



# OHIO DEPARTMENT OF TRANSPORTATION

CENTRAL OFFICE, 1980 W. BROAD ST., COLUMBUS, OHIO 43216-0899

January 21, 2011

To: Users of the Standard Bridge Drawings  
From: Tim Keller, Administrator, Office of Structural Engineering  
By: Sean Meddles, Bridge Standards Engineer  
Re: Standard Bridge Drawing Updates

The following Standard Bridge Drawings are now available:

- Bearing Details for Box Beam Bridges (BD-1-11)
- Prestressed Concrete Box Beam Bridge Details (PSBD-2-07)

A brief summary of each drawing follows:

### **BD-1-11:**

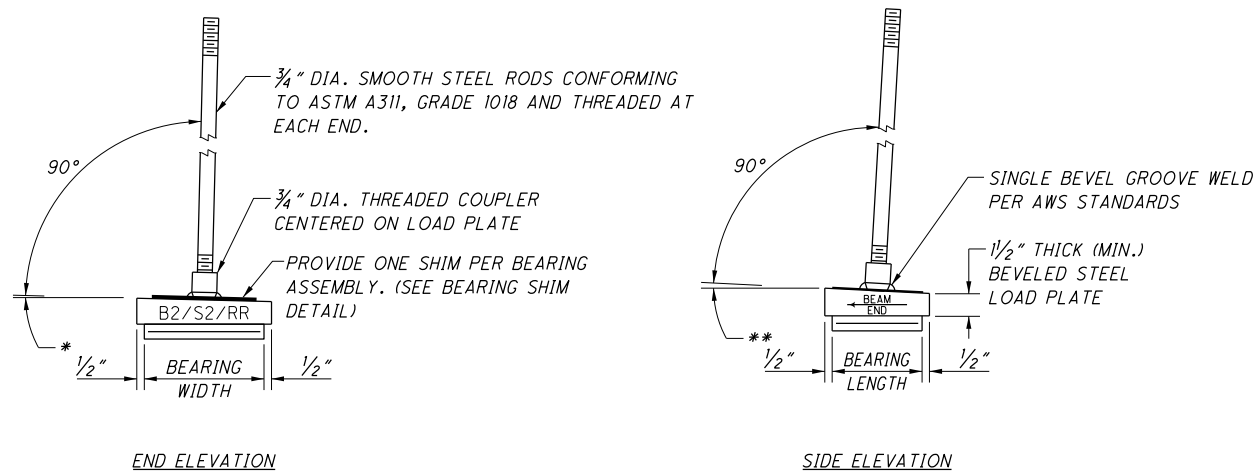
This is a new standard drawing that provides standardized bearing details for box beam bridges located on steep roadway grades.

This revision should be implemented on all projects beginning Stage 2 Detail Design after January 21, 2011.

### **PSBD-2-07 (Sheet 2 of 4):**

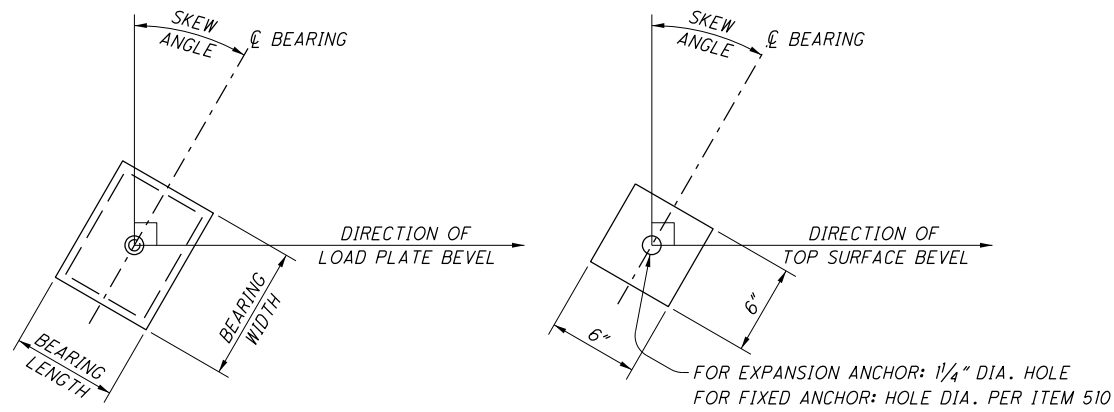
This revision incorporates the number of diaphragm and tie rod locations required per prestressed box beam by span length. Prestressed fabricators have asked the Department to place this information on the Standard Bridge Drawing. Previously, this information was located in design data sheets and the Bridge Design Manual.

This revision should be implemented on all projects beginning Stage 3 Detail Design after January 21, 2011.



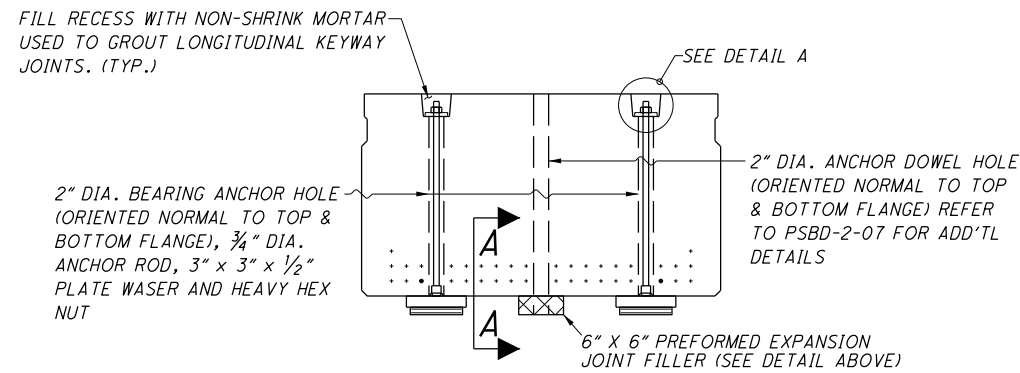
**BEARING DETAIL**

\* - BEVEL = LONGITUDINAL GRADE x SIN (SKEW ANGLE)  
 \*\* - BEVEL = LONGITUDINAL GRADE x COS (SKEW ANGLE)



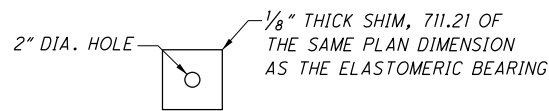
**BEARING ORIENTATION**

**6"x6" PREFORMED FILLER ORIENTATION**

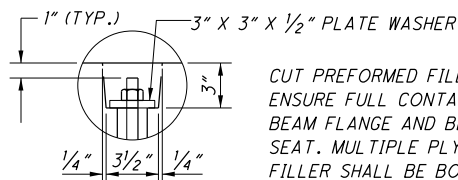


**END ELEVATION**

(BEAM END WITHOUT NOTCH)

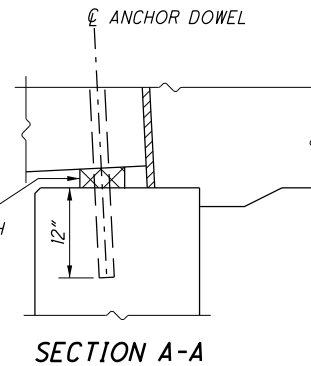


**BEARING SHIM DETAIL**

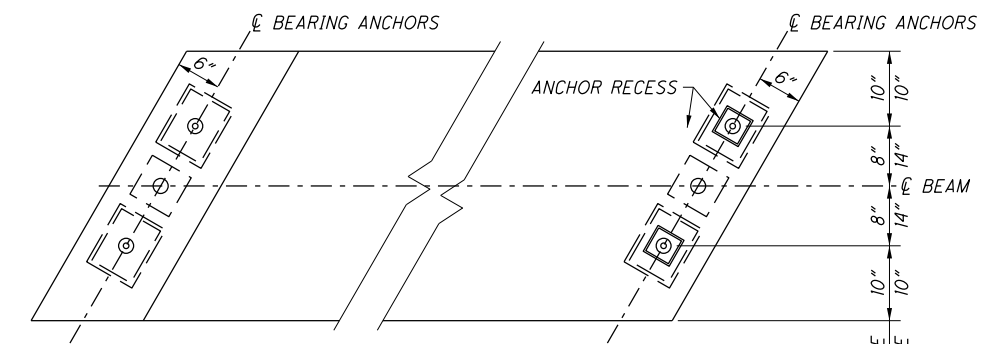


**DETAIL A**

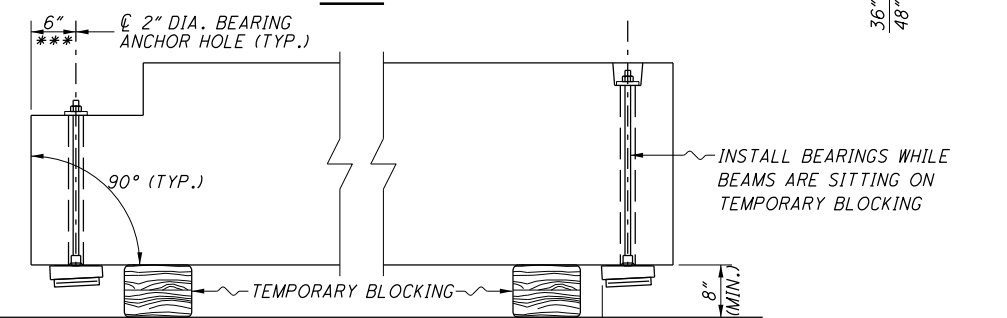
CUT PREFORMED FILLER TO ENSURE FULL CONTACT WITH BEAM FLANGE AND BEARING SEAT. MULTIPLE PLYS OF FILLER SHALL BE BONDED TOGETHER WITH ADHESIVE.



**SECTION A-A**



**PLAN**



**SIDE ELEVATION**

\*\*\* - MEASURED PERPENDICULAR TO BEAM END

LOCATE TEMPORARY SUPPORT AS CLOSE AS PRACTICAL TO ALLOW BEARING INSTALLATION. (TYP.)

**NOTES**

**GENERAL:** THE PURPOSE OF THIS STANDARD DRAWING IS TO MINIMIZE BEARING ROTATION CAUSED BY ROADWAY GRADE. THIS DRAWING IS NOT REQUIRED FOR ELASTOMERIC BEARING DESIGNS THAT CAN ACCOMMODATE THE ROADWAY GRADE ROTATION. THE PROJECT PLANS SHALL INCLUDE: LONGITUDINAL GRADE, SKEW ANGLE, BEARING DIMENSIONS, LOAD PLATE DIMENSIONS AND BEAM SIZES.

BOX BEAM BEARINGS SHALL BE DESIGNED FOR FOUR SOURCES OF ROTATION: ROADWAY GRADE; CAMBER; DEAD LOAD; AND LIVE LOAD. THE MAGNITUDE OF EACH SOURCE OF ROTATION MAY BE EQUAL AT EACH END OF THE BEAM; BUT, THE DIRECTION OF EACH SOURCE OF ROTATION MAY BE DIFFERENT. AT THE REAR END OF THE BOX, POSITIVE CAMBER WILL BE COUNTERCLOCKWISE; DEAD & LIVE LOAD WILL BE CLOCKWISE; NEGATIVE GRADE WILL BE CLOCKWISE; POSITIVE GRADE WILL BE COUNTERCLOCKWISE. AT THE FORWARD END OF THE BOX, POSITIVE CAMBER WILL BE CLOCKWISE; DEAD & LIVE LOAD WILL BE COUNTERCLOCKWISE; NEGATIVE GRADE WILL BE CLOCKWISE; POSITIVE GRADE WILL BE COUNTERCLOCKWISE.

DESIGNERS SHOULD ANALYZE THE EFFECT FROM ALL SOURCES OF ROTATION ON THE ELASTOMERIC BEARING DESIGN TO DETERMINE IF THIS STANDARD DRAWING IS REQUIRED.

**BEARING INSTALLATION:** BEARINGS MAY BE INSTALLED WHILE BEAMS ARE SUPPORTED ON TEMPORARY BLOCKING AS SHOWN HEREIN. TIGHTEN BEARING ANCHOR NUTS SUCH THAT THE GAP AT THE PERIMETER OF THE LOAD PLATE BETWEEN THE BOTTOM OF THE BEAM AND THE LOAD PLATE DOES NOT EXCEED 0.125 INCH AT ANY LOCATION. PROPERLY ALIGN BEARINGS ACCORDING TO MARKINGS.

**WELDING:** CONTROL WELDING SO THAT THE PLATE TEMPERATURE AT THE ELASTOMER BONDED SURFACE DOES NOT EXCEED 300°F AS DETERMINED BY USE OF PYROMETRIC STICKS OR OTHER TEMPERATURE MONITORING DEVICES. REPAIR GALVANIZED COATING DAMAGED BY WELDING ACCORDING TO 711.02.

**LIFTING INSERTS:** SHIFT LIFTING INSERTS AS NECESSARY TO CLEAR BEARING ANCHOR HOLES AND RECESS POCKETS BY 1/4" MINIMUM. REFER TO PSBD-2-07 FOR ADDITIONAL INFORMATION.

**PREFORMED BEARING PADS:** IN ADDITION TO THE PREFORMED BEARING PADS REQUIRED ABOVE EACH LOAD PLATE AS SHOWN HEREIN, SUPPLY PREFORMED BEARING PADS ACCORDING TO PSBD-2-07.

**BEARING MARKINGS:** PERMANENTLY MARK BOTH SIDES OF EACH LOAD PLATE WITH AN ARROW POINTING TO THE NEAREST BEAM END AS SHOWN IN THE BEARING DETAIL SIDE ELEVATION. PERMANENTLY LABEL EACH END OF THE LOAD PLATE WITH THE BEAM NUMBER, SPAN NUMBER AND LOCATION AS FOLLOWS:  
 EX. B2/S2/RR - BEAM LINE #2, SPAN #2, RIGHT REAR END  
 EX. B1/S2/LF - BEAM LINE #1, SPAN #2, LEFT FORWARD END

**MATERIAL:** FURNISH MATERIAL CONFORMING TO THE FOLLOWING:

LOAD PLATE: ASTM A709, GRADE 50, GALVANIZED ACCORDING TO C&MS 711.02

ELASTOMERIC BEARING: C&MS 711.23

BEARING SHIM: C&MS 711.21

REBAR COUPLER: CAPABLE OF DEVELOPING 125 PERCENT OF YIELD STRENGTH OF CONNECTED BAR (PROOF LOAD = 33 KIP), GALVANIZE ACCORDING TO C&MS 711.02.

BEARING ANCHOR RODS: 3/4" DIA. SMOOTH STEEL RODS CONFORMING TO ASTM A311, GRADE 1018 (Fy = 60 KSI), GALVANIZED ACCORDING TO C&MS 711.02 AND THREADED AT EACH END. THREADS SHALL BE IN ACCORDANCE WITH ANSI B1.1.

PLATE WASHER: ASTM A36, GALVANIZED ACCORDING TO C&MS 711.02

NUTS: ACCORDING TO C&MS 711.09.

GROUT: ACCORDING TO PSBD-2-07

PREFORMED FILLER: SHALL BE CORK IN ACCORDANCE WITH AASHTO M153, TYPE II OR SELF EXPANDING CORK IN ACCORDANCE WITH AASHTO M153, TYPE III

**MEASUREMENT & PAYMENT:**

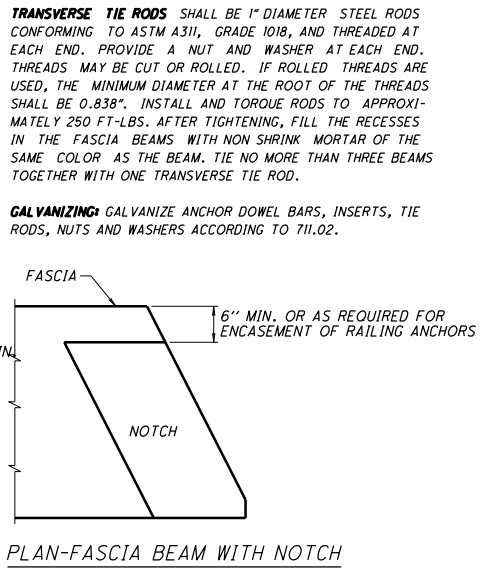
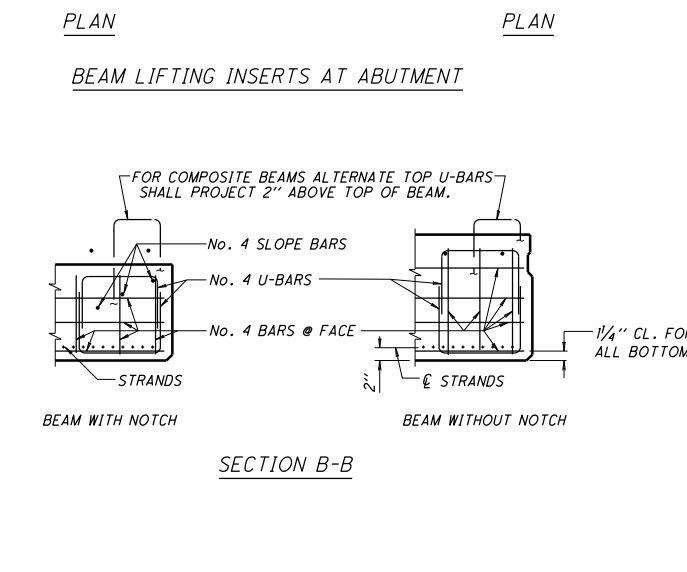
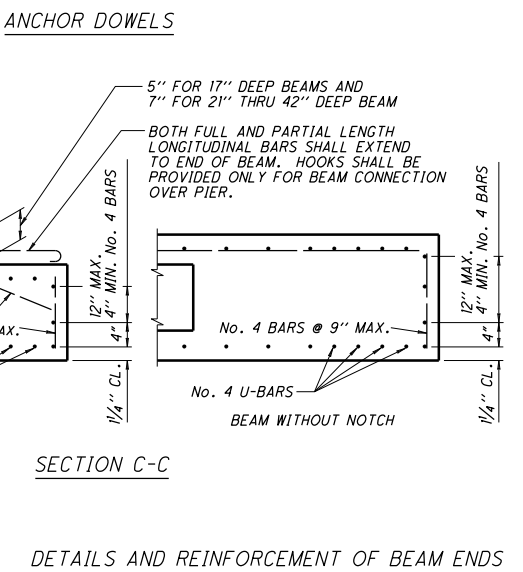
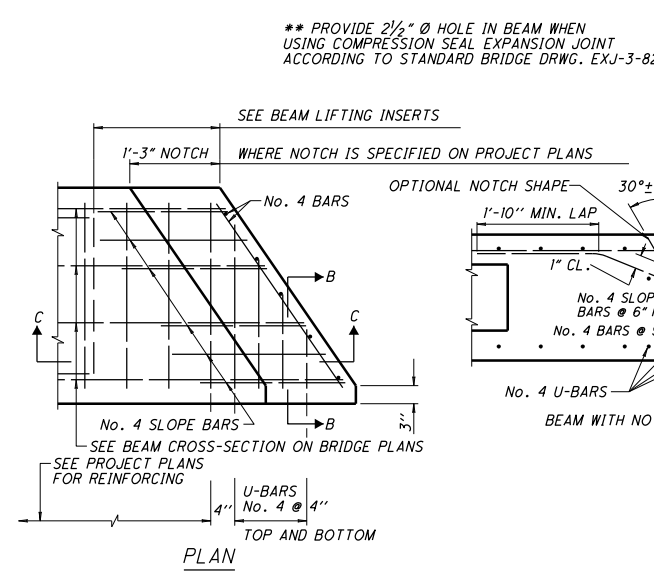
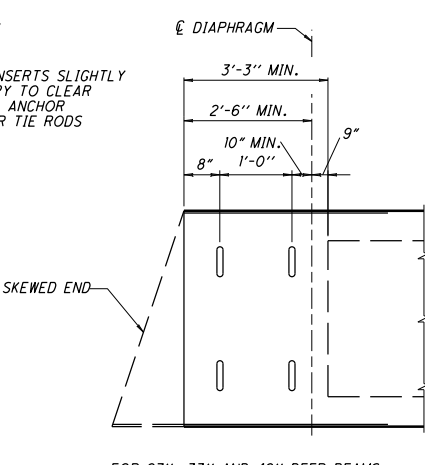
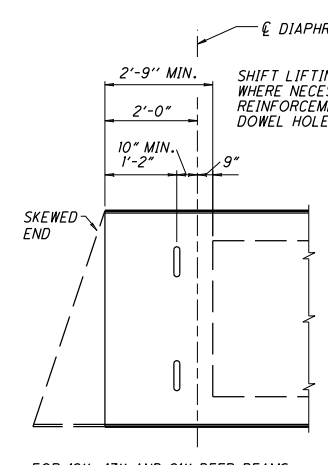
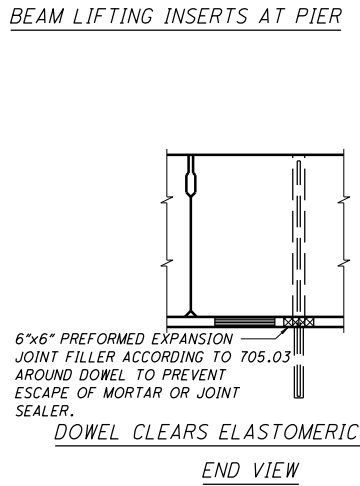
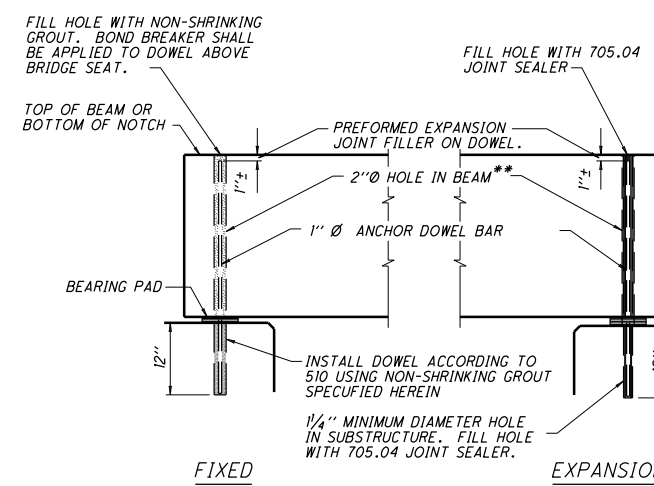
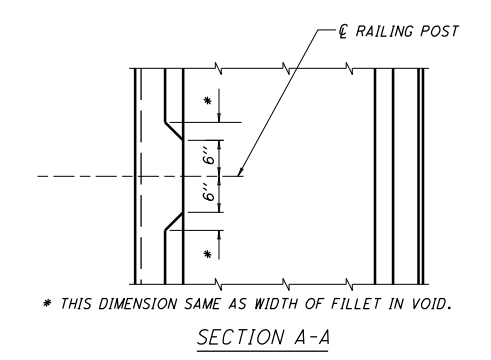
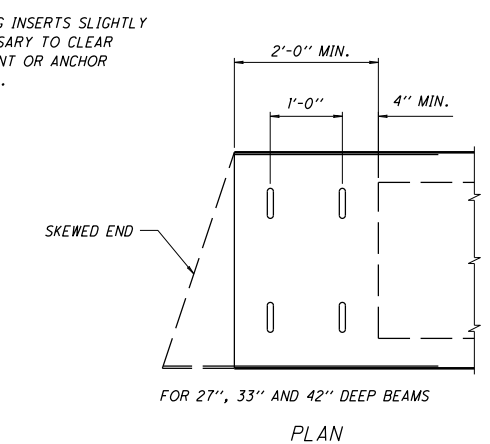
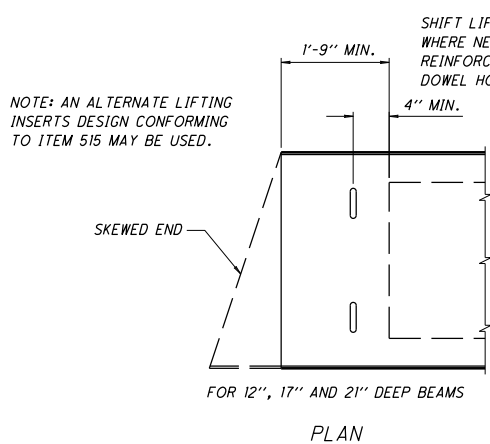
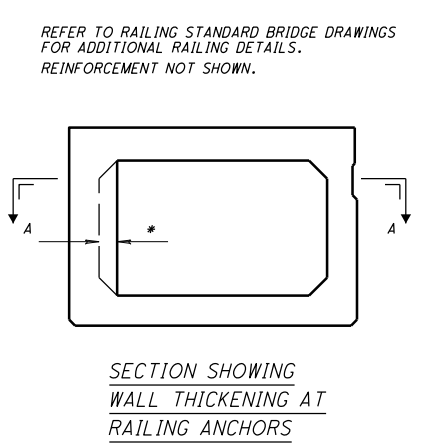
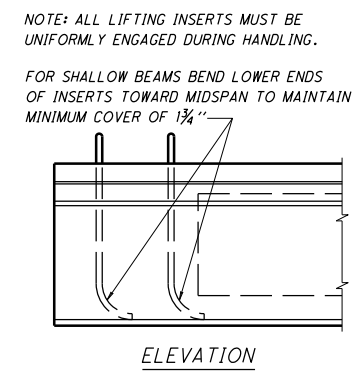
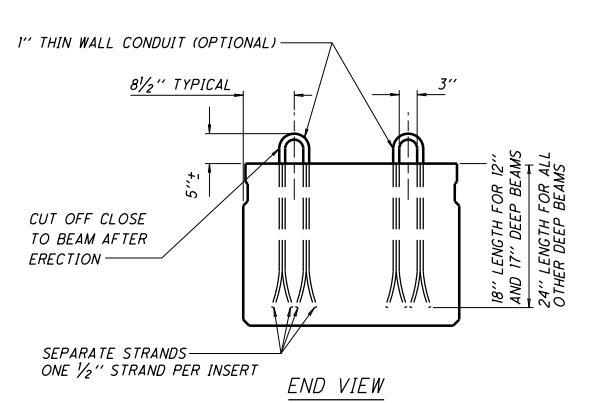
THE DEPARTMENT WILL INCLUDE THE MORTAR USED FOR THE BEARING ANCHOR RECESS HOLES AND PREFORMED FILLER WITH THE BOX BEAMS FOR PAYMENT.

THE DEPARTMENT WILL PAY FOR ACCEPTED PREFORMED BEARING SHIMS AT THE CONTRACT PRICE AS FOLLOWS:

ITEM 516 EACH 1/8-INCH PREFORMED BEARING PADS

THE DEPARTMENT WILL PAY FOR ACCEPTED BEARING ASSEMBLIES INCLUDING LAMINATED ELASTOMERIC BEARINGS, LOAD PLATE, REBAR COUPLER, THREADED REBAR, HARDWARE, MATERIAL, AND LABOR AT THE CONTRACT PRICE AS FOLLOWS:

ITEM 516 EACH ELASTOMERIC BEARING WITH INTERNAL LAMINATES AND LOAD PLATE



INTERIOR BEAM WITH NOTCH AND INTERIOR/EXTERIOR BEAM WITHOUT NOTCH SHOWN. SEE ALTERNATE PLAN FOR FASCIA BEAM WITH NOTCH.

NOTE: THE FABRICATOR'S SHOP DRAWINGS SHALL SHOW COMPLETE DETAILS OF THE BEAM REINFORCING.

REFER TO RAILING STANDARD BRIDGE DRAWINGS FOR ADDITIONAL RAILING DETAILS. REINFORCEMENT NOT SHOWN.

**GENERAL NOTES:**

- GENERAL:** THIS STANDARD DRAWING PROVIDES DESIGN AND GENERAL CONSTRUCTION DETAILS FOR PRESTRESSED CONCRETE BOX BEAM BRIDGES. THE DETAILS IN THIS STANDARD ARE APPLICABLE TO STRUCTURES WITH SKEW ANGLES OF 30° OR LESS. AS A MINIMUM, THE PROJECT PLANS FOR EACH STRUCTURE SHALL INCLUDE THE FOLLOWING DETAILS:
1. THE DESIGNER SHALL CHOOSE A 28-DAY CONCRETE STRENGTH BETWEEN 5500 PSI AND 7000 PSI; A RELEASE STRENGTH BETWEEN 4000 PSI AND 5000 PSI; AND A NOMINAL STRAND AREA OF 0.153 IN<sup>2</sup> OR 0.167 IN<sup>2</sup>. THE DESIGNER SHALL USE THESE VALUES IN THE DESIGN AND LIST THESE VALUES IN THE STRUCTURE GENERAL NOTES.
  2. A BEAM LAYOUT PLAN SHOWING: SPAN LENGTH; BEAM LENGTH; SKEW ANGLE; FIXED AND EXPANSION ENDS OF BEAMS; LOCATION OF ANCHOR DOWELS; SIZE, LOCATION AND HARDNESS OF ELASTOMERIC BEARING PADS; LOCATION OF DIAPHRAGM CENTERLINES; AND LOCATIONS OF RAILING POSTS.
  3. A TRANSVERSE CROSS SECTION THROUGH THE DECK.
  4. A BEAM ELEVATION/LONGITUDINAL CROSS SECTION SHOWING THE STIRRUP SPACING AND VARIABLE TOPPING THICKNESS IN SUFFICIENT DETAIL.
  5. A CROSS SECTION OF THE BEAM SHOWING BEAM TYPE AND SIZE; SIZE, NUMBER, STRENGTH AND LOCATION OF STRANDS; DEBONDED STRAND REQUIREMENTS; ALL REINFORCING STEEL DETAILS; AND THE DESIGN DATA.
  6. EXPANSION JOINT DETAILS.
  7. ALL PLAN QUANTITY PAY ITEMS REQUIRED TO PROPERLY COVER THE COST OF FABRICATION, ERECTION AND CONSTRUCTION OF THE BEAMS.
  8. DETAILS OF ABUTMENTS AND PIERS.
  9. SEALING OF CONCRETE SURFACE LIMITS AND SEALER TYPE.
  10. ALL OTHER DETAILS AND INFORMATION NECESSARY TO COMPLETE THE PLANS.

IT IS NOT INTENDED THAT DETAILS SHOWN ON THIS STANDARD DRAWING BE REPEATED ON THE PROJECT PLANS EXCEPT AS MAY BE REQUIRED FOR CLARITY.

**DESIGN STRESSES:**

PRESTRESSED CONCRETE - F'C = \* (28-DAY)  
 F'C = \*\* (RELEASE)  
 CAST-IN-PLACE CONCRETE - F'C = 4500 PSI

REINFORCING STEEL - MIN. YIELD STRENGTH = 60,000 PSI.  
 ALL REINFORCING STEEL IN THE COMPOSITE SLAB AND BARS PROJECTING FROM THE PRESTRESSED BOX BEAMS SHALL CONFORM TO 709.00.  
 PRESTRESSING STRAND - FURNISH MATERIAL CONFORMING TO 711.27 (ASTM A416), GRADE 270, LOW RELAXATION, UNCOATED, SEVEN WIRE STRAND. STRANDS SHALL BE 0.5 INCH DIAMETER WITH A TOTAL CROSS-SECTIONAL AREA OF EITHER 0.153 IN<sup>2</sup> OR 0.167 IN<sup>2</sup> \*\*\*

- \* - THE DESIGNER SHALL SPECIFY A 28-DAY COMPRESSIVE STRENGTH IN THE RANGE OF 5500 PSI MINIMUM TO 7000 PSI MAXIMUM AND LIST THE VALUE IN THE STRUCTURE'S GENERAL NOTES.
- \*\* - THE DESIGNER SHALL SPECIFY A RELEASE STRENGTH IN THE RANGE OF 4000 PSI MINIMUM TO 5000 PSI MAXIMUM AND LIST THE VALUE IN THE STRUCTURE'S GENERAL NOTES.
- \*\*\* - THE DESIGNER SHALL SPECIFY THE STRAND AREA IN THE STRUCTURE'S GENERAL NOTES.

**TRANSVERSE TIE RODS** SHALL BE 1" DIAMETER STEEL RODS CONFORMING TO ASTM A311, GRADE 1018, AND THREADED AT EACH END. PROVIDE A NUT AND WASHER AT EACH END. THREADS MAY BE CUT OR ROLLED. IF ROLLED THREADS ARE USED, THE MINIMUM DIAMETER AT THE ROOT OF THE THREADS SHALL BE 0.838". INSTALL AND TORQUE RODS TO APPROXIMATELY 250 FT-LBS. AFTER TIGHTENING, FILL THE RECESSES IN THE FASCIA BEAMS WITH NON SHRINK MORTAR OF THE SAME COLOR AS THE BEAM. TIE NO MORE THAN THREE BEAMS TOGETHER WITH ONE TRANSVERSE TIE ROD.

**GALVANIZING:** GALVANIZE ANCHOR DOWEL BARS, INSERTS, TIE RODS, NUTS AND WASHERS ACCORDING TO 711.02.

**ANCHOR DOWELS** SHALL BE 1" DIAMETER SMOOTH STEEL RODS CONFORMING TO ASTM A311, GRADE 1018. THE DESIGNER SHALL INDICATE ON THE PLANS WHICH BEAM ENDS ARE TO BE ANCHORED AND IF THE ANCHOR IS FIXED OR EXPANSION. LOCATE THE ANCHOR DOWEL HOLES AND PRESTRESSING STRANDS TO AVOID MUTUAL INTERFERENCE. THE LATERAL SPACING OF THE HOLES IN THE BEAM SHALL BE SUCH THAT THE ANCHOR DOWELS CLEAR THE ELASTOMERIC BEARING AND ARE AS CLOSE TO THE CENTERLINE OF BEAM AS POSSIBLE.

AFTER TENSIONING OF THE TRANSVERSE TIE RODS, DRILL 1/16" MINIMUM DIAMETER DOWEL HOLES FOR FIXED DOWELS OR 1/4" MINIMUM DIAMETER HOLES FOR EXPANSION DOWELS INTO THE ABUTMENT OR PIER SEAT. CLEAN AND DRY DOWEL HOLES AND INSTALL DOWELS.

**ELASTOMERIC BEARINGS:** FOUR ELASTOMERIC BEARINGS ARE REQUIRED PER BEAM. POSITION AS SHOWN ON SHEET 4 OF 4.

**PREFORMED BEARING PADS:** WHERE THE ENGINEER DEEMS THAT SHIMS ARE REQUIRED, INSTALL PREFORMED BEARING PADS, 7/16", 1/2" THICK AND OF THE SAME PLAN DIMENSIONS AS THE ELASTOMERIC BEARINGS.

**BEAM ENDS:** APPLY ITEM 512 TYPE B WATERPROOFING TO THE BOX BEAM ENDS THAT ARE NOT COMPLETELY ENCASED IN CONCRETE.

**NOTCHES:** PROVIDE NOTCHES IN THE BEAM ENDS AT ABUTMENTS TO ACCOMMODATE EXPANSION JOINT ANCHORAGES AS SHOWN ON STANDARD BRIDGE DRAWINGS EKJ-3-82 AND EKJ-5-93 AND AT PIERS TO ACCOMMODATE CONTINUITY AS SHOWN ON SHEET 4 OF 4.

**DRIP GROOVES** ON THE UNDERSIDE OF THE FASCIA BEAM ARE NOT PERMITTED.

**SURFACE PREPARATION FOR MORTAR:** THE FABRICATOR SHALL SANDBLAST THE KEYWAY SURFACES WITHIN FOUR DAYS OF SHIPMENT TO THE PROJECT SITE. THE SANDBLASTING SHALL YIELD A VISUAL APPEARANCE AND TEXTURE EQUAL OR ROUGHER THAN 100 GRIT SANDPAPER OVER THE ENTIRE KEYWAY SURFACE. WHEN STAINS ARE VISIBLE BEFORE BLASTING THE CONCRETE, USE A DEGREASER TO ENSURE REMOVAL OF GREASE, OILS AND OTHER SIMILAR CONTAMINATES. THE DEGREASER SHALL BE WATER SOLUBLE SO IT CAN BE REMOVED BEFORE THE BLASTING BEGINS. BEFORE MORTARING, REMOVE ALL DIRT, DUST, GREASE, OIL AND OTHER FOREIGN MATERIAL FROM THE SURFACES USING A HIGH PRESSURE WASH OF AT LEAST 1000 PSI AT A DELIVERY RATE OF AT LEAST 4 GAL/MIN.

**MORTAR:** MORTAR OR GROUT FOR TIE ROD RECESSES, ANCHOR DOWEL HOLES AND KEYWAYS BETWEEN PRESTRESSED CONCRETE BOX BEAMS, SHALL BE A NON-SHRINK TYPE AS DESCRIBED IN THE ALTERNATES BELOW. DURING THE GROUTING OPERATION, PREPARE AT LEAST THREE, 3" DIAMETER BY 6" LONG TEST CYLINDERS OF THE GROUTING MATERIAL. SUBMIT THE CYLINDERS TO THE LABORATORY TO DETERMINE THE MINIMUM COMPRESSIVE STRENGTH OF THE GROUT.

ALTERNATE 1 - OPEN TO TRAFFIC LATER THAN 7 DAYS AFTER GROUTING:

FURNISH MORTAR CONFORMING TO 705.22 OR TO PROPOSAL NOTE FOR HIGH EARLY STRENGTH KEYWAY GROUT. AFTER THE TIE RODS ARE TIGHTENED, PREPARE PLACE AND CURE THE MORTAR ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS. PLACE MORTAR IN A MANNER THAT ENSURES COMPLETE AND SOLID FILLING. THE MINIMUM STRENGTH OF THE MORTAR SHALL BE 5000 PSI BEFORE CONSTRUCTION OR VEHICULAR TRAFFIC IS ALLOWED ON THE BEAMS.

ALTERNATE 2 - PART WIDTH CONSTRUCTION OR OPEN TO TRAFFIC WITHIN 7 DAYS AFTER GROUTING:

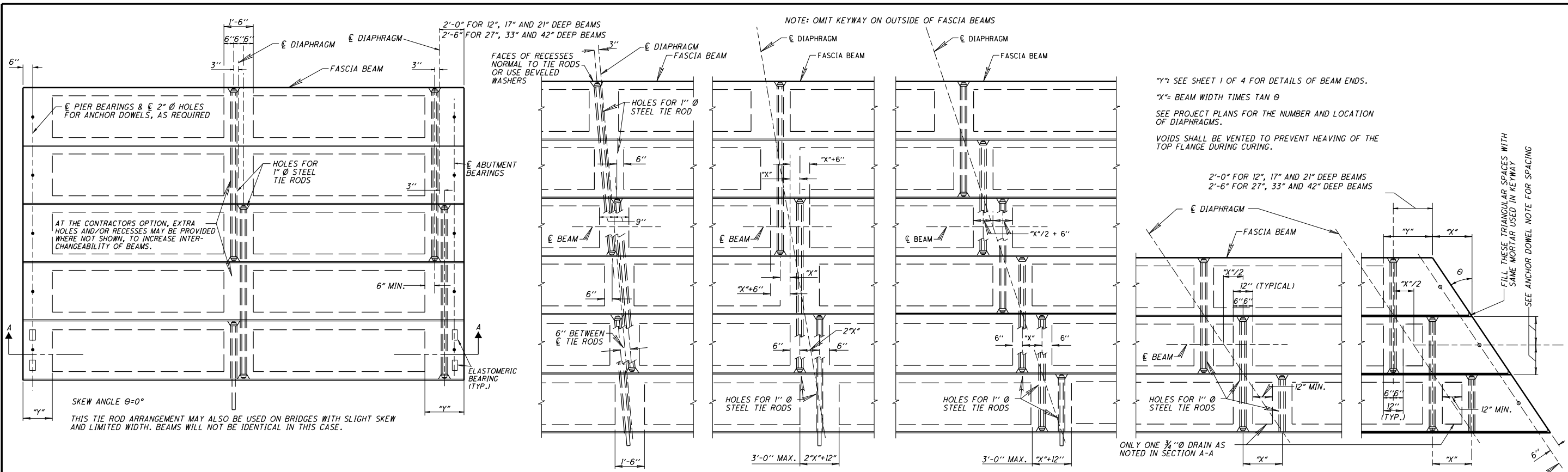
FURNISH MORTAR CONFORMING TO PROPOSAL NOTE FOR HIGH EARLY STRENGTH GROUT. AFTER THE TIE RODS ARE TIGHTENED, PREPARE, PLACE AND CURE THE MORTAR ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS. PLACE MORTAR IN A MANNER THAT ENSURES COMPLETE AND SOLID FILLING. THE MINIMUM STRENGTH OF THE MORTAR SHALL BE 5000 PSI BEFORE CONSTRUCTION OR VEHICULAR TRAFFIC IS ALLOWED ON THE BEAMS.

**COMPOSITE BRIDGES:**

1. SURFACE PREPARATION: THOROUGHLY CLEAN THE TOP SURFACE OF THE BEAMS OF ALL DIRT, DUST AND OTHER FOREIGN MATERIALS WITH WATER, AIR UNDER PRESSURE OR ANY OTHER METHOD THAT PRODUCES SATISFACTORY RESULTS. THOROUGHLY DRENCH THE SURFACE WITH CLEAN WATER. BEFORE PLACING THE CONCRETE, ALLOW THE SURFACE TO DRY TO A DAMP CONDITION.
2. SLAB PLACEMENT: COMPOSITE SLAB POURS ON MULTISPAN SPAN BRIDGES SHALL BE AS LONG AS PRACTICAL. IF NECESSARY, PLACE CONSTRUCTION JOINTS NEAR MIDSPAN, PERPENDICULAR TO THE CENTERLINE OF THE ROADWAY. WHEN STRUCTURAL EXPANSION JOINTS ARE LOCATED AT THE PIERS, PLACE COMPOSITE SLAB BETWEEN THESE JOINTS WITHOUT ADDITIONAL CONSTRUCTION JOINTS EXCEPT AS NOTED IN 511.

**BASIS OF PAYMENT:** ALL COSTS ASSOCIATED WITH FURNISHING AND INSTALLING THE KEYWAY GROUT, THE ANCHOR DOWELS AND THE PREFORMED EXPANSION JOINT FILLER BETWEEN THE BEARINGS, IS CONSIDERED INCIDENTAL TO THE BOX BEAMS.

THE DEPARTMENT WILL PAY FOR FURNISHING AND INSTALLING TYPE B WATERPROOFING SEPARATELY.

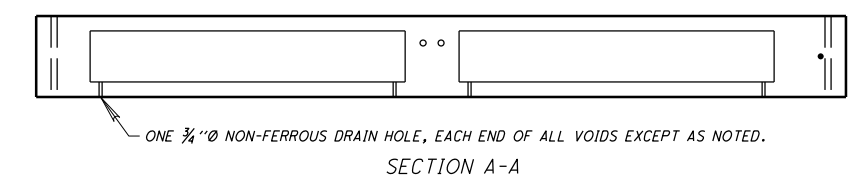


\*Y\* = SEE SHEET 1 OF 4 FOR DETAILS OF BEAM ENDS.  
 \*X\* = BEAM WIDTH TIMES TAN  $\theta$   
 SEE PROJECT PLANS FOR THE NUMBER AND LOCATION OF DIAPHRAGMS.  
 VOIDS SHALL BE VENTED TO PREVENT HEAVING OF THE TOP FLANGE DURING CURING.

- $\theta = 0^\circ$  TO  $5^\circ$  FOR 3' WIDE BEAMS \*
- $\theta = 0^\circ$  TO  $4^\circ$  FOR 4' WIDE BEAMS \*
- $\theta$  OVER  $5^\circ$  TO  $18^\circ$  FOR 3' WIDE BEAMS \*
- $\theta$  OVER  $4^\circ$  TO  $14^\circ$  FOR 4' WIDE BEAMS \*
- $\theta$  OVER  $18^\circ$  TO  $30^\circ$  FOR 3' WIDE BEAMS \*
- $\theta$  OVER  $14^\circ$  TO  $26^\circ$  FOR 4' WIDE BEAMS \*
- $\theta$  OVER  $26^\circ$  TO  $30^\circ$  FOR 4' WIDE BEAMS \*

\* AS AN OPTION THE FABRICATOR MAY MAKE PROVISION FOR GREATER INTERCHANGEABILITY OF INTERIOR BEAMS BY FURNISHING DOUBLE TIE ROD HOLES IN THE DIAPHRAGMS AND PERMITTING ONE TIE ROD TO TIE TWO BEAMS TOGETHER.

ONLY ONE  $\frac{3}{4}$ "  $\emptyset$  DRAIN AS NOTED IN SECTION A-A  
 FILL THESE TRIANGULAR SPACES WITH SAME MORTAR USED IN KEYWAY  
 SEE ANCHOR DOWEL NOTE FOR SPACING  
 $\emptyset$  ABUTMENT BEARINGS AND  $\emptyset$  2" MIN. HOLES FOR ANCHOR DOWEL AS REQUIRED

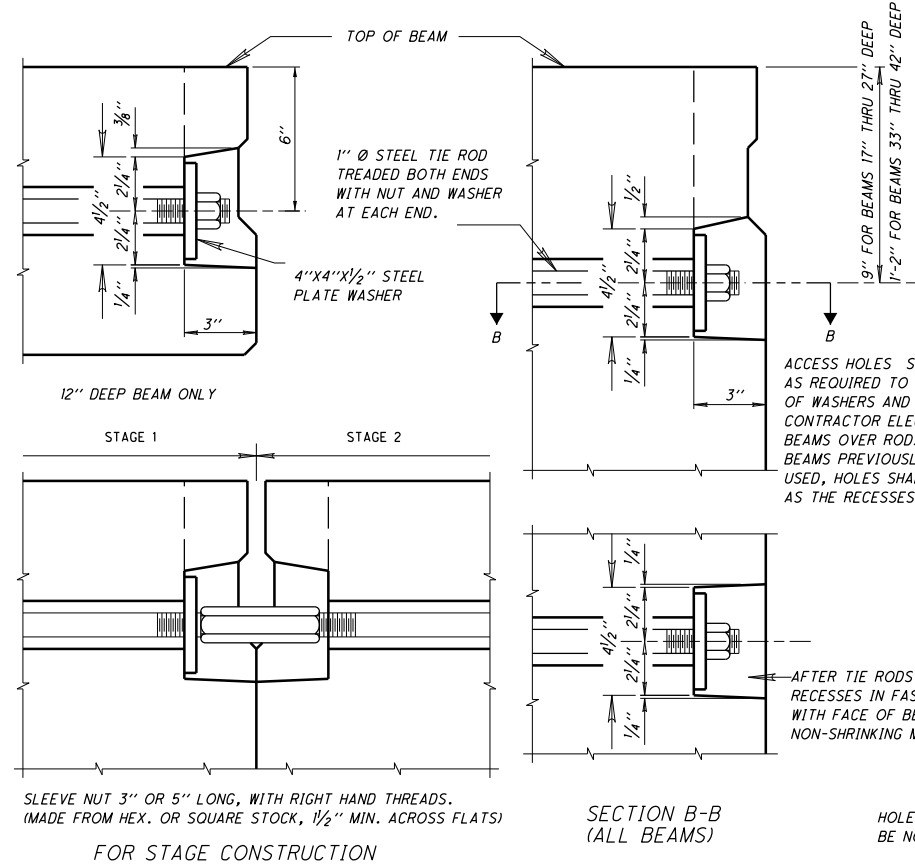


SECTION A-A

TYPICAL PLANS OF DIAPHRAGMS AND TRANSVERSE TIE RODS

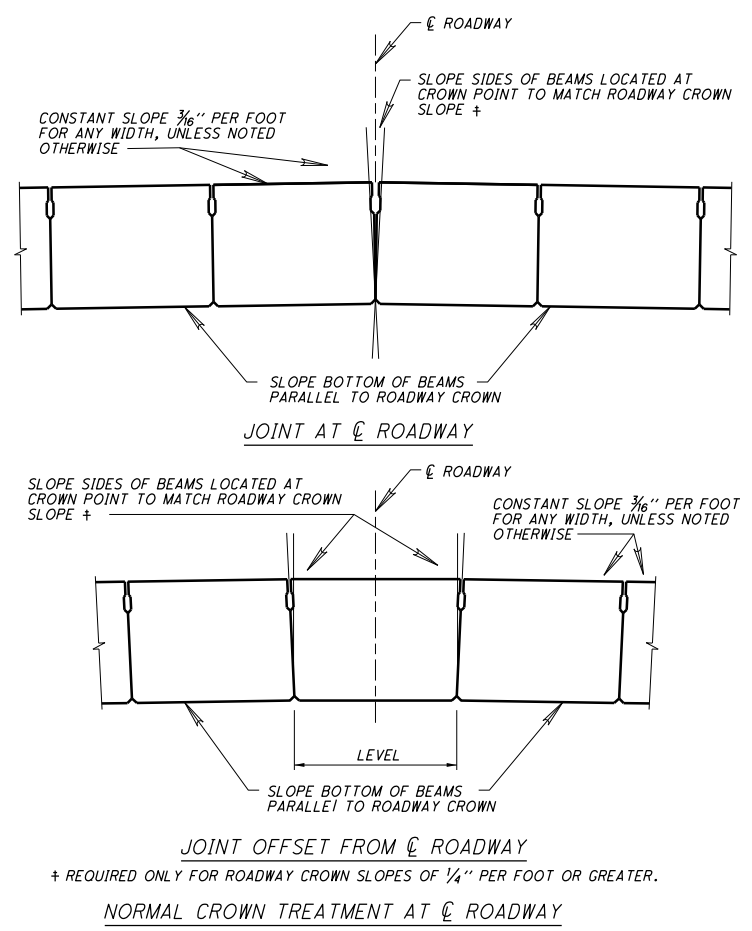
DIAPHRAGM PLACEMENT

PROVIDE INTERMEDIATE DIAPHRAGMS AS FOLLOWS:  
 SPAN  $\leq$  50'-0", ONE DIAPHRAGM  
 50'-0" < SPAN  $\leq$  75'-0", TWO DIAPHRAGMS  
 SPAN > 75'-0", THREE DIAPHRAGMS



SECTION B-B (ALL BEAMS)

END DETAILS OF TRANSVERSE TIE ROD ANCHORAGE



JOINT OFFSET FROM ROADWAY  
 + REQUIRED ONLY FOR ROADWAY CROWN SLOPES OF 1/4" PER FOOT OR GREATER.  
 NORMAL CROWN TREATMENT AT ROADWAY

HOLES IN BEAMS FOR TRANSVERSE TIE RODS SHALL BE NOT LESS THAN 2"  $\emptyset$  AND NOT MORE THAN 3"  $\emptyset$ .  
 DIMENSIONS OF RECESSES IN FASCIA BEAMS AND SHEAR KEYS AND VERTICAL LOCATION OF TRANSVERSE TIE RODS MAY VARY FROM THE DIMENSIONS SHOWN HEREON, SUBJECT TO APPROVAL BY THE DIRECTOR.

SLEEVE NUT 3" OR 5" LONG, WITH RIGHT HAND THREADS. (MADE FROM HEX. OR SQUARE STOCK, 1/2" MIN. ACROSS FLATS)

FOR STAGE CONSTRUCTION

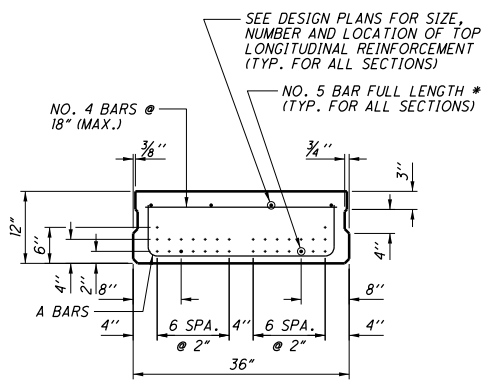
ACCESS HOLES SHALL BE PROVIDED AS REQUIRED TO PERMIT PLACEMENT OF WASHERS AND NUTS UNLESS THE CONTRACTOR ELECTS TO THREAD BEAMS OVER RODS PROJECTING FROM BEAMS PREVIOUSLY PLACED. WHEN USED, HOLES SHALL BE THE SAME SHAPE AS THE RECESSES SHOWN IN SECTION B-B.

AFTER TIE RODS ARE TIGHTENED FILL RECESSES IN FASCIA BEAM FLUSH WITH FACE OF BEAM WITH NON-SHRINKING MORTAR.

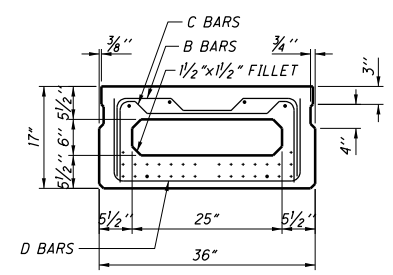
AT THE CONTRACTORS OPTION, EXTRA HOLES AND/OR RECESSES MAY BE PROVIDED WHERE NOT SHOWN, TO INCREASE INTERCHANGEABILITY OF BEAMS.

THIS TIE ROD ARRANGEMENT MAY ALSO BE USED ON BRIDGES WITH SLIGHT SKEW AND LIMITED WIDTH. BEAMS WILL NOT BE IDENTICAL IN THIS CASE.

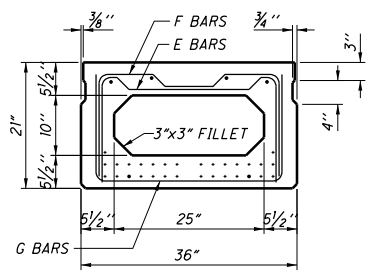
\* - TWO BOTTOM REINFORCING BARS (NO. 5 FULL LENGTH) SHALL BE LOCATED AS SHOWN. IF NECESSARY, A LAP OF 3'-3" SHALL BE LOCATED WITHIN THE OUTER QUARTER OF THE SPAN.



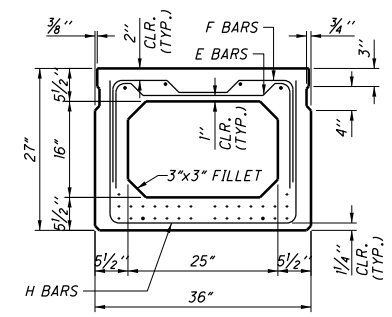
**B12-36**  
 (STRAND PATTERN TYPICAL FOR ALL 36" WIDE BEAMS)



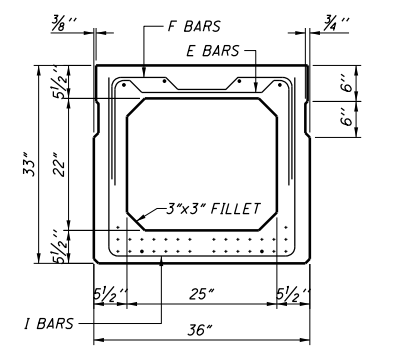
**B17-36**



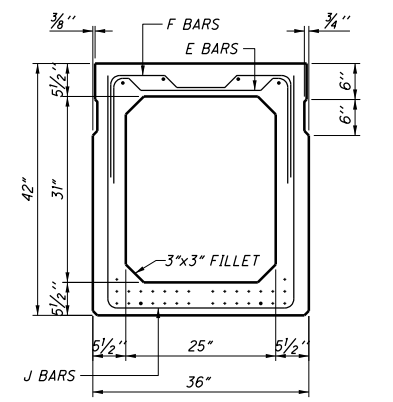
**B21-36**



**B27-36**

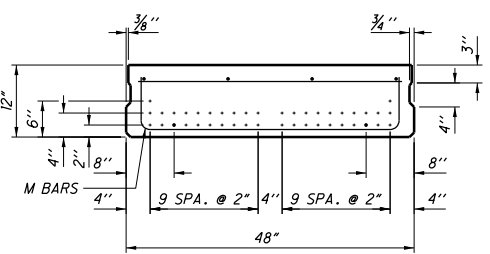


**B33-36**

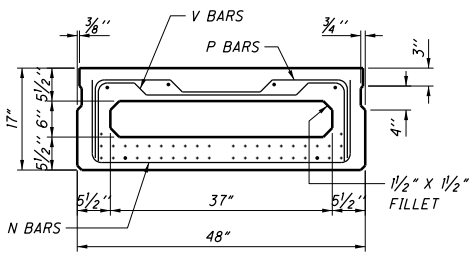


**B42-36**

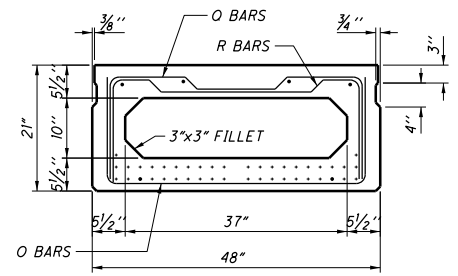
**36" WIDE NON-COMPOSITE BEAMS**



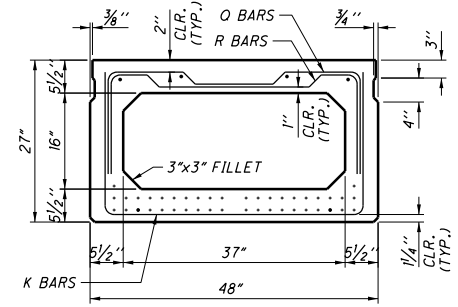
**B12-48**  
 (STRAND PATTERN TYPICAL FOR ALL 48" WIDE BEAMS)



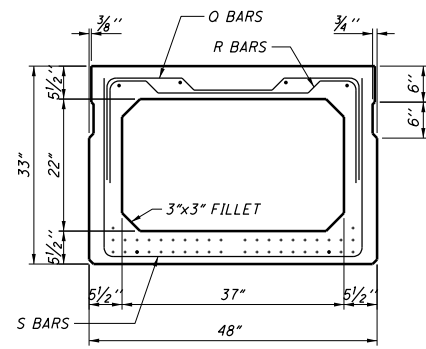
**B17-48**



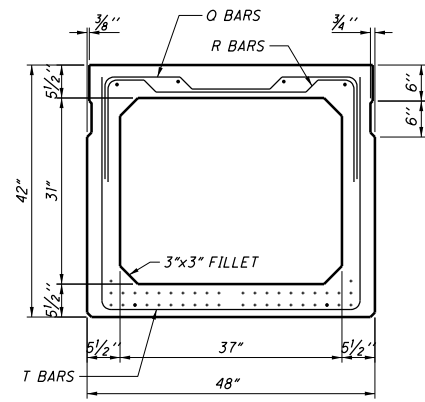
**B21-48**



**B27-48**

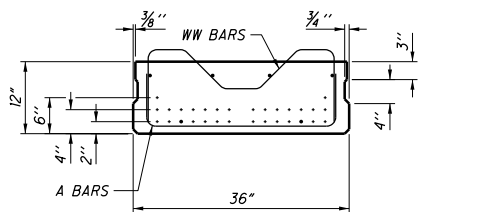


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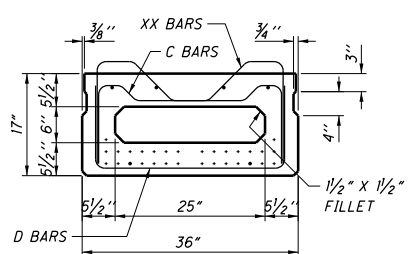


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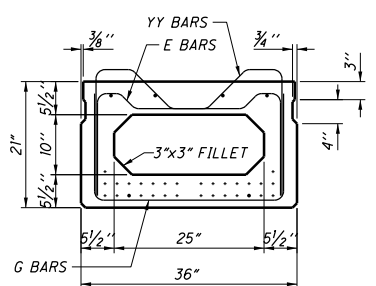
**48" WIDE NON-COMPOSITE BEAMS**



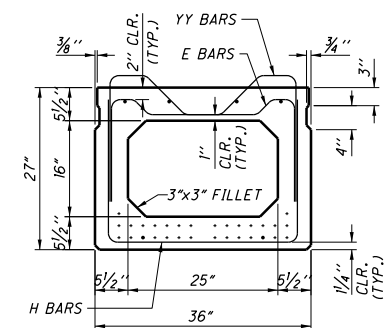
**CB12-36**



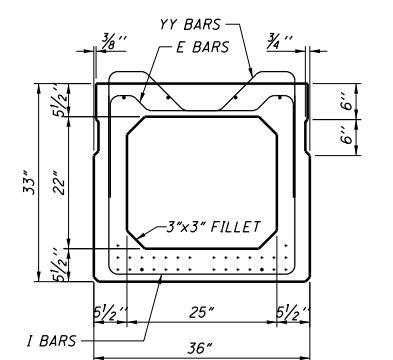
**CB17-36**



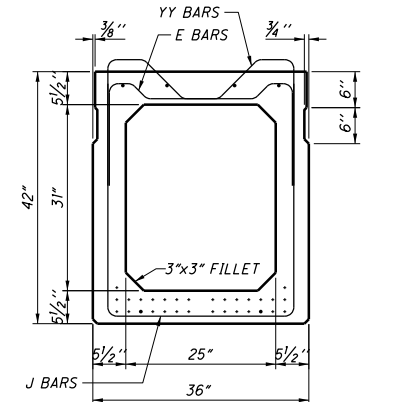
**CB21-36**



**CB27-36**

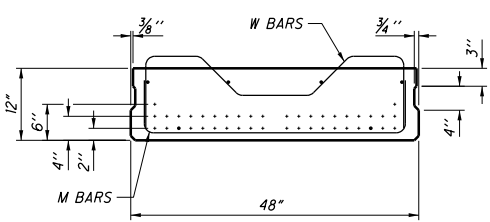


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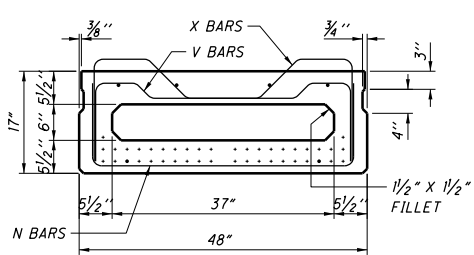


**CB42-36**

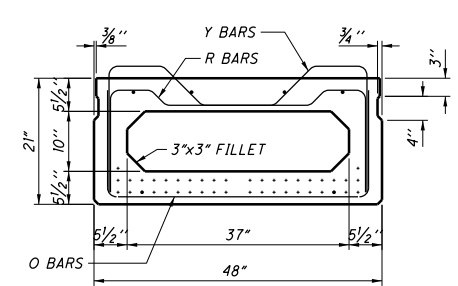
**36" WIDE COMPOSITE BEAMS**



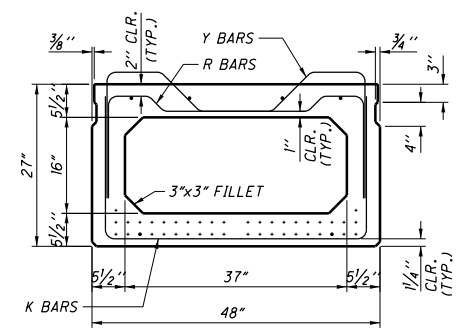
**CB12-48**



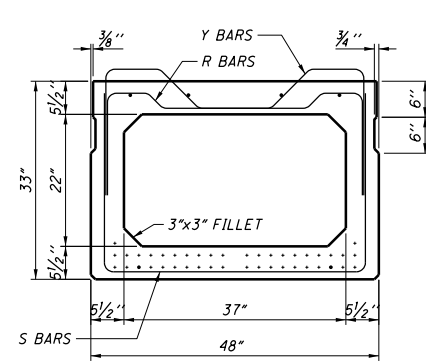
**CB17-48**



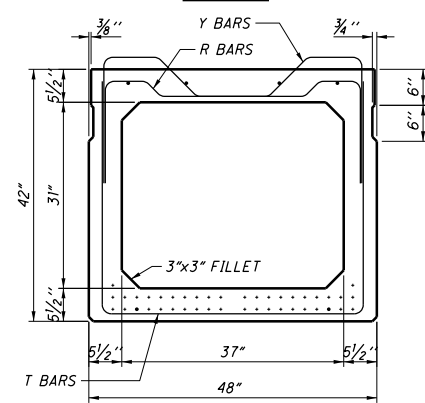
**CB21-48**



**CB27-48**



**CB33-48**

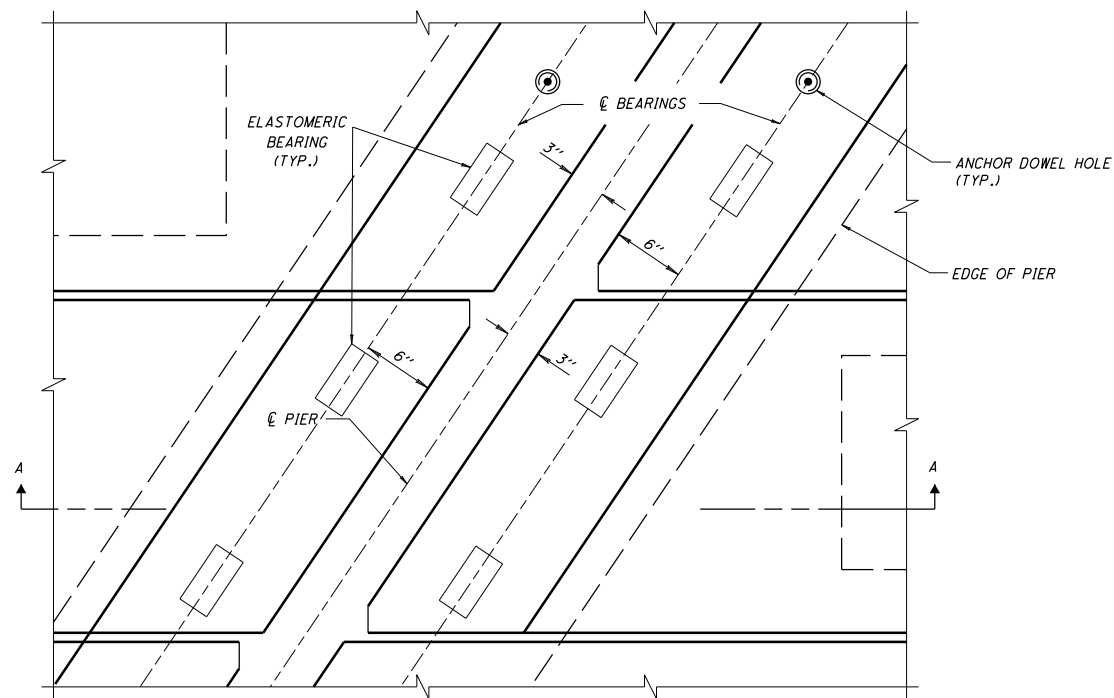


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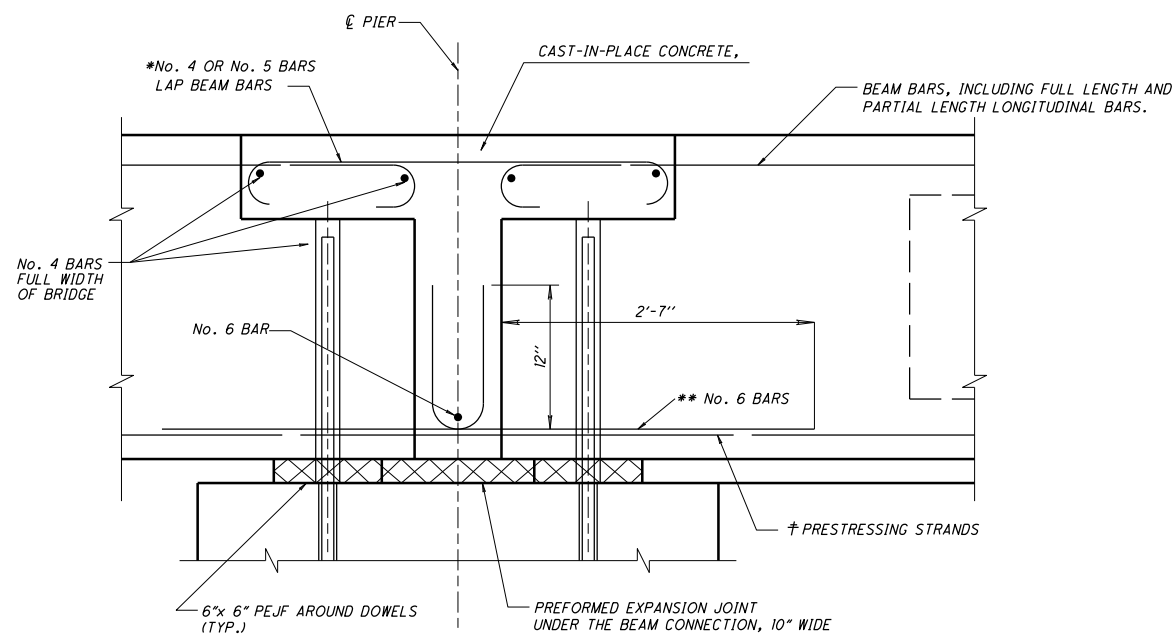
**48" WIDE COMPOSITE BEAMS**

NOTES:  
 1. STRANDS SHALL BE PLACED AS SHOWN AND SHALL BE DISTRIBUTED SYMMETRICALLY OVER THE BEAM WIDTH. STRAND PATTERN AND THE DEBOND LENGTH SHALL BE SYMMETRICAL ABOUT THE VERTICAL C OF THE BEAM. DEBONDED STRANDS SHALL BE IN THE BOTTOM LAYER.  
 2. ALTERNATE TOP STIRRUPS TO LAP BOTTOM STIRRUPS AT EACH END OF BEAM WHERE TWO TYPES OF TOP STIRRUPS ARE PROVIDED.  
 3. THE MINIMUM TOP LONGITUDINAL REINFORCING STEEL SHALL BE 4-NO. 5 BARS. SEE PROJECT PLANS FOR ADDITIONAL REQUIREMENTS.

NOTES: (CONTINUED)  
 4. FABRICATOR'S SHOP DRAWINGS SHALL SHOW COMPLETE DETAILS OF BEAM REINFORCING.  
 5. SEE SHEET 4 OF 4 FOR REINFORCEMENT DETAILS, BENDING DIAGRAMS, AND BEAM SECTION PROPERTIES.



PARTIAL PLAN OF BEAM CONNECTION OVER PIER

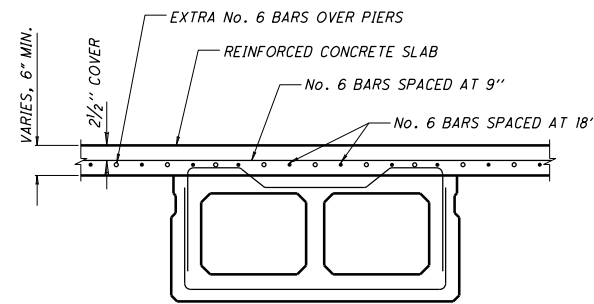


SECTION A-A

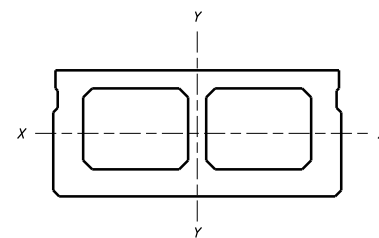
- \* LAP BARS SAME SIZE AND NUMBER AS BEAM BARS. HOOKS MAY BE ROTATED FROM THE VERTICAL POSITION TO PROVIDE THE REQUIRED CLEARANCE.
  - \*\* PROVIDE 6 No. 6 BARS EACH BEAM END IN 48" WIDE BEAMS AND 4 No. 6 BARS EACH BEAM END IN 36" WIDE BEAMS. No. 6 BARS SHALL BE LOCATED ON TOP OF STIRRUPS AND SHALL BE UNIFORMLY SPACED ACROSS THE BEAM.
  - † AT THE FABRICATOR'S OPTION, STRANDS MAY BE EXTENDED AND BENT UP IN LIEU OF No. 6 BARS. 48" WIDE BEAMS WITH A TOTAL OF 12 OR MORE STRANDS SHALL HAVE A MINIMUM OF 6 STRANDS BENT UP. 48" WIDE BEAMS WITH LESS THAN 12 STRANDS TOTAL SHALL HAVE APPROXIMATELY ONE HALF OF THE TOTAL NUMBER OF STRANDS BENT UP. 36" WIDE BEAMS WITH A TOTAL OF 8 OR MORE STRANDS SHALL HAVE A MINIMUM OF 4 STRANDS BENT UP. 36" WIDE BEAMS WITH LESS THAN 8 STRANDS TOTAL SHALL HAVE APPROXIMATELY ONE HALF OF THE TOTAL NUMBER OF STRANDS BENT UP.
- NOTE: THE PRESTRESSING STRANDS WHICH ARE BENT UP SHALL BE STAGGERED IN ABUTTING BEAM ENDS TO AVOID INTERFERENCE.

BENT REINFORCING BARS							BENDING DIAGRAMS	
MARK	TYPE	A	B	C	D	E		
A	1	32"	8"					
B	2	32"	13"	10 1/2"	2"	7"		
C	2	32"	13"	4 1/2"	2"	19"		
D	1	32"	13"					
E	2	32"	17"	4 1/2"	2"	19"		
F	2	32"	17"	10 1/2"	2"	7"		
G	1	32"	17"					
H	1	32"	23"					
I	1	32"	29"					
J	1	32"	38"					
K	1	44"	23"					
M	1	44"	8"					
N	1	44"	13"					
O	1	44"	17"					
P	2	44"	13"	13 1/2"	2"	13"		
Q	2	44"	17"	13 1/2"	2"	13"		
R	2	44"	17"	7 1/2"	2"	25"		
S	1	44"	29"					
T	1	44"	38"					
V	2	44"	13"	7 1/2"	2"	25"		
W	2	44"	12"	9 1/2"	6 1/2"	12"		
X	2	44"	17"	9 1/2"	6 1/2"	12"		
Y	2	44"	21"	9 1/2"	6 1/2"	12"		
WW	2	32"	12"	6 1/2"	6 1/2"	6"		
XX	2	32"	17"	6 1/2"	6 1/2"	6"		
YY	2	32"	21"	6 1/2"	6 1/2"	6"		

NOTE: ALL BARS ARE #4



36" OR 48" WIDE COMPOSITE BEAM WITH SLAB



36" OR 48" WIDE COMPOSITE BEAM

48" WIDE BOX BEAM - SECTION PROPERTIES							
BEAM ONLY	D	12"	17"	21"	27"	33"	42"
	A <sub>b</sub>	567.8	590.3	647.8	713.8	774.5	873.5
I <sub>b</sub>	6850	18819	33884	66222	111342	205459	
Y <sub>b</sub>	5.97"	8.44"	10.42"	13.39"	16.33"	20.78"	
Z <sub>t</sub>	1136	2198	3202	4866	6681	9684	
Z <sub>b</sub>	1147	2230	3253	4945	6816	9886	
COMPOSITE SECTION	I <sub>c</sub>	18681	38620	62057	109704	173831	303315
	Y <sub>b</sub> <sup>c</sup>	8.32	11.40	13.69	17.13	20.51	25.49
	Z <sub>t</sub> <sup>c</sup>	5079	6898	8489	11119	13922	18367
Z <sub>b</sub> <sup>c</sup>	2245	3387	4533	6403	8474	11901	

36" WIDE BOX BEAMS - SECTION PROPERTIES							
BEAM ONLY	D	12"	17"	21"	27"	33"	42"
	A <sub>b</sub>	423.8	458.3	515.8	581.8	642.5	741.5
I <sub>b</sub>	5122	14122	25622	50634	86049	161155	
Y <sub>b</sub>	5.96"	8.42"	10.40"	13.37"	16.30"	20.75"	
Z <sub>t</sub>	848	1646	2416	3714	5153	7582	
Z <sub>b</sub>	859	1677	2464	3788	5279	7768	
COMPOSITE SECTION	I <sub>c</sub>	14003	29153	47126	83956	134078	236517
	Y <sub>b</sub> <sup>c</sup>	8.32	11.31	13.53	16.88	20.17	25.00
	Z <sub>t</sub> <sup>c</sup>	3809	5127	6308	8296	10448	13916
Z <sub>b</sub> <sup>c</sup>	1682	2577	3483	4974	6649	9459	

SECTION PROPERTIES FOR COMPOSITE SECTIONS ARE COMPUTED WITH A SLAB THICKNESS OF 5". TOTAL THICKNESS OF SLAB IS 6" WHICH INCLUDES 1" MONOLITHIC WEARING SURFACE.

$$\frac{E_{slab}}{E_{beam}} = 0.90$$

DEFINITIONS:

- D = TOTAL DEPTH OF THE NON-COMPOSITE BEAM (IN)
- A<sub>b</sub> = CROSS-SECTIONAL AREA OF THE NON-COMPOSITE BEAM (IN<sup>2</sup>)
- I<sub>b</sub> = MOMENT OF INERTIA OF THE NON-COMPOSITE BEAM ABOUT THE X-X AXIS (IN<sup>4</sup>)
- Y<sub>b</sub> = LOCATION OF THE NEUTRAL AXIS OF THE NON-COMPOSITE SECTION MEASURED FROM THE EXTREME BOTTOM FIBER (IN)
- Z<sub>t</sub> = SECTION MODULUS FOR THE EXTREME TOP FIBER OF THE NON-COMPOSITE BEAM (IN<sup>3</sup>)
- Z<sub>b</sub> = SECTION MODULUS FOR THE EXTREME BOTTOM FIBER OF THE NON-COMPOSITE BEAM (IN<sup>3</sup>)
- I<sub>c</sub> = MOMENT OF INERTIA OF THE COMPOSITE BEAM ABOUT THE X-X AXIS (IN<sup>4</sup>)
- Y<sub>b</sub><sup>c</sup> = LOCATION OF NEUTRAL AXIS OF COMPOSITE SECTION MEASURED FROM THE EXTREME BOTTOM FIBER (IN)
- Z<sub>t</sub><sup>c</sup> = SECTION MODULUS FOR THE EXTREME TOP FIBER OF COMPOSITE SECTION (IN<sup>3</sup>)
- Z<sub>b</sub><sup>c</sup> = SECTION MODULUS FOR THE EXTREME BOTTOM FIBER OF THE COMPOSITE SECTION (IN<sup>3</sup>)