

**GENERAL:** THIS STANDARD DRAWING PROVIDES DESIGN AND GENERAL CONSTRUCTION DETAILS FOR PRESTRESSED CONCRETE I-BEAM BRIDGES. THE DETAILS IN THIS STANDARD ARE APPLICABLE TO STRUCTURES WITH BEAM SPACINGS LESS THAN 14'-0" AND SKEWS LESS THAN 45°. 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 VALUES CHOSEN BY THE DESIGNER SHALL BE LISTED IN THE GENERAL NOTES.
2. A TRANSVERSE CROSS-SECTION THROUGH THE DECK, DETAILING (AT A MINIMUM) THE I-BEAM SPACING, DECK THICKNESS, HAUNCH DIMENSIONS, DECK REINFORCING AND COVER.
3. FRAMING PLAN SHOWING (AT A MINIMUM) SPAN LENGTHS, BEAM SPACINGS, SKEW ANGLE, DIAPHRAGM LOCATIONS, AND CENTERLINES OF BEARINGS.
4. BEAM ELEVATION AND SECTION VIEWS FOR EACH BEAM DETAILING BEAM LENGTHS, BEAM HEIGHT, STRAND LOCATIONS AND NUMBER, STRAND DEBONDING LENGTHS, CROSS SECTION OF I-BEAM ENDS SHOWING NUMBER AND LOCATION OF BENT UP ANCHOR STRANDS, REINFORCING STEEL, INSERT LOCATIONS AND EMBEDDED STEEL PLATES (IF ANY).
5. VARIABLE HAUNCH THICKNESSES AND SCREED ELEVATIONS.
6. LAMINATED ELASTOMERIC BEARING DETAILS, INCLUDING DIMENSIONS, DUROMETER AND LOAD PLATE (IF ANY).
7. DETAILS OF END AND PIER DIAPHRAGMS, INCLUDING DIMENSIONS, REINFORCING STEEL SIZE AND SPACING.
8. EXPANSION JOINT DETAILS.
9. DETAILS OF ABUTMENTS AND PIERS, INCLUDING DOWEL ROD POSITIONS, CENTERLINE OF BEAM BEARINGS, ORIENTATION OF BEARINGS AND FIXED DOWEL REQUIREMENTS.
10. ALL PLAN QUANTITY ITEMS REQUIRED TO PROPERLY COVER THE COST OF FABRICATION, ERECTION AND CONSTRUCTION OF THE BEAMS.
11. PLAN NOTES, INCLUDING BUT NOT LIMITED TO, CONCRETE PLACEMENT SEQUENCE.
12. 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 CRITERIA:**

**DESIGN SPECIFICATIONS:** THIS STANDARD DRAWING CONFORMS TO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES" ADOPTED BY THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, 1996, INCLUDING THE 1997 AND 1998 INTERIM SPECIFICATIONS AND THE ODOT BRIDGE DESIGN MANUAL.

**DESIGN LOADING:** HS-20 AND THE ALTERNATE MILITARY LOAD

**DESIGN STRESSES:**

PRESTRESSED CONCRETE -  $f'c = *$  (28-DAY)  
 $f'ci = **$  (RELEASE)

DIAPHRAGM CONCRETE - CLASS S CONCRETE (SUPERSTRUCTURE)  
 $f'c = 4500$  PSI

REINFORCING STEEL - ASTM A615, A616 OR A617 GRADE 60 WITH A MINIMUM YIELD STRENGTH OF 60 KSI AND SHALL BE EPOXY COATED

PRESTRESSING STRAND - ASTM A416 GRADE 270, 1/2" DIA. SEVEN-WIRE, UNCOATED, LOW-RELAXATION STRANDS.  
NOMINAL STRAND AREA - \*\*\*

STRUCTURAL STEEL - ASTM A709, YIELD STRENGTH = 36 KSI OR 50 KSI.

\* - THE DESIGNER HAS A CHOICE OF 28 DAY COMPRESSIVE STRENGTHS RANGING FROM 5500 PSI TO 7000 PSI. THE COMPRESSIVE STRENGTH CHOSEN FOR THE DESIGN SHALL BE SPECIFIED HERE.

\*\* - THE DESIGNER HAS A CHOICE OF RELEASE STRENGTHS RANGING FROM 4000 PSI TO 5000 PSI. THE RELEASE STRENGTH CHOSEN FOR THE DESIGN SHALL BE SPECIFIED HERE.

\*\*\* - THE DESIGNER HAS A CHOICE OF NOMINAL STRAND AREAS EQUAL TO 0.153 IN<sup>2</sup> OR 0.167 IN<sup>2</sup>. THE NOMINAL STRAND AREA CHOSEN FOR THE DESIGN SHALL BE SPECIFIED HERE.

A SINGLE STRUCTURE SHOULD BE LIMITED TO ONE STRAND SIZE, ONE RELEASE STRENGTH AND ONE 28-DAY STRENGTH.

DECK REINFORCING: DECK REINFORCING OVER PIERS SHALL BE DESIGNED TO RESIST THE NEGATIVE MOMENTS INDUCED BY ANY SUPERIMPOSED DEAD LOADS AND LIVE LOADS.

LAP SPLICES FOR REINFORCING STEEL IN I-BEAMS AND DIAPHRAGMS SHALL BE:

- 2'-0" IN LENGTH FOR #4 BARS
- 2'-6" IN LENGTH FOR #5 BARS
- 3'-0" IN LENGTH FOR #6 BARS
- 5'-0" IN LENGTH FOR #8 BARS

SEISMIC RESTRAINTS SHALL BE DESIGNED TO MEET THE CRITERIA FOR ZONE "A" AS DEFINED IN THE AASHTO SPECIFICATIONS.

MULTIPLE SPAN CONTINUOUS STRUCTURES SHALL BE DESIGNED SUCH THAT NONCOMPOSITE DEAD LOADS ARE APPLIED TO THE I-BEAM MODELED AS A SIMPLE SPAN. SUPERIMPOSED DEAD LOADS AND LIVE LOADS ARE TO BE APPLIED TO THE COMPOSITE I-BEAM MODELED AS A CONTINUOUS STRUCTURE. SUPERIMPOSED DEAD LOADS ARE THOSE LOADS APPLIED TO THE STRUCTURE AFTER THE CAST-IN-PLACE CONCRETE DECK HAS REACHED ITS REQUIRED COMPRESSIVE STRENGTH.

**STRANDS:**

TENSILE STRESSES AT THE BEAM ENDS SHALL BE ACCOMMODATED BY THE FOLLOWING METHODS, LISTED IN ORDER OF PREFERENCE.

1. STRAIGHT STRANDS WITH NO DEBONDING: STRANDS MAY BE LOCATED ABOVE THE NEUTRAL AXIS IN ORDER TO RELIEVE EXCESSIVE STRESSES AT THE BEAM ENDS. SUCH STRANDS SHALL BE PLACED INSIDE THE WEB AND TOP FLANGE REINFORCING AND SHALL BE SYMMETRICAL ABOUT THE CENTERLINE OF THE BEAM. ALL STRANDS SHALL BE SPACED AT 2 INCH INCREMENTS.

2. DEBONDED STRANDS: DEBONDING OR SHIELDING OF THE STRANDS WITH AN APPROVED PLASTIC SHEATH, MAY BE DONE AT THE BEAM ENDS TO RELIEVE EXCESSIVE STRESSES. THE MAXIMUM DEBONDED LENGTH SHALL NOT BE GREATER THAN 0.16 TIMES THE SPAN LENGTH MINUS 40". A MINIMUM OF ONE-HALF THE NUMBER OF DEBONDED STRANDS SHALL HAVE A DEBONDED LENGTH EQUAL TO ONE-HALF TIMES THE MAXIMUM DEBONDED LENGTH. NO MORE THAN 25% OF THE TOTAL NUMBER OF STRANDS IN THE BEAM SHALL BE DEBONDED WITH NO MORE THAN 40% OF THE STRANDS IN ANY ONE ROW DEBONDED. DEBONDED STRANDS SHALL BE SYMMETRICAL ABOUT THE CENTERLINE OF THE BEAM. STRANDS EXTENDED FROM A BEAM TO DEVELOP POSITIVE MOMENT RESISTANCE AT PIER LOCATIONS SHALL NOT BE DEBONDED.

3. DRAPED STRANDS: DRAPING OF THE STRANDS MAY BE DONE TO RELIEVE EXCESSIVE STRESSES AT THE BEAM ENDS. THE ANGLE OF THE DEFLECTED STRANDS SHALL NOT EXCEED 9°. THE DEFLECTED STRANDS SHALL MAINTAIN A 2 INCH VERTICAL SPACING ALONG THE ENTIRE LENGTH OF THE BEAM.

**FABRICATION AND CONSTRUCTION REQUIREMENTS:**

ERECTION PROCEDURE: THE CONTRACTOR SHALL SUBMIT, TO THE DIRECTOR FOR APPROVAL, PLANS DETAILING THE ERECTION AND HANDLING OF THE I-BEAMS. THE ERECTION PROCEDURE SHALL BE PREPARED BY A REGISTERED PROFESSIONAL ENGINEER AND SUBMITTED AT LEAST 30 DAYS BEFORE THE ACTUAL ERECTION. ERECTION SHALL NOT BEGIN UNTIL THE ERECTION PROCEDURE HAS BEEN APPROVED.

ERECTION AND LIFTING DEVICES: THE GIRDER FABRICATOR IS RESPONSIBLE FOR THE DESIGN OF A LIFTING SYSTEM FOR HANDLING I-BEAMS. TWO LIFT POINTS SHALL BE USED; ONE WITHIN 5 FEET OF EACH END. THE LIFTING SYSTEM SHALL BE SHOWN ON THE SHOP DRAWINGS AND A FACTOR OF SAFETY OF FOUR USED IN THE DESIGN. THE FABRICATOR IS REFERRED TO PART 5 OF THE PCI HANDBOOK.

THE GIRDERS MUST BE MAINTAINED IN AN UPRIGHT POSITION AT ALL TIMES.

TEMPORARY STABILITY FOR DECK PLACEMENT: THE ERECTION PROCEDURE SHALL INCLUDE ANY ADDITIONAL TEMPORARY DIAPHRAGMS OR SUPPORTS NEEDED TO ASSURE THE I-BEAMS WILL REMAIN STABLE BEFORE, DURING AND THROUGH COMPLETION OF THE PLACEMENT OF THE CONCRETE DECK.

THE PLACEMENT OF DECK CONCRETE SHALL NOT PROCEED UNTIL ALL INTERMEDIATE DIAPHRAGMS HAVE BEEN PROPERLY INSTALLED. CONCRETE INTERMEDIATE DIAPHRAGMS SHALL BE COMPLETED AT LEAST 48 HOURS BEFORE DECK PLACEMENT BEGINS.

CAST-IN-PLACE DECK CONCRETE: BEFORE PLACEMENT OF DECK CONCRETE, THE TOP OF ALL BEAMS SHALL BE THOROUGHLY CLEANED OF ALL DIRT, DUST, LAITANCE AND OTHER DEBRIS. THE SURFACE SHALL BE FLUSHED WITH CLEAN WATER AND SHALL BE DAMP WHEN THE CONCRETE IS PLACED. ANY STANDING WATER SHALL BE REMOVED.

THE DESIGN PLANS FOR MULTI-SPAN, CONTINUOUS BRIDGES SHALL INCLUDE A DECK POUR SEQUENCE. TWO CONSTRUCTION JOINTS SPACED AT 8'-0", PARALLEL TO AND CENTERED ABOUT THE PIERS ARE REQUIRED. NO CONCRETE SHALL BE PLACED BETWEEN THESE CONSTRUCTION JOINTS PRIOR TO THE PLACEMENT OF CONCRETE IN EACH ADJACENT SPAN. UPON COMPLETION OF THE CONCRETE PLACEMENT IN THE ADJACENT SPANS, THE DIAPHRAGM AND DECK CONCRETE BETWEEN THE CONSTRUCTION JOINTS CAN BE PLACED. THE CONSTRUCTION JOINTS SHALL BE SEALED WITH A HIGH MOLECULAR WEIGHT METHACRYLATE RESIN 2'-0" WIDE AND CENTERED OVER THE JOINT. REFER TO SUPPLEMENTAL SPECIFICATION 846 FOR SURFACE PREPARATION AND APPLICATION PROCEDURES.

CONTINUOUS DECK POUR PROCEDURES, WHICH PROCEED FROM END TO END OF THE BRIDGE AND PLACE THE PIER DIAPHRAGM CONCRETE CONCURRENTLY WITH THE DECK CONCRETE, MAY BE APPROVED BY THE DIRECTOR IF THE PLACEMENT SUBMITTAL CAN ASSURE THAT THE DECK CONCRETE IN ADJACENT SPANS WILL BE PLACED BEFORE THE PIER DIAPHRAGM CONCRETE HAS REACHED ITS INITIAL SET.

SURFACE FINISH OF I-BEAM TOP FLANGES TO BE INCORPORATED INTO THE DECK CONCRETE SHALL BE INTENTIONALLY ROUGHENED TO AN AMPLITUDE OF APPROXIMATELY 1/4" BEFORE THE CONCRETE HAS REACHED ITS INITIAL SET. ALL LAITENCE SHALL BE REMOVED.

**GALVANIZING:** ALL STRUCTURAL STEEL, ANCHOR BOLTS, STUDS, INSERTS, THREADED RODS, NUTS AND WASHERS, INSERT PLATES AND BEARING LOAD PLATES (IF ANY) SHALL BE GALVANIZED AS PER 711.02.

**SEALING OF FASCIA BEAMS:** THE FASCIA I-BEAM SHALL BE SEALED WITH AN EPOXY-URETHANE. (SEE SHEET 7/8 FOR THE SEALING LIMITS). PAYMENT TO BE INCLUDED WITH ITEM SPECIAL, SEALING OF CONCRETE SURFACES.

**DIAPHRAGMS:** END AND PIER DIAPHRAGMS SHALL BE CAST-IN-PLACE. THE TYPE OF INTERMEDIATE DIAPHRAGM SHALL BE CHOSEN BY THE CONTRACTOR. INTERMEDIATE DIAPHRAGMS ARE NOT REQUIRED IN SPANS UP TO 40 FEET. DIAPHRAGMS ARE REQUIRED AT MIDSPAN FOR SPANS 40 - 80 FEET AND AT QUARTER POINTS FOR SPANS GREATER THAN 80 FEET. THE DESIGN PLANS SHALL SHOW THE CENTERLINE LOCATION OF EACH INTERMEDIATE DIAPHRAGM. ALL INTERMEDIATE DIAPHRAGM DETAILS AND ASSOCIATED PRESTRESSED BEAM DETAILS SHALL BE INCLUDED IN THE FABRICATOR'S SHOP DRAWINGS. ONLY ONE TYPE OF INTERMEDIATE DIAPHRAGM MAY BE USED PER STRUCTURE.

ALL STRUCTURAL STEEL, INCLUDING BOLTS, NUTS AND WASHERS FOR INTERMEDIATE DIAPHRAGMS SHALL CONFORM TO THE REQUIREMENTS OF SS863.

CONCRETE FOR INTERMEDIATE DIAPHRAGMS SHALL CONFORM TO THE REQUIREMENTS OF SS842. CLASS S CONCRETE SHALL BE USED.

**ALTERNATE DESIGNS:** AT NO EXPENSE TO THE PROJECT AND UPON WRITTEN ACCEPTANCE AND APPROVAL OF THE DIRECTOR, THE CONTRACTOR MAY SUBSTITUTE ALTERNATE DESIGNS FOR DETAILS AND I-BEAM SECTIONS TO THOSE SHOWN IN THE PLANS. IF AN ALTERNATE DESIGN IS APPROVED, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REVISION OF THE PROJECT PLANS. DESIGN AND PLAN MODIFICATIONS SHALL BE DONE AT THE CONTRACTOR'S EXPENSE. THE DEPARTMENT SHALL HAVE 30 DAYS TO APPROVE ANY PROPOSED ALTERNATE DESIGNS AND REVISIONS.

**METHOD OF MEASUREMENT:** THE QUANTITY FOR ITEM 865 SHALL BE THE NUMBER OR LENGTH OF MEMBERS. THIS ITEM INCLUDES THREADED INSERTS AND RODS FOR ABUTMENT AND PIER DIAPHRAGMS, REINFORCING STEEL FULLY OR PARTIALLY ENCASED IN THE MEMBERS, GALVANIZED INSERT PLATES TO ACCEPT BEAM BEARINGS, TEMPORARY DIAPHRAGMS FOR I-BEAM AND DECK POUR STABILITY, AND ALL OTHER MATERIALS AND LABOR REQUIRED FOR FABRICATION AND ERECTION.

CONCRETE FOR PIER AND ABUTMENT DIAPHRAGMS SHALL BE INCLUDED IN THE PAYMENT FOR ITEM 842, CLASS S CONCRETE, SUPERSTRUCTURE.

PAYMENT FOR INTERMEDIATE DIAPHRAGMS SHALL BE MADE AT THE CONTRACT PRICE FOR ITEM 865, EACH, PRESTRESSED CONCRETE BRIDGE I-BEAM MEMBERS, MISC.: DIAPHRAGMS. THE NUMBER OF DIAPHRAGMS TO BE PAID FOR SHALL BE THE ACTUAL NUMBER INSTALLED AND ACCEPTED. PAYMENT FOR THE CONCRETE OPTION SHALL INCLUDE CONCRETE, REINFORCING STEEL, THREADED INSERTS, THREADED RODS AND ALL OTHER MATERIALS AND LABOR REQUIRED FOR FABRICATION AND ERECTION. PAYMENT FOR THE STEEL OPTION SHALL INCLUDE ALL STRUCTURAL STEEL, BOLTS, NUTS, WASHERS, PIPE SLEEVES AND ALL OTHER MATERIALS AND LABOR REQUIRED FOR FABRICATION AND ERECTION.

DESIGN AGENCY	OFFICE OF	STRUCTURAL ENGINEERING
STATE OF OHIO DEPARTMENT OF TRANSPORTATION	09-07-99	DATE
ADMINISTRATOR	Brad Fogwell	
REVIEWED	PSID-1-99	
CHECKED		
DESIGNED		
REVISIONS	10-20-00	
STANDARD	PRESTRESSED CONCRETE I-BEAM	BRIDGE DETAILS
8	8	