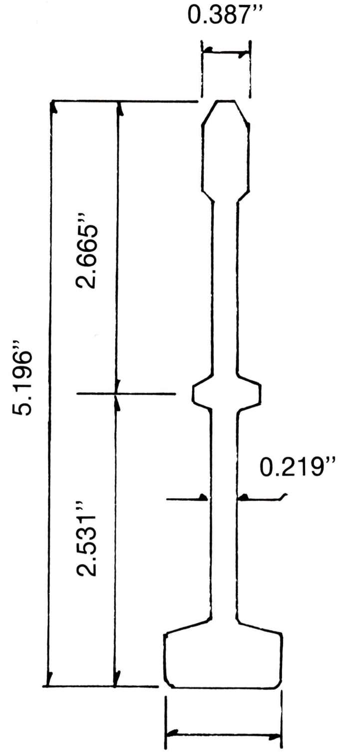
5" SPECIAL SECTION

Total Weight: 5.58#/ft.

I = Value of 5.097 in.^{4}

S_T = Value of 1.693 in.^{3}

S_b = Value of 2.342 in.^{3}



5" SPECIAL SECTION

Total Weight: 6.09 #/ft.

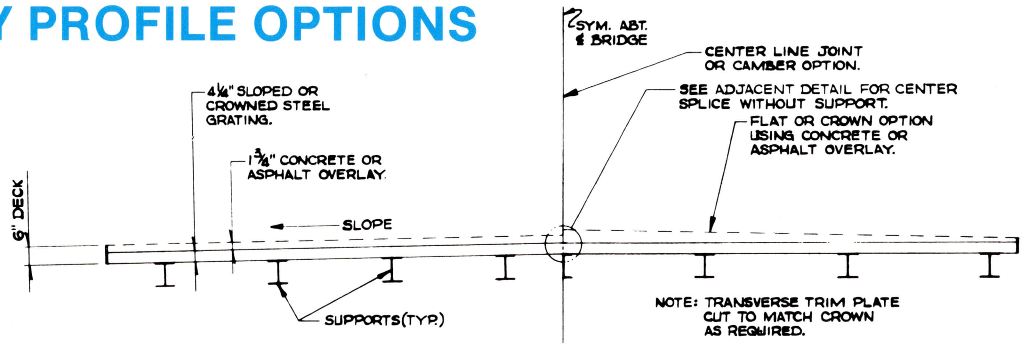
I = 5.108 in.^{4}

S_T = 1.674 in.^{3}

S_b = 2.391 in.^{3}

NOTE: Properties of 5" Decks are based on 5 3/16" I-Beam @ 5.58#/ft. (6.09#/ft. I-Beam is similar and generally considered interchangeable with the 5.58#/ft. section).

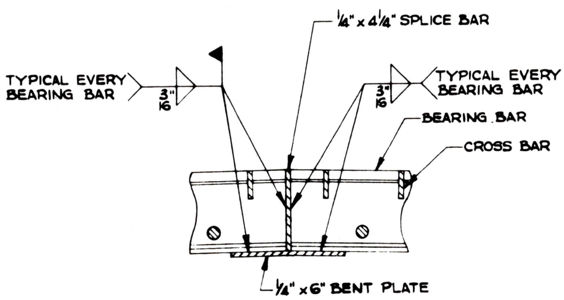
ROADWAY PROFILE OPTIONS



SLOPE OPTION

FLAT OPTION

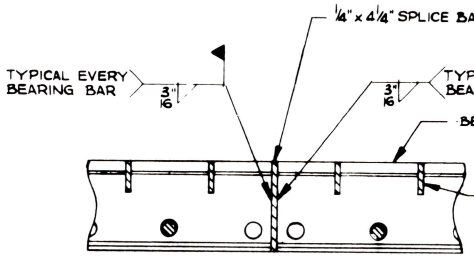
ROADWAY PROFILE OPTION



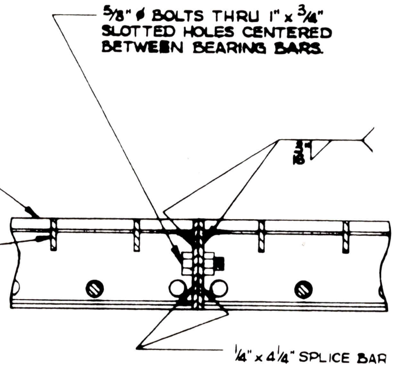
CENTER SPLICE WITHOUT SUPPORT

FILLED GRID DETAILS

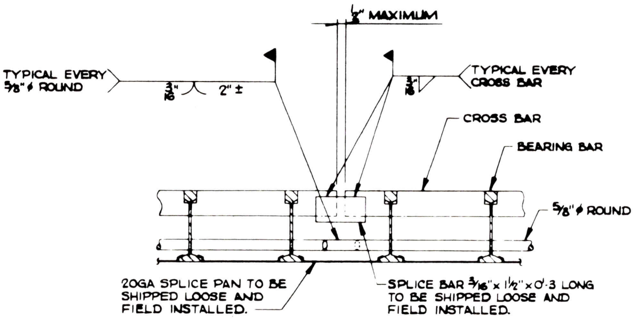
TYPICAL SPLICE DETAILS



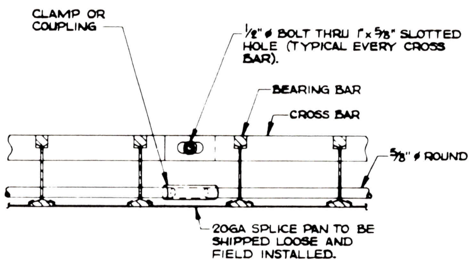
WELDED OPTION



BOLTED OPTION

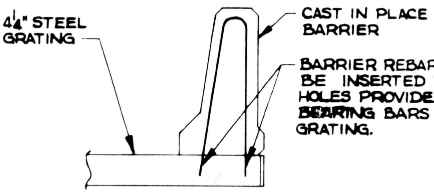


WELDED OPTION

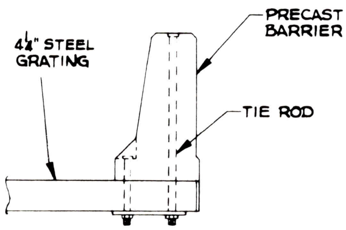


BOLTED OPTION

TYPICAL BARRIER DETAILS

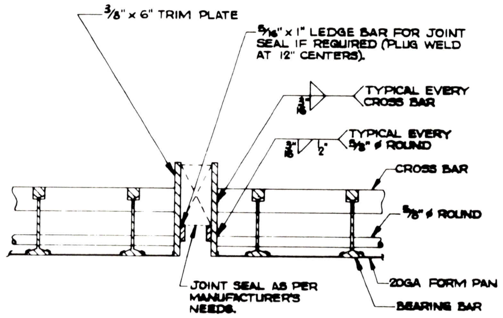


CAST IN PLACE OPTION

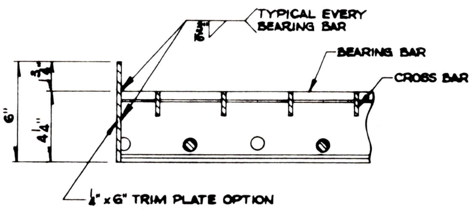


PRECAST OPTION

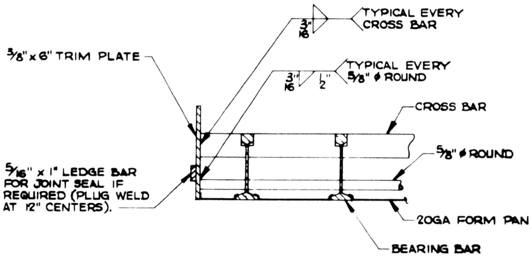
TYPICAL EXPANSION/RELIEF JOINT



END TRIM DETAIL



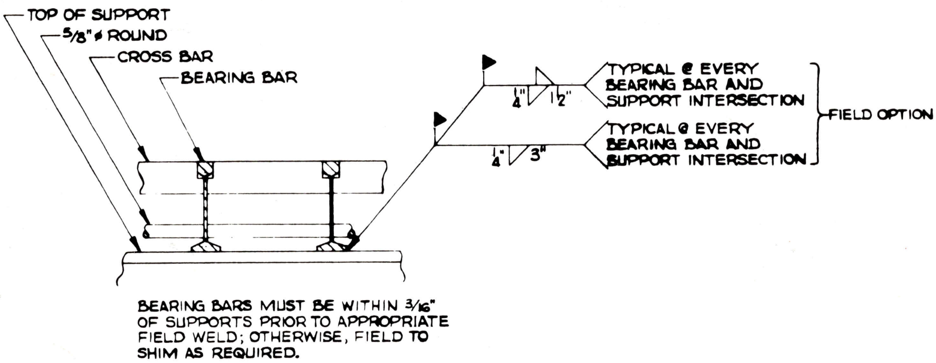
TRIM PLATE TO RETAIN CONCRETE AND OVERLAY OR FIELD FORM AS REQUIRED



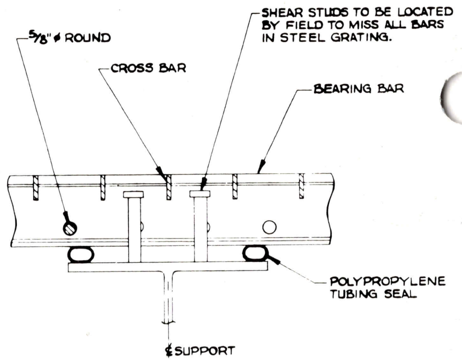
EXPANSION/RELIEF JOINT AT ABUTMENT

NOTE: Details shown on pages 10 & 11 are based on 4¼" Grid; 5 3/16" Grid is similar.

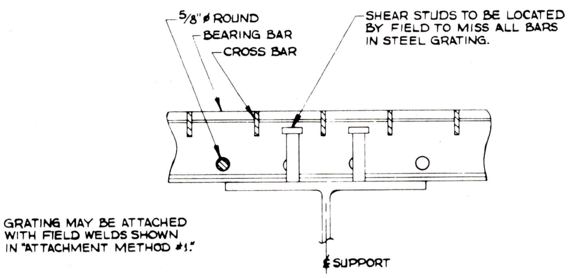
ATTACHMENT METHODS



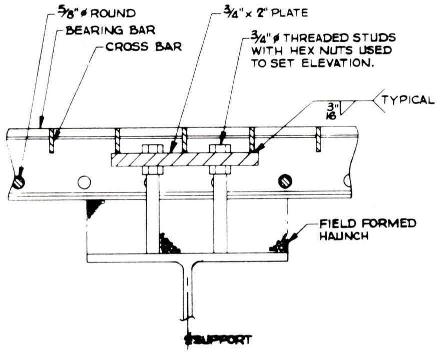
ATTACHMENT METHOD #1



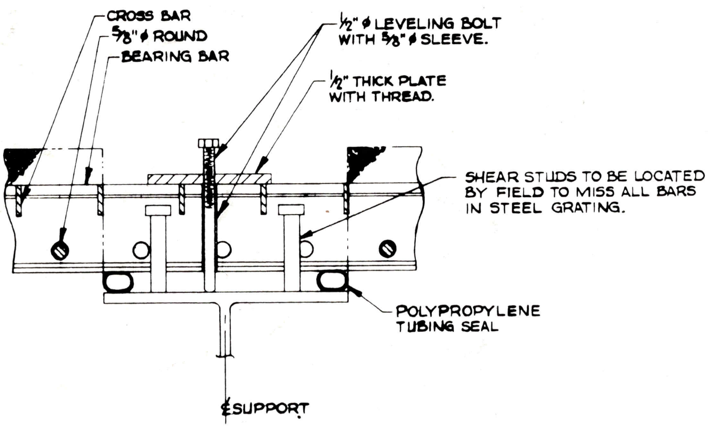
ATTACHMENT METHOD #2



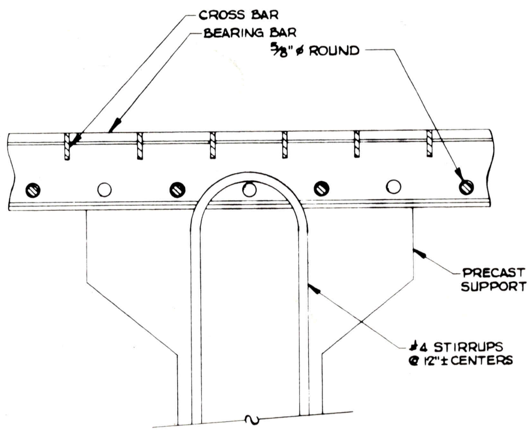
ATTACHMENT METHOD #3



ATTACHMENT METHOD #4



ATTACHMENT METHOD #5



ATTACHMENT METHOD #6

BRIDGE GRID FLOORING MANUFACTURERS ASSOCIATION

231 SOUTH CHURCH ST.
MT. PLEASANT, PA 15666
PHONE: (412) 547-2660

MEMBERS:

L.B. FOSTER COMPANY
Pittsburgh, Pennsylvania

IKG/GREULICH, DIV. HARSCO CORP.
Pittsburgh, Pennsylvania

McDONALD STEEL CORPORATION
McDonald, Ohio