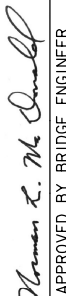





**B24-16 SINGLE SPAN  
CONCRETE BOX BEAM BRIDGE STANDARDS**

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B24-44-16	27" x 48" x 50'-0" PPCBB DETAILS, REINFORCING BAR LIST
B24-45-16	27" x 48" x 60'-0" PPCBB DETAILS, 0° SKEW
B24-46-16	27" x 48" x 60'-0" PPCBB DETAILS, 15° AND 30° SKEW
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B24-48-16	33" x 48" PPCBB DETAILS
B24-49-16	33" x 48" x 70'-0" PPCBB DETAILS, 0° SKEW
B24-50-16	33" x 48" x 70'-0" PPCBB DETAILS, 15° AND 30° SKEW
B24-51-16	33" x 48" x 70'-0" PPCBB DETAILS, REINFORCING BAR LIST
B24-52-16	27" x 48" RCBB DETAILS
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B24-54-16	27" x 48" x 30'-0" RCBB DETAILS, 15° AND 30° SKEW
B24-55-16	27" x 48" x 30'-0" RCBB DETAILS, REINFORCING BAR LIST
B24-56-16	27" x 48" x 40'-0" RCBB DETAILS, 0° SKEW
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LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		
		STANDARD DESIGN - 24'-0" ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		INDEX SHEET	B24-01-16

## SPECIFICATIONS:

DESIGN: AASHTO LRFD 7th Ed, SERIES OF 2014, EXCEPT AS NOTED ON THE PRESTRESSED CONCRETE BEAM SHEETS.

CONSTRUCTION: IOWA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION, SERIES 2015, PLUS APPLICABLE GENERAL SUPPLEMENTAL SPECIFICATIONS, DEVELOPMENTAL SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS AND SPECIAL PROVISIONS SHALL APPLY TO CONSTRUCTION WORK ON THIS PROJECT.

## DESIGN STRESSES:

DESIGN STRESSES FOR THE FOLLOWING MATERIALS ARE IN ACCORDANCE WITH THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7th ED, SERIES OF 2014.

- REINFORCING STEEL IN ACCORDANCE WITH LRFD AASHTO SECTION 5, GRADE 60.
- CONCRETE IN ACCORDANCE WITH LRFD AASHTO SECTION 5,  $f'_c = 4.0$  KSI.
- STANDARD CONCRETE BOX BEAMS, SEE SHEETS B24-34-16 THRU B24-62-16.
- PRECAST ABUTMENT FOOTING CONCRETE IN ACCORDANCE WITH LRFD AASHTO SECTION 5,  $f'_c = 5.0$  KSI.
- ULTRA HIGH PERFORMANCE CONCRETE IN ACCORDANCE WITH THE REQUIREMENTS ON SHEET B24-25-16 THRU B24-26-16.
- STRUCTURAL STEEL IN ACCORDANCE WITH LRFD AASHTO SECTION 6, ASTM A709 GRADE 36, GRADE 50 AND GRADE 50W (AASHTO M270 GRADE 36, GRADE 50 AND GRADE 50W), UNLESS OTHERWISE SHOWN OR NOTED.
- SELF-CONSOLIDATING STRUCTURAL CONCRETE (HIGH EARLY STRENGTH) IN ACCORDANCE WITH THE REQUIREMENTS SHOWN ON SHEET B24-03-16.

## GENERAL NOTES:

THE B24-16 BRIDGE STANDARDS PROVIDE THE STRUCTURAL PLANS NECESSARY TO CONSTRUCT SINGLE SPAN 24'-0" ROADWAY CONCRETE BOX BEAM BRIDGES WITH LENGTHS OF 30'-0", 40'-0", 50'-0", 60'-0" AND 70'-0" MEASURED CENTER OF BEARING TO CENTER OF BEARING.

THESE BRIDGES MAY BE BUILT ON A 0°, 15° OR 30° SKEW. THESE PLANS SHOW THE BRIDGE SKEWED IN ONE DIRECTION, BUT ALL DIMENSIONS AND DETAILS ARE APPLICABLE FOR THE OPPOSITE SKEW.

THESE BRIDGES ARE DESIGNED FOR HL93 LOADING PLUS 50 LBS. PER SQ. FT. OF ROADWAY FOR FUTURE WEARING SURFACE OR GRAVEL.

THESE PLANS PROVIDE DETAILS FOR PRECAST OR CAST-IN-PLACE ABUTMENTS.

THE DECK, AS SHOWN, INCLUDES A 1/2" INTEGRAL WEARING SURFACE.

THE ABUTMENTS FOR THESE STANDARDS HAVE BEEN DESIGNED FOR THE USE OF HPI0x57 PILES AS PER BRIDGE DESIGN MANUAL (BDM) ARTICLE 6.2.6.1, STRUCTURAL RESISTANCE LEVEL-1 (SRL-1). STRUCTURAL RESISTANCE LEVEL-1 (SRL-1) REPLACES THE 50 TON STEEL PILE DESIGNATION. FOR MORE INFORMATION ON SRL-1, SEE THE BRIDGE DESIGN MANUAL, LOCATED ON THE IOWA DEPARTMENT OF TRANSPORTATION, OFFICE OF BRIDGES AND STRUCTURES WEB SITE.

ALL REINFORCING STEEL AND MECHANICAL COUPLERS SHALL BE EPOXY COATED, UNLESS NOTED OTHERWISE.

KEYWAY DIMENSIONS SHOWN ON THE PLANS ARE BASED ON NOMINAL DIMENSIONS UNLESS STATED OTHERWISE. IN ADDITION, THE BEVEL USED ON THE KEYWAY SHALL BE LIMITED TO A MAXIMUM OF 10 DEGREES FROM VERTICAL.

THESE BRIDGE PLANS LABEL ALL REINFORCING STEEL WITH ENGLISH NOTATION (5d1 IS 5/8 INCH DIAMETER BAR). ENGLISH REINFORCING STEEL RECEIVED IN THE FIELD MAY DISPLAY THE FOLLOWING "BAR DESIGNATION". THE "BAR DESIGNATION" IS THE STAMPED IMPRESSION ON THE REINFORCING BARS, AND IS EQUIVALENT TO THE BAR DIAMETER IN MILLIMETERS.

ENGLISH SIZE	3	4	5	6	7	8	9	10	11
BAR DESIGNATION	10	13	16	19	22	25	29	32	36

## SHOP DRAWING SUBMITTALS

SHOP DRAWINGS SHALL BE SUBMITTED FOR THE FOLLOWING ITEMS SHOWN IN THE TABLE BELOW. (NOTE ADDITIONAL SHOP DRAWINGS MAY BE REQUIRED IN ACCORDANCE WITH ARTICLE 1105.03 OF THE STANDARD SPECIFICATIONS.)

SUBMITTAL REQUIREMENTS FOR SHOP DRAWINGS SHOULD BE IN ACCORDANCE WITH ARTICLE 1105.03 OF THE STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION OF THE IOWA DEPARTMENT OF TRANSPORTATION.

1	SHEET PILING, TIES, WALERS, AS PER STEEL SHEET PILING NOTES
2	BRIDGE RAIL POSTS

## OTHER SUBMITTALS

THE CONTRACTOR SHALL PROVIDE SUBMITTALS FOR THE FOLLOWING ITEMS SHOWN IN THE TABLE BELOW.

REQUIREMENTS FOR THE FOLLOWING SUBMITTALS SHALL BE IN ACCORDANCE WITH THE DESIGN PLANS.

1	PRECAST CONCRETE MIX DESIGN(S).
2	SELF-CONSOLIDATING (HIGH EARLY STRENGTH) CONCRETE MIX DESIGN(S).
3	UHPC MIX DESIGN, PLACEMENT PLAN AND LIST OF SIMILAR PROJECTS.
4	QUALITY CONTROL PLAN (ALTERNATE SITE CASTING)
5	LIFTING LOOP PATCH AND STRUCTURAL REPAIR PROCEDURES.
6	MATERIAL PROPERTY CERTIFICATION FOR HIGH MOLECULAR WEIGHT METHACRYLATE (FOR REPAIR OF LEAKING BEAM JOINTS).

## TOLERANCES

### BOX BEAM DIMENSIONAL TOLERANCES

LENGTH OF BEAM	$\pm \frac{1}{8}"$ PER 10' AND $\pm \frac{3}{4}"$ MAX.
DEPTH OF BEAM	$\pm \frac{1}{4}"$
FLANGE WIDTH	$\pm \frac{1}{4}"$
FLANGE THICKNESS EXCLUDING FILLETS:	
TOP	$+\frac{1}{2}"$
BOTTOM	$+\frac{1}{2}"$ OR $-\frac{1}{8}"$
WIDTH OF BEAM WALLS	$+\frac{3}{8}"$ OR $-\frac{1}{4}"$
WIDTH OF VOID	$\pm \frac{1}{2}"$
HEIGHT OF VOID	$\pm \frac{1}{2}"$
DEVIATION FROM VERTICAL	$\pm \frac{1}{8}"$
DEVIATION FROM SKEW ANGLE	$\pm 0.5^\circ$

### BOX BEAM ACCESSORY TOLERANCES

POSITION OF RAIL POST ANCHORS	$\pm \frac{1}{4}"$
POSITION OF LIFTING DEVICES	$\pm 3"$
POSITION OF SLEEVES	$\pm \frac{1}{2}"$

### BOX BEAM SWEEP AND CAMBER TOLERANCES

HORIZONTAL SWEEP	$\frac{1}{8}"$ PER 10'-0"
MAXIMUM GAP BETWEEN BEAMS	1"
CAMBER DEVIATION FROM DESIGN CAMBER	$\pm 30\%$ OF PLAN CAMBER

### PRECAST SUBSTRUCTURE ELEMENT TOLERANCES

LENGTH	$\pm \frac{1}{4}"$ PER 25'-0"
DEPTH	$+\frac{1}{2}"$ OR $-\frac{1}{4}"$
WIDTH	$+\frac{3}{8}"$ OR $-\frac{1}{4}"$

## NOTES TO DESIGNER:

THESE STANDARDS GIVE MOST OF THE INFORMATION NECESSARY TO BUILD THESE BRIDGES ON A STRAIGHT GRADE. BECAUSE OF THE INFINITE NUMBER OF GRADE POSSIBILITIES, IT WILL BE NECESSARY TO SHOW ON THE PLANS THE ABUTMENT CONTROL ELEVATIONS. TO AID IN OBTAINING THE INFORMATION, SEE "EXAMPLES OF BRIDGE ELEVATION CALCULATIONS" ON SHEET B24-05-16.

THE ABUTMENT FOOTING CONCRETE QUANTITIES SHOWN IN THESE PLANS ARE CALCULATED BASED ON 0% GRADE. FOR HIGHER GRADES, THESE CONCRETE QUANTITIES FOR BRIDGES SKEWED AT 15° AND 30° NEED TO BE INCREASED AS SHOWN IN "ADDITIONAL CONCRETE" TABLES ON SHEETS B24-15-16 AND B24-16-16.

FOR 0° SKEW BRIDGES, THE DESIGNER WILL NEED TO PROVIDE WING ELEVATIONS "A" AND "B" AS NOTED ON THE STANDARD SHEET B24-08-16.

FOR STEEL PILES, THE DESIGNER WILL NEED TO DETERMINE THE CONSTRUCTION CONTROL METHOD, CONTRACT LENGTH, AND DRIVING TARGET AND GIVE THAT INFORMATION ON THE FRONT SHEET OF THE PLANS. BRIDGE DESIGN MANUAL CADD NOTES E718, E719, E818, AND E819 ARE APPROPRIATE FOR THAT PURPOSE. THE NOTES, AS WELL AS THE BRIDGE DESIGN MANUAL AND DESIGN EXAMPLES ARE AVAILABLE ON THE OFFICE OF BRIDGES AND STRUCTURES WEB SITE: [HTTP://WWW.IOWADOT.GOV/BRIDGE/INDEX.HTM](http://www.iowadot.gov/bridge/index.htm).

THESE STANDARDS CONTAIN OPTIONS FOR:

1) BOX BEAM BRIDGES WITH CAST-IN-PLACE CONCRETE ABUTMENTS (SHEETPILE WINGS (0° SKEW ONLY) OR CONCRETE WINGS (0°, 15°, 30° SKEWS))

2) BOX BEAM BRIDGES WITH PRECAST CONCRETE ABUTMENTS (SHEETPILE WINGS (0° SKEW ONLY) OR CONCRETE WINGS (0°, 15°, 30° SKEWS))

3) PRESTRESSED AND NON-PRESTRESSED CONCRETE BOX BEAMS.

REFER TO QUANTITY SUMMARY SHEETS B24-28-16 TO B24-31-16 FOR APPROPRIATE BID ITEMS TO USE IN PLAN DEVELOPMENT.

LATEST REVISION DATE

*Thomas L. Mc Donald*  
APPROVED BY BRIDGE ENGINEER



Highway Division

STANDARD DESIGN - 24'-0" ROADWAY, SINGLE SPAN  
CONCRETE BOX BEAM BRIDGES

DECEMBER, 2016

GENERAL NOTES  
(SHEET 1 OF 3)

B24-02-16

# PRECAST CONCRETE ELEMENT NOTES:

## DESCRIPTION:

- A. FURNISH AND INSTALL PRECAST CONCRETE SUBSTRUCTURE AND SUPERSTRUCTURE ELEMENTS, INCLUDING BRIDGE ABUTMENT FOOTINGS, BRIDGE ABUTMENT BACKWALLS AND BOX BEAMS, HEREIN REFERRED TO AS PRECAST ELEMENTS. THIS WORK INCLUDES ALL NECESSARY MATERIALS AND EQUIPMENT TO COMPLETE THE WORK AS SHOWN IN THE CONTRACT DOCUMENTS. USE OF ALTERNATE CAST-IN-PLACE CONCRETE WILL BE ALLOWED, WITH APPROVAL OF THE ENGINEER, FOR ABUTMENTS AND BACKWALLS AS SHOWN IN THE PLANS.
- B. MATERIALS AND REQUIREMENTS FOR PRECAST/PRESTRESSED CONCRETE BRIDGE ELEMENTS SHALL CONFORM TO SECTION 2407 OF THE STANDARD SPECIFICATIONS AND MATERIALS I.M. 570 LRFD. MATERIALS AND REQUIREMENTS FOR NON-PRESTRESSED PRECAST CONCRETE BRIDGE ELEMENTS SHALL CONFORM TO SECTION 2407 OF THE STANDARD SPECIFICATIONS AND MATERIALS I.M. 445, EXCEPT AS PERMITTED IN THE ALTERNATE SITE CASTING NOTES IN THESE DESIGN PLANS. THE FOLLOWING PRECAST CONCRETE ELEMENT NOTES APPLY TO ALL PLANT CAST PRECAST CONCRETE ELEMENTS AND ALTERNATE SITE CAST PRECAST CONCRETE ELEMENTS:

## SUBMITTALS:

- A. PROVIDE SUBMITTALS TO THE ENGINEER AS REQUIRED ON SHEET B24-02-16 IN ACCORDANCE WITH ARTICLE 1105.03 OF THE STANDARD SPECIFICATIONS.

## MATERIALS:

- A. CONCRETE:
1. CONCRETE MATERIALS FOR PRECAST ELEMENTS CONSTRUCTED EITHER AT A PREAPPROVED FABRICATION PLANT OR IN ACCORDANCE WITH THE ALTERNATE SITE CASTING NOTES SHALL BE IN ACCORDANCE WITH SECTION 2407 OF THE STANDARD SPECIFICATIONS, WITH A MINIMUM 28-DAY COMPRESSIVE STRENGTH AS NOTED IN THE PLANS. CONCRETE MIX DESIGN MUST BE APPROVED BY THE ENGINEER PRIOR TO CONCRETE PLACEMENT.
  2. SELF-CONSOLIDATING CONCRETE FOR SUBSTRUCTURE PILE POCKETS:
    - a. HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE MIX DESIGNS SHALL BE APPROVED BY THE ENGINEER. SELF-CONSOLIDATING CONCRETE SHALL COMPLY WITH MATERIALS I.M. 445, APPENDIX D.
    - b. HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE SHALL INCLUDE THE FOLLOWING PROPERTIES:
      - MAXIMUM TOP SIZE AGGREGATE SHALL BE LIMITED TO 1/2 INCH.
      - MINIMUM 6-HOUR COMPRESSIVE STRENGTH SHALL BE 2500 PSI.
      - MINIMUM 7-DAY COMPRESSIVE STRENGTH SHALL BE 4000 PSI.
      - MINIMUM 28-DAY COMPRESSIVE STRENGTH SHALL BE 5000 PSI.
      - MIX SHALL CONTAIN SHRINKAGE COMPENSATING ADDITIVES SUCH THAT THERE WILL BE NO SEPARATION OF PILE POCKET FILL CONCRETE FROM THE ADJACENT PRECAST ELEMENTS.
      - SHRINKAGE-COMPENSATING ADDITIVE SHALL PRODUCE EXPANSION IN THE HIGH EARLY STRENGTH CONCRETE OF NO MORE THAN 3%.
- B. REINFORCING STEEL:  
CONFORM TO SECTION 2404 OF THE STANDARD SPECIFICATIONS.
- C. CORRUGATED METAL PIPE:  
USE CORRUGATED METAL PIPE TO FORM PILE POCKETS IN PRECAST SUBSTRUCTURE ELEMENTS OF THE DIAMETER AND LENGTH INDICATED IN THE PLANS. CORRUGATED METAL PIPE SHALL BE GALVANIZED, TYPE 1, 16 GAGE, IN ACCORDANCE WITH SECTION 4141 OF THE STANDARD SPECIFICATIONS AND MATERIALS I.M. 441.

## CONSTRUCTION:

- A. QUALITY ASSURANCE:
1. PRECAST/PRESTRESSED ELEMENTS SHALL BE CONSTRUCTED BY A PREAPPROVED FABRICATOR AT A PREAPPROVED FACILITY, IN ACCORDANCE WITH MATERIALS I.M. 570. FABRICATOR SHALL HAVE EXPERIENCE IN THE MANUFACTURE OF SIMILAR PRODUCTS, SATISFACTORY TO THE CONTRACTING AUTHORITY, AND UPON REQUEST BY THE ENGINEER, SHALL PROVIDE DOCUMENTATION DEMONSTRATING ADEQUATE STAFF, EXPERIENCE, EQUIPMENT AND QUALITY CONTROL.
  2. NON-PRESTRESSED PRECAST ELEMENTS SHALL BE CONSTRUCTED BY A PREAPPROVED FABRICATOR AT A PREAPPROVED FACILITY, IN ACCORDANCE WITH MATERIALS I.M. 445, EXCEPT AS PERMITTED IN THE ALTERNATE SITE CASTING NOTES IN THESE PLANS.

- B. FABRICATION:  
TO ALLOW COORDINATION OF INSPECTION AND TESTING, THE ENGINEER SHALL BE PROVIDED WITH A MINIMUM 14 DAY NOTICE PRIOR TO THE ANTICIPATED DATE OF SHIPPING OF PRECAST ELEMENTS TO THE PROJECT SITE (FOR PLANT-CAST ELEMENTS) OR 14 DAY NOTICE PRIOR TO PLACEMENT OF CONCRETE FOR PRECAST ELEMENTS (FOR ALTERNATE SITE-CAST ELEMENTS). CONCRETE PLACEMENT FOR ALTERNATE SITE-CAST ELEMENTS SHALL NOT PROCEED UNTIL ENGINEER HAS INSPECTED AND APPROVED THE FORMING AND REINFORCING STEEL PLACEMENT.

- C. HANDLING AND TRANSPORTATION:  
IN ADDITION TO THE REQUIREMENTS OF ARTICLE 2407.03, K OF THE STANDARD SPECIFICATIONS, THE FOLLOWING PROVISIONS APPLY:

1. WHEN NO LONGER NEEDED, LIFTING LOOPS SHALL BE REMOVED AND PATCHED AFTER USE BY MEANS APPROVED BY THE ENGINEER.
2. IF MORE THAN ONE PRECAST ELEMENT IS TRANSPORTED PER VEHICLE, PROPER SUPPORT AND SEPARATION MUST BE PROVIDED BETWEEN INDIVIDUAL PRECAST ELEMENTS. PRECAST ELEMENTS SHALL BE STORED AND TRANSPORTED IN THEIR UPRIGHT POSITION, UNLESS OTHERWISE APPROVED.
3. HANDLING AND ERECTION BRACING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

- D. SURFACE DEFECTS AND DAMAGE REPAIR:  
REPAIR OF SURFACE DEFECTS AND DAMAGE CAUSED TO THE PRECAST ELEMENTS DURING FABRICATION, LIFTING AND HANDLING, OR TRANSPORTATION SHALL BE IN ACCORDANCE WITH MATERIALS I.M. 570. REOCCURRING DAMAGE TO PRECAST ELEMENTS SHALL BE CAUSE FOR STOPPAGE OF FABRICATION OPERATIONS UNTIL THE CAUSE OF THE DAMAGE CAN BE REMEDIED. ALL PROPOSED REPAIR PROCEDURES SHALL BE SUBMITTED IN WRITING AND APPROVED BY THE ENGINEER IN ADVANCE. CONCRETE REPAIR WORK MUST REESTABLISH THE ELEMENT'S STRUCTURAL INTEGRITY, DURABILITY AND AESTHETICS TO THE SATISFACTION OF THE ENGINEER.

- E. GENERAL PROCEDURES FOR INSTALLATION OF PRECAST SUBSTRUCTURE ELEMENTS:

1. ESTABLISH WORKING POINTS, WORKING LINES, AND BENCHMARK ELEVATIONS PRIOR TO PLACEMENT OF ALL PRECAST ELEMENTS.
2. CHECK THE CONDITION OF THE RECEIVING BONDING/BEARING SURFACE PRIOR TO PLACEMENT AND/OR CONNECTION OF PRECAST ELEMENTS. TAKE NECESSARY MEASURES TO REMOVE DUST, RUST, DEBRIS, ETC. AS NECESSARY TO PROVIDE PROPER SUPPORT OF PRECAST ELEMENT AND SATISFACTORY CONNECTION TO STRUCTURE.
3. LIFT PRECAST SUBSTRUCTURE ELEMENTS USING THE LIFTING ATTACHMENT POINTS DETAILED IN THE PLANS. ALIGN THE PILE POCKET VOIDS IN THE PRECAST ELEMENTS OVER THE SUPPORTING STEEL BEARING PILING. THE CONTRACTOR SHALL BE PERMITTED TO MAKE MINOR ADJUSTMENTS TO THE POSITIONS OF THE TOPS OF THE STEEL BEARING PILING.
4. CONTRACTOR IS ADVISED TO KEEP THE PRECAST SUBSTRUCTURE ELEMENT RIGGED AND SUPPORTED BY THE CRANE(S) UNTIL FINAL PLACEMENT AND ADJUSTMENT IS COMPLETED.
  - a. BRIDGE ABUTMENT FOOTING WITH SHEET PILE WINGS:  
PRECAST BRIDGE ABUTMENT FOOTING SHALL BE SUPPORTED BY THE STEEL BEARING PILING THAT WILL BECOME PERMANENTLY CONNECTED TO THE ABUTMENT FOOTING AS A PART OF THE DESIGN. SUPPORT SYSTEM FOR BRIDGE ABUTMENT FOOTING SHALL ACCOMMODATE AN APPROVED METHOD OF ADJUSTING VERTICAL AND HORIZONTAL POSITION OF THE PRECAST ELEMENT TO WITHIN ACCEPTABLE TOLERANCES OF INTENDED DESIGN POSITION.
  - b. BRIDGE ABUTMENT FOOTING WITH CONCRETE WINGS:  
PRECAST BRIDGE ABUTMENT FOOTING SHALL BE SUPPORTED ON A LEVEL AND SUFFICIENTLY FIRM PREPARED BEARING PAD, UNLESS OTHER MEANS OF SUPPORT ARE APPROVED. SUPPORT SYSTEM FOR BRIDGE ABUTMENT FOOTING SHALL ACCOMMODATE AN APPROVED METHOD OF ADJUSTING VERTICAL AND HORIZONTAL POSITION OF THE PRECAST ELEMENT TO WITHIN ACCEPTABLE TOLERANCES OF INTENDED DESIGN POSITION.
5. SURVEY THE POSITION AND ELEVATION OF THE PRECAST SUBSTRUCTURE ELEMENT AS PLACED AND SUPPORTED. UTILIZE ADJUSTMENT DEVICES (JIGS, TEMPLATES, SHIMS, LEVELING DEVICES, ETC.) AS REQUIRED TO ESTABLISH THE DESIGN HORIZONTAL AND VERTICAL POSITION OF THE PRECAST SUBSTRUCTURE ELEMENT.

6. INSTALL TEMPORARY BRACING AS REQUIRED. STABILITY OF THE PRECAST SUBSTRUCTURE ELEMENT AND THE COMPREHENSIVE SUBSTRUCTURE SYSTEM SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR FOR THE DURATION OF CONSTRUCTION.

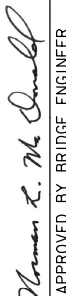

7. ENSURE THAT PILES EXTEND INTO THE PILE POCKETS AT LEAST THE MINIMUM EMBEDMENT LENGTH SPECIFIED IN THE PLANS. ENSURE PILE POCKET VOIDS ARE PROPERLY AND SUFFICIENTLY FORMED FOR PLACEMENT OF SELF-CONSOLIDATING CONCRETE MATERIALS.

8. PLACE APPROVED SELF-CONSOLIDATING HIGH EARLY STRENGTH CONCRETE WITHIN THE PILE POCKET VOIDS. FINISH THE TOP OF THE PILE POCKET FILL WITH A SMOOTH TROWELED FINISH. CORRUGATED METAL PIPE FOR PILE POCKET FORMED BLOCKOUTS SHALL BE PREVENTED FROM EXTENDING ABOVE THE FINISHED SURFACE OF THE PRECAST CONCRETE PORTION OF THE SUBSTRUCTURE ELEMENT. PILE POCKET FILL FOR BRIDGE ABUTMENT FOOTINGS SHALL BE ALLOWED TO FLOW PARTIALLY UNDER THE PRECAST ELEMENT (THE ENTIRE UNDERSIDE OF THE PRECAST FOOTING NEED NOT BE FILLED) IF THE BOTTOM OF THE ABUTMENT IS NOT EXPOSED IN ITS FINAL CONDITION. OTHERWISE, IT SHALL BE FORMED FLUSH WITH THE BOTTOM.

9. TEMPORARY SUPPORTS AND/OR BRACING, AS REQUIRED, SHALL REMAIN IN PLACE UNTIL SELF-CONSOLIDATING CONCRETE USED FOR PERMANENT ATTACHMENT OF THE COMPONENT HAS ACHIEVED A MINIMUM DESIGN STRENGTH OF 4000 PSI.

- F. GENERAL PROCEDURES FOR INSTALLATION OF PRECAST AND PRECAST / PRESTRESSED BOX BEAM ELEMENTS:

1. BOXES SHALL NOT BE PLACED ON SUBSTRUCTURE COMPONENTS UNTIL THE SUBSTRUCTURE COMPONENTS AND/OR PILE POCKET CONCRETE HAVE ACHIEVED DESIGN STRENGTH AND SUFFICIENT BRACING HAS BEEN PROVIDED AT THE SUBSTRUCTURE COMPONENTS TO FACILITATE THE CONTRACTOR'S INTENDED BOX BEAM PLACEMENT PROCEDURES. SUBSTRUCTURE STABILITY DURING CONSTRUCTION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND REQUIRED BRACING SHALL BE DESIGNED BY THE CONTRACTOR.
2. SURVEY THE TOP ELEVATION OF THE PRECAST SUBSTRUCTURES. ESTABLISH WORKING POINTS, WORKING LINES, AND BENCHMARK ELEVATIONS PRIOR TO PLACEMENT OF BOX BEAM ELEMENTS.
3. CLEAN BEARING SURFACES BEFORE BOX BEAMS ARE ERECTED. ENSURE SUBSTRUCTURE BEARING AREA IS WITHIN ACCEPTABLE CONSTRUCTION TOLERANCES, ALLOWING FOR PROPER PERFORMANCE OF NEOPRENE BEARINGS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. LOCALIZED SMOOTHING OF BEARING SURFACES MAY BE PERFORMED BY GRINDING OR OTHER METHODS APPROVED BY THE ENGINEER.
4. LIFT AND ERECT BOX BEAMS USING LIFTING ATTACHMENT POINTS SHOWN ON THE PLANS.
5. SET BOX BEAMS IN THE DESIGNATED BEARING LOCATIONS FOLLOWING MATCH-MARKS. DO NOT ALLOW BOX BEAMS TO BEAR AT ANY LOCATION ON THE SUBSTRUCTURE NOT DESIGNATED AS A DESIGN BEARING LOCATION. SURVEY THE TOP ELEVATIONS OF THE BOX BEAMS. CHECK FOR PROPER ALIGNMENT AND GRADE WITHIN SPECIFIED TOLERANCES. APPROVED NEOPRENE SHIM PADS SHALL BE USED BETWEEN THE BEARING AND THE SUBSTRUCTURE TO COMPENSATE FOR MINOR DIFFERENCES IN ELEVATIONS. NO MORE THAN TWO SHIM PADS SHALL BE ALLOWED AT ANY ONE BEARING LOCATION, UNLESS OTHERWISE APPROVED BY THE ENGINEER.
6. TEMPORARILY SUPPORT, ANCHOR, AND BRACE ALL ERECTED BOX BEAMS AS NECESSARY FOR STABILITY AND TO RESIST GRAVITY LOADS, WIND LOADS OR OTHER LOADS UNTIL THEY ARE PERMANENTLY SECURED BY THE CAST-IN-PLACE UHPC JOINTS.

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		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
<b>GENERAL NOTES (SHEET 2 OF 3)</b>		<b>B24-03-16</b>	

**PRECAST CONCRETE ELEMENT NOTES (CONT):**

- F. GENERAL PROCEDURES FOR INSTALLATION OF PRECAST AND PRECAST / PRESTRESSED BOX BEAM ELEMENTS (CONT):
- 7. ALL CLOSURE POUR SURFACES SHALL BE WETTED TO SATURATED SURFACE DRY (SSD) CONDITION PRIOR TO CASTING THE UHPC JOINT. JOINT SURFACE PREPARATION SHALL BE IN ACCORDANCE WITH THE DESIGN PLANS.
- 8. DO NOT APPLY SUPERIMPOSED DEAD LOADS OR CONSTRUCTION LIVE LOADS TO, OR PERFORM GRINDING OPERATIONS ON THE ASSEMBLED SUPERSTRUCTURE UNTIL THE COMPRESSIVE STRENGTH TEST RESULTS FOR THE LONGITUDINAL UHPC CLOSURE POURS HAVE REACHED A MINIMUM COMPRESSIVE STRENGTH OF AT LEAST 10,000 PSI, OR AS OTHERWISE RECOMMENDED BY THE UHPC MANUFACTURER, WHICHEVER IS GREATER.
- 9. AFTER REMOVAL OF LIFTING LOOPS, CONCRETE SHALL BE PATCHED AS REQUIRED BY THE ENGINEER.

**METHOD OF MEASUREMENT:**

- A. BRIDGE ABUTMENT FOOTINGS:  
THE QUANTITY BY COUNT OF PRECAST CONCRETE BRIDGE ABUTMENT FOOTINGS WILL BE THE PLAN QUANTITY.
- B. BRIDGE ABUTMENT BACKWALL:  
THE QUANTITY BY COUNT OF PRECAST CONCRETE BRIDGE ABUTMENT BACKWALLS WILL BE THE PLAN QUANTITY.
- C. PRECAST BOX BEAMS:  
THE QUANTITY BY COUNT OF PRECAST CONCRETE BOX BEAMS WILL BE THE PLAN QUANTITY.
- D. PRECAST/PRESTRESSED BOX BEAMS:  
THE QUANTITY BY COUNT OF PRECAST/PRESTRESSED CONCRETE BOX BEAMS WILL BE THE PLAN QUANTITY.

**BASIS OF PAYMENT:**

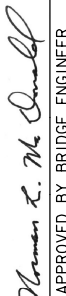

- A. BRIDGE ABUTMENT FOOTINGS:  
PAYMENT WILL BE FULL COMPENSATION FOR THE MANUFACTURING, FURNISHING AND PLACEMENT OF EACH BRIDGE ABUTMENT FOOTING, INCLUDING STRUCTURAL CONCRETE, SELF-CONSOLIDATING (HIGH EARLY STRENGTH) CONCRETE, DRILLING FOR AND PLACING SMOOTH DOWELS, GROUT, NON-COATED REINFORCING STEEL, EPOXY COATED REINFORCING STEEL, EPOXY COATED MECHANICAL SPLICE ASSEMBLIES, GALVANIZED CORRUGATED METAL PIPE, LIFTING DEVICES, \*POROUS BACKFILL, \*FLOODABLE BACKFILL (INCLUDES WATER FOR FLOODING), \*GRANULAR BACKFILL, \*GEOTEXTILE FABRIC FOR ABUTMENT BACKFILL, AND \*SUBDRAINS.  
  
\*FOR ABUTMENTS USING SHEETPILE WINGS AND PRECAST ABUTMENT UNITS, THESE ITEMS ARE EXCLUDED OR INCLUDED IN A BID ITEM FOR GRANULAR BACKFILL. SEE NOTES ON SHEET B24-69-16.
- B. BRIDGE ABUTMENT BACKWALLS:  
PAYMENT WILL BE FULL COMPENSATION FOR THE MANUFACTURING, FURNISHING AND PLACEMENT OF EACH PRECAST CONCRETE BRIDGE ABUTMENT BACKWALL, INCLUDING STRUCTURAL CONCRETE, EPOXY COATED REINFORCING STEEL, CORRUGATED TUBES AND GROUT.
- C. PRECAST BOX BEAMS:  
PAYMENT WILL BE FULL COMPENSATION FOR THE MANUFACTURING, FURNISHING AND PLACEMENT OF EACH PRECAST CONCRETE BOX BEAM, NEOPRENE BEARING PADS, NEOPRENE SHIM PADS, EXPANSION JOINT MATERIAL, POLYSTYRENE PLUG FOR ANCHOR DOWELS, FOAM BACKER RODS, REINFORCING STEEL, EPOXY COATED REINFORCING STEEL, PRESTRESSING STEEL, EPOXY COATED MECHANICAL SPLICE ASSEMBLIES AND STRUCTURAL CONCRETE.
- D. PRECAST/PRESTRESSED BOX BEAMS:  
PAYMENT WILL BE FULL COMPENSATION FOR THE MANUFACTURING, FURNISHING AND PLACEMENT OF EACH PRECAST/PRESTRESSED CONCRETE BOX BEAM, NEOPRENE BEARING PADS, NEOPRENE SHIM PADS, EXPANSION JOINT MATERIAL, POLYSTYRENE PLUG FOR ANCHOR DOWELS, FOAM BACKER RODS, REINFORCING STEEL, EPOXY COATED REINFORCING STEEL, PRESTRESSING STEEL, EPOXY COATED MECHANICAL SPLICE ASSEMBLIES AND STRUCTURAL CONCRETE.

**ALTERNATE SITE CASTING NOTES:**

- THE CONTRACTOR MAY ELECT TO FABRICATE NON-PRESTRESSED PRECAST CONCRETE COMPONENTS AT AN ALTERNATE SITE DETERMINED BY THE CONTRACTOR, IN LIEU OF FABRICATING THESE COMPONENTS AT A PREQUALIFIED FABRICATION PLANT. ALTERNATE SITE CASTING SHALL COMPLY WITH THE FOLLOWING:
- A. ALTERNATE SITE CASTING:  
CONCRETE FOR ALTERNATE SITE CASTING SHALL BE PROVIDED BY AN OFF-SITE READY MIX PRODUCER. SECTION 2403 AND APPLICABLE SECTIONS OF ARTICLE 2407.03.D (CURING) OF THE STANDARD SPECIFICATIONS SHALL APPLY TO THE PRODUCTION, FABRICATION AND CONSTRUCTION OF PRECAST CONCRETE ELEMENTS. ARTICLE 2403.02.D.2 SHALL NOT APPLY.
    - 1. READY MIX CONCRETE SHALL BE SUPPLIED BY AN APPROVED READY MIX CONCRETE PLANT.
    - 2. CASTING BEDS SHALL BE RIGIDLY CONSTRUCTED AND SUPPORTED SO THAT UNDER THE WEIGHT (MASS) OF CONCRETE AND FORMS, THERE WILL BE NO VERTICAL DEFORMATION OF THE BED.
    - 3. THE PRODUCER OF THE PRECAST ELEMENTS SHALL PROVIDE TECHNICAL PERSONNEL, EXPERIENCED AND SKILLED IN THE APPLICATION OF PRECAST SYSTEMS, SUPPLEMENTED WITH A SUFFICIENT STAFF OF SKILLED LABOR TO CONSTRUCT FORMS, PLACE AND TIE REINFORCING STEEL AND PLACE, CONSOLIDATE AND FINISH WET CONCRETE. THE PRODUCER SHALL UTILIZE A TECHNICIAN WITH A VALID IOWA DOT LEVEL I PCC CERTIFICATION OR AN ACI LEVEL I CERTIFICATION WHEN CASTING OPERATIONS REQUIRE PHYSICAL TESTING SUCH AS AIR ENTRAINMENT, SLUMP TESTING, ETC.
    - 4. A MINIMUM OF 30 DAYS PRIOR TO BEGINNING PRECAST CONCRETE OPERATIONS, THE PRODUCER SHALL SUBMIT A PLAN TO THE ENGINEER INDICATING THE QUALITY CONTROL INSPECTION PROCEDURES TO BE USED IN THE MANUFACTURE OF THE PRECAST PRODUCTS, INCLUDING:
      - a. REINFORCING STEEL FABRICATION AND PLACEMENT
      - b. CONCRETE MIX DESIGN AND PROPORTIONING
      - c. CONCRETE PLACEMENT AND CONSOLIDATION
      - d. CONCRETE CURING
      - e. FREQUENCY AND PROCEDURES FOR PHYSICAL TESTING OF CONCRETE, INCLUDING AIR ENTRAINMENT TESTING, SLUMP TESTING, AND CONCRETE CYLINDER PRODUCTION / TESTING.
    - 5. APPLY ARTICLES 2407.03, D, 1; 2407.03, D, 2; 2407.03, D, 3, a-d; 2407.03, D, 3, f; AND 2407.03, D, 4 TO THE CURING OF PRECAST CONCRETE WHEN USING ACCELERATED HEAT CURING.
    - 6. FINISH ALL SURFACES WHICH WILL BE EXPOSED IN THE FINISHED STRUCTURE AS PROVIDED IN ARTICLE 2403.03, P, 2, b, AND AS NOTED IN THESE PLANS, AND ENSURE THEY ARE FREE OF HONEYCOMB OR SURFACE DEFECTS. SUBMIT STRUCTURAL REPAIR PROCEDURES TO THE ENGINEER FOR APPROVAL.

**PILE TOLERANCE NOTE:**

THE CONTRACTOR SHALL NOTE THAT TIGHTER PILE LOCATION TOLERANCE SHALL BE REQUIRED FOR USE WITH THE PRECAST ABUTMENT FOOTING OPTION. THE CMP PILE POCKET SIZE NOTED IN THE PLANS IS BASED ON MAXIMUM PILE DEVIATION OF 2" FROM PLAN VALUE, MEASURED AT THE LOCATION OF THE PILE POCKET. USE OF A PILE DRIVING TEMPLATE IS STRONGLY ENCOURAGED. THE CONTRACTOR SHALL BE PERMITTED TO MAKE MINOR ADJUSTMENTS TO POSITION THE TOP OF PILE BY JACKING OR OTHER APPROVED MEANS, TO FACILITATE PROPER FITUP OF THE PRECAST FOOTING. ADJUSTMENT METHODS THAT DAMAGE OR PERMANENTLY DEFORM THE PILE SHALL NOT BE PERMITTED.

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		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
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		<b>GENERAL NOTES (SHEET 3 OF 3)</b>
		<b>B24-04-16</b>

# EXAMPLES OF BRIDGE ELEVATION CALCULATIONS:

THE DESIGNER SHALL SHOW ON THE PLANS THE THREE ELEVATIONS REQUIRED FOR EACH ABUTMENT. FOR 0° SKEWED BRIDGES, THE DESIGNER SHALL ALSO SHOW ON THE PLANS THE REQUIRED TOP OF WING ELEVATIONS AS SHOWN IN THE PLANS AT EACH CORNER OF THE BRIDGE.

THE BOXED DETAILS IN THE FOLLOWING EXAMPLES SHOW HOW THE ABUTMENT ELEVATIONS SHOULD BE INDICATED ON THE PLANS.

### EXAMPLE NO. 1

BRIDGE LOCATED ON A CONSTANT GRADE. FOR THIS EXAMPLE, THE GRADE IS -3.00% WITH THE P.I. STATION OF 199+00.00 AND A P.I. ELEVATION OF 600.00. THE BRIDGE LENGTH IS 70'-0" CL TO CL OF ABUTMENT BEARINGS WITH 30° RIGHT HAND AHEAD SKEW.

#### STATIONS

CL BRIDGE STATION	=	200+35.00
CL ABUT. NO. 1 BRG.	=	200+00.00
CL ABUT. NO. 2 BRG.	=	200+70.00

#### ELEVATIONS ALONG PROFILE GRADE

CL ABUT. NO. 1 BRG.	=	600.00 + (20000.00 - 19900.00)(-0.0300)	=	597.00
CL ABUT. NO. 2 BRG.	=	600.00 + (20070.00 - 19900.00)(-0.0300)	=	594.90

#### SKEW ANGLE CORRECTION

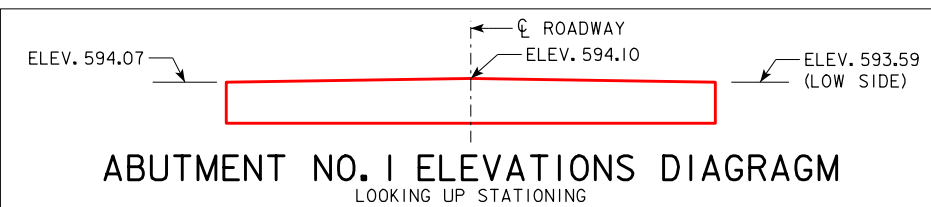
$$\begin{aligned} &(\text{OFFSET TO END OF ABUT.}) (\text{TAN SKEW ANGLE}) (\text{GRADE}) \\ &= (13.67') (\text{TAN } 30^\circ) (0.0300) \\ &= 0.24' \end{aligned}$$

#### ABUTMENT CROWN CORRECTION

$$\begin{aligned} &(\text{OFFSET TO END OF ABUT.}) (-0.02) \\ &= (13.67') (-0.02) \\ &= -0.27' \end{aligned}$$

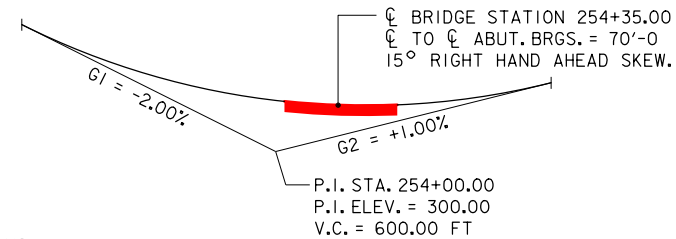
#### ABUTMENT NO. 1

LOCATION	LEFT END	CL ROADWAY	RIGHT END
PGL ELEVATION	597.00	597.00	597.00
SKEW ANGLE CORR.	+ 0.24	0.00	- 0.24
"X" (2'-10 3/4) ▲	- 2.90	- 2.90	- 2.90
ABUT. CROWN CORR.	- 0.27	0.00	- 0.27
TOP OF ABUT. ELEV.	594.07	594.10	593.59



### EXAMPLE NO. 2

BRIDGE LOCATED ON A PARABOLIC VERTICAL CURVE. FOR THIS EXAMPLE, THE VERTICAL CURVE IS AS SHOWN BELOW.



#### STATIONS

CL BRIDGE STATION	=	254+35.00
CL ABUT. NO. 1 BRG.	=	254+00.00
CL ABUT. NO. 2 BRG.	=	254+70.00

#### ELEVATIONS ALONG PROFILE GRADE

CL ABUT. NO. 1 BRG.	=	302.25
CL ABUT. NO. 2 BRG.	=	302.02

#### BRIDGE GRADE

$$\text{GRADE} = \frac{(302.02 - 302.25)(100)}{70.00} = -0.329\%$$

(ESTABLISH GRADE ALONG CL ROADWAY AND USE THIS GRADE FOR BRIDGE GEOMETRICS SINCE THE BOX BEAMS NEED TO BE ORIENTED IN THE SAME PLANE ON EACH SIDE OF CL ROADWAY).

#### SKEW ANGLE CORRECTION

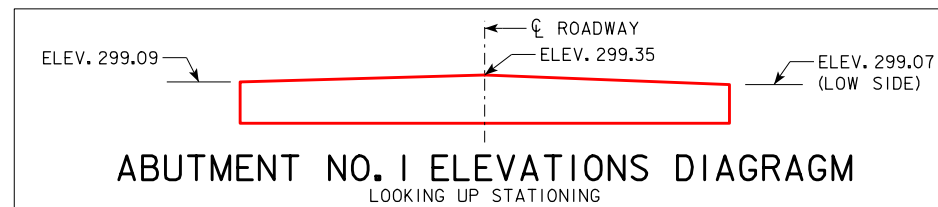
$$\begin{aligned} &(\text{OFFSET TO END OF ABUT.}) (\text{TAN SKEW ANGLE}) (\text{GRADE}) \\ &= (13.67') (\text{TAN } 15^\circ) (0.00329) \\ &= 0.01' \end{aligned}$$

#### ABUTMENT CROWN CORRECTION

$$\begin{aligned} &(\text{OFFSET TO END OF ABUT.}) (-0.02) \\ &= (13.67') (-0.02) \\ &= -0.27' \end{aligned}$$

#### ABUTMENT NO. 1

LOCATION	LEFT END	CL ROADWAY	RIGHT END
PGL ELEVATION	302.25	302.25	302.25
SKEW ANGLE CORR.	+ 0.01	0.00	- 0.01
"X" (2'-10 3/4) ▲	- 2.90	- 2.90	- 2.90
ABUT. CROWN CORR.	- 0.27	0.00	- 0.27
TOP OF ABUT. ELEV.	299.09	299.35	299.07



▲ BEAM DEPTH PLUS BEARING HEIGHT. SEE ABUTMENT DETAILS SHEETS FOR "X" DIMENSIONS.

## NOTES TO DESIGNER:

THE BRIDGE DESIGNER SHALL OBTAIN SOIL BORINGS AT EACH ABUTMENT TO EVALUATE WHETHER THE REQUIRED STEEL SHEET PILING EMBEDMENT CAN BE OBTAINED, AND TO ASSESS THE CONSTRUCTION CONSIDERATIONS FOR THE PROJECT.

ADDITIONALLY, THE DESIGNER SHALL VERIFY THE SOIL PROPERTIES OBTAINED FROM THE SOIL BORINGS FOR THE ACTUAL BRIDGE SITE WILL NOT AFFECT THE EMBEDMENT LENGTHS REQUIRED FOR THE STEEL SHEET PILING.

THE FOLLOWING SOIL CONDITIONS WERE ASSUMED IN THE DESIGN OF THE STEEL SHEET PILING:

#### BACKFILL MATERIAL

- SHALL CONSIST OF WELL DRAINED GRANULAR MATERIAL WITH LESS THAN 8% FINES.
- MATERIAL SHALL CONSIST OF GRADATION AS NOTED ON BACKFILL DETAILS SHEET.
- BACKFILL SHALL BE PLACED AS NOTED ON ABUTMENT BACKFILL DETAILS SHEET, 0° SKEW.
- UNIT WEIGHT OF GRANULAR BACKFILL ASSUMED TO BE 120 PCF.
- Φ, INTERNAL FRICTION ANGLE = 34 DEGREES.
- SUBDRAIN TO BE OF TYPE SPECIFIED ON BACKFILL DETAILS SHEET.

#### FOUNDATION SOILS

- CONSISTS OF EITHER ALLUVIUM, LOESS OR GLACIAL TILL, ALL OF WHICH WILL BE COMPRISED OF CLAY SOILS.
- UNIT WEIGHT OF 120 PCF.
- STRENGTH WAS CONSERVATIVELY MODELED ASSUMING A LONG TERM EFFECTIVE STRENGTH Φ', EQUAL TO 28 DEGREES.
- THE STRENGTH AND UNIT WEIGHT ARE CONSIDERED CONSERVATIVE AND APPLICABLE IF LOOSE ALLUVIAL SAND COMPRISES THE SOILS.
- BERM SLOPE SHALL NOT BE STEEPER THAN 2:1.

LATEST REVISION DATE

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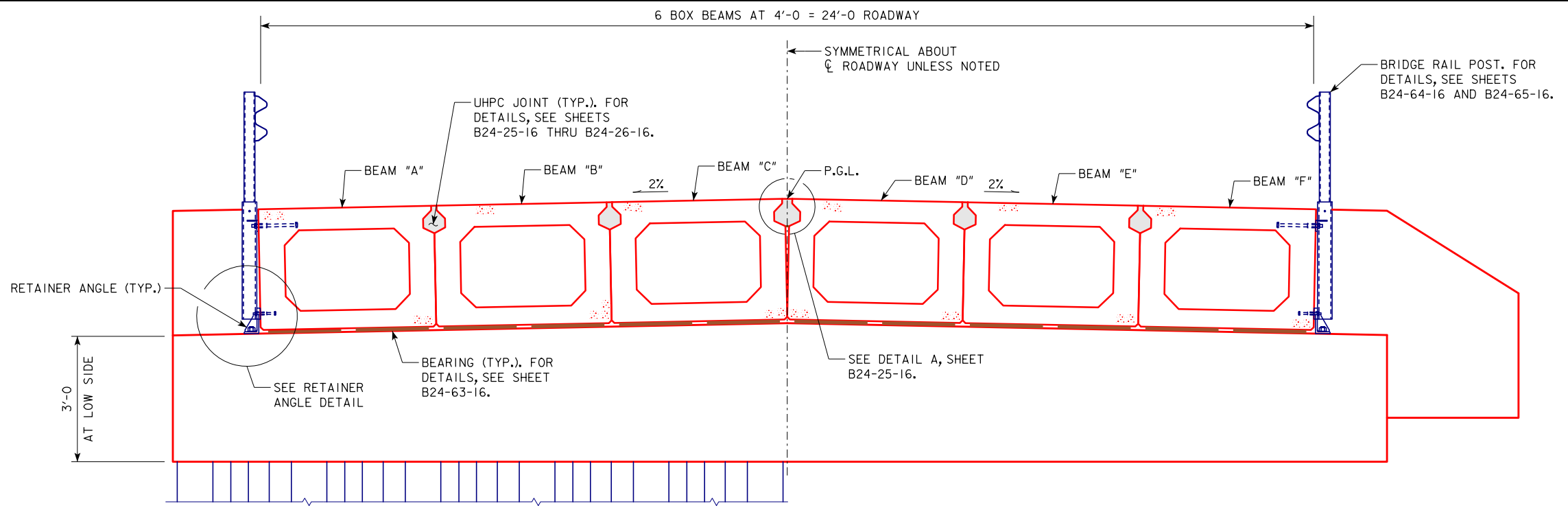
Highway Division

STANDARD DESIGN - 24'-0" ROADWAY, SINGLE SPAN  
**CONCRETE BOX BEAM BRIDGES**

DECEMBER, 2016

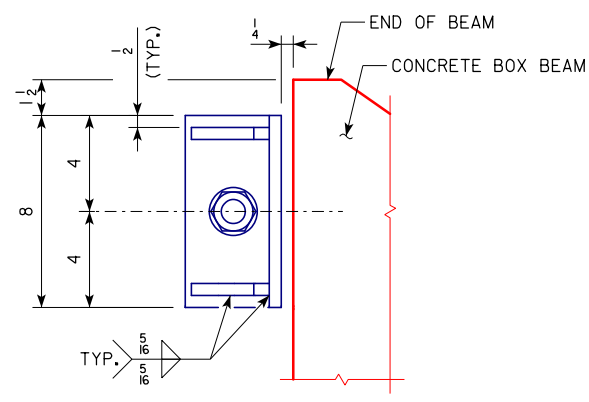
GENERAL INFORMATION

B24-05-16

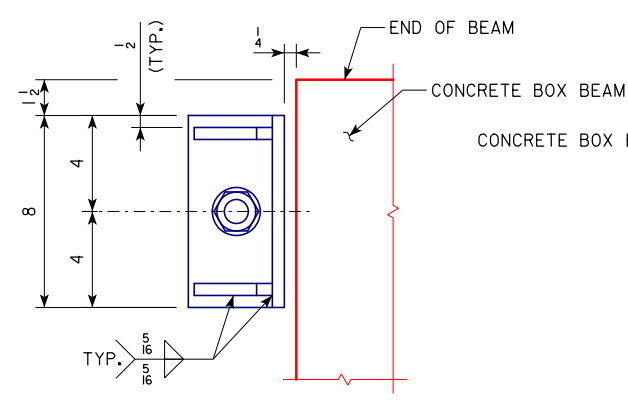


SECTION NEAR ABUTMENT WITH SHEET PILE WINGS

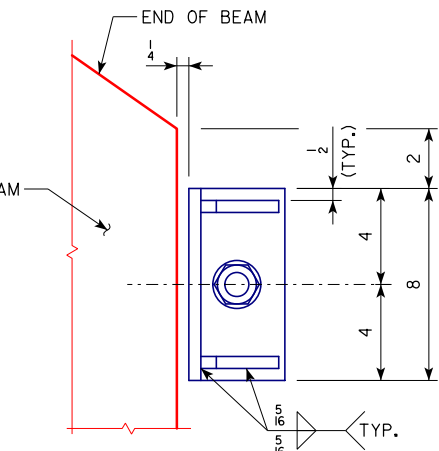
SECTION NEAR ABUTMENT WITH CONCRETE WINGS



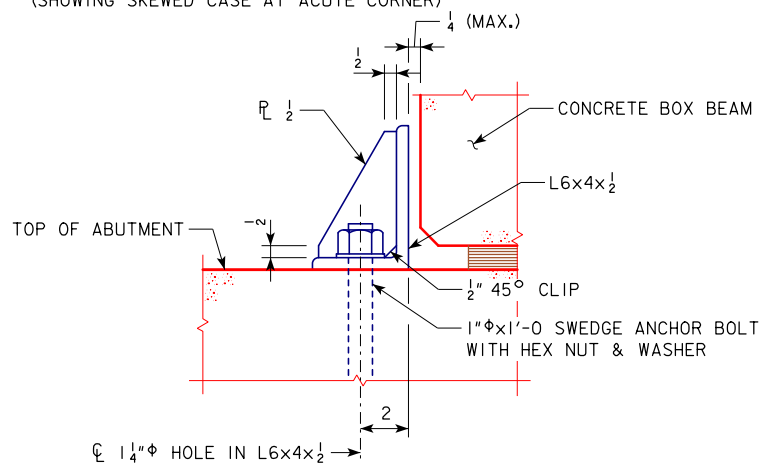
PLAN (SHOWING SKEWED CASE AT ACUTE CORNER)



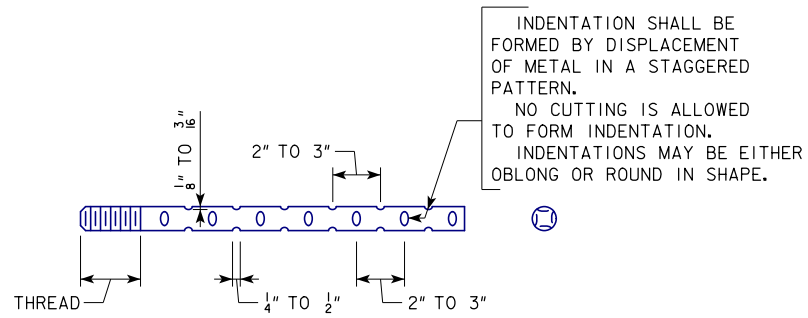
PLAN (SHOWING 0° SKEW CASE)



PLAN (SHOWING SKEWED CASE AT OBTUSE CORNER)



RETAINER ANGLE DETAIL



ANCHOR BOLT SWEDGE DETAIL

RETAINER ANGLE NOTES:

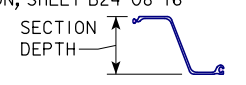
ANCHOR BOLTS, NUTS AND WASHERS SHALL MEET THE REQUIREMENTS OF IM 453.08 AND SHALL BE GRADE 36 AND GALVANIZED.  
 ANGLES AND PLATES SHALL COMPLY WITH ASTM A709, GRADE 36.  
 ANCHOR BOLTS SHALL BE SET IN ACCORDANCE WITH ARTICLE 2405.03, H, 2 OF THE STANDARD SPECIFICATIONS.  
 RETAINER ANGLE ASSEMBLIES SHALL BE GALVANIZED. ALL WELDING SHALL BE COMPLETED PRIOR TO GALVANIZING. GALVANIZING SHALL BE IN ACCORDANCE WITH ASTM A123 AND ARTICLE 4100.07, E OF THE STANDARD SPECIFICATIONS.  
 ALL COSTS FOR FURNISHING AND INSTALLING THE RETAINER ANGLES AND ANCHOR BOLTS SHALL BE INCLUDED IN THE PRICE BID FOR "STRUCTURAL STEEL".  
 WEIGHT FOR FOUR RETAINER ANGLE ASSEMBLIES = 72 LBS.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		TYPICAL SECTION	B24-06-16

### STEEL SHEET PILING NOTES:

AS A MINIMUM, ALL STEEL SHEET PILING SHALL BE PZ27 AND SHALL CONFORM TO ASTM A328 STEEL AND SHALL MEET THE FOLLOWING REQUIREMENTS:

SECTION LENGTH	SEE TYPICAL SECTION, SHEET B24-08-16
MAXIMUM SECTION DEPTH	12 IN
MINIMUM SECTION THICKNESS	0.375 IN
ELASTIC SECTION MODULUS	30.2 IN <sup>3</sup> /FT



THE CONTRACTOR SHALL SUBMIT FOR REVIEW A SHOP PLAN OF THE SHEET PILE LAYOUT, INCLUDING THE TIES AND WALERS, SHOWING ALL PERTINENT DIMENSIONS, DETAILS, AND SECTION PROPERTIES. THE CONTRACTOR SHALL NOT PROCEED WITH INSTALLATION OF STEEL SHEET PILING AND STEEL BEARING PILING PRIOR TO APPROVAL OF THE SUBMITTAL BY THE ENGINEER.

THE PAY QUANTITY WILL BE BASED ON THE SHEET PILE WALL DIMENSIONS SHOWN.

TIE RODS SHALL BE POSITIONED AND DETAILED TO AVOID CONFLICTS WITH THE GUARDRAIL POSTS.

TIE RODS SHALL BE ASTM A615 GRADE 75 AND GALVANIZED IN ACCORDANCE WITH ASTM A123.

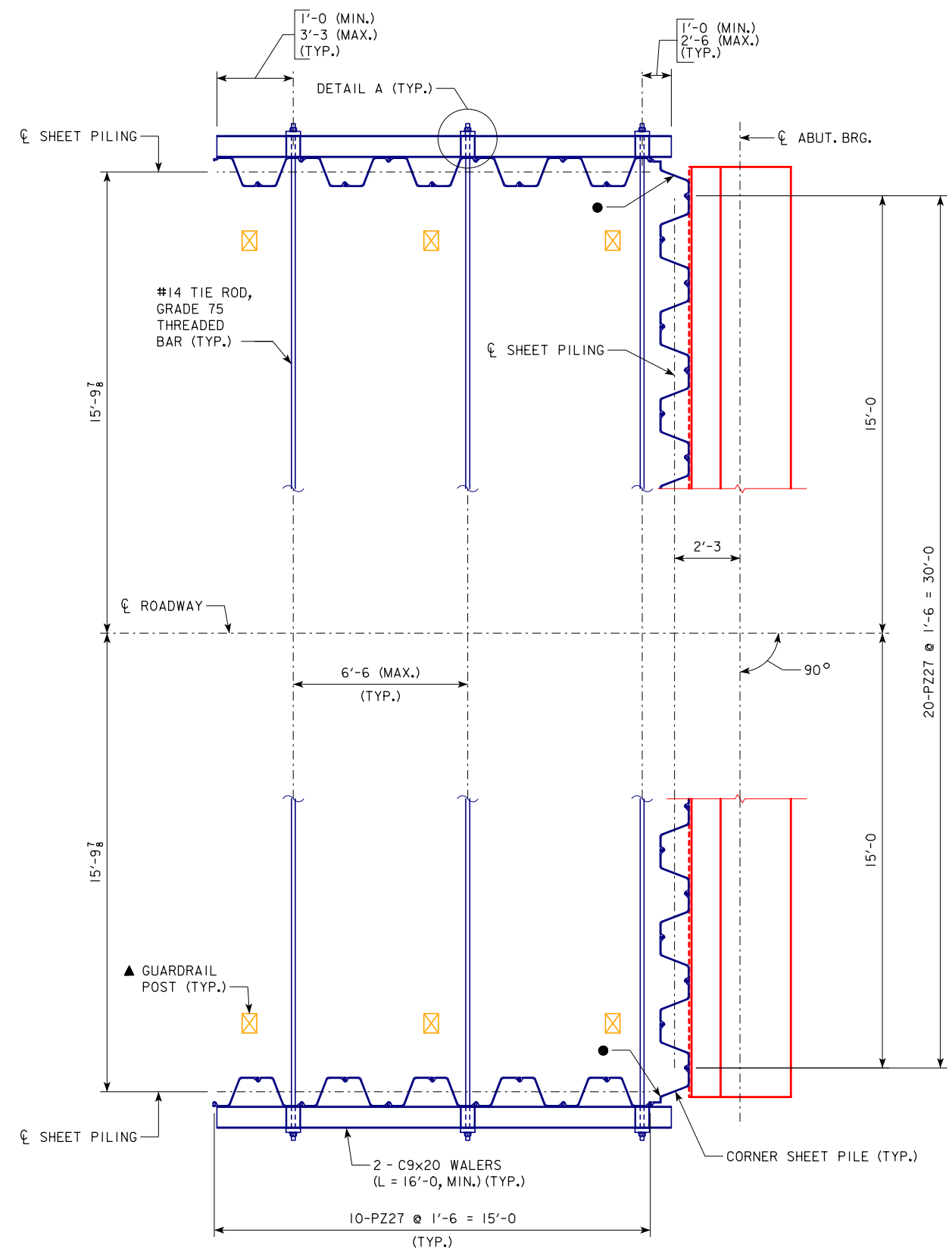
LOCK NUTS AND WASHERS SHALL BE GALVANIZED AND PROVIDED BY THE TIE ROD MANUFACTURER.

STEEL CHANNELS, BEARING PLATES AND OTHER MISCELLANEOUS PLATES SHALL CONFORM TO ASTM A709, GRADE 50.

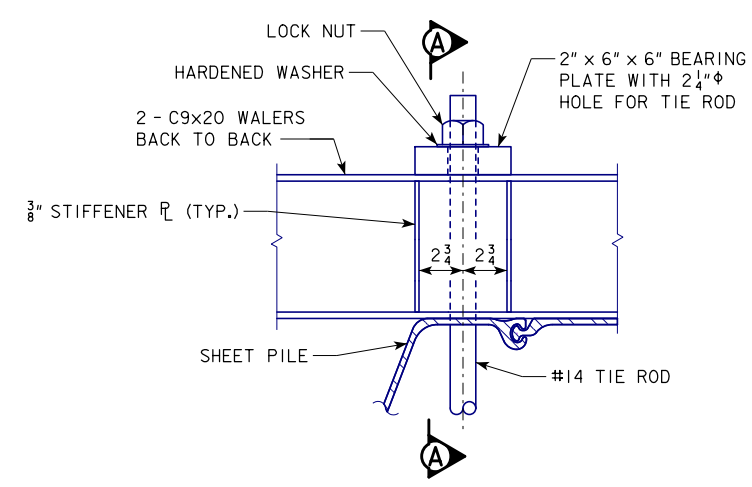
FIELD WELDING SHALL MEET THE REQUIREMENTS OF MATERIALS I.M. 558.

THE STEEL WALERS SHALL BEAR UNIFORMLY AGAINST THE SHEET PILES AT EACH CONTACT POINT AS SHOWN PRIOR TO TIGHTENING THE TIE ROD NUTS. 6" x 6" SHIM PLATES SHALL BE USED TO PROVIDE UNIFORM BEARING.

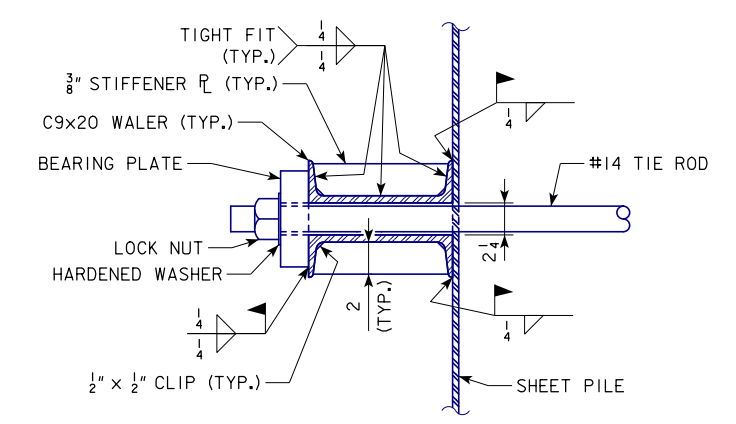
THE COST OF FURNISHING AND INSTALLING THE WALERS, TIE RODS, BEARING PLATES, LOCK NUTS, WASHERS, STIFFENER PLATES, COVER PLATES AND SHIM PLATES SHALL BE INCLUDED IN THE PRICE BID FOR "PILES, STEEL SHEET".



**STEEL SHEET PILING PLAN VIEW**  
(COVER PLATES NOT SHOWN FOR CLARITY.)



**DETAIL A**



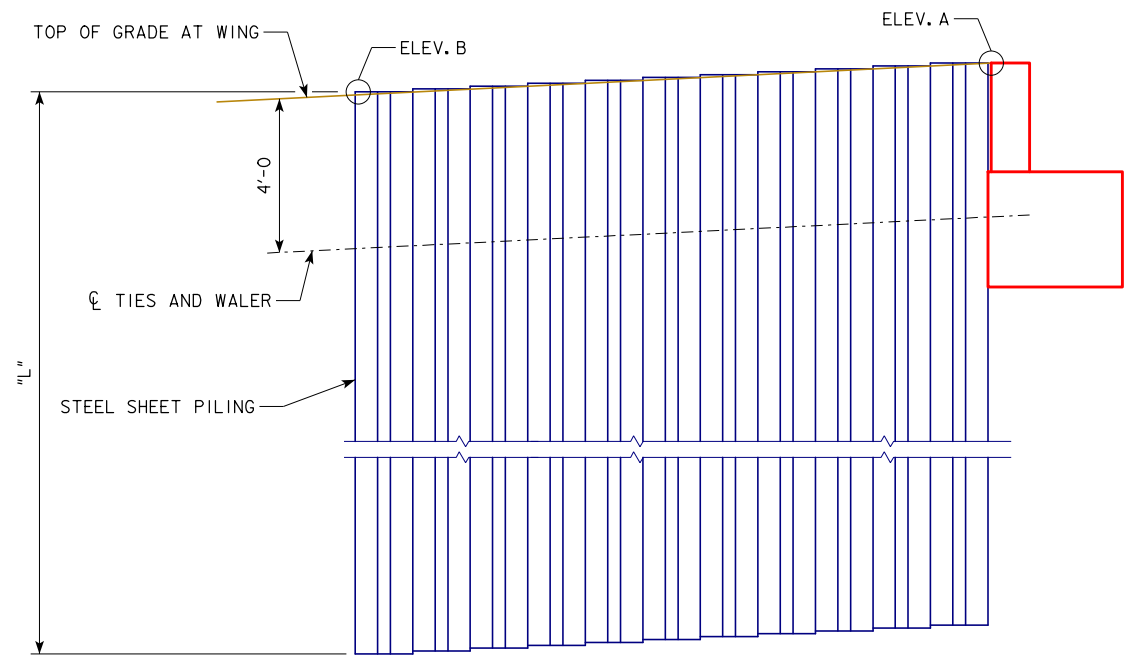
**SECTION A-A**

- NOTES:
- TOP OF SHEET PILING AT WINGS TO MATCH TOP OF BACKWALL ELEVATION.
  - FOR SHEET PILE COVER PLATE DETAILS, SEE SHEETS B24-08-16 AND B24-09-16.
  - ▲ REFER TO OTHER PLAN SHEETS FOR LOCATION.

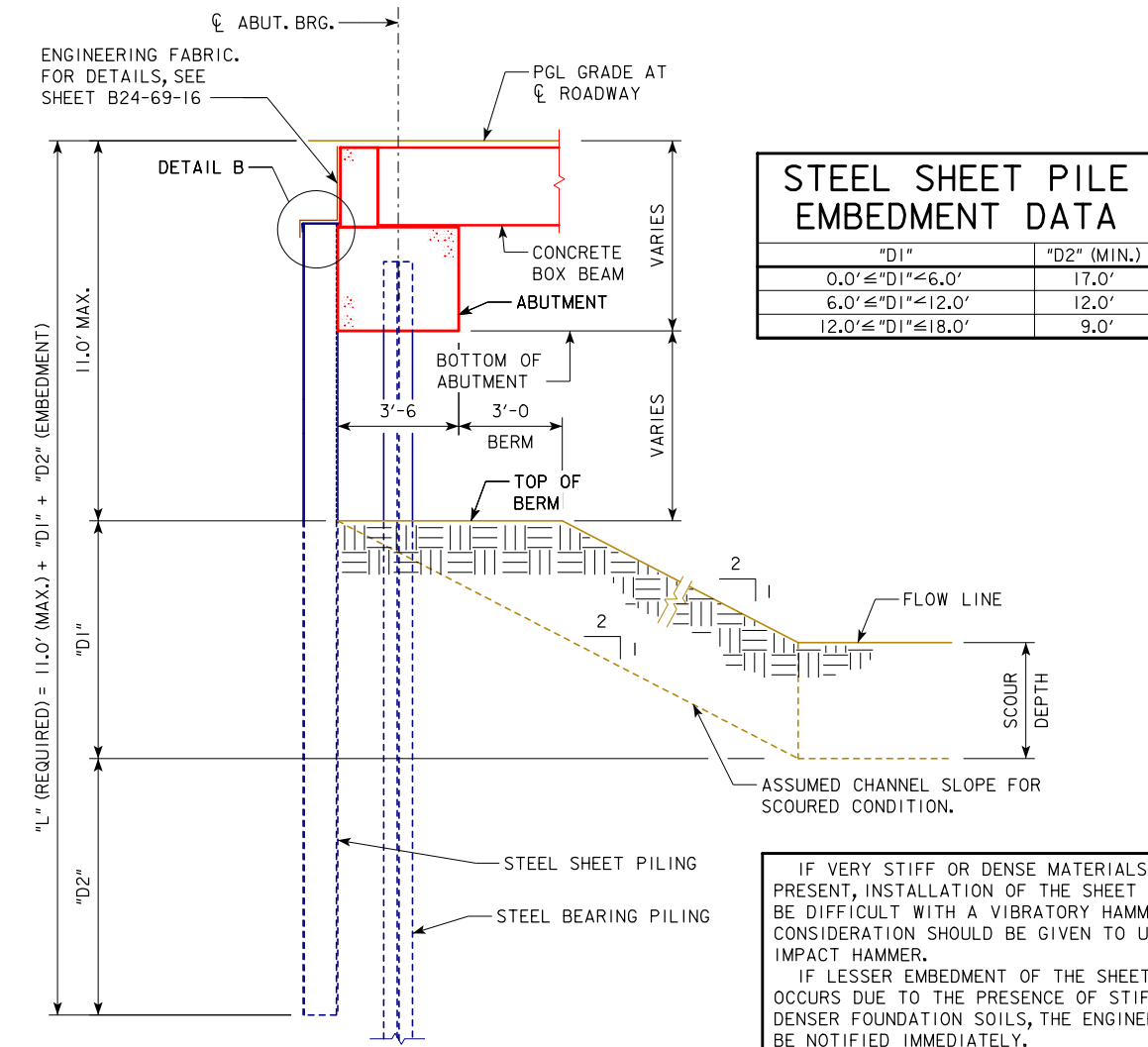
LATEST REVISION DATE  <i>Thomas L. Mc Donald</i> APPROVED BY BRIDGE ENGINEER	
	STANDARD DESIGN - 24'-0" ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
	DECEMBER, 2016
<b>STEEL SHEET PILING DETAILS</b> 0° SKEW (SHEET 1 OF 3)	<b>B24-07-16</b>

SHEET PILE DATA TABLE								
	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
SPAN	30'-0"	40'-0"	50'-0"	30'-0"	40'-0"	50'-0"	60'-0"	70'-0"
"V"	2'-3 <sup>3</sup> / <sub>4</sub> "	2'-3 <sup>3</sup> / <sub>4</sub> "	2'-9 <sup>3</sup> / <sub>4</sub> "	1'-9 <sup>3</sup> / <sub>4</sub> "	1'-9 <sup>3</sup> / <sub>4</sub> "	2'-3 <sup>3</sup> / <sub>4</sub> "	2'-3 <sup>3</sup> / <sub>4</sub> "	2'-9 <sup>3</sup> / <sub>4</sub> "

\* SHEET PILE AREA (S.F.) = ((15'+15'+2'+2') X (L)) + (30') X (L-V)  
 \* INCLUDES AREA OF CORNER SHEET PILES ASSUMING EXPOSED SURFACE AREA OF EACH CORNER PILE IS 2'-0". EQUATION IS FOR AREA OF SHEET PILING AT ONE ABUTMENT. AREA FOR SHEET PILING AT EACH ABUTMENT SHALL BE CALCULATED BECAUSE THEY MAY BE DIFFERENT FROM EACH OTHER DEPENDING ON GEOMETRICS.



**WING ELEVATION**  
(SLOPING GROUND LINE ALONG FRONT FACE OF WING NOT SHOWN.)

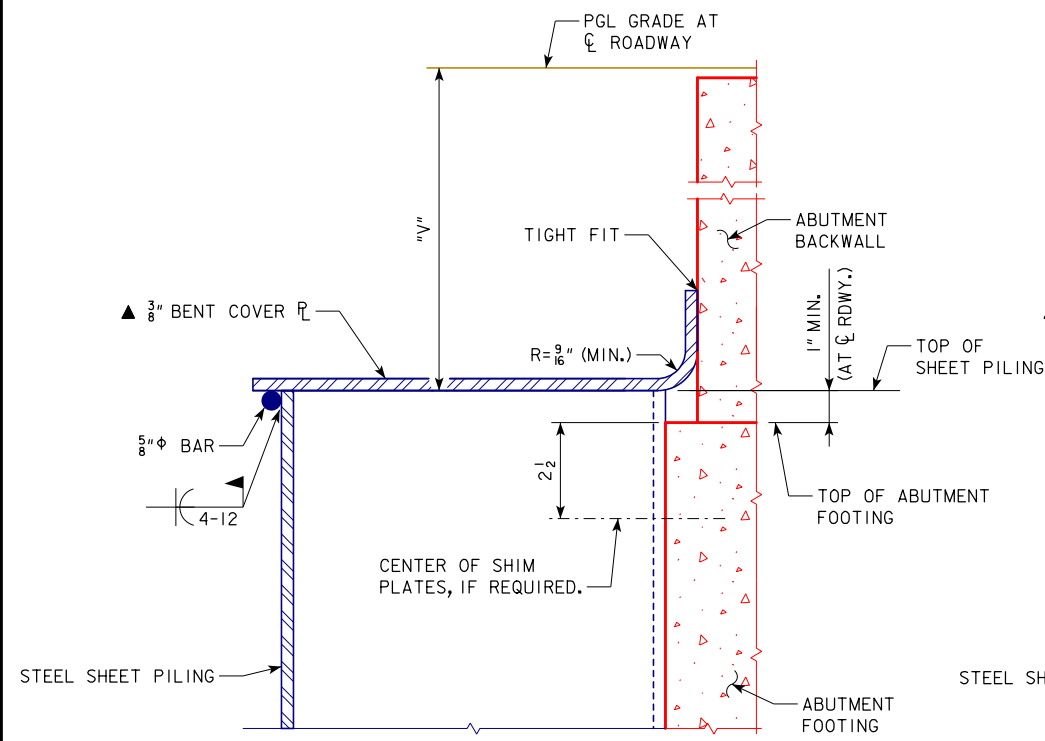


STEEL SHEET PILE EMBEDMENT DATA	
"D1"	"D2" (MIN.)
0.0' ≤ "D1" < 6.0'	17.0'
6.0' ≤ "D1" < 12.0'	12.0'
12.0' ≤ "D1" < 18.0'	9.0'

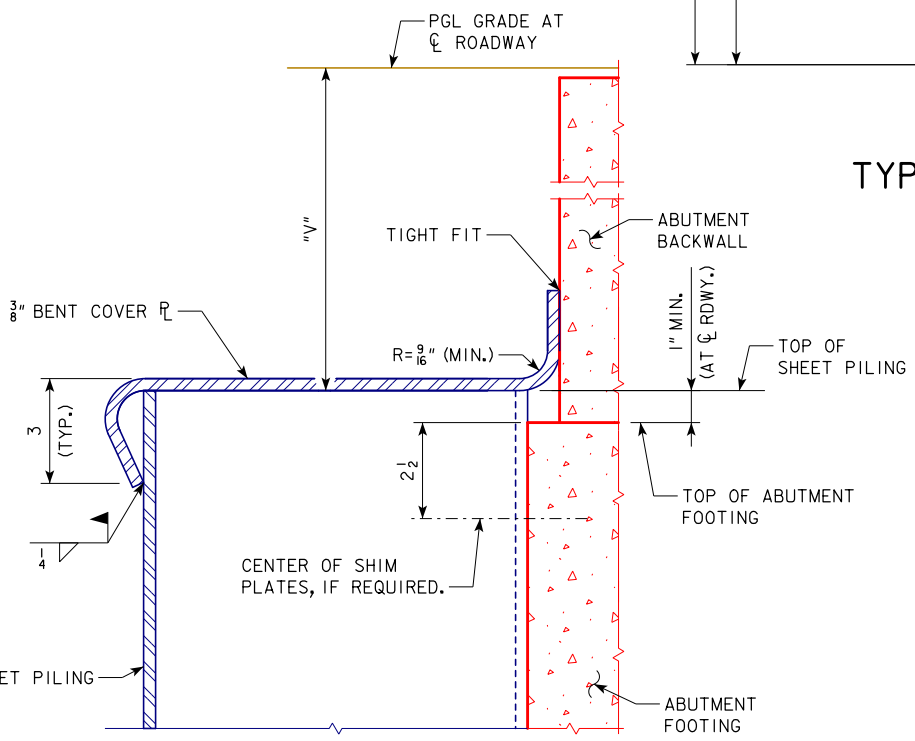
**TYPICAL SECTION THRU ABUTMENT**

IF VERY STIFF OR DENSE MATERIALS ARE PRESENT, INSTALLATION OF THE SHEET PILES MAY BE DIFFICULT WITH A VIBRATORY HAMMER AND CONSIDERATION SHOULD BE GIVEN TO USING AN IMPACT HAMMER.  
 IF LESSER EMBEDMENT OF THE SHEET PILE OCCURS DUE TO THE PRESENCE OF STIFFER OR DENSER FOUNDATION SOILS, THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY.

NOTES:  
 THE SHEET PILING SHALL BEAR UNIFORMLY AGAINST THE ABUTMENT PRIOR TO BACK FILLING. 6" x 6" SHIM PLATES SHALL BE USED TO PROVIDE UNIFORM BEARING.  
 THE INTENDED PURPOSE OF THE COVER PLATES IS TO PREVENT THE BACKFILL FROM SPILLING BETWEEN THE BURIED SHEET PILING AND THE ABUTMENT. THE COVER PLATE MAY BE MADE UP OF INDIVIDUAL PLATES OF 10'-0" MINIMUM LENGTH WITH 4" MINIMUM LAPS THAT ARE SEAL WELDED.  
 FOR ADDITIONAL COVER PLATE DETAILS, SEE SHEET B24-09-16.

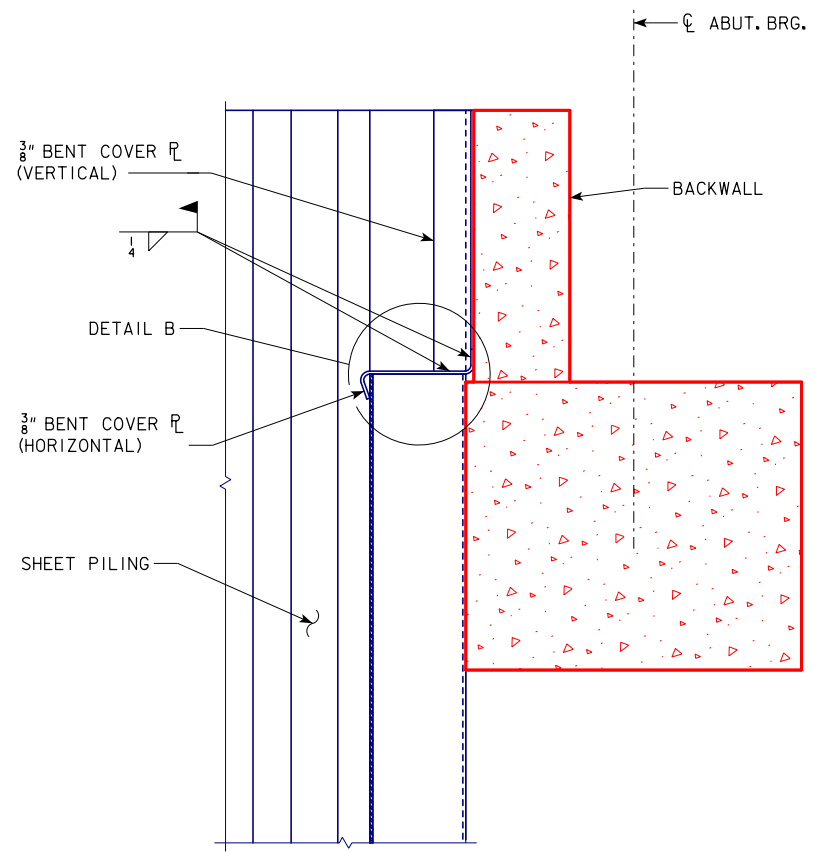


**DETAIL B (ALTERNATE)**  
(ENGINEERING FABRIC NOT SHOWN)

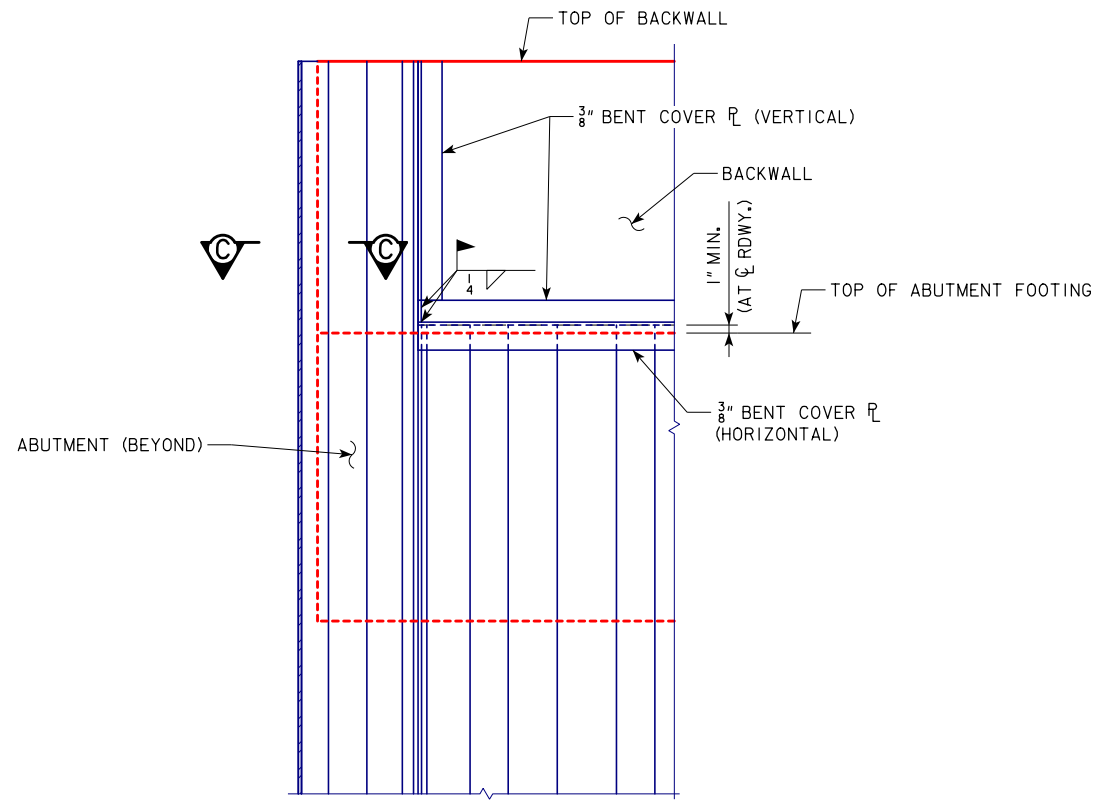


**DETAIL B**  
(ENGINEERING FABRIC NOT SHOWN)

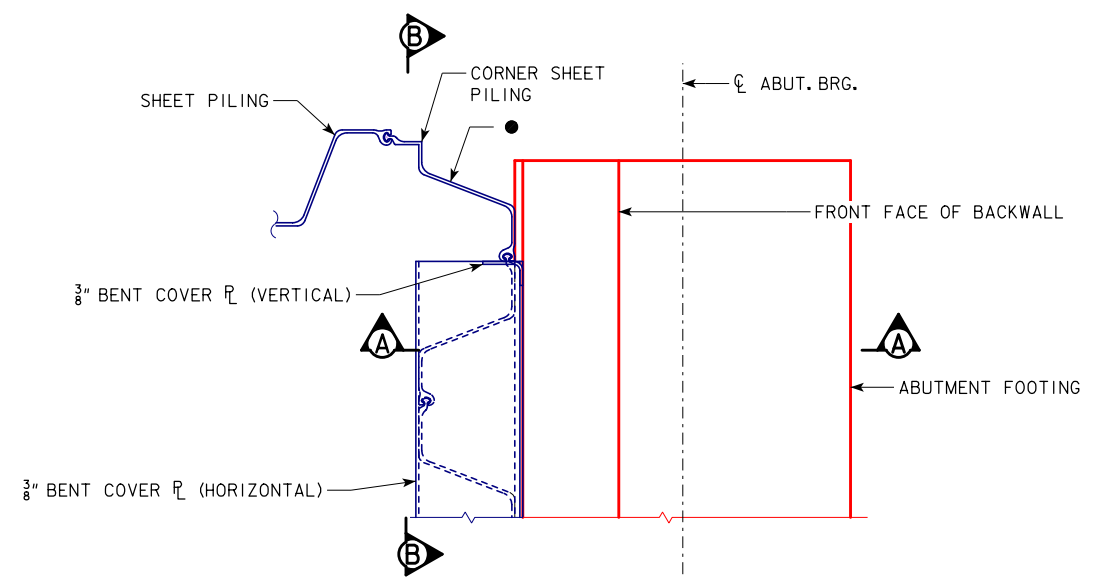
LATEST REVISION DATE	<i>Thomas L. Mc Donald</i> APPROVED BY BRIDGE ENGINEER		
		STANDARD DESIGN - 24'-0" ROADWAY, SINGLE SPAN	
		<b>CONCRETE BOX BEAM BRIDGES</b> DECEMBER, 2016	
<b>STEEL SHEET PILING DETAILS</b> 0° SKEW (SHEET 2 OF 3)		<b>B24-08-16</b>	



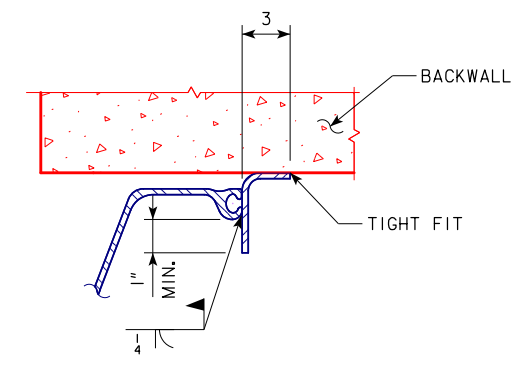
SECTION A-A



VIEW B-B



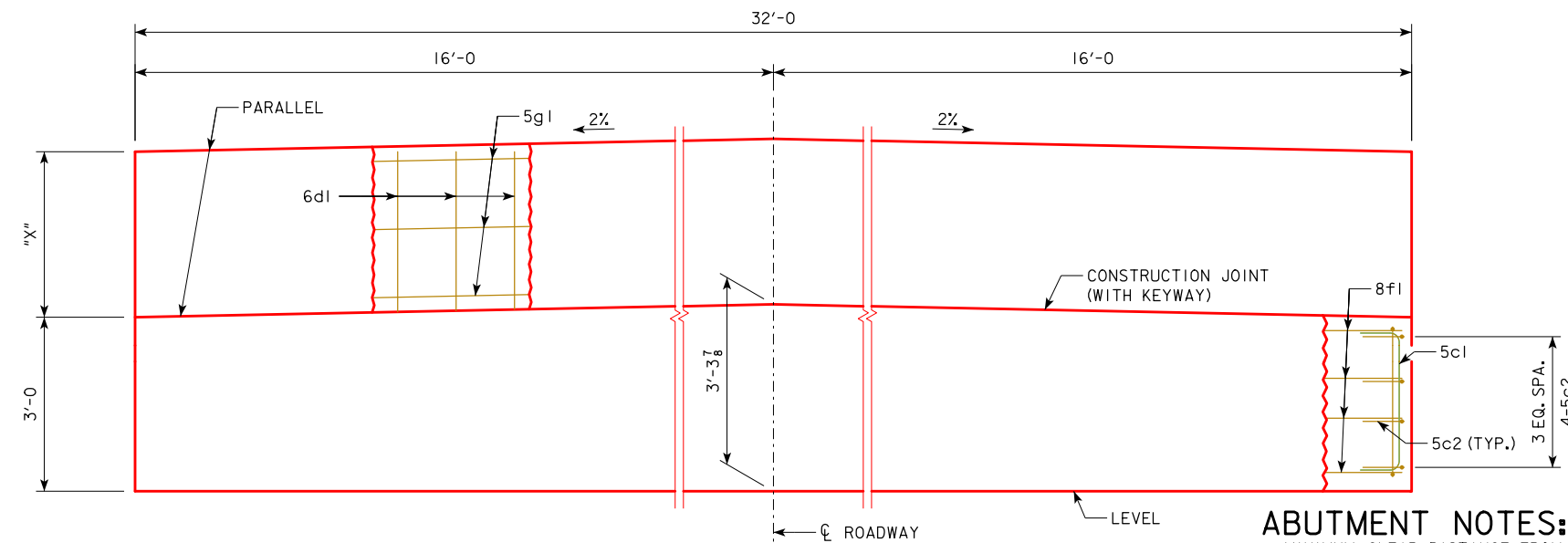
PARTIAL PLAN VIEW AT END OF ABUTMENT



SECTION C-C

NOTES:  
 FOR DETAIL B, SEE SHEET B24-08-16.  
 ● TOP OF SHEET PILING AT WINGS TO MATCH TOP OF BACKWALL ELEVATION.

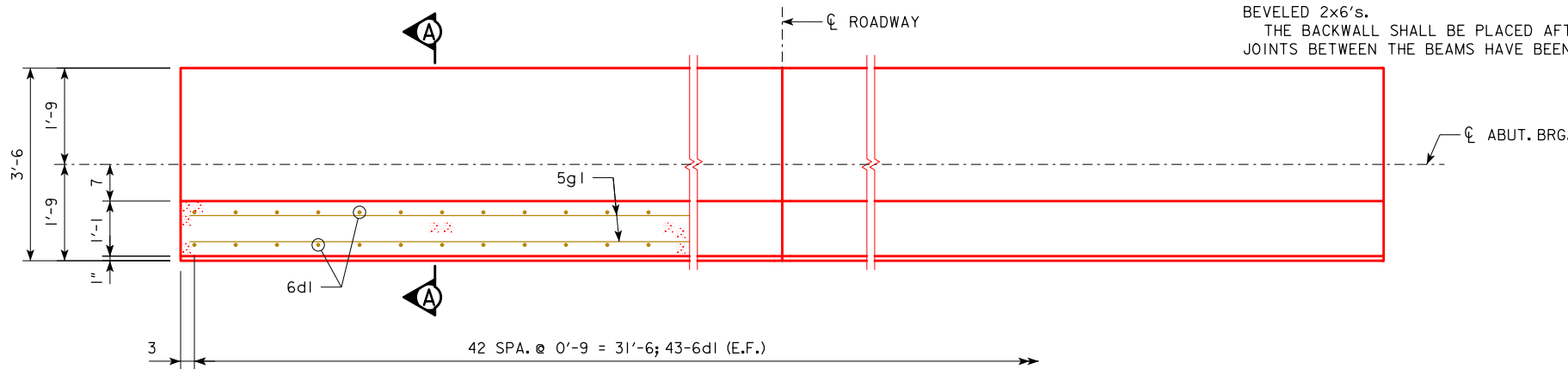
LATEST REVISION DATE  <i>Thomas L. Mc Donald</i> APPROVED BY BRIDGE ENGINEER		
	STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
	DECEMBER, 2016	
<b>STEEL SHEET PILING DETAILS</b> 0° SKEW (SHEET 3 OF 3)		<b>B24-09-16</b>



REAR ELEVATION AT ABUTMENT

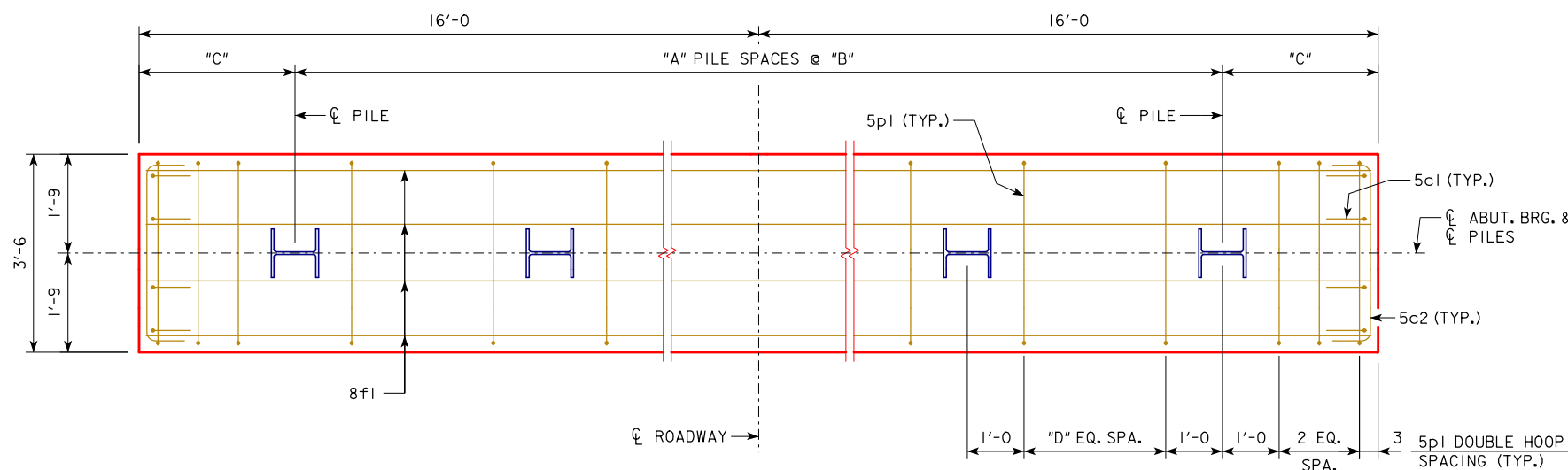
**ABUTMENT NOTES:**

MINIMUM CLEAR DISTANCE FROM FACE OF CONCRETE TO NEAR REINFORCING BAR IS TO BE 2" UNLESS OTHERWISE NOTED OR SHOWN.  
 ABUTMENT PILES SHALL BE DRIVEN TO VALUES SHOWN IN THE DESIGN PLANS.  
 CONSTRUCTION KEYWAYS ARE TO BE FORMED WITH BEVELED 2x6's.  
 THE BACKWALL SHALL BE PLACED AFTER THE UHPC JOINTS BETWEEN THE BEAMS HAVE BEEN COMPLETED.



PART SECTION THROUGH BACKWALL

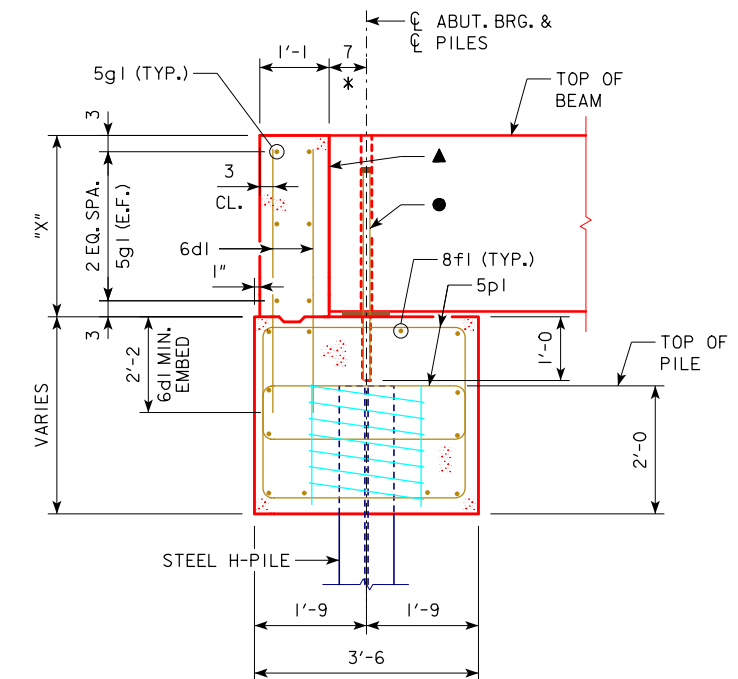
PART PLAN VIEW



ABUTMENT PILE PLAN

SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
	30'-0"	40'-0"	50'-0"	30'-0"	40'-0"	50'-0"	60'-0"	70'-0"
"X" (FT. - IN.)	2'-4 <sup>3</sup> / <sub>4</sub>	2'-4 <sup>3</sup> / <sub>4</sub>	2'-10 <sup>3</sup> / <sub>4</sub>	1'-10 <sup>3</sup> / <sub>4</sub>	1'-10 <sup>3</sup> / <sub>4</sub>	2'-4 <sup>3</sup> / <sub>4</sub>	2'-4 <sup>3</sup> / <sub>4</sub>	2'-10 <sup>3</sup> / <sub>4</sub>
"A" PILE SPACES	4	4	4	4	4	4	5	6
"B" (FT. - IN.)	6'-9"	6'-9"	6'-9"	6'-9"	6'-9"	6'-9"	5'-4"	4'-6"
"C" (FT. - IN.)	2'-6"	2'-6"	2'-6"	2'-6"	2'-6"	2'-6"	2'-8"	2'-6"
"D" EQUAL SPACES	6	6	6	6	6	6	4	3
NO. OF HPI0x57 PILES PER ABUT.	5	5	5	5	5	5	6	7
P <sub>u</sub> , STRENGTH I DESIGN LOAD (KIPS)	107	124	144	104	120	139	130	126

NOTE:  
 P<sub>u</sub>, STRENGTH I DESIGN LOAD (KIPS) IS NOT THE VALUE USED IN THE FIELD FOR DRIVING PILES.












SECTION A-A

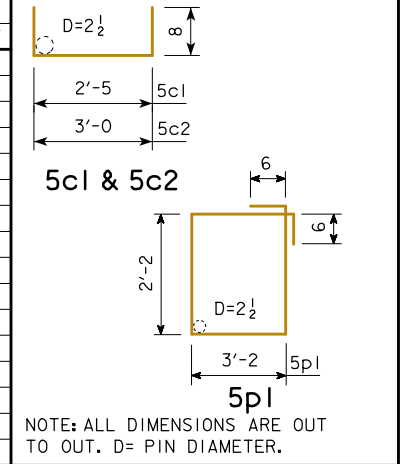
NOTES:  
 ● 1<sup>1</sup>/<sub>4</sub>"  $\phi$  SMOOTH DOWELS (A36). DRILL A 1<sup>1</sup>/<sub>2</sub>"  $\phi$  HOLE 12" DEEP INTO ABUTMENT AFTER BEAMS ARE IN PLACE. USE LOW IMPACT ROTARY DRILL. PLACE 2"  $\phi$  x 1" THICK POLYSTYRENE PLUG ON TOP OF DOWEL. PRIOR TO SETTING DOWEL, FILL HOLE TO A DEPTH OF 4" WITH A POLYMER GROUT SYSTEM IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. FILL REMAINDER OF HOLE ABOVE PLUG WITH NON-SHRINK GROUT.  
 \* THIS DIMENSION MAY VARY. TILTING OF THE BACKWALL DURING CONSTRUCTION MAY BE NECESSARY TO ACCOMMODATE BEAM CAMBER AND LONGITUDINAL GRADE.  
 ▲ THE SPIRAL AT THE TOP OF EACH PILE TO BE 7 TURNS OF NO. 2 BAR, 21" DIAMETER, 3" PITCH WITH 3-L<sup>1</sup>/<sub>2</sub> x 3/8 x 3/8 SPACERS PUNCHED TO HOLD SPIRAL.  
 ▲ FOR CAST-IN-PLACE ABUTMENT BACKWALLS, CAST BACKWALL CONCRETE DIRECTLY AGAINST ENDS OF CONCRETE BOXES.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0" ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		<b>ABUTMENT DETAILS (CAST-IN-PLACE)</b> <b>SHEET PILE WINGS</b> <b>0° SKEW</b> <b>(SHEET 1 OF 2)</b>	<b>B24-10-16</b>

## EPOXY COATED REINFORCING BAR LIST, CAST-IN-PLACE ABUTMENT (TWO ABUTMENTS)

## BENT BAR DETAILS

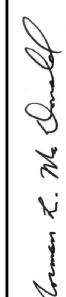

BAR	LOCATION	SPAN	REINFORCED CONCRETE BOX BEAMS									PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS														
			30'-0			40'-0			50'-0			30'-0			40'-0			50'-0			60'-0			70'-0		
			NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
5c1	FOOTING END, VERTICAL		16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63
5c2	FOOTING END, HORIZONTAL		16	4'-4	72	16	4'-4	72	16	4'-4	72	16	4'-4	72	16	4'-4	72	16	4'-4	72	16	4'-4	72	16	4'-4	72
6d1	BACKWALL, VERTICAL		172	4'-4	1119	172	4'-4	1119	172	4'-10	1249	172	3'-10	990	172	3'-10	990	172	4'-4	1119	172	4'-4	1119	172	4'-10	1249
8f1	FOOTING, LONGITUDINAL		24	31'-8	2029	24	31'-8	2029	24	31'-8	2029	24	31'-8	2029	24	31'-8	2029	24	31'-8	2029	24	31'-8	2029	24	31'-8	2029
5g1	BACKWALL, HORIZONTAL		12	31'-8	396	12	31'-8	396	12	31'-8	396	12	31'-8	396	12	31'-8	396	12	31'-8	396	12	31'-8	396	12	31'-8	396
5p1	FOOTING HOOPS		136	11'-8	1655	136	11'-8	1655	136	11'-8	1655	136	11'-8	1655	136	11'-8	1655	124	11'-8	1509	120	11'-8	1460			
	1 1/4" DIA. SMOOTH DOWELS		12	2'-9	138	12	2'-9	138	12	3'-3	163	12	2'-3	113	12	2'-3	113	12	2'-9	138	12	2'-9	138	12	3'-3	163
#2	PILE SPIRAL *		10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	12	38'-6	77	14	38'-6	90
	SPIRAL SPACERS L 7/8 x 7/8 x 0.70 *		30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	36	1'-10	46	42	1'-10	54
TOTAL (LBS.)				5,574		5,574		5,729		5,420		5,420		5,574		5,449		5,576								

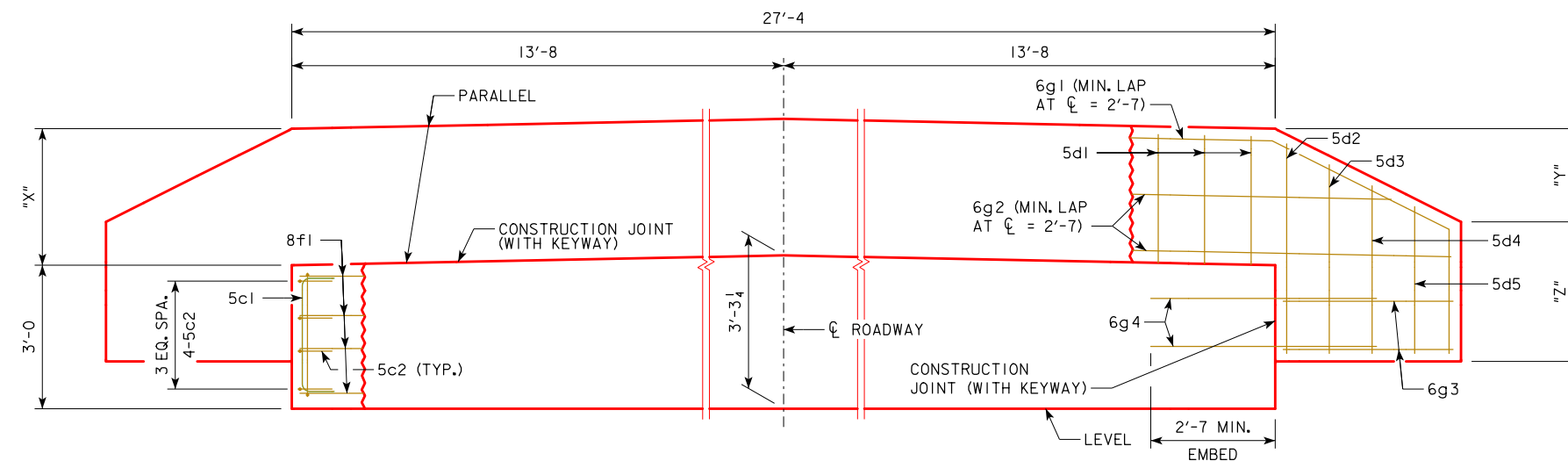


\* EPOXY COATING NOT REQUIRED

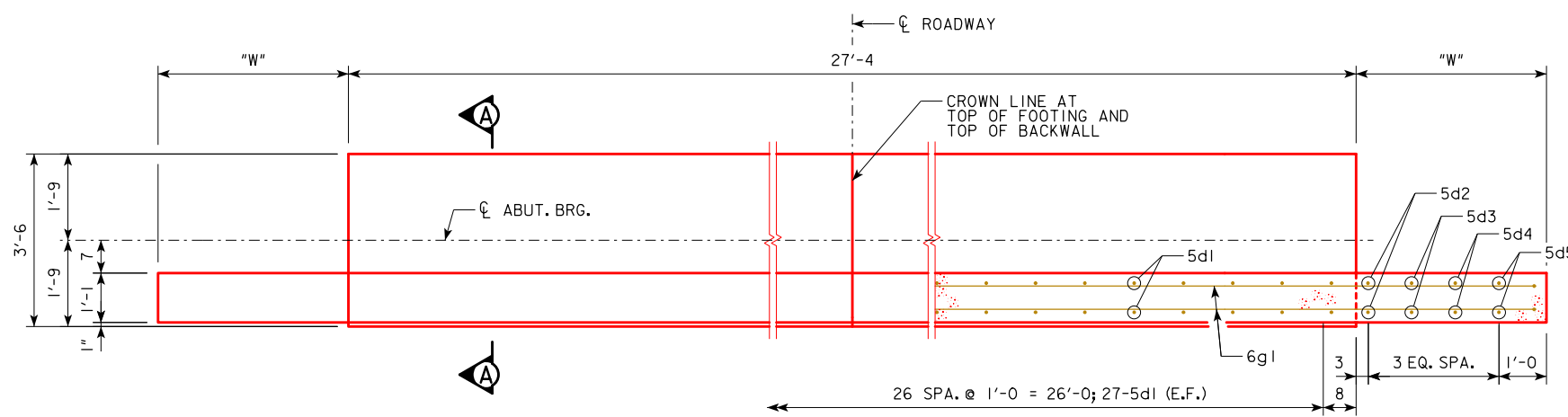
## CONCRETE PLACEMENT QUANTITIES (TWO ABUTMENTS)

LOCATION	SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
BACKWALLS (C.Y.)		6.2	6.2	7.4	4.9	4.9	6.2	6.2	7.4
FOOTINGS (C.Y.)		26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2
TOTAL (C.Y.)		32.4	32.4	33.6	31.1	31.1	32.4	32.4	33.6

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <h3 style="margin: 0;">CONCRETE BOX BEAM BRIDGES</h3> DECEMBER, 2016 ABUTMENT DETAILS (CAST-IN-PLACE) SHEET PILE WINGS 0° SKEW (SHEET 2 OF 2)	B24-11-16
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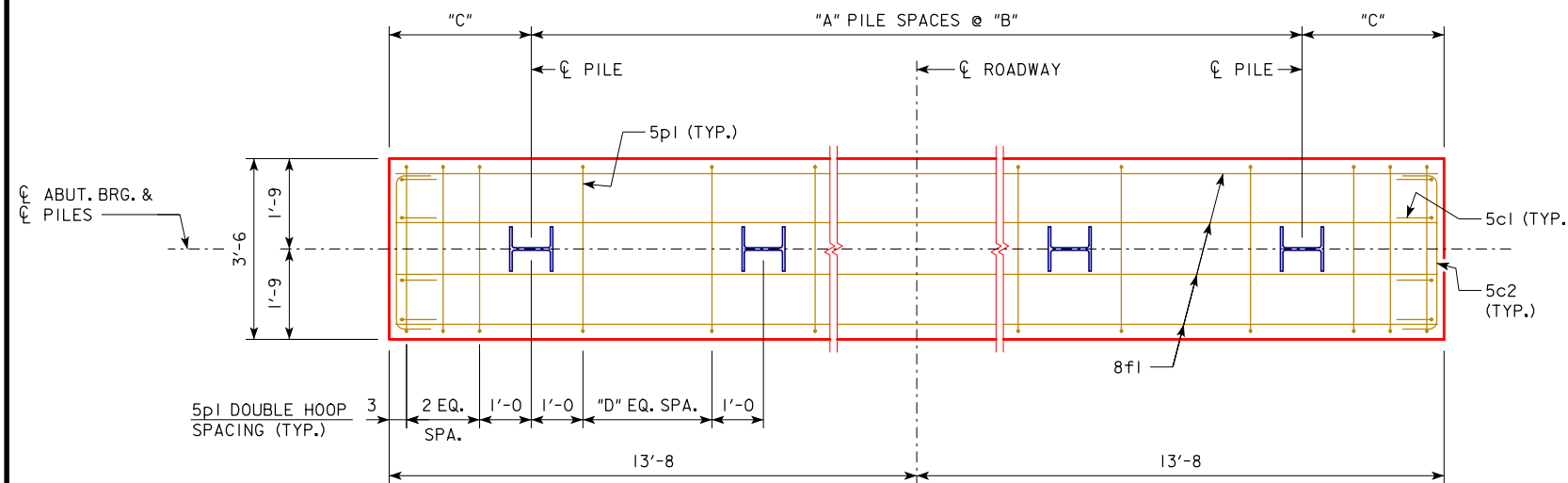


REAR ELEVATION AT ABUTMENT



PART PLAN VIEW

PART SECTION THROUGH BACKWALL



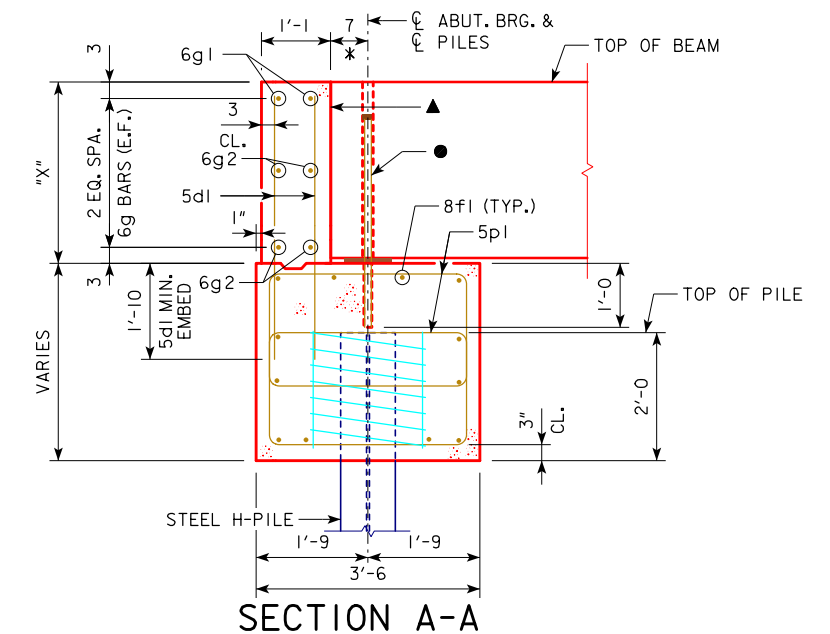
ABUTMENT PILE PLAN

ABUTMENT DATA (0° SKEW)								
SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
	30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
"W" (FT. - IN.)	4'-0	4'-0	4'-0	3'-0	3'-0	4'-0	4'-0	4'-0
"X" (FT. - IN.)	2'-4 <sup>3</sup> / <sub>4</sub>	2'-4 <sup>3</sup> / <sub>4</sub>	2'-10 <sup>3</sup> / <sub>4</sub>	1'-10 <sup>3</sup> / <sub>4</sub>	1'-10 <sup>3</sup> / <sub>4</sub>	2'-4 <sup>3</sup> / <sub>4</sub>	2'-4 <sup>3</sup> / <sub>4</sub>	2'-10 <sup>3</sup> / <sub>4</sub>
"Y" (FT. - IN.)	2'-0	2'-0	2'-0	1'-6	1'-6	2'-0	2'-0	2'-0
"Z" (FT. - IN.)	2'-4	2'-4	2'-10	2'-4	2'-4	2'-4	2'-4	2'-10
"A" PILE SPACES	4	4	4	4	4	4	4	5
"B" (FT. - IN.)	5'-7	5'-7	5'-7	5'-7	5'-7	5'-7	5'-7	4'-5
"C" (FT. - IN.)	2'-6	2'-6	2'-6	2'-6	2'-6	2'-6	2'-6	2'-7 <sup>1</sup> / <sub>2</sub>
"D" EQUAL SPACES	4	4	4	4	4	4	4	3
NO. OF PILES PER ABUT.	5	5	5	5	5	5	5	6
Pu, STRENGTH I DESIGN LOAD (KIPS)	97	114	133	94	109	128	141	137

NOTE:  
Pu, STRENGTH I DESIGN LOAD (KIPS) IS NOT THE VALUE USED IN THE FIELD FOR DRIVING PILES.

**ABUTMENT NOTES:**

MINIMUM CLEAR DISTANCE FROM FACE OF CONCRETE TO NEAR REINFORCING BAR IS TO BE 2" UNLESS OTHERWISE NOTED OR SHOWN.  
ABUTMENT PILES SHALL BE DRIVEN TO VALUES SHOWN IN THE DESIGN PLANS.  
CONSTRUCTION KEYWAYS ARE TO BE FORMED WITH BEVELED 2x6's.  
THE BACKWALL SHALL BE PLACED AFTER THE UHPC JOINTS BETWEEN THE BEAMS HAVE BEEN COMPLETED.



















SECTION A-A

NOTES:  
● 1 1/4" φ SMOOTH DOWELS (A36). DRILL A 1 1/2" φ HOLE 12" DEEP INTO ABUTMENT AFTER BEAMS ARE IN PLACE. USE LOW IMPACT ROTARY DRILL. PRIOR TO SETTING DOWEL, FILL HOLE TO A DEPTH OF 4" WITH A POLYMER GROUT SYSTEM IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. PLACE 2" φ x 1" THICK POLYSTYRENE PLUG ON TOP OF DOWEL. FILL REMAINDER OF HOLE ABOVE PLUG WITH NON-SHRINK GROUT.  
\* THIS DIMENSION MAY VARY. TILTING OF THE BACKWALL DURING CONSTRUCTION MAY BE NECESSARY TO ACCOMMODATE BEAM CAMBER AND LONGITUDINAL GRADE.  
THE SPIRAL AT THE TOP OF EACH PILE TO BE 7 TURNS OF NO. 2 BAR, 21" DIAMETER, 3" PITCH WITH 3-L<sup>3</sup>/<sub>8</sub> x 7/8 x 1/8 SPACERS PUNCHED TO HOLD SPIRAL.  
▲ FOR CAST-IN-PLACE ABUTMENT BACKWALLS, CAST BACKWALL CONCRETE DIRECTLY AGAINST ENDS OF CONCRETE BOXES.

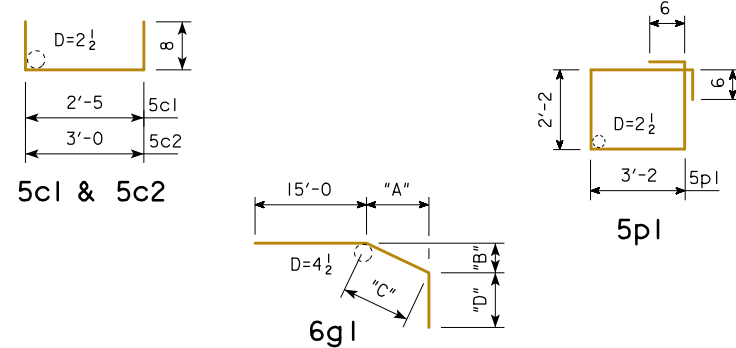
LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
<b>ABUTMENT DETAILS (CAST-IN-PLACE) CONCRETE WINGS 0° SKEW</b>		<b>B24-12-16</b>	

## EPOXY COATED REINFORCING BAR LIST, CAST-IN-PLACE ABUTMENT (TWO ABUTMENTS)

BAR	LOCATION	SPAN	REINFORCED CONCRETE BOX BEAMS									PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS														
			30'-0			40'-0			50'-0			30'-0			40'-0			50'-0			60'-0			70'-0		
			NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
5c1	FOOTING END, VERTICAL		16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63
5c2	FOOTING END, HORIZONTAL		16	4'-4	72	16	4'-4	72	16	4'-4	72	16	4'-4	72	16	4'-4	72	16	4'-4	72	16	4'-4	72	16	4'-4	72
5d1	BACKWALL, VERTICAL		108	4'-0	451	108	4'-0	451	108	4'-6	507	108	3'-6	394	108	3'-6	394	108	4'-0	451	108	4'-0	451	108	4'-6	507
5d2	BACKWALL, VERTICAL		8	3'-10	32	8	3'-10	32	8	4'-4	36	8	3'-4	28	8	3'-10	32	8	3'-10	32	8	3'-10	32	8	4'-4	36
5d3	BACKWALL, VERTICAL		8	3'-4	28	8	3'-4	28	8	3'-10	32	8	3'-0	25	8	3'-0	25	8	3'-4	28	8	3'-4	28	8	3'-10	32
5d4	BACKWALL, VERTICAL		8	2'-11	24	8	2'-11	24	8	3'-5	29	8	2'-9	23	8	2'-9	23	8	2'-11	24	8	2'-11	24	8	3'-5	29
5d5	BACKWALL, VERTICAL		8	2'-5	20	8	2'-5	20	8	2'-11	24	8	2'-5	20	8	2'-5	20	8	2'-5	20	8	2'-5	20	8	2'-11	24
8f1	FOOTING, LONGITUDINAL		24	27'-0	1730	24	27'-0	1730	24	27'-0	1730	24	27'-0	1730	24	27'-0	1730	24	27'-0	1730	24	27'-0	1730	24	27'-0	1730
6g1	BACKWALL, HORIZONTAL		8	21'-2	254	8	21'-2	254	8	21'-8	260	8	20'-1	241	8	20'-1	241	8	21'-2	254	8	21'-2	254	8	21'-8	260
6g2	BACKWALL, HORIZONTAL		16	18'-10	453	16	18'-10	453	16	18'-10	453	16	17'-10	429	16	17'-10	429	16	18'-10	453	16	18'-10	453	16	18'-10	453
6g3	BACKWALL, HORIZONTAL		16	3'-8	88	16	3'-8	88	16	3'-8	88	16	2'-8	64	16	2'-8	64	16	3'-8	88	16	3'-8	88	16	3'-8	88
6g4	FOOTING TO BACKWALL, HORIZONTAL		16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128
5p1	FOOTING HOOPS		104	11'-8	1266	104	11'-8	1266	104	11'-8	1266	104	11'-8	1266	104	11'-8	1266	104	11'-8	1266	104	11'-8	1266	104	11'-8	1266
	1/4" DIA. SMOOTH DOWELS		12	2'-9	138	12	2'-9	138	12	3'-3	163	12	2'-3	113	12	2'-3	113	12	2'-9	138	12	2'-9	138	12	3'-3	163
#2	PILE SPIRAL *		10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	12	38'-6	77
	SPIRAL SPACERS L 7/8" x 7/8" x 0.70 *		30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	36	1'-10	46
TOTAL (LBS.)			4,849			4,849			4,953			4,698			4,698			4,849			4,849			4,974		

\* EPOXY COATING NOT REQUIRED

### BENT BAR DETAILS

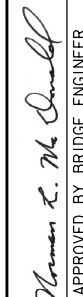



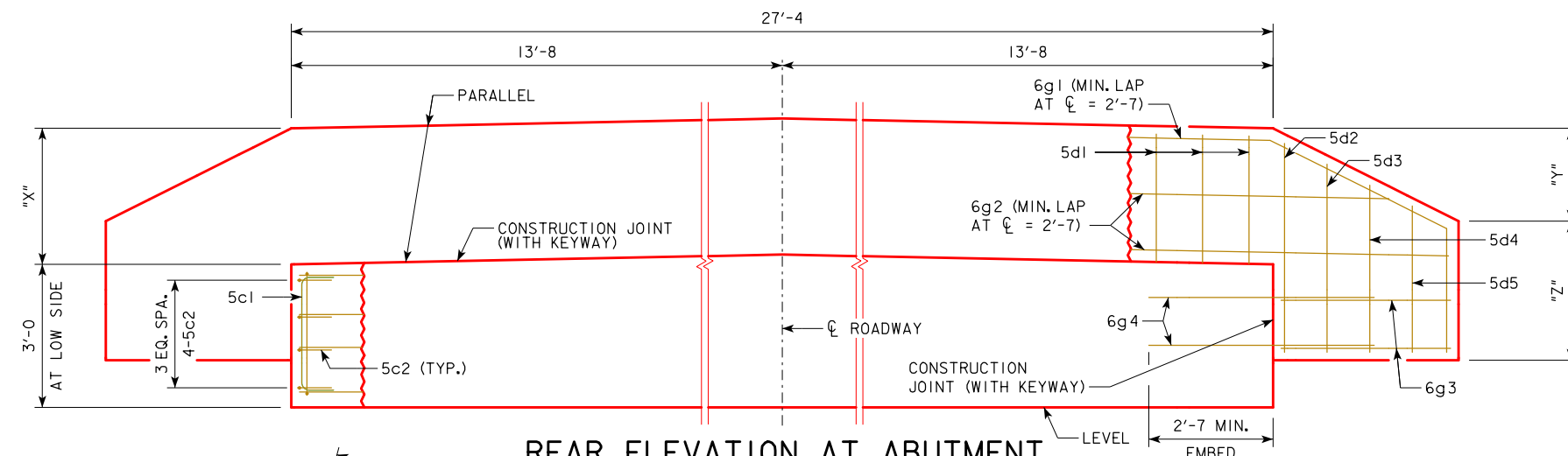
	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
	30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
"A"	3'-9	3'-9	3'-9	2'-9	2'-9	3'-9	3'-9	3'-9
"B"	1'-10 1/2	1'-10 1/2	1'-10 1/2	1'-4 1/2	1'-4 1/2	1'-10 1/2	1'-10 1/2	1'-10 1/2
"C"	4'-2	4'-2	4'-2	3'-1	3'-1	4'-2	4'-2	4'-2
"D"	2'-0	2'-0	2'-6	2'-0	2'-0	2'-0	2'-0	2'-6

NOTE: ALL DIMENSIONS ARE OUT TO OUT. D= PIN DIAMETER.

### CONCRETE PLACEMENT QUANTITIES (TWO ABUTMENTS)

LOCATION	SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
BACKWALLS (C.Y.)		7.4	7.4	8.8	5.7	5.7	7.4	7.4	8.8
FOOTINGS (C.Y.)		22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2
TOTAL (C.Y.)		29.6	29.6	31.0	27.9	27.9	29.6	29.6	31.0

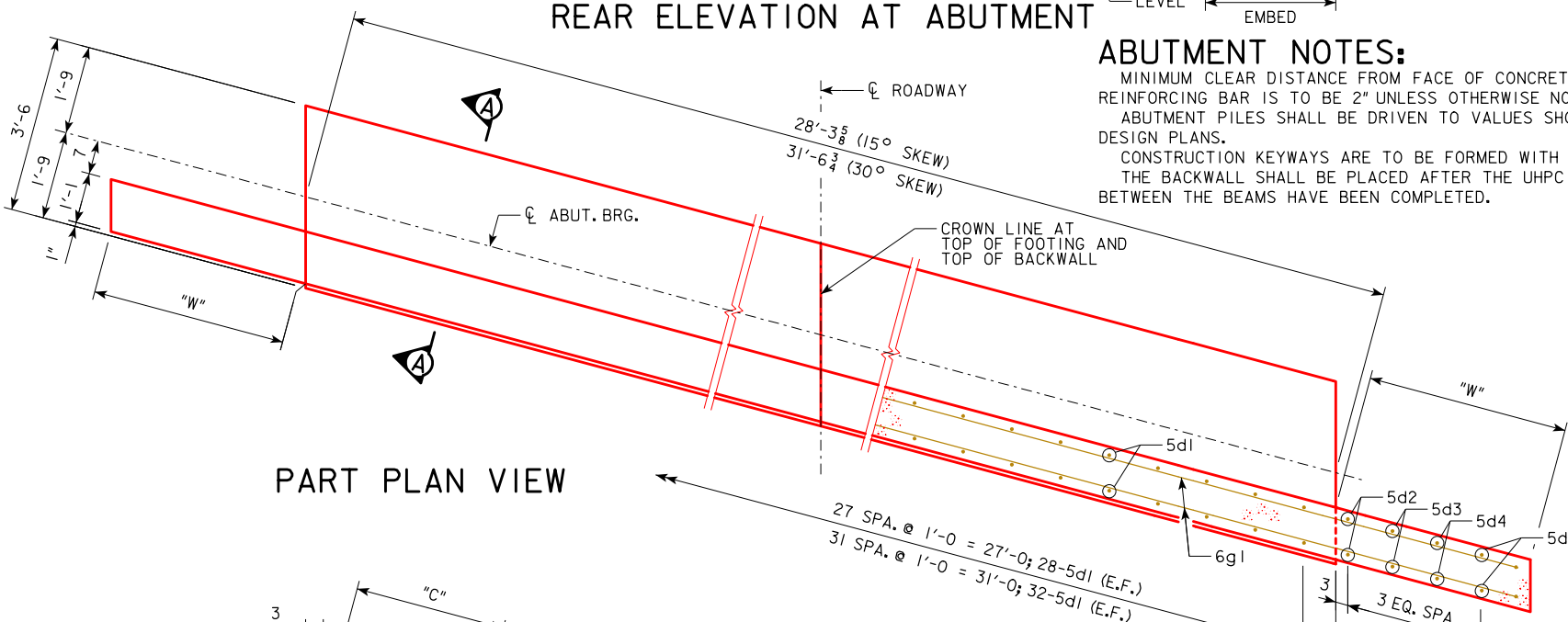
LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 Highway Division
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
		<b>ABUTMENT DETAILS (CAST-IN-PLACE)                  CONCRETE WINGS                  QUANTITIES                  0° SKEW</b>
		B24-13-16



REAR ELEVATION AT ABUTMENT

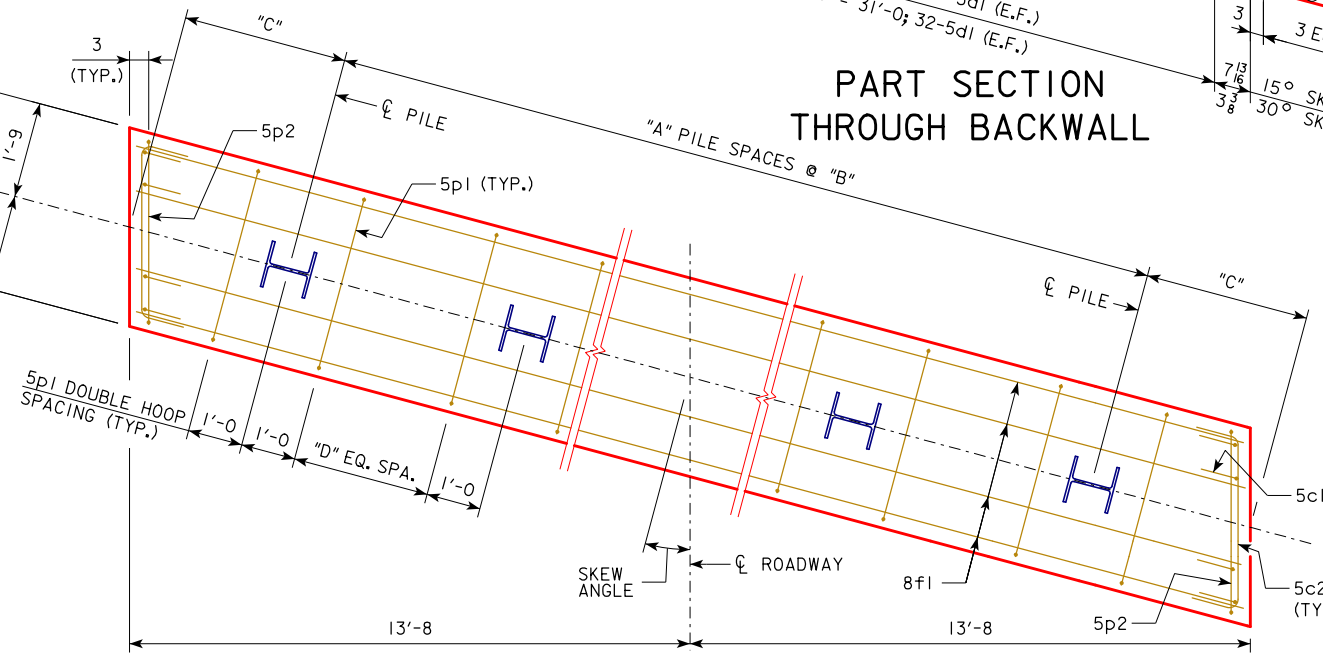
**ABUTMENT NOTES:**

MINIMUM CLEAR DISTANCE FROM FACE OF CONCRETE TO NEAR REINFORCING BAR IS TO BE 2" UNLESS OTHERWISE NOTED OR SHOWN. ABUTMENT PILES SHALL BE DRIVEN TO VALUES SHOWN IN THE DESIGN PLANS. CONSTRUCTION KEYWAYS ARE TO BE FORMED WITH BEVELED 2x6'S. THE BACKWALL SHALL BE PLACED AFTER THE UHPC JOINTS BETWEEN THE BEAMS HAVE BEEN COMPLETED.



PART PLAN VIEW

**PART SECTION THROUGH BACKWALL**



ABUTMENT PILE PLAN

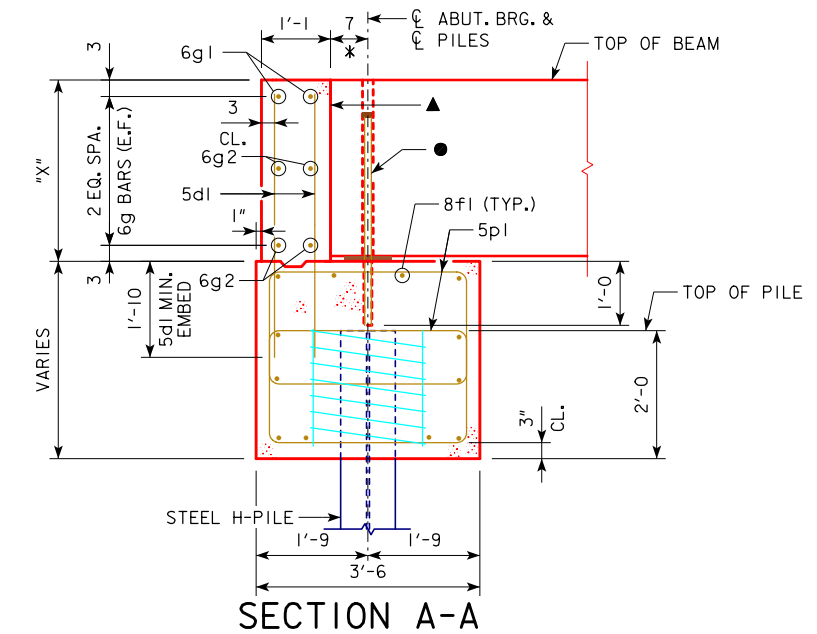
**NOTES:**

- 1/4"  $\phi$  SMOOTH DOWELS (A36). DRILL A 1/2"  $\phi$  HOLE 12" DEEP INTO ABUTMENT AFTER BEAMS ARE IN PLACE. USE LOW IMPACT ROTARY DRILL. PRIOR TO SETTING DOWEL, FILL HOLE TO A DEPTH OF 4" WITH A POLYMER GROUT SYSTEM IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. PLACE 2"  $\phi$  x 1" THICK POLYSTYRENE PLUG ON TOP OF DOWEL. FILL REMAINDER OF HOLE ABOVE PLUG WITH NON-SHRINK GROUT.
- \* THIS DIMENSION MAY VARY. TILTING OF THE BACKWALL DURING CONSTRUCTION MAY BE NECESSARY TO ACCOMMODATE BEAM CAMBER AND LONGITUDINAL GRADE. THE SPIRAL AT THE TOP OF EACH PILE TO BE 7 TURNS OF NO. 2 BAR, 21" DIAMETER, 3" PITCH WITH 3-L/8 x 7/8 SPACERS PUNCHED TO HOLD SPIRAL.
- ▲ FOR CAST-IN-PLACE ABUTMENT BACKWALLS, CAST BACKWALL CONCRETE DIRECTLY AGAINST ENDS OF CONCRETE BOXES.

ABUTMENT DATA (15° SKEW)								
SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
	"W" (FT. - IN.)	4'-0	4'-0	4'-0	3'-0	3'-0	4'-0	4'-0
"X" (FT. - IN.)	2'-4 3/4	2'-4 3/4	2'-10 3/4	1'-10 3/4	1'-10 3/4	2'-4 3/4	2'-4 3/4	2'-10 3/4
"Y" (FT. - IN.)	2'-0	2'-0	2'-0	1'-6	1'-6	2'-0	2'-0	2'-0
"Z" (FT. - IN.)	2'-4	2'-4	2'-10	2'-4	2'-4	2'-4	2'-4	2'-10
"A" PILE SPACES	4	4	4	4	4	4	4	5
"B" (FT. - IN.)	6'-0	6'-0	6'-0	6'-0	6'-0	6'-0	6'-0	4'-10
"C" (FT. - IN.)	2'-1 13/16	2'-1 13/16	2'-1 13/16	2'-1 13/16	2'-1 13/16	2'-1 13/16	2'-1 13/16	2'-0 13/16
"D" EQUAL SPACES	4	4	4	4	4	4	4	3
NO. OF PILES PER ABUT.	5	5	5	5	5	5	5	6
Pu, STRENGTH I DESIGN LOAD (KIPS)	97	113	133	93	109	127	141	135

ABUTMENT DATA (30° SKEW)								
SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
	"W" (FT. - IN.)	4'-0	4'-0	4'-0	3'-0	3'-0	4'-0	4'-0
"X" (FT. - IN.)	2'-4 3/4	2'-4 3/4	2'-10 3/4	1'-10 3/4	1'-10 3/4	2'-4 3/4	2'-4 3/4	2'-10 3/4
"Y" (FT. - IN.)	2'-0	2'-0	2'-0	1'-6	1'-6	2'-0	2'-0	2'-0
"Z" (FT. - IN.)	2'-4	2'-4	2'-10	2'-4	2'-4	2'-4	2'-4	2'-10
"A" PILE SPACES	4	4	4	4	4	4	4	5
"B" (FT. - IN.)	6'-9	6'-9	6'-9	6'-9	6'-9	6'-9	6'-9	5'-5
"C" (FT. - IN.)	2'-3 3/8	2'-3 3/8	2'-3 3/8	2'-3 3/8	2'-3 3/8	2'-3 3/8	2'-3 3/8	2'-2 7/8
"D" EQUAL SPACES	5	5	5	5	5	5	5	4
NO. OF PILES PER ABUT.	5	5	5	5	5	5	5	6
Pu, STRENGTH I DESIGN LOAD (KIPS)	99	115	135	95	110	129	143	137

NOTE: Pu, STRENGTH I DESIGN LOAD (KIPS) IS NOT THE VALUE USED IN THE FIELD FOR DRIVING PILES.



SECTION A-A

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		<b>ABUTMENT DETAILS (CAST-IN-PLACE)          CONCRETE WINGS          15° AND 30° SKEW</b>	<b>B24-14-16</b>

## EPOXY COATED REINFORCING BAR LIST, CAST-IN-PLACE ABUTMENT (TWO ABUTMENTS)

BAR	LOCATION	SPAN SHAPE	REINFORCED CONCRETE BOX BEAMS									PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS														
			30'-0			40'-0			50'-0			30'-0			40'-0			50'-0			60'-0			70'-0		
			NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
5c1	FOOTING END, VERTICAL		16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63
5c2	FOOTING END, HORIZONTAL		16	4'-5	74	16	4'-5	74	16	4'-5	74	16	4'-5	74	16	4'-5	74	16	4'-5	74	16	4'-5	74	16	4'-5	74
5d1	BACKWALL, VERTICAL		112	4'-0	467	112	4'-0	467	112	4'-6	526	112	3'-6	409	112	3'-6	409	112	4'-0	467	112	4'-0	467	112	4'-6	526
5d2	BACKWALL, VERTICAL		8	3'-10	32	8	3'-10	32	8	4'-4	36	8	3'-4	28	8	3'-4	28	8	3'-10	32	8	3'-10	32	8	4'-4	36
5d3	BACKWALL, VERTICAL		8	3'-4	28	8	3'-4	28	8	3'-10	32	8	3'-0	25	8	3'-0	25	8	3'-4	28	8	3'-4	28	8	3'-10	32
5d4	BACKWALL, VERTICAL		8	2'-11	24	8	2'-11	24	8	3'-5	29	8	2'-9	23	8	2'-9	23	8	2'-11	24	8	2'-11	24	8	3'-5	29
5d5	BACKWALL, VERTICAL		8	2'-5	20	8	2'-5	20	8	2'-11	24	8	2'-5	20	8	2'-5	20	8	2'-5	20	8	2'-5	20	8	2'-11	24
8f1	FOOTING, LONGITUDINAL		24	27'-11	1789	24	27'-11	1789	24	27'-11	1789	24	27'-11	1789	24	27'-11	1789	24	27'-11	1789	24	27'-11	1789	24	27'-11	1789
6g1	BACKWALL, HORIZONTAL		8	21'-8	260	8	21'-8	260	8	22'-2	266	8	20'-7	247	8	20'-7	247	8	21'-8	260	8	21'-8	260	8	22'-2	266
6g2	BACKWALL, HORIZONTAL		16	19'-4	465	16	19'-4	465	16	19'-4	465	16	18'-4	441	16	18'-4	441	16	19'-4	465	16	19'-4	465	16	19'-4	465
6g3	BACKWALL, HORIZONTAL		16	3'-7	86	16	3'-7	86	16	3'-7	86	16	2'-7	62	16	2'-7	62	16	3'-7	86	16	3'-7	86	16	3'-7	86
6g4	FOOTING TO BACKWALL, HORIZONTAL		16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128
5p1	FOOTING HOOPS		88	11'-8	1071	88	11'-8	1071	88	11'-8	1071	88	11'-8	1071	88	11'-8	1071	88	11'-8	1071	88	11'-8	1071	88	11'-8	1071
5p2	FOOTING HOOPS		8	11'-10	99	8	11'-10	99	8	11'-10	99	8	11'-10	99	8	11'-10	99	8	11'-10	99	8	11'-10	99	8	11'-10	99
	1 1/4" DIA. SMOOTH DOWELS		12	2'-9	138	12	2'-9	138	12	3'-3	163	12	2'-3	113	12	2'-3	113	12	2'-9	138	12	2'-9	138	12	3'-3	163
#2	PILE SPIRAL *		10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	12	38'-6	77
	SPIRAL SPACERS L 7/8 x 3/8 x 0.70 *		30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	36	1'-10	46
TOTAL (LBS.)			4,846			4,846			4,953			4,694			4,694			4,846			4,846			4,974		

\* EPOXY COATING NOT REQUIRED

### BENT BAR DETAILS

	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
	30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
"A"	3'-9	3'-9	3'-9	2'-9	2'-9	3'-9	3'-9	3'-9
"B"	1'-10 1/2	1'-10 1/2	1'-10 1/2	1'-4 1/2	1'-4 1/2	1'-10 1/2	1'-10 1/2	1'-10 1/2
"C"	4'-2	4'-2	4'-2	3'-1	3'-1	4'-2	4'-2	4'-2
"D"	2'-0	2'-0	2'-6	2'-0	2'-0	2'-0	2'-0	2'-6

NOTE: ALL DIMENSIONS ARE OUT TO OUT. D= PIN DIAMETER.

### CONCRETE PLACEMENT QUANTITIES (TWO ABUTMENTS)

LOCATION	SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
BACKWALLS (C.Y.)		7.6	7.6	9.0	5.8	5.8	7.6	7.6	9.0
FOOTINGS (C.Y.)		23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
TOTAL (C.Y.)		30.6	30.6	32.0	28.8	28.8	30.6	30.6	32.0

### ADDITIONAL CONCRETE

EACH FOOTING (C.Y.)	ROADWAY GRADE AT ABUTMENT				
	1%	2%	3%	4%	5%
	-	-	-	0.5	0.7

### NOTES:

THE ADDITIONAL CONCRETE TABLE LISTS THE ADDITIONAL CONCRETE VOLUME REQUIRED IN EACH ABUTMENT FOOTING BASED ON THE ROADWAY GRADE AT EACH ABUTMENT. ADDITIONAL CONCRETE SHOULD BE ADDED TO THE PLANS FOR EACH ABUTMENT FOOTING THAT HAS 0.5 CU. YDS. OR MORE OF ADDITIONAL CONCRETE. VALUES SHOULD BE EXCLUDED FOR SCENARIOS THAT HAVE LESS THAN 0.5 CU. YDS. OF ADDITIONAL CONCRETE PER ABUTMENT FOOTING. VALUES MAY BE INTERPOLATED FOR GRADES BETWEEN THE VALUES SHOWN IN THE TABLE.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	Highway Division
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
<b>ABUTMENT DETAILS (CAST-IN-PLACE)                  CONCRETE WINGS                  QUANTITIES                  15° SKEW</b>		<b>B24-15-16</b>

## EPOXY COATED REINFORCING BAR LIST, CAST-IN-PLACE ABUTMENT (TWO ABUTMENTS)

BAR	LOCATION	SPAN SHAPE	REINFORCED CONCRETE BOX BEAMS									PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS																	
			30'-0			40'-0			50'-0			30'-0			40'-0			50'-0			60'-0			70'-0					
			NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
5c1	FOOTING END, VERTICAL		16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63	16	3'-9	63
5c2	FOOTING END, HORIZONTAL		16	4'-9	79	16	4'-9	79	16	4'-9	79	16	4'-9	79	16	4'-9	79	16	4'-9	79	16	4'-9	79	16	4'-9	79	16	4'-9	79
5d1	BACKWALL, VERTICAL		128	4'-0	534	128	4'-0	534	128	4'-6	601	128	3'-6	467	128	3'-6	467	128	4'-0	534	128	4'-0	534	128	4'-6	601	128	4'-6	601
5d2	BACKWALL, VERTICAL		8	3'-10	32	8	3'-10	32	8	4'-4	36	8	3'-4	28	8	3'-4	28	8	3'-10	32	8	3'-10	32	8	4'-4	36	8	4'-4	36
5d3	BACKWALL, VERTICAL		8	3'-4	28	8	3'-4	28	8	3'-10	32	8	3'-0	25	8	3'-0	25	8	3'-4	28	8	3'-4	28	8	3'-10	32	8	3'-10	32
5d4	BACKWALL, VERTICAL		8	2'-11	24	8	2'-11	24	8	3'-5	29	8	2'-9	23	8	2'-9	23	8	2'-11	24	8	2'-11	24	8	3'-5	29	8	3'-5	29
5d5	BACKWALL, VERTICAL		8	2'-5	20	8	2'-5	20	8	2'-11	24	8	2'-5	20	8	2'-5	20	8	2'-5	20	8	2'-5	20	8	2'-11	24	8	2'-11	24
8f1	FOOTING, LONGITUDINAL		24	31'-2	1997	24	31'-2	1997	24	31'-2	1997	24	31'-2	1997	24	31'-2	1997	24	31'-2	1997	24	31'-2	1997	24	31'-2	1997	24	31'-2	1997
6g1	BACKWALL, HORIZONTAL		8	23'-3	279	8	23'-3	279	8	23'-9	285	8	22'-2	266	8	22'-2	266	8	23'-3	279	8	23'-3	279	8	23'-9	285	8	23'-9	285
6g2	BACKWALL, HORIZONTAL		16	20'-11	503	16	20'-11	503	16	20'-11	503	16	19'-11	479	16	19'-11	479	16	20'-11	503	16	20'-11	503	16	20'-11	503	16	20'-11	503
6g3	BACKWALL, HORIZONTAL		16	3'-7	86	16	3'-7	86	16	3'-7	86	16	2'-7	62	16	2'-7	62	16	3'-7	86	16	3'-7	86	16	3'-7	86	16	3'-7	86
6g4	FOOTING TO BACKWALL, HORIZONTAL		16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128	16	5'-4	128
5p1	FOOTING HOOPS		104	11'-8	1266	104	11'-8	1266	104	11'-8	1266	104	11'-8	1266	104	11'-8	1266	104	11'-8	1266	104	11'-8	1266	104	11'-8	1266	108	11'-8	1314
5p2	FOOTING HOOPS		8	12'-8	106	8	12'-8	106	8	12'-8	106	8	12'-8	106	8	12'-8	106	8	12'-8	106	8	12'-8	106	8	12'-8	106	8	12'-8	106
	1/4" DIA. SMOOTH DOWELS		12	2'-9	138	12	2'-9	138	12	3'-3	163	12	2'-3	113	12	2'-3	113	12	2'-9	138	12	2'-9	138	12	2'-9	138	12	3'-3	163
#2	PILE SPIRAL *		10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	10	38'-6	64	12	38'-6	77
	SPIRAL SPACERS L 7/8 x 7/8 x 0.70 *		30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	30	1'-10	38	36	1'-10	46
TOTAL (LBS.)			5,385			5,385			5,500			5,224			5,224			5,385			5,385			5,569					

\* EPOXY COATING NOT REQUIRED

### BENT BAR DETAILS

	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
	30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
"A"	3'-9	3'-9	3'-9	2'-9	2'-9	3'-9	3'-9	3'-9
"B"	1'-10 1/2	1'-10 1/2	1'-10 1/2	1'-4 1/2	1'-4 1/2	1'-10 1/2	1'-10 1/2	1'-10 1/2
"C"	4'-2	4'-2	4'-2	3'-1	3'-1	4'-2	4'-2	4'-2
"D"	2'-0	2'-0	2'-6	2'-0	2'-0	2'-0	2'-0	2'-6

NOTE: ALL DIMENSIONS ARE OUT TO OUT. D= PIN DIAMETER.

### CONCRETE PLACEMENT QUANTITIES (TWO ABUTMENTS)

LOCATION	SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
BACKWALLS (C.Y.)		8.2	8.2	9.8	6.3	6.3	8.2	8.2	9.8
FOOTINGS (C.Y.)		25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
TOTAL (C.Y.)		33.9	33.9	35.5	32.0	32.0	33.9	33.9	35.5

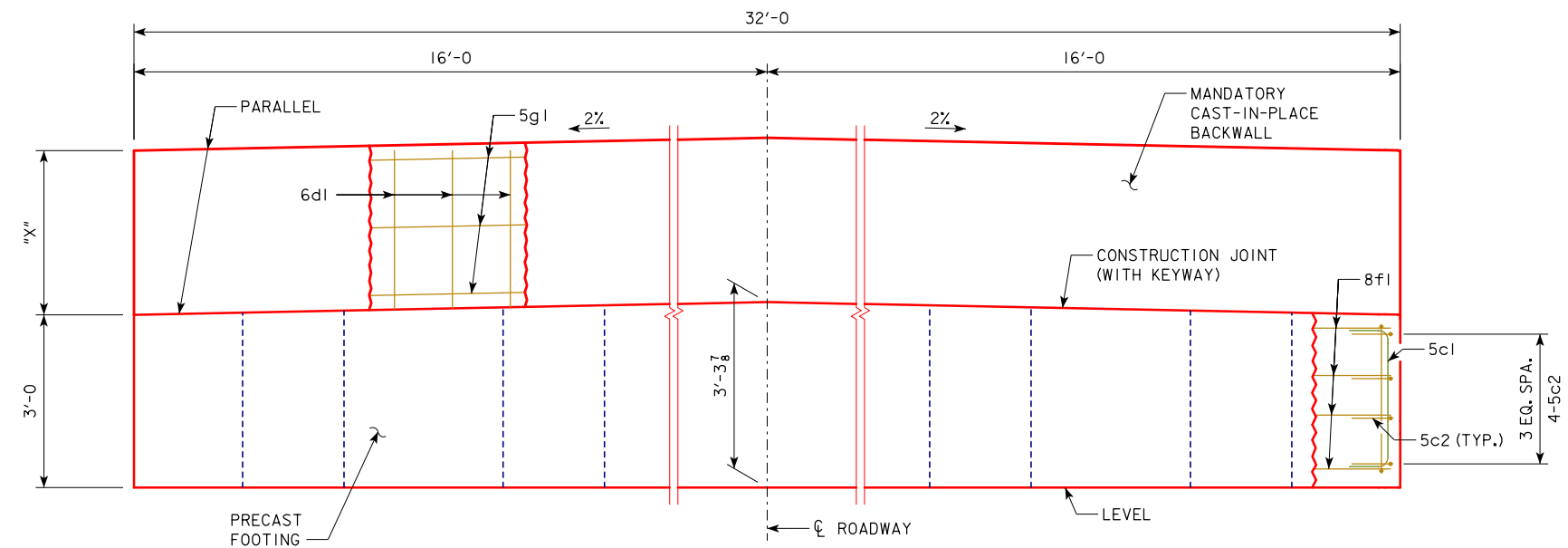
### ADDITIONAL CONCRETE

EACH FOOTING (C.Y.)	ROADWAY GRADE AT ABUTMENT				
	1%	2%	3%	4%	5%
	-	0.6	1.0	1.3	1.6

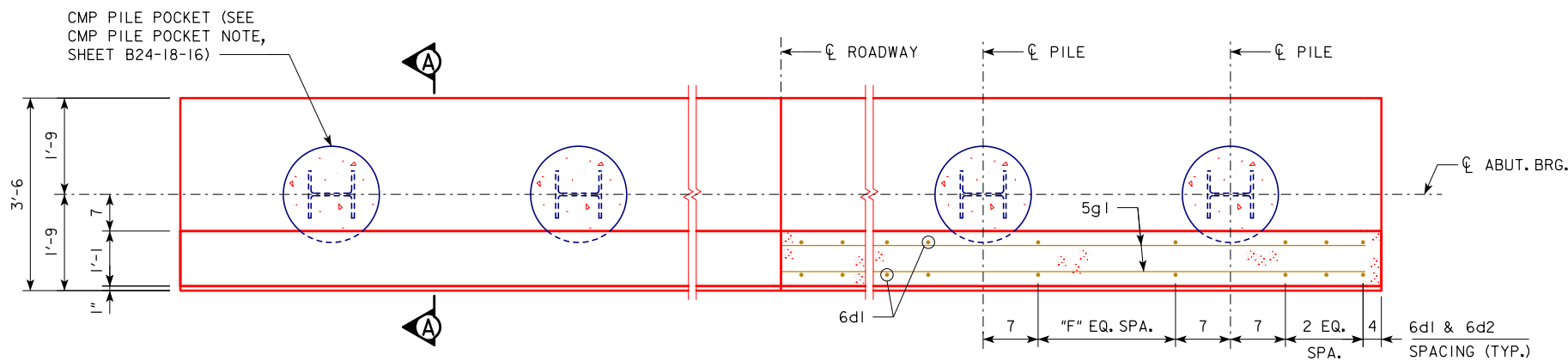
### NOTES:

THE ADDITIONAL CONCRETE TABLE LISTS THE ADDITIONAL CONCRETE VOLUME REQUIRED IN EACH ABUTMENT FOOTING BASED ON THE ROADWAY GRADE AT EACH ABUTMENT. ADDITIONAL CONCRETE SHOULD BE ADDED TO THE PLANS FOR EACH ABUTMENT FOOTING THAT HAS 0.5 CU. YDS. OR MORE OF ADDITIONAL CONCRETE. VALUES SHOULD BE EXCLUDED FOR SCENARIOS THAT HAVE LESS THAN 0.5 CU. YDS. OF ADDITIONAL CONCRETE PER ABUTMENT FOOTING. VALUES MAY BE INTERPOLATED FOR GRADES BETWEEN THE VALUES SHOWN IN THE TABLE.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	Highway Division
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
<b>ABUTMENT DETAILS (CAST-IN-PLACE)</b> CONCRETE WINGS QUANTITIES 30° SKEW		<b>B24-16-16</b>

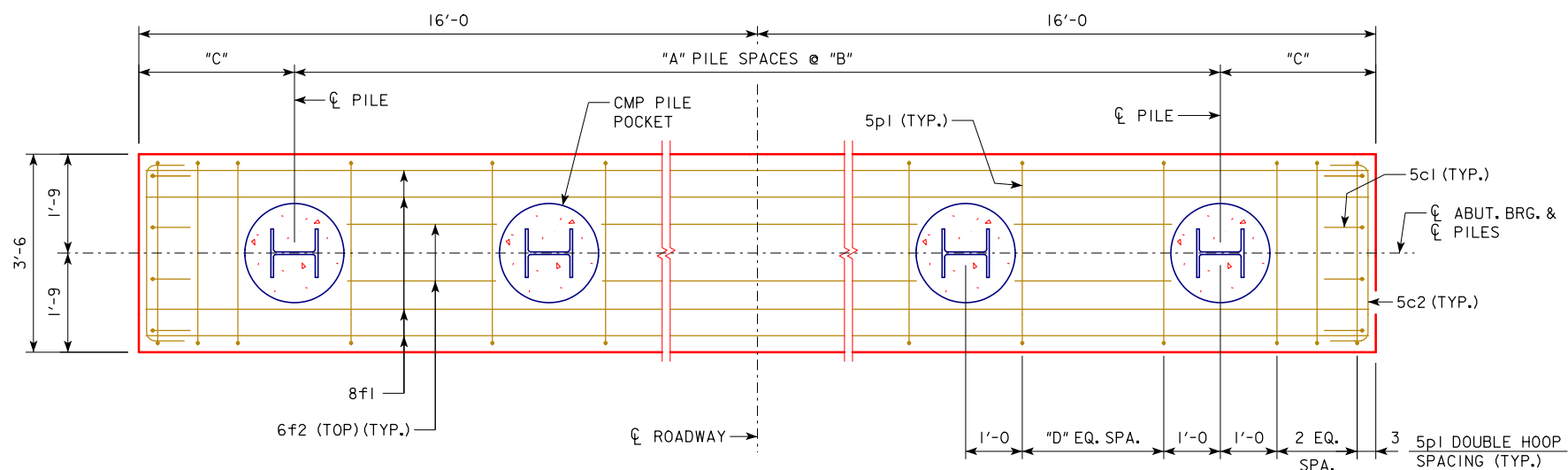


REAR ELEVATION AT ABUTMENT



PART PLAN VIEW

PART SECTION THROUGH BACKWALL

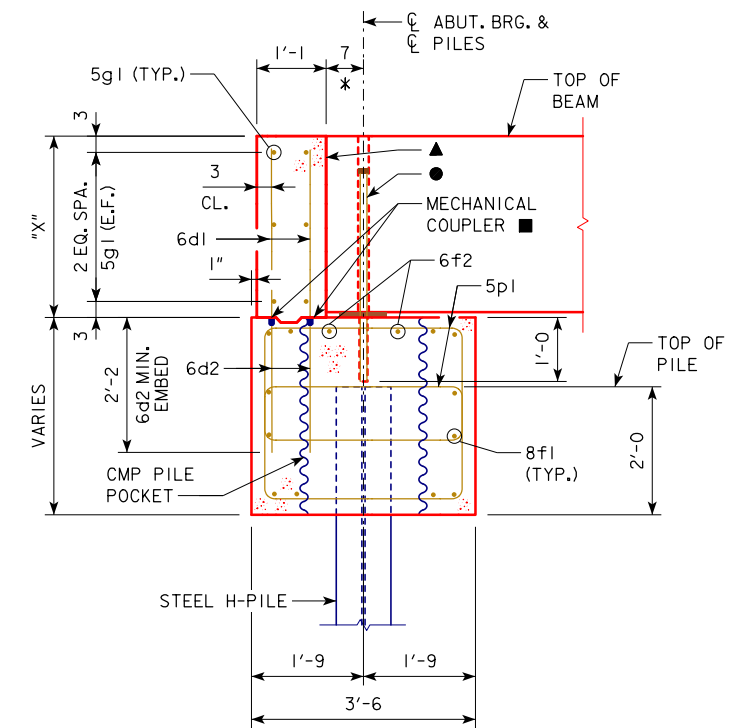


ABUTMENT PILE PLAN

SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
	30'-0"	40'-0"	50'-0"	30'-0"	40'-0"	50'-0"	60'-0"	70'-0"
"X" (FT. - IN.)	2'-4 3/4	2'-4 3/4	2'-10 3/4	1'-10 3/4	1'-10 3/4	2'-4 3/4	2'-4 3/4	2'-10 3/4
"A" PILE SPACES	4	4	4	4	4	4	5	6
"B" (FT. - IN.)	6'-9	6'-9	6'-9	6'-9	6'-9	6'-9	5'-4	4'-6
"C" (FT. - IN.)	2'-6	2'-6	2'-6	2'-6	2'-6	2'-6	2'-8	2'-6
"D" EQUAL SPACES	6	6	6	6	6	6	4	3
"F" EQUAL SPACES	8	8	8	8	8	8	6	5
NO. OF HP10x57 PILES PER ABUT.	5	5	5	5	5	5	6	7
P <sub>u</sub> , STRENGTH I DESIGN LOAD (KIPS)	107	124	144	104	120	139	130	126

NOTE:

P<sub>u</sub>, STRENGTH I DESIGN LOAD (KIPS) IS NOT THE VALUE USED IN THE FIELD FOR DRIVING PILES.



SECTION A-A

NOTES:

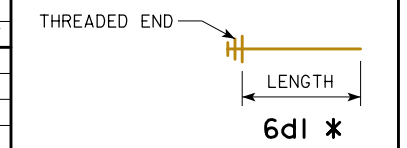
- 1 1/4" Ø SMOOTH DOWELS (A36). DRILL A 1 1/2" Ø HOLE 12" DEEP INTO ABUTMENT AFTER BEAMS ARE IN PLACE. USE LOW IMPACT ROTARY DRILL. PRIOR TO SETTING DOWEL, FILL HOLE TO A DEPTH OF 4" WITH A POLYMER GROUT SYSTEM IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. PLACE 2" Ø x 1" THICK POLYSTYRENE PLUG ON TOP OF DOWEL. FILL REMAINDER OF HOLE ABOVE PLUG WITH NON-SHRINK GROUT.
- \* THIS DIMENSION MAY VARY. TILTING OF THE BACKWALL DURING CONSTRUCTION MAY BE NECESSARY TO ACCOMMODATE BEAM CAMBER AND LONGITUDINAL GRADE.
- ▲ FOR CAST-IN-PLACE ABUTMENT BACKWALLS, CAST BACKWALL CONCRETE DIRECTLY AGAINST ENDS OF CONCRETE BOXES.
- IN LIEU OF MECHANICAL COUPLERS, 6d1 AND 6d2 MAY BE COMBINED INTO ONE BAR EXTENDING FROM THE FOOTING INTO THE BACKWALL.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		
		STANDARD DESIGN - 24'-0" ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		<b>ABUTMENT DETAILS (PRECAST) SHEET PILE WINGS 0° SKEW (SHEET 1 OF 2)</b>	<b>B24-17-16</b>

**EPOXY COATED REINFORCING BAR LIST  
CAST-IN-PLACE ABUTMENT BACKWALL (TWO ABUTMENTS)**

**BENT BAR DETAILS**

BAR	LOCATION	SPAN SHAPE	REINFORCED CONCRETE BOX BEAMS									PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS														
			30'-0			40'-0			50'-0			30'-0			40'-0			50'-0			60'-0			70'-0		
			NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
6dl *	BACKWALL, VERTICAL		168	2'-2	547	168	2'-2	547	168	2'-8	673	168	1'-8	421	168	1'-8	421	168	2'-2	547	164	2'-2	534	168	2'-8	673
5gl	BACKWALL, HORIZONTAL		12	31'-8	396	12	31'-8	396	12	31'-8	396	12	31'-8	396	12	31'-8	396	12	31'-8	396	12	31'-8	396	12	31'-8	396
	1 1/4" DIA. SMOOTH DOWELS		12	2'-9	138	12	2'-9	138	12	3'-3	163	12	2'-3	113	12	2'-3	113	12	2'-9	138	12	2'-9	138	12	3'-3	163
TOTAL (LBS.)			1,081			1,081			1,232			930			930			1,081			1,068			1,232		



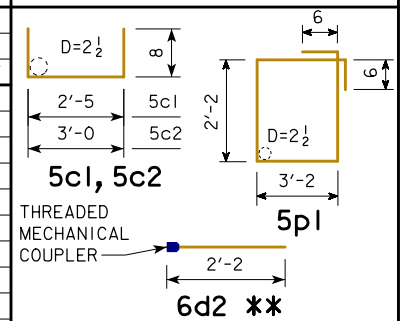
NOTE: ALL DIMENSIONS ARE OUT TO OUT. D= PIN DIAMETER.

\* SEE BENT BAR DETAILS. THE LENGTHS SHOWN DO NOT INCLUDE AN ALLOWANCE FOR THE THREADED END. BAR LENGTHS MAY NEED TO INCREASE DEPENDING ON THE MECHANICAL COUPLER ASSEMBLY USED. THE COST OF THE THREADED PORTION OF THESE BARS IS TO BE INCLUDED IN THE PRICE BID FOR "REINFORCING STEEL EPOXY COATED" AND NO ADDITIONAL PAYMENT WILL BE MADE. THE WEIGHT OF THE THREADED END IS NOT INCLUDED IN THE QUANTITY SHOWN FOR "REINFORCING STEEL EPOXY COATED".

**EPOXY COATED REINFORCING BAR LIST  
PRECAST ABUTMENT FOOTING (ONE FOOTING)  
(INCLUDED IN BID ITEM "PRECAST FOOTING (SHEET PILE WINGS)", EACH)**

**BENT BAR DETAILS**

BAR	LOCATION	SPAN SHAPE	REINFORCED CONCRETE BOX BEAMS									PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS														
			30'-0			40'-0			50'-0			30'-0			40'-0			50'-0			60'-0			70'-0		
			NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
5c1	FOOTING END, VERTICAL		8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31
5c2	FOOTING END, HORIZONTAL		8	4'-4	36	8	4'-4	36	8	4'-4	36	8	4'-4	36	8	4'-4	36	8	4'-4	36	8	4'-4	36	8	4'-4	36
6d2 **	FOOTING, VERTICAL		84	2'-2	273	84	2'-2	273	84	2'-2	273	84	2'-2	273	84	2'-2	273	84	2'-2	273	82	2'-2	267	84	2'-2	273
8f1	FOOTING, LONGITUDINAL		12	31'-8	1015	12	31'-8	1015	12	31'-8	1015	12	31'-8	1015	12	31'-8	1015	12	31'-8	1015	12	31'-8	1015	12	31'-8	1015
6f2	FOOTING, LONGITUDINAL, TOP		8	4'-9	57	8	4'-9	57	8	4'-9	57	8	4'-9	57	8	4'-9	57	10	3'-4	50	12	2'-6	45			
5pl	FOOTING HOOPS		68	11'-8	827	68	11'-8	827	68	11'-8	827	68	11'-8	827	68	11'-8	827	68	11'-8	827	62	11'-8	754	60	11'-8	730
TOTAL (LBS.)			2,239			2,239			2,239			2,239			2,239			2,239			2,153			2,130		



NOTE: ALL DIMENSIONS ARE OUT TO OUT. D= PIN DIAMETER.

\*\* INCLUDES MECHANICAL COUPLERS. SEE BENT BAR DETAILS.

**CAST-IN-PLACE CONCRETE PLACEMENT QUANTITIES  
(TWO ABUTMENTS)**

LOCATION	SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
BACKWALLS (C.Y.)		6.2	6.2	7.4	4.9	4.9	6.2	6.2	7.4

**PRECAST CONCRETE PLACEMENT QUANTITIES  
(ONE FOOTING)  
(INCLUDED IN BID ITEM "PRECAST FOOTING (SHEET PILE WINGS)", EACH)**

LOCATION	SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
FOOTING (C.Y.)		11.7	11.7	11.7	11.7	11.7	11.7	11.4	11.1
CMP PILE POCKETS (C.Y.) **		1.4	1.4	1.4	1.4	1.4	1.4	1.7	2.0
TOTAL (C.Y.)		13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1

\*\* HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE.

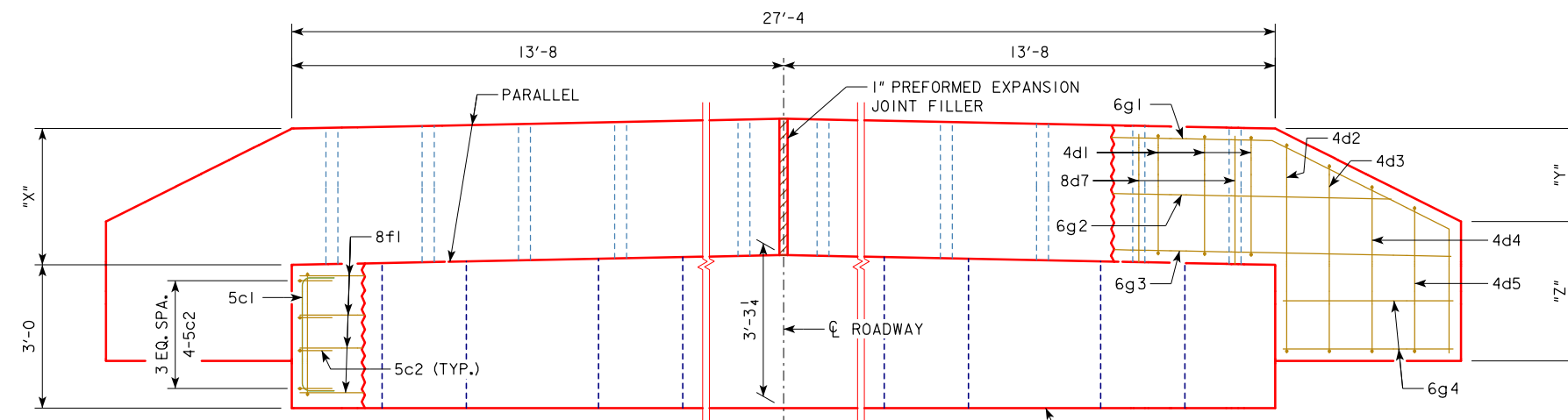
**ABUTMENT NOTES:**

MINIMUM CLEAR DISTANCE FROM FACE OF CONCRETE TO NEAR REINFORCING BAR IS TO BE 2" UNLESS OTHERWISE NOTED OR SHOWN.  
 ABUTMENT PILES SHALL BE DRIVEN TO VALUES SHOWN IN THE DESIGN PLANS.  
 CONSTRUCTION KEYWAYS ARE TO BE FORMED WITH BEVELED 2x6's.  
 THE BACKWALL SHALL BE PLACED AFTER THE UHPC JOINTS BETWEEN THE BEAMS HAVE BEEN COMPLETED.  
 MECHANICAL COUPLERS SHALL BE EPOXY COATED.  
 THE MECHANICAL COUPLERS SHALL MEET THE REQUIREMENTS OF MATERIALS IM 451 APPENDIX E, EXCEPT THE MECHANICAL SPLICE IS REQUIRED TO BE EMBEDDED ON THE ABUTMENT FOOTING SIDE OF THE CONSTRUCTION JOINT.

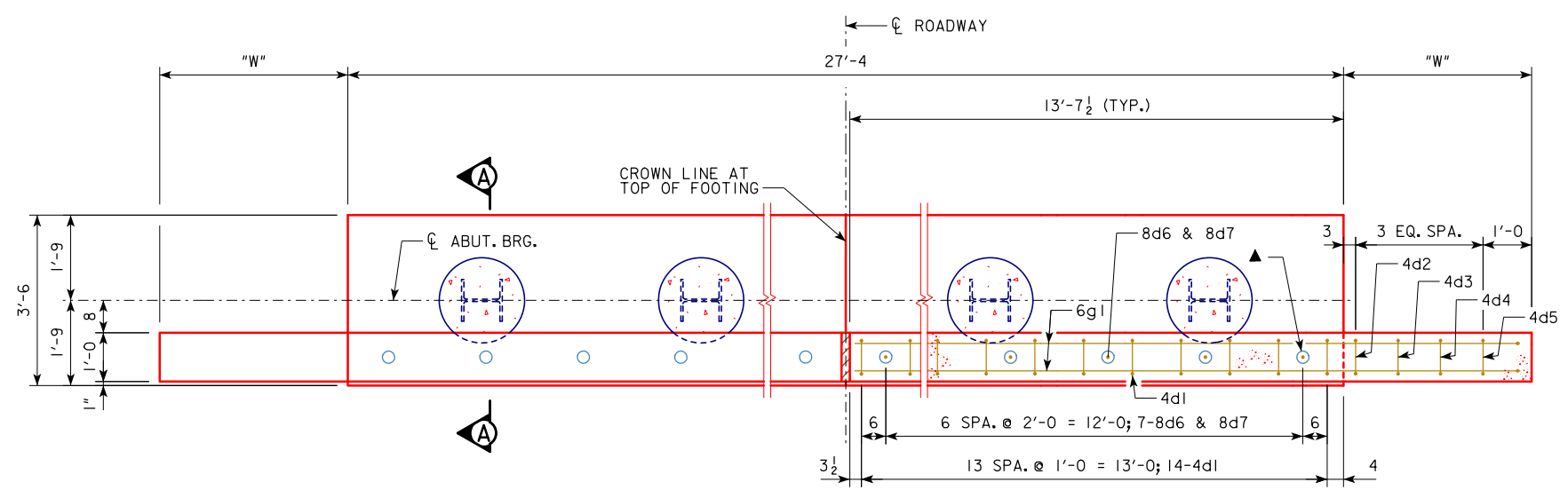
**CMP PILE POCKET NOTE:**

PILE POCKETS SHALL CONSIST OF GALVANIZED STEEL CORRUGATED METAL PIPE (CMP), TYPE 1, 16 GAGE, IN ACCORDANCE WITH THE PRECAST CONCRETE ELEMENTS NOTES. CMP FOR INDIVIDUAL POCKETS SHALL CONSIST OF A SINGLE LENGTH OF PIPE; SPLICING OF PIPE SECTIONS SHALL NOT BE ALLOWED. NOMINAL CMP SIZE SHALL BE 21". FOLLOWING SETTING OF THE FOOTING, THE PILE POCKETS SHALL BE FILLED LEVEL WITH THE TOP OF FOOTING USING HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE IN ACCORDANCE WITH THE PRECAST CONCRETE ELEMENTS NOTES.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
		ABUTMENT DETAILS (PRECAST) SHEET PILE WINGS 0° SKEW (SHEET 2 OF 2)
		<b>B24-18-16</b>

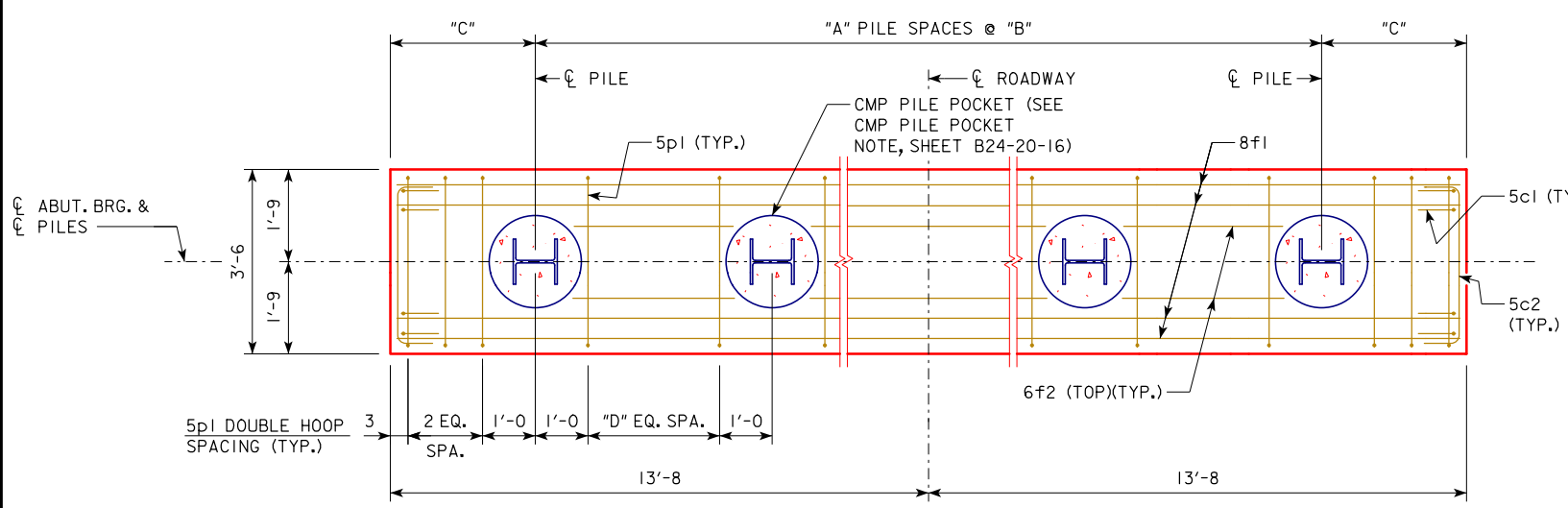


REAR ELEVATION AT ABUTMENT



PART PLAN VIEW

PART SECTION THROUGH BACKWALL

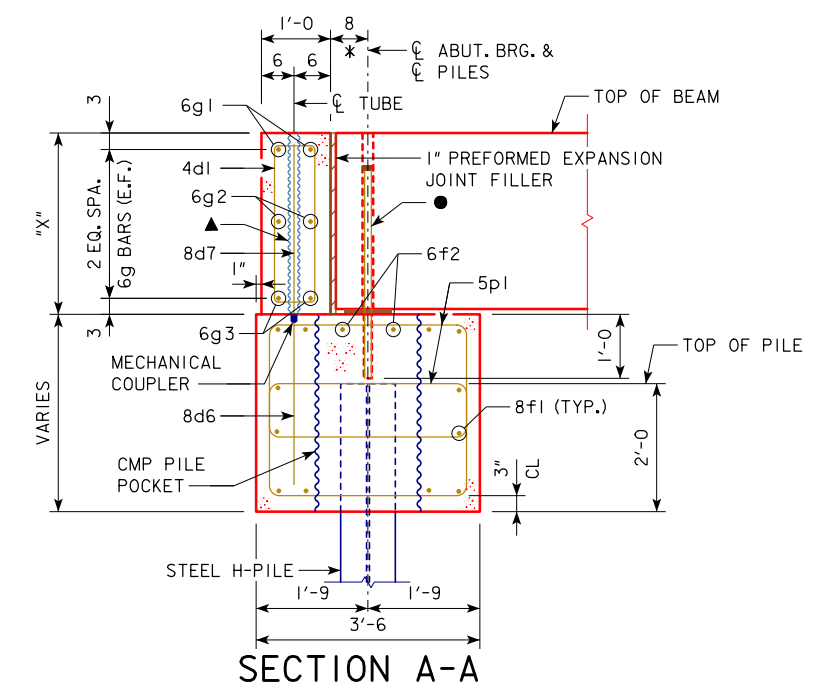


ABUTMENT PILE PLAN

NOTES:  
 ● 1 1/4"  $\phi$  SMOOTH DOWELS (A36).  
 DRILL A 1 1/2"  $\phi$  HOLE 12" DEEP INTO ABUTMENT AFTER BEAMS ARE IN PLACE. USE LOW IMPACT ROTARY DRILL. PRIOR TO SETTING DOWEL, FILL HOLE TO A DEPTH OF 4" WITH A POLYMER GROUT SYSTEM IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. PLACE 2"  $\phi$  x 1" THICK POLYSTYRENE PLUG ON TOP OF DOWEL. FILL REMAINDER OF HOLE ABOVE PLUG WITH NON-SHRINK GROUT.  
 \* THIS DIMENSION MAY VARY. TILTING OF THE BACKWALL DURING CONSTRUCTION MAY BE NECESSARY TO ACCOMMODATE BEAM CAMBER AND LONGITUDINAL GRADE.  
 ▲ 3" DIAMETER PLASTIC CORRUGATED TUBE. COVER TOP OF DOWELS WITH 2" OF GROUT.

ABUTMENT DATA (0° SKEW)								
SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
	30'-0"	40'-0"	50'-0"	30'-0"	40'-0"	50'-0"	60'-0"	70'-0"
"W" (FT. - IN.)	4'-0"	4'-0"	4'-0"	3'-0"	3'-0"	4'-0"	4'-0"	4'-0"
"X" (FT. - IN.)	2'-4 3/4"	2'-4 3/4"	2'-10 3/4"	1'-10 3/4"	1'-10 3/4"	2'-4 3/4"	2'-4 3/4"	2'-10 3/4"
"Y" (FT. - IN.)	2'-0"	2'-0"	2'-0"	1'-6"	1'-6"	2'-0"	2'-0"	2'-0"
"Z" (FT. - IN.)	2'-4"	2'-4"	2'-10"	2'-4"	2'-4"	2'-4"	2'-4"	2'-10"
"A" PILE SPACES	4	4	4	4	4	4	4	5
"B" (FT. - IN.)	5'-7"	5'-7"	5'-7"	5'-7"	5'-7"	5'-7"	5'-7"	4'-5"
"C" (FT. - IN.)	2'-6"	2'-6"	2'-6"	2'-6"	2'-6"	2'-6"	2'-6"	2'-7 1/2"
"D" EQUAL SPACES	4	4	4	4	4	4	4	3
NO. OF PILES PER ABUT.	5	5	5	5	5	5	5	6
P <sub>u</sub> , STRENGTH I DESIGN LOAD (KIPS)	97	114	133	94	109	128	141	137

NOTE:  
 P<sub>u</sub>, STRENGTH I DESIGN LOAD (KIPS) IS NOT THE VALUE USED IN THE FIELD FOR DRIVING PILES.



SECTION A-A

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0" ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		<b>ABUTMENT DETAILS (PRECAST)          CONCRETE WINGS          0° SKEW</b>	<b>B24-19-16</b>

## EPOXY COATED REINFORCING BAR LIST, PRECAST ABUTMENT BACKWALL (0° SKEW, ONE UNIT)

(INCLUDED IN BID ITEM "PRECAST ABUTMENT BACKWALL (CONCRETE WINGS)", EACH)

BAR	LOCATION	SHAPE	REINFORCED CONCRETE BOX BEAMS									PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS																				
			30'-0			40'-0			50'-0			30'-0			40'-0			50'-0			60'-0			70'-0								
			NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT			
4d1	BACKWALL, VERTICAL STIRRUPS		14	6'-1	57	14	6'-1	57	14	7'-1	66	14	5'-1	48	14	5'-1	48	14	6'-1	57	14	6'-1	57	14	7'-1	66	14	7'-1	66			
4d2	BACKWALL, VERTICAL STIRRUPS		1	9'-9	7	1	9'-9	7	1	10'-9	7	1	8'-9	6	1	8'-9	6	1	9'-9	7	1	9'-9	7	1	10'-9	7	1	10'-9	7			
4d3	BACKWALL, VERTICAL STIRRUPS		1	8'-9	6	1	8'-9	6	1	9'-9	7	1	8'-1	5	1	8'-1	5	1	8'-9	6	1	8'-9	6	1	9'-9	7	1	9'-9	7			
4d4	BACKWALL, VERTICAL STIRRUPS		1	7'-11	5	1	7'-11	5	1	8'-11	6	1	7'-7	5	1	7'-7	5	1	7'-11	5	1	7'-11	5	1	8'-11	6	1	8'-11	6			
4d5	BACKWALL, VERTICAL STIRRUPS		1	6'-11	5	1	6'-11	5	1	7'-11	5	1	6'-11	5	1	6'-11	5	1	6'-11	5	1	6'-11	5	1	7'-11	5	1	7'-11	5			
8d7 *	BACKWALL, VERTICAL		7	2'-2	40	7	2'-2	40	7	2'-8	50	7	1'-8	31	7	1'-8	31	7	2'-2	40	7	2'-2	40	7	2'-8	50	7	2'-8	50			
6g1	BACKWALL, HORIZONTAL		2	19'-7	59	2	19'-7	59	2	20'-1	60	2	18'-6	56	2	18'-6	56	2	19'-7	59	2	19'-7	59	2	20'-1	60	2	20'-1	60			
6g2	BACKWALL, HORIZONTAL		2	15'-3	46	2	15'-3	46	2	15'-9	47	2	14'-9	44	2	14'-9	44	2	15'-3	46	2	15'-3	46	2	15'-9	47	2	15'-9	47			
6g3	BACKWALL, HORIZONTAL		2	17'-3	52	2	17'-3	52	2	17'-3	52	2	16'-3	49	2	16'-3	49	2	17'-3	52	2	17'-3	52	2	17'-3	52	2	17'-3	52			
6g4	BACKWALL, HORIZONTAL		4	3'-7	22	4	3'-7	22	4	3'-7	22	4	2'-7	16	4	2'-7	16	4	3'-7	22	4	3'-7	22	4	3'-7	22	4	3'-7	22			
TOTAL (LBS.)			299			299			322			265			265			299			299			322								

\* SEE BENT BAR DETAILS. THE LENGTHS SHOWN DO NOT INCLUDE AN ALLOWANCE FOR THE THREADED END. BAR LENGTHS MAY NEED TO INCREASE DEPENDING ON THE MECHANICAL COUPLER ASSEMBLY USED. THE COST OF THE THREADED PORTION OF THESE BARS IS TO BE INCLUDED IN THE PRICE BID FOR THE BACKWALLS. THE WEIGHT OF THE THREADED END IS NOT INCLUDED IN THE QUANTITY SHOWN.

### ABUTMENT NOTES:

MINIMUM CLEAR DISTANCE FROM FACE OF CONCRETE TO NEAR REINFORCING BAR IS TO BE 2" UNLESS OTHERWISE NOTED OR SHOWN. ABUTMENT PILES SHALL BE DRIVEN TO VALUES SHOWN IN THE DESIGN PLANS.

THE BACKWALL SHALL BE PLACED AFTER THE UHPC JOINTS BETWEEN THE BEAMS HAVE BEEN COMPLETED.

MECHANICAL COUPLERS SHALL BE EPOXY COATED.

THE MECHANICAL COUPLERS SHALL MEET THE REQUIREMENTS OF MATERIALS IM 451 APPENDIX E, EXCEPT THE MECHANICAL SPLICE IS REQUIRED TO BE EMBEDDED ON THE ABUTMENT FOOTING SIDE OF THE CONSTRUCTION JOINT.

THE PRECAST BACKWALLS SHALL BE DRY FITTED TO THE PRECAST ABUTMENTS IN THE PRECASTER'S YARD OR SHOP BEFORE SHIPPING THE PIECES TO THE FIELD.

THE ENGINEER SHALL HAVE 48 HOURS NOTICE TO VIEW AND APPROVE THE CONNECTED PRECAST PIECES BEFORE THEY ARE SHIPPED TO THE FIELD.

## EPOXY COATED REINFORCING BAR LIST, PRECAST ABUTMENT FOOTING (ONE FOOTING)

(INCLUDED IN BID ITEM "PRECAST FOOTING (CONCRETE WINGS)", EACH)

BAR	LOCATION	SHAPE	REINFORCED CONCRETE BOX BEAMS									PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS																				
			30'-0			40'-0			50'-0			30'-0			40'-0			50'-0			60'-0			70'-0								
			NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT			
5c1	FOOTING END, VERTICAL		8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31			
5c2	FOOTING END, HORIZONTAL		8	4'-4	36	8	4'-4	36	8	4'-4	36	8	4'-4	36	8	4'-4	36	8	4'-4	36	8	4'-4	36	8	4'-4	36	8	4'-4	36			
8d6**	FOOTING, VERTICAL		14	2'-7	97	14	2'-7	97	14	2'-7	97	14	2'-7	97	14	2'-7	97	14	2'-7	97	14	2'-7	97	14	2'-7	97	14	2'-7	97			
8f1	FOOTING, LONGITUDINAL		12	27'-0	865	12	27'-0	865	12	27'-0	865	12	27'-0	865	12	27'-0	865	12	27'-0	865	12	27'-0	865	12	27'-0	865	12	27'-0	865			
6f2	FOOTING, LONGITUDINAL		8	3'-7	43	8	3'-7	43	8	3'-7	43	8	3'-7	43	8	3'-7	43	8	3'-7	43	8	3'-7	43	10	2'-5	36	8	3'-7	43			
5p1	FOOTING, HOOPS		52	11'-8	633	52	11'-8	633	52	11'-8	633	52	11'-8	633	52	11'-8	633	52	11'-8	633	52	11'-8	633	52	11'-8	633	52	11'-8	633			
	1/4" DIA. SMOOTH DOWELS		6	2'-9	69	6	2'-9	69	6	3'-3	82	6	2'-3	56	6	2'-3	56	6	2'-9	69	6	2'-9	69	6	2'-9	69	6	3'-3	82			
TOTAL (LBS.)			1,774			1,774			1,787			1,761			1,761			1,774			1,774			1,780								

\*\* INCLUDES MECHANICAL COUPLERS. SEE BENT BAR DETAILS.

### CMP PILE

### POCKET NOTE:

PILE POCKETS SHALL CONSIST OF GALVANIZED STEEL CORRUGATED METAL PIPE (CMP), TYPE 1, 16 GAGE, IN ACCORDANCE WITH THE PRECAST CONCRETE ELEMENTS NOTES. CMP FOR INDIVIDUAL POCKETS SHALL CONSIST OF A SINGLE LENGTH OF PIPE; SPLICING OF PIPE SECTIONS SHALL NOT BE ALLOWED. NOMINAL CMP SIZE SHALL BE 21". FOLLOWING SETTING OF THE FOOTING, THE PILE POCKETS SHALL BE FILLED LEVEL WITH THE TOP OF FOOTING USING HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE IN ACCORDANCE WITH THE PRECAST CONCRETE ELEMENTS NOTES.

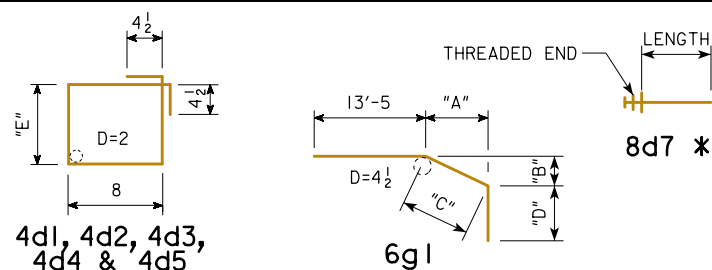
### BACKWALL SETTING NOTES:

THE 8d7 BARS SHALL BE SET AS DOWELS IN PREFORMED HOLES. THE DOWELS SHALL BE INSTALLED IN ACCORDANCE WITH THE GROUT MANUFACTURER'S RECOMMENDATIONS. A POLYMER GROUT SYSTEM IN ACCORDANCE WITH STANDARD SPECIFICATIONS SHALL BE USED AS A BONDING AGENT FOR VERTICAL DOWELS.

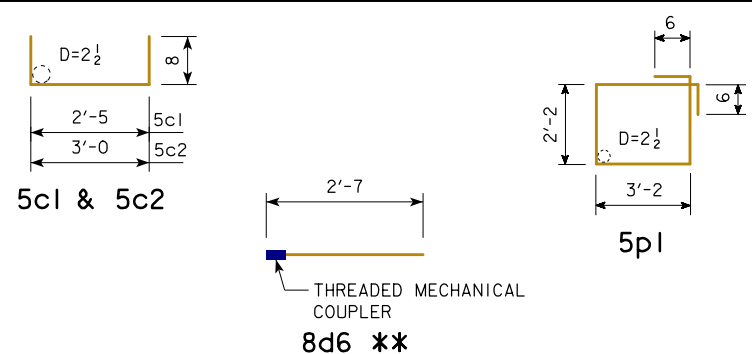
SET PRECAST BACKWALLS ON A EPOXY GROUT BED TO HELP LEVEL AND CONNECT THE PRECAST ELEMENTS.

FOLLOW ALL MANUFACTURER'S RECOMMENDATIONS FOR INSTALLATION.

### BACKWALL BENT BAR DETAILS



### FOOTING BENT BAR DETAILS



NOTE: ALL DIMENSIONS ARE OUT TO OUT. D= PIN DIAMETER.

### PRECAST CONCRETE QUANTITIES (INCLUDED IN PRECAST UNITS. (CONCRETE WINGS))

LOCATION	SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
EACH BACKWALL UNIT (C.Y.) *		1.7	1.7	2.0	1.3	1.3	1.7	1.7	2.0
EACH FOOTING (C.Y.)		9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.4
CMP PILE POCKETS (EACH FOOTING) (C.Y.) **		1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.7

\* INCLUDES THE COST OF FURNISHING AND PLACING ALL PREFORMED EXPANSION JOINT FILLER.  
\*\* HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE.

BAR	DIM.	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
6g1	"A"	3'-9	3'-9	3'-9	2'-9	2'-9	3'-9	3'-9	3'-9
6g1	"B"	1'-10 1/2	1'-10 1/2	1'-10 1/2	1'-4 1/2	1'-4 1/2	1'-10 1/2	1'-10 1/2	1'-10 1/2
6g1	"C"	4'-2	4'-2	4'-2	3'-1	3'-1	4'-2	4'-2	4'-2
6g1	"D"	2'-0	2'-0	2'-6	2'-0	2'-0	2'-0	2'-0	2'-6
4d1	"E"	2'-0	2'-0	2'-6	1'-6	1'-6	2'-0	2'-0	2'-6
4d2	"E"	3'-10	3'-10	4'-4	3'-4	3'-4	3'-10	3'-10	4'-4
4d3	"E"	3'-4	3'-4	3'-10	3'-0	3'-0	3'-4	3'-4	3'-10
4d4	"E"	2'-11	2'-11	3'-5	2'-9	2'-9	2'-11	2'-11	3'-5
4d5	"E"	2'-5	2'-5	2'-11	2'-5	2'-5	2'-5	2'-5	2'-11

NOTE: ALL DIMENSIONS ARE OUT TO OUT. D= PIN DIAMETER.

LATEST REVISION DATE

STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN  
**CONCRETE BOX BEAM BRIDGES**

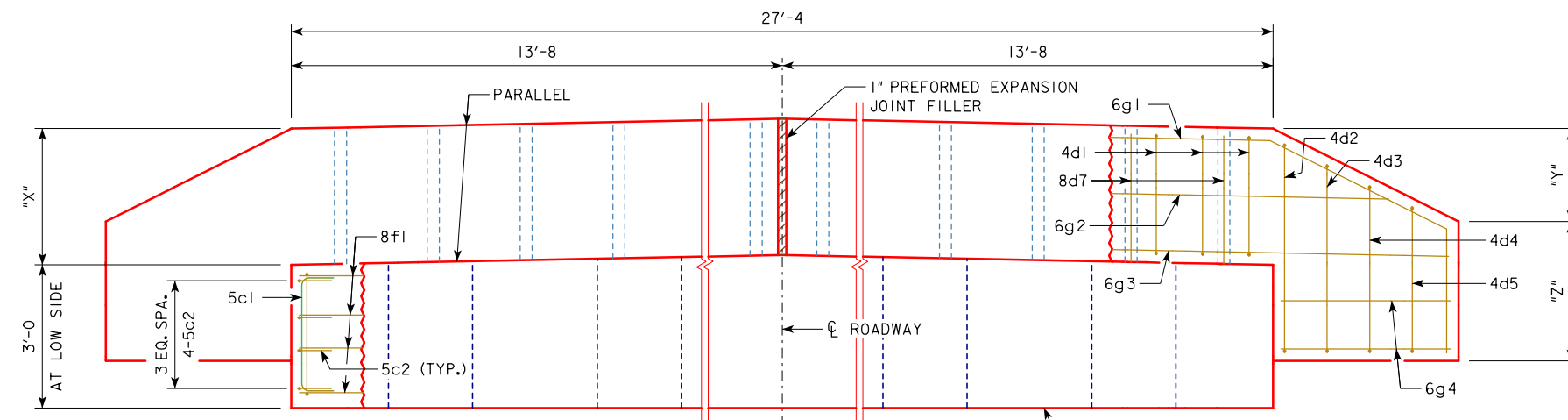
DECEMBER, 2016

**ABUTMENT DETAILS (PRECAST)  
CONCRETE WINGS  
QUANTITIES  
0° SKEW**

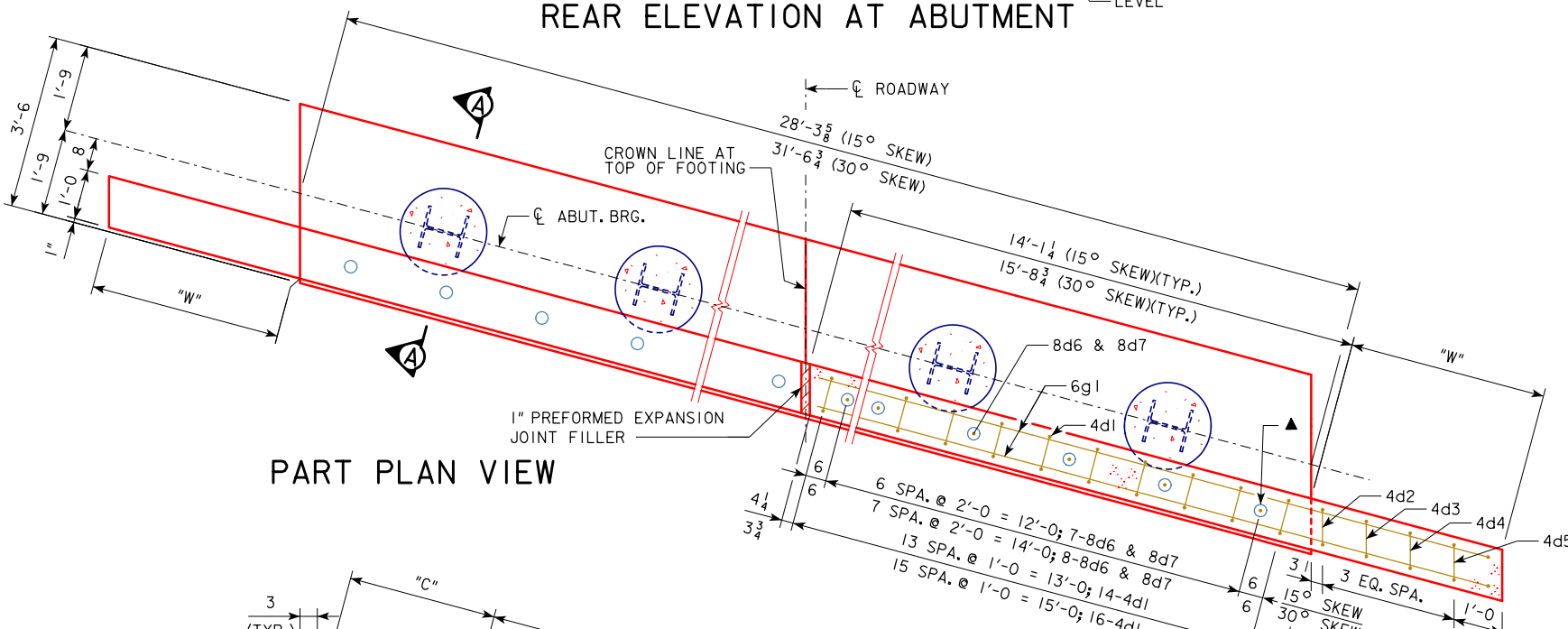
**B24-20-16**

APPROVED BY BRIDGE ENGINEER

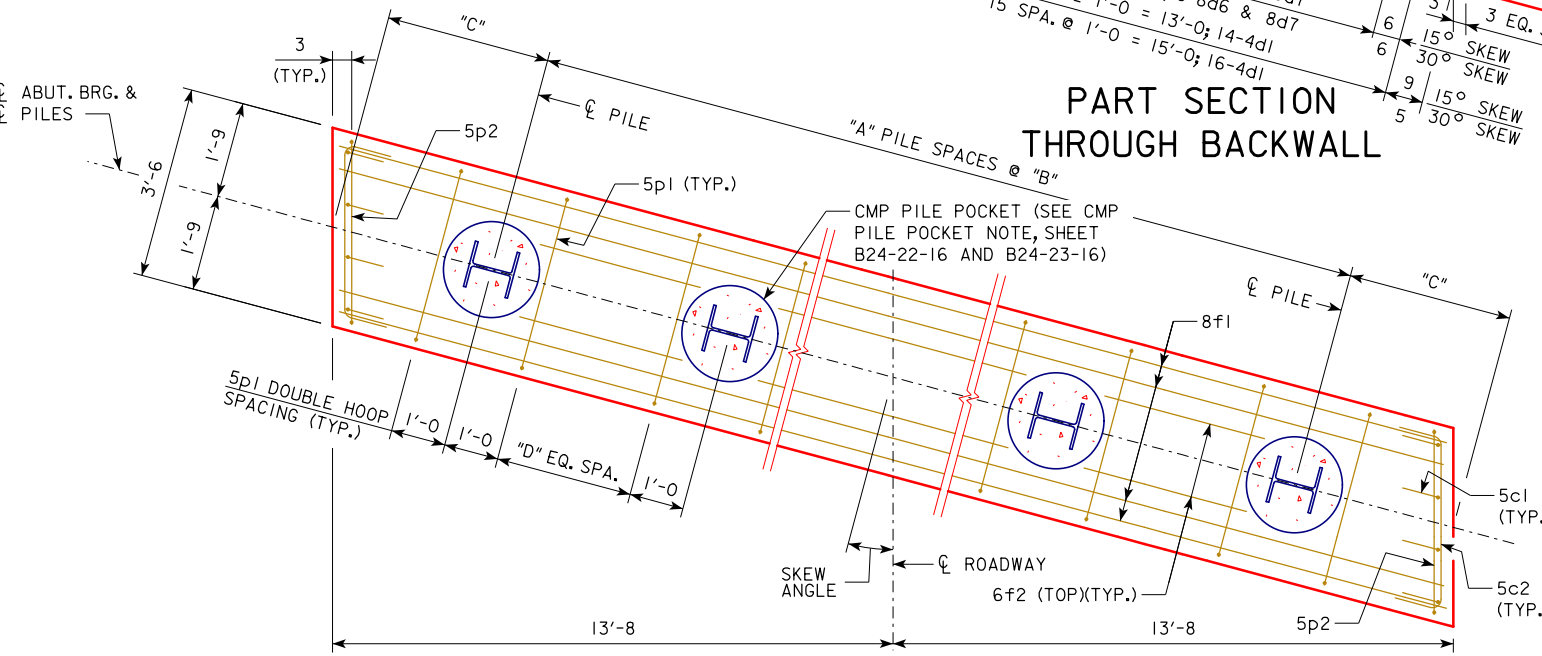
*Thomas L. Mc Donald*



REAR ELEVATION AT ABUTMENT



PART PLAN VIEW



PART SECTION THROUGH BACKWALL



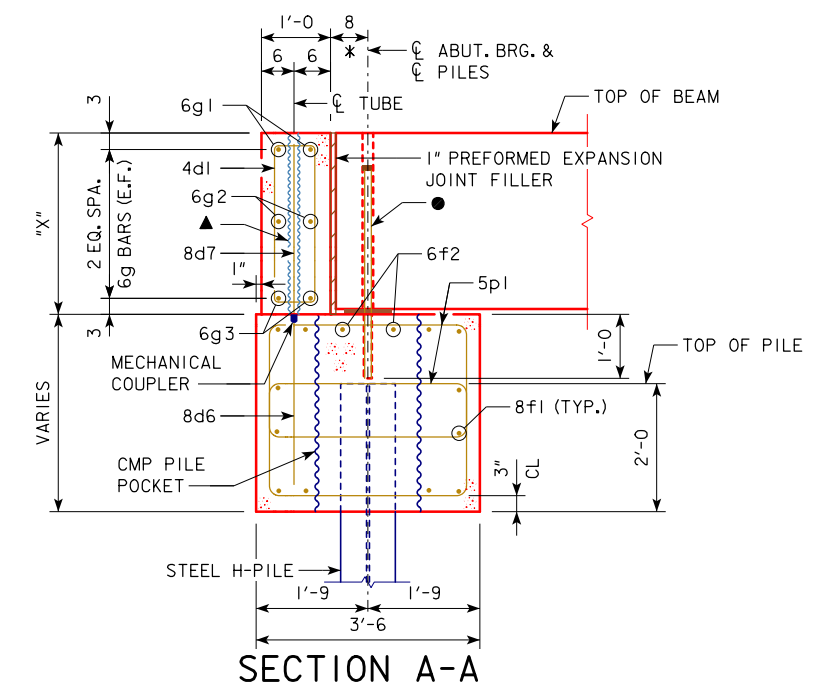
ABUTMENT PILE PLAN

NOTES:  
 ● 1 1/4" Ø SMOOTH DOWELS (A36).  
 DRILL A 1 1/2" Ø HOLE 12" DEEP INTO ABUTMENT AFTER BEAMS ARE IN PLACE. USE LOW IMPACT ROTARY DRILL. PRIOR TO SETTING DOWEL, FILL HOLE TO A DEPTH OF 4" WITH A POLYMER GROUT SYSTEM IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. PLACE 2" Ø x 1" THICK POLYSTYRENE PLUG ON TOP OF DOWEL. FILL REMAINDER OF HOLE ABOVE PLUG WITH NON-SHRINK GROUT.  
 \* THIS DIMENSION MAY VARY. TILTING OF THE BACKWALL DURING CONSTRUCTION MAY BE NECESSARY TO ACCOMMODATE BEAM CAMBER AND LONGITUDINAL GRADE.  
 ▲ 3" DIAMETER PLASTIC CORRUGATED TUBE. COVER TOP OF DOWELS WITH 2" OF GROUT.

ABUTMENT DATA (15° SKEW)								
SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
	30'-0"	40'-0"	50'-0"	30'-0"	40'-0"	50'-0"	60'-0"	70'-0"
"W" (FT. - IN.)	4'-0"	4'-0"	4'-0"	3'-0"	3'-0"	4'-0"	4'-0"	4'-0"
"X" (FT. - IN.)	2'-4 3/4"	2'-4 3/4"	2'-10 3/4"	1'-10 3/4"	1'-10 3/4"	2'-4 3/4"	2'-4 3/4"	2'-10 3/4"
"Y" (FT. - IN.)	2'-0"	2'-0"	2'-0"	1'-6"	1'-6"	2'-0"	2'-0"	2'-0"
"Z" (FT. - IN.)	2'-4"	2'-4"	2'-10"	2'-4"	2'-4"	2'-4"	2'-4"	2'-10"
"A" PILE SPACES	4	4	4	4	4	4	4	5
"B" (FT. - IN.)	6'-0"	6'-0"	6'-0"	6'-0"	6'-0"	6'-0"	6'-0"	4'-10"
"C" (FT. - IN.)	2'-1 13/16"	2'-1 13/16"	2'-1 13/16"	2'-1 13/16"	2'-1 13/16"	2'-1 13/16"	2'-1 13/16"	2'-0 13/16"
"D" EQUAL SPACES	4	4	4	4	4	4	4	3
NO. OF PILES PER ABUT.	5	5	5	5	5	5	5	6
PU, STRENGTH I DESIGN LOAD (KIPS)	97	113	133	93	109	127	141	135

ABUTMENT DATA (30° SKEW)								
SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
	30'-0"	40'-0"	50'-0"	30'-0"	40'-0"	50'-0"	60'-0"	70'-0"
"W" (FT. - IN.)	4'-0"	4'-0"	4'-0"	3'-0"	3'-0"	4'-0"	4'-0"	4'-0"
"X" (FT. - IN.)	2'-4 3/4"	2'-4 3/4"	2'-10 3/4"	1'-10 3/4"	1'-10 3/4"	2'-4 3/4"	2'-4 3/4"	2'-10 3/4"
"Y" (FT. - IN.)	2'-0"	2'-0"	2'-0"	1'-6"	1'-6"	2'-0"	2'-0"	2'-0"
"Z" (FT. - IN.)	2'-4"	2'-4"	2'-10"	2'-4"	2'-4"	2'-4"	2'-4"	2'-10"
"A" PILE SPACES	4	4	4	4	4	4	4	5
"B" (FT. - IN.)	6'-9"	6'-9"	6'-9"	6'-9"	6'-9"	6'-9"	6'-9"	5'-5"
"C" (FT. - IN.)	2'-3 3/8"	2'-3 3/8"	2'-3 3/8"	2'-3 3/8"	2'-3 3/8"	2'-3 3/8"	2'-3 3/8"	2'-2 7/8"
"D" EQUAL SPACES	5	5	5	5	5	5	5	4
NO. OF PILES PER ABUT.	5	5	5	5	5	5	5	6
PU, STRENGTH I DESIGN LOAD (KIPS)	99	115	135	95	110	129	143	137

NOTE:  
 PU, STRENGTH I DESIGN LOAD (KIPS) IS NOT THE VALUE USED IN THE FIELD FOR DRIVING PILES.



SECTION A-A

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		<b>ABUTMENT DETAILS (PRECAST)          CONCRETE WINGS          15° AND 30° SKEW</b>	<b>B24-21-16</b>

## EPOXY COATED REINFORCING BAR LIST, PRECAST ABUTMENT BACKWALL (ONE UNIT)

(INCLUDED IN BID ITEM "PRECAST ABUTMENT BACKWALL (CONCRETE WINGS)", EACH)

BAR		LOCATION		SPAN		REINFORCED CONCRETE BOX BEAMS									PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS														
						30'-0			40'-0			50'-0			30'-0			40'-0			50'-0			60'-0			70'-0		
						NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4d1	BACKWALL, VERTICAL STIRRUPS	□	14	6'-1	57	14	6'-1	57	14	7'-1	66	14	5'-1	48	14	5'-1	48	14	6'-1	57	14	6'-1	57	14	7'-1	66			
4d2	BACKWALL, VERTICAL STIRRUPS	□	1	9'-9	7	1	9'-9	7	1	10'-9	7	1	8'-9	6	1	8'-9	6	1	9'-9	7	1	9'-9	7	1	10'-9	7			
4d3	BACKWALL, VERTICAL STIRRUPS	□	1	8'-9	6	1	8'-9	6	1	9'-9	7	1	8'-1	5	1	8'-1	5	1	8'-9	6	1	8'-9	6	1	9'-9	7			
4d4	BACKWALL, VERTICAL STIRRUPS	□	1	7'-11	5	1	7'-11	5	1	8'-11	6	1	7'-7	5	1	7'-7	5	1	7'-11	5	1	7'-11	5	1	8'-11	6			
4d5	BACKWALL, VERTICAL STIRRUPS	□	1	6'-11	5	1	6'-11	5	1	7'-11	5	1	6'-11	5	1	6'-11	5	1	6'-11	5	1	6'-11	5	1	7'-11	5			
8d7 *	BACKWALL, VERTICAL	—	7	2'-2	40	7	2'-2	40	7	2'-8	50	7	1'-8	31	7	1'-8	31	7	2'-2	40	7	2'-2	40	7	2'-8	50			
6g1	BACKWALL, HORIZONTAL	—	2	20'-1	60	2	20'-1	60	2	20'-7	62	2	19'-0	57	2	19'-0	57	2	20'-1	60	2	20'-1	60	2	20'-7	62			
6g2	BACKWALL, HORIZONTAL	—	2	15'-9	47	2	15'-9	47	2	16'-3	49	2	15'-3	46	2	15'-3	46	2	15'-9	47	2	15'-9	47	2	16'-3	49			
6g3	BACKWALL, HORIZONTAL	—	2	17'-9	53	2	17'-9	53	2	17'-9	53	2	16'-9	50	2	16'-9	50	2	17'-9	53	2	17'-9	53	2	17'-9	53			
6g4	BACKWALL, HORIZONTAL	—	4	3'-7	22	4	3'-7	22	4	3'-7	22	4	2'-7	16	4	2'-7	16	4	3'-7	22	4	3'-7	22	4	3'-7	22			
TOTAL (LBS.)			302			302			327			269			269			302			302			327					

\* SEE BENT BAR DETAILS. THE LENGTHS SHOWN DO NOT INCLUDE AN ALLOWANCE FOR THE THREADED END. BAR LENGTHS MAY NEED TO INCREASE DEPENDING ON THE MECHANICAL COUPLER ASSEMBLY USED. THE COST OF THE THREADED PORTION OF THESE BARS IS TO BE INCLUDED IN THE PRICE BID FOR THE BACKWALLS. THE WEIGHT OF THE THREADED END IS NOT INCLUDED IN THE QUANTITY SHOWN.

### ABUTMENT NOTES:

MINIMUM CLEAR DISTANCE FROM FACE OF CONCRETE TO NEAR REINFORCING BAR IS TO BE 2" UNLESS OTHERWISE NOTED OR SHOWN. ABUTMENT PILES SHALL BE DRIVEN TO VALUES SHOWN IN THE DESIGN PLANS.

THE BACKWALL SHALL BE PLACED AFTER THE UHPC JOINTS BETWEEN THE BEAMS HAVE BEEN COMPLETED.

MECHANICAL COUPLERS SHALL BE EPOXY COATED.

THE MECHANICAL COUPLERS SHALL MEET THE REQUIREMENTS OF MATERIALS IM 451 APPENDIX E, EXCEPT THE MECHANICAL SPLICE IS REQUIRED TO BE EMBEDDED ON THE ABUTMENT FOOTING SIDE OF THE CONSTRUCTION JOINT.

THE PRECAST BACKWALLS SHALL BE DRY FITTED TO THE PRECAST ABUTMENTS IN THE PRECASTER'S YARD OR SHOP BEFORE SHIPPING THE PIECES TO THE FIELD.

THE ENGINEER SHALL HAVE 48 HOURS NOTICE TO VIEW AND APPROVE THE CONNECTED PRECAST PIECES BEFORE THEY ARE SHIPPED TO THE FIELD.

## EPOXY COATED REINFORCING BAR LIST, PRECAST ABUTMENT FOOTING (ONE FOOTING)

(INCLUDED IN BID ITEM "PRECAST FOOTING (CONCRETE WINGS)", EACH)

BAR		LOCATION		SPAN		REINFORCED CONCRETE BOX BEAMS									PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS														
						30'-0			40'-0			50'-0			30'-0			40'-0			50'-0			60'-0			70'-0		
						NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
5c1	FOOTING END, VERTICAL	□	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31			
5c2	FOOTING END, HORIZONTAL	—	8	4'-5	37	8	4'-5	37	8	4'-5	37	8	4'-5	37	8	4'-5	37	8	4'-5	37	8	4'-5	37	8	4'-5	37			
8d6**	FOOTING, VERTICAL	—	14	2'-7	97	14	2'-7	97	14	2'-7	97	14	2'-7	97	14	2'-7	97	14	2'-7	97	14	2'-7	97	14	2'-7	97			
8f1	FOOTING, LONGITUDINAL	—	12	27'-11	894	12	27'-11	894	12	27'-11	894	12	27'-11	894	12	27'-11	894	12	27'-11	894	12	27'-11	894	12	27'-11	894			
6f2	FOOTING, LONGITUDINAL	—	8	4'-0	48	8	4'-0	48	8	4'-0	48	8	4'-0	48	8	4'-0	48	8	4'-0	48	8	4'-0	48	10	2'-10	43			
5p1	FOOTING, HOOPS	□	44	11'-8	535	44	11'-8	535	44	11'-8	535	44	11'-8	535	44	11'-8	535	44	11'-8	535	44	11'-8	535	44	11'-8	535			
5p2	FOOTING, HOOPS	□	4	11'-10	49	4	11'-10	49	4	11'-10	49	4	11'-10	49	4	11'-10	49	4	11'-10	49	4	11'-10	49	4	11'-10	49			
1/4" DIA. SMOOTH DOWELS		—	6	2'-9	69	6	2'-9	69	6	3'-3	82	6	2'-3	56	6	2'-3	56	6	2'-9	69	6	2'-9	69	6	3'-3	82			
TOTAL (LBS.)			1,760			1,760			1,773			1,747			1,747			1,760			1,760			1,768					

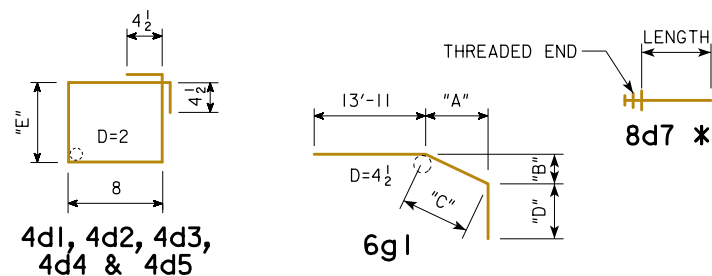
\*\* INCLUDES MECHANICAL COUPLERS. SEE BENT BAR DETAILS.

### CMP PILE

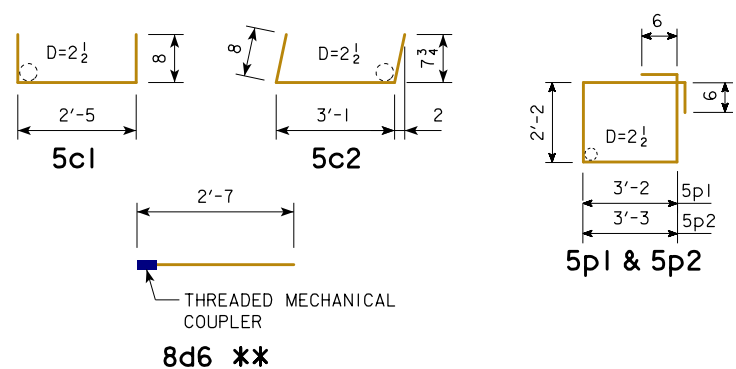
### POCKET NOTE:

PILE POCKETS SHALL CONSIST OF GALVANIZED STEEL CORRUGATED METAL PIPE (CMP), TYPE 1, 16 GAGE, IN ACCORDANCE WITH THE PRECAST CONCRETE ELEMENTS NOTES. CMP FOR INDIVIDUAL POCKETS SHALL CONSIST OF A SINGLE LENGTH OF PIPE; SPLICING OF PIPE SECTIONS SHALL NOT BE ALLOWED. NOMINAL CMP SIZE SHALL BE 21". FOLLOWING SETTING OF THE FOOTING, THE PILE POCKETS SHALL BE FILLED LEVEL WITH THE TOP OF FOOTING USING HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE IN ACCORDANCE WITH THE PRECAST CONCRETE ELEMENTS NOTES.

### BACKWALL BENT BAR DETAILS



### FOOTING BENT BAR DETAILS



NOTE: ALL DIMENSIONS ARE OUT TO OUT. D= PIN DIAMETER.

### ADDITIONAL CONCRETE

EACH FOOTING (C.Y.)	ROADWAY GRADE AT ABUTMENT				
	1%	2%	3%	4%	5%
-	-	-	-	0.5	0.7

### NOTES:

THE ADDITIONAL CONCRETE TABLE LISTS THE ADDITIONAL CONCRETE VOLUME REQUIRED IN EACH PRECAST ABUTMENT FOOTING BASED ON THE ROADWAY GRADE AT EACH ABUTMENT. THIS ADDITIONAL CONCRETE IS INCLUDED IN THE BID ITEM FOR PRECAST FOOTING (CONCRETE WINGS). THE QUANTITIES SHOWN IN THE PRECAST CONCRETE QUANTITIES TABLE ARE BASED ON 0% GRADE.

### BACKWALL SETTING NOTES:

THE 8d7 BARS SHALL BE SET AS DOWELS IN PREFORMED HOLES. THE DOWELS SHALL BE INSTALLED IN ACCORDANCE WITH THE GROUT MANUFACTURER'S RECOMMENDATIONS. A POLYMER GROUT SYSTEM IN ACCORDANCE WITH STANDARD SPECIFICATIONS SHALL BE USED AS A BONDING AGENT FOR VERTICAL DOWELS.

SET PRECAST BACKWALLS ON A EPOXY GROUT BED TO HELP LEVEL AND CONNECT THE PRECAST ELEMENTS.

FOLLOW ALL MANUFACTURER'S RECOMMENDATIONS FOR INSTALLATION.

BAR	DIM.	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
6g1	"A"	3'-9	3'-9	3'-9	2'-9	2'-9	3'-9	3'-9	3'-9
6g1	"B"	1'-10 1/2	1'-10 1/2	1'-10 1/2	1'-4 1/2	1'-4 1/2	1'-10 1/2	1'-10 1/2	1'-10 1/2
6g1	"C"	4'-2	4'-2	4'-2	3'-1	3'-1	4'-2	4'-2	4'-2
6g1	"D"	2'-0	2'-0	2'-6	2'-0	2'-0	2'-0	2'-0	2'-6
4d1	"E"	2'-0	2'-0	2'-6	1'-6	1'-6	2'-0	2'-0	2'-6
4d2	"E"	3'-10	3'-10	4'-4	3'-4	3'-4	3'-10	3'-10	4'-4
4d3	"E"	3'-4	3'-4	3'-10	3'-0	3'-0	3'-4	3'-4	3'-10
4d4	"E"	2'-11	2'-11	3'-5	2'-9	2'-9	2'-11	2'-11	3'-5
4d5	"E"	2'-5	2'-5	2'-11	2'-5	2'-5	2'-5	2'-5	2'-11

NOTE: ALL DIMENSIONS ARE OUT TO OUT. D= PIN DIAMETER.

### PRECAST CONCRETE QUANTITIES (INCLUDED IN PRECAST UNITS. (CONCRETE WINGS))

LOCATION	SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
EACH BACKWALL UNIT (C.Y.) *		1.7	1.7	2.1	1.3	1.3	1.7	1.7	2.1
EACH FOOTING (C.Y.)		10.1	10.1	10.1	10.1	10.1	10.1	10.1	9.8
CMP PILE POCKETS (EACH FOOTING) (C.Y.) **		1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.7

\* INCLUDES THE COST OF FURNISHING AND PLACING ALL PREFORMED EXPANSION JOINT FILLER.  
\*\* HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016		<b>ABUTMENT DETAILS (PRECAST) CONCRETE WINGS QUANTITIES 15° SKEW</b>
		B24-22-16		

## EPOXY COATED REINFORCING BAR LIST, PRECAST ABUTMENT BACKWALL (ONE UNIT)

(INCLUDED IN BID ITEM "PRECAST ABUTMENT BACKWALL (CONCRETE WINGS)", EACH)

BAR		LOCATION		SPAN		REINFORCED CONCRETE BOX BEAMS									PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS														
						30'-0			40'-0			50'-0			30'-0			40'-0			50'-0			60'-0			70'-0		
						NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4d1	BACKWALL, VERTICAL STIRRUPS	□	16	6'-1	65	16	6'-1	65	16	7'-1	76	16	5'-1	54	16	5'-1	54	16	6'-1	65	16	6'-1	65	16	7'-1	76			
4d2	BACKWALL, VERTICAL STIRRUPS	□	1	9'-11	7	1	9'-11	7	1	10'-11	7	1	8'-11	6	1	8'-11	6	1	9'-11	7	1	9'-11	7	1	10'-11	7			
4d3	BACKWALL, VERTICAL STIRRUPS	□	1	8'-11	6	1	8'-11	6	1	9'-11	7	1	8'-3	6	1	8'-3	6	1	8'-11	6	1	8'-11	6	1	9'-11	7			
4d4	BACKWALL, VERTICAL STIRRUPS	□	1	8'-1	5	1	8'-1	5	1	9'-1	6	1	7'-9	5	1	7'-9	5	1	8'-1	5	1	8'-1	5	1	9'-1	6			
4d5	BACKWALL, VERTICAL STIRRUPS	□	1	7'-1	5	1	7'-1	5	1	8'-1	5	1	7'-1	5	1	7'-1	5	1	7'-1	5	1	7'-1	5	1	8'-1	5			
8d7 *	BACKWALL, VERTICAL	—	8	2'-2	46	8	2'-2	46	8	2'-8	57	8	1'-8	36	8	1'-8	36	8	2'-2	46	8	2'-2	46	8	2'-8	57			
6g1	BACKWALL, HORIZONTAL	—	2	21'-8	65	2	21'-8	65	2	22'-2	67	2	20'-7	62	2	20'-7	62	2	21'-8	65	2	21'-8	65	2	22'-2	67			
6g2	BACKWALL, HORIZONTAL	—	2	17'-6	53	2	17'-6	53	2	18'-0	54	2	17'-0	51	2	17'-0	51	2	17'-6	53	2	17'-6	53	2	18'-0	54			
6g3	BACKWALL, HORIZONTAL	—	2	19'-4	58	2	19'-4	58	2	19'-4	58	2	18'-4	55	2	18'-4	55	2	19'-4	58	2	19'-4	58	2	19'-4	58			
6g4	BACKWALL, HORIZONTAL	—	4	3'-7	22	4	3'-7	22	4	3'-7	22	4	2'-7	16	4	2'-7	16	4	3'-7	22	4	3'-7	22	4	3'-7	22			
TOTAL (LBS.)			332			332			359			296			296			332			332			359					

\* SEE BENT BAR DETAILS. THE LENGTHS SHOWN DO NOT INCLUDE AN ALLOWANCE FOR THE THREADED END. BAR LENGTHS MAY NEED TO INCREASE DEPENDING ON THE MECHANICAL COUPLER ASSEMBLY USED. THE COST OF THE THREADED PORTION OF THESE BARS IS TO BE INCLUDED IN THE PRICE BID FOR THE BACKWALLS. THE WEIGHT OF THE THREADED END IS NOT INCLUDED IN THE QUANTITY SHOWN.

### ABUTMENT NOTES:

MINIMUM CLEAR DISTANCE FROM FACE OF CONCRETE TO NEAR REINFORCING BAR IS TO BE 2" UNLESS OTHERWISE NOTED OR SHOWN. ABUTMENT PILES SHALL BE DRIVEN TO VALUES SHOWN IN THE DESIGN PLANS.

THE BACKWALL SHALL BE PLACED AFTER THE UHPC JOINTS BETWEEN THE BEAMS HAVE BEEN COMPLETED.

MECHANICAL COUPLERS SHALL BE EPOXY COATED.

THE MECHANICAL COUPLERS SHALL MEET THE REQUIREMENTS OF MATERIALS IM 451 APPENDIX E, EXCEPT THE MECHANICAL SPLICE IS REQUIRED TO BE EMBEDDED ON THE ABUTMENT FOOTING SIDE OF THE CONSTRUCTION JOINT.

THE PRECAST BACKWALLS SHALL BE DRY FITTED TO THE PRECAST ABUTMENTS IN THE PRECASTER'S YARD OR SHOP BEFORE SHIPPING THE PIECES TO THE FIELD.

THE ENGINEER SHALL HAVE 48 HOURS NOTICE TO VIEW AND APPROVE THE CONNECTED PRECAST PIECES BEFORE THEY ARE SHIPPED TO THE FIELD.

## EPOXY COATED REINFORCING BAR LIST, PRECAST ABUTMENT FOOTING (ONE FOOTING)

(INCLUDED IN BID ITEM "PRECAST FOOTING (CONCRETE WINGS)", EACH)

BAR		LOCATION		SPAN		REINFORCED CONCRETE BOX BEAMS									PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS														
						30'-0			40'-0			50'-0			30'-0			40'-0			50'-0			60'-0			70'-0		
						NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
5c1	FOOTING END, VERTICAL	□	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31	8	3'-9	31			
5c2	FOOTING END, HORIZONTAL	□	8	4'-9	40	8	4'-9	40	8	4'-9	40	8	4'-9	40	8	4'-9	40	8	4'-9	40	8	4'-9	40	8	4'-9	40			
8d6**	FOOTING, VERTICAL	—	16	2'-7	110	16	2'-7	110	16	2'-7	110	16	2'-7	110	16	2'-7	110	16	2'-7	110	16	2'-7	110	16	2'-7	110			
8f1	FOOTING, LONGITUDINAL	—	12	31'-2	999	12	31'-2	999	12	31'-2	999	12	31'-2	999	12	31'-2	999	12	31'-2	999	12	31'-2	999	12	31'-2	999			
6f2	FOOTING, LONGITUDINAL	—	8	4'-9	57	8	4'-9	57	8	4'-9	57	8	4'-9	57	8	4'-9	57	8	4'-9	57	8	4'-9	57	10	3'-5	51			
5p1	FOOTING, HOOPS	□	52	11'-8	633	52	11'-8	633	52	11'-8	633	52	11'-8	633	52	11'-8	633	52	11'-8	633	52	11'-8	633	54	11'-8	657			
5p2	FOOTING, HOOPS	□	4	12'-8	53	4	12'-8	53	4	12'-8	53	4	12'-8	53	4	12'-8	53	4	12'-8	53	4	12'-8	53	4	12'-8	53			
	1/4" DIA. SMOOTH DOWELS	—	6	2'-9	69	6	2'-9	69	6	3'-3	82	6	2'-3	56	6	2'-3	56	6	2'-9	64	6	2'-9	69	6	3'-3	82			
TOTAL (LBS.)			1,992			1,992			2,005			1,979			1,979			1,992			1,992			2,023					

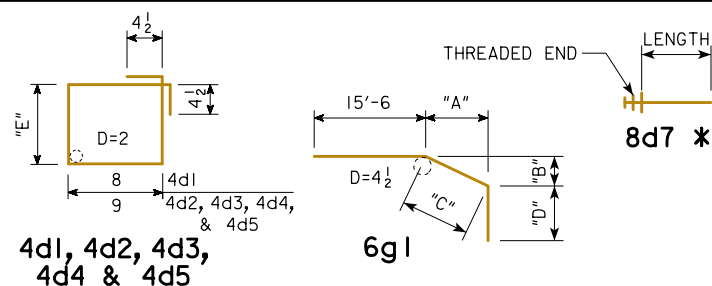
\*\* INCLUDES MECHANICAL COUPLERS. SEE BENT BAR DETAILS.

### CMP PILE

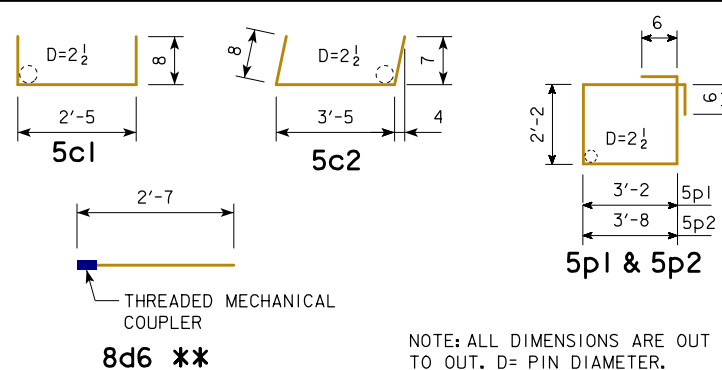
### POCKET NOTE:

PILE POCKETS SHALL CONSIST OF GALVANIZED STEEL CORRUGATED METAL PIPE (CMP), TYPE 1, 16 GAGE, IN ACCORDANCE WITH THE PRECAST CONCRETE ELEMENTS NOTES. CMP FOR INDIVIDUAL POCKETS SHALL CONSIST OF A SINGLE LENGTH OF PIPE; SPLICING OF PIPE SECTIONS SHALL NOT BE ALLOWED. NOMINAL CMP SIZE SHALL BE 21". FOLLOWING SETTING OF THE FOOTING, THE PILE POCKETS SHALL BE FILLED LEVEL WITH THE TOP OF FOOTING USING HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE IN ACCORDANCE WITH THE PRECAST CONCRETE ELEMENTS NOTES.

### BACKWALL BENT BAR DETAILS



### FOOTING BENT BAR DETAILS



NOTE: ALL DIMENSIONS ARE OUT TO OUT. D= PIN DIAMETER.

### ADDITIONAL CONCRETE

EACH FOOTING (C.Y.)	ROADWAY GRADE AT ABUTMENT				
	1%	2%	3%	4%	5%
-	0.6	1.0	1.3	1.6	

### NOTES:

THE ADDITIONAL CONCRETE TABLE LISTS THE ADDITIONAL CONCRETE VOLUME REQUIRED IN EACH PRECAST ABUTMENT FOOTING BASED ON THE ROADWAY GRADE AT EACH ABUTMENT. THIS ADDITIONAL CONCRETE IS INCLUDED IN THE BID ITEM FOR PRECAST FOOTING (CONCRETE WINGS). THE QUANTITIES SHOWN IN THE PRECAST CONCRETE QUANTITIES TABLE ARE BASED ON 0% GRADE.

### BACKWALL SETTING NOTES:

THE 8d7 BARS SHALL BE SET AS DOWELS IN PREFORMED HOLES. THE DOWELS SHALL BE INSTALLED IN ACCORDANCE WITH THE GROUT MANUFACTURER'S RECOMMENDATIONS. A POLYMER GROUT SYSTEM IN ACCORDANCE WITH STANDARD SPECIFICATIONS SHALL BE USED AS A BONDING AGENT FOR VERTICAL DOWELS.

SET PRECAST BACKWALLS ON A EPOXY GROUT BED TO HELP LEVEL AND CONNECT THE PRECAST ELEMENTS.

FOLLOW ALL MANUFACTURER'S RECOMMENDATIONS FOR INSTALLATION.

BAR	DIM.	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
6g1	"A"	3'-9	3'-9	3'-9	2'-9	2'-9	3'-9	3'-9	3'-9
6g1	"B"	1'-10 1/2	1'-10 1/2	1'-10 1/2	1'-4 1/2	1'-4 1/2	1'-10 1/2	1'-10 1/2	1'-10 1/2
6g1	"C"	4'-2	4'-2	4'-2	3'-1	3'-1	4'-2	4'-2	4'-2
6g1	"D"	2'-0	2'-0	2'-6	2'-0	2'-0	2'-0	2'-0	2'-6
4d1	"E"	2'-0	2'-0	2'-6	1'-6	1'-6	2'-0	2'-0	2'-6
4d2	"E"	3'-10	3'-10	4'-4	3'-4	3'-4	3'-10	3'-10	4'-4
4d3	"E"	3'-4	3'-4	3'-10	3'-0	3'-0	3'-4	3'-4	3'-10
4d4	"E"	2'-11	2'-11	3'-5	2'-9	2'-9	2'-11	2'-11	3'-5
4d5	"E"	2'-5	2'-5	2'-11	2'-5	2'-5	2'-5	2'-5	2'-11

NOTE: ALL DIMENSIONS ARE OUT TO OUT. D= PIN DIAMETER.

### PRECAST CONCRETE QUANTITIES (INCLUDED IN PRECAST UNITS. (CONCRETE WINGS))

LOCATION	SPAN	REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
EACH BACKWALL UNIT (C.Y.) *		1.9	1.9	2.3	1.5	1.5	1.9	1.9	2.3
EACH FOOTING (C.Y.)		11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.1
CMP PILE POCKETS (EACH FOOTING) (C.Y.) **		1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.7

\* INCLUDES THE COST OF FURNISHING AND PLACING ALL PREFORMED EXPANSION JOINT FILLER.  
\*\* HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE.

LATEST REVISION DATE

STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN  
**CONCRETE BOX BEAM BRIDGES**

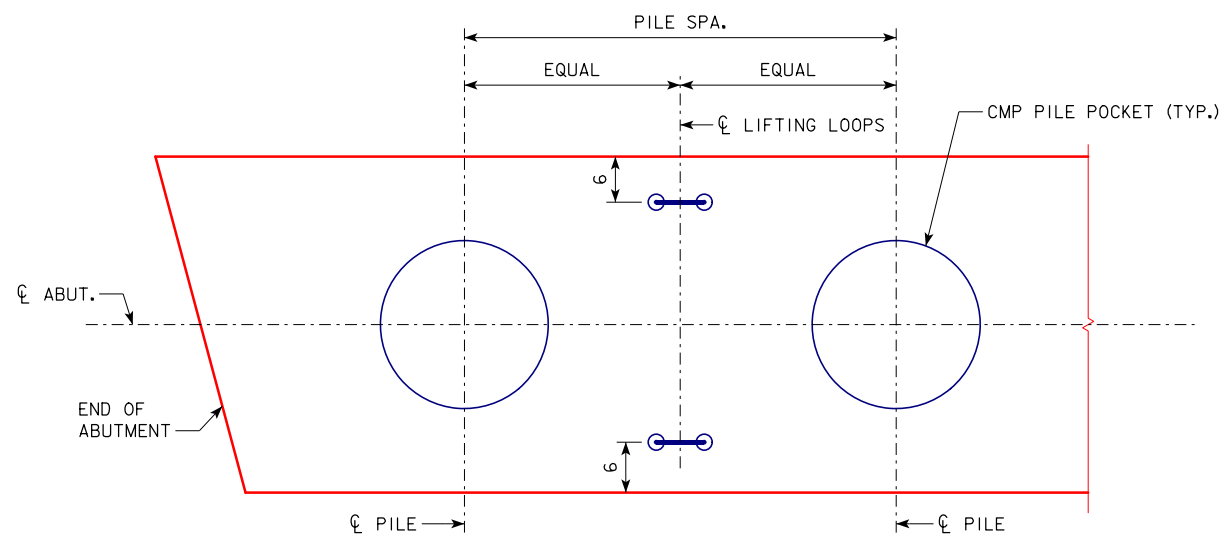
DECEMBER, 2016

**ABUTMENT DETAILS (PRECAST)  
CONCRETE WINGS  
QUANTITIES  
30° SKEW**

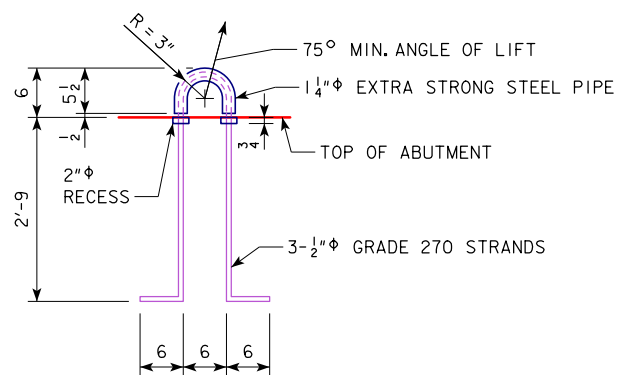
**B24-23-16**

APPROVED BY BRIDGE ENGINEER

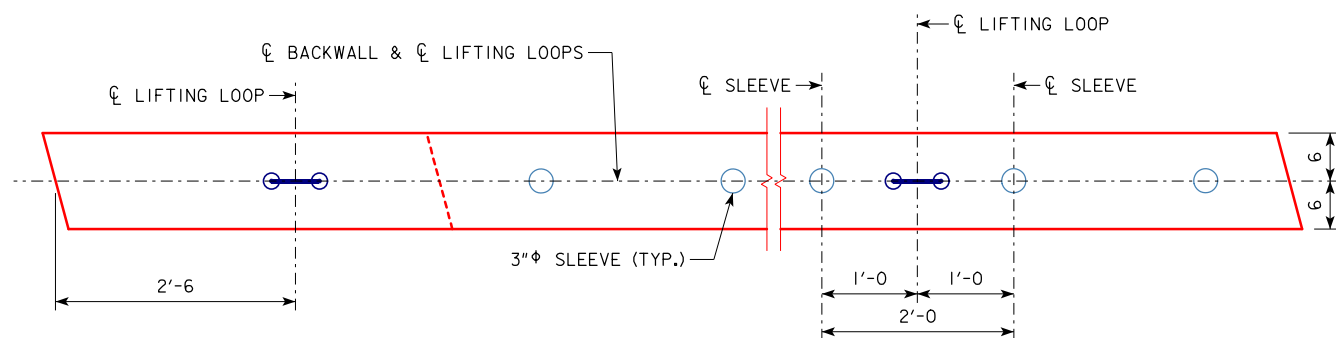
*Thomas L. Mc Donald*



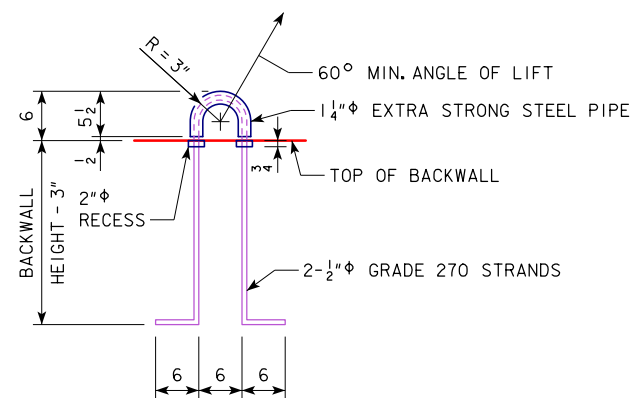
PARTIAL PLAN  
ABUTMENT FOOTING LIFTING LOOP DETAILS



LIFTING LOOP



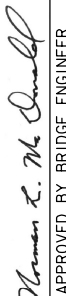

PARTIAL PLAN  
ABUTMENT BACKWALL LIFTING LOOP DETAILS

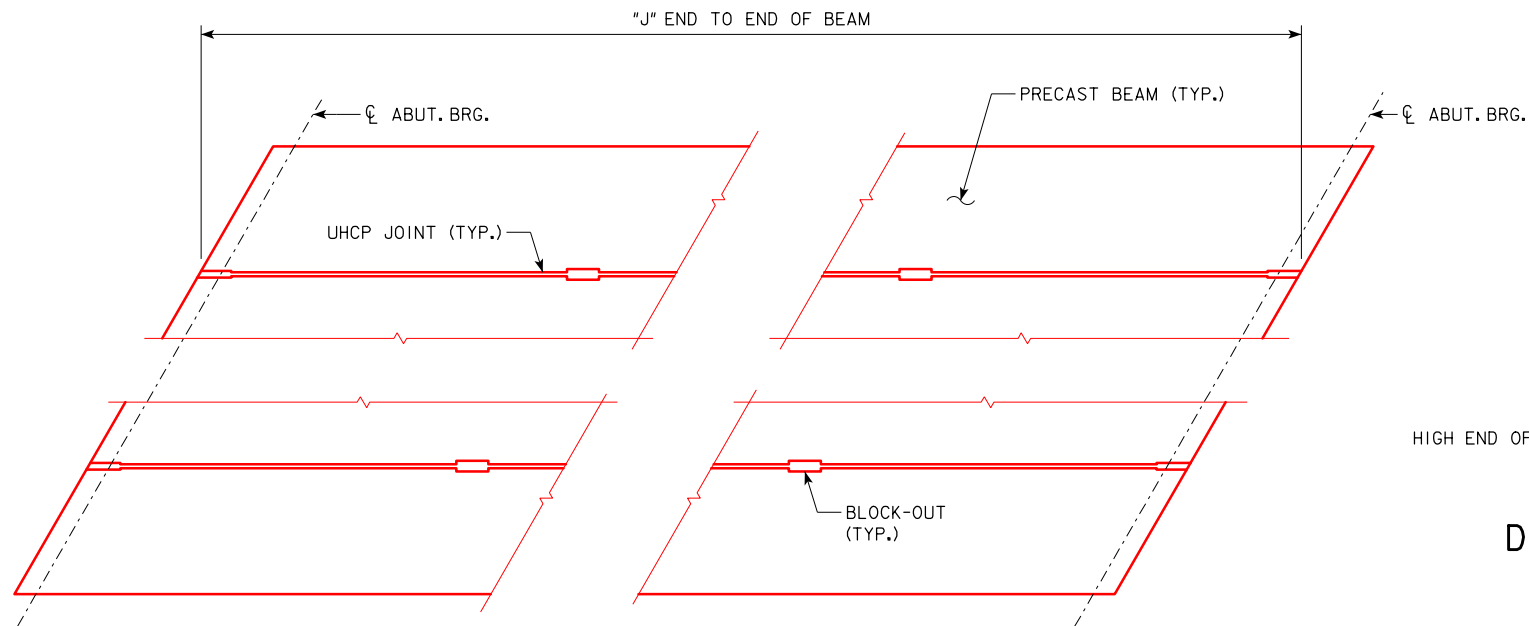


LIFTING LOOP

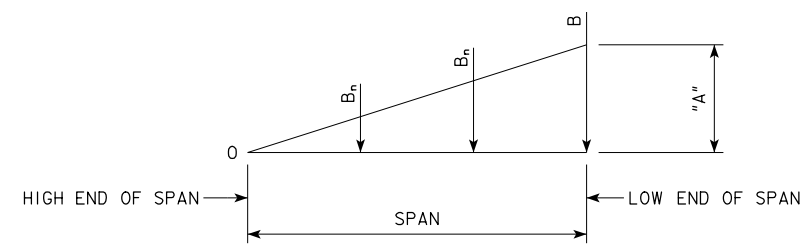
**NOTES:**

- ALTERNATE LIFTING DEVICES AND/OR ATTACHMENT POINTS SHALL BE SUBMITTED FOR APPROVAL.
- LIFTING OPERATIONS SHALL BE PERFORMED IN A MANNER THAT LIFTING LOOPS CARRY LOADS EQUALLY.
- LIFTING DEVICES SHALL BE REMOVED AFTER INSTALLATION AND RECESSES SHALL BE FILLED WITH GROUT.
- ALL COSTS ASSOCIATED WITH LIFTING DEVICES AND FILLING RECESSES SHALL BE INCIDENTAL TO THE PRICE BID FOR THE PRECAST COMPONENTS.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
<b>PRECAST ABUTMENT LIFTING LOOP DETAILS</b>		<b>B24-24-16</b>



**PART PLAN SHOWING LONGITUDINAL UHPC JOINTS BETWEEN BEAMS**  
(SKEWED BRIDGE SHOWN, 0 DEGREE SKEW BRIDGE SIMILAR)



**DEAD WEIGHT LOADING DIAGRAM**

**UHPC JOINT NOTES:**

LONGITUDINAL JOINTS BETWEEN BEAMS SHALL BE CONSTRUCTED OF ULTRA HIGH PERFORMANCE CONCRETE (UHPC). THE CONTRACTOR SHALL BE REQUIRED TO BATCH AND PLACE ALL UHPC MATERIAL IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND THE ULTRA HIGH PERFORMANCE CONCRETE NOTES ON SHEETS B24-26-16.

THE CONTRACTOR SHALL BE REQUIRED TO COORDINATE WITH THE MANUFACTURER OF THE UHPC MATERIALS TO DETERMINE THE OPTIMUM TIMEFRAME FOR GRINDING OF THE UHPC. SPECIALIZED GRINDING EQUIPMENT MAY BE REQUIRED TO GRIND THE UHPC MATERIALS. COST FOR GRINDING IS TO BE INCLUDED IN PRICE BID FOR UHPC JOINT.

**UHPC FORMWORK NOTES:**

MATERIAL PROPERTIES OF UHPC VARY CONSIDERABLY FROM CONVENTIONAL CONCRETE, BOTH DURING THE PLASTIC STATE AND AT THE HARDENED STATE. THE CONTRACTOR SHALL NOTE THAT ADDITIONAL FORMING EFFORT WILL BE REQUIRED TO ENSURE THE FORMS ARE PROPERLY SEALED AND ARE CAPABLE OF RESISTING THE ANTICIPATED FORM PRESSURES.

THE CONTRACTOR SHALL NOTE THAT UHPC PLACEMENT ON GRADE TYPICALLY REQUIRES TOP FORMS FOR CONTAINMENT OF THE MATERIAL WITHIN THE DESIGNATED PLACEMENT AREA. TOP FORMS COMMONLY REQUIRE APPLICATION OF DEAD WEIGHT AS DEPICTED ON THIS SHEET TO RESIST PRESSURES CREATED BY THE FLUID UHPC MATERIALS. OTHER MEANS TO RESIST THE HYDROSTATIC PRESSURE ARE FEASIBLE AND MAY BE PROPOSED BY THE CONTRACTOR FOR REVIEW. MECHANICAL INSERTS IN THE TOP OF THE BEAMS ARE NOT ALLOWED. IF STEEL TIES ARE USED TO TIE THE FORMWORK TO THE INSIDE SURFACE OF THE JOINT, THE TIES SHALL BE STAINLESS STEEL.

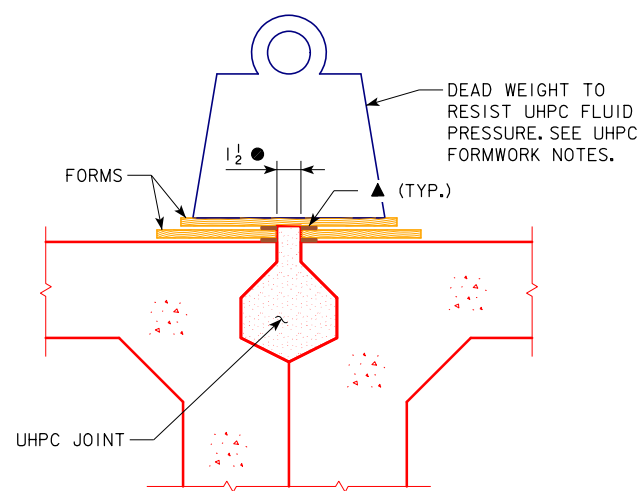
IF DEAD WEIGHT IS USED TO RESIST THE HYDROSTATIC FORCE, A TRIANGULAR LOAD WITH A MAXIMUM VALUE "A" AT THE LOW END OF THE SPAN SHALL BE APPLIED ALONG THE LENGTH OF THE JOINT FORMWORK AS SHOWN IN TABLE 1. ADDITIONALLY, POINT LOADS WITH A MAXIMUM VALUE "B" AS SHOWN IN TABLE 2 SHALL BE APPLIED AT EACH BLOCK-OUT LOCATION. POINT LOADS "B" ARE FOR BLOCK-OUTS AT THE LOW END OF THE SPAN AND POINT LOADS "B<sub>n</sub>" AT OTHER BLOCK-OUTS ALONG THE LENGTH OF THE SPAN SHALL BE REDUCED PROPORTIONALLY DEPENDING ON THEIR LOCATION ALONG THE SPAN. DEAD WEIGHTS FOR FORMS ARE COMPUTED ASSUMING A UHPC UNIT WEIGHT OF 156 PCF. DEAD WEIGHTS SHALL BE APPLIED TO ALL JOINTS CONCURRENTLY AND SHALL NOT BE REMOVED UNTIL THE UHPC JOINTS HAVE ATTAINED A MINIMUM REQUIRED STRENGTH OF 10 KSI.

**TABLE 1: TRIANGULAR LOAD DEAD WEIGHT "A" ALONG JOINT (PLF)**

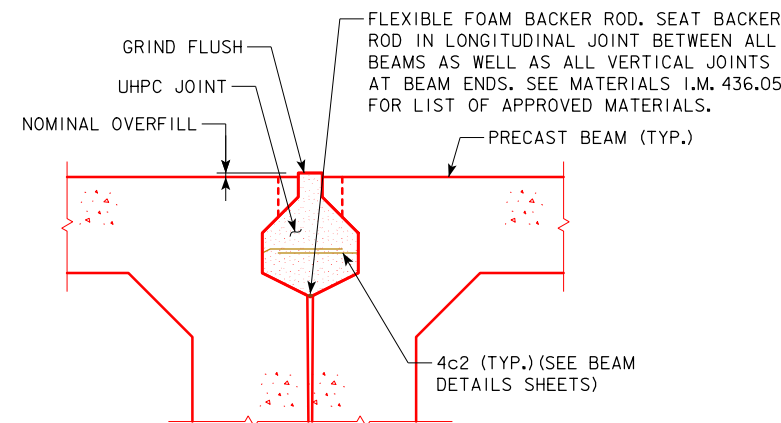
BEAM SPAN		30'-0	40'-0	50'-0	60'-0	70'-0
GRADE	1%	6	8	10	12	14
	2%	12	16	20	23	27
	3%	18	23	29	35	41
	4%	23	31	39	47	55
	5%	29	39	49	59	68

**TABLE 2: POINT LOAD DEAD WEIGHT "B" AT JOINT BLOCKOUTS (LBS)**

BEAM SPAN		30'-0	40'-0	50'-0	60'-0	70'-0
GRADE	1%	16	21	26	31	36
	2%	31	42	52	62	73
	3%	18	23	29	35	41
	4%	62	83	104	125	146
	5%	78	104	130	156	182



**TYPICAL SECTION THRU UHPC JOINT**  
(FOAM STRIPS SHOWN UNCOMPRESSED FOR CLARITY)



**DETAIL A**  
(SHOWN AT ROADWAY CROWN)

NOTES:  
 FOR LOCATION OF DETAIL A, SEE SHEET B24-06-16.  
 FOR KEYWAY JOINT PREPARATION NOTES AND BLOCK-OUT DETAIL, SEE SHEET B24-32-16.  
 ▲ EPDM FOAM STRIP WITH ADHESIVE BACK.  
 ● MAXIMUM DISTANCE BETWEEN FOAM STRIPS.

**UHPC JOINT QUANTITY TABLE**

SPAN (FT.)	"J" END TO END OF BEAM (FT.)			NO. OF JOINTS	TOTAL (L.F.)		
	0° SKEW	15° SKEW	30° SKEW		0° SKEW	15° SKEW	30° SKEW
30	31.17	31.21	31.34	5	156	156	157
40	41.17	41.21	41.34		206	206	207
50	51.17	51.21	51.34		256	256	257
60	61.17	61.21	61.34		306	306	307
70	71.17	71.21	71.34		356	356	357

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
		<b>UHPC JOINT DETAILS</b> (SHEET 1 OF 2)
		<b>B24-25-16</b>

# ULTRA HIGH PERFORMANCE CONCRETE JOINT FOR CONCRETE BOX BEAM BRIDGE NOTES:

## DESCRIPTION:

A. FURNISH ALL MATERIALS, TOOLS, AND LABOR NECESSARY FOR THE PERFORMANCE OF ALL WORK TO FORM, PREPARE BONDING SURFACES, CAST, FINISH, AND CURE ULTRA HIGH PERFORMANCE CONCRETE (UHPC) WHERE REQUIRED PER PLAN FOR ULTRA HIGH PERFORMANCE CONCRETE JOINTS.

## B. SUBMITTALS:

PROVIDE SUBMITTALS TO THE ENGINEER IN ELECTRONIC FORMAT, IN ACCORDANCE WITH ARTICLE 1105.03, F OF THE STANDARD SPECIFICATIONS.

THE SUBMITTALS REQUIRING WRITTEN APPROVAL FROM THE ENGINEER ARE AS FOLLOWS:

### 1. UHPC PLACEMENT PLAN:

a. SUBMIT THE UHPC PLACEMENT PLAN FOR APPROVAL 28 DAYS BEFORE PLACEMENT OF UHPC FOR LONGITUDINAL BEAM JOINTS.

b. THE UHPC PLACEMENT PLAN SHALL INCLUDE, BUT NOT NECESSARILY BE LIMITED TO, THE FOLLOWING:

- PROPOSED METHOD(S) OF JOINT SURFACE PREPARATION TO ACHIEVE THE REQUIRED CONCRETE SURFACE PROFILE TEXTURE, AS REQUIRED IN THE DESIGN PLANS.
- PROPOSED FORMING METHOD(S).
- PROPOSED BATCHING SEQUENCE. THE BATCHING SEQUENCE SHALL INCLUDE THE ORDER AND TIME OF INTRODUCTION OF THE MATERIALS AND THE MIXING TIME.
- PROPOSED SEQUENCE AND SCHEDULE FOR UHPC PLACEMENT OPERATIONS.
- DETAILS OF ALL EQUIPMENT TO BE USED TO BATCH AND PLACE UHPC MATERIALS, INCLUDING MIXERS, PUMPS, CONCRETE BUGGIES, ETC.
- CURING PROCEDURES, INCLUDING MINIMUM CURE TIME AND MINIMUM STRENGTH REQUIREMENTS PRIOR TO LOADING.
- TESTING PROCEDURES.
- QUALITY CONTROL / QUALITY ASSURANCE PROCEDURES FOR VERIFICATION OF MIX UNIFORMITY.

### 2. UHPC MIX DESIGN:

SUBMIT UHPC MIX DESIGN AND RESULTS OF THE FOLLOWING TESTS TO THE ENGINEER 60 DAYS PRIOR TO FIRST PLACEMENT OF UHPC. THE ENGINEER MAY WAIVE THE TESTS OF THE UHPC MIX IF THESE TESTS HAVE BEEN PREVIOUSLY PERFORMED FOR MATERIAL SUPPLIED BY THE MANUFACTURER.

A MINIMUM OF EIGHT CYLINDERS 3 IN. x 6 IN. FOR COMPRESSIVE STRENGTH TESTING AND THREE ADDITIONAL 12 IN. DIAMETER x 7 1/2 IN. DEEP CYLINDERS FOR PULLOUT TESTING SHALL BE CAST FOR MIX DESIGN TESTING.

ALL COMPRESSIVE TEST CYLINDERS SHALL BE CURED USING THE SAME METHOD OF CURING PROPOSED TO BE USED IN THE FIELD. THE TEMPERATURE DURING CURING SHALL BE WITHIN 18°F OF THE LOW END OF THE PROPOSED TEMPERATURE RANGE FOR CURING IN THE FIELD. COMPRESSIVE TESTING TIMES ARE AT 4 DAYS, 7 DAYS, 21 DAYS AND 28 DAYS AND TWO CYLINDERS SHALL BE TESTED FOR EACH TESTING DAY. THE COMPRESSIVE STRENGTH SHALL BE MEASURED BY ASTM C39 AND SHALL MEET 12 KSI MINIMUM AT 4 DAYS AND 21 KSI MINIMUM AT 28 DAYS. ONLY A UHPC MIX DESIGN THAT PASSES THESE TESTS MAY BE USED TO FORM THE JOINTS.

THE ADDITIONAL THREE 12 IN. DIAMETER x 7 1/2 IN. CYLINDERS SHALL EACH HAVE ONE 3/2 IN. LONG EPOXY-COATED REINFORCING BAR CAST IN THE CENTER OF THE CIRCULAR FACE FOR PULLOUT TESTING. THE AXIS OF THE BAR SHALL BE PERPENDICULAR TO THE FORMED SURFACE. THE BARS SHALL BE #4 BARS EMBEDDED 3 INCHES DEEP. THESE CYLINDERS SHALL BE KEPT WET FOR FOUR DAYS PRIOR TO DELIVERY TO THE TESTING LAB. PULLOUT TESTING SHALL BE IN ACCORDANCE WITH ASTM E488. THE TEST SHALL BE PERFORMED AS SOON AS PRACTICAL AFTER CORRESPONDING COMPRESSIVE TEST SAMPLES REACH 12 KSI COMPRESSIVE STRENGTH. PULLOUT TEST SAMPLES PASS IF THE BARS YIELD WITHOUT THE UHPC FAILING AND WITHOUT THE BARS PULLING OUT OF THE UHPC.

RESULTS OF ALL COMPRESSIVE AND PULLOUT TESTS, CONDUCTED BY AN AASHTO ACCREDITED TESTING LAB, SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL 60 DAYS PRIOR TO USE OF THE UHPC IN THE FIELD.

### 3. LIST OF SIMILAR BRIDGE PROJECTS:

60 DAYS PRIOR TO FIRST PLACEMENT OF UHPC, PROVIDE TO THE ENGINEER A LIST OF BRIDGE PROJECTS IN WHICH THE PROPOSED UHPC MATERIAL HAS BEEN USED AS JOINT FILL BETWEEN PRECAST CONCRETE ELEMENTS (WITHIN OR OUTSIDE THE USA). THE ENGINEER RESERVES THE RIGHT TO REJECT PROPOSED UHPC MATERIAL WHICH LACKS A PROVEN TRACK RECORD FOR PRECAST CONCRETE JOINT FILLING IN BRIDGE APPLICATIONS.

## MATERIALS (CONTINUED):

- |   |                 |
|---|-----------------|
| 6. SCALING RESISTANCE (ASTM C672)   | y<3             |
| 7. ABRASION RESISTANCE (ASTM C944 2X WEIGHT; GROUND SURF.)                                  | <0.025 OZ. LOST |
| 8. FREEZE-THAW RESISTANCE (ASTM C666A; 600 CYCLES)  | RDM>96%         |
| 9. ALKALI-SILICA REACTION (ASTM C1260; TESTED FOR 28 DAYS)                                  | INNOCUOUS       |
| * HEAT TREATED ACCORDING TO MANUFACTURER'S RECOMMENDATION; TEMPERATURE NOT TO EXCEED 250°F. |                 |
| ** NOT HEAT-TREATED-CURED AT A TEMPERATURE OF 60°F ± 3°                                     |                 |

## B. WATER:

FREE FROM FOREIGN MATERIALS IN AMOUNTS HARMFUL TO CONCRETE AND EMBEDDED STEEL AND MEETING THE FOLLOWING REQUIREMENTS:

- |   |           |
|---|-----------|
| 1. PRESENCE OF OIL                          | NONE      |
| 2. pH (AASHTO T26)                          | 5.0 - 8.5 |
| 3. ORGANIC SOLIDS (AASHTO T26, PPM)         | 200 MAX.  |
| 4. TOTAL INORGANIC SOLIDS (AASHTO T26, PPM) | 2000 MAX. |
| 5. CHLORIDE ION CONTENT (PPM)               | 500 MAX.  |
| 6. SULPHATE ION CONTENT (PPM)               | 1000 MAX. |

POTABLE WATER OBTAINED FROM A MUNICIPAL SUPPLY, SUITABLE FOR DRINKING, MAY BE ACCEPTED WITHOUT TESTING.

## C. FIBER REINFORCEMENT:

STEEL FIBERS ARE REQUIRED FOR THE UHPC.

## CONSTRUCTION:

### A. QUALITY ASSURANCE:

MEASURE SLUMP FLOW ON EACH BATCH OF UHPC. THE SLUMP FLOW WILL BE CONDUCTED USING A MINI-SLUMP CONE. THE FLOW FOR EACH BATCH SHALL BE BETWEEN 7 IN. AND 10 IN. RECORD THE SLUMP FLOW FOR EACH BATCH IN THE QA/QC LOG. PROVIDE A COPY OF THE LOG TO THE ENGINEER.

### B. PRE-POUR MEETING:

PRIOR TO THE INITIAL PLACEMENT OF UHPC, ARRANGE FOR AN ON SITE MEETING WITH THE UHPC REPRESENTATIVE AND THE ENGINEER. THE CONTRACTOR'S STAFF AND THE CONTRACTING AUTHORITY'S INSPECTORS SHALL ATTEND THE SITE MEETING. THE OBJECTIVE OF THE MEETING WILL BE TO CLEARLY OUTLINE THE PROCEDURES FOR MIXING, TRANSPORTING, FINISHING AND CURING OF THE UHPC MATERIAL. ARRANGE FOR A REPRESENTATIVE OF THE UHPC SUPPLIER TO BE ON SITE DURING THE PLACEMENT OF ALL UHPC, INCLUSIVE OF ALL LONGITUDINAL BEAM CONNECTIONS. THE UHPC REPRESENTATIVE SHALL BE KNOWLEDGEABLE IN THE SUPPLY, MIXING, DELIVERY, PLACEMENT, AND CURING OF THE UHPC MATERIAL.

### C. STORAGE:

ASSURE THE PROPER STORAGE OF UHPC PREMIX FIBERS AND ADDITIVES AS REQUIRED BY THE UHPC SUPPLIER'S SPECIFICATIONS IN ORDER TO PROTECT MATERIALS AGAINST LOSS OF PHYSICAL AND MECHANICAL PROPERTIES.

### D. FORMING, BATCHING, PLACEMENT, AND CURING:

WORK TOGETHER WITH UHPC MANUFACTURER TO ENSURE APPROPRIATE INITIAL STRENGTH GAINS TO MEET THE DESIRED PROJECT SCHEDULE.

GRINDING OF THE UHPC SURFACE CAN BE PERFORMED WHEN STRENGTH OF 10 KSI HAS BEEN ACHIEVED, UNLESS OTHERWISE RECOMMENDED BY UHPC MANUFACTURER. IF SIGNIFICANT FIBER PULLOUT IS OBSERVED DURING GRINDING OPERATIONS, GRINDING SHALL BE SUSPENDED AND SHALL NOT RESUME UNTIL WRITTEN APPROVAL IS OBTAINED FROM THE ENGINEER.

THE BRIDGE CAN BE OPENED TO TRAFFIC WHEN STRENGTH OF 15 KSI HAS BEEN ACHIEVED, UNLESS OTHERWISE RECOMMENDED BY THE UHPC MANUFACTURER.

CONSTRUCTION LOADS APPLIED TO THE BRIDGE DURING UHPC PLACEMENT AND CURING ARE THE RESPONSIBILITY OF THE CONTRACTOR. SUBMIT THE WEIGHT AND PLACEMENT OF CONCRETE BUGGIES, GRINDING EQUIPMENT OR OTHER SIGNIFICANT CONSTRUCTION LOADS TO THE ENGINEER FOR REVIEW PRIOR TO THE PRE-POUR MEETING DESCRIBED ABOVE.

FORMING, BATCHING, PLACING, AND CURING SHALL BE IN ACCORDANCE WITH THE PROCEDURES AS SUBMITTED TO AND ACCEPTED BY THE ENGINEER.

THE DESIGN AND FABRICATION OF FORMS SHALL FOLLOW APPROVED INSTALLATION DRAWINGS AND SHALL FOLLOW THE RECOMMENDATIONS OF THE UHPC MANUFACTURER. ALL THE FORMS FOR UHPC SHALL BE CONSTRUCTED FROM PLYWOOD. THE FORMS SHALL BE COATED TO PREVENT ABSORPTION OF WATER.

FOLLOW THE BATCHING SEQUENCE AS SPECIFIED BY THE UHPC MANUFACTURER AND AS APPROVED BY THE ENGINEER.

OVERFILL THE SURFACE OF THE UHPC FIELD JOINTS BY UP TO 1/8 INCH ABOVE THE TOP OF THE PRECAST CONCRETE BOX BEAMS.

EACH UHPC JOINT SHALL BE CAST USING ONE CONTINUOUS PLACEMENT. NO COLD JOINTS SHALL BE PERMITTED BETWEEN ANY INDIVIDUAL LENGTHS OF UHPC JOINT.

THE CONCRETE IN THE FORM SHALL BE CURED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS AT A MINIMUM TEMPERATURE OF 60°F TO ATTAIN THE DESIGN STRENGTH.

## E. MATERIAL TESTING:

CAST FOUR SETS OF COMPRESSIVE TEST CYLINDERS FOR EACH DAY OF UHPC PLACEMENT. EACH SET SHALL CONSIST OF THREE 3 IN. x 6 IN. CYLINDERS. ALL SETS SHALL BE CURED IN AN ENVIRONMENT SIMILAR TO THE MATERIAL THEY REPRESENT.

COMPRESSIVE TESTS SHALL BE PERFORMED IN ACCORDANCE WITH ASTM C39. THREE SPECIMENS SHALL BE TESTED TO VALIDATE ACHIEVEMENT OF THE 10 KSI COMPRESSIVE STRENGTH REQUIRED PRIOR TO GRINDING UHPC OVERFILL. THREE SPECIMENS SHALL BE TESTED TO VALIDATE ACHIEVEMENT OF 15 KSI COMPRESSIVE STRENGTH PRIOR TO OPENING THE BRIDGE TO TRAFFIC. THREE SPECIMENS SHALL BE TESTED AT 28 DAYS TO VALIDATE THE REQUIRED 21 KSI FINAL STRENGTH. THE REMAINING THREE SPECIMENS SHALL BE TREATED AS RESERVES.

## METHOD OF MEASUREMENT:

### A. UHPC JOINT FOR CONCRETE BOX BEAM BRIDGE:

MEASUREMENT WILL BE BY LENGTH OF UHPC JOINTS PLACED FOR LONGITUDINAL BEAM CONNECTIONS. THE LENGTH OF IN-PLACE UHPC SHALL BE MEASURED TO THE NEAREST LINEAR FOOT.

## BASIS OF PAYMENT:

### A. UHPC JOINT FOR CONCRETE BOX BEAM BRIDGE:

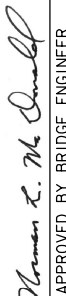

PAYMENT SHALL BE BASED ON FIELD MEASUREMENT OF LINEAR FEET PLACED AT THE CONTRACT PRICE FOR UHPC JOINT FOR CONCRETE BOX BEAM BRIDGE AND SHALL BE FULL COMPENSATION FOR ALL LABOR, EQUIPMENT, FORMS, MATERIAL AND TESTING TO COMPLETE THE WORK FOR ULTRA HIGH PERFORMANCE CONCRETE JOINTS, AS DESCRIBED IN THE PLANS AND THESE NOTES.

## MATERIALS:

### A. UHPC MATERIAL:

UHPC MATERIAL SHALL MEET THE FOLLOWING REQUIREMENTS AT 28 DAYS, UNLESS NOTED OTHERWISE:

- |   |                          |
|---|--------------------------|
| 1. MINIMUM COMPRESSIVE STRENGTH (ASTM C39)                    |                          |
| HEAT-TREATED*   | ≥25 KSI                  |
| NOT HEAT-TREATED**  | ≥21 KSI                  |
| NOT HEAT-TREATED 4 DAY**                                      | ≥12 KSI                  |
| 2. PRISM FLEXURAL TENSILE TOUGHNESS (ASTM C1018; 10 IN. SPAN) | 130248                   |
| 3. LONG-TERM SHRINKAGE (ASTM C157; INITIAL READING AFTER SET) | ≤766 MICROSTRAIN         |
| 4. CHLORIDE ION PENETRABILITY (ASTM C1202)                    | ≤250 COULOMBS            |
| 5. CHLORIDE ION PENETRABILITY (AASHTO T259; 1/5 IN. DEPTH)    | ≤0.07 OZ/FT <sup>3</sup> |

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		<b>UHPC JOINT DETAILS</b> (SHEET 2 OF 2)	<b>B24-26-16</b>

# UHPC WATER INTEGRITY TEST NOTES:

**DESCRIPTION:**

- A. FURNISH ALL MATERIALS, TOOLS, AND LABOR NECESSARY FOR THE PERFORMANCE OF ALL WORK TO WATER INTEGRITY TEST THE UHPC JOINTS.
- B. SUBMITTALS:  
PROVIDE SUBMITTALS TO THE ENGINEER IN ELECTRONIC FORMAT, IN ACCORDANCE WITH ARTICLE 1105.03, F OF THE STANDARD SPECIFICATIONS.

THE SUBMITTALS REQUIRING WRITTEN APPROVAL FROM THE ENGINEER ARE AS FOLLOWS:  
1. PROPOSED SCHEDULE FOR WATERTIGHT INTEGRITY TESTING OF COMPLETED UHPC JOINT.

**MATERIALS:**

- A. HIGH WEIGHT METHYL METHACRYLATE (FOR REPAIR OF LEAKING JOINTS):  
THE HIGH MOLECULAR WEIGHT METHACRYLATE (HMWM) RESIN SHALL BE LOW VISCOSITY AND NON-FUMING. ACCEPTANCE IS BASED ON THE MANUFACTURER CERTIFYING THAT IT CONFORMS TO THE FOLLOWING REQUIREMENTS AND THE CONTRACTOR FORWARDING THE CERTIFICATION TO THE ENGINEER:
  1. VISCOSITY LESS THAN 25 CPS WHEN MEASURED ACCORDING TO ASTM D2849
  2. DENSITY GREATER THAN 8.4 LB./GAL. @ 77°F
  3. FLASH POINT GREATER THAN 200°F
  4. VAPOR PRESSURE LESS THAN 1.0 mm Hg @ 77°F (ASTM D323)
  5. TG (DSC) GREATER THAN 136°F (ASTM D3418)
  6. GEL TIME GREATER THAN 40 MINUTES FOR 100 GRAM MASS
  7. PERCENT SOLIDS GREATER THAN 90% BY WEIGHT
  8. BOND STRENGTH GREATER THAN 1522.3 PSI (ASTM C882)

INCLUDE THE FOLLOWING INFORMATION ON THE CONTAINER FOR THE HMWM: THE NAME OF THE MANUFACTURER, THE BRAND NAME OF THE PRODUCT AND THE DATE OF MANUFACTURE.

THE SAND SHALL BE COMMERCIAL QUALITY DRY BLAST SAND. 95% OF THE SAND SHALL PASS THE #8 SIEVE, AND 95% SHALL BE RETAINED ON THE #30 SIEVE.

**CONSTRUCTION:**

- A. WATERTIGHT INTEGRITY TESTING:  
FOLLOWING ATTAINMENT OF 28-DAY STRENGTH AND AT LEAST FIVE DAYS AFTER THE JOINT SYSTEM HAS BEEN FULLY INSTALLED, PERFORM WATERTIGHT INTEGRITY TESTING OF ONE LONGITUDINAL UHPC JOINT PER BRIDGE SPAN. LOCATION OF THE LONGITUDINAL JOINT TO BE TESTED SHALL BE DETERMINED BY THE ENGINEER.

THE PROCEDURE FOR WATERTIGHT INTEGRITY TESTING SHALL BE AS FOLLOWS:

1. TEST THE DESIGNATED UHPC JOINT BY BLOCKING OUT AND COVERING THE JOINT WITH PONDED OR FLOWING WATER TO A DEPTH OF AT LEAST 1 INCH, FOR AT LEAST 15 MINUTES. THE CONTRACTOR MAY CONDUCT A SINGLE TEST OF THE ENTIRE JOINT OR MAY CONDUCT SEPARATE TESTS OF OVERLAPPING LENGTHS OF THE JOINT.
2. DURING THE TEST AND FOR 45 MINUTES AFTER THE SUPPLY OF WATER HAS STOPPED, THE INSPECTOR WILL EXAMINE THE UNDERSIDE OF THE JOINT FOR LEAKAGE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING THE INSPECTOR WITH SAFE ACCESS TO THE UNDERSIDE OF THE DECK. THE JOINT SHALL BE CONSIDERED WATERTIGHT IF NO DRIPPING WATER OR WATER DROPLETS ARE VISIBLE AT THE UNDERDECK AREAS ALONG THE FULL LENGTH OF JOINT. PATCHES OF MOISTURE SHALL NOT BE CAUSE FOR NON-ACCEPTANCE.
3. IF LEAKING JOINTS ARE IDENTIFIED, THE CONTRACTOR MAY BE REQUIRED TO PERFORM ADDITIONAL WATERTIGHT INTEGRITY TESTING, AT LOCATIONS TO BE DETERMINED BY THE ENGINEER, AT NO ADDITIONAL COST TO THE CONTRACTING AUTHORITY.

**B. LEAKING JOINT REPAIR:**

IF LEAKAGE OCCURS, SEAL ENTIRE LENGTH OF LEAKING JOINT AS FOLLOWS USING HIGH MOLECULAR WEIGHT METHYLACRYLATE AT NO ADDITIONAL COST TO THE CONTRACTING AUTHORITY:  
ABRASIVE BLAST CLEAN THE AREA TO BE TREATED, REMOVING ALL CONTAMINANTS FROM THE SURFACE. CLEAN ADJACENT SURFACES OF THE LEAKING JOINTS USING COMPRESSED AIR FREE OF OIL AND MOISTURE.

DO NOT APPLY RESIN IF RAIN IS EXPECTED WITHIN 12 HOURS OF COMPLETION. APPLY RESIN TO CLEAN, DRY SURFACES WHEN SURFACE TEMPERATURE IS AT LEAST 50°F, AND IF NEAR 50°F, TEMPERATURE SHALL BE RISING. MIX AND APPLY RESIN ACCORDING TO MANUFACTURER'S INSTRUCTIONS AND NO MORE THAN 5 GALLONS AT A TIME. POUR RESIN OVER JOINTS.

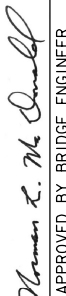

WHEN METHACRYLATE SURFACE WILL BE USED AS A DRIVING SURFACE, APPLY SAND TO PROVIDE FRICTION. ALLOW AT LEAST 20 MINUTES TO ELAPSE AFTER RESIN HAS BEEN APPLIED BEFORE APPLYING SAND. BROADCAST SAND AT A RATE OF APPROXIMATELY TWO POUNDS PER SQUARE YARD, COMPLETELY COVERING THE RESIN. RESIN MUST BE TACK-FREE BEFORE CONSTRUCTION TRAFFIC IS PERMITTED TO RESUME.

**METHOD OF MEASUREMENT:**

A. MEASUREMENT WILL BE BY THE LENGTH OF UHPC JOINT TESTED. THE LENGTH OF JOINT TESTED SHALL BE MEASURED TO THE NEAREST LINEAR FOOT.

**BASIS OF PAYMENT:**

A. PAYMENT WILL BE BASED ON FIELD MEASUREMENT OF LINEAR FEET TESTED AT THE CONTRACT PRICE FOR UHPC WATER INTEGRITY TEST AND SHALL BE FULL COMPENSATION FOR ALL LABOR, EQUIPMENT, MATERIAL AND TESTING TO COMPLETE THE WORK FOR UHPC WATER INTEGRITY TEST AS DESCRIBED IN THE PLANS AND THESE NOTES.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
<b>UHPC WATER INTEGRITY TEST</b>		<b>B24-27-16</b>	

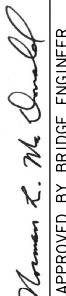

ESTIMATED QUANTITIES (WITH CAST-IN-PLACE ABUTMENTS)									
		REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
SPAN		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
UHPC JOINT FOR CONCRETE BOX BEAM BRIDGE	L.F.	156	206	256	156	206	256	306	356
STRUCTURAL CONCRETE *	C.Y.	32.4	32.4	33.6	31.1	31.1	32.4	32.4	33.6
EPOXY COATED REINFORCING STEEL *	LBS.	5,574	5,574	5,729	5,420	5,420	5,574	5,449	5,576
STRUCTURAL STEEL **	LBS.	1,726	2,222	3,112	1,478	1,900	2,718	3,215	4,442
REINFORCED CONCRETE BOX BEAM	NO.	6-27"x48"x30'-0 RCBB	6-27"x48"x40'-0 RCBB	6-33"x48"x50'-0 RCBB	-	-	-	-	-
PRETENSIONED PRESTRESSED CONCRETE BOX BEAM	NO.	-	-	-	6-21"x48"x30'-0 PPCBB	6-21"x48"x40'-0 PPCBB	6-27"x48"x50'-0 PPCBB	6-27"x48"x60'-0 PPCBB	6-33"x48"x70'-0 PPCBB
NO. OF STEEL H-PILES (HP 10x57) FOR TWO ABUTMENTS	NO.	10	10	10	10	10	10	12	14

NOTES:  
 \* INCLUDES TWO ABUTMENT FOOTINGS AND TWO ABUTMENT BACKWALLS.  
 \*\* INCLUDES FOUR RETAINER ANGLE ASSEMBLIES AND BRIDGE RAIL POSTS.  
 FOR REQUIRED STEEL SHEET PILE QUANTITY, SEE SHEET B24-08-16. PAY ITEM, "PILES STEEL SHEET-CONCRETE BOX BEAM BRIDGE".

ESTIMATED QUANTITIES (WITH PRECAST ABUTMENTS)									
		REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
SPAN		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
UHPC JOINT FOR CONCRETE BOX BEAM BRIDGE	L.F.	156	206	256	156	206	256	306	356
STRUCTURAL CONCRETE *	C.Y.	6.0	6.0	7.3	4.7	4.7	6.0	6.0	7.3
EPOXY COATED REINFORCING STEEL *	LBS.	1,081	1,081	1,232	930	930	1,081	1,068	1,232
STRUCTURAL STEEL **	LBS.	1,726	2,222	3,112	1,478	1,900	2,718	3,215	4,442
PRECAST FOOTING (SHEET PILE WINGS) ***	NO.	2	2	2	2	2	2	2	2
REINFORCED CONCRETE BOX BEAM	NO.	6-27"x48"x30'-0 RCBB	6-27"x48"x40'-0 RCBB	6-33"x48"x50'-0 RCBB	-	-	-	-	-
PRETENSIONED PRESTRESSED CONCRETE BOX BEAM	NO.	-	-	-	6-21"x48"x30'-0 PPCBB	6-21"x48"x40'-0 PPCBB	6-27"x48"x50'-0 PPCBB	6-27"x48"x60'-0 PPCBB	6-33"x48"x70'-0 PPCBB
NO. OF STEEL H-PILES (HP 10x57) FOR TWO ABUTMENTS	NO.	10	10	10	10	10	10	12	14

NOTES:  
 \* INCLUDES TWO ABUTMENT BACKWALLS.  
 \*\* INCLUDES FOUR RETAINER ANGLE ASSEMBLIES AND BRIDGE RAIL POSTS.  
 \*\*\* INCLUDES HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE FOR CMP PILE POCKETS. SEE SHEET B24-18-16 FOR VOLUME OF HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE REQUIRED FOR EACH BOX BEAM TYPE AND SPAN LENGTH.  
 FOR REQUIRED STEEL SHEET PILE QUANTITY, SEE SHEET B24-08-16. PAY ITEM, "PILES STEEL SHEET-CONCRETE BOX BEAM BRIDGE".

NOTE:  
 QUANTITIES SHOWN ONLY INCLUDE QUANTITIES COVERED BY THESE STANDARDS. OTHER QUANTITIES, AS REQUIRED, MAY ALSO NEED TO BE COMPUTED BY THE USER OF THESE STANDARDS SUCH AS UHPC JOINT WATER INTEGRITY TEST, EXCAVATION CLASS 20 OR 21, REMOVAL OF STRUCTURE, BRIDGE WING ARMORING AND GRANULAR BACKFILL, ETC.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
<b>QUANTITY SUMMARIES</b> <b>SHEET PILE WINGS</b> <b>0° SKEW</b>		<b>B24-28-16</b>	

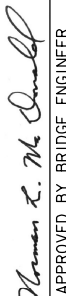

ESTIMATED QUANTITIES (WITH CAST-IN-PLACE ABUTMENTS)									
		REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
SPAN		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
UHPC JOINT FOR CONCRETE BOX BEAM BRIDGE	L.F.	156	206	256	156	206	256	306	356
STRUCTURAL CONCRETE *	C.Y.	29.6	29.6	31.0	27.9	27.9	29.6	29.6	31.0
EPOXY COATED REINFORCING STEEL *	LBS.	4,849	4,849	4,953	4,698	4,698	4,849	4,849	4,974
STRUCTURAL STEEL **	LBS.	1,726	2,222	3,112	1,478	1,900	2,718	3,215	4,442
REINFORCED CONCRETE BOX BEAM	NO.	6-27"x48"x30'-0 RCBB	6-27"x48"x40'-0 RCBB	6-33"x48"x50'-0 RCBB	-	-	-	-	-
PRETENSIONED PRESTRESSED CONCRETE BOX BEAM	NO.	-	-	-	6-21"x48"x30'-0 PPCBB	6-21"x48"x40'-0 PPCBB	6-27"x48"x50'-0 PPCBB	6-27"x48"x60'-0 PPCBB	6-33"x48"x70'-0 PPCBB
NO. OF STEEL H-PILES (HP 10x57) FOR TWO ABUTMENTS	NO.	10	10	10	10	10	10	10	12

NOTES:  
 \* INCLUDES TWO ABUTMENT FOOTINGS AND TWO ABUTMENT BACKWALLS.  
 \*\* INCLUDES FOUR RETAINER ANGLE ASSEMBLIES AND BRIDGE RAIL POSTS.

ESTIMATED QUANTITIES (WITH PRECAST ABUTMENTS)									
		REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
SPAN		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
UHPC JOINT FOR CONCRETE BOX BEAM BRIDGE	L.F.	156	206	256	156	206	256	306	356
STRUCTURAL STEEL **	LBS.	1,726	2,222	3,112	1,478	1,900	2,718	3,215	4,442
PRECAST FOOTING (CONCRETE WINGS) ***	NO.	2	2	2	2	2	2	2	2
PRECAST ABUTMENT BACKWALL	NO.	4	4	4	4	4	4	4	4
REINFORCED CONCRETE BOX BEAM	NO.	6-27"x48"x30'-0 RCBB	6-27"x48"x40'-0 RCBB	6-33"x48"x50'-0 RCBB	-	-	-	-	-
PRETENSIONED PRESTRESSED CONCRETE BOX BEAM	NO.	-	-	-	6-21"x48"x30'-0 PPCBB	6-21"x48"x40'-0 PPCBB	6-27"x48"x50'-0 PPCBB	6-27"x48"x60'-0 PPCBB	6-33"x48"x70'-0 PPCBB
NO. OF STEEL H-PILES (HP 10x57) FOR TWO ABUTMENTS	NO.	10	10	10	10	10	10	10	12

NOTES:  
 \*\* INCLUDES FOUR RETAINER ANGLE ASSEMBLIES AND BRIDGE RAIL POSTS.  
 \*\*\* INCLUDES HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE FOR CMP PILE POCKETS. SEE SHEET B24-20-16 FOR VOLUME OF HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE REQUIRED FOR EACH BOX BEAM TYPE AND SPAN LENGTH.

NOTES:  
 QUANTITIES SHOWN ONLY INCLUDE QUANTITIES COVERED BY THESE STANDARDS. OTHER QUANTITIES, AS REQUIRED, MAY ALSO NEED TO BE COMPUTED BY THE USER OF THESE STANDARDS SUCH AS UHPC JOINT WATER INTEGRITY TEST, EXCAVATION CLASS 20 OR 21, REMOVAL OF STRUCTURE, BRIDGE WING ARMORING, ETC.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
<b>QUANTITY SUMMARIES</b> <b>CONCRETE WINGS</b> <b>0° SKEW</b>		<b>B24-29-16</b>	

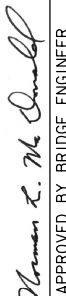

ESTIMATED QUANTITIES (WITH CAST-IN-PLACE ABUTMENTS)									
		REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
SPAN		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
UHPC JOINT FOR CONCRETE BOX BEAM	L.F.	156	206	256	156	206	256	306	356
STRUCTURAL CONCRETE *	C.Y.	30.6	30.6	32.0	28.8	28.8	30.6	30.6	32.0
EPOXY COATED REINFORCING STEEL *	LBS.	4,846	4,846	4,953	4,694	4,694	4,846	4,846	4,974
STRUCTURAL STEEL **	LBS.	1,726	2,222	3,112	1,478	1,900	2,718	3,215	4,442
REINFORCED CONCRETE BOX BEAM	NO.	6-27"x48"x30'-0 RCBB	6-27"x48"x40'-0 RCBB	6-33"x48"x50'-0 RCBB	-	-	-	-	-
PRETENSIONED PRESTRESSED CONCRETE BOX BEAM	NO.	-	-	-	6-21"x48"x30'-0 PPCBB	6-21"x48"x40'-0 PPCBB	6-27"x48"x50'-0 PPCBB	6-27"x48"x60'-0 PPCBB	6-33"x48"x70'-0 PPCBB
NO. OF STEEL H-PILES (HP 10x57) FOR TWO ABUTMENTS	NO.	10	10	10	10	10	10	10	12

NOTES:  
 \* INCLUDES TWO ABUTMENT FOOTINGS AND TWO ABUTMENT BACKWALLS. SEE SHEET B24-15-16 FOR ADDITIONAL CONCRETE REQUIRED IN ABUTMENT FOOTINGS.  
 \*\* INCLUDES FOUR RETAINER ANGLE ASSEMBLIES AND BRIDGE RAIL POSTS.

ESTIMATED QUANTITIES (WITH PRECAST ABUTMENTS)									
		REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
SPAN		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
UHPC JOINT FOR CONCRETE BOX BEAM	L.F.	156	206	256	156	206	256	306	356
STRUCTURAL STEEL **	LBS.	1,726	2,222	3,112	1,478	1,900	2,718	3,215	4,442
PRECAST ABUTMENT BACKWALL	NO.	4	4	4	4	4	4	4	4
PRECAST FOOTING (CONCRETE WINGS) ***	NO.	2	2	2	2	2	2	2	2
REINFORCED CONCRETE BOX BEAM	NO.	6-27"x48"x30'-0 RCBB	6-27"x48"x40'-0 RCBB	6-33"x48"x50'-0 RCBB	-	-	-	-	-
PRETENSIONED PRESTRESSED CONCRETE BOX BEAM	NO.	-	-	-	6-21"x48"x30'-0 PPCBB	6-21"x48"x40'-0 PPCBB	6-27"x48"x50'-0 PPCBB	6-27"x48"x60'-0 PPCBB	6-33"x48"x70'-0 PPCBB
NO. OF STEEL H-PILES (HP 10x57) FOR TWO ABUTMENTS	NO.	10	10	10	10	10	10	10	12

NOTES:  
 \*\* INCLUDES FOUR RETAINER ANGLE ASSEMBLIES AND BRIDGE RAIL POSTS.  
 \*\*\* INCLUDES HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE FOR CMP PILE POCKETS. SEE SHEET B24-22-16 FOR VOLUME OF HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE REQUIRED FOR EACH BOX BEAM TYPE AND SPAN LENGTH.

NOTES:  
 QUANTITIES SHOWN ONLY INCLUDE QUANTITIES COVERED BY THESE STANDARDS. OTHER QUANTITIES, AS REQUIRED, MAY ALSO NEED TO BE COMPUTED BY THE USER OF THESE STANDARDS SUCH AS UHPC JOINT WATER INTEGRITY TEST, EXCAVATION CLASS 20 OR 21, REMOVAL OF STRUCTURE, BRIDGE WING ARMORING, ETC.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
<b>QUANTITY SUMMARIES</b> <b>CONCRETE WINGS</b> <b>15° SKEW</b>		<b>B24-30-16</b>

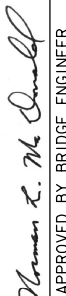

ESTIMATED QUANTITIES (WITH CAST-IN-PLACE ABUTMENTS)									
		REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
SPAN		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
UHPC JOINT FOR CONCRETE BOX BEAM BRIDGE	L.F.	157	207	257	157	207	257	307	357
STRUCTURAL CONCRETE *	C.Y.	33.9	33.9	35.5	32.0	32.0	33.9	33.9	35.5
EPOXY COATED REINFORCING STEEL *	LBS.	5,385	5,385	5,500	5,224	5,224	5,385	5,385	5,569
STRUCTURAL STEEL **	LBS.	1,726	2,222	3,112	1,478	1,900	2,718	3,215	4,442
REINFORCED CONCRETE BOX BEAM	NO.	6-27"x48"x30'-0 RCBB	6-27"x48"x40'-0 RCBB	6-33"x48"x50'-0 RCBB	-	-	-	-	-
PRETENSIONED PRESTRESSED CONCRETE BOX BEAM	NO.	-	-	-	6-21"x48"x30'-0 PPCBB	6-21"x48"x40'-0 PPCBB	6-27"x48"x50'-0 PPCBB	6-27"x48"x60'-0 PPCBB	6-33"x48"x70'-0 PPCBB
NO. OF STEEL H-PILES (HP 10x57) FOR TWO ABUTMENTS	NO.	10	10	10	10	10	10	10	12

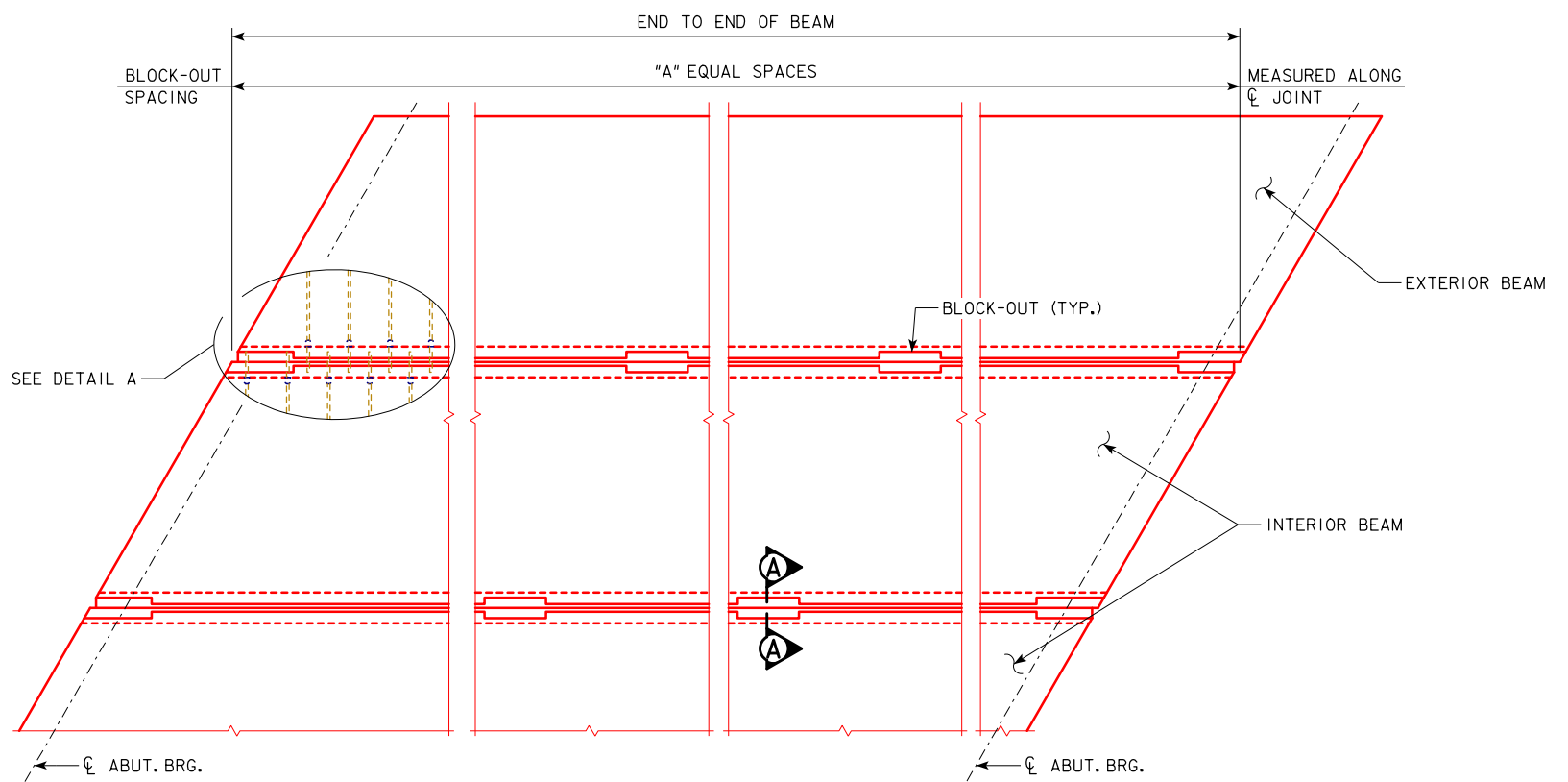
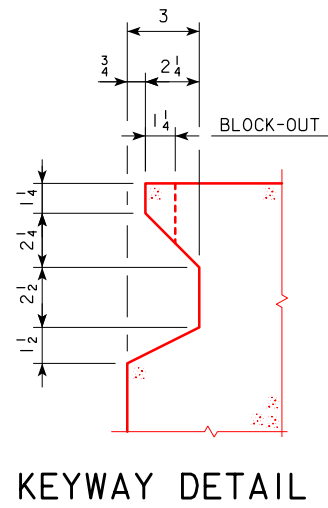
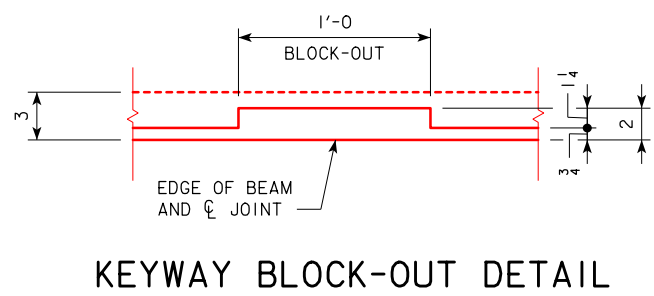
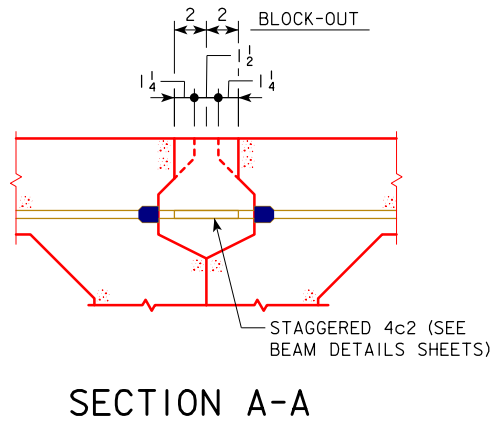
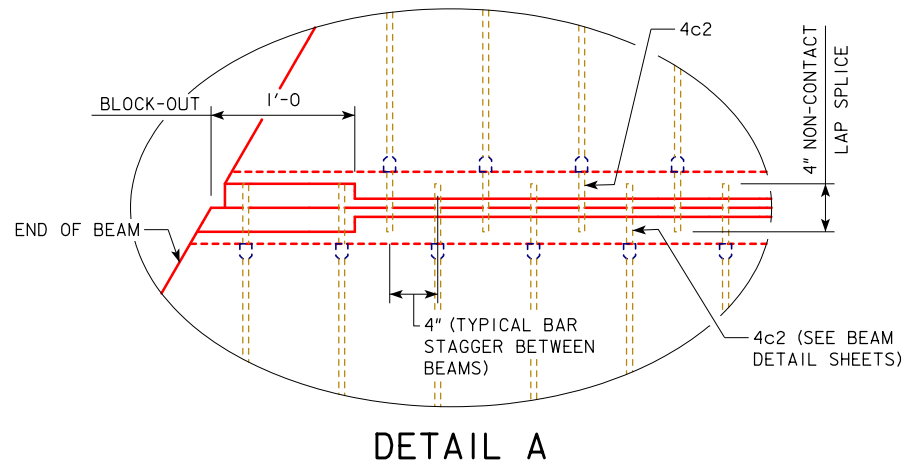
NOTES:  
 \* INCLUDES TWO ABUTMENT FOOTINGS AND TWO ABUTMENT BACKWALLS. SEE SHEET B24-16-16 FOR ADDITIONAL CONCRETE REQUIRED IN ABUTMENT FOOTINGS.  
 \*\* INCLUDES FOUR RETAINER ANGLE ASSEMBLIES AND BRIDGE RAIL POSTS.

ESTIMATED QUANTITIES (WITH PRECAST ABUTMENTS)									
		REINFORCED CONCRETE BOX BEAMS			PRETENSIONED PRESTRESSED CONCRETE BOX BEAMS				
SPAN		30'-0	40'-0	50'-0	30'-0	40'-0	50'-0	60'-0	70'-0
UHPC JOINT FOR CONCRETE BOX BEAM BRIDGE	L.F.	157	207	257	157	207	257	307	357
STRUCTURAL STEEL **	LBS.	1,726	2,222	3,112	1,478	1,900	2,718	3,215	4,442
PRECAST ABUTMENT BACKWALL	NO.	4	4	4	4	4	4	4	4
PRECAST FOOTING (CONCRETE WINGS) ***	NO.	2	2	2	2	2	2	2	2
REINFORCED CONCRETE BOX BEAM	NO.	6-27"x48"x30'-0 RCBB	6-27"x48"x40'-0 RCBB	6-33"x48"x50'-0 RCBB	-	-	-	-	-
PRETENSIONED PRESTRESSED CONCRETE BOX BEAM	NO.	-	-	-	6-21"x48"x30'-0 PPCBB	6-21"x48"x40'-0 PPCBB	6-27"x48"x50'-0 PPCBB	6-27"x48"x60'-0 PPCBB	6-33"x48"x70'-0 PPCBB
NO. OF STEEL H-PILES (HP 10x57) FOR TWO ABUTMENTS	NO.	10	10	10	10	10	10	10	12

NOTES:  
 \*\* INCLUDES FOUR RETAINER ANGLE ASSEMBLIES AND BRIDGE RAIL POSTS.  
 \*\*\* INCLUDES HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE FOR CMP PILE POCKETS. SEE SHEET B24-23-16 FOR VOLUME OF HIGH EARLY STRENGTH SELF-CONSOLIDATING CONCRETE REQUIRED FOR EACH BOX BEAM TYPE AND SPAN LENGTH.

NOTES:  
 QUANTITIES SHOWN ONLY INCLUDE QUANTITIES COVERED BY THESE STANDARDS. OTHER QUANTITIES, AS REQUIRED, MAY ALSO NEED TO BE COMPUTED BY THE USER OF THESE STANDARDS SUCH AS UHPC JOINT WATER INTEGRITY TEST, EXCAVATION CLASS 20 OR 21, REMOVAL OF STRUCTURE, BRIDGE WING ARMORING, ETC.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
<b>QUANTITY SUMMARIES</b> CONCRETE WINGS 30° SKEW		<b>B24-31-16</b>



**PARTIAL PLAN**  
(30° SKEW SHOWN, 0° SKEW AND 15° SKEW SIMILAR)

KEYWAY BLOCK-OUT DATA	
SPAN (FT.)	"A" EQUAL SPACES
30	4
40	4
50	4
60	6
70	6

**KEYWAY JOINT PREPARATION NOTES:**

KEYED JOINT SURFACES OF CONCRETE BOX BEAMS FOR LONGITUDINAL UHPC JOINTS SHALL RECEIVE A TEXTURED FINISH CONSISTING OF MICRO-TEXTURE AND MACRO-TEXTURE. JOINT SURFACES SHALL BE TEXTURED TO "CONCRETE SURFACE PROFILE 6" OR ROUGHER, AS ESTABLISHED BY THE INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI). JOINT TEXTURE MAY BE ACHIEVED BY ONE OR MORE OF THE FOLLOWING MEANS:

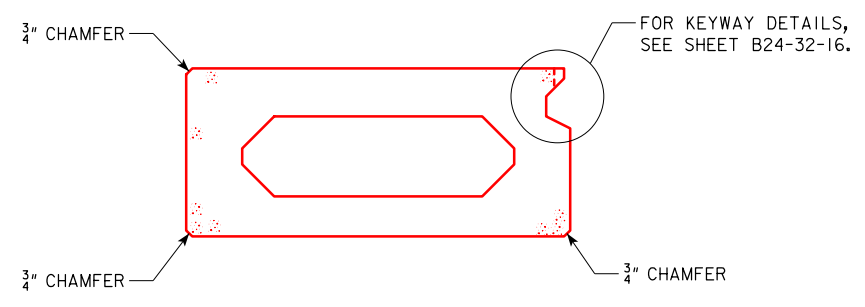
- MEDIA BLASTING
- USE OF A TEXTURED FORMLINER
- USE OF A FORM RETARDER AT THE JOINT SURFACE, FOLLOWED BY PRESSURE WASHING AFTER INITIAL SET TO PROVIDE AN EXPOSED AGGREGATE FINISH
- OTHER MEANS, SUBJECT TO ENGINEER'S APPROVAL

IN ADDITION TO THE ABOVE JOINT PREPARATION REQUIREMENTS, THE REQUIREMENTS OF SECTION 2403.03,1,1 OF THE STANDARD SPECIFICATIONS SHALL APPLY (INCLUDES SANDBLAST AND AIR BLAST CLEANING OF JOINT SURFACES).

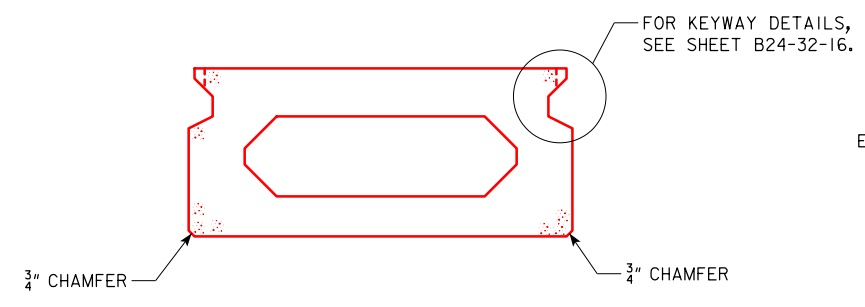
KEYWAY SURFACES SHALL BE WETTED TO A SATURATED SURFACE DRY CONDITION PRIOR TO CASTING THE UHPC JOINT.

ALL WORK FOR PREPARATION AND TEXTURING OF KEYED JOINT SURFACES FOR LONGITUDINAL BEAM CONNECTIONS SHALL BE INCLUDED IN THE PRICE BID FOR THE BEAMS.

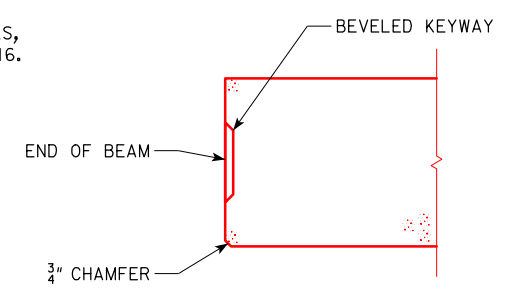
LATEST REVISION DATE  <i>Thomas L. Mc Donald</i> APPROVED BY BRIDGE ENGINEER	
	STANDARD DESIGN - 24'-0" ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
	DECEMBER, 2016
<b>BEAM KEYWAY AND BLOCK-OUT DETAILS</b>	<b>B24-32-16</b>



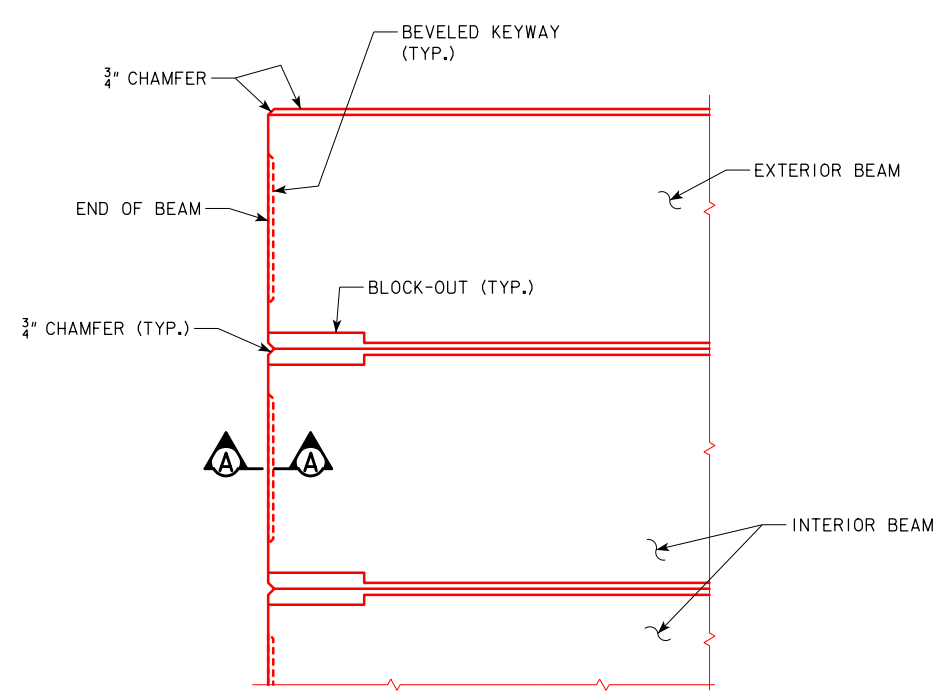
EXTERIOR BEAM



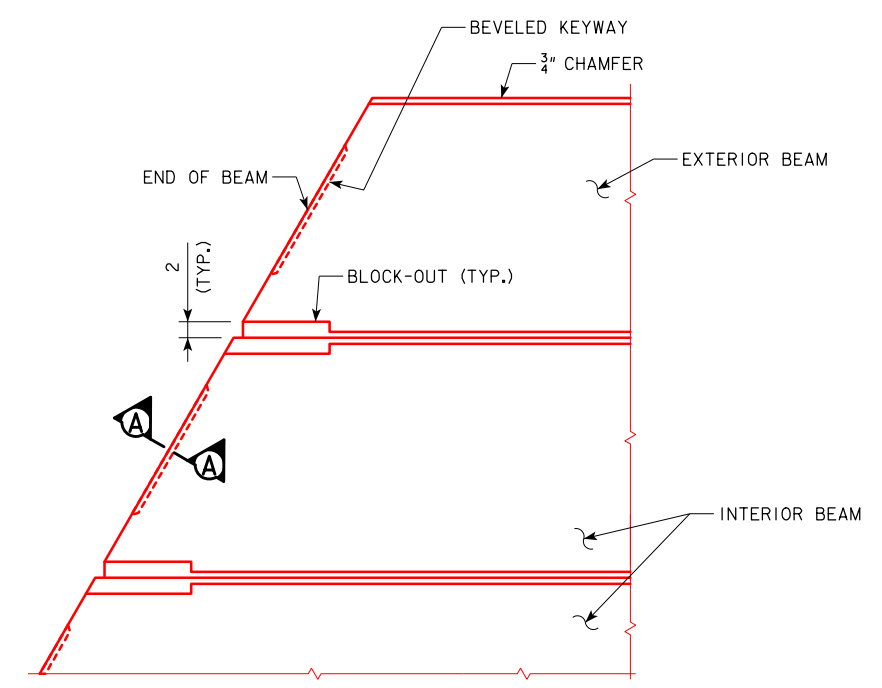
INTERIOR BEAM



SECTION A-A



PARTIAL PLAN  
(0° SKEW)



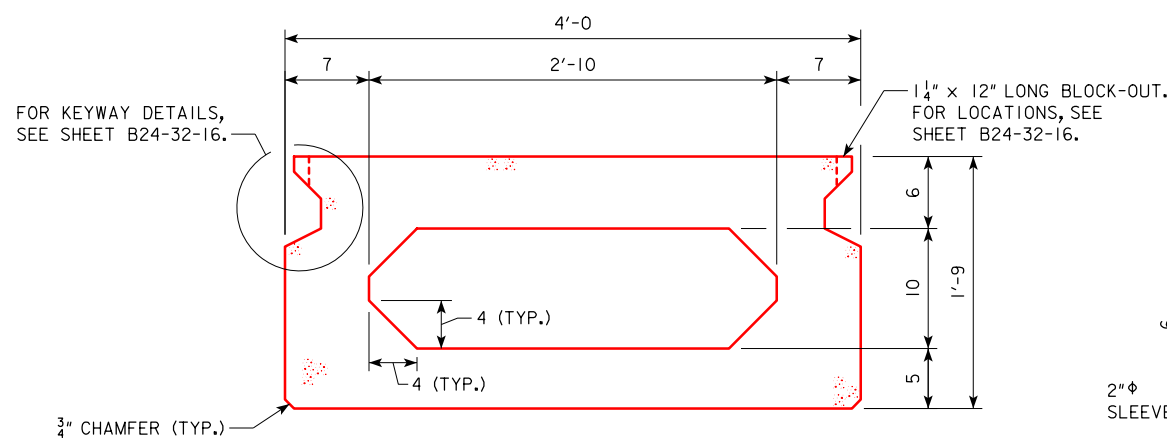
PARTIAL PLAN  
(30° SKEW SHOWN, 15° SKEW SIMILAR)

NOTE:  
FOR BEVELED KEYWAY DETAILS, SEE BEAM DETAILS SHEETS.

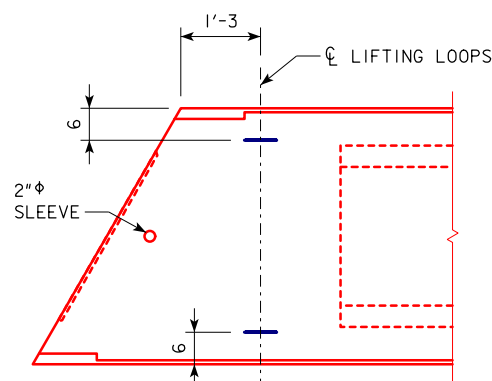
LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b> DECEMBER, 2016	
		BEAM CHAMFER DETAILS	B24-33-16

## 21" x 48" PRETENSIONED PRESTRESSED CONCRETE BOX BEAM DATA

BEAM	SKEW (DEGREES)	SPAN LENGTH ℄-℄ BEARING	OVERALL BEAM LENGTH	CONCRETE STRENGTH		STRAND SIZE DIA. (in.)	NO. OF STRANDS	TOTAL INITIAL PRESTRESS (KIPS)	CAMBER (in.)		WEIGHT (TONS)	CONCRETE (C.Y.)	REINFORCING STEEL (LBS.)
				f'ci (ksi)	f'c (ksi)				AT RELEASE	AFTER LOSSES			
PPCBB 21" x 48" x 30'-0"	0	30'-0"	31'-2"	4.5	5.0	0.6	12	510	0.2	0.4	11.7	5.8	SEE SHEET B24-37-16
	15		31'-2½"										
	30		31'-4½"										
PCBB 21" x 48" x 40'-0"	0	40'-0"	41'-2"	4.5	5.0	0.6	16	681	0.5	1.0	15.2	7.5	SEE SHEET B24-40-16
	15		41'-2½"										
	30		41'-4½"										



**INTERIOR BEAM CROSS SECTION**



**LIFTING LOOP PLAN**

$A = 670 \text{ in}^2$   
 $Y_b = 10.4 \text{ in}$   
 $I = 33,302 \text{ in}^4$

**BEAM SECTION  
PROPERTIES  
(INTERIOR BEAM)**

**SPECIFICATIONS:**

DESIGN: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH ED., SERIES OF 2014, EXCEPT AS NOTED IN "LIVE LOAD DISTRIBUTION FACTOR NOTES".

CONSTRUCTION: STANDARD SPECIFICATIONS OF THE IOWA DEPARTMENT OF TRANSPORTATION, CURRENT SERIES, WITH CURRENT APPLICABLE SPECIAL PROVISIONS AND SUPPLEMENTAL SPECIFICATIONS.

**LIVE LOAD DISTRIBUTION FACTOR NOTES:**

LIVE LOAD DISTRIBUTION FACTORS USED FOR THE FLEXURAL DESIGN OF THE BEAMS WAS BASED ON PAST STUDIES CONDUCTED BY IADOT. HOWEVER, AASHTO EQUATIONS INCLUDING SKEW EFFECTS WERE USED FOR DETERMINING THE LIVE LOAD DISTRIBUTION FACTOR FOR SHEAR. CONTROLLING LIVE LOAD DISTRIBUTION FACTORS ARE:

- 30'-0" SPAN  
MOMENT = 0.50 LANES / BEAM  
SHEAR = 0.69 LANES / BEAM
- 40'-0" SPAN  
MOMENT = 0.50 LANES / BEAM  
SHEAR = 0.67 LANES / BEAM

**DESIGN STRESSES:**

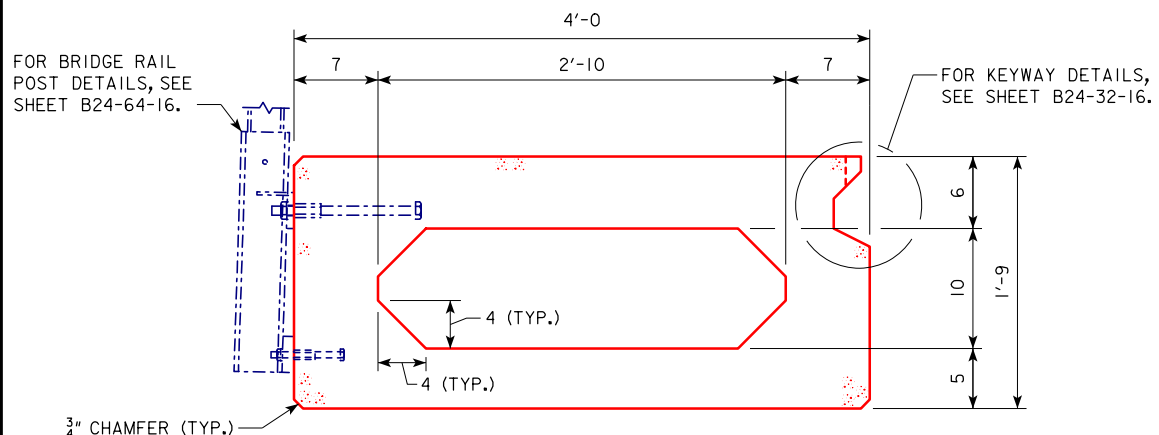
DESIGN STRESSES FOR THE FOLLOWING MATERIALS ARE TO BE IN ACCORDANCE WITH AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH ED., SERIES OF 2014:

- REINFORCING STEEL IN ACCORDANCE WITH SECTION 5, GRADE 60.
- CONCRETE IN ACCORDANCE WITH SECTION 5.
- PRESTRESSING STEEL IN ACCORDANCE WITH SECTION 5, GRADE 270.

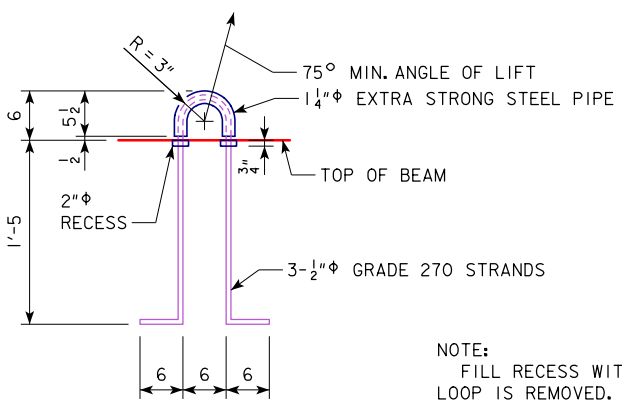
**NOTES:**

THESE BEAMS ARE DESIGNED FOR HL93 LOADING WITH AN ALLOWANCE OF 50 lb. PER SQUARE FOOT OF ROADWAY FOR GRAVEL OR FUTURE WEARING SURFACE.  
 ALL PRESTRESSING STRANDS SHALL CONFORM TO ASTM A416 GRADE 270 LOW RELAXATION STRANDS.  
 TOPS OF BEAMS ARE TO BE STRUCK OFF LEVEL AND LONGITUDINALLY TINED IN ACCORDANCE WITH ARTICLE 2301.03, H, 3 OF THE STANDARD SPECIFICATIONS.  
 BEARINGS SHALL BE AS DETAILED ON OTHER DESIGN SHEETS.  
 BEAMS ARE TO BE AT LEAST 28 DAYS OLD BEFORE THE FUTURE WEARING SURFACE, IF USED, IS PLACED UNLESS A SHORTER CURING TIME IS APPROVED BY THE BRIDGE ENGINEER.  
 ALL BEAMS ARE TO BE INCREASED IN LENGTH TO COMPENSATE FOR ELASTIC SHORTENING, CREEP AND SHRINKAGE.  
 0.6" DIAMETER STRANDS STRESSED TO NOT MORE THAN 5,000 LBS. EACH MAY BE USED IN LIEU OF THE  $\alpha$  BARS WHICH RUN THE FULL LENGTH OF THE BEAM IN THE TOP SLAB.  
 TOTAL INITIAL PRESTRESS IS BASED ON 72.6% f's, f's = 270 ksi AND  $A_s = 0.217 \text{ sq. in.}$   
 LIFTING OPERATIONS SHALL BE PERFORMED IN A MANNER THAT LIFTING LOOPS CARRY LOADS EQUALLY.

NOTES:  
 FOR VIEW B-B LOCATION, SEE SHEETS B24-35-16 & B24-36-16.  
 FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

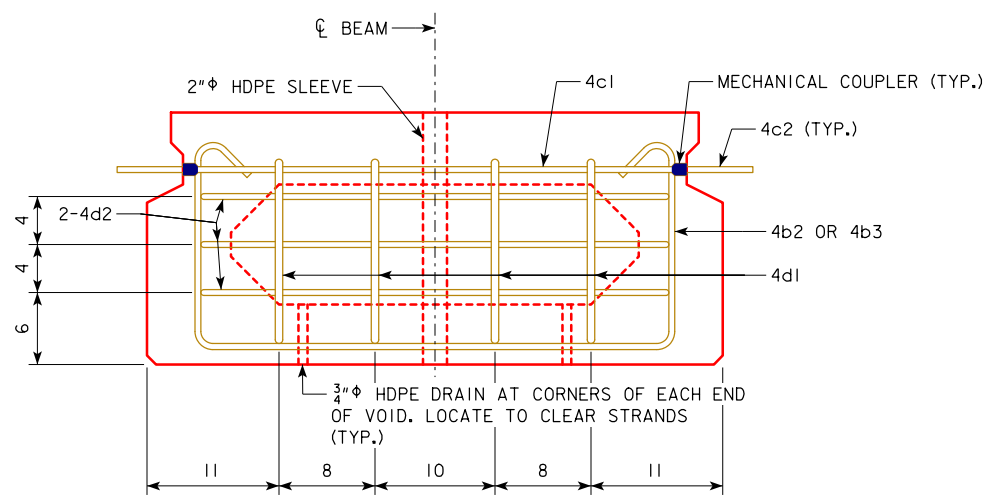


**EXTERIOR BEAM CROSS SECTION**

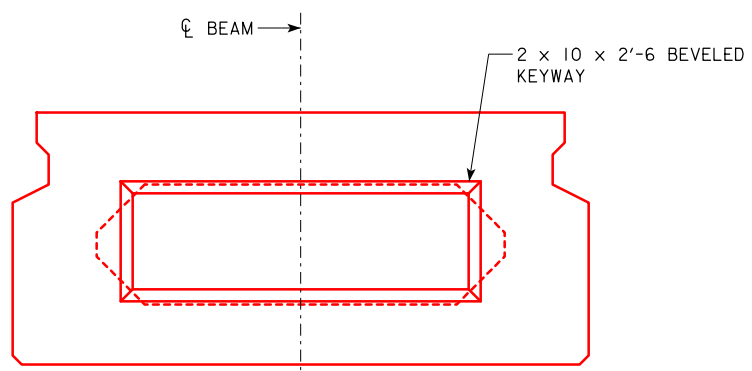


**LIFTING LOOP DETAIL**

ALTERNATE TYPES OF LIFTING LOOPS MAY BE SUBMITTED FOR APPROVAL.

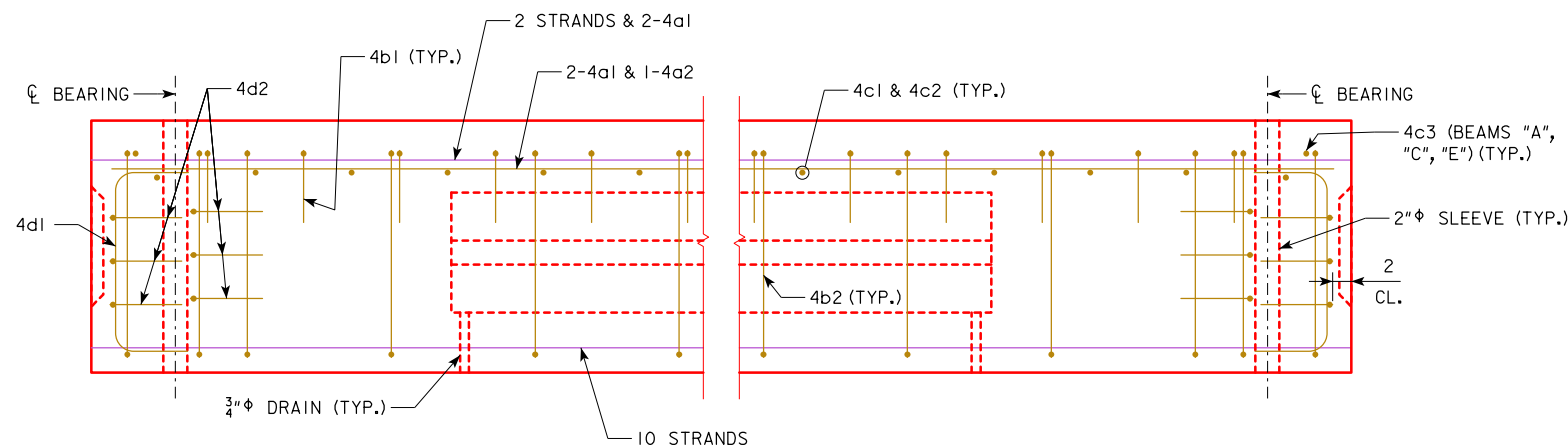


**VIEW B-B  
(INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR)**

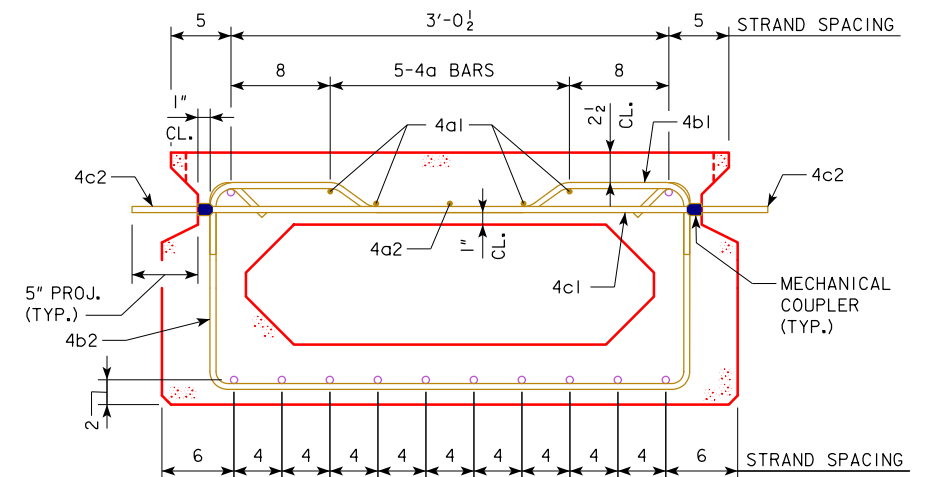


**VIEW B-B  
(INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR)  
(SHOWING KEYWAY)**

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b> DECEMBER, 2016	<b>B24-34-16</b>
<b>21" x 48" PPCBB DETAILS</b>		<b>B24-34-16</b>	

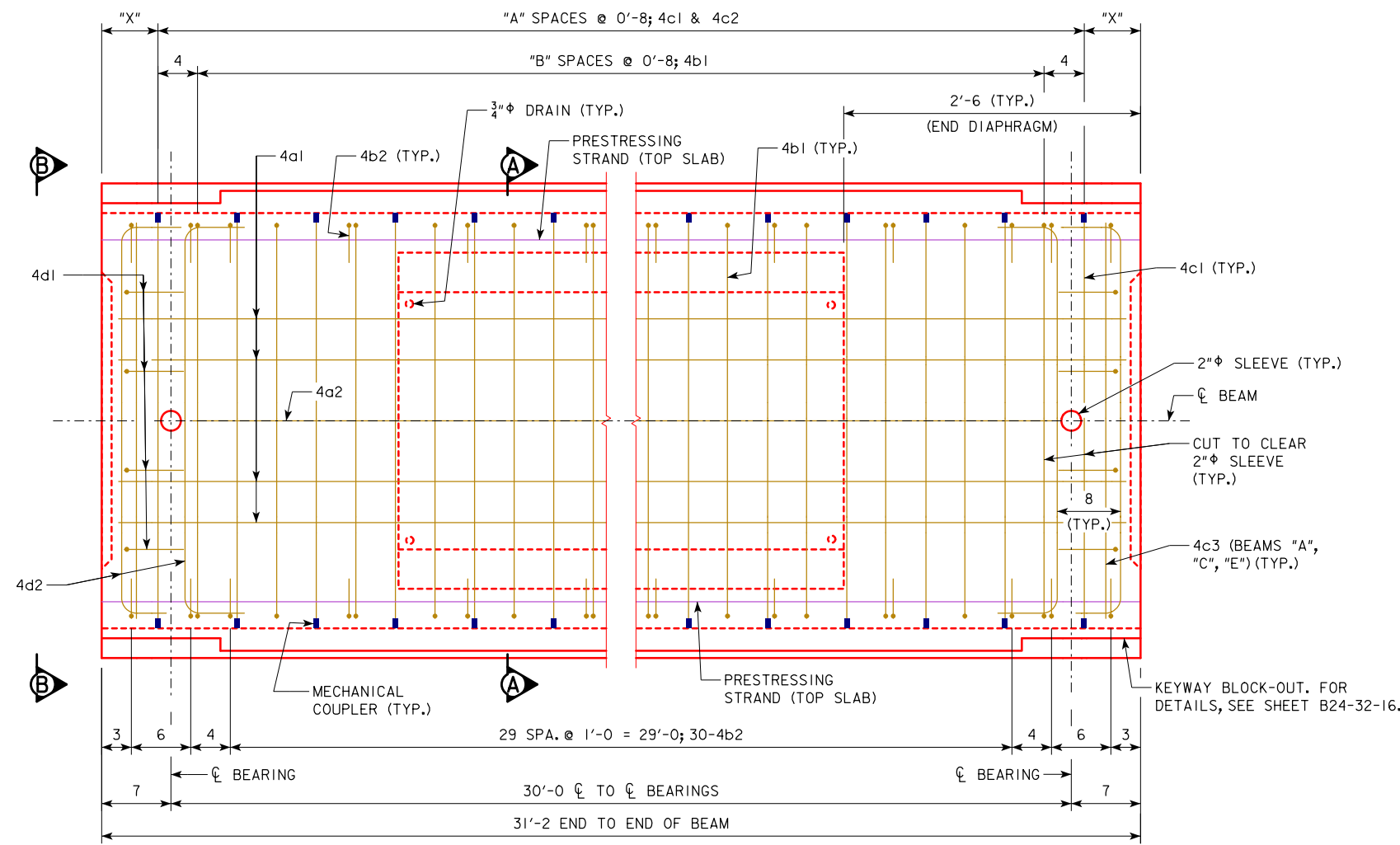


**ELEVATION**  
(KEYWAY NOT SHOWN FOR CLARITY)



**SECTION A-A**

NOTE:  
OMIT KEYWAY, MECHANICAL COUPLERS, AND 4c2 BARS ON EXTERIOR FACE OF EXTERIOR BEAMS.



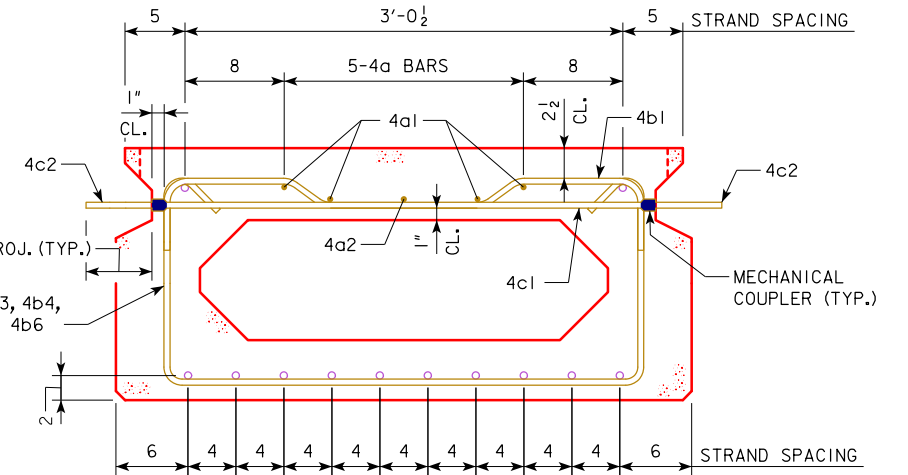
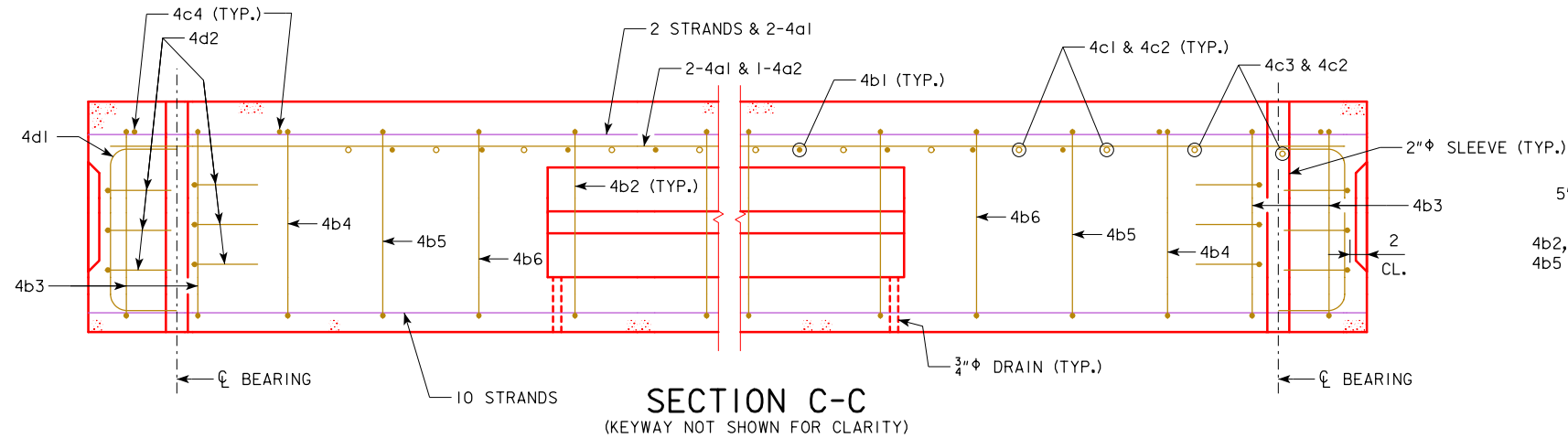
**PLAN**  
(INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR)  
(PRESTRESSING STRANDS IN BOTTOM SLAB AND 4c2 BARS NOT SHOWN FOR CLARITY)

TABLE OF DIMENSION DATA			
BEAM LINE	"X" (INCHES)	"A" (SPACES)	"B" (SPACES)
A	7	45	44
B	3	46	45
C	7	45	44
D	3	46	45
E	7	45	44
F	3	46	45

NOTE:  
FOR BEAM LINE DESIGNATIONS, SEE SHEET B24-06-16.

NOTES:  
FOR VIEW B-B, SEE SHEET B24-34-16.  
FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		<b>21" x 48" x 30'-0 PPCBB DETAILS</b> 0° SKEW	<b>B24-35-16</b>



SECTION A-A

NOTE:  
OMIT KEYWAY, MECHANICAL COUPLERS, AND 4c2 BARS ON EXTERIOR FACE OF EXTERIOR BEAMS.

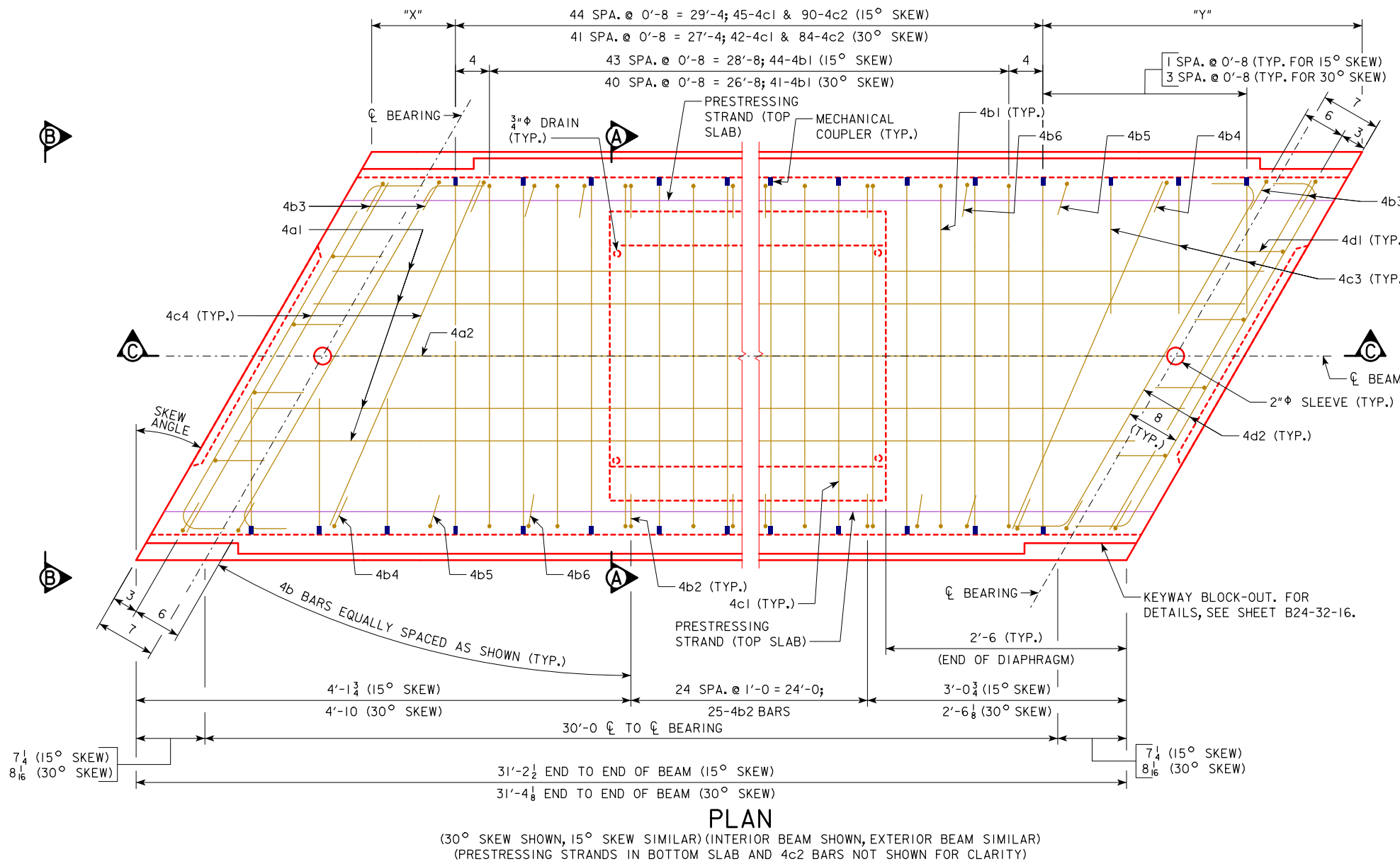


TABLE OF DIMENSION DATA

BEAM LINE	15° SKEW		30° SKEW	
	"X"	"Y"	"X"	"Y"
A	2 <sup>5</sup> / <sub>8</sub>	1'-7 <sup>7</sup> / <sub>8</sub>	11	3'-1 <sup>1</sup> / <sub>8</sub>
B	3 <sup>1</sup> / <sub>2</sub>	1'-7	10 <sup>5</sup> / <sub>8</sub>	3'-1 <sup>1</sup> / <sub>2</sub>
C	4 <sup>3</sup> / <sub>8</sub>	1'-6 <sup>1</sup> / <sub>8</sub>	10 <sup>3</sup> / <sub>8</sub>	3'-1 <sup>3</sup> / <sub>4</sub>
D	5 <sup>1</sup> / <sub>4</sub>	1'-5 <sup>1</sup> / <sub>4</sub>	10	3'-2 <sup>1</sup> / <sub>8</sub>
E	6 <sup>1</sup> / <sub>8</sub>	1'-4 <sup>3</sup> / <sub>8</sub>	9 <sup>3</sup> / <sub>4</sub>	3'-2 <sup>3</sup> / <sub>8</sub>
F	7	1'-3 <sup>1</sup> / <sub>2</sub>	9 <sup>1</sup> / <sub>2</sub>	3'-2 <sup>5</sup> / <sub>8</sub>

NOTE:  
FOR BEAM LINE DESIGNATIONS, SEE SHEET B24-06-16.

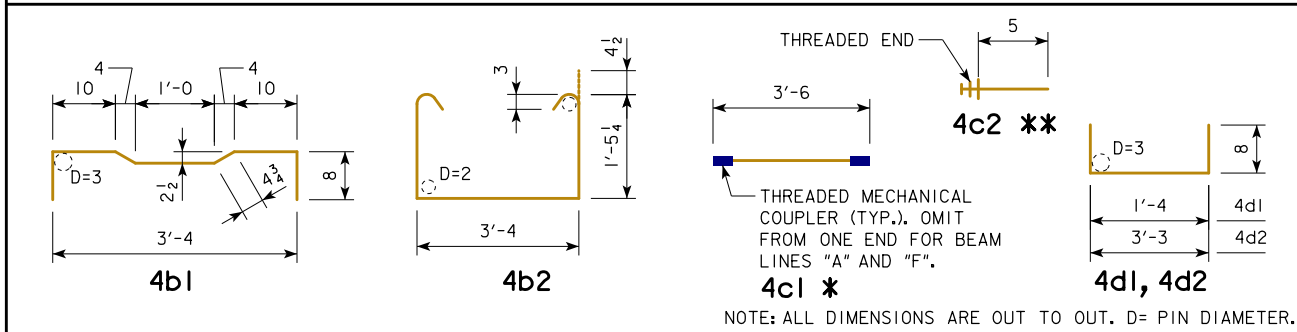
NOTES:  
FOR VIEW B-B, SEE SHEET B24-34-16.  
FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	<b>B24-36-16</b>
		DECEMBER, 2016	
		<b>21" x 48" x 30'-0 PPCBB DETAILS 15° AND 30° SKEW</b>	

**EPOXY COATED REINFORCING BAR LIST**  
21" x 48" x 30'-0 PPCBB, 0° SKEW

BEAM LINE		BEAM LINE "A"			BEAM LINES "B" AND "D"			BEAM LINES "C" AND "E"			BEAM LINE "F"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	4	30'-10	82	4	30'-10	82	4	30'-10	82	4	30'-10	82
4a2	—	1	29'-8	20	1	29'-8	20	1	29'-8	20	1	29'-8	20
4b1	⌋	45	4'-9½	144	46	4'-9½	147	45	4'-9½	144	46	4'-9½	147
4b2	⌋	34	6'-11½	158	34	6'-11½	158	34	6'-11½	158	34	6'-11½	158
4c1 *	—	46	3'-6	108	47	3'-6	110	46	3'-6	108	47	3'-6	110
4c2 **	—	46	0'-5	13	94	0'-5	26	92	0'-5	26	47	0'-5	13
4c3	—	2	3'-2	4	-	-	-	2	3'-2	4	-	-	-
4d1	⌋	8	2'-8	14	8	2'-8	14	8	2'-8	14	8	2'-8	14
4d2	⌋	12	4'-7	37	12	4'-7	37	12	4'-7	37	12	4'-7	37
TOTAL (LBS.)		580			594			593			581		

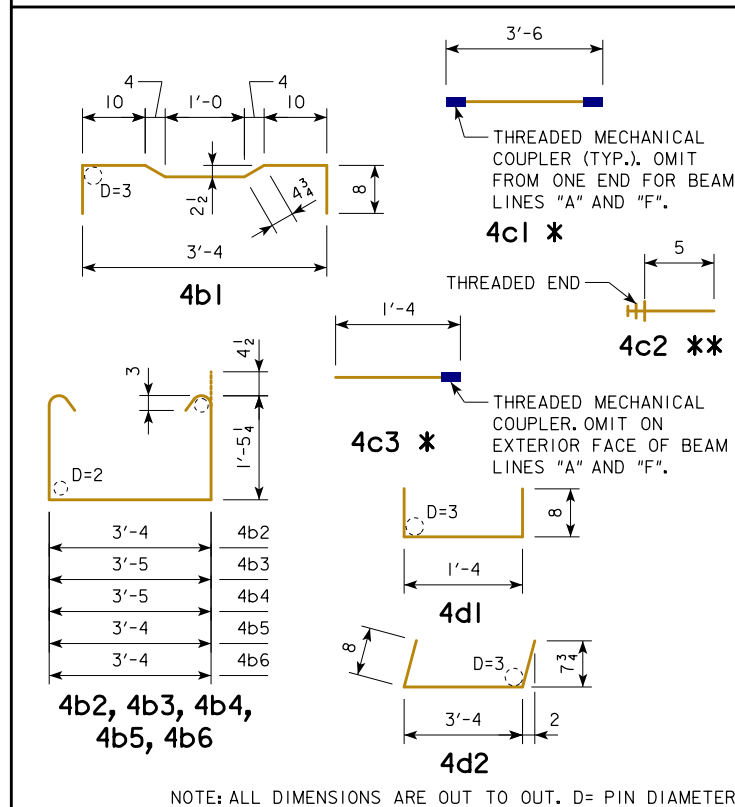
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
21" x 48" x 30'-0 PPCBB, 15° SKEW

BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	4	30'-10	82	4	30'-10	82
4a2	—	1	29'-8	20	1	29'-8	20
4b1	⌋	44	4'-9½	141	44	4'-9½	141
4b2	⌋	25	6'-11½	116	25	6'-11½	116
4b3	⌋	4	7'-0½	19	4	7'-0½	19
4b4	⌋	2	7'-0½	9	2	7'-0½	9
4b5	⌋	2	6'-11½	9	2	6'-11½	9
4b6	⌋	2	6'-11½	9	2	6'-11½	9
4c1 *	—	45	3'-6	105	45	3'-6	105
4c2 **	—	46	0'-5	13	92	0'-5	26
4c3 *	—	2	1'-4	2	2	1'-4	2
4c4	—	4	3'-4	9	4	3'-4	9
4d1	⌋	8	2'-8	14	8	2'-8	14
4d2	⌋	12	4'-8	37	12	4'-8	37
TOTAL (LBS.)		585			598		

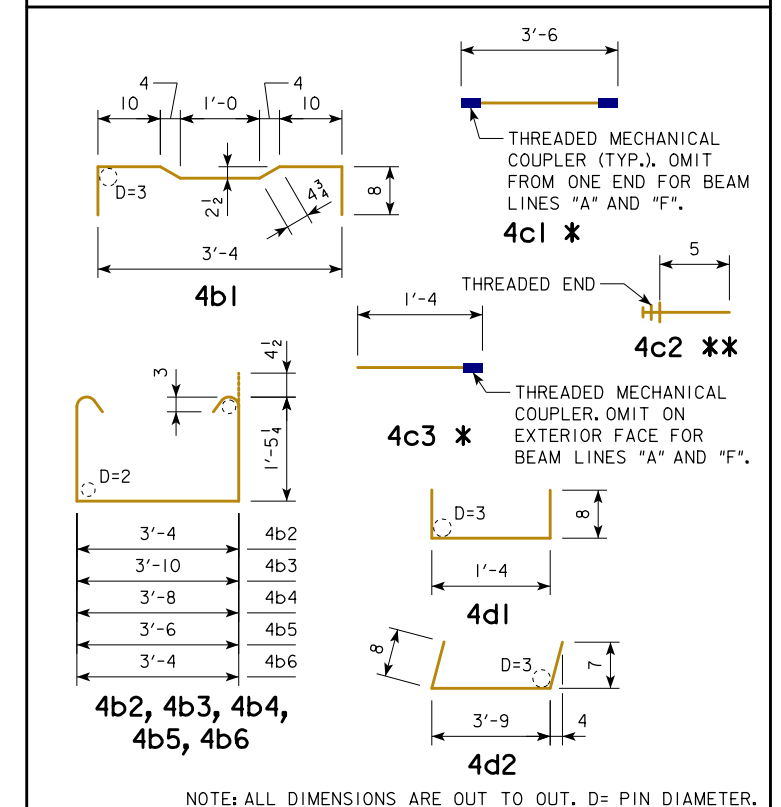
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
21" x 48" x 30'-0 PPCBB, 30° SKEW

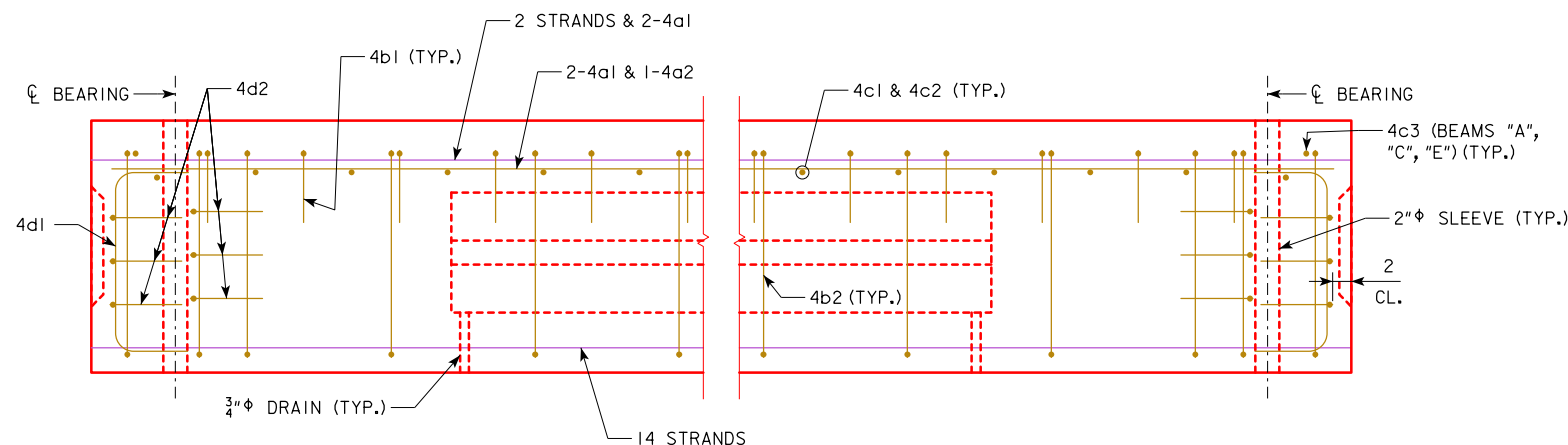
BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	4	30'-10	82	4	30'-10	82
4a2	—	1	29'-8	20	1	29'-8	20
4b1	⌋	41	4'-9½	131	41	4'-9½	131
4b2	⌋	25	6'-11½	116	25	6'-11½	116
4b3	⌋	4	7'-5½	20	4	7'-5½	20
4b4	⌋	2	7'-3½	10	2	7'-3½	10
4b5	⌋	2	7'-1½	10	2	7'-1½	10
4b6	⌋	2	6'-11½	9	2	6'-11½	9
4c1 *	—	42	3'-6	98	42	3'-6	98
4c2 **	—	45	0'-5	13	90	0'-5	25
4c3 *	—	6	1'-4	5	6	1'-4	5
4c4	—	4	3'-8	10	4	3'-8	10
4d1	⌋	8	2'-8	14	8	2'-8	14
4d2	⌋	12	5'-1	41	12	5'-1	41
TOTAL (LBS.)		579			591		

**BENT BAR DETAILS**

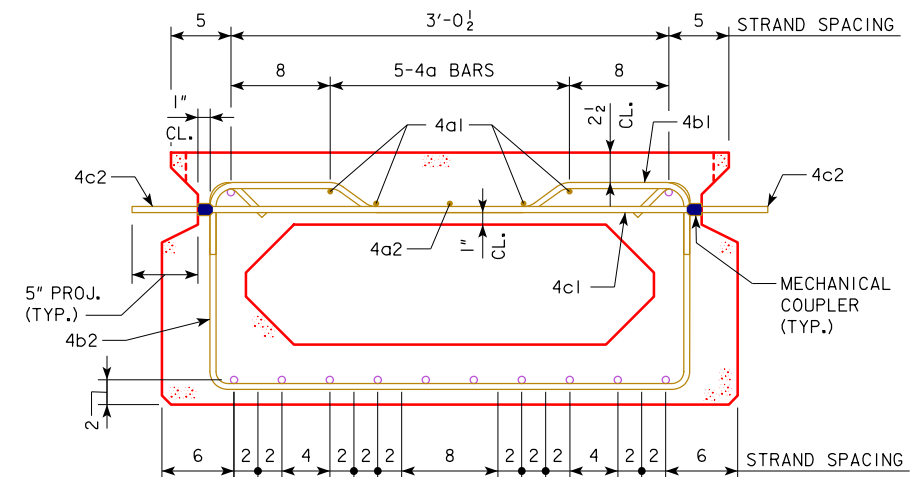


NOTES:  
 \* INCLUDES MECHANICAL COUPLER(S). SEE BENT BAR DETAILS.  
 \*\* SEE BENT BAR DETAILS. THE LENGTHS SHOWN DO NOT INCLUDE AN ALLOWANCE FOR THE THREADED END. BAR LENGTHS MAY NEED TO INCREASE DEPENDING ON THE MECHANICAL COUPLER ASSEMBLY USED. THE COST OF THE THREADED PORTION OF THESE BARS IS TO BE INCLUDED IN THE PRICE BID FOR THE BEAMS. THE WEIGHT OF THE THREADED END IS NOT INCLUDED IN THE QUANTITY SHOWN.

LATEST REVISION DATE	Approved by <i>Thomas L. Mc Donald</i> BRIDGE ENGINEER	
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
21" x 48" x 30'-0 PPCBB DETAILS REINFORCING BAR LIST		<b>B24-37-16</b>

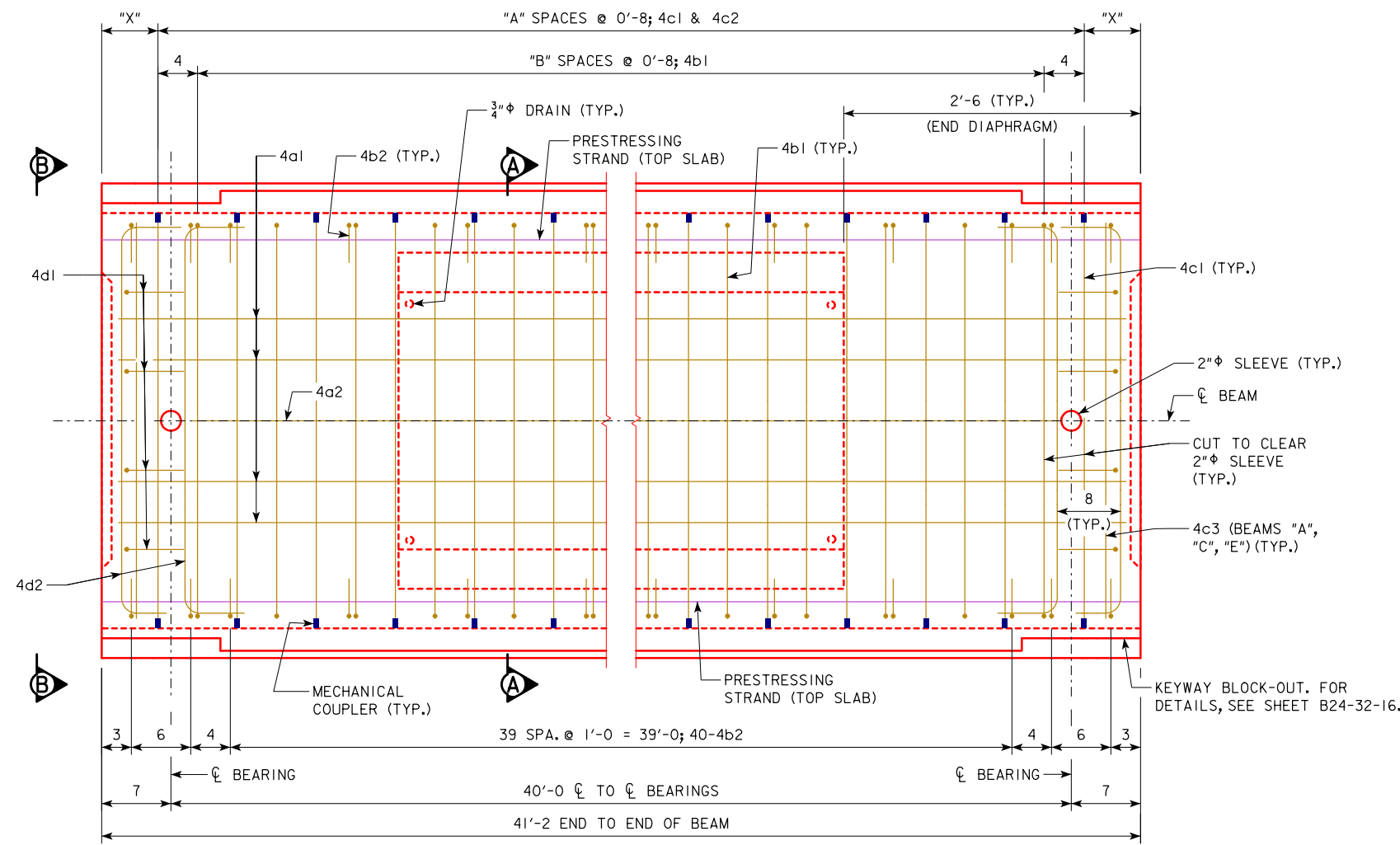


**ELEVATION**  
(KEYWAY NOT SHOWN FOR CLARITY)



**SECTION A-A**

NOTE:  
OMIT KEYWAY, MECHANICAL COUPLERS, AND 4c2 BARS ON EXTERIOR FACE OF EXTERIOR BEAMS.



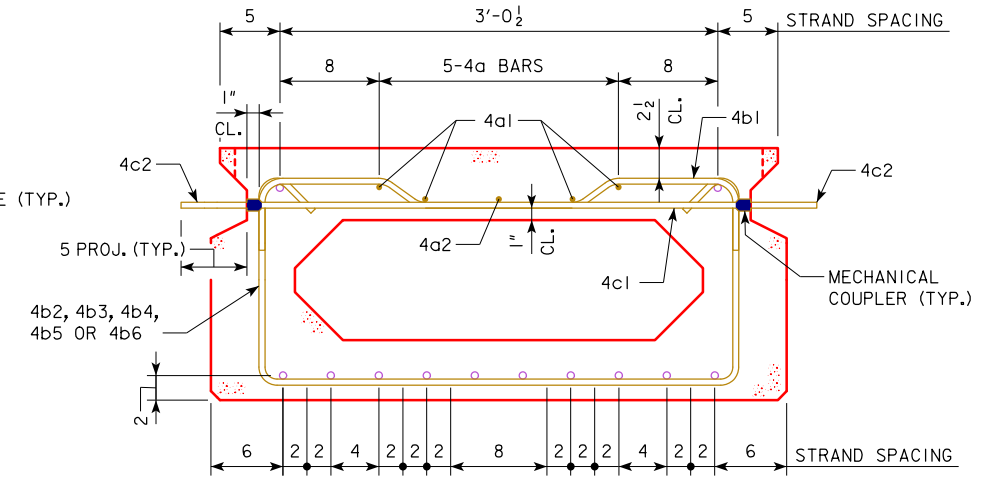
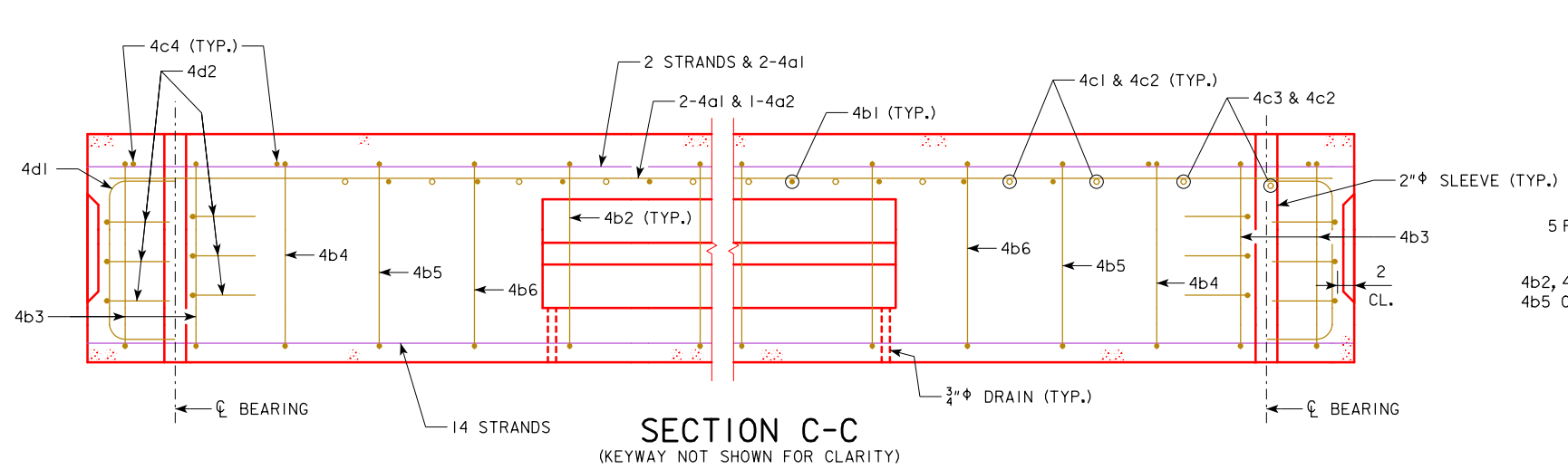
**PLAN**  
(INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR)  
(PRESTRESSING STRANDS IN BOTTOM SLAB AND 4c2 BARS NOT SHOWN FOR CLARITY)

TABLE OF DIMENSION DATA			
BEAM LINE	"X" (INCHES)	"A" (SPACES)	"B" (SPACES)
A	7	60	59
B	3	61	60
C	7	60	59
D	3	61	60
E	7	60	59
F	3	61	60

NOTE:  
FOR BEAM LINE DESIGNATIONS, SEE SHEET B24-06-16.

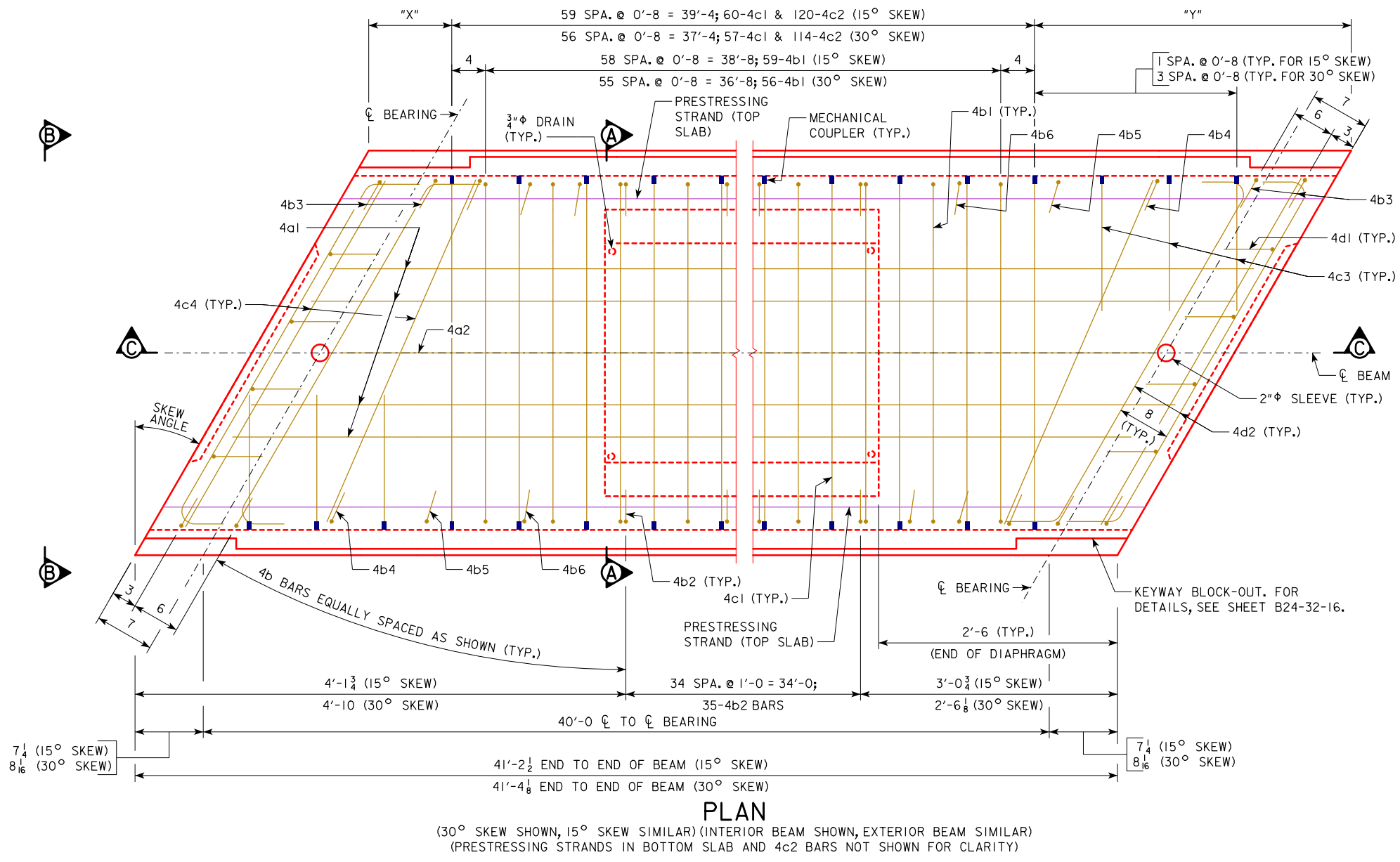
NOTES:  
FOR VIEW B-B, SEE SHEET B24-34-16.  
FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		<b>21" x 48" x 40'-0 PPCBB DETAILS</b> 0° SKEW	<b>B24-38-16</b>



SECTION A-A

NOTE:  
OMIT KEYWAY, MECHANICAL COUPLERS, AND 4c2 BARS ON EXTERIOR FACE OF EXTERIOR BEAMS.



PLAN

(30° SKEW SHOWN, 15° SKEW SIMILAR) (INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR)  
(PRESTRESSING STRANDS IN BOTTOM SLAB AND 4c2 BARS NOT SHOWN FOR CLARITY)

TABLE OF DIMENSION DATA

BEAM LINE	15° SKEW		30° SKEW	
	"X"	"Y"	"X"	"Y"
A	2 5/8	1'-7 7/8	11	3'-1 1/8
B	3 1/2	1'-7	10 5/8	3'-1 1/2
C	4 3/8	1'-6 1/8	10 3/8	3'-1 3/4
D	5 1/4	1'-5 1/4	10	3'-2 1/8
E	6 1/8	1'-4 3/8	9 3/4	3'-2 3/8
F	7	1'-3 1/2	9 1/2	3'-2 5/8

NOTE:  
FOR BEAM LINE DESIGNATIONS, SEE SHEET B24-06-16.

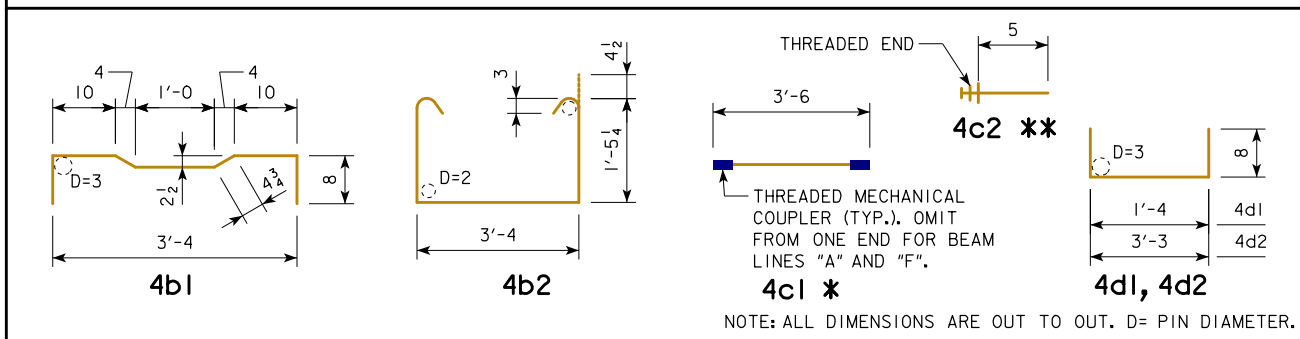
NOTES:  
FOR VIEW B-B, SEE SHEET B24-34-16.  
FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		<b>21" x 48" x 40'-0 PPCBB DETAILS 15° AND 30° SKEW</b>	<b>B24-39-16</b>

**EPOXY COATED REINFORCING BAR LIST**  
21" x 48" x 40'-0 PPCBB, 0° SKEW

BEAM LINE		BEAM LINE "A"			BEAM LINES "B" AND "D"			BEAM LINES "C" AND "E"			BEAM LINE "F"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	4	40'-10	109	4	40'-10	109	4	40'-10	109	4	40'-10	109
4a2	—	1	39'-8	26	1	39'-8	26	1	39'-8	26	1	39'-8	26
4b1	⌋	60	4'-9½	192	61	4'-9½	195	60	4'-9½	192	61	4'-9½	195
4b2	⌋	44	6'-11½	205	44	6'-11½	205	44	6'-11½	205	44	6'-11½	205
4c1 *	—	61	3'-6	143	62	3'-6	145	61	3'-6	143	62	3'-6	145
4c2 **	—	61	0'-5	17	124	0'-5	35	122	0'-5	34	62	0'-5	17
4c3	—	2	3'-2	4	-	-	-	2	3'-2	4	-	-	-
4d1	⌋	8	2'-8	14	8	2'-8	14	8	2'-8	14	8	2'-8	14
4d2	⌋	12	4'-7	37	12	4'-7	37	12	4'-7	37	12	4'-7	37
TOTAL (LBS.)		747			766			764			748		

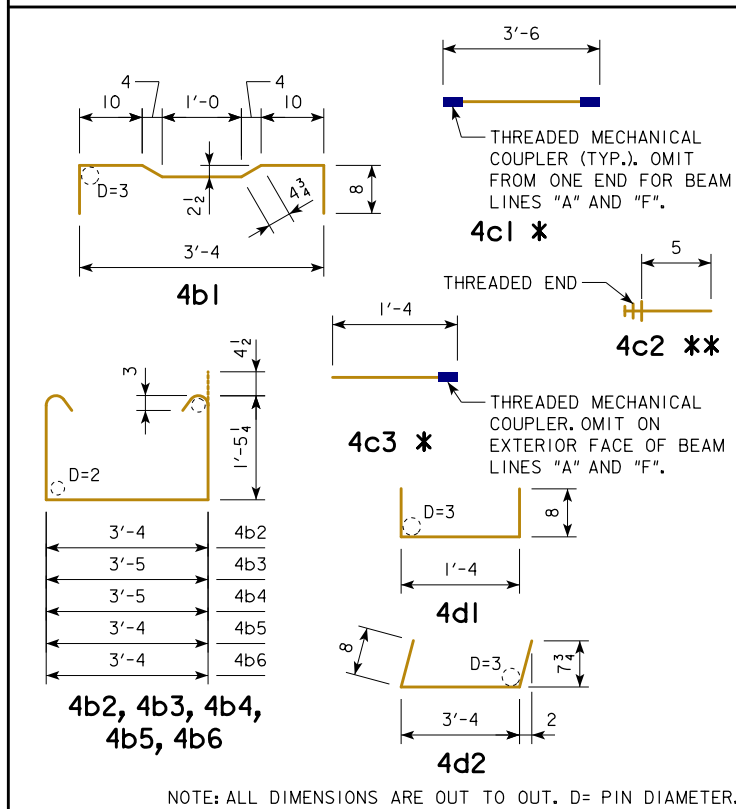
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
21" x 48" x 40'-0 PPCBB, 15° SKEW

BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	4	40'-10	109	4	40'-10	109
4a2	—	1	39'-8	26	1	39'-8	26
4b1	⌋	59	4'-9½	189	59	4'-9½	189
4b2	⌋	35	6'-11½	163	35	6'-11½	163
4b3	⌋	4	7'-0½	19	4	7'-0½	19
4b4	⌋	2	7'-0½	9	2	7'-0½	9
4b5	⌋	2	6'-11½	9	2	6'-11½	9
4b6	⌋	2	6'-11½	9	2	6'-11½	9
4c1 *	—	60	3'-6	140	60	3'-6	140
4c2 **	—	61	0'-5	17	122	0'-5	34
4c3 *	—	2	1'-4	2	2	1'-4	2
4c4	—	4	3'-4	9	4	3'-4	9
4d1	⌋	8	2'-8	14	8	2'-8	14
4d2	⌋	12	4'-8	37	12	4'-8	37
TOTAL (LBS.)		752			769		

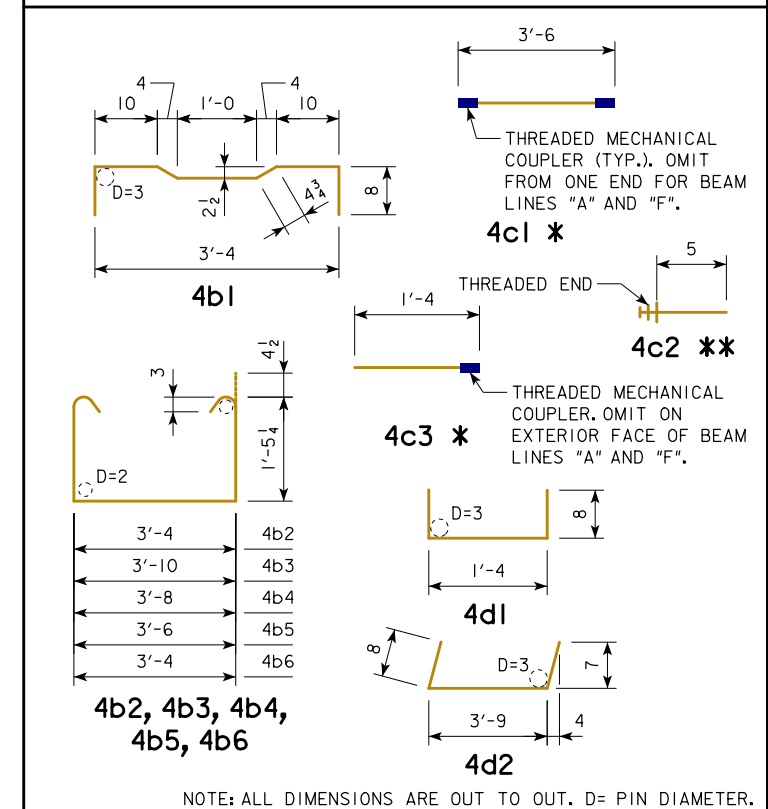
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
21" x 48" x 40'-0 PPCBB, 30° SKEW

BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	4	40'-10	109	4	40'-10	109
4a2	—	1	39'-8	26	1	39'-8	26
4b1	⌋	56	4'-9½	179	56	4'-9½	179
4b2	⌋	35	6'-11½	163	35	6'-11½	163
4b3	⌋	4	7'-5½	20	4	7'-5½	20
4b4	⌋	2	7'-3½	10	2	7'-3½	10
4b5	⌋	2	7'-1½	10	2	7'-1½	10
4b6	⌋	2	6'-11½	9	2	6'-11½	9
4c1 *	—	57	3'-6	133	57	3'-6	133
4c2 **	—	60	0'-5	17	120	0'-5	33
4c3 *	—	6	1'-4	5	6	1'-4	5
4c4	—	4	3'-8	10	4	3'-8	10
4d1	⌋	8	2'-8	14	8	2'-8	14
4d2	⌋	12	5'-1	41	12	5'-1	41
TOTAL (LBS.)		746			762		

**BENT BAR DETAILS**

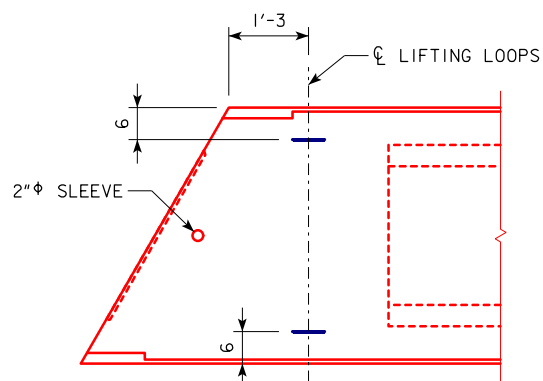
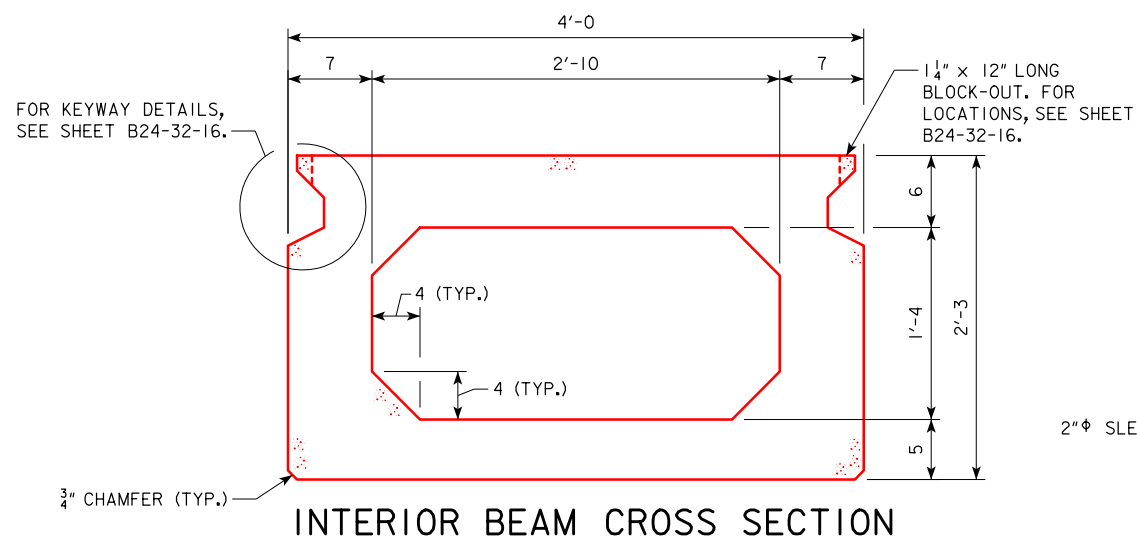


NOTES:  
 \* INCLUDES MECHANICAL COUPLER(S). SEE BENT BAR DETAILS.  
 \*\* SEE BENT BAR DETAILS. THE LENGTHS SHOWN DO NOT INCLUDE AN ALLOWANCE FOR THE THREADED END. BAR LENGTHS MAY NEED TO INCREASE DEPENDING ON THE MECHANICAL COUPLER ASSEMBLY USED. THE COST OF THE THREADED PORTION OF THESE BARS IS TO BE INCLUDED IN THE PRICE BID FOR THE BEAMS. THE WEIGHT OF THE THREADED END IS NOT INCLUDED IN THE QUANTITY SHOWN.

LATEST REVISION DATE	Approved by <i>Thomas L. Mc Donald</i> BRIDGE ENGINEER	
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
		21" x 48" x 40'-0 PPCBB DETAILS REINFORCING BAR LIST
		<b>B24-40-16</b>

## 27" x 48" PRETENSIONED PRESTRESSED CONCRETE BOX BEAM DATA

BEAM	SKEW (DEGREES)	SPAN LENGTH ℄-℄ BEARING	OVERALL BEAM LENGTH	CONCRETE STRENGTH		STRAND SIZE DIA. (in.)	NO. OF STRANDS	TOTAL INITIAL PRESTRESS (KIPS)	CAMBER (in.)		WEIGHT (TONS)	CONCRETE (C.Y.)	REINFORCING STEEL (LBS.)
				f'ci (ksi)	f'c (ksi)				AT RELEASE	AFTER LOSSES			
PPCBB 27" x 48" x 50'-0	0	50'-0	51'-2	5.0	6.0	0.6	16	681	0.5	0.8	21.4	10.6	SEE SHEET B24-44-16
	15		51'-2½								21.7	10.7	
	30		51'-4½								22.1	10.9	
PPCBB 27" x 48" x 60'-0	0	60'-0	61'-2	5.0	6.0	0.6	22	936	0.9	1.7	25.4	12.5	SEE SHEET B24-47-16
	15		61'-2½								25.7	12.7	
	30		61'-4½								26.0	12.9	



A = 754 in<sup>2</sup>  
 Y<sub>b</sub> = 13.5 in  
 I = 65,754 in<sup>4</sup>

### BEAM SECTION PROPERTIES (INTERIOR BEAM)

### SPECIFICATIONS:

DESIGN: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH ED., SERIES OF 2014, EXCEPT AS NOTED IN "LIVE LOAD DISTRIBUTION FACTOR NOTES".

CONSTRUCTION: STANDARD SPECIFICATIONS OF THE IOWA DEPARTMENT OF TRANSPORTATION, CURRENT SERIES, WITH CURRENT APPLICABLE SPECIAL PROVISIONS AND SUPPLEMENTAL SPECIFICATIONS.

### LIVE LOAD DISTRIBUTION FACTOR NOTES:

LIVE LOAD DISTRIBUTION FACTORS USED FOR THE FLEXURAL DESIGN OF THE BEAMS WAS BASED ON PAST STUDIES CONDUCTED BY IADOT. HOWEVER, AASHTO EQUATIONS INCLUDING SKEW EFFECTS WERE USED FOR DETERMINING THE LIVE LOAD DISTRIBUTION FACTOR FOR SHEAR. CONTROLLING LIVE LOAD DISTRIBUTION FACTORS ARE:

- 50'-0 SPAN
- MOMENT = 0.50 LANES / BEAM
- SHEAR = 0.69 LANES / BEAM
- 60'-0 SPAN
- MOMENT = 0.50 LANES / BEAM
- SHEAR = 0.69 LANES / BEAM

### DESIGN STRESSES:

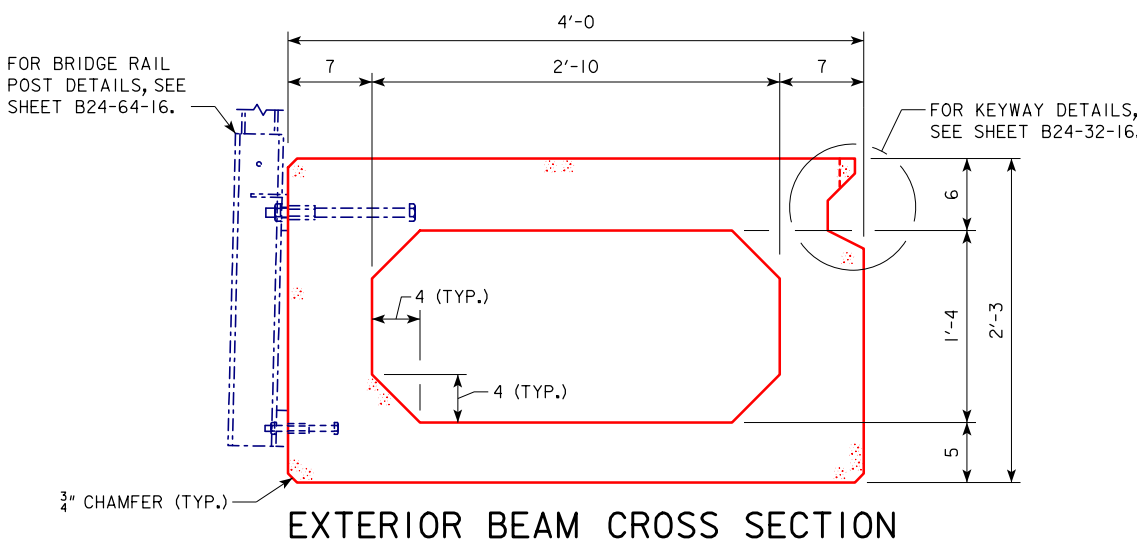
DESIGN STRESSES FOR THE FOLLOWING MATERIALS ARE TO BE IN ACCORDANCE WITH AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH ED., SERIES OF 2014:

- REINFORCING STEEL IN ACCORDANCE WITH SECTION 5, GRADE 60.
- CONCRETE IN ACCORDANCE WITH SECTION 5.
- PRESTRESSING STEEL IN ACCORDANCE WITH SECTION 5, GRADE 270.

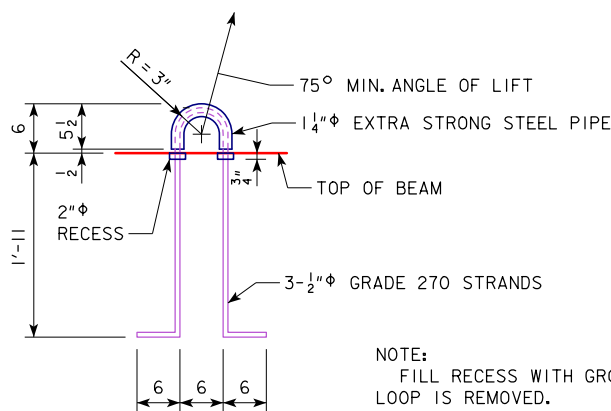
### NOTES:

- THESE BEAMS ARE DESIGNED FOR HL93 LOADING WITH AN ALLOWANCE OF 50 lb. PER SQUARE FOOT OF ROADWAY FOR GRAVEL OR FUTURE WEARING SURFACE.
- ALL PRESTRESSING STRANDS SHALL CONFORM TO ASTM A416 GRADE 270 LOW RELAXATION STRANDS.
- TOPS OF BEAMS ARE TO BE STRUCK OFF LEVEL AND LONGITUDINALLY TINED IN ACCORDANCE WITH ARTICLE 2301.03, H, 3 OF THE STANDARD SPECIFICATIONS.
- BEARINGS SHALL BE AS DETAILED ON OTHER DESIGN SHEETS.
- BEAMS ARE TO BE AT LEAST 28 DAYS OLD BEFORE THE FUTURE WEARING SURFACE, IF USED, IS PLACED UNLESS A SHORTER CURING TIME IS APPROVED BY THE BRIDGE ENGINEER.
- ALL BEAMS ARE TO BE INCREASED IN LENGTH TO COMPENSATE FOR ELASTIC SHORTENING, CREEP AND SHRINKAGE.
- 0.6" DIAMETER STRANDS STRESSED TO NOT MORE THAN 5,000 LBS. EACH MAY BE USED IN LIEU OF THE  $\alpha$  BARS WHICH RUN THE FULL LENGTH OF THE BEAM IN THE TOP SLAB.
- TOTAL INITIAL PRESTRESS IS BASED ON 72.6% f's, f's = 270 ksi AND A<sub>s</sub> = 0.217 sq. in.
- LIFTING OPERATIONS SHALL BE PERFORMED IN A MANNER THAT LIFTING LOOPS CARRY LOADS EQUALLY.

- NOTES:
- FOR VIEW B-B LOCATION, SEE SHEETS B24-42-16 & B24-43-16.
  - FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

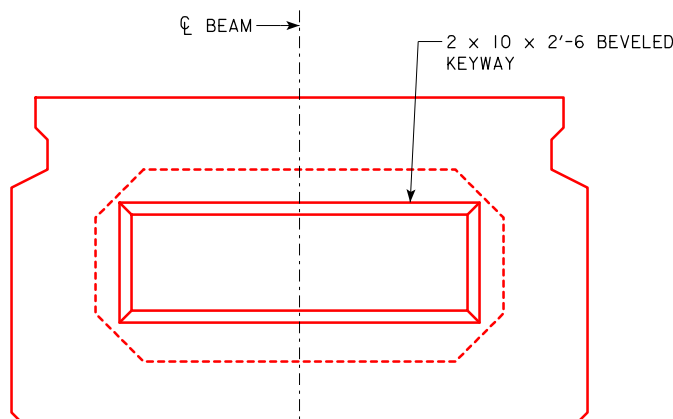
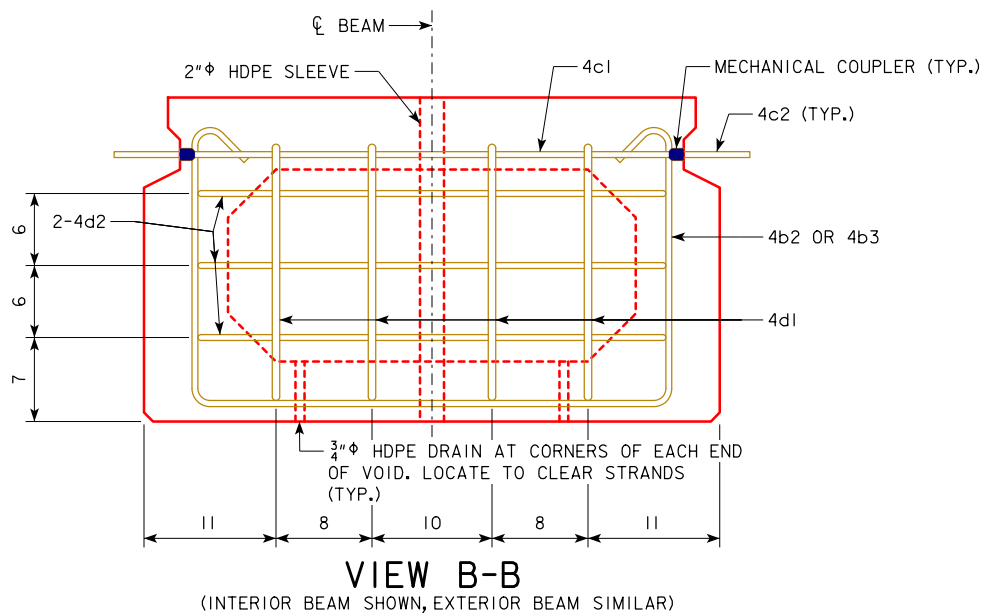


### LIFTING LOOP PLAN

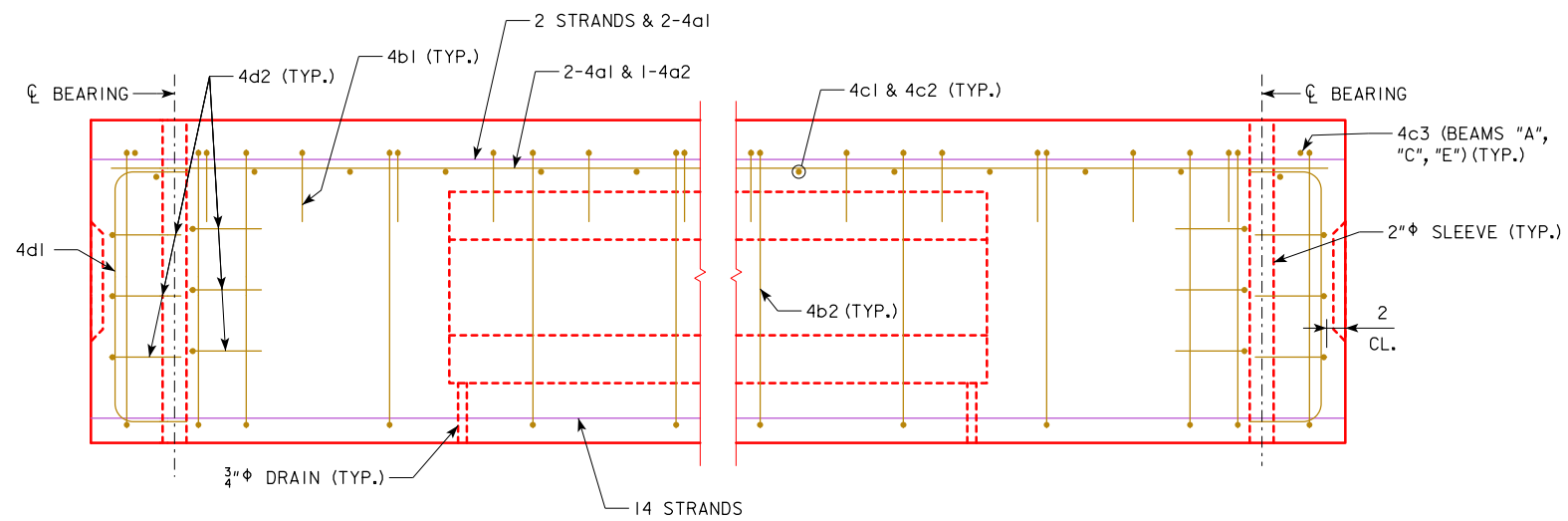


### LIFTING LOOP DETAIL

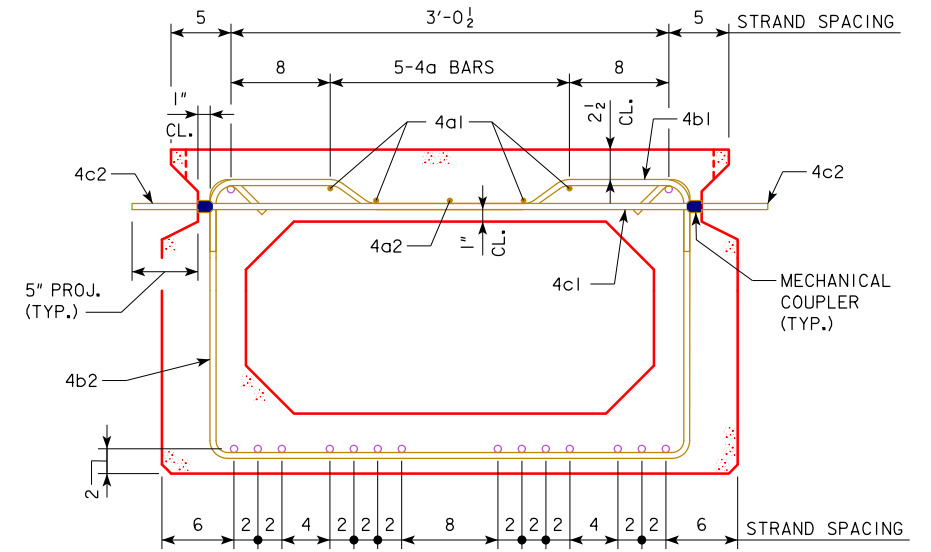
ALTERNATE TYPES OF LIFTING LOOPS MAY BE SUBMITTED FOR APPROVAL.



LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016	
		27" x 48" PPCBB DETAILS	B24-41-16

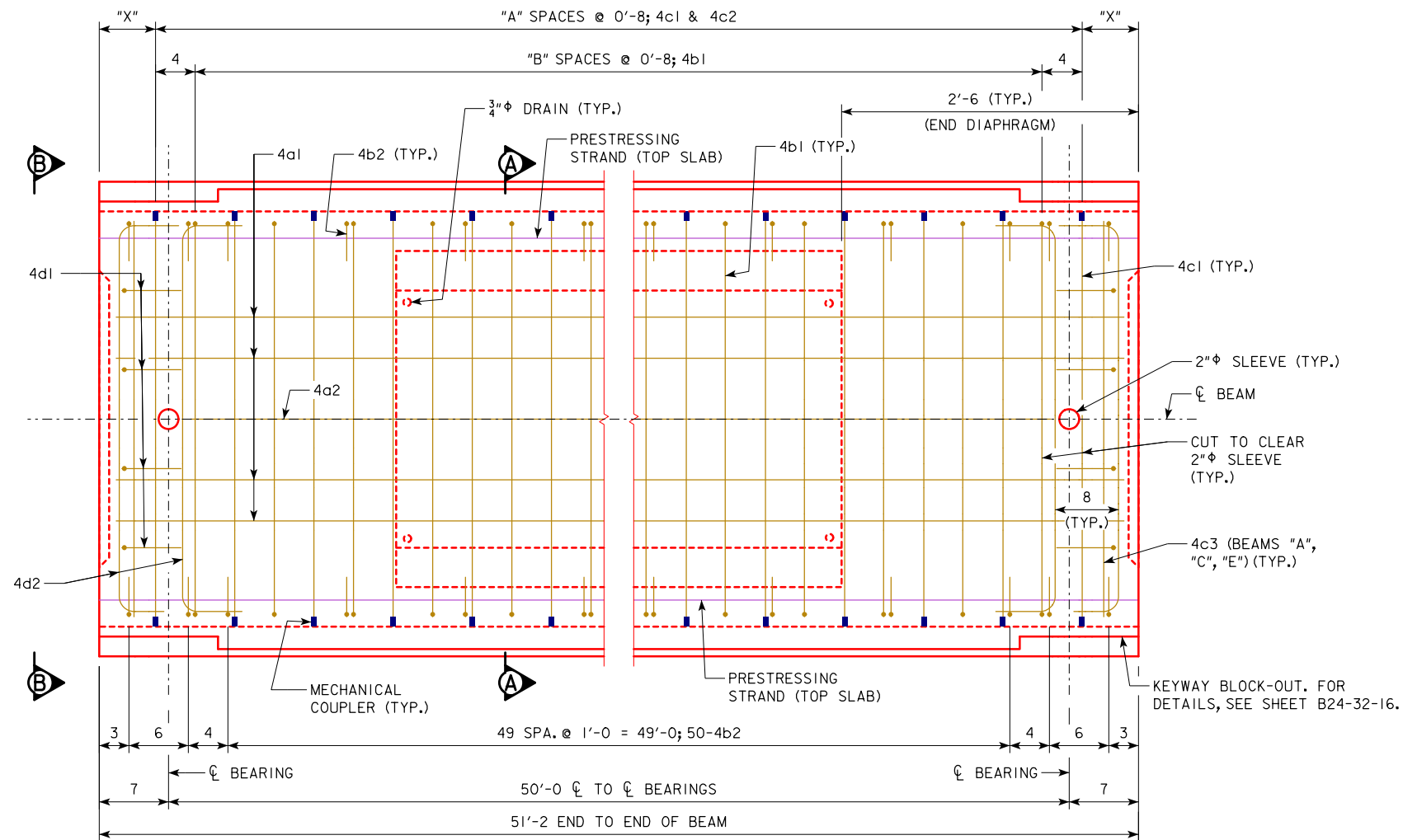


**ELEVATION**  
(KEYWAY NOT SHOWN FOR CLARITY)



**SECTION A-A**

NOTE:  
OMIT KEYWAY, MECHANICAL COUPLERS, AND 4c2 BARS ON EXTERIOR FACE OF EXTERIOR BEAMS.



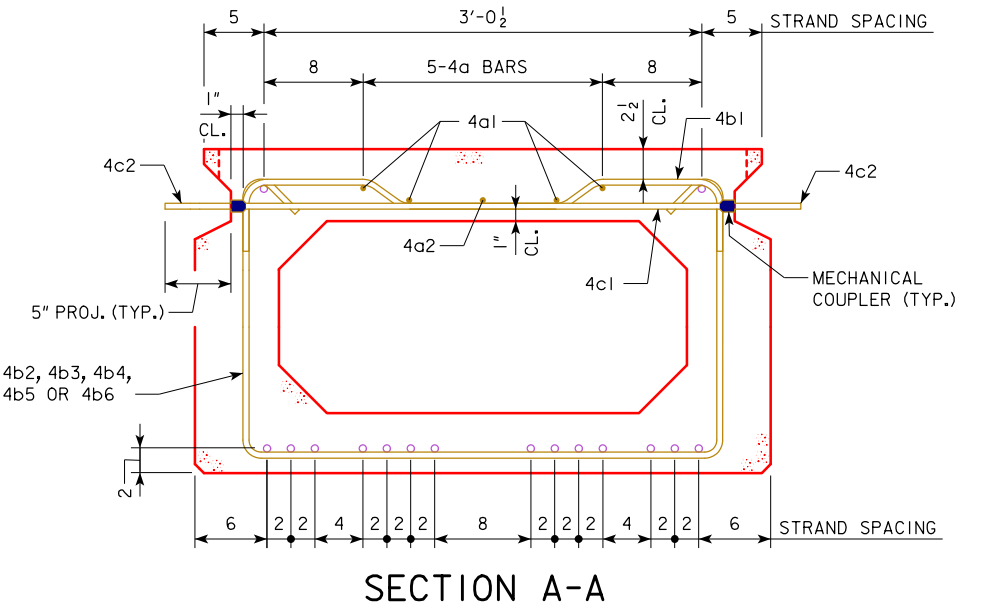
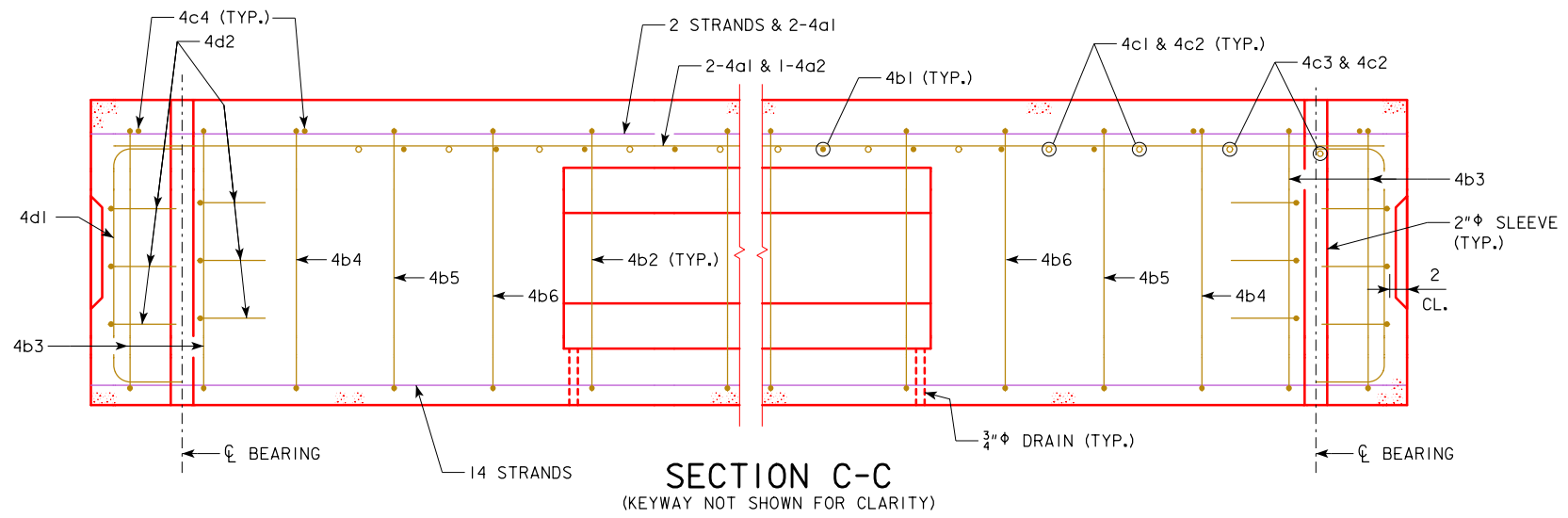
**PLAN**  
(INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR)  
(PRESTRESSING STRANDS IN BOTTOM SLAB AND 4c2 BARS NOT SHOWN FOR CLARITY)

TABLE OF DIMENSION DATA			
BEAM LINE	"X" (INCHES)	"A" (SPACES)	"B" (SPACES)
A	7	75	74
B	3	76	75
C	7	75	74
D	3	76	75
E	7	75	74
F	3	76	75

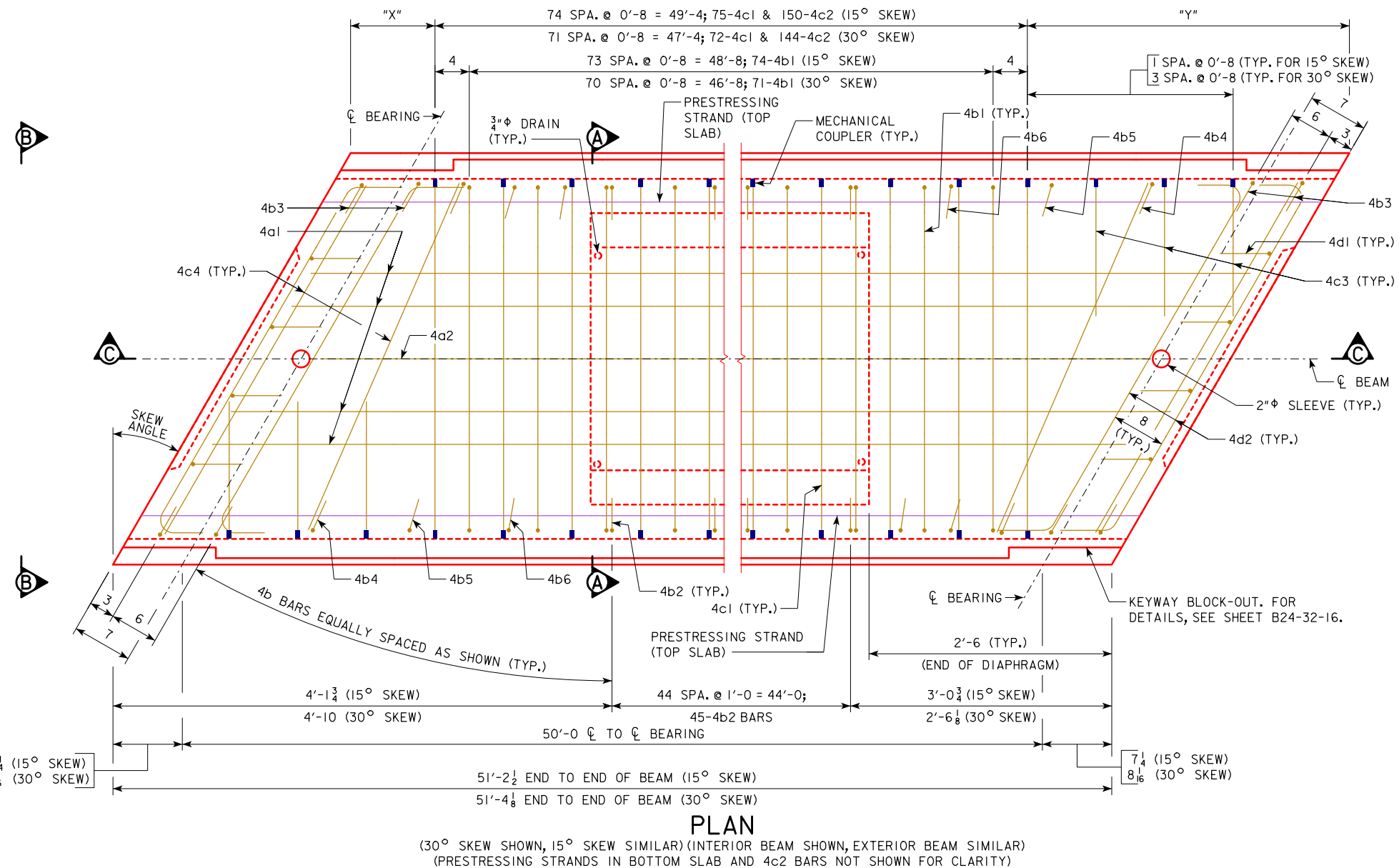
NOTE:  
FOR BEAM LINE DESIGNATIONS, SEE SHEET B24-06-16.

NOTES:  
FOR VIEW B-B, SEE SHEET B24-41-16.  
FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
<b>27" x 48" x 50'-0 PPCBB DETAILS</b> 0° SKEW		<b>B24-42-16</b>



NOTE:  
OMIT KEYWAY, MECHANICAL COUPLERS, AND 4c2 BARS ON EXTERIOR FACE OF EXTERIOR BEAMS.



BEAM LINE	15° SKEW		30° SKEW	
	"X"	"Y"	"X"	"Y"
A	2 5/8	1'-7 7/8	11	3'-1 1/8
B	3 1/2	1'-7	10 5/8	3'-1 1/2
C	4 3/8	1'-6 1/8	10 3/8	3'-1 3/4
D	5 1/4	1'-5 1/4	10	3'-2 1/8
E	6 1/8	1'-4 3/8	9 3/4	3'-2 3/8
F	7	1'-3 1/2	9 1/2	3'-2 3/8

NOTE:  
FOR BEAM LINE DESIGNATIONS, SEE SHEET B24-06-16.

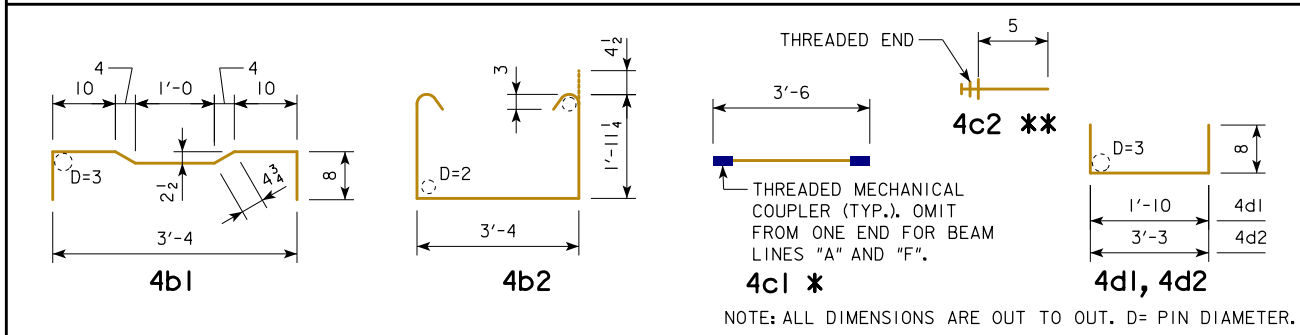
NOTES:  
FOR VIEW B-B, SEE SHEET B24-41-16.  
FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	<b>B24-43-16</b>
		DECEMBER, 2016	
		<b>27" x 48" x 50'-0 PPCBB DETAILS 15° AND 30° SKEW</b>	

**EPOXY COATED REINFORCING BAR LIST**  
**27" x 48" x 50'-0 PPCBB, 0° SKEW**

BEAM LINE		BEAM LINE "A"			BEAM LINES "B" AND "D"			BEAM LINES "C" AND "E"			BEAM LINE "F"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	4	50'-10	136	4	50'-10	136	4	50'-10	136	4	50'-10	136
4a2	—	1	49'-8	33	1	49'-8	33	1	49'-8	33	1	49'-8	33
4b1	⌋	75	4'-9½	240	76	4'-9½	243	75	4'-9½	240	76	4'-9½	243
4b2	⌋	54	7'-11½	287	54	7'-11½	287	54	7'-11½	287	54	7'-11½	287
4c1 *	—	76	3'-6	178	77	3'-6	180	76	3'-6	178	77	3'-6	180
4c2 **	—	76	0'-5	21	154	0'-5	43	152	0'-5	42	77	0'-5	21
4c3	—	2	3'-2	4	-	-	-	2	3'-2	4	-	-	-
4d1	⌋	8	3'-2	17	8	3'-2	17	8	3'-2	17	8	3'-2	17
4d2	⌋	12	4'-7	37	12	4'-7	37	12	4'-7	37	12	4'-7	37
TOTAL (LBS.)		953			976			974			954		

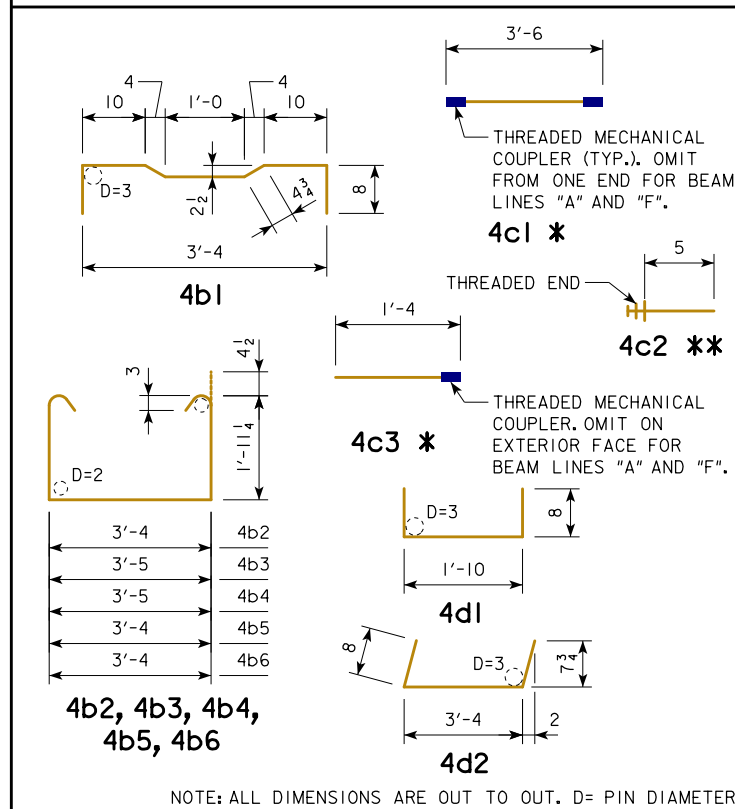
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
**27" x 48" x 50'-0 PPCBB, 15° SKEW**

BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	4	50'-10	136	4	50'-10	136
4a2	—	1	49'-8	33	1	49'-8	33
4b1	⌋	74	4'-9½	237	74	4'-9½	237
4b2	⌋	45	7'-11½	239	45	7'-11½	239
4b3	⌋	4	8'-0½	21	4	8'-0½	21
4b4	⌋	2	8'-0½	11	2	8'-0½	11
4b5	⌋	2	7'-11½	11	2	7'-11½	11
4b6	⌋	2	7'-11½	11	2	7'-11½	11
4c1 *	—	75	3'-6	175	75	3'-6	175
4c2 **	—	76	0'-5	21	152	0'-5	42
4c3 *	—	2	1'-4	2	2	1'-4	2
4c4	—	4	3'-4	9	4	3'-4	9
4d1	⌋	8	3'-2	17	8	3'-2	17
4d2	⌋	12	4'-8	37	12	4'-8	37
TOTAL (LBS.)		960			981		

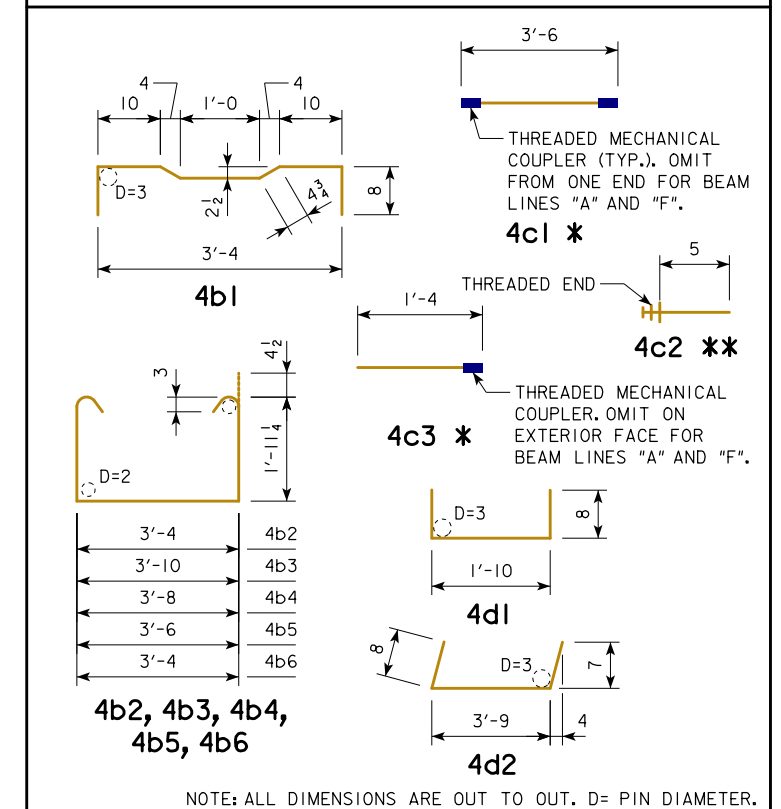
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
**27" x 48" x 50'-0 PPCBB, 30° SKEW**

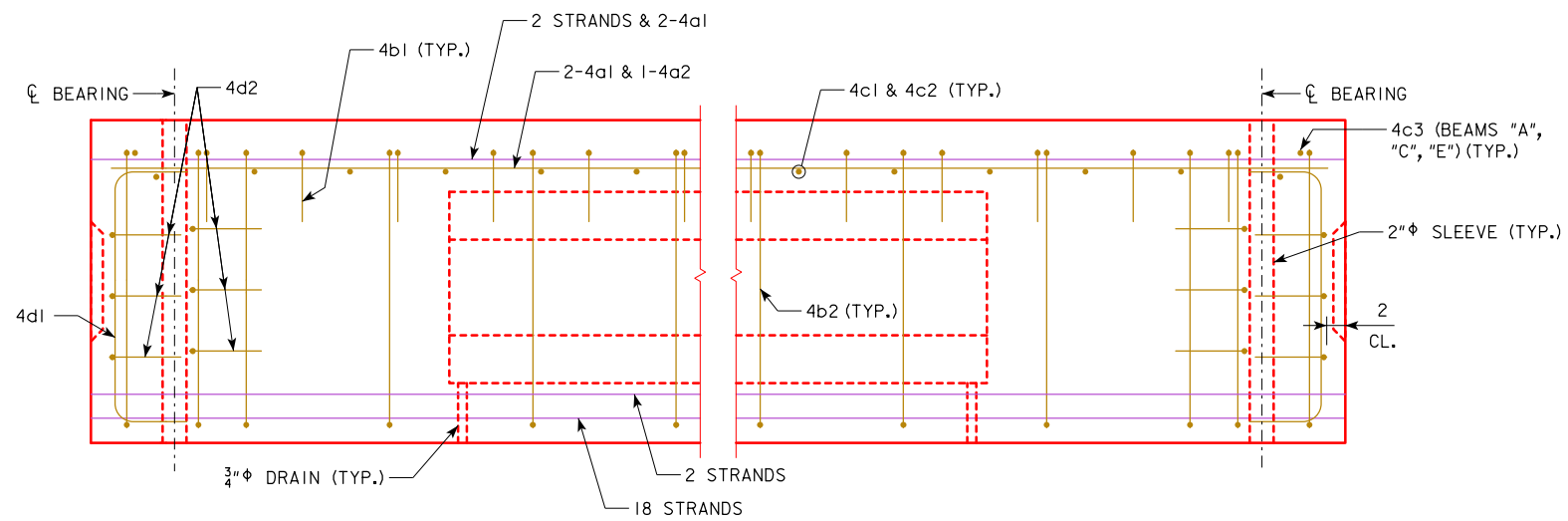
BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	4	50'-10	136	4	50'-10	136
4a2	—	1	49'-8	33	1	49'-8	33
4b1	⌋	71	4'-9½	227	71	4'-9½	227
4b2	⌋	45	7'-11½	239	45	7'-11½	239
4b3	⌋	4	8'-5½	23	4	8'-5½	23
4b4	⌋	2	8'-3½	11	2	8'-3½	11
4b5	⌋	2	8'-1½	11	2	8'-1½	11
4b6	⌋	2	7'-11½	11	2	7'-11½	11
4c1 *	—	72	3'-6	168	72	3'-6	168
4c2 **	—	75	0'-5	21	150	0'-5	42
4c3 *	—	6	1'-4	5	6	1'-4	5
4c4	—	4	3'-8	10	4	3'-8	10
4d1	⌋	8	3'-2	17	8	3'-2	17
4d2	⌋	12	5'-1	41	12	5'-1	41
TOTAL (LBS.)		953			974		

**BENT BAR DETAILS**

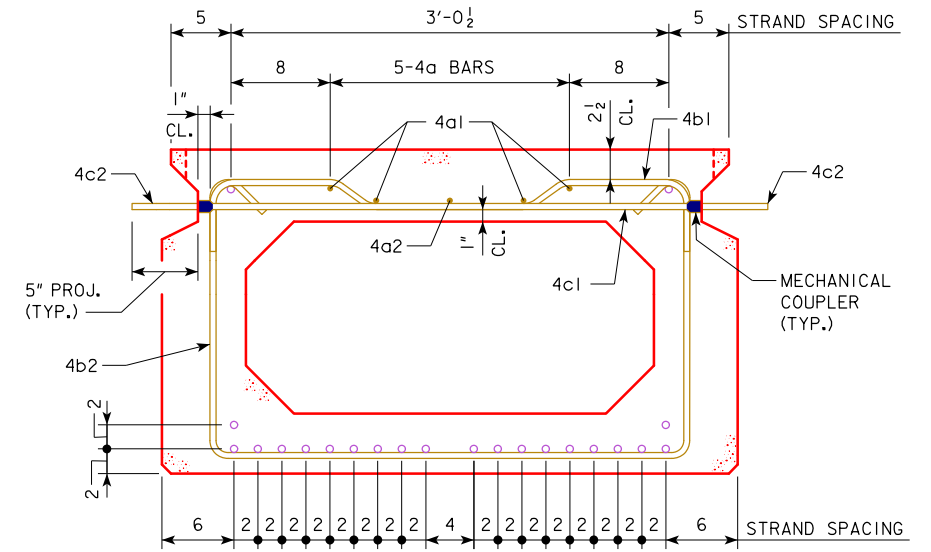


NOTES:  
 \* INCLUDES MECHANICAL COUPLER(S). SEE BENT BAR DETAILS.  
 \*\* SEE BENT BAR DETAILS. THE LENGTHS SHOWN DO NOT INCLUDE AN ALLOWANCE FOR THE THREADED END. BAR LENGTHS MAY NEED TO INCREASE DEPENDING ON THE MECHANICAL COUPLER ASSEMBLY USED. THE COST OF THE THREADED PORTION OF THESE BARS IS TO BE INCLUDED IN THE PRICE BID FOR THE BEAMS. THE WEIGHT OF THE THREADED END IS NOT INCLUDED IN THE QUANTITY SHOWN.

LATEST REVISION DATE	Approved by <i>Thomas L. Mc Donald</i> BRIDGE ENGINEER	
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
27" x 48" x 50'-0 PPCBB DETAILS REINFORCING BAR LIST		<b>B24-44-16</b>

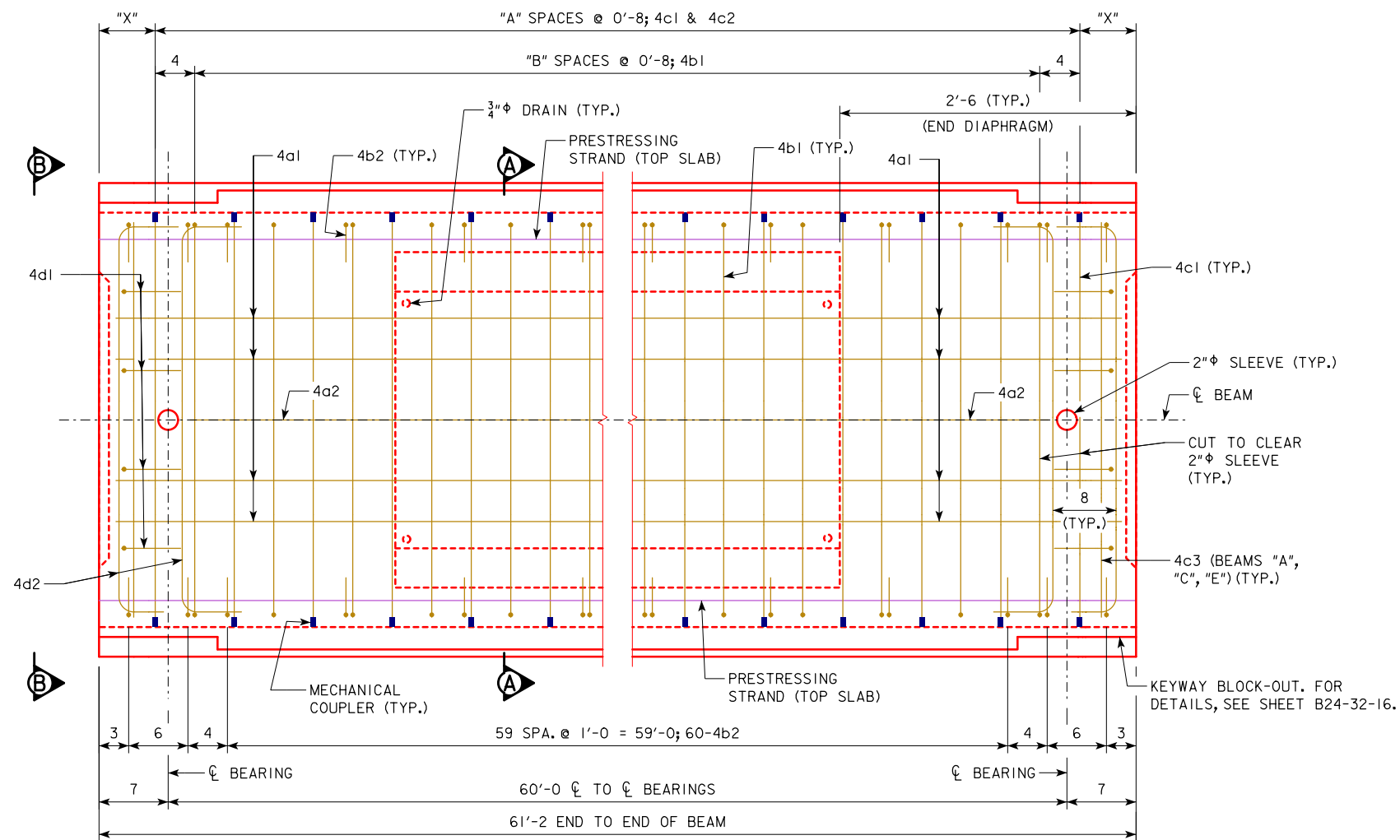


**ELEVATION**  
(KEYWAY NOT SHOWN FOR CLARITY)



**SECTION A-A**

NOTE:  
OMIT KEYWAY, MECHANICAL COUPLERS, AND 4c2 BARS ON EXTERIOR FACE OF EXTERIOR BEAMS.



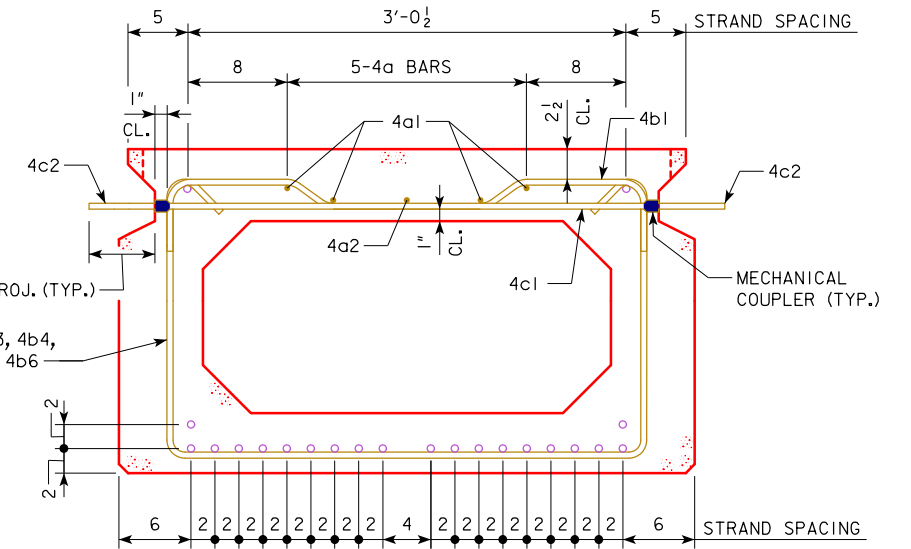
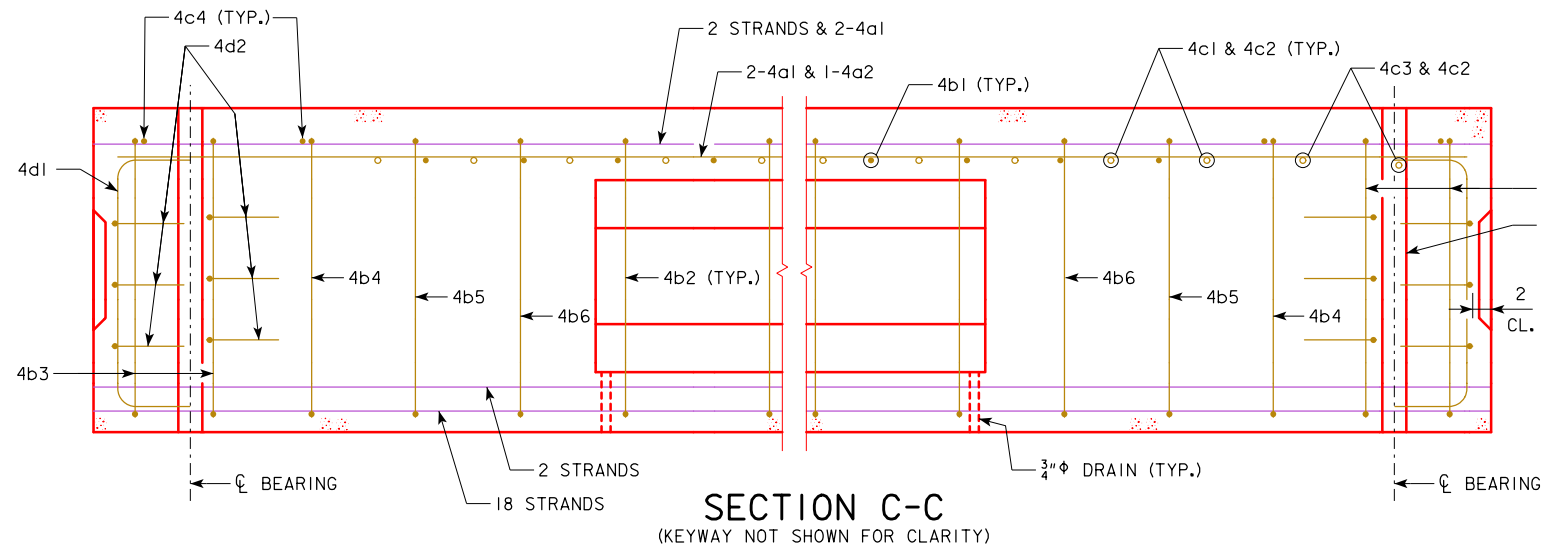
**PLAN**  
(INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR)  
(PRESTRESSING STRANDS IN BOTTOM SLAB AND 4c2 BARS NOT SHOWN FOR CLARITY)

TABLE OF DIMENSION DATA			
BEAM LINE	"X" (INCHES)	"A" (SPACES)	"B" (SPACES)
A	7	90	89
B	3	91	90
C	7	90	89
D	3	91	90
E	7	90	89
F	3	91	90

NOTE:  
FOR BEAM LINE DESIGNATIONS, SEE SHEET B24-06-16.

NOTES:  
FOR VIEW B-B, SEE SHEET B24-41-16.  
4a1 & 4a2 BARS SHALL BE LAP SPLICED 1'-7" MINIMUM AT MIDSPAN.  
FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	<b>B24-45-16</b>
		DECEMBER, 2016	
		<b>27" x 48" x 60'-0 PPCBB DETAILS</b> <b>0° SKEW</b>	



SECTION A-A

NOTE:  
OMIT KEYWAY, MECHANICAL COUPLERS, AND 4c2 BARS ON EXTERIOR FACE OF EXTERIOR BEAMS.

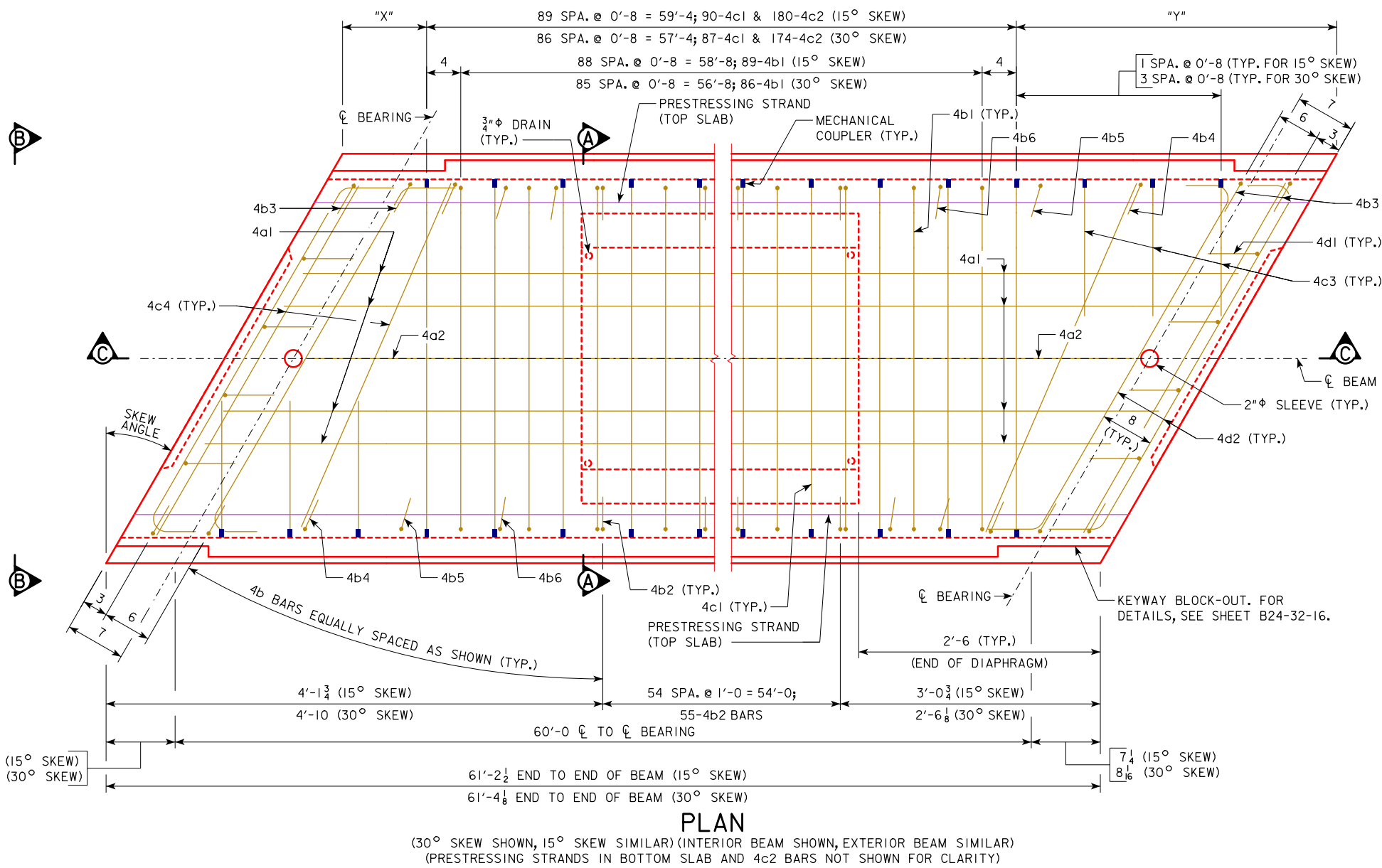


TABLE OF DIMENSION DATA

BEAM LINE	15° SKEW		30° SKEW	
	"X"	"Y"	"X"	"Y"
A	2 <sup>5</sup> / <sub>8</sub>	1'-7 <sup>7</sup> / <sub>8</sub>	11	3'-1 <sup>1</sup> / <sub>8</sub>
B	3 <sup>1</sup> / <sub>2</sub>	1'-7	10 <sup>5</sup> / <sub>8</sub>	3'-1 <sup>1</sup> / <sub>2</sub>
C	4 <sup>3</sup> / <sub>8</sub>	1'-6 <sup>1</sup> / <sub>8</sub>	10 <sup>3</sup> / <sub>8</sub>	3'-1 <sup>3</sup> / <sub>4</sub>
D	5 <sup>1</sup> / <sub>4</sub>	1'-5 <sup>1</sup> / <sub>4</sub>	10	3'-2 <sup>1</sup> / <sub>8</sub>
E	6 <sup>1</sup> / <sub>8</sub>	1'-4 <sup>3</sup> / <sub>8</sub>	9 <sup>3</sup> / <sub>4</sub>	3'-2 <sup>3</sup> / <sub>8</sub>
F	7	1'-3 <sup>1</sup> / <sub>2</sub>	9 <sup>1</sup> / <sub>2</sub>	3'-2 <sup>3</sup> / <sub>8</sub>

NOTE:  
FOR BEAM LINE DESIGNATIONS, SEE SHEET B24-06-16.

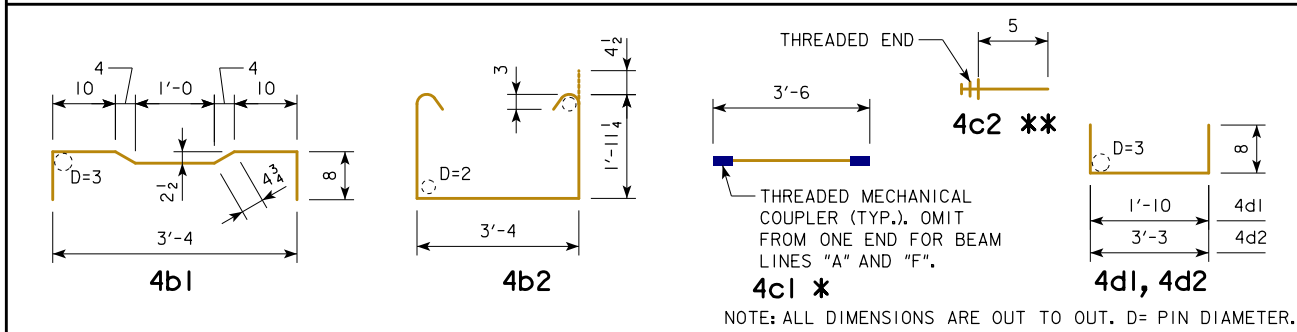
NOTES:  
FOR VIEW B-B, SEE SHEET B24-41-16.  
4a1 & 4a2 SHALL BE LAP SPLICED 1'-7" MINIMUM AT MIDSPAN.  
FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE	<i>Thomas L. Mc Donald</i> APPROVED BY BRIDGE ENGINEER	<b>IOWADOT</b> Highway Division	
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		<b>27" x 48" x 60'-0 PPCBB DETAILS 15° AND 30° SKEW</b>	<b>B24-46-16</b>

**EPOXY COATED REINFORCING BAR LIST**  
27" x 48" x 60'-0 PPCBB, 0° SKEW

BEAM LINE		BEAM LINE "A"			BEAM LINES "B" AND "D"			BEAM LINES "C" AND "E"			BEAM LINE "F"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	8	31'-3	167	8	31'-3	167	8	31'-3	167	8	31'-3	167
4a2	—	2	30'-8	41	2	30'-8	41	2	30'-8	41	2	30'-8	41
4b1	⌋	90	4'-9½	288	91	4'-9½	291	90	4'-9½	288	91	4'-9½	291
4b2	⌋	64	7'-11½	340	64	7'-11½	340	64	7'-11½	340	64	7'-11½	340
4c1 *	—	91	3'-6	213	92	3'-6	215	91	3'-6	213	92	3'-6	215
4c2 **	—	91	0'-5	25	184	0'-5	51	182	0'-5	51	92	0'-5	26
4c3	—	2	3'-2	4	-	-	-	2	3'-2	4	-	-	-
4d1	⌋	8	3'-2	17	8	3'-2	17	8	3'-2	17	8	3'-2	17
4d2	⌋	12	4'-7	37	12	4'-7	37	12	4'-7	37	12	4'-7	37
TOTAL (LBS.)		1132			1159			1158			1134		

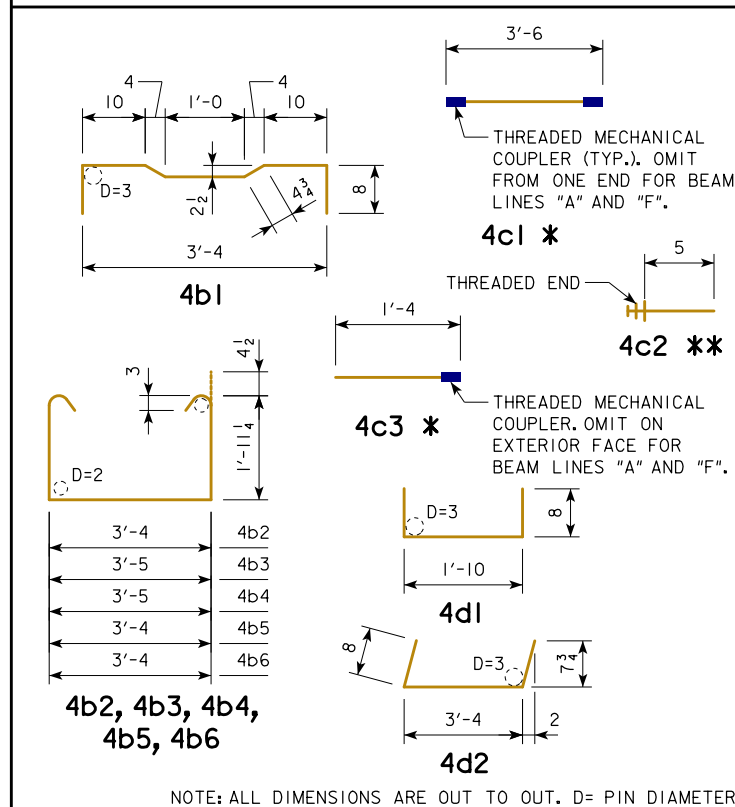
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
27" x 48" x 60'-0 PPCBB, 15° SKEW

BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	8	31'-3	167	8	31'-3	167
4a2	—	2	30'-8	41	2	30'-8	41
4b1	⌋	89	4'-9½	285	89	4'-9½	285
4b2	⌋	55	7'-11½	292	55	7'-11½	292
4b3	⌋	4	8'-0½	21	4	8'-0½	21
4b4	⌋	2	8'-0½	11	2	8'-0½	11
4b5	⌋	2	7'-11½	11	2	7'-11½	11
4b6	⌋	2	7'-11½	11	2	7'-11½	11
4c1 *	—	90	3'-6	210	90	3'-6	210
4c2 **	—	91	0'-5	25	182	0'-5	51
4c3 *	—	2	1'-4	2	2	1'-4	2
4c4	—	4	3'-4	9	4	3'-4	9
4d1	⌋	8	3'-2	17	8	3'-2	17
4d2	⌋	12	4'-8	37	12	4'-8	37
TOTAL (LBS.)		1139			1165		

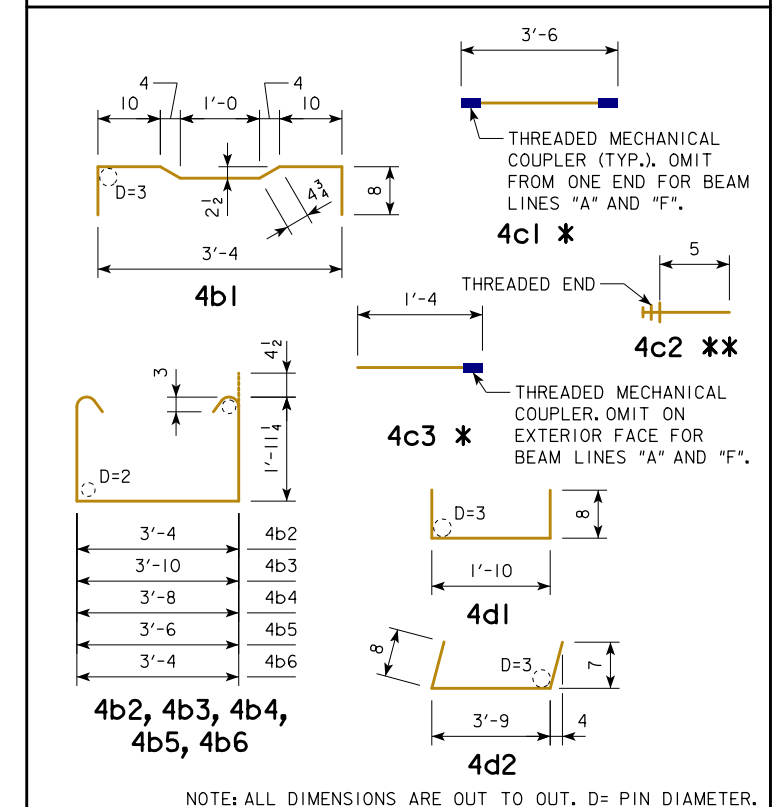
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
27" x 48" x 60'-0 PPCBB, 30° SKEW

BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	8	31'-3	167	8	31'-3	167
4a2	—	2	30'-8	41	2	30'-8	41
4b1	⌋	86	4'-9½	275	86	4'-9½	275
4b2	⌋	55	7'-11½	292	55	7'-11½	292
4b3	⌋	4	8'-5½	23	4	8'-5½	23
4b4	⌋	2	8'-3½	11	2	8'-3½	11
4b5	⌋	2	8'-1½	11	2	8'-1½	11
4b6	⌋	2	7'-11½	11	2	7'-11½	11
4c1 *	—	87	3'-6	203	87	3'-6	203
4c2 **	—	90	0'-5	25	180	0'-5	50
4c3 *	—	6	1'-4	5	6	1'-4	5
4c4	—	4	3'-8	10	4	3'-8	10
4d1	⌋	8	3'-2	17	8	3'-2	17
4d2	⌋	12	5'-1	41	12	5'-1	41
TOTAL (LBS.)		1132			1157		

**BENT BAR DETAILS**

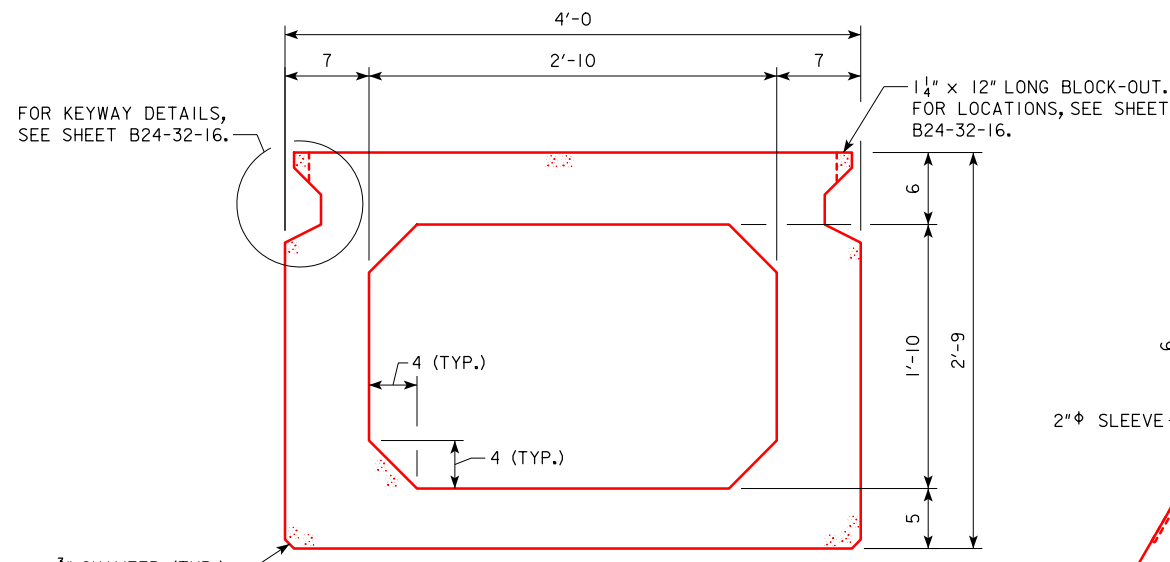


NOTES:  
 \* INCLUDES MECHANICAL COUPLER(S). SEE BENT BAR DETAILS.  
 \*\* SEE BENT BAR DETAILS. THE LENGTHS SHOWN DO NOT INCLUDE AN ALLOWANCE FOR THE THREADED END. BAR LENGTHS MAY NEED TO INCREASE DEPENDING ON THE MECHANICAL COUPLER ASSEMBLY USED. THE COST OF THE THREADED PORTION OF THESE BARS IS TO BE INCLUDED IN THE PRICE BID FOR THE BEAMS. THE WEIGHT OF THE THREADED END IS NOT INCLUDED IN THE QUANTITY SHOWN.

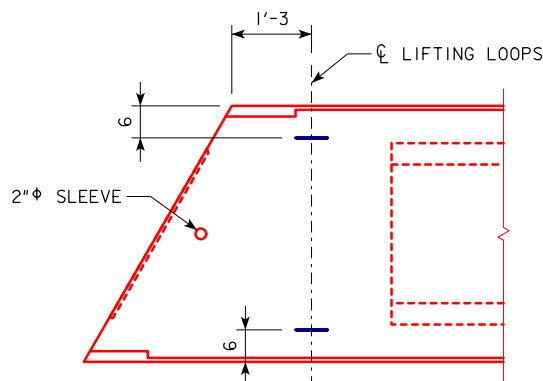
LATEST REVISION DATE	Approved by <i>Thomas L. Mc Donald</i> BRIDGE ENGINEER	
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
27" x 48" x 60'-0 PPCBB DETAILS REINFORCING BAR LIST		<b>B24-47-16</b>

### 33" x 48" PRETENSIONED PRESTRESSED CONCRETE BOX BEAM DATA

BEAM	SKEW (DEGREES)	SPAN LENGTH ℄-℄ BEARING	OVERALL BEAM LENGTH	CONCRETE STRENGTH		STRAND SIZE DIA. (in.)	NO. OF STRANDS	TOTAL INITIAL PRESTRESS (KIPS)	CAMBER (in.)		WEIGHT (TONS)	CONCRETE (C.Y.)	REINFORCING STEEL (LBS.)
				f'ci (ksi)	f'c (ksi)				AT RELEASE	AFTER LOSSES			
PPCBB 33" x 48" x 70'-0"	0	70'-0"	71'-2"	5.0	6.0	0.6	22	936	0.8	1.5	32.9	16.3	SEE SHEET B24-51-16
	15	70'-0"	71'-2½"								33.3	16.5	
	30	70'-0"	71'-4⅛"								33.9	16.7	



**INTERIOR BEAM CROSS SECTION**



**LIFTING LOOP PLAN**

A = 838 in<sup>2</sup>  
 Y<sub>b</sub> = 16.48 in  
 I = 111,784 in<sup>4</sup>

**BEAM SECTION PROPERTIES**  
 (INTERIOR BEAM)

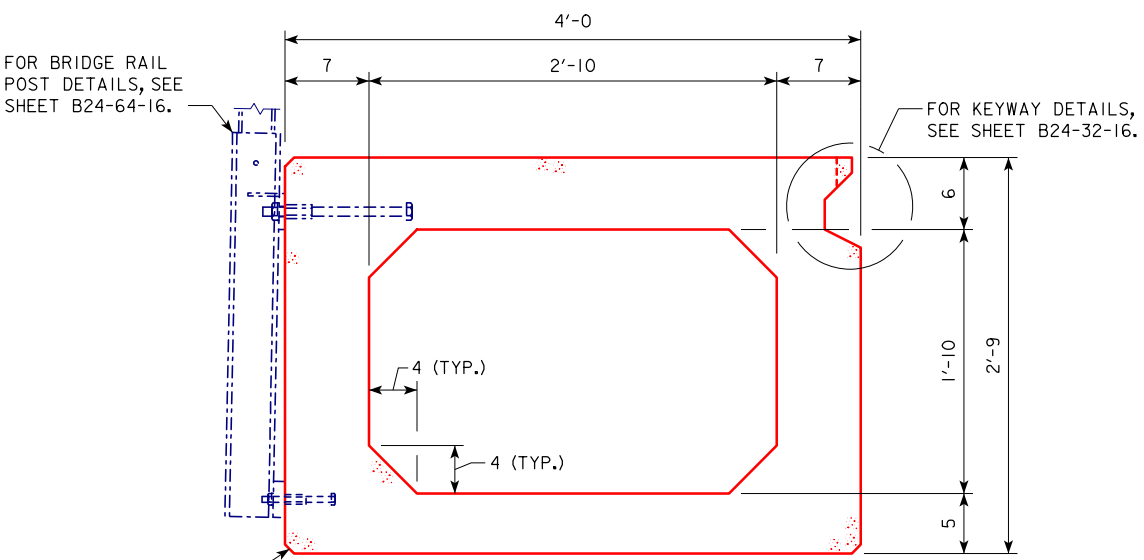
**SPECIFICATIONS:**

DESIGN: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH ED., SERIES OF 2014, EXCEPT AS NOTED IN "LIVE LOAD DISTRIBUTION FACTOR NOTES".

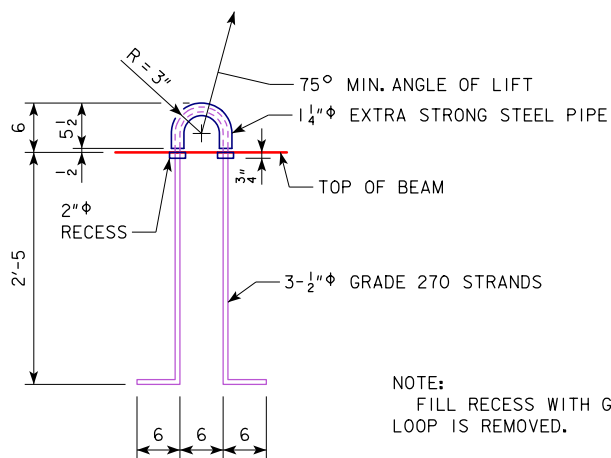
CONSTRUCTION: STANDARD SPECIFICATIONS OF THE IOWA DEPARTMENT OF TRANSPORTATION, CURRENT SERIES, WITH CURRENT APPLICABLE SPECIAL PROVISIONS AND SUPPLEMENTAL SPECIFICATIONS.

**LIVE LOAD DISTRIBUTION FACTOR NOTES:**

LIVE LOAD DISTRIBUTION FACTORS USED FOR THE FLEXURAL DESIGN OF THE BEAMS WAS BASED ON PAST STUDIES CONDUCTED BY IADOT. HOWEVER, AASHTO EQUATIONS INCLUDING SKEW EFFECTS WERE USED FOR DETERMINING THE LIVE LOAD DISTRIBUTION FACTOR FOR SHEAR. CONTROLLING LIVE LOAD DISTRIBUTION FACTORS ARE:  
 70'-0" SPAN  
 MOMENT = 0.50 LANES / BEAM  
 SHEAR = 0.67 LANES / BEAM



**EXTERIOR BEAM CROSS SECTION**



**LIFTING LOOP DETAIL**

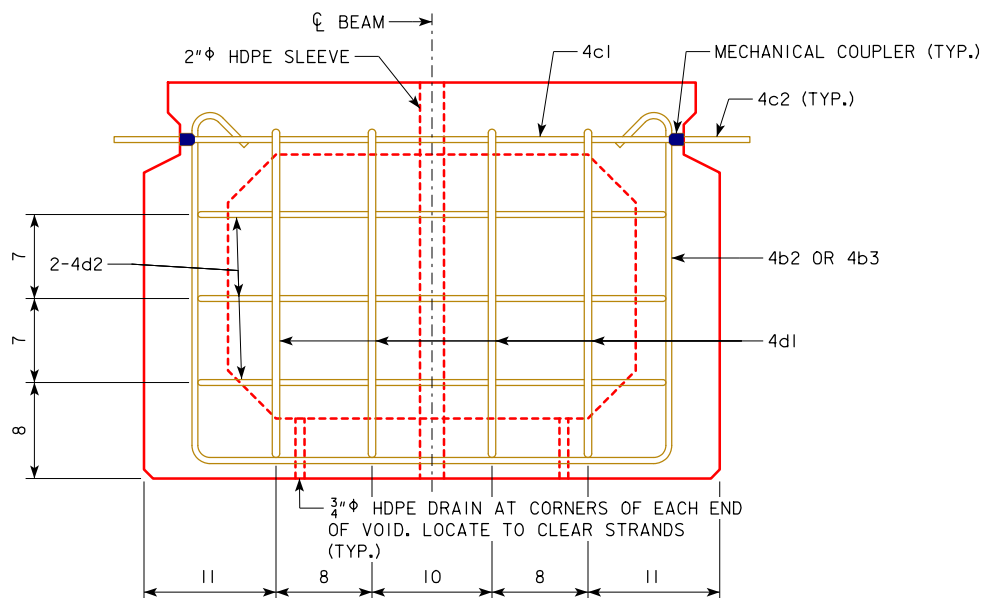
ALTERNATE TYPES OF LIFTING LOOPS MAY BE SUBMITTED FOR APPROVAL

**DESIGN STRESSES:**

DESIGN STRESSES FOR THE FOLLOWING MATERIALS ARE TO BE IN ACCORDANCE WITH AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH ED., SERIES OF 2014:  
 -REINFORCING STEEL IN ACCORDANCE WITH SECTION 5, GRADE 60.  
 -CONCRETE IN ACCORDANCE WITH SECTION 5.  
 -PRESTRESSING STEEL IN ACCORDANCE WITH SECTION 5, GRADE 270.

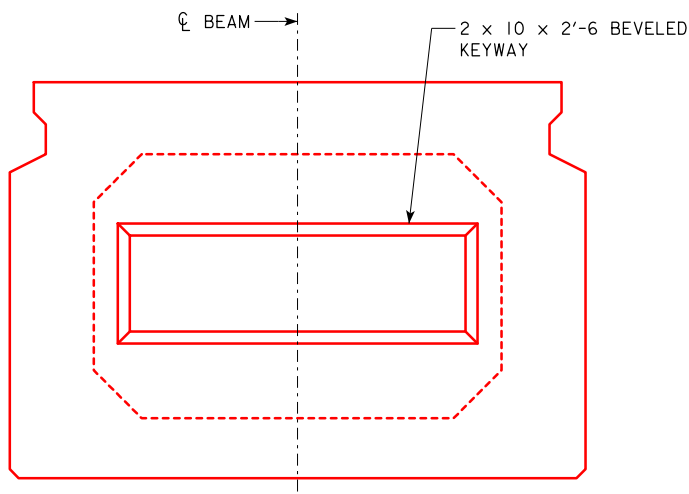
**NOTES:**

THESE BEAMS ARE DESIGNED FOR HL93 LOADING WITH AN ALLOWANCE OF 50 lb. PER SQUARE FOOT OF ROADWAY FOR GRAVEL OR FUTURE WEARING SURFACE. ALL PRESTRESSING STRANDS SHALL CONFORM TO ASTM A416 GRADE 270 LOW RELAXATION STRANDS. TOPS OF BEAMS ARE TO BE STRUCK OFF LEVEL AND LONGITUDINALLY TINED IN ACCORDANCE WITH ARTICLE 2301.03, H, 3 OF THE STANDARD SPECIFICATIONS. BEARINGS SHALL BE AS DETAILED ON OTHER DESIGN SHEETS. BEAMS ARE TO BE AT LEAST 28 DAYS OLD BEFORE THE FUTURE WEARING SURFACE, IF USED, IS PLACED UNLESS A SHORTER CURING TIME IS APPROVED BY THE BRIDGE ENGINEER. ALL BEAMS ARE TO BE INCREASED IN LENGTH TO COMPENSATE FOR ELASTIC SHORTENING, CREEP AND SHRINKAGE. 0.6" DIAMETER STRANDS STRESSED TO NOT MORE THAN 5,000 LBS. EACH MAY BE USED IN LIEU OF THE α BARS WHICH RUN THE FULL LENGTH OF THE BEAM IN THE TOP SLAB. TOTAL INITIAL PRESTRESS IS BASED ON 72.6% f's, f's = 270 ksi AND A<sub>s</sub> = 0.217 sq. in. LIFTING OPERATIONS SHALL BE PERFORMED IN A MANNER THAT LIFTING LOOPS CARRY LOADS EQUALLY.



**VIEW B-B**

(INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR)



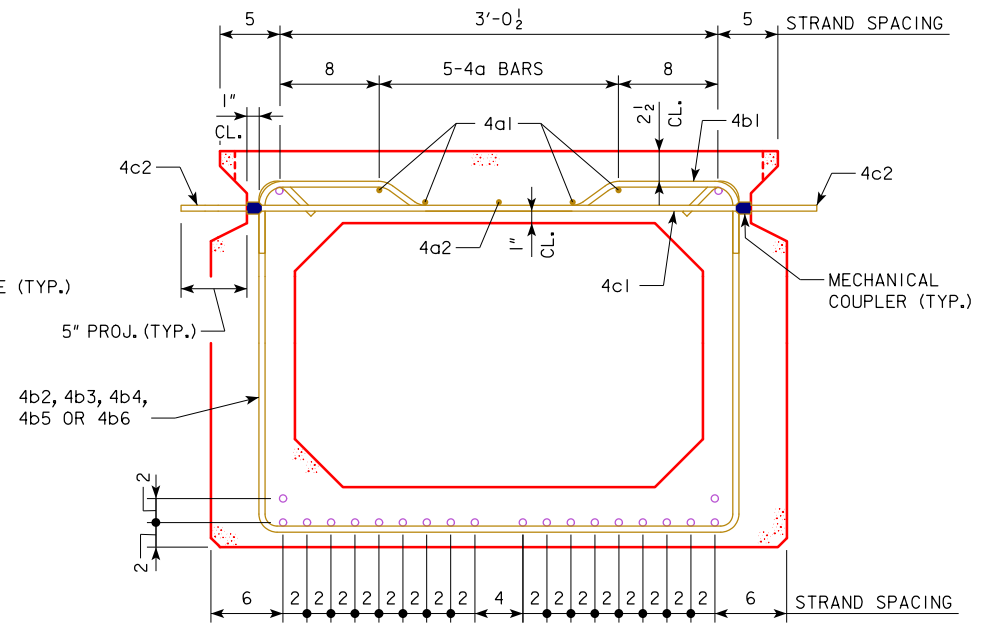
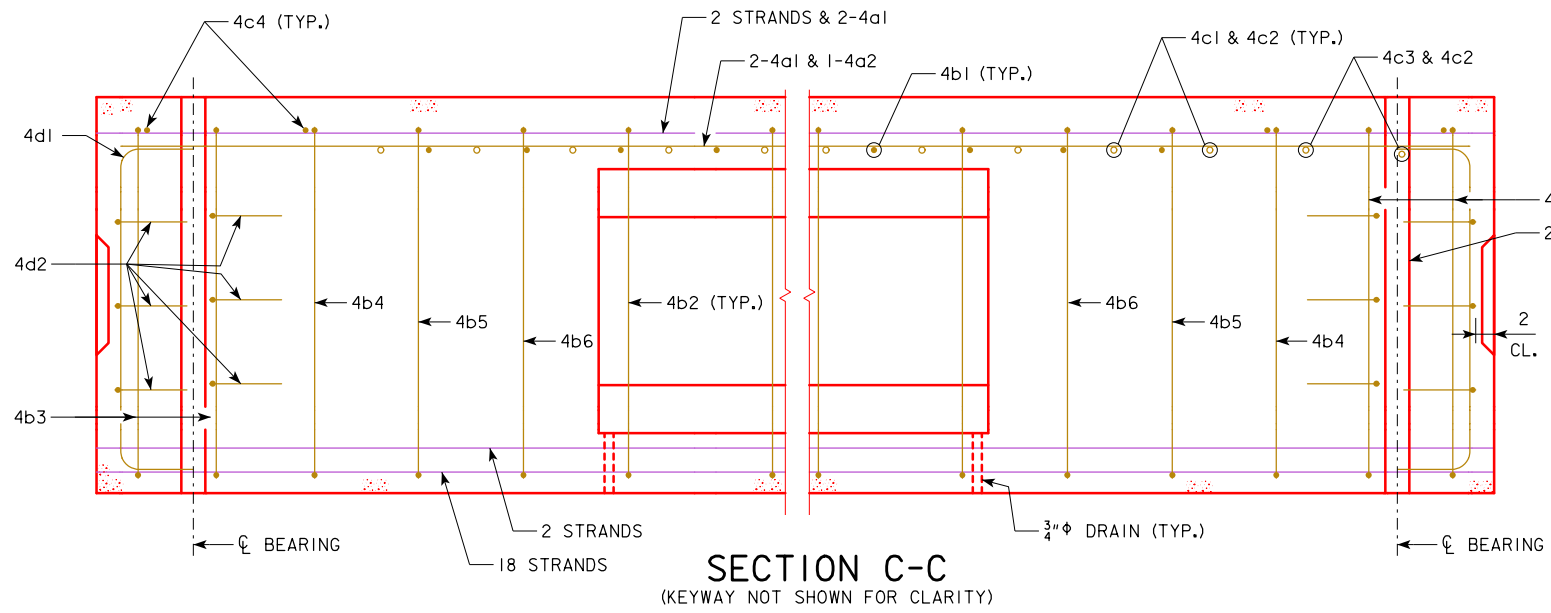
**VIEW B-B**

(INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR) (SHOWING KEYWAY)

NOTES:  
 FOR VIEW B-B LOCATION, SEE SHEETS B24-49-16 & B24-50-16.  
 FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE	APPROVED BY BRIDGE ENGINEER <i>Thomas L. Mc Donald</i>	
		STANDARD DESIGN - 24'-0" ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
<b>33" x 48" PPCBB DETAILS</b>		<b>B24-48-16</b>





SECTION A-A

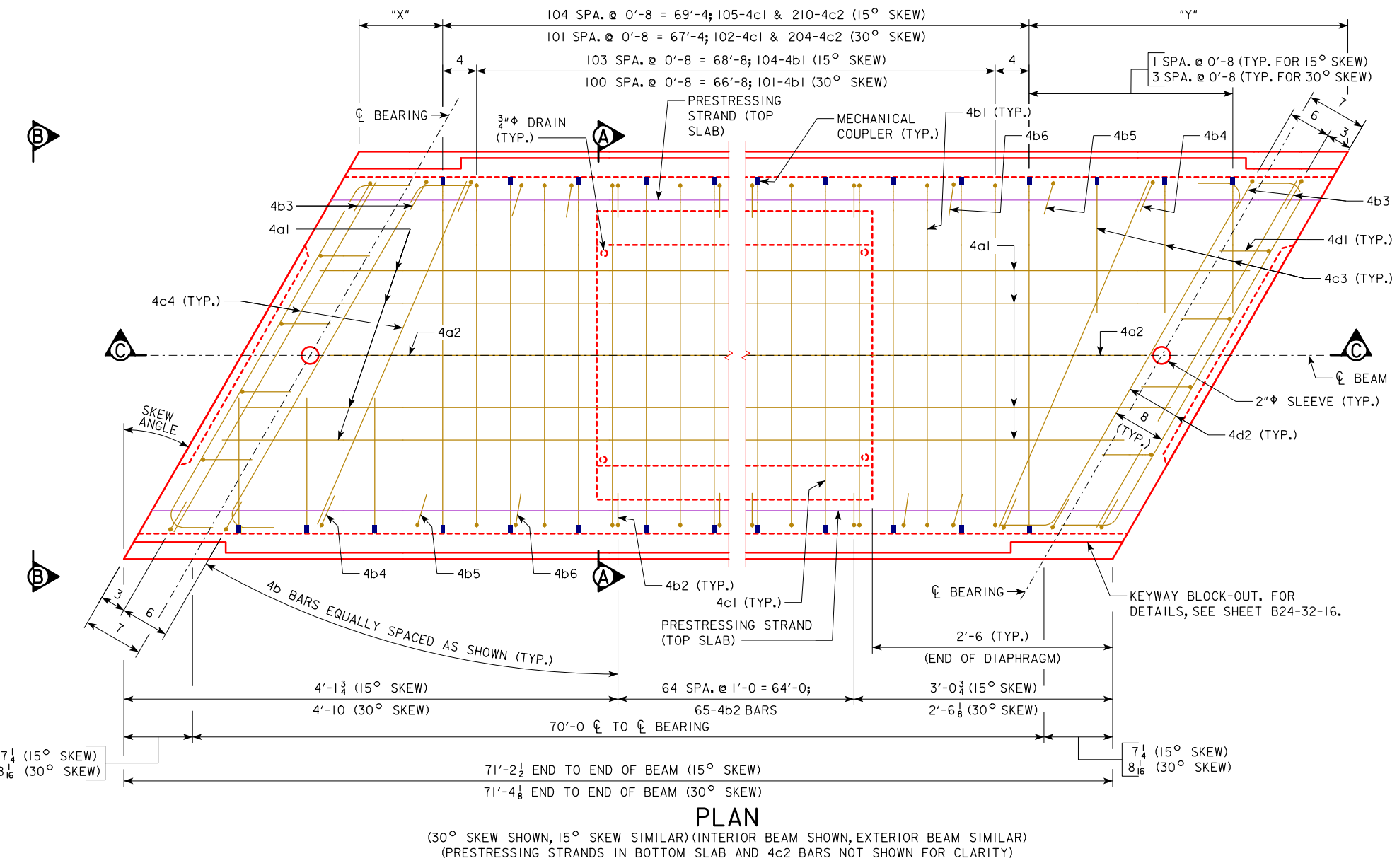
NOTE:  
OMIT KEYWAY, MECHANICAL COUPLERS, AND 4c2 BARS ON EXTERIOR FACE OF EXTERIOR BEAMS.

TABLE OF DIMENSION DATA

BEAM LINE	15° SKEW		30° SKEW	
	"X"	"Y"	"X"	"Y"
A	2 <sup>5</sup> / <sub>8</sub>	1'-7 <sup>7</sup> / <sub>8</sub>	11	3'-1 <sup>1</sup> / <sub>8</sub>
B	3 <sup>1</sup> / <sub>2</sub>	1'-7	10 <sup>5</sup> / <sub>8</sub>	3'-1 <sup>1</sup> / <sub>2</sub>
C	4 <sup>3</sup> / <sub>8</sub>	1'-6 <sup>1</sup> / <sub>8</sub>	10 <sup>3</sup> / <sub>8</sub>	3'-1 <sup>3</sup> / <sub>4</sub>
D	5 <sup>1</sup> / <sub>4</sub>	1'-5 <sup>1</sup> / <sub>4</sub>	10	3'-2 <sup>1</sup> / <sub>8</sub>
E	6 <sup>1</sup> / <sub>8</sub>	1'-4 <sup>3</sup> / <sub>8</sub>	9 <sup>3</sup> / <sub>4</sub>	3'-2 <sup>3</sup> / <sub>8</sub>
F	7	1'-3 <sup>1</sup> / <sub>2</sub>	9 <sup>1</sup> / <sub>2</sub>	3'-2 <sup>3</sup> / <sub>8</sub>

NOTE:  
FOR BEAM LINE DESIGNATIONS, SEE SHEET B24-06-16.

NOTES:  
FOR VIEW B-B, SEE SHEET B24-48-16.  
4a1 AND 4a2 BARS SHALL BE LAP SPICED 1'-7" MINIMUM AT MIDSPAN.  
FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.



PLAN

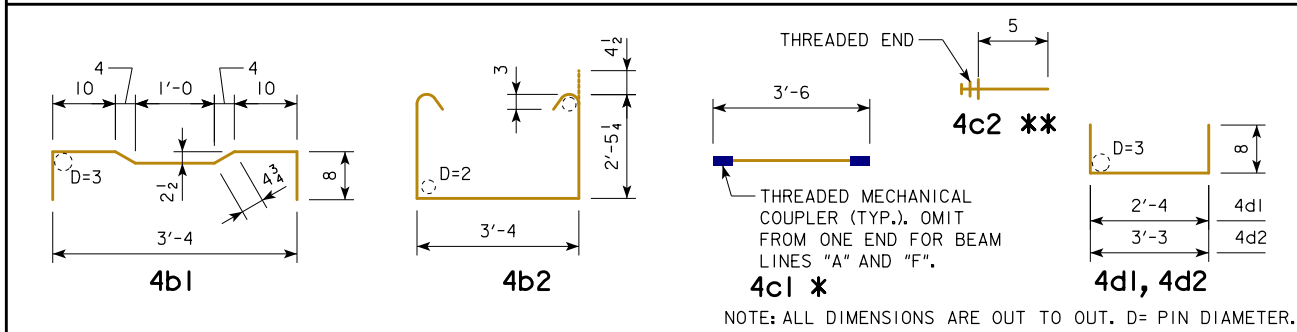
(30° SKEW SHOWN, 15° SKEW SIMILAR) (INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR)  
(PRESTRESSING STRANDS IN BOTTOM SLAB AND 4c2 BARS NOT SHOWN FOR CLARITY)

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	<b>B24-50-16</b>
		DECEMBER, 2016	
		<b>33" x 48" x 70'-0 PPCBB DETAILS 15° AND 30° SKEW</b>	

**EPOXY COATED REINFORCING BAR LIST**  
**33" x 48" x 70'-0 PPCBB, 0° SKEW**

BEAM LINE		BEAM LINE "A"			BEAM LINES "B" AND "D"			BEAM LINES "C" AND "E"			BEAM LINE "F"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	8	36'-3	194	8	36'-3	194	8	36'-3	194	8	36'-3	194
4a2	—	2	35'-8	48	2	35'-8	48	2	35'-8	48	2	35'-8	48
4b1	⌋	105	4'-9½	336	106	4'-9½	339	105	4'-9½	336	106	4'-9½	339
4b2	⌋	74	8'-11½	443	74	8'-11½	443	74	8'-11½	443	74	8'-11½	443
4c1 *	—	106	3'-6	248	107	3'-6	250	106	3'-6	248	107	3'-6	250
4c2 **	—	106	0'-5	30	214	0'-5	60	212	0'-5	59	107	0'-5	30
4c3	—	2	3'-2	4	-	-	-	2	3'-2	4	-	-	-
4d1	⌋	8	3'-8	20	8	3'-8	20	8	3'-8	20	8	3'-8	20
4d2	⌋	12	4'-7	37	12	4'-7	37	12	4'-7	37	12	4'-7	37
TOTAL (LBS.)		1360			1391			1389			1361		

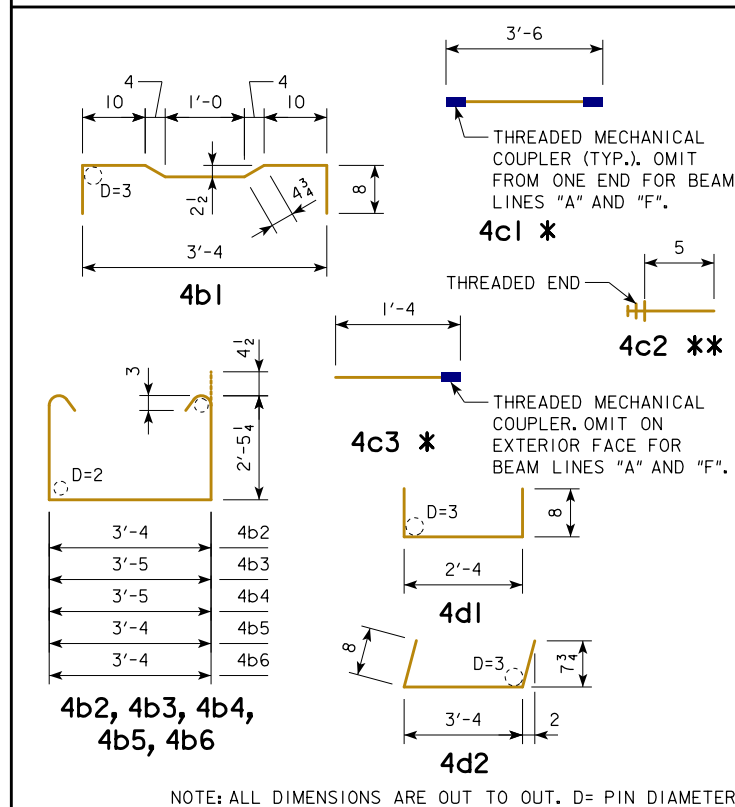
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
**33" x 48" x 70'-0 PPCBB, 15° SKEW**

BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	8	36'-3	194	8	36'-3	194
4a2	—	2	35'-8	48	2	35'-8	48
4b1	⌋	104	4'-9½	333	104	4'-9½	333
4b2	⌋	65	8'-11½	389	65	8'-11½	389
4b3	⌋	4	9'-0½	24	4	9'-0½	24
4b4	⌋	2	9'-0½	12	2	9'-0½	12
4b5	⌋	2	8'-11½	12	2	8'-11½	12
4b6	⌋	2	8'-11½	12	2	8'-11½	12
4c1 *	—	105	3'-6	245	105	3'-6	245
4c2 **	—	106	0'-5	30	212	0'-5	59
4c3 *	—	2	1'-4	2	2	1'-4	2
4c4	—	4	3'-4	9	4	3'-4	9
4d1	⌋	8	3'-8	20	8	3'-8	20
4d2	⌋	12	4'-8	37	12	4'-8	37
TOTAL (LBS.)		1367			1396		

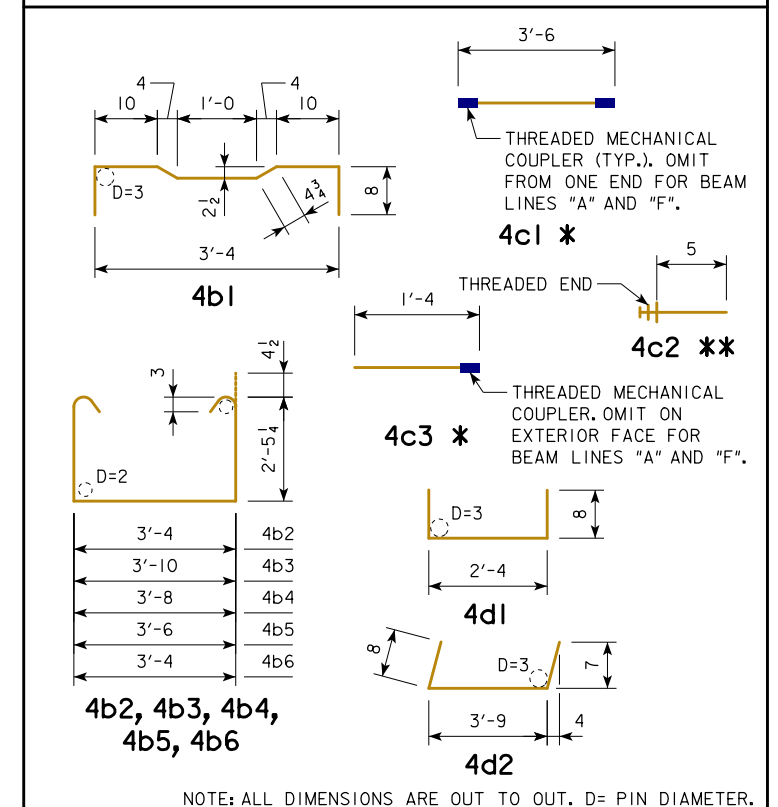
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
**33" x 48" x 70'-0 PPCBB, 30° SKEW**

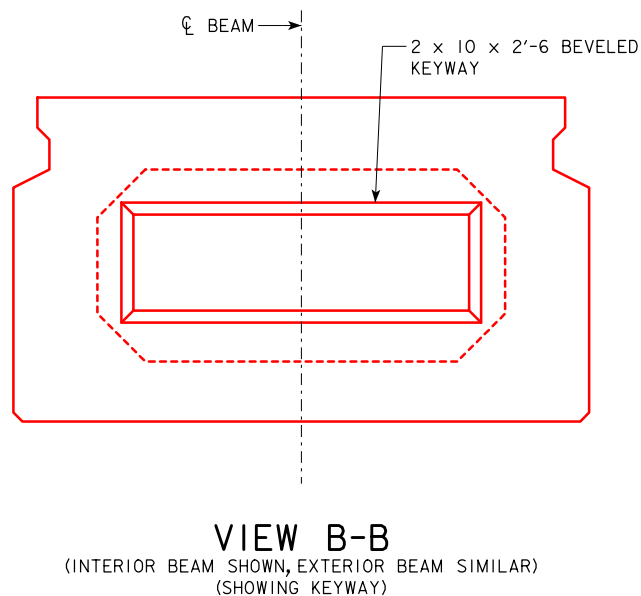
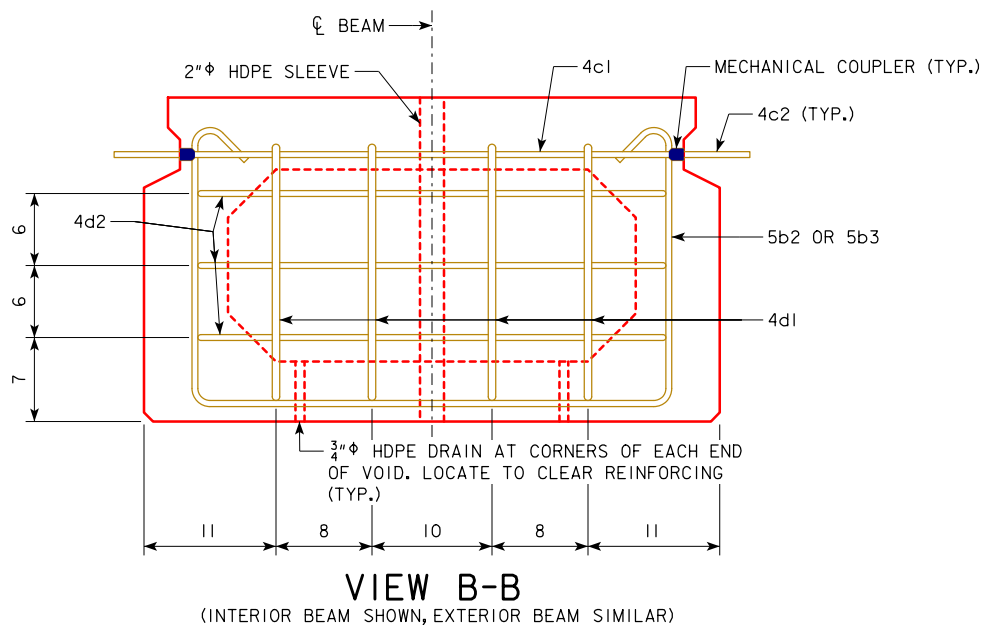
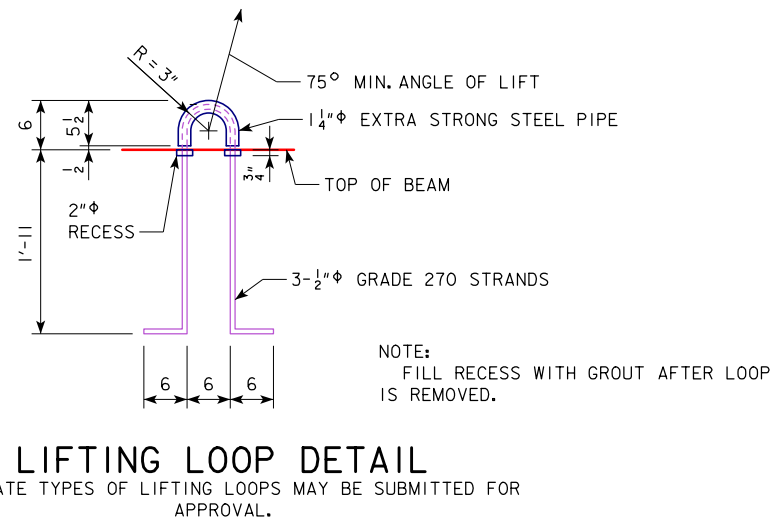
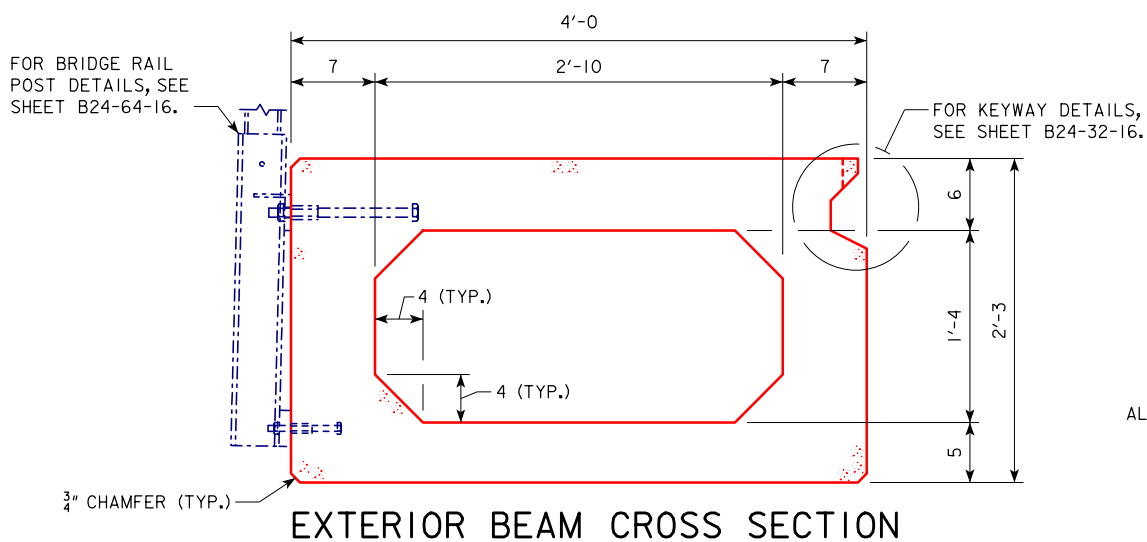
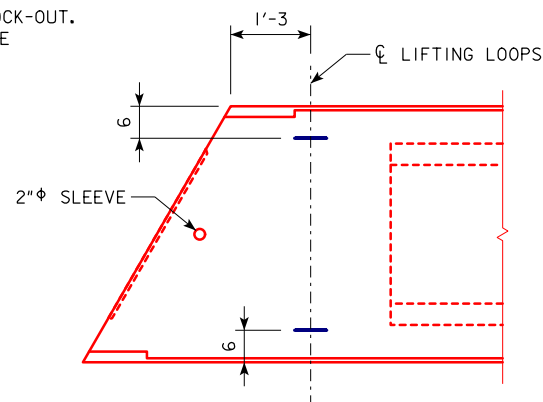
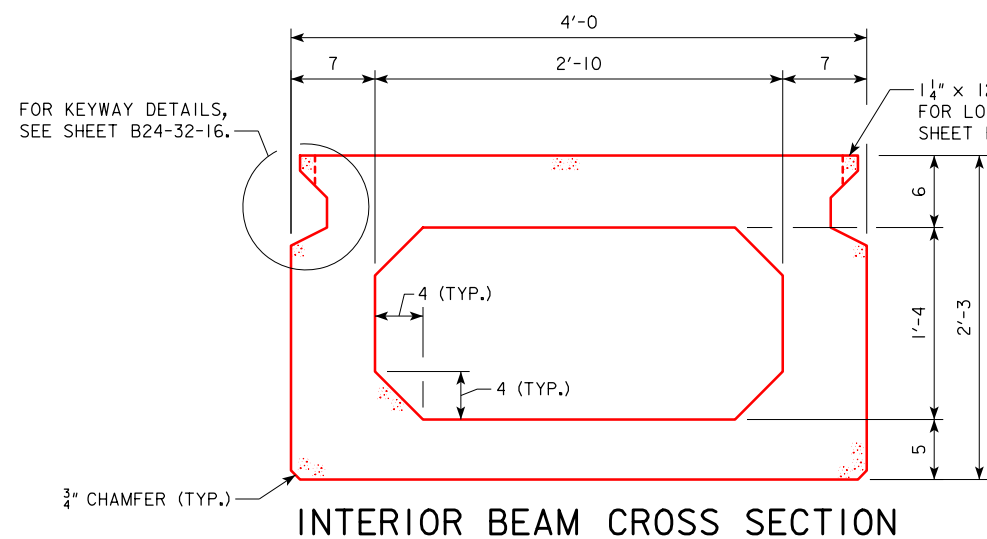
BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	8	36'-3	194	8	36'-3	194
4a2	—	2	35'-8	48	2	35'-8	48
4b1	⌋	101	4'-9½	323	101	4'-9½	323
4b2	⌋	65	8'-11½	389	65	8'-11½	389
4b3	⌋	4	9'-5½	25	4	9'-5½	25
4b4	⌋	2	9'-3½	12	2	9'-3½	12
4b5	⌋	2	9'-1½	12	2	9'-1½	12
4b6	⌋	2	8'-11½	12	2	8'-11½	12
4c1 *	—	102	3'-6	238	102	3'-6	238
4c2 **	—	105	0'-5	29	210	0'-5	58
4c3 *	—	6	1'-4	5	6	1'-4	5
4c4	—	4	3'-8	10	4	3'-8	10
4d1	⌋	8	3'-8	20	8	3'-8	20
4d2	⌋	12	5'-1	41	12	5'-1	41
TOTAL (LBS.)		1358			1387		

**BENT BAR DETAILS**



NOTES:  
 \* INCLUDES MECHANICAL COUPLER(S). SEE BENT BAR DETAILS.  
 \*\* SEE BENT BAR DETAILS. THE LENGTHS SHOWN DO NOT INCLUDE AN ALLOWANCE FOR THE THREADED END. BAR LENGTHS MAY NEED TO INCREASE DEPENDING ON THE MECHANICAL COUPLER ASSEMBLY USED. THE COST OF THE THREADED PORTION OF THESE BARS IS TO BE INCLUDED IN THE PRICE BID FOR THE BEAMS. THE WEIGHT OF THE THREADED END IS NOT INCLUDED IN THE QUANTITY SHOWN.

LATEST REVISION DATE	Approved by: <i>Thomas L. Mc Donald</i> BRIDGE ENGINEER	
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
<b>33" x 48" x 70'-0 PPCBB DETAILS REINFORCING BAR LIST</b>		<b>B24-51-16</b>



27" x 48" REINFORCED CONCRETE BOX BEAM DATA							
BEAM	SKIEW (DEGREES)	SPAN LENGTH $\phi$ - $\phi$ BEARING	OVERALL BEAM LENGTH	f'c (ksi)	WEIGHT (TONS)	CONCRETE (C.Y.)	REINFORCING STEEL (LBS.)
RCBB 27" x 48" x 30'-0	0	30'-0	31'-2	5.0	13.6	6.7	SEE SHEET B24-55-16
	15		31'-2 1/2		13.9	6.9	
	30		31'-4 1/8		14.3	7.0	
RCBB 27" x 48" x 40'-0	0	40'-0	41'-2	5.0	17.5	8.6	SEE SHEET B24-58-16
	15		41'-2 1/2		17.8	8.8	
	30		41'-4 1/8		18.2	9.0	

**SPECIFICATIONS:**

DESIGN: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH ED., SERIES OF 2014.

CONSTRUCTION: STANDARD SPECIFICATIONS OF THE IOWA DEPARTMENT OF TRANSPORTATION, CURRENT SERIES, WITH CURRENT APPLICABLE SPECIAL PROVISIONS AND SUPPLEMENTAL SPECIFICATIONS.

**LIVE LOAD DISTRIBUTION FACTOR NOTES:**

AASHTO EQUATIONS WERE USED FOR DETERMINING THE LIVE LOAD DISTRIBUTION FACTORS FOR THE DESIGN OF THE BEAMS. SKEW EFFECTS WERE INCLUDED IN THE LIVE LOAD DISTRIBUTION FACTOR FOR SHEAR AND CONSERVATIVELY IGNORED FOR THE LIVE LOAD DISTRIBUTION FACTOR FOR MOMENT. CONTROLLING LIVE LOAD DISTRIBUTION FACTORS ARE:

- 30'-0 SPAN
- MOMENT = 0.39 LANES / BEAM
- SHEAR = 0.70 LANES / BEAM
- 40'-0 SPAN
- MOMENT = 0.37 LANES / BEAM
- SHEAR = 0.69 LANES / BEAM

**DESIGN STRESSES:**

DESIGN STRESSES FOR THE FOLLOWING MATERIALS ARE TO BE IN ACCORDANCE WITH AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH ED., SERIES OF 2014:

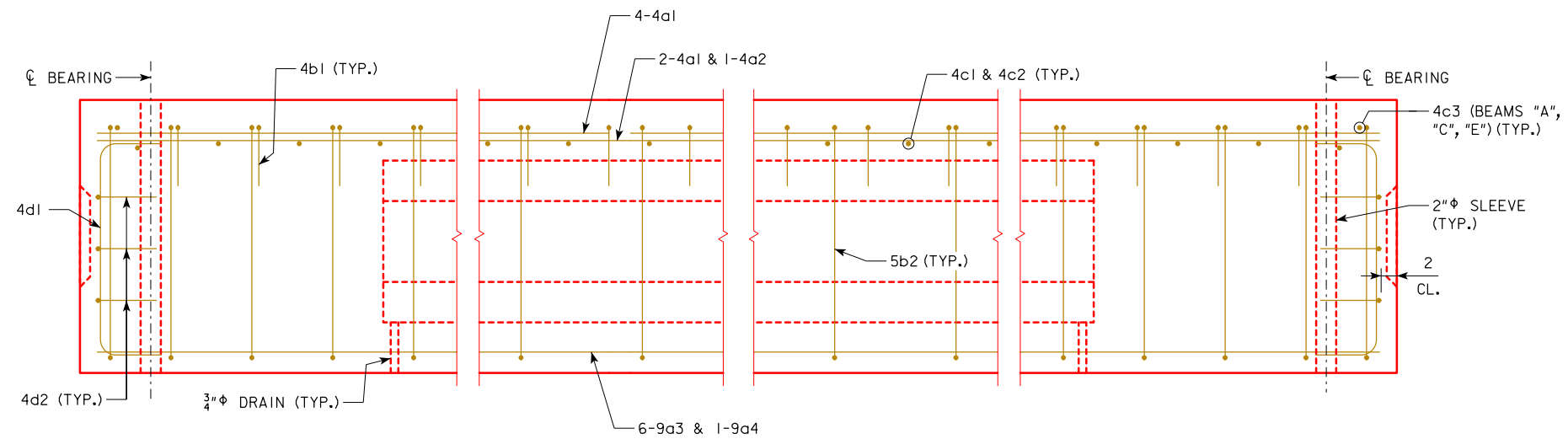
- REINFORCING STEEL IN ACCORDANCE WITH SECTION 5, GRADE 60.
- CONCRETE IN ACCORDANCE WITH SECTION 5.

**NOTES:**

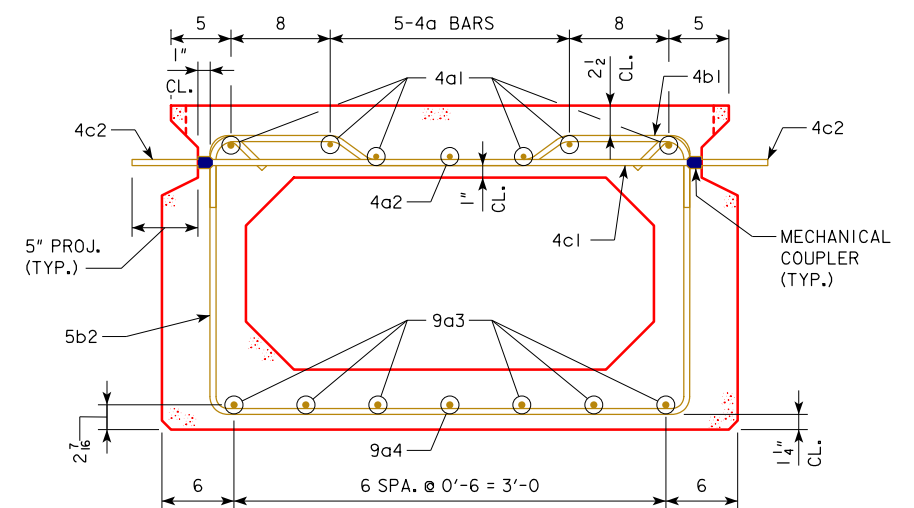
- THESE BEAMS ARE DESIGNED FOR HL93 LOADING WITH AN ALLOWANCE OF 50 lb. PER SQUARE FOOT OF ROADWAY FOR GRAVEL OR FUTURE WEARING SURFACE.
- TOPS OF BEAMS ARE TO BE STRUCK OFF LEVEL AND LONGITUDINALLY TINED IN ACCORDANCE WITH ARTICLE 2301.03, H, 3 OF THE STANDARD SPECIFICATIONS.
- BEARINGS SHALL BE AS DETAILED ON OTHER DESIGN SHEETS.
- BEAMS ARE TO BE AT LEAST 28 DAYS OLD BEFORE THE FUTURE WEARING SURFACE, IF USED, IS PLACED UNLESS A SHORTER CURING TIME IS APPROVED BY THE BRIDGE ENGINEER.
- LIFTING OPERATIONS SHALL BE PERFORMED IN SUCH A MANNER THAT LIFTING LOOPS CARRY LOADS EQUALLY.

- NOTES:
- FOR VIEW B-B LOCATION, SEE SHEETS B24-53-16 & B24-54-16.
- FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
<b>27" x 48" RCBB DETAILS</b>		<b>B24-52-16</b>

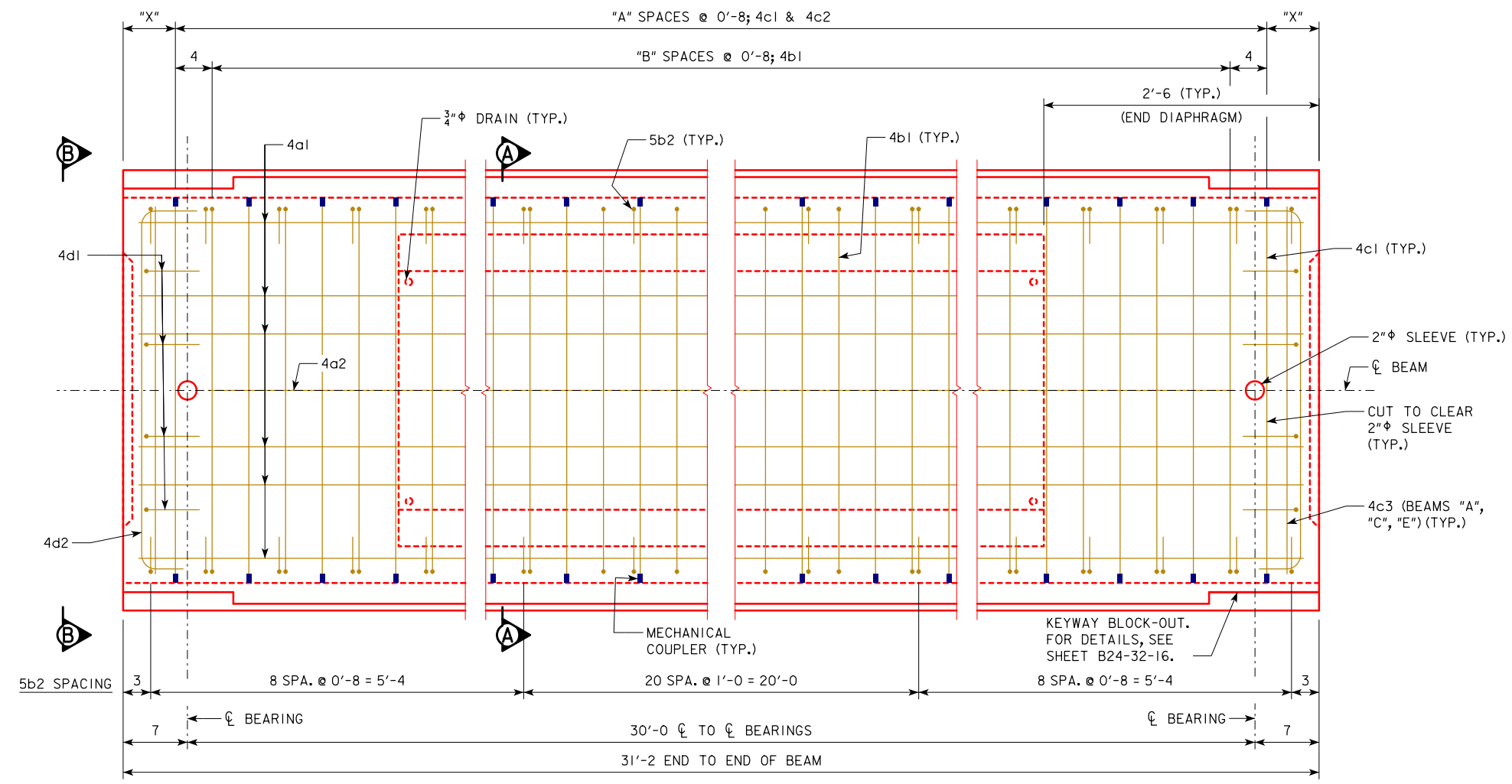


**ELEVATION**  
(KEYWAY NOT SHOWN FOR CLARITY)



**SECTION A-A**

NOTE:  
OMIT KEYWAY, MECHANICAL COUPLERS, AND 4c2 BARS ON EXTERIOR FACE OF EXTERIOR BEAMS.



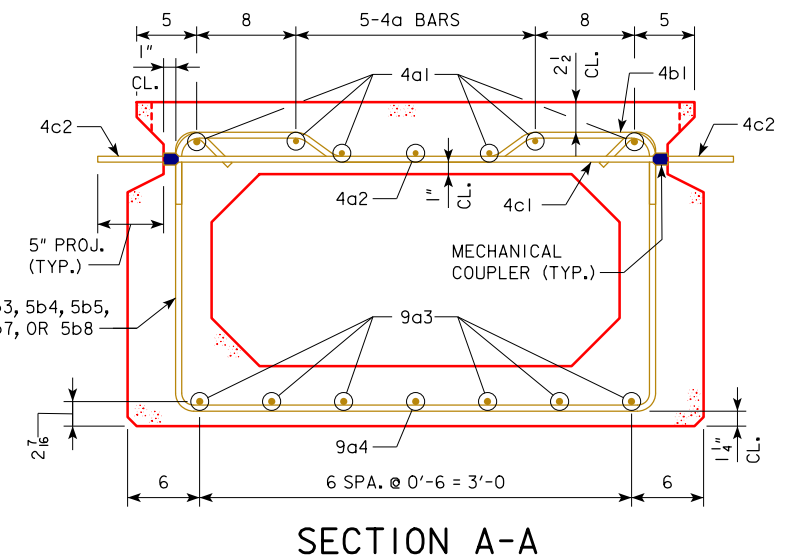
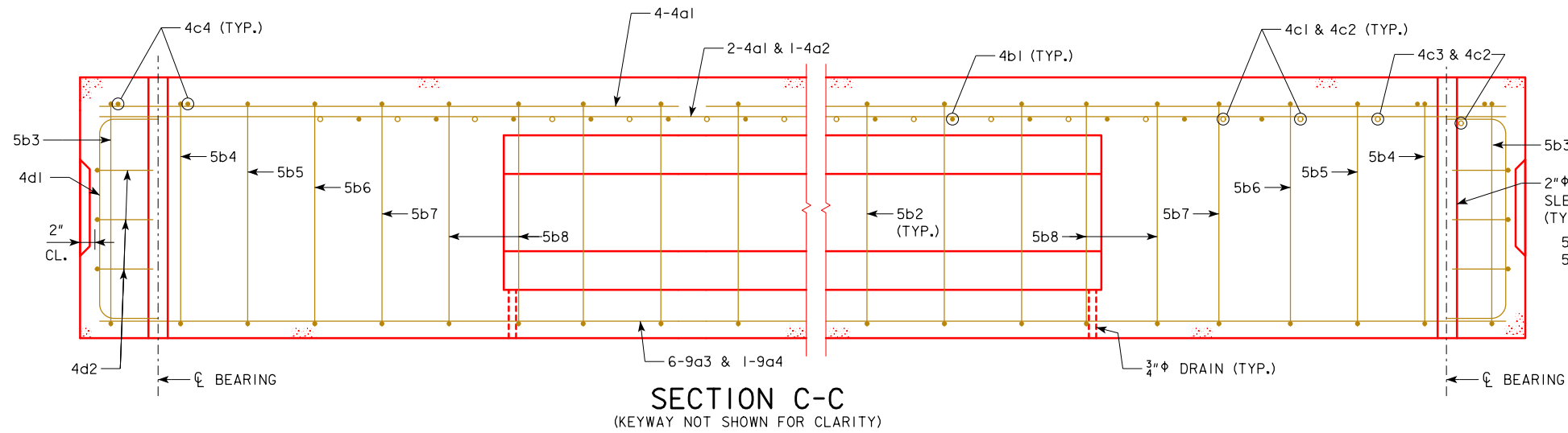
**PLAN**  
(INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR)  
(9a BARS IN BOTTOM SLAB AND 4c2 BARS NOT SHOWN FOR CLARITY)

TABLE OF DIMENSION DATA			
BEAM LINE	"X" (INCHES)	"A" (SPACES)	"B" (SPACES)
A	7	45	44
B	3	46	45
C	7	45	44
D	3	46	45
E	7	45	44
F	3	46	45

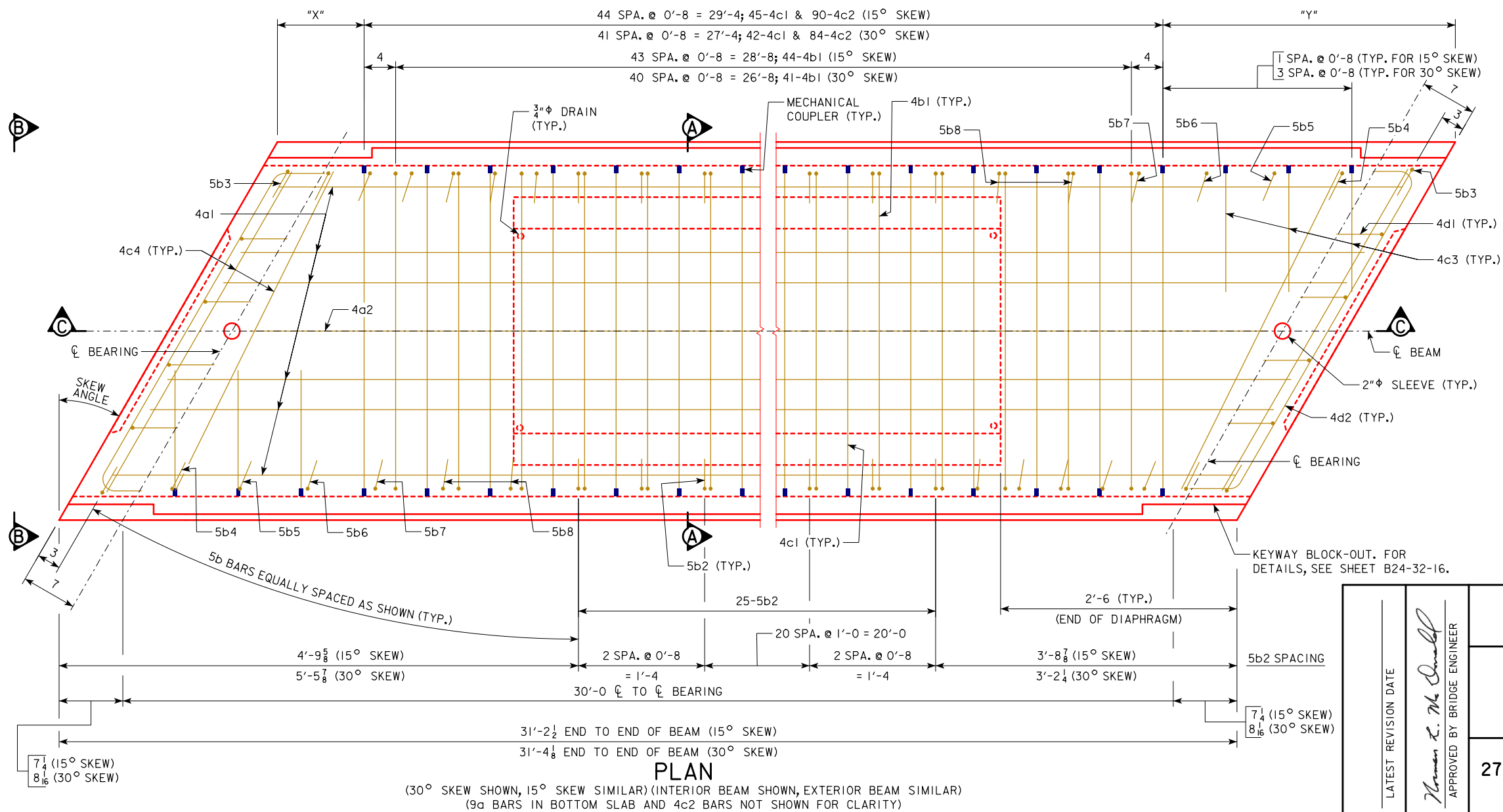
NOTE:  
FOR BEAM LINE DESIGNATIONS, SEE SHEET B24-06-16.

NOTES:  
FOR VIEW B-B, SEE SHEET B24-52-16.  
FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		<b>27" x 48" x 30'-0 RCBB DETAILS</b> 0° SKEW	<b>B24-53-16</b>



NOTE:  
OMIT KEYWAY, MECHANICAL COUPLERS, AND 4c2 BARS ON EXTERIOR FACE OF EXTERIOR BEAMS.



BEAM LINE	15° SKEW		30° SKEW	
	"X"	"Y"	"X"	"Y"
A	2 <sup>5</sup> / <sub>8</sub>	1'-7 <sup>7</sup> / <sub>8</sub>	11	3'-1 <sup>1</sup> / <sub>8</sub>
B	3 <sup>1</sup> / <sub>2</sub>	1'-7	10 <sup>5</sup> / <sub>8</sub>	3'-1 <sup>1</sup> / <sub>2</sub>
C	4 <sup>3</sup> / <sub>8</sub>	1'-6 <sup>1</sup> / <sub>8</sub>	10 <sup>3</sup> / <sub>8</sub>	3'-1 <sup>3</sup> / <sub>4</sub>
D	5 <sup>1</sup> / <sub>4</sub>	1'-5 <sup>1</sup> / <sub>4</sub>	10	3'-2 <sup>1</sup> / <sub>8</sub>
E	6 <sup>1</sup> / <sub>8</sub>	1'-4 <sup>3</sup> / <sub>8</sub>	9 <sup>3</sup> / <sub>4</sub>	3'-2 <sup>3</sup> / <sub>8</sub>
F	7	1'-3 <sup>1</sup> / <sub>2</sub>	9 <sup>1</sup> / <sub>2</sub>	3'-2 <sup>5</sup> / <sub>8</sub>

NOTE:  
FOR BEAM LINE DESIGNATIONS, SEE SHEET B24-06-16.

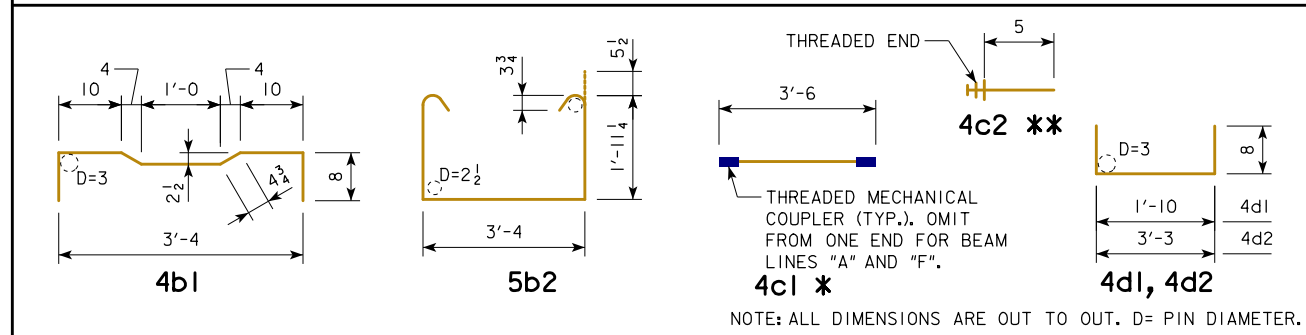
NOTES:  
FOR VIEW B-B, SEE SHEET B24-52-16.  
FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE  Approved by <i>Thomas L. Mc Donald</i> BRIDGE ENGINEER	
	STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
	DECEMBER, 2016
<b>27" x 48" x 30'-0 RCBB DETAILS 15° AND 30° SKEW</b>	
<b>B24-54-16</b>	

**EPOXY COATED REINFORCING BAR LIST**  
27" x 48" x 30'-0 RCBB, 0° SKEW

BEAM LINE		BEAM LINE "A"			BEAM LINES "B" AND "D"			BEAM LINES "C" AND "E"			BEAM LINE "F"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	6	30'-10	124	6	30'-10	124	6	30'-10	124	6	30'-10	124
4a2	—	1	29'-8	20	1	29'-8	20	1	29'-8	20	1	29'-8	20
9a3	—	6	30'-10	629	6	30'-10	629	6	30'-10	629	6	30'-10	629
9a4	—	1	29'-8	101	1	29'-8	101	1	29'-8	101	1	29'-8	101
4b1	⌋	45	4'-9½	144	46	4'-9½	147	45	4'-9½	144	46	4'-9½	147
5b2	⌋	37	8'-1½	314	37	8'-1½	314	37	8'-1½	314	37	8'-1½	314
4c1 *	—	46	3'-6	108	47	3'-6	110	46	3'-6	108	47	3'-6	110
4c2 **	—	46	0'-5	13	94	0'-5	26	92	0'-5	26	47	0'-5	13
4c3	—	2	3'-2	4	-	-	-	2	3'-2	4	-	-	-
4d1	⌋	8	3'-2	17	8	3'-2	17	8	3'-2	17	8	3'-2	17
4d2	⌋	6	4'-7	18	6	4'-7	18	6	4'-7	18	6	4'-7	18
TOTAL (LBS.)		1492			1506			1505			1493		

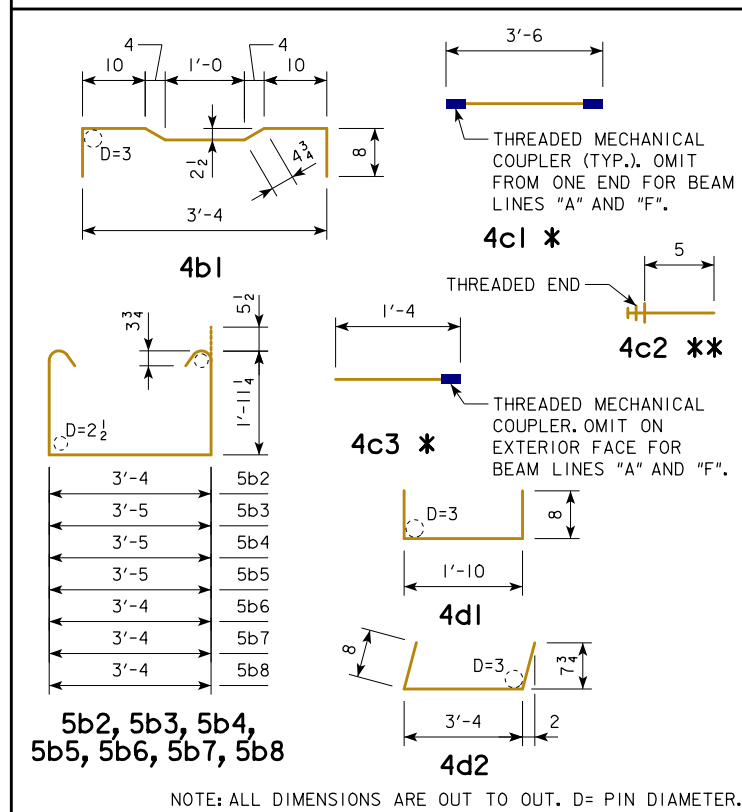
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
27" x 48" x 30'-0 RCBB, 15° SKEW

BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	6	30'-10	124	6	30'-10	124
4a2	—	1	29'-8	20	1	29'-8	20
9a3	—	6	30'-10	629	6	30'-10	629
9a4	—	1	29'-8	101	1	29'-8	101
4b1	⌋	44	4'-9½	141	44	4'-9½	141
5b2	⌋	25	8'-1½	212	25	8'-1½	212
5b3	⌋	2	8'-2½	17	2	8'-2½	17
5b4	⌋	2	8'-2½	17	2	8'-2½	17
5b5	⌋	2	8'-2½	17	2	8'-2½	17
5b6	⌋	2	8'-1½	17	2	8'-1½	17
5b7	⌋	2	8'-1½	17	2	8'-1½	17
5b8	⌋	4	8'-1½	34	4	8'-1½	34
4c1 *	—	45	3'-6	105	45	3'-6	105
4c2 **	—	46	0'-5	13	92	0'-5	26
4c3 *	—	2	1'-4	2	2	1'-4	2
4c4	—	4	3'-4	9	4	3'-4	9
4d1	⌋	8	3'-2	17	8	3'-2	17
4d2	⌋	6	4'-8	19	6	4'-8	19
TOTAL (LBS.)		1511			1524		

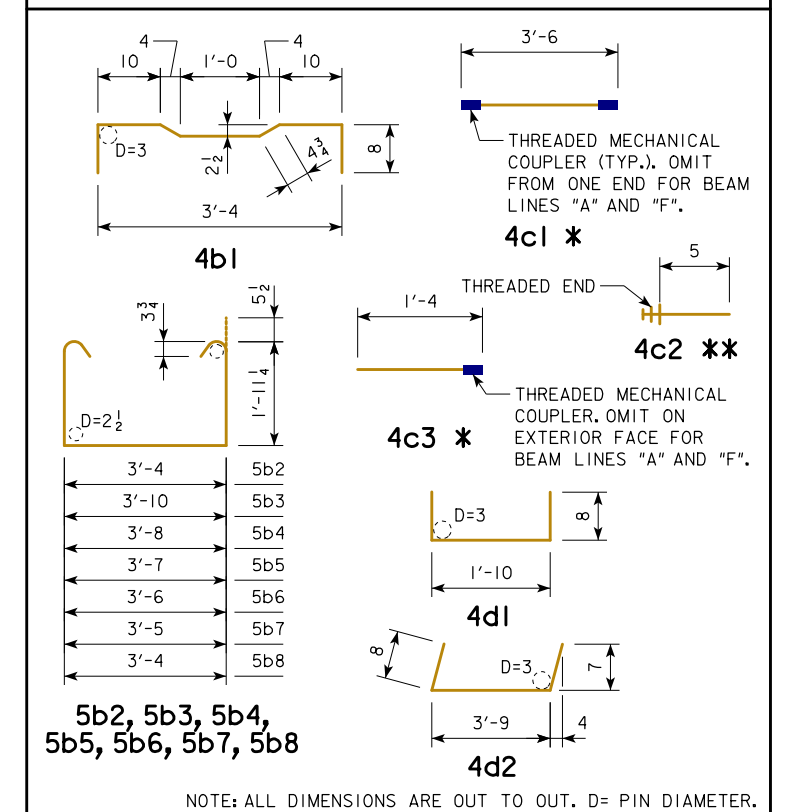
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
27" x 48" x 30'-0 RCBB, 30° SKEW

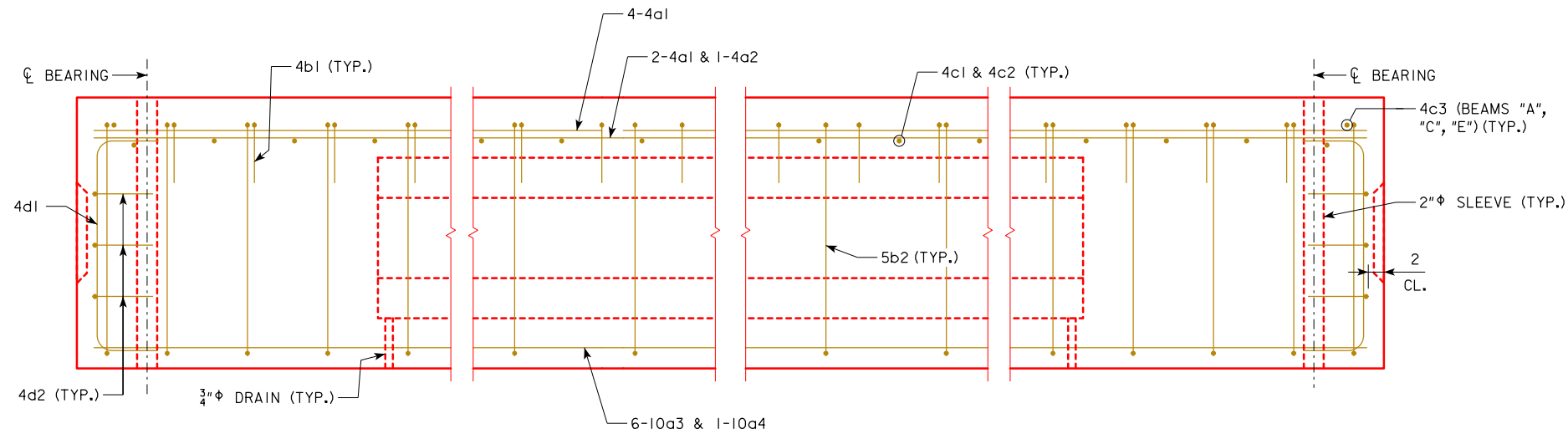
BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	6	30'-10	124	6	30'-10	124
4a2	—	1	29'-8	20	1	29'-8	20
9a3	—	6	30'-10	629	6	30'-10	629
9a4	—	1	29'-8	101	1	29'-8	101
4b1	⌋	41	4'-9½	131	41	4'-9½	131
5b2	⌋	25	8'-1½	212	25	8'-1½	212
5b3	⌋	2	8'-7½	18	2	8'-7½	18
5b4	⌋	2	8'-5½	18	2	8'-5½	18
5b5	⌋	2	8'-4½	17	2	8'-4½	17
5b6	⌋	2	8'-3½	17	2	8'-3½	17
5b7	⌋	2	8'-2½	17	2	8'-2½	17
5b8	⌋	4	8'-1½	34	4	8'-1½	34
4c1 *	—	42	3'-6	98	42	3'-6	98
4c2 **	—	45	0'-5	13	90	0'-5	25
4c3 *	—	6	1'-4	5	6	1'-4	5
4c4	—	4	3'-8	10	4	3'-8	10
4d1	⌋	8	3'-2	17	8	3'-2	17
4d2	⌋	6	5'-1	20	6	5'-1	20
TOTAL (LBS.)		1501			1513		

**BENT BAR DETAILS**

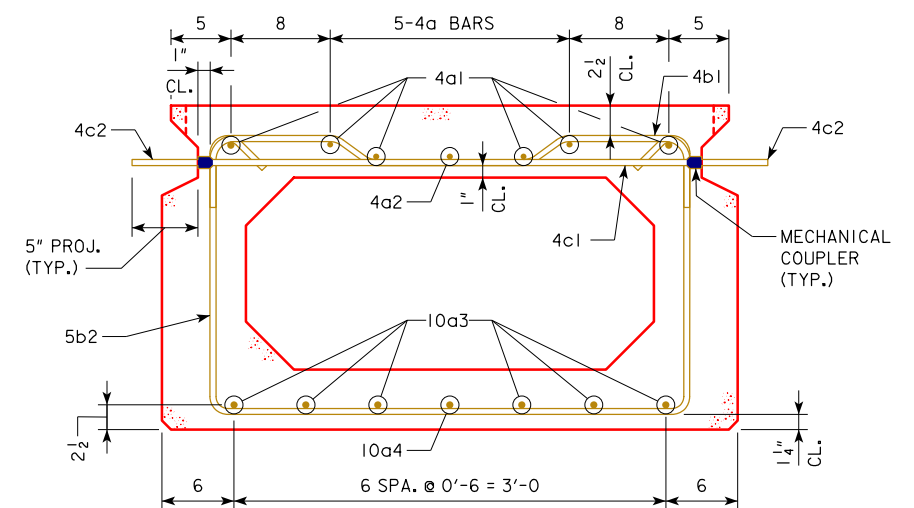


NOTES:  
 \* INCLUDES MECHANICAL COUPLER(S). SEE BENT BAR DETAILS.  
 \*\* SEE BENT BAR DETAILS. THE LENGTHS SHOWN DO NOT INCLUDE AN ALLOWANCE FOR THE THREADED END. BAR LENGTHS MAY NEED TO INCREASE DEPENDING ON THE MECHANICAL COUPLER ASSEMBLY USED. THE COST OF THE THREADED PORTION OF THESE BARS IS TO BE INCLUDED IN THE PRICE BID FOR THE BEAMS. THE WEIGHT OF THE THREADED END IS NOT INCLUDED IN THE QUANTITY SHOWN.

LATEST REVISION DATE	APPROVED BY BRIDGE ENGINEER <i>Thomas L. Mc Donald</i>	
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
27" x 48" x 30'-0 RCBB DETAILS REINFORCING BAR LIST		<b>B24-55-16</b>

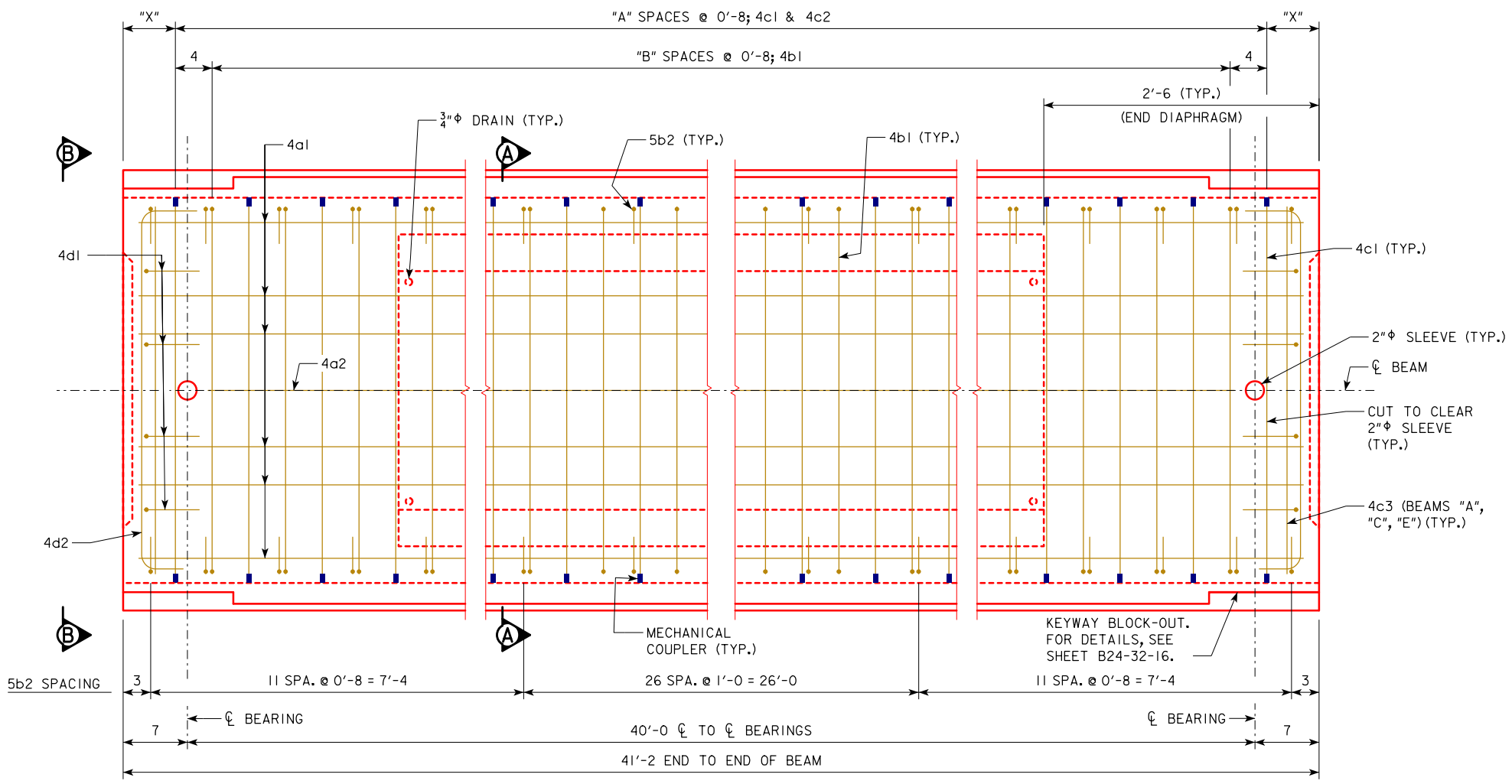


**ELEVATION**  
(KEYWAY NOT SHOWN FOR CLARITY)



**SECTION A-A**

NOTE:  
OMIT KEYWAY, MECHANICAL COUPLERS, AND 4c2 BARS ON EXTERIOR FACE OF EXTERIOR BEAMS.



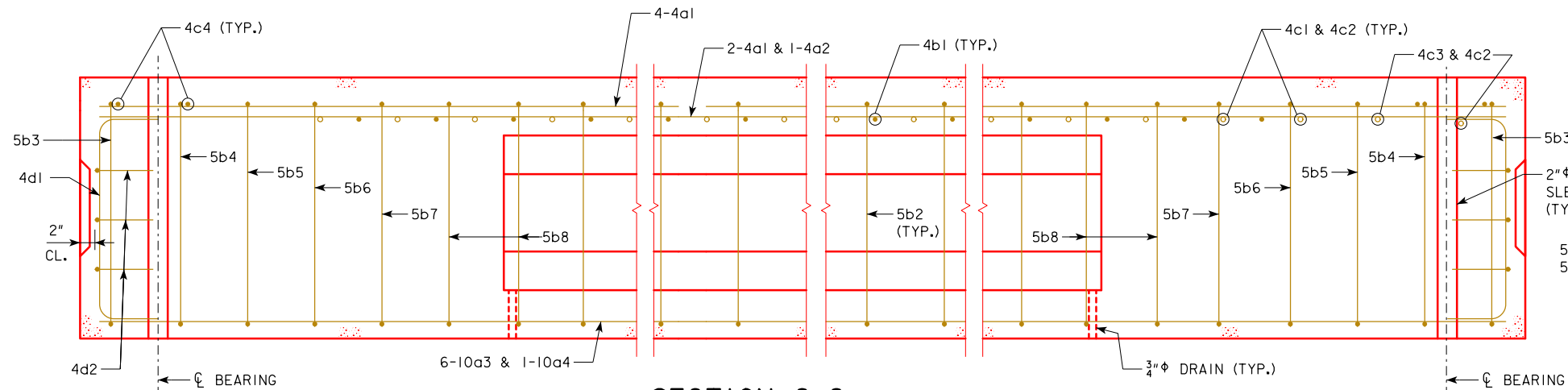
**PLAN**  
(INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR)  
(10a BARS IN BOTTOM SLAB AND 4c2 BARS NOT SHOWN FOR CLARITY)

BEAM LINE	"X" (INCHES)	"A" (SPACES)	"B" (SPACES)
A	7	60	59
B	3	61	60
C	7	60	59
D	3	61	60
E	7	60	59
F	3	61	60

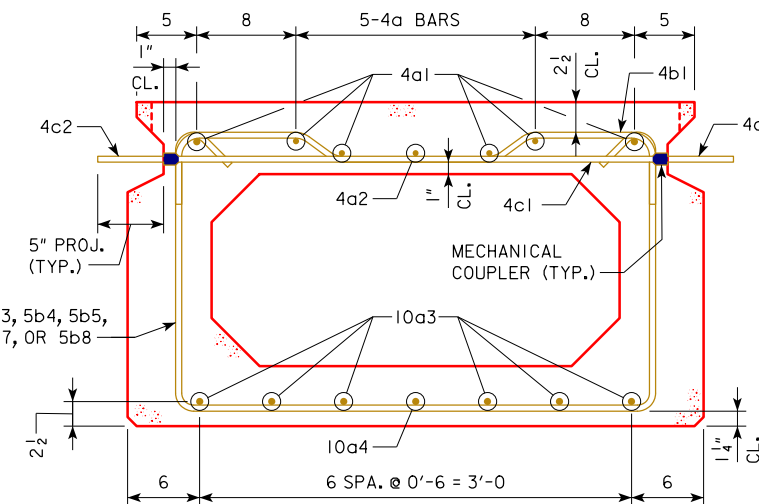
NOTE:  
FOR BEAM LINE DESIGNATIONS, SEE SHEET B24-06-16.

NOTE:  
FOR VIEW B-B, SEE SHEET B24-52-16.  
FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		<b>27" x 48" x 40'-0 RCBB DETAILS</b> 0° SKEW	<b>B24-56-16</b>

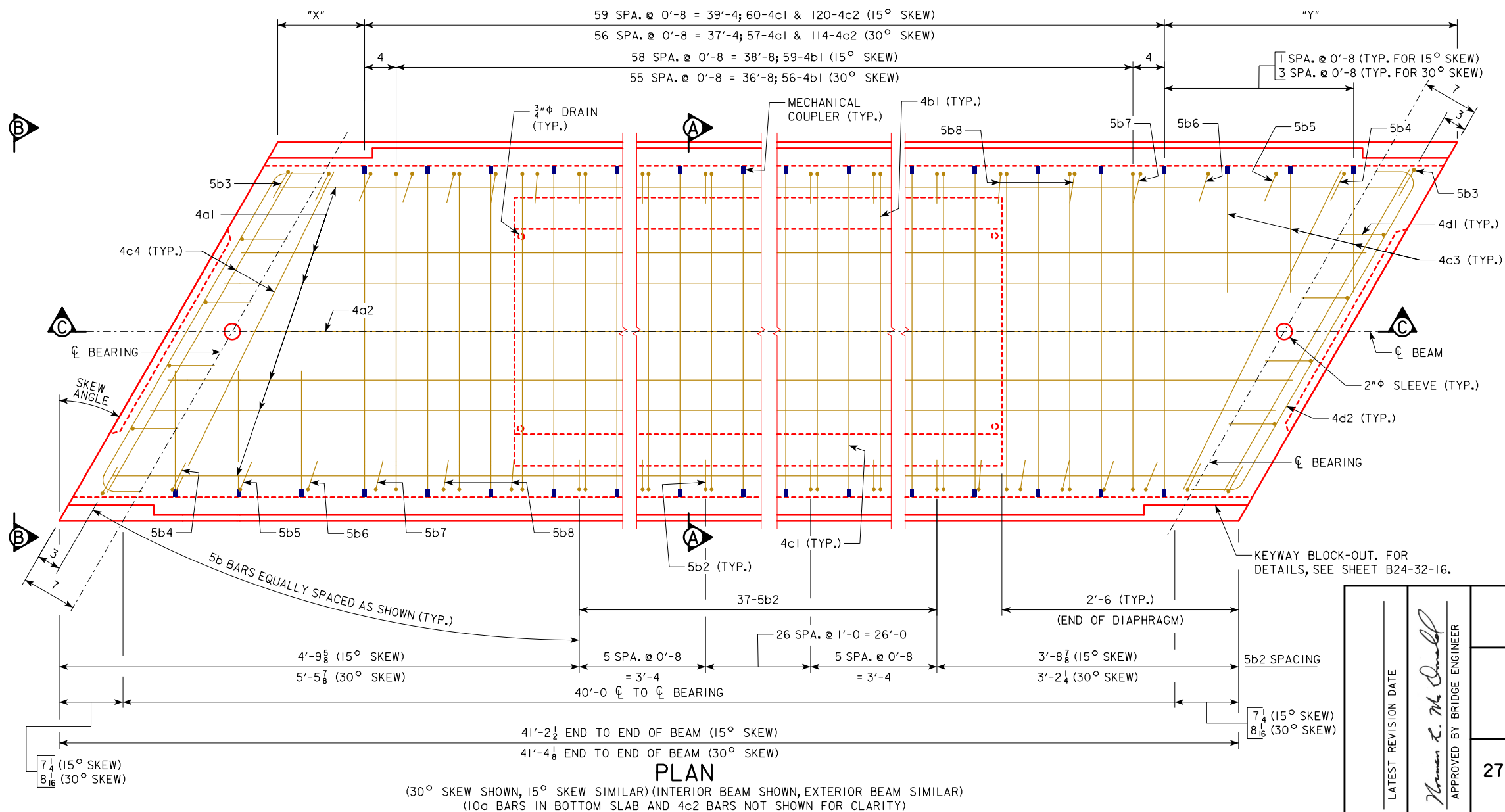


**SECTION C-C**  
(KEYWAY NOT SHOWN FOR CLARITY)



**SECTION A-A**

NOTE:  
OMIT KEYWAY, MECHANICAL COUPLERS, AND 4c2 BARS ON EXTERIOR FACE OF EXTERIOR BEAMS.



**PLAN**

(30° SKEW SHOWN, 15° SKEW SIMILAR) (INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR)  
(10a BARS IN BOTTOM SLAB AND 4c2 BARS NOT SHOWN FOR CLARITY)

**TABLE OF DIMENSION DATA**

BEAM LINE	15° SKEW		30° SKEW	
	"X"	"Y"	"X"	"Y"
A	2 <sup>5</sup> / <sub>8</sub>	1'-7 <sup>7</sup> / <sub>8</sub>	11	3'-1 <sup>1</sup> / <sub>8</sub>
B	3 <sup>1</sup> / <sub>2</sub>	1'-7	10 <sup>5</sup> / <sub>8</sub>	3'-1 <sup>1</sup> / <sub>2</sub>
C	4 <sup>3</sup> / <sub>8</sub>	1'-6 <sup>1</sup> / <sub>8</sub>	10 <sup>3</sup> / <sub>8</sub>	3'-1 <sup>3</sup> / <sub>4</sub>
D	5 <sup>1</sup> / <sub>4</sub>	1'-5 <sup>1</sup> / <sub>4</sub>	10	3'-2 <sup>1</sup> / <sub>8</sub>
E	6 <sup>1</sup> / <sub>8</sub>	1'-4 <sup>3</sup> / <sub>8</sub>	9 <sup>3</sup> / <sub>4</sub>	3'-2 <sup>3</sup> / <sub>8</sub>
F	7	1'-3 <sup>1</sup> / <sub>2</sub>	9 <sup>1</sup> / <sub>2</sub>	3'-2 <sup>5</sup> / <sub>8</sub>

NOTE:  
FOR BEAM LINE DESIGNATIONS, SEE SHEET B24-06-16.

NOTES:  
FOR VIEW B-B, SEE SHEET B24-52-16.  
FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

REVISION DATE

APPROVED BY BRIDGE ENGINEER  
*Thomas L. Mc Donald*

**IOWADOT** Highway Division

STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN  
**CONCRETE BOX BEAM BRIDGES**

DECEMBER, 2016

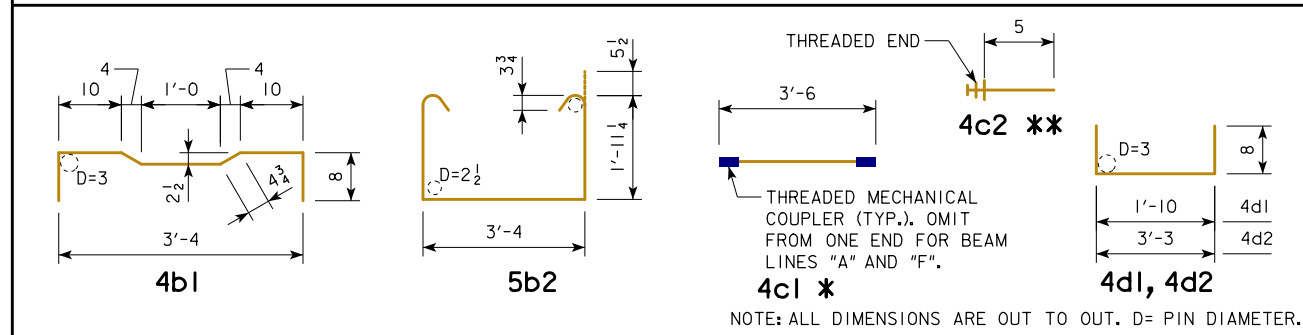
27" x 48" x 40'-0 RCBB DETAILS  
15° AND 30° SKEW

B24-57-16

**EPOXY COATED REINFORCING BAR LIST**  
27" x 48" x 40'-0 RCBB, 0° SKEW

BEAM LINE		BEAM LINE "A"			BEAM LINES "B" AND "D"			BEAM LINES "C" AND "E"			BEAM LINE "F"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	6	40'-10	164	6	40'-10	164	6	40'-10	164	6	40'-10	164
4a2	—	1	39'-8	26	1	39'-8	26	1	39'-8	26	1	39'-8	26
10a3	—	6	40'-10	1054	6	40'-10	1054	6	40'-10	1054	6	40'-10	1054
10a4	—	1	39'-8	171	1	39'-8	171	1	39'-8	171	1	39'-8	171
4b1	⌋	60	4'-9½	192	61	4'-9½	195	60	4'-9½	192	61	4'-9½	195
5b2	⌋	49	8'-1½	415	49	8'-1½	415	49	8'-1½	415	49	8'-1½	415
4c1 *	—	61	3'-6	143	62	3'-6	145	61	3'-6	143	62	3'-6	145
4c2 **	—	61	0'-5	17	124	0'-5	35	122	0'-5	34	62	0'-5	17
4c3	—	2	3'-2	4	-	-	-	2	3'-2	4	-	-	-
4d1	⌋	8	3'-2	17	8	3'-2	17	8	3'-2	17	8	3'-2	17
4d2	⌋	6	4'-7	18	6	4'-7	18	6	4'-7	18	6	4'-7	18
TOTAL (LBS.)		2221			2240			2238			2222		

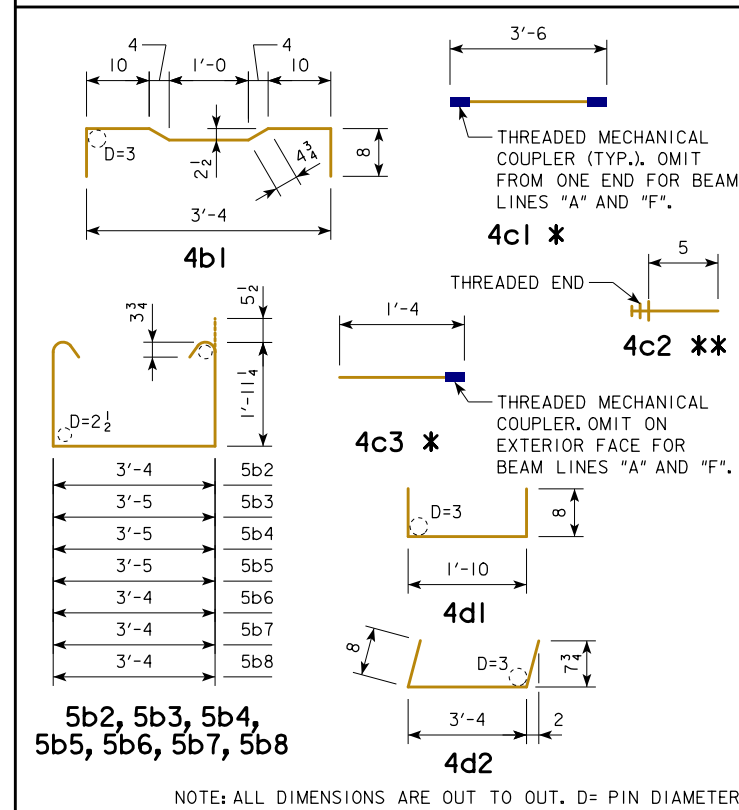
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
27" x 48" x 40'-0 RCBB, 15° SKEW

BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	6	40'-10	164	6	40'-10	164
4a2	—	1	39'-8	26	1	39'-8	26
10a3	—	6	40'-10	1054	6	40'-10	1054
10a4	—	1	39'-8	171	1	39'-8	171
4b1	⌋	59	4'-9½	189	59	4'-9½	189
5b2	⌋	37	8'-1½	314	37	8'-1½	314
5b3	⌋	2	8'-2½	17	2	8'-2½	17
5b4	⌋	2	8'-2½	17	2	8'-2½	17
5b5	⌋	2	8'-2½	17	2	8'-2½	17
5b6	⌋	2	8'-1½	17	2	8'-1½	17
5b7	⌋	2	8'-1½	17	2	8'-1½	17
5b8	⌋	4	8'-1½	34	4	8'-1½	34
4c1 *	—	60	3'-6	140	60	3'-6	140
4c2 **	—	61	0'-5	17	122	0'-5	34
4c3 *	—	2	1'-4	2	2	1'-4	2
4c4	—	4	3'-4	9	4	3'-4	9
4d1	⌋	8	3'-2	17	8	3'-2	17
4d2	⌋	6	4'-8	19	6	4'-8	19
TOTAL (LBS.)		2241			2258		

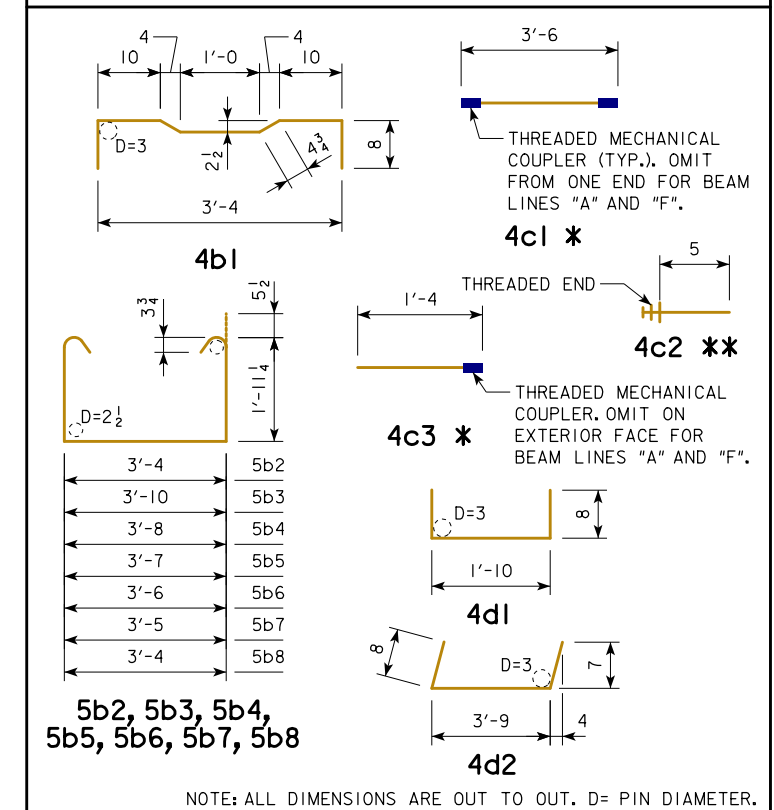
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
27" x 48" x 40'-0 RCBB, 30° SKEW

BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	6	40'-10	164	6	40'-10	164
4a2	—	1	39'-8	26	1	39'-8	26
10a3	—	6	40'-10	1054	6	40'-10	1054
10a4	—	1	39'-8	171	1	39'-8	171
4b1	⌋	56	4'-9½	179	56	4'-9½	179
5b2	⌋	37	8'-1½	314	37	8'-1½	314
5b3	⌋	2	8'-7½	18	2	8'-7½	18
5b4	⌋	2	8'-5½	18	2	8'-5½	18
5b5	⌋	2	8'-4½	17	2	8'-4½	17
5b6	⌋	2	8'-3½	17	2	8'-3½	17
5b7	⌋	2	8'-2½	17	2	8'-2½	17
5b8	⌋	4	8'-1½	34	4	8'-1½	34
4c1 *	—	57	3'-6	133	57	3'-6	133
4c2 **	—	60	0'-5	17	120	0'-5	33
4c3 *	—	6	1'-4	5	6	1'-4	5
4c4	—	4	3'-8	10	4	3'-8	10
4d1	⌋	8	3'-2	17	8	3'-2	17
4d2	⌋	6	5'-1	20	6	5'-1	20
TOTAL (LBS.)		2231			2247		

**BENT BAR DETAILS**



NOTES:  
 \* INCLUDES MECHANICAL COUPLER(S). SEE BENT BAR DETAILS.  
 \*\* SEE BENT BAR DETAILS. THE LENGTHS SHOWN DO NOT INCLUDE AN ALLOWANCE FOR THE THREADED END. BAR LENGTHS MAY NEED TO INCREASE DEPENDING ON THE MECHANICAL COUPLER ASSEMBLY USED. THE COST OF THE THREADED PORTION OF THESE BARS IS TO BE INCLUDED IN THE PRICE BID FOR THE BEAMS. THE WEIGHT OF THE THREADED END IS NOT INCLUDED IN THE QUANTITY SHOWN.

LATEST REVISION DATE	
	STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
	DECEMBER, 2016
APPROVED BY BRIDGE ENGINEER 	27" x 48" x 40'-0 RCBB DETAILS REINFORCING BAR LIST
	<b>B24-58-16</b>

### 33" x 48" REINFORCED CONCRETE BOX BEAM DATA

BEAM	SKEW (DEGREES)	SPAN LENGTH $\bar{C}-\bar{C}$ BEARING	OVERALL BEAM LENGTH	f'c (ksi)	WEIGHT (TONS)	CONCRETE (C.Y.)	REINFORCING STEEL (LBS.)
RCBB 33" x 48" x 50'-0	0	50'-0	51'-2	5.0	24.2	12.0	SEE SHEET B24-62-16
	15		51'-2 $\frac{1}{2}$		24.6	12.2	
	30		51'-4 $\frac{1}{8}$		25.1	12.4	

#### SPECIFICATIONS:

DESIGN: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH ED., SERIES OF 2014.

CONSTRUCTION: STANDARD SPECIFICATIONS OF THE IOWA DEPARTMENT OF TRANSPORTATION, CURRENT SERIES, WITH CURRENT APPLICABLE SPECIAL PROVISIONS AND SUPPLEMENTAL SPECIFICATIONS.

#### LIVE LOAD DISTRIBUTION FACTOR NOTES:

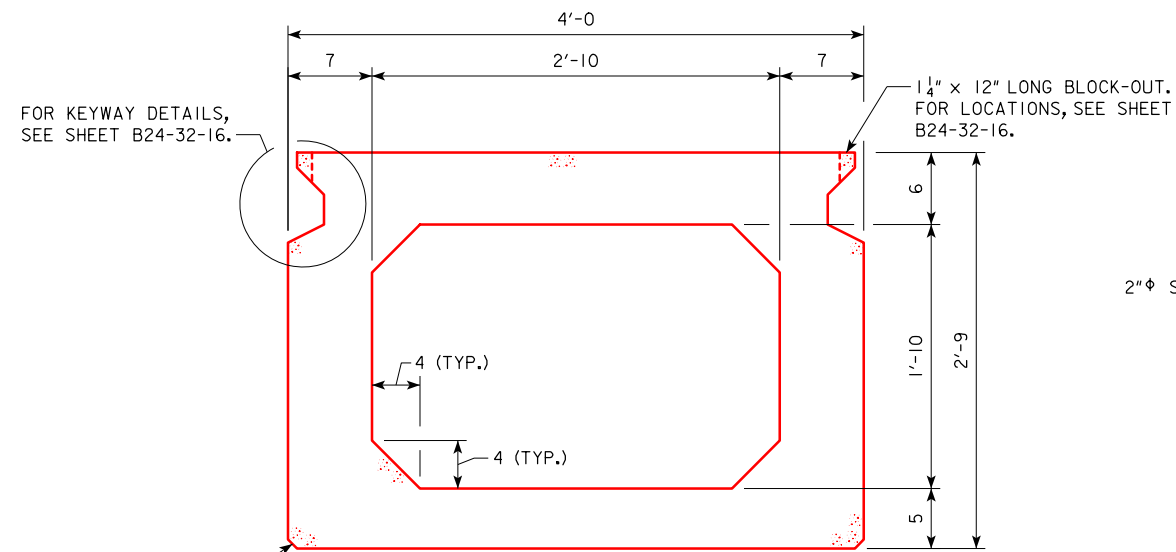
AASHTO EQUATIONS WERE USED FOR DETERMINING THE LIVE LOAD DISTRIBUTION FACTORS FOR THE DESIGN OF THE BEAMS. SKEW EFFECTS WERE INCLUDED IN THE LIVE LOAD DISTRIBUTION FACTOR FOR SHEAR AND CONSERVATIVELY IGNORED FOR THE LIVE LOAD DISTRIBUTION FACTOR FOR MOMENT. CONTROLLING LIVE LOAD DISTRIBUTION FACTORS ARE:  
 50'-0 SPAN  
 MOMENT = 0.35 LANES / BEAM  
 SHEAR = 0.67 LANES / BEAM

#### DESIGN STRESSES:

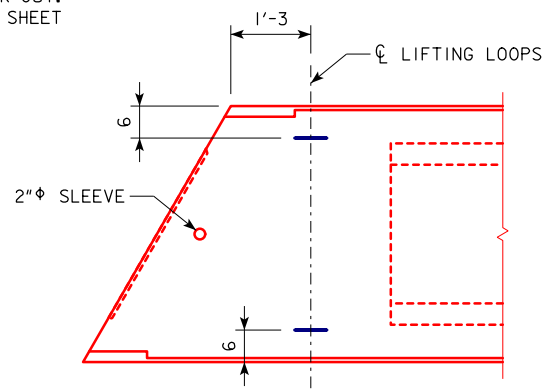
DESIGN STRESSES FOR THE FOLLOWING MATERIALS ARE TO BE IN ACCORDANCE WITH AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH ED., SERIES OF 2014:  
 -REINFORCING STEEL IN ACCORDANCE WITH SECTION 5, GRADE 60.  
 -CONCRETE IN ACCORDANCE WITH SECTION 5.

#### NOTES:

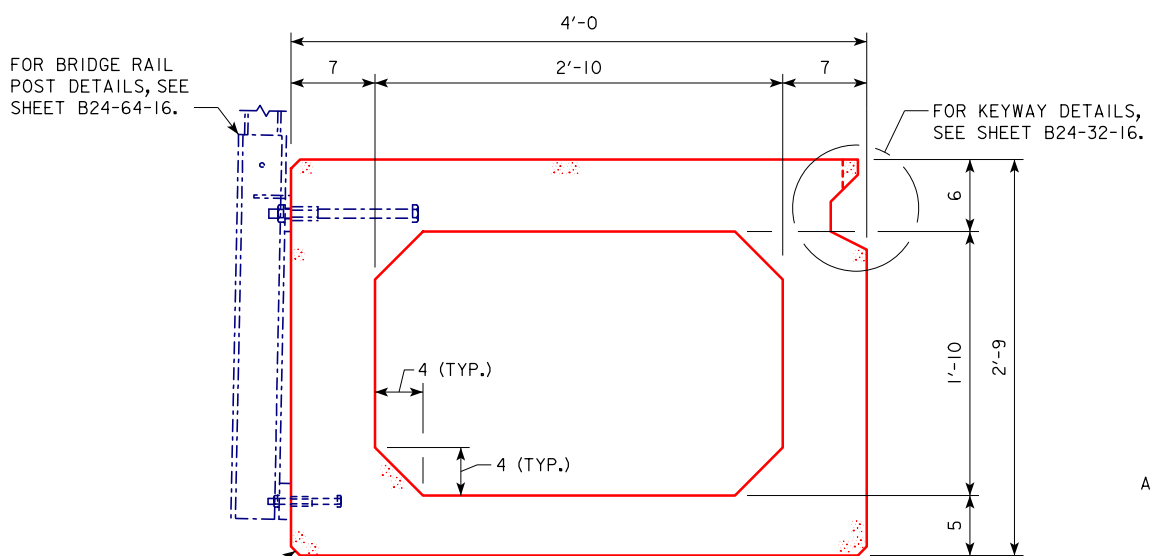
THESE BEAMS ARE DESIGNED FOR HL93 LOADING WITH AN ALLOWANCE OF 50 lb. PER SQUARE FOOT OF ROADWAY FOR GRAVEL OR FUTURE WEARING SURFACE.  
 TOPS OF BEAMS ARE TO BE STRUCK OFF LEVEL AND LONGITUDINALLY TINED IN ACCORDANCE WITH ARTICLE 2301.03, H, 3 OF THE STANDARD SPECIFICATIONS.  
 BEARINGS SHALL BE AS DETAILED ON OTHER DESIGN SHEETS.  
 BEAMS ARE TO BE AT LEAST 28 DAYS OLD BEFORE THE FUTURE WEARING SURFACE, IF USED, IS PLACED UNLESS A SHORTER CURING TIME IS APPROVED BY THE BRIDGE ENGINEER.  
 LIFTING OPERATIONS SHALL BE PERFORMED IN SUCH A MANNER THAT LIFTING LOOPS CARRY LOADS EQUALLY.



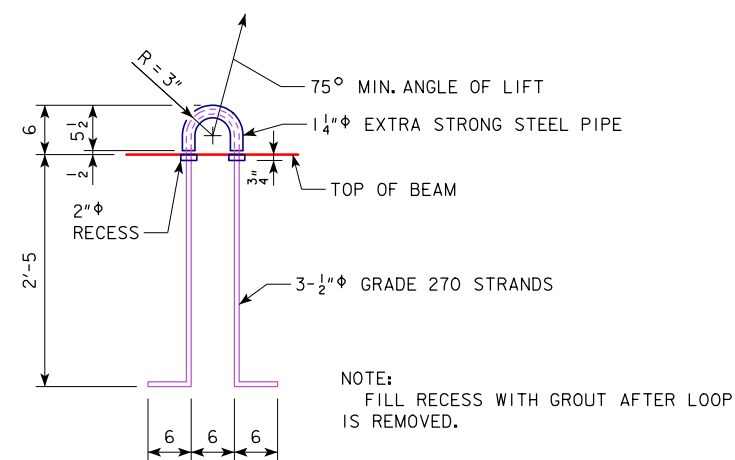
INTERIOR BEAM CROSS SECTION



LIFTING LOOP PLAN

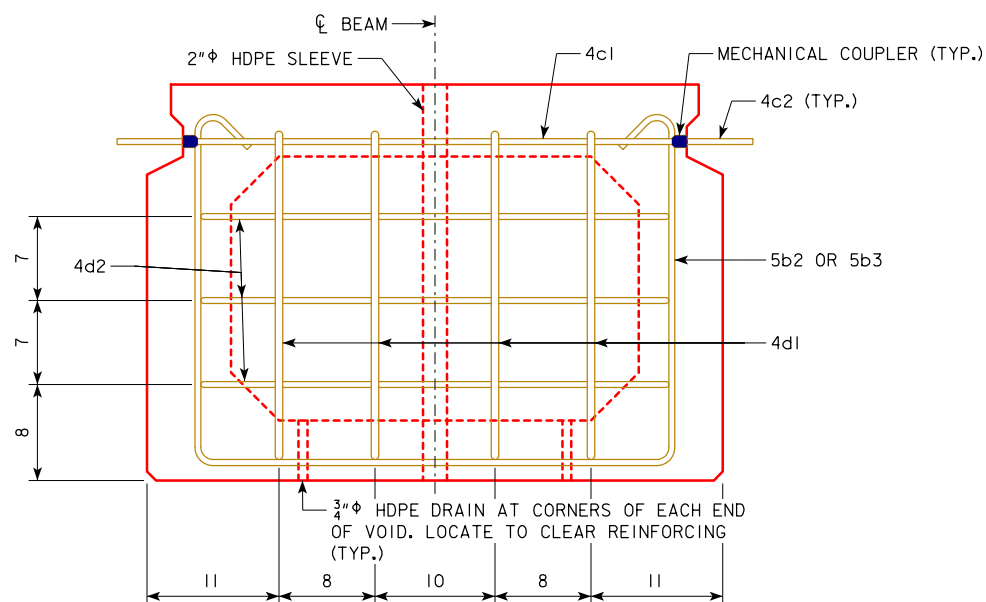


EXTERIOR BEAM CROSS SECTION



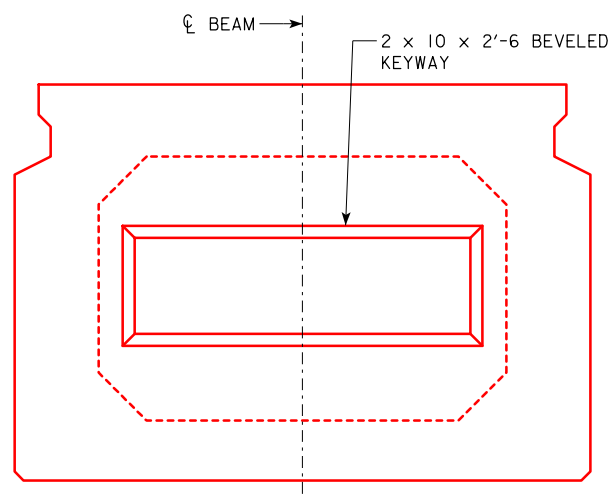
LIFTING LOOP DETAIL

ALTERNATE TYPES OF LIFTING LOOPS MAY BE SUBMITTED FOR APPROVAL.



VIEW B-B

(INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR)



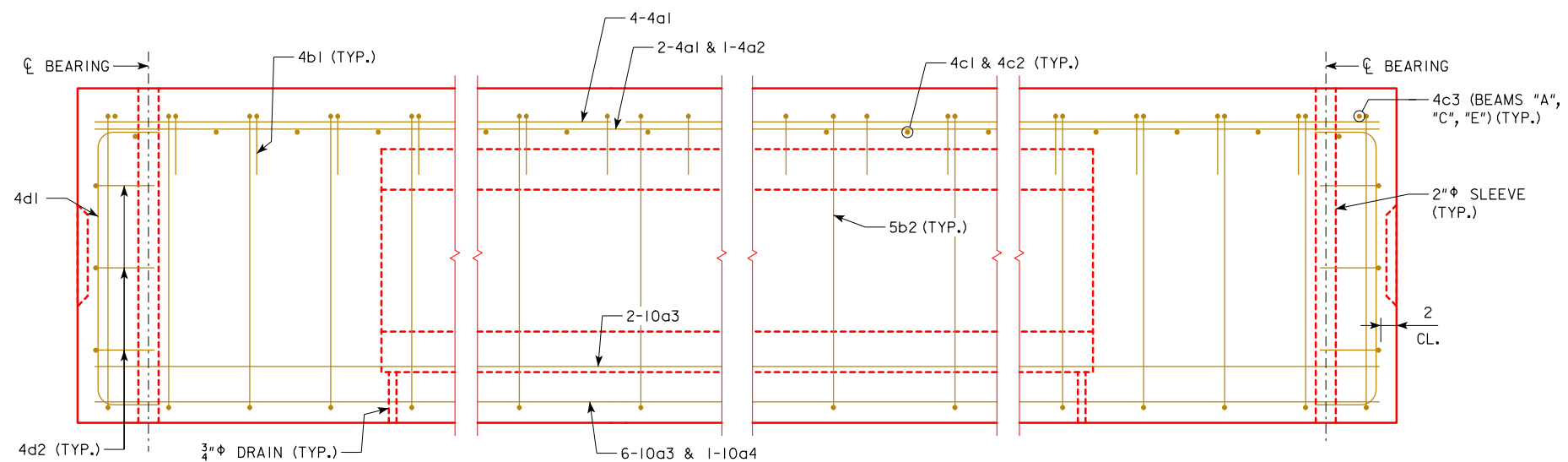
VIEW B-B

(INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR) (SHOWING KEYWAY)

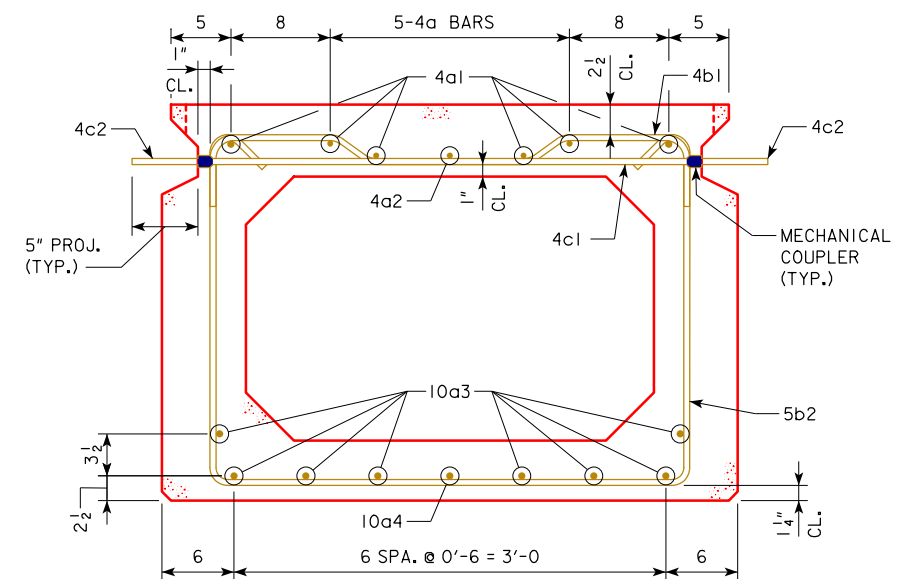
NOTES:  
 FOR VIEW B-B LOCATION, SEE SHEETS B24-60-16 & B24-61-16.  
 FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
		<b>33" x 48" RCBB DETAILS</b>

B24-59-16

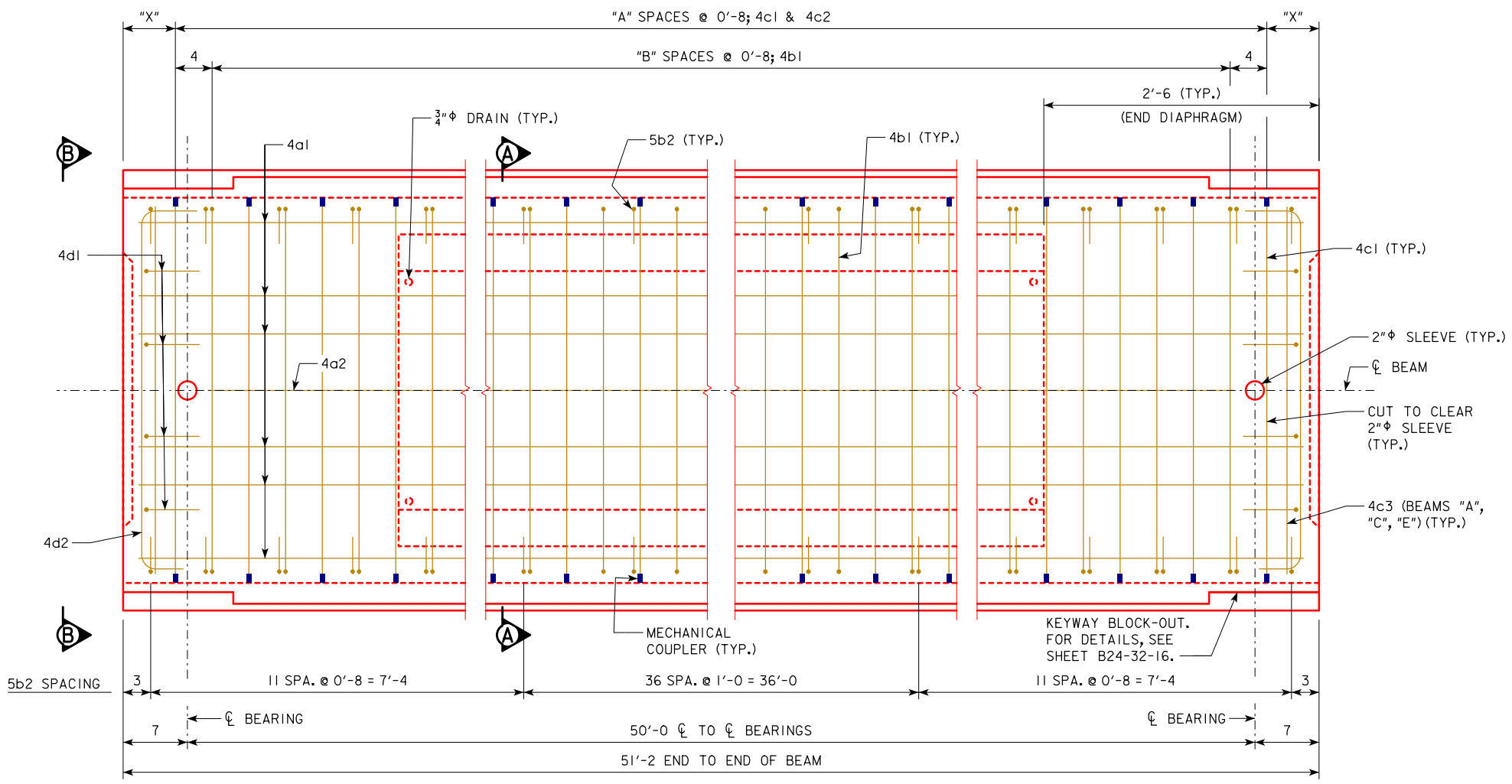


**ELEVATION**  
(KEYWAY NOT SHOWN FOR CLARITY)



**SECTION A-A**

NOTE:  
OMIT KEYWAY, MECHANICAL COUPLERS, AND 4c2 BARS ON EXTERIOR FACE OF EXTERIOR BEAMS.



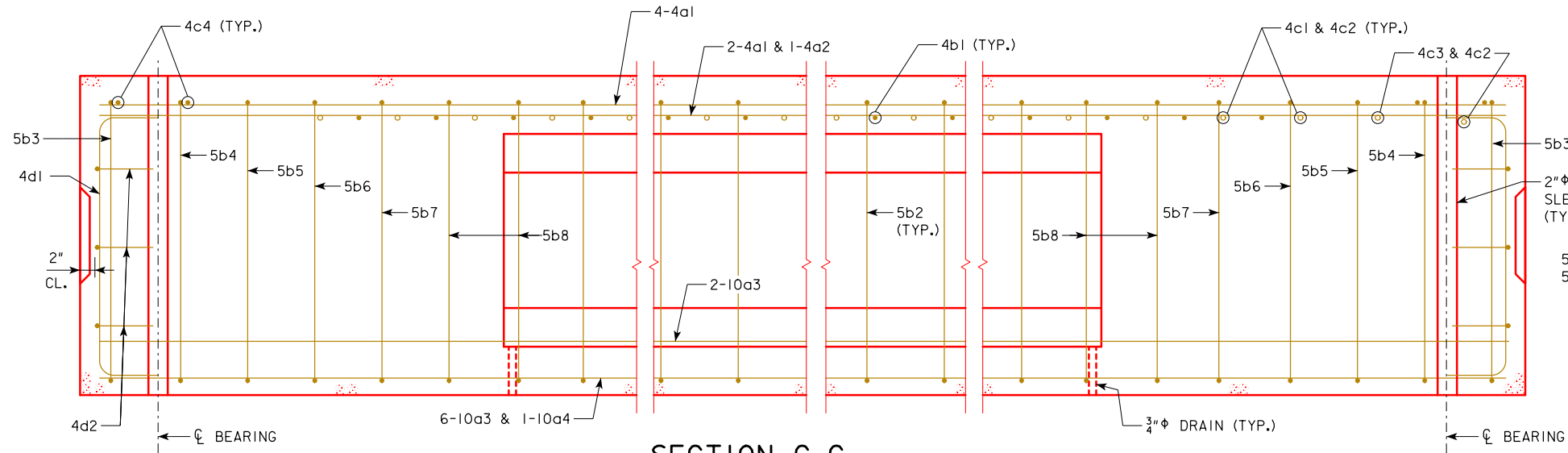
**PLAN**  
(INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR)  
(10a BARS IN BOTTOM SLAB AND 4c2 BARS NOT SHOWN FOR CLARITY)

TABLE OF DIMENSION DATA			
BEAM LINE	"X" (INCHES)	"A" (SPACES)	"B" (SPACES)
A	7	75	74
B	3	76	75
C	7	75	74
D	3	76	75
E	7	75	74
F	3	76	75

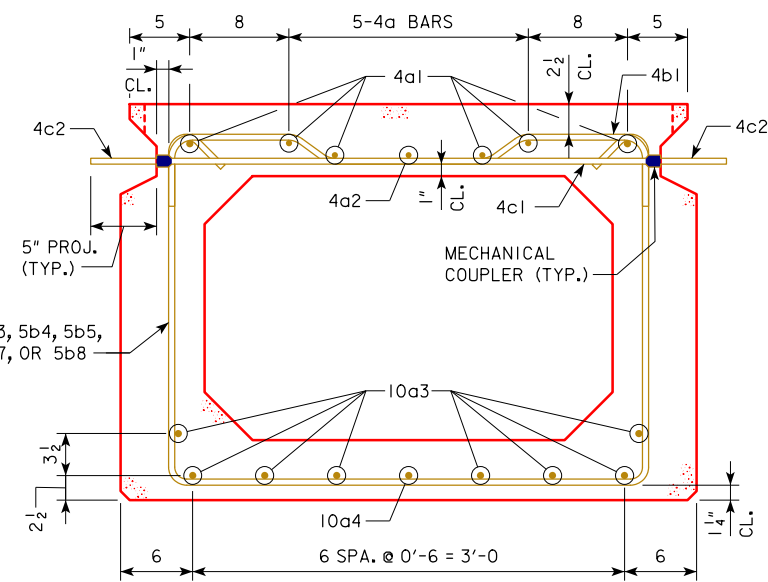
NOTE:  
FOR BEAM LINE DESIGNATIONS, SEE SHEET B24-06-16.

NOTES:  
FOR VIEW B-B, SEE SHEET B24-59-16.  
FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	<b>B24-60-16</b>
		DECEMBER, 2016	
		<b>33" x 48" x 50'-0 RCBB DETAILS</b> <b>0° SKEW</b>	

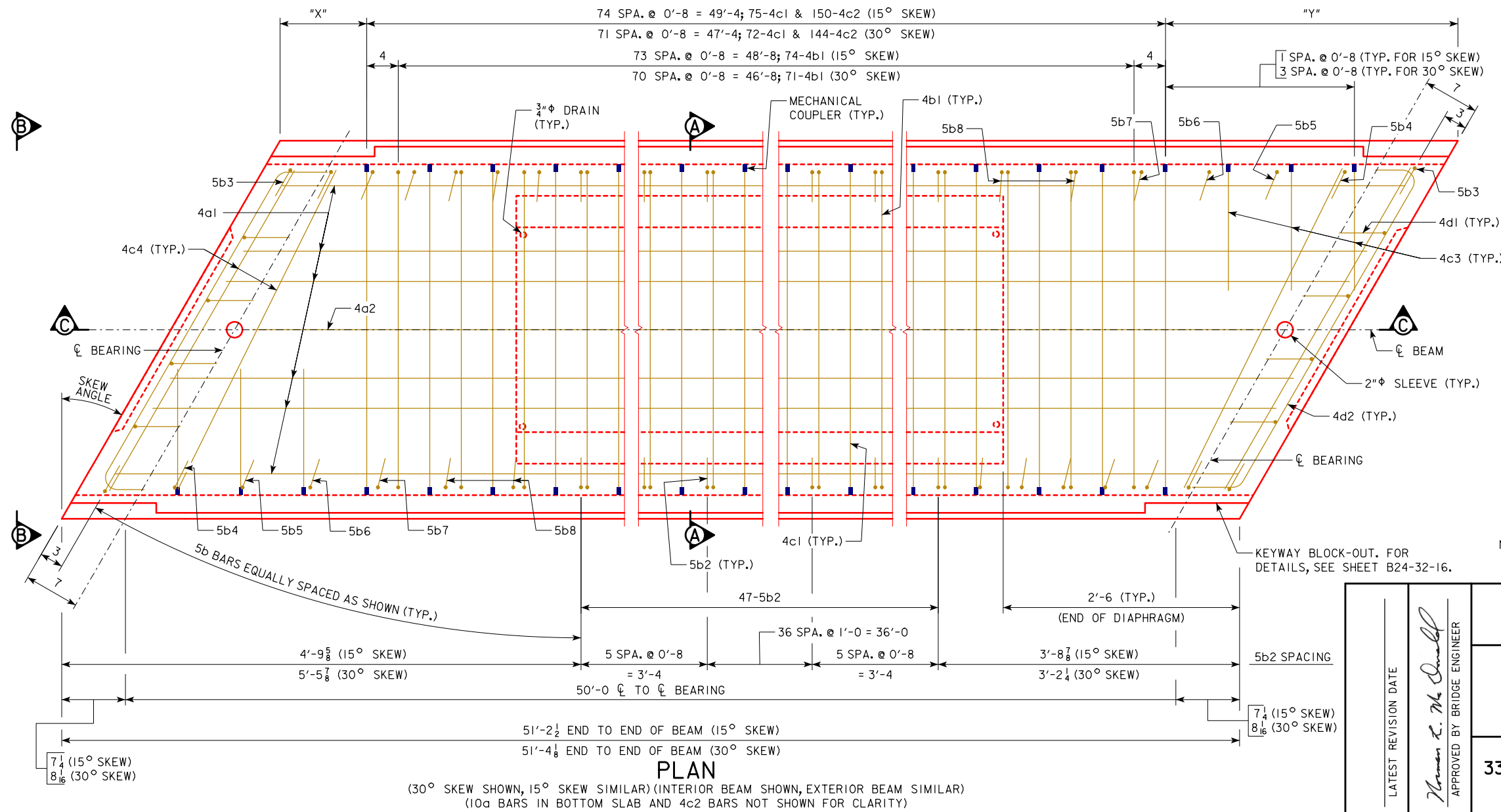


**SECTION C-C**  
(KEYWAY NOT SHOWN FOR CLARITY)



**SECTION A-A**

NOTE:  
OMIT KEYWAY, MECHANICAL COUPLERS, AND 4c2 BARS ON EXTERIOR FACE OF EXTERIOR BEAMS.



**PLAN**

(30° SKEW SHOWN, 15° SKEW SIMILAR) (INTERIOR BEAM SHOWN, EXTERIOR BEAM SIMILAR)  
(10a BARS IN BOTTOM SLAB AND 4c2 BARS NOT SHOWN FOR CLARITY)

BEAM LINE	15° SKEW		30° SKEW	
	"X"	"Y"	"X"	"Y"
A	2 <sup>5</sup> / <sub>8</sub>	1'-7 <sup>7</sup> / <sub>8</sub>	11	3'-1 <sup>1</sup> / <sub>8</sub>
B	3 <sup>1</sup> / <sub>2</sub>	1'-7	10 <sup>5</sup> / <sub>8</sub>	3'-1 <sup>1</sup> / <sub>2</sub>
C	4 <sup>3</sup> / <sub>8</sub>	1'-6 <sup>1</sup> / <sub>8</sub>	10 <sup>3</sup> / <sub>8</sub>	3'-1 <sup>3</sup> / <sub>4</sub>
D	5 <sup>1</sup> / <sub>4</sub>	1'-5 <sup>1</sup> / <sub>4</sub>	10	3'-2 <sup>1</sup> / <sub>8</sub>
E	6 <sup>1</sup> / <sub>8</sub>	1'-4 <sup>3</sup> / <sub>8</sub>	9 <sup>3</sup> / <sub>4</sub>	3'-2 <sup>3</sup> / <sub>8</sub>
F	7	1'-3 <sup>1</sup> / <sub>2</sub>	9 <sup>1</sup> / <sub>2</sub>	3'-2 <sup>5</sup> / <sub>8</sub>

NOTE:  
FOR BEAM LINE DESIGNATIONS, SEE SHEET B24-06-16.

NOTES:  
FOR VIEW B-B, SEE SHEET B24-59-16.  
FOR BEAM CHAMFER DETAILS, SEE SHEET B24-33-16.

LATEST REVISION DATE  
*Thomas L. Mc Donald*  
APPROVED BY BRIDGE ENGINEER



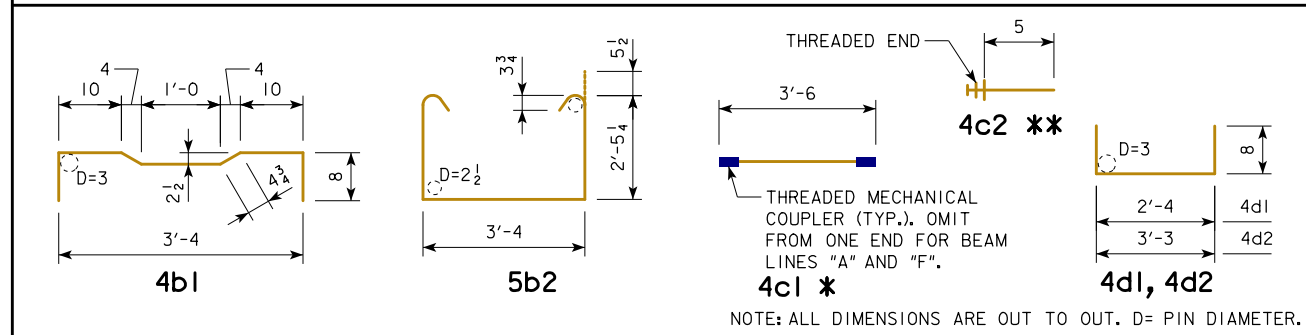
STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN  
**CONCRETE BOX BEAM BRIDGES**  
DECEMBER, 2016

**33" x 48" x 50'-0 RCBB DETAILS**  
15° AND 30° SKEW  
**B24-61-16**

**EPOXY COATED REINFORCING BAR LIST**  
**33" x 48" x 50'-0 RCBB, 0° SKEW**

BEAM LINE		BEAM LINE "A"			BEAM LINES "B" AND "D"			BEAM LINES "C" AND "E"			BEAM LINE "F"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	6	50'-10	204	6	50'-10	204	6	50'-10	204	6	50'-10	204
4a2	—	1	49'-8	33	1	49'-8	33	1	49'-8	33	1	49'-8	33
10a3	—	8	50'-10	1750	8	50'-10	1750	8	50'-10	1750	8	50'-10	1750
10a4	—	1	49'-8	214	1	49'-8	214	1	49'-8	214	1	49'-8	214
4b1	⌋	75	4'-9½	240	76	4'-9½	243	75	4'-9½	240	76	4'-9½	243
5b2	⌋	59	9'-1½	562	59	9'-1½	562	59	9'-1½	562	59	9'-1½	562
4c1 *	—	76	3'-6	178	77	3'-6	180	76	3'-6	178	77	3'-6	180
4c2 **	—	76	0'-5	21	154	0'-5	43	152	0'-5	42	77	0'-5	21
4c3	—	2	3'-2	4	-	-	-	2	3'-2	4	-	-	-
4d1	⌋	8	3'-8	20	8	3'-8	20	8	3'-8	20	8	3'-8	20
4d2	⌋	6	4'-7	18	6	4'-7	18	6	4'-7	18	6	4'-7	18
TOTAL (LBS.)		3244			3267			3265			3245		

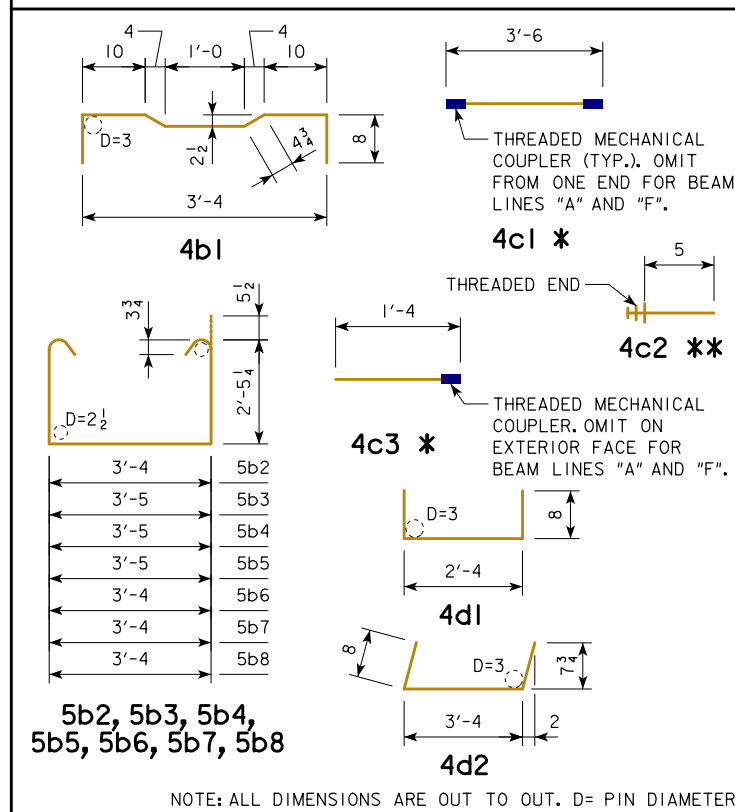
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
**33" x 48" x 50'-0 RCBB, 15° SKEW**

BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	6	50'-10	204	6	50'-10	204
4a2	—	1	49'-8	33	1	49'-8	33
10a3	—	8	50'-10	1750	8	50'-10	1750
10a4	—	1	49'-8	214	1	49'-8	214
4b1	⌋	74	4'-9½	237	74	4'-9½	237
5b2	⌋	47	9'-1½	447	47	9'-1½	447
5b3	⌋	2	9'-2½	19	2	9'-2½	19
5b4	⌋	2	9'-2½	19	2	9'-2½	19
5b5	⌋	2	9'-2½	19	2	9'-2½	19
5b6	⌋	2	9'-1½	19	2	9'-1½	19
5b7	⌋	2	9'-1½	19	2	9'-1½	19
5b8	⌋	4	9'-1½	38	4	9'-1½	38
4c1 *	—	75	3'-6	175	75	3'-6	175
4c2 **	—	76	0'-5	21	152	0'-5	42
4c3 *	—	2	1'-4	2	2	1'-4	2
4c4	—	4	3'-4	9	4	3'-4	9
4d1	⌋	8	3'-8	20	8	3'-8	20
4d2	⌋	6	4'-8	19	6	4'-8	19
TOTAL (LBS.)		3264			3285		

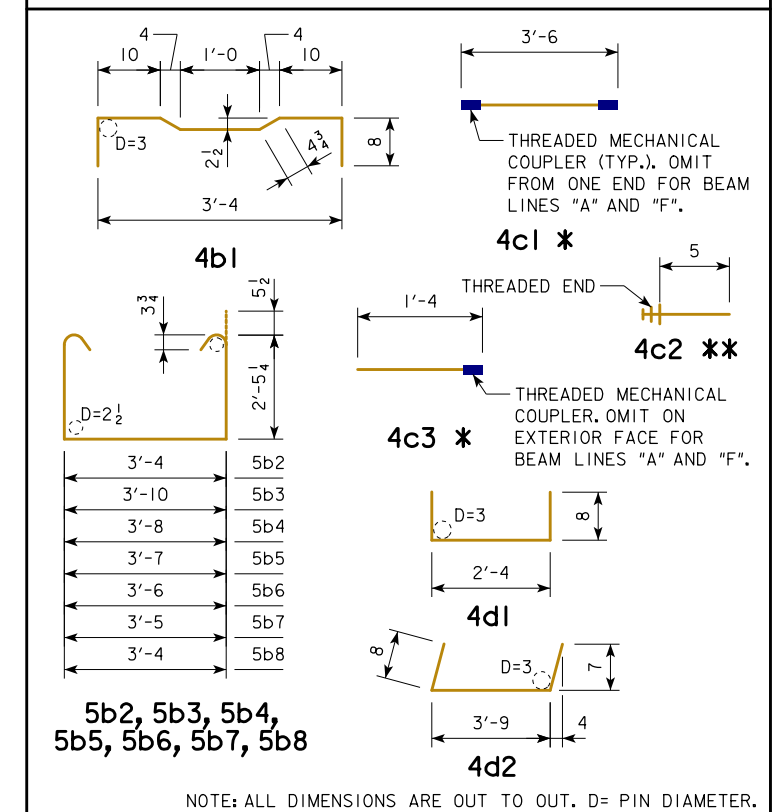
**BENT BAR DETAILS**



**EPOXY COATED REINFORCING BAR LIST**  
**33" x 48" x 50'-0 RCBB, 30° SKEW**

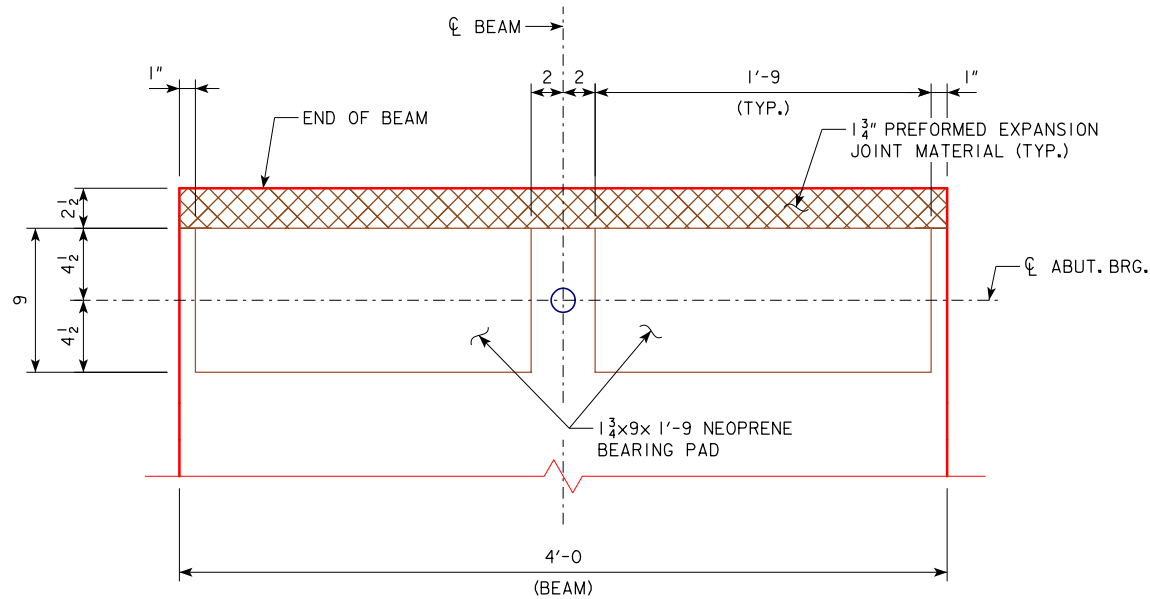
BEAM LINE		BEAM LINES "A" AND "F"			BEAM LINES "B", "C", "D", "E"		
BAR	SHAPE	NO.	LENGTH	WEIGHT	NO.	LENGTH	WEIGHT
4a1	—	6	50'-10	204	6	50'-10	204
4a2	—	1	49'-8	33	1	49'-8	33
10a3	—	8	50'-10	1750	8	50'-10	1750
10a4	—	1	49'-8	214	1	49'-8	214
4b1	⌋	71	4'-9½	227	71	4'-9½	227
5b2	⌋	47	9'-1½	447	47	9'-1½	447
5b3	⌋	2	9'-7½	20	2	9'-7½	20
5b4	⌋	2	9'-5½	20	2	9'-5½	20
5b5	⌋	2	9'-4½	20	2	9'-4½	20
5b6	⌋	2	9'-3½	19	2	9'-3½	19
5b7	⌋	2	9'-2½	19	2	9'-2½	19
5b8	⌋	4	9'-1½	38	4	9'-1½	38
4c1 *	—	72	3'-6	168	72	3'-6	168
4c2 **	—	75	0'-5	21	150	0'-5	42
4c3 *	—	6	1'-4	5	6	1'-4	5
4c4	—	4	3'-8	10	4	3'-8	10
4d1	⌋	8	3'-8	20	8	3'-8	20
4d2	⌋	6	5'-1	20	6	5'-1	20
TOTAL (LBS.)		3255			3276		

**BENT BAR DETAILS**

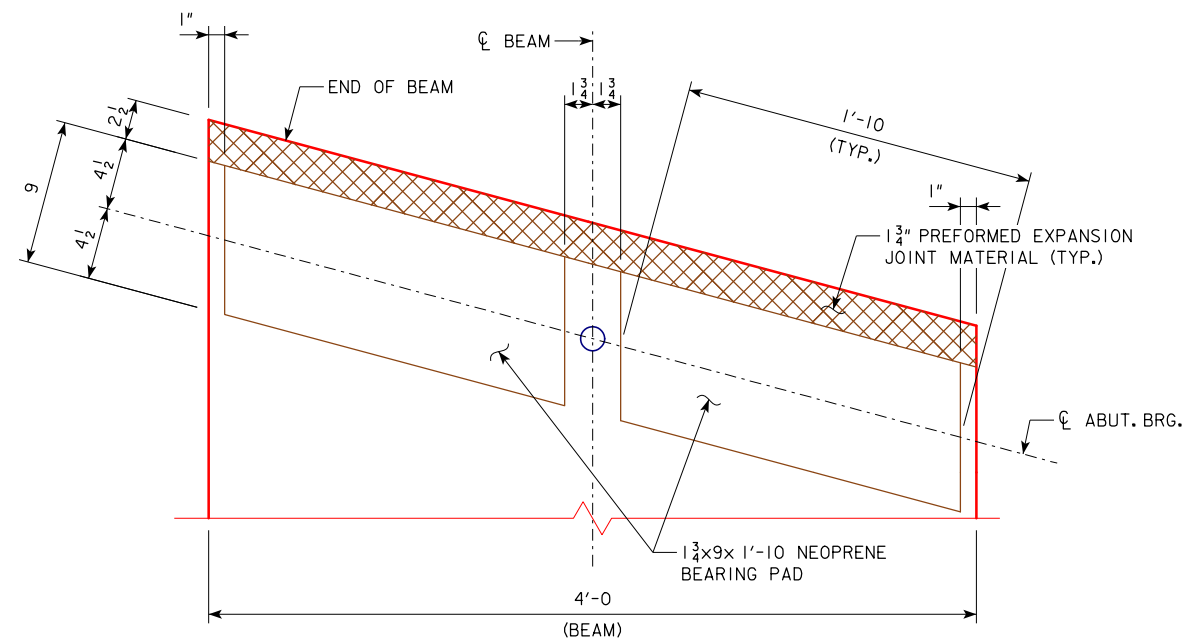


NOTES:  
 \* INCLUDES MECHANICAL COUPLER(S). SEE BENT BAR DETAILS.  
 \*\* SEE BENT BAR DETAILS. THE LENGTHS SHOWN DO NOT INCLUDE AN ALLOWANCE FOR THE THREADED END. BAR LENGTHS MAY NEED TO INCREASE DEPENDING ON THE MECHANICAL COUPLER ASSEMBLY USED. THE COST OF THE THREADED PORTION OF THESE BARS IS TO BE INCLUDED IN THE PRICE BID FOR THE BEAMS. THE WEIGHT OF THE THREADED END IS NOT INCLUDED IN THE QUANTITY SHOWN.

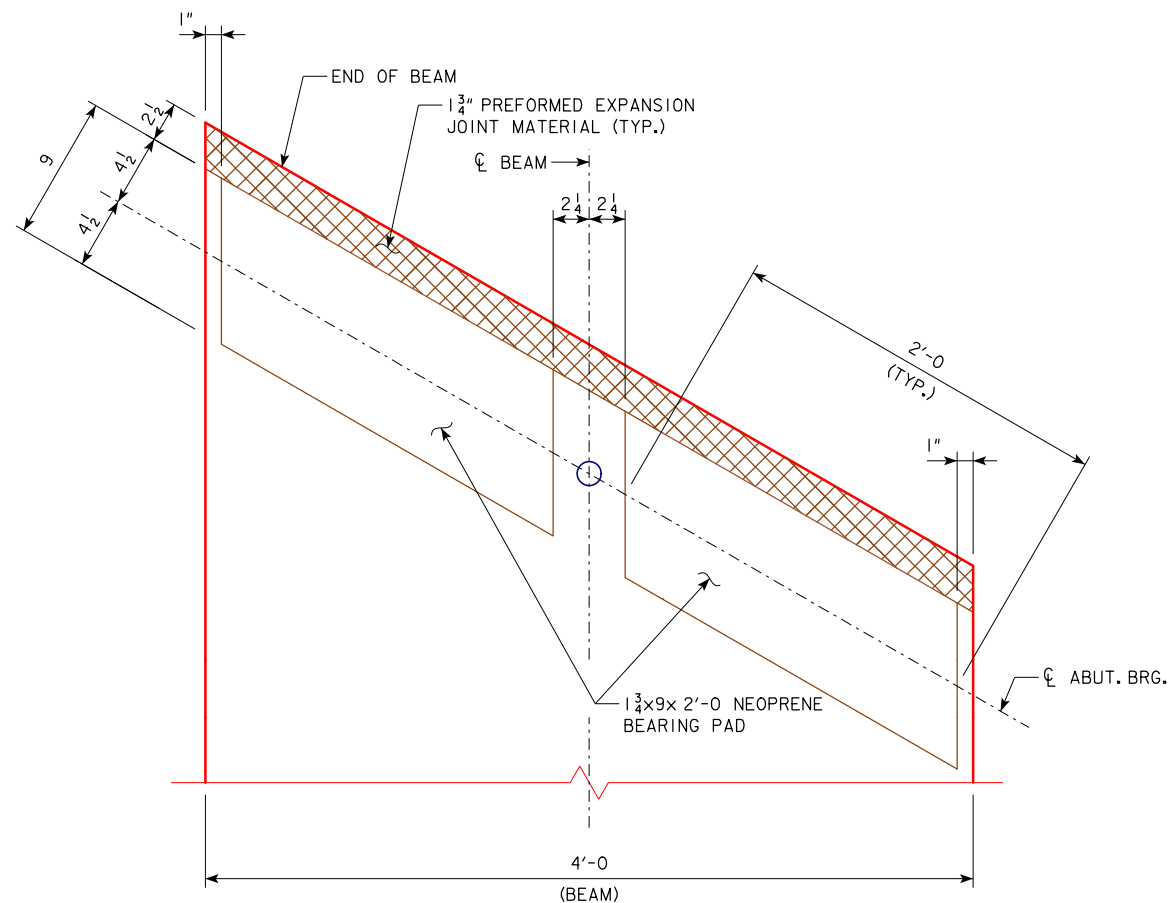
LATEST REVISION DATE	
	STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
	DECEMBER, 2016
APPROVED BY BRIDGE ENGINEER 	33" x 48" x 50'-0 RCBB DETAILS REINFORCING BAR LIST
	<b>B24-62-16</b>



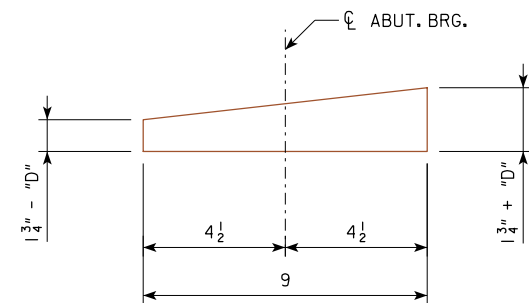
**BEARING PAD PLAN - 0° SKEW**  
(24 BEARING PADS REQUIRED)



**BEARING PAD PLAN - 15° SKEW**  
(24 BEARING PADS REQUIRED)



**BEARING PAD PLAN - 30° SKEW**  
(24 BEARING PADS REQUIRED)



**SECTION THROUGH BEARING PAD**

$$\text{BEAM SLOPE} = 100\% \left[ \frac{\text{P/G ELEV. @ ABUT. NO. 2} - \text{P/G ELEV. @ ABUT. NO. 1}}{\text{SPAN LENGTH}} \right]$$

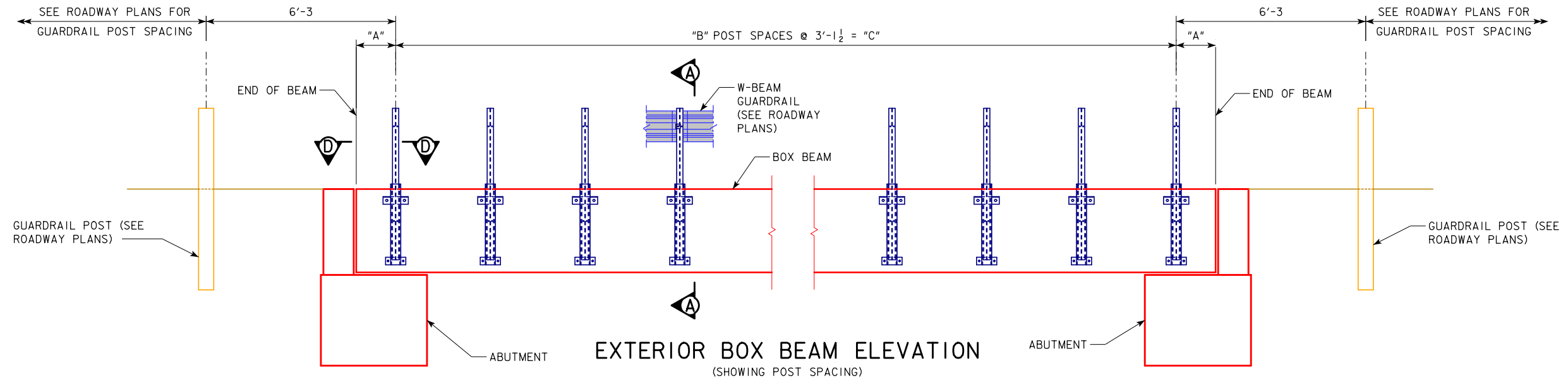
**SLOPE CALCULATION FORMULA**

BEAM SLOPE %	"D" (INCHES)		
	0° SKEW	15° SKEW	30° SKEW
SLOPE ≤ 1.4	0	0	1/16
1.4 < SLOPE ≤ 2.0	1/16	1/16	1/8
2.0 < SLOPE ≤ 3.0	1/8	1/8	1/4
3.0 < SLOPE ≤ 4.0	3/16	3/16	1/2
4.0 < SLOPE ≤ 4.5	1/2	1/2	3/4
4.5 < SLOPE ≤ 5.0	3/4	3/4	1

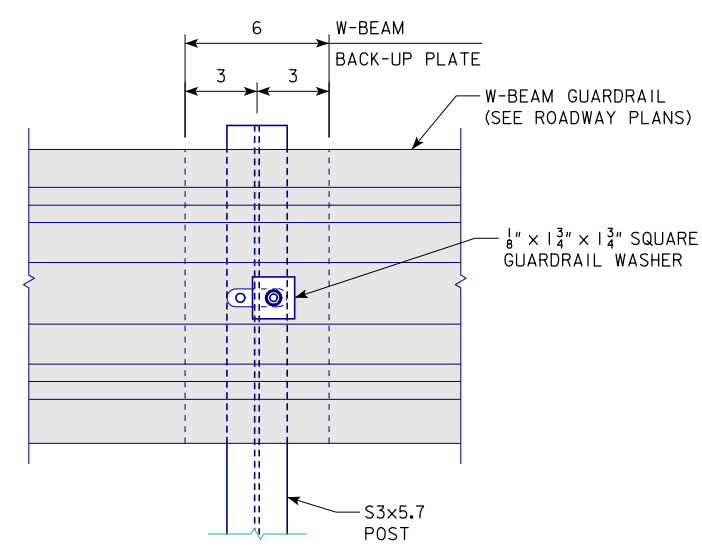
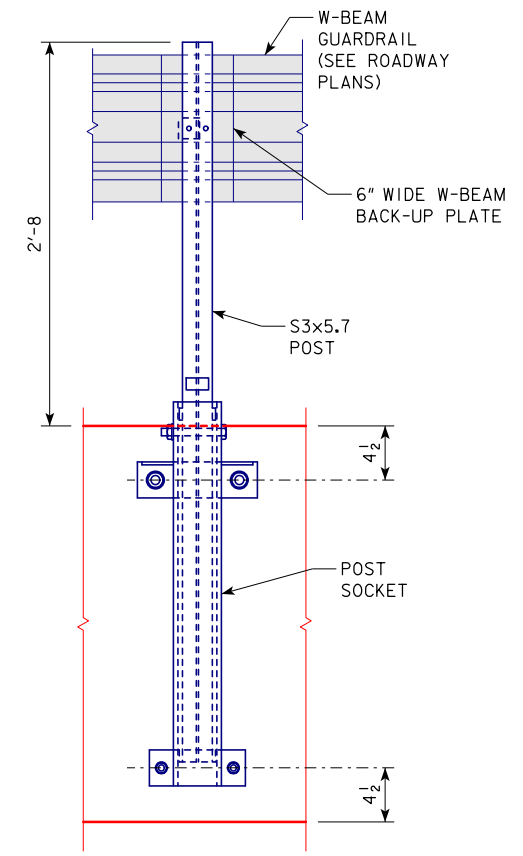
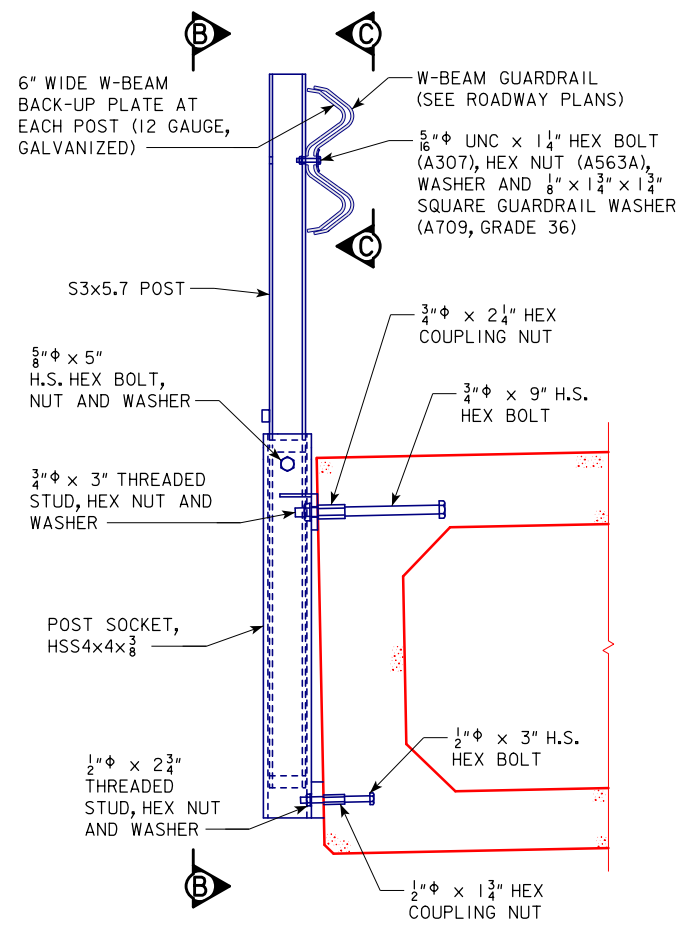
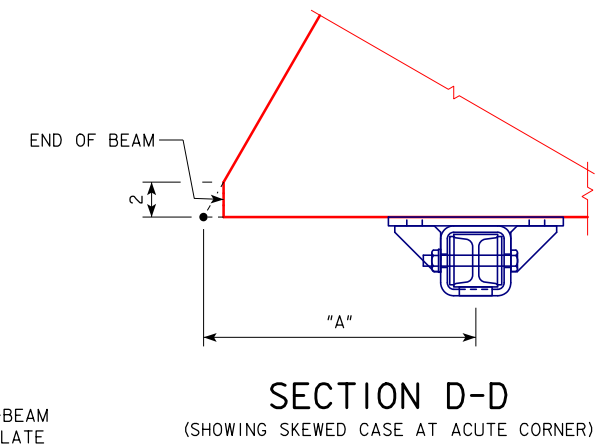
**BEARING NOTES:**

- MATERIAL FOR NEOPRENE PADS TO BE OF 70 DUROMETER NEOPRENE.
- THE NEOPRENE BEARING PADS SHALL BE TAPERED AS SHOWN IN THE "BEARING TAPER TABLE".
- IF NECESSARY, BEARING SEAT SURFACES SHALL BE ADJUSTED BY SHIMMING TO ASSURE FIRM AND EVEN BEARING OF THE BOX BEAMS. TWO 1/8" NEOPRENE ADJUSTING SHIMS WITH THE DIMENSIONS OF THE BEARING PAD SHALL BE PROVIDED FOR ADJUSTING EACH BEARING.
- COST OF NEOPRENE PADS AND SHIMS SHALL BE INCLUDED IN THE PRICE BID FOR THE BEAMS.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
		DECEMBER, 2016
		<b>BEARING DETAILS</b>
		<b>B24-63-16</b>



SPAN	"A" DIMENSION			"B" POST SPACES AT 3'-1 1/2"	"C"	TOTAL NUMBER OF POSTS ON BRIDGE
	0° SKEW	15° SKEW	30° SKEW			
30'-0	1'-6 1/4	1'-6 1/2	1'-7 5/16	9	28'-1 1/2	20
40'-0	1'-10	1'-10 1/4	1'-11 1/16	12	37'-6	26
50'-0	2'-1 3/4	2'-2	2'-2 13/16	15	46'-10 1/2	32
60'-0	2'-5 1/2	2'-5 3/4	2'-6 3/16	18	56'-3	38
70'-0	1'-2 1/2	1'-2 3/4	1'-3 5/16	22	68'-9	46

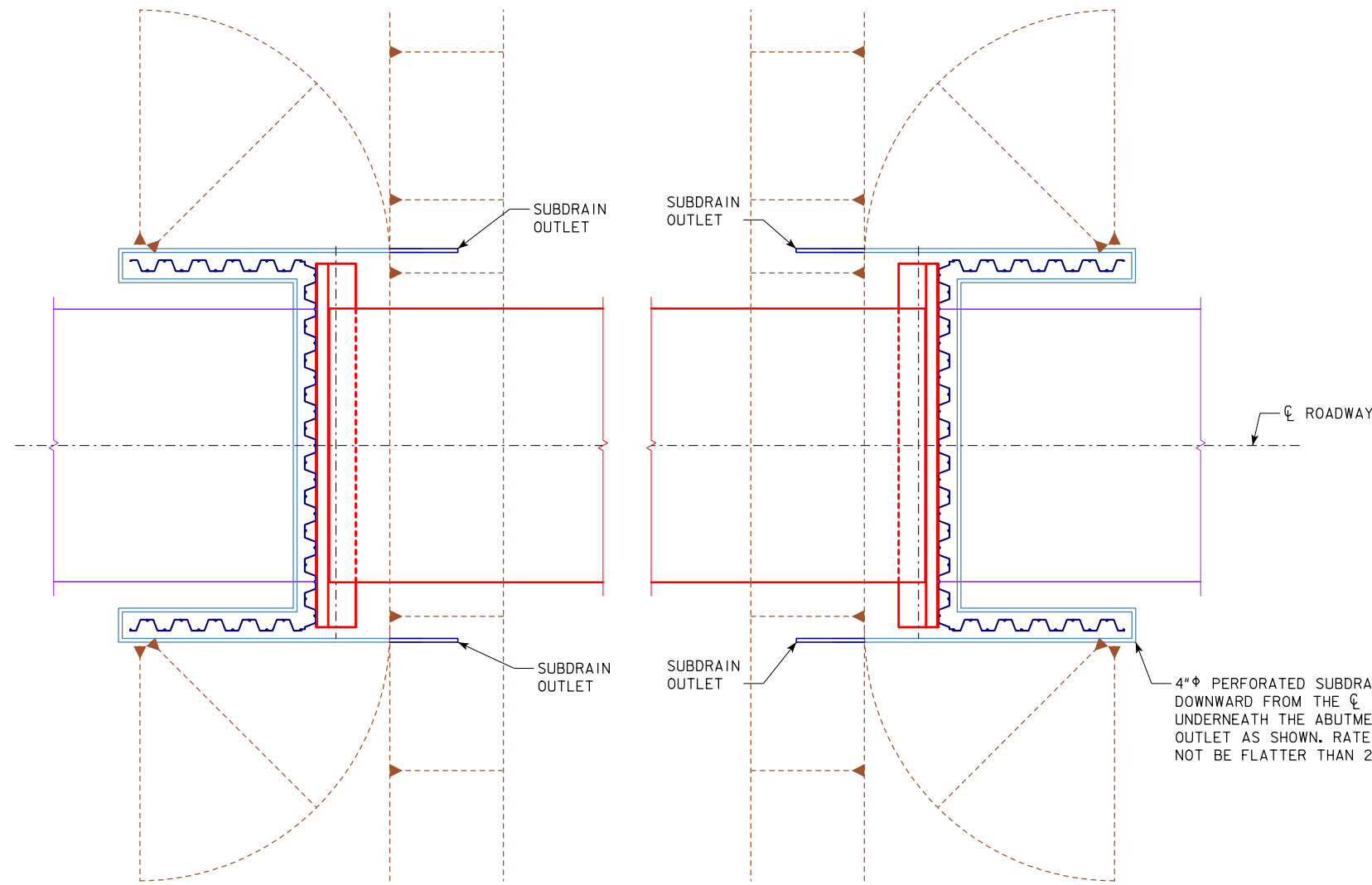


**BRIDGE RAIL POST NOTES:**

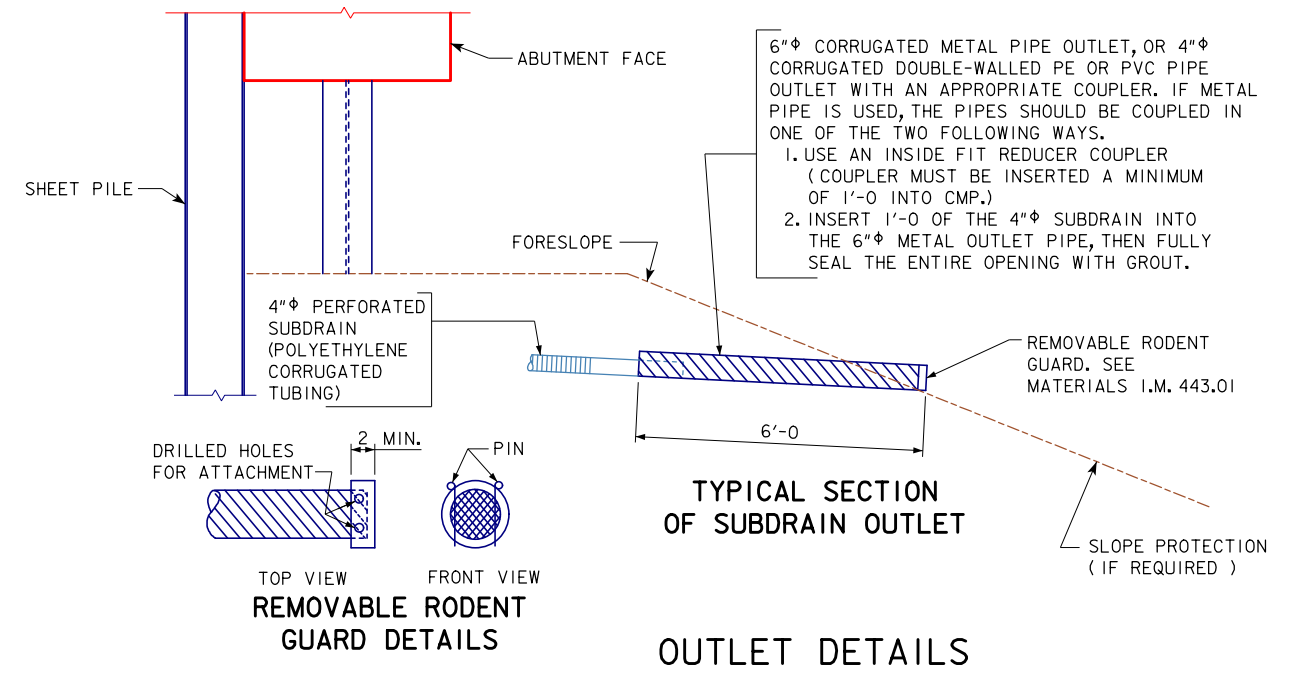
- ALL MATERIAL INCLUDING BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED.
- ALL STRUCTURAL STEEL SHALL CONFORM TO ASTM A709 GRADE 50, UNLESS OTHERWISE NOTED OR SHOWN.
- POST SOCKETS SHALL CONFORM TO ASTM A500 GRADE B.
- ALL BOLTS SHALL BE ASTM A325, UNLESS OTHERWISE NOTED OR SHOWN.
- ALL THREADED STUDS SHALL BE ASTM A449.
- ALL NUTS, INCLUDING COUPLING NUTS SHALL BE ASTM A563, GRADE DH, UNLESS OTHERWISE NOTED OR SHOWN.
- ALL WASHERS SHALL BE ASTM F436.
- SHOP DRAWINGS OF THE STEEL POSTS SHOWING LAYOUT AND DETAILS SHALL BE SUBMITTED FOR REVIEW.
- ALL COSTS FOR FURNISHING AND INSTALLING THE STEEL POSTS, INCLUDING THE COST OF W-BEAM BACK-UP PLATES, SHALL BE INCLUDED IN THE PRICE BID FOR STRUCTURAL STEEL.

LATEST REVISION DATE	<i>Thomas L. Mc Donald</i> APPROVED BY BRIDGE ENGINEER	<b>IOWADOT</b> Highway Division	
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		BRIDGE RAIL POST DETAILS (SHEET 1 OF 2)	B24-64-16





**SITUATION PLAN**  
REFER TO SITUATION PLAN FOR NORTH ARROW

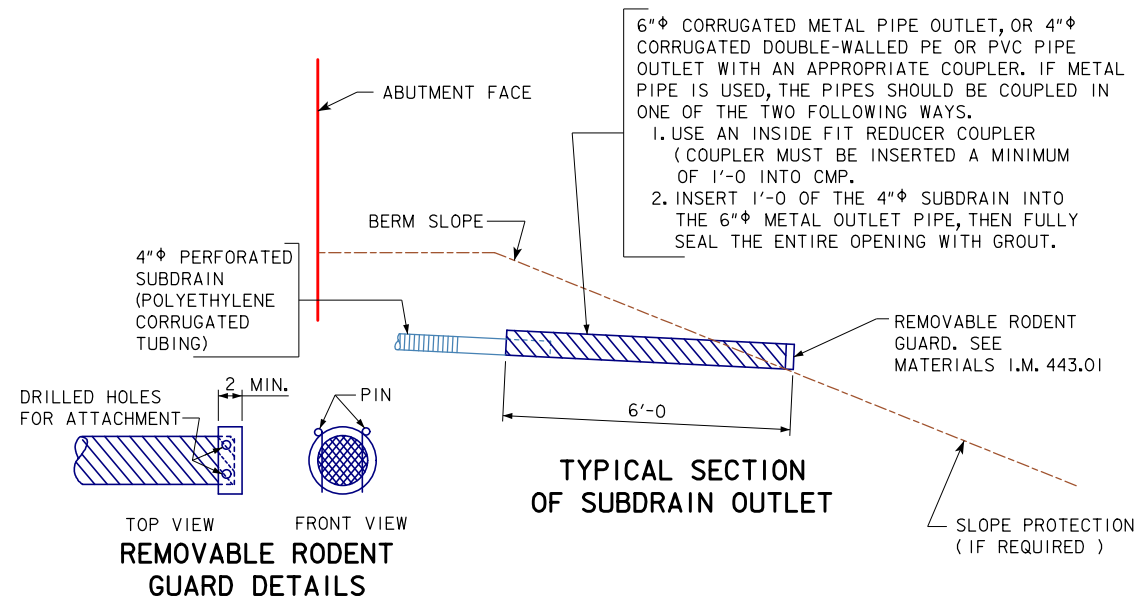


**TYPICAL SECTION OF SUBDRAIN OUTLET**  
**OUTLET DETAILS**

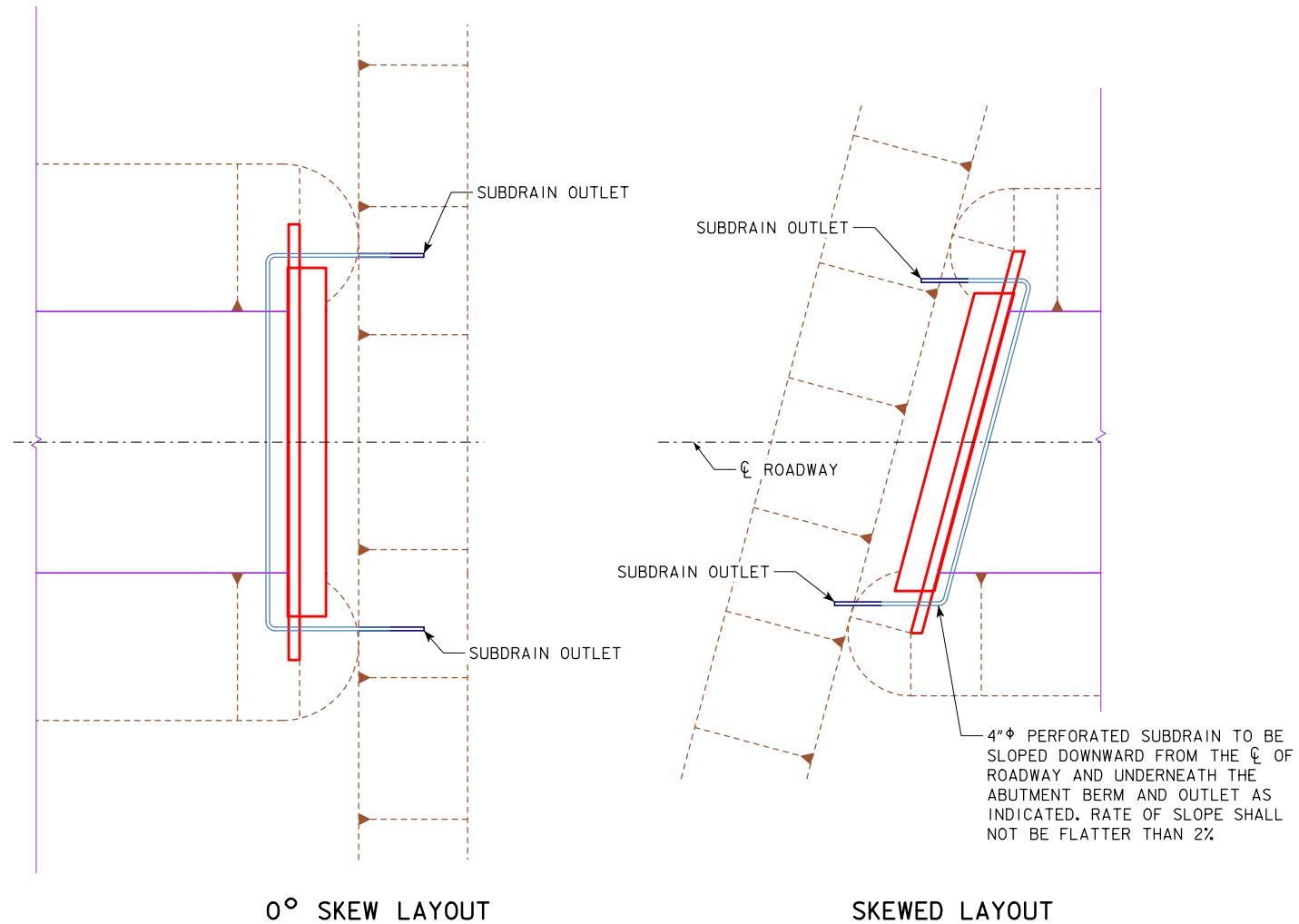
4" PERFORATED SUBDRAIN TO BE SLOPED DOWNWARD FROM THE CL OF ROADWAY AND UNDERNEATH THE ABUTMENT BERM AND OUTLET AS SHOWN. RATE OF SLOPE SHALL NOT BE FLATTER THAN 2%.

NOTES:  
SEE BRIDGE WING ARMORING SHEET AND ABUTMENT BACKFILL DETAILS SHEET FOR DETAILS NOT SHOWN ON THIS SHEET WHICH ARE PERTINENT TO THIS STRUCTURE.  
THE SUBDRAIN OUTLET SHALL CONSIST OF A 6'-0 LENGTH OF PIPE WITH A REMOVABLE RODENT GUARD AS DETAILED ON THIS SHEET.  
FOR WING ARMORING DETAILS, SEE SHEET B24-68-16.

LATEST REVISION DATE  <i>Thomas L. Mc Donald</i> APPROVED BY BRIDGE ENGINEER	
	STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>
	DECEMBER, 2016
<b>SUBDRAIN DETAILS SHEET PILE WINGS</b>	<b>B24-66-16</b>



OUTLET DETAILS

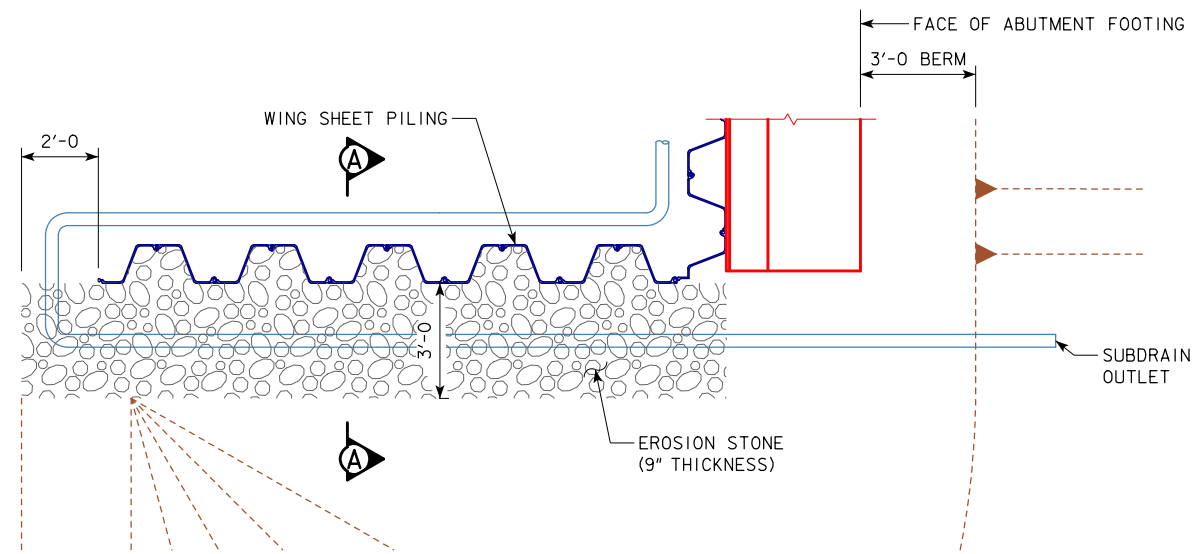


SITUATION PLANS

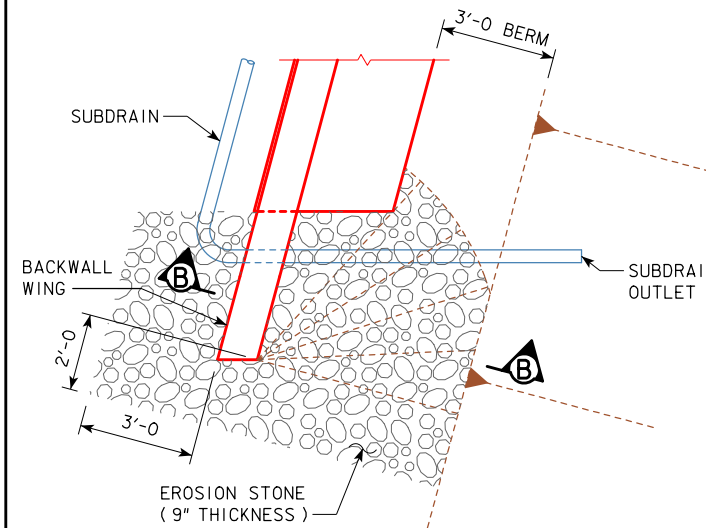
REFER TO SITUATION PLAN FOR NORTH ARROW.

NOTES:  
 SEE BRIDGE WING ARMORING SHEET AND ABUTMENT BACKFILL DETAILS SHEET FOR DETAILS NOT SHOWN ON THIS SHEET WHICH ARE PERTINENT TO THIS STRUCTURE.  
 THE SUBDRAIN OUTLET SHALL CONSIST OF A 6'-0" LENGTH OF PIPE WITH A REMOVABLE RODENT GUARD AS DETAILED ON THIS SHEET.  
 FOR WING ARMORING DETAILS, SEE SHEET B24-68-16.

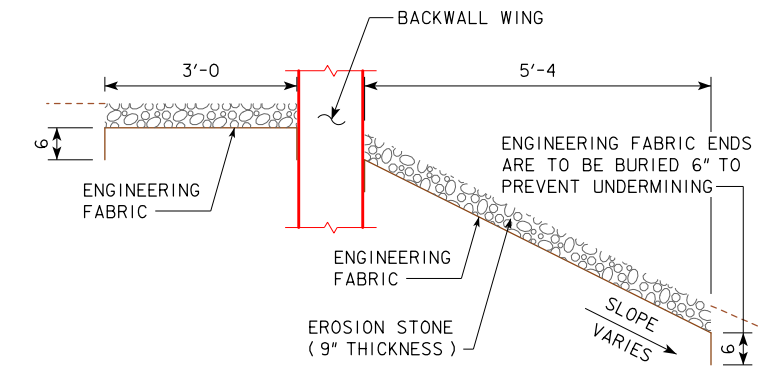
LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		
		STANDARD DESIGN - 24'-0" ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		<b>SUBDRAIN DETAILS          CONCRETE WINGS</b>	<b>B24-67-16</b>



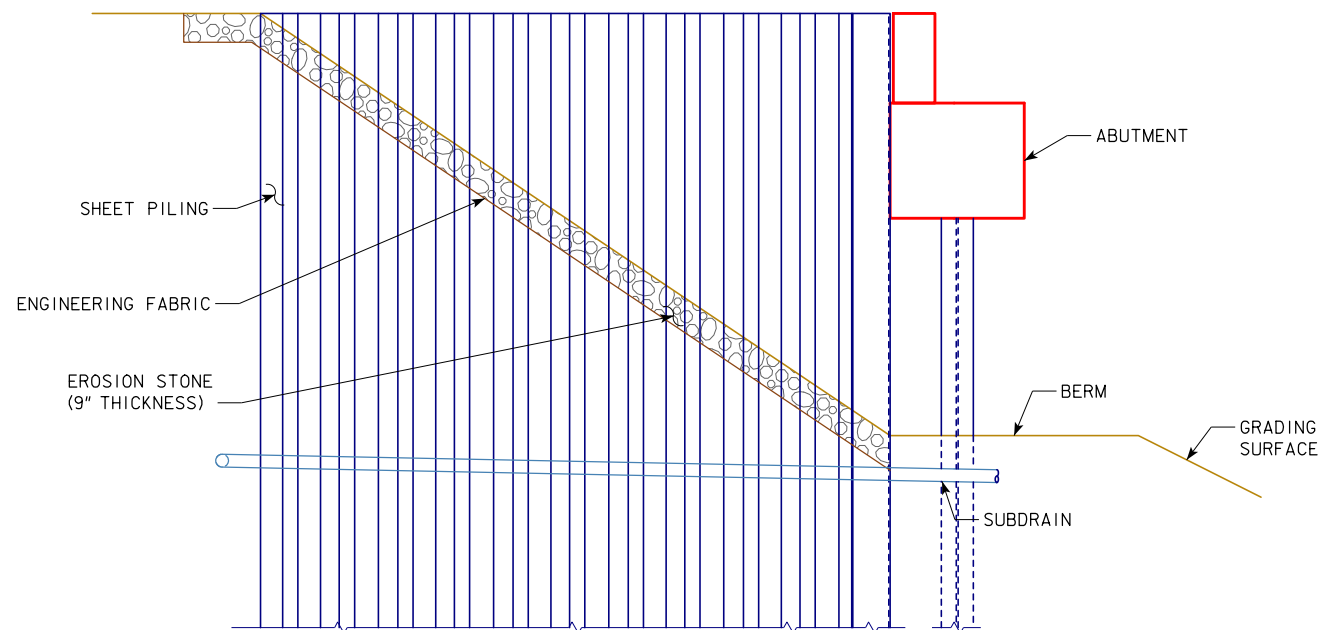
TOP VIEW OF WING ARMORING



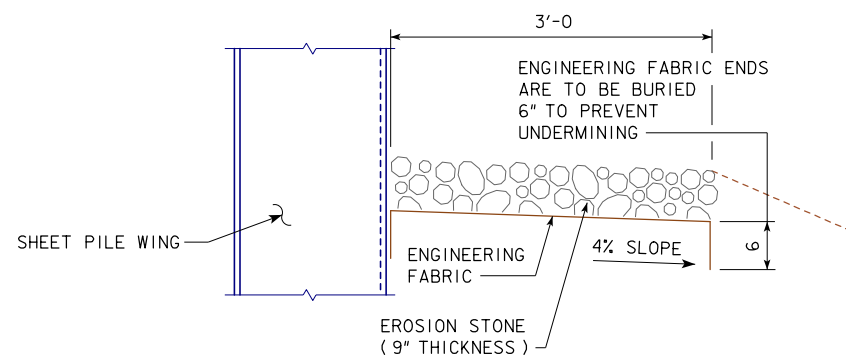
TOP VIEW OF WING ARMORING



SECTION B-B



PROFILE VIEW OF WING ARMORING



SECTION A-A

ABUTMENTS WITH SHEET PILE WINGS

ABUTMENTS WITH CONCRETE WINGS  
(SKEWED LAYOUT SHOWN, 0° SKEW SIMILAR)

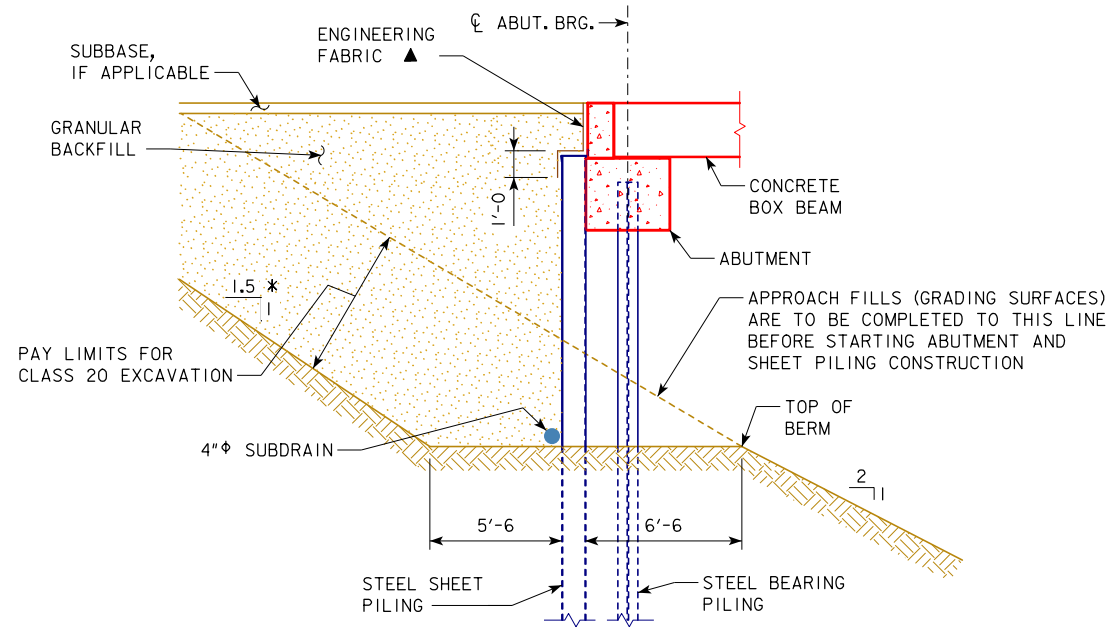
SUBDRAIN NOTES:

SEE B24-66-16 AND B24-67-16 SHEETS FOR DETAILS OF PLACING ALL SUBDRAINS AND SUBDRAIN OUTLETS REQUIRED FOR THIS STRUCTURE.  
THE BRIDGE CONTRACTOR IS TO INSTALL SUBDRAINS BEHIND THE ABUTMENT. THE SUBDRAINS SHALL BE 4" IN DIAMETER AND MEET THE REQUIREMENTS OF SECTION 4143.01,B OF THE CURRENT I.D.O.T. STANDARD SPECIFICATION. THE SUBDRAIN OUTLET SHALL CONSIST OF A 6'-0" LENGTH OF PIPE WITH A REMOVABLE RODENT GUARD.

EROSION STONE WING ARMORING NOTES:

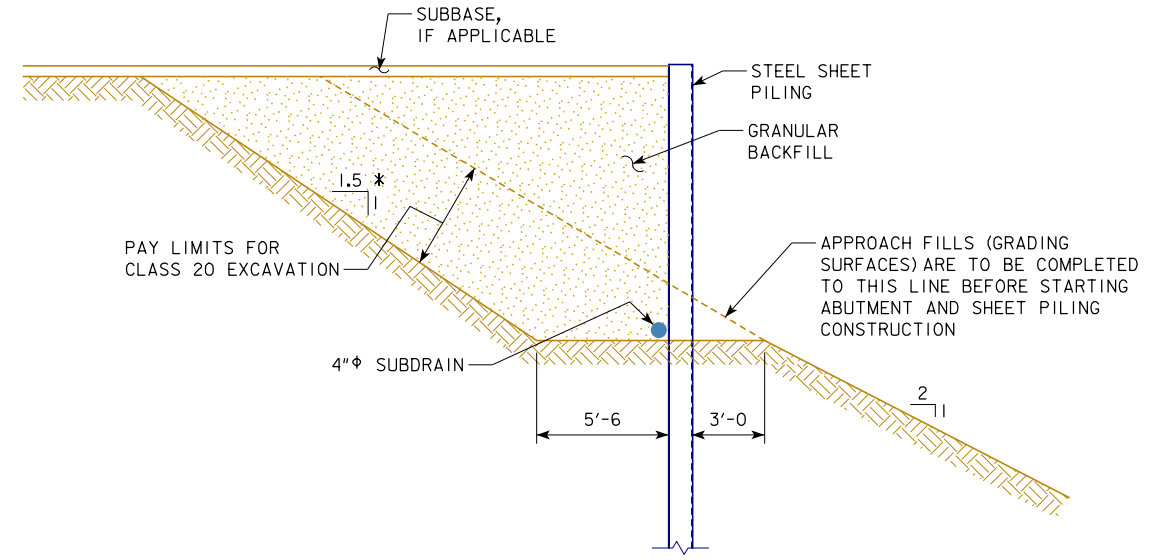
EROSION STONE SHALL BE PLACED ALONG THE SIDES OF THE WINGS AS SHOWN. THIS IS TYPICAL AT EACH CORNER OF THE BRIDGE UNLESS OTHERWISE NOTED IN THE PLANS. THE EROSION STONE AT THESE LOCATIONS SHALL BE UNDERLAYED WITH ENGINEERING FABRIC IN ACCORDANCE WITH ARTICLE 4196.01, B, 3, OF THE STANDARD SPECIFICATIONS.  
THE EROSION STONE SHALL BE IN ACCORDANCE WITH SECTION 4130 OF THE STANDARD SPECIFICATIONS. MATERIAL PASSING THE 3 INCH SCREEN BUT 100% RETAINED ON A 1 INCH SCREEN MAY BE USED AS CHOKE STONE.  
THE EROSION STONE SHALL BE DEPOSITED, SPREAD, CONSOLIDATED AND SHAPED BY MECHANICAL OR HAND METHODS THAT WILL PROVIDE UNIFORM 9" DEPTH AND DENSITY AND PROVIDE UNIFORM SURFACE APPEARANCE.  
PAYMENT FOR THE BRIDGE WING ARMORING WILL BE BID PER SQUARE YARD. COST WILL INCLUDE ENGINEERING FABRIC, EROSION STONE, EXCAVATION, SHAPING, AND COMPACTION TO DIMENSIONS SHOWN IN THESE PLANS. BID ITEM SHALL BE "BRIDGE WING ARMORING - EROSION STONE".

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0" ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		BRIDGE WING ARMORING	B24-68-16



**BACKFILL DETAIL  
(SECTION THRU ABUTMENT)**

NOTES:  
 SUBDRAIN SHALL SLOPE DOWNWARD 2% FROM  $\phi$  APPROACH ROADWAY.  
 \* OR FLATTER AS REQUIRED FOR STABILITY.



**BACKFILL DETAIL  
(SECTION THRU WING)**

NOTES:  
 SUBDRAIN SHALL SLOPE DOWNWARD 2% FROM  $\phi$  APPROACH ROADWAY.  
 \* OR FLATTER AS REQUIRED FOR STABILITY.

**ABUTMENT BACKFILL NOTES:**

THE GRANULAR BACKFILL SHALL CONSIST OF IOWA DOT GRADATION NO. 1 (4110-PCC FINE AGGREGATE).  
 PLACE BACKFILL BEHIND BOTH ABUTMENTS SIMULTANEOUSLY SO THAT THE TWO FILLS ARE KEPT AT APPROXIMATELY THE SAME DEPTH AT ALL TIMES.  
 THE COST OF FURNISHING AND PLACING SUBDRAINS (INCLUDING EXCAVATION), SUBDRAIN OUTLETS, AND ENGINEERING FABRIC SHALL BE INCLUDED IN THE CONTRACT UNIT PRICE BID FOR "GRANULAR BACKFILL". NO EXTRA PAYMENT WILL BE MADE.

NOTES:  
 ▲ ENGINEERING FABRIC IS TO BE PLACED FULL WIDTH OF SHEET PILING AND EXTEND 2'-0" MINIMUM PAST VERTICAL COVER PLATES.  
 THE ENGINEERING FABRIC SHALL BE IN ACCORDANCE WITH ARTICLE 4196.01,B,6 OF THE STANDARD SPECIFICATIONS. IF THE ENGINEERING FABRIC IS LAPPED, THE LAPS SHALL BE A MINIMUM OF ONE FOOT IN LENGTH, SHINGLE FASHION AND STAPLED FOR CONTINUITY.  
 THE INTENDED PURPOSE OF THE ENGINEERING FABRIC IS TO PREVENT THE BACKFILL FROM SPILLING BETWEEN SHEET PILING AND ABUTMENT. THE CONTRACTOR SHALL ENSURE ALL GAPS ARE SEALED TO RETAIN THE BACKFILL TO THE SATISFACTION OF THE ENGINEER.

NOTE:  
 CONSTRUCTION AND INSTALLATION OF BEAMS, BEAM PINS, UHPC JOINTS AND ABUTMENT BACKWALL SHALL BE COMPLETED PRIOR TO BEGINNING INSTALLATION OF BACKFILL.

NOTE:  
 SEE SUBDRAIN DETAILS SHEET FOR DETAILS NOT SHOWN ON THIS SHEET WHICH ARE PERTINENT TO THIS STRUCTURE.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER	 STANDARD DESIGN - 24'-0" ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
		<b>ABUTMENT BACKFILL DETAILS SHEET PILE WINGS</b>	<b>B24-69-16</b>

"W" DIMENSION	
SKEW	DIMENSION
15°	2'-2 $\frac{7}{8}$ "
30°	2'-6"

### ABUTMENT BACKFILL PROCESS:

THE BASE OF THE EXCAVATION SUBGRADE BEHIND THE ABUTMENT IS TO BE GRADED WITH A 4% SLOPE AWAY FROM THE ABUTMENT FOOTING AND A 2% CROSS SLOPE IN THE DIRECTION OF THE SUBDRAIN OUTLET. THIS EXCAVATION SHAPING IS TO BE DONE PRIOR TO BEGINNING INSTALLATION OF THE GEOTEXTILE AND BACKFILL MATERIAL.

AFTER THE SUBGRADE HAS BEEN SHAPED, THE GEOTEXTILE FABRIC SHALL BE INSTALLED IN ACCORDANCE WITH THE DETAILS SHOWN. THE FABRIC IS INTENDED TO BE INSTALLED IN THE BASE OF THE EXCAVATION AND EXTENDED VERTICALLY UP THE ABUTMENT BACKWALL, BACKWALL WING WALLS, AND EXCAVATION FACE TO A HEIGHT THAT WILL BE APPROXIMATELY 1 TO 2 FOOT HIGHER THAN THE HEIGHT OF THE POROUS BACKFILL PLACEMENT AS SHOWN IN THE "BACKFILL DETAILS" ON THIS SHEET. THE STRIPS OF THE FABRIC PLACED SHALL OVERLAP APPROXIMATELY 1 FOOT AND SHALL BE PINNED IN PLACE. THE FABRIC SHALL BE ATTACHED TO THE ABUTMENT BY USING LATH FOLDED IN THE FABRIC AND SECURED TO THE CONCRETE WITH SHALLOW CONCRETE NAILS. THE FABRIC PLACED AGAINST THE EXCAVATION FACE SHALL BE PINNED.

WHEN THE FABRIC IS IN PLACE, THE SUBDRAIN SHALL BE INSTALLED DIRECTLY ON THE FABRIC AT THE TOE OF THE REAR EXCAVATION SLOPE. A SLOT WILL NEED TO BE CUT IN THE FABRIC AT THE POINT WHERE THE SUBDRAIN EXITS THE FABRIC NEAR THE BACKWALL WING WALL.

POROUS BACKFILL IS THEN PLACED AND LEVELED, NO COMPACTION IS REQUIRED.

THE REMAINING WORK INVOLVES BACKFILLING WITH FLOODABLE BACKFILL, SURFACE FLOODING, AND VIBRATORY COMPACTION. THE FLOODABLE BACKFILL MATERIAL SHALL BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. THE FLOODABLE BACKFILL SHALL BE PLACED IN INDIVIDUAL LIFTS, SURFACE FLOODED, AND COMPACTED WITH VIBRATORY COMPACTION TO ENSURE FULL CONSOLIDATION. LIMIT THE LOOSE LIFTS TO NO MORE THAN 2 FEET OF THICKNESS.

START SURFACE FLOODING FOR EACH FLOODABLE BACKFILL LIFT AT THE HIGH POINT OF THE SUBDRAIN AND PROGRESS TO THE LOW POINT WHERE THE SUBDRAIN EXITS THE FABRIC. TO ENSURE UNIFORM SURFACE FLOODING, WATER RUNNING FULL IN A 2-INCH DIAMETER HOSE SHOULD BE SPRAYED IN SUCCESSIVE 6-FOOT TO 8-FOOT INCREMENTS FOR 5 MINUTES WITHIN EACH INCREMENT.

FLOODABLE BACKFILL LIFT PLACEMENT, FLOODING, AND COMPACTION SHALL PROGRESS UNTIL THE REQUIRED FULL THICKNESS OF THE ABUTMENT BACKFILL HAS BEEN COMPLETED.

WATER REQUIRED FOR FLOODING, SUBDRAINS, POROUS BACKFILL, FLOODABLE BACKFILL, AND GEOTEXTILE FABRIC FURNISHED AT THE BRIDGE ABUTMENTS WILL NOT BE MEASURED SEPARATELY FOR PAYMENT.

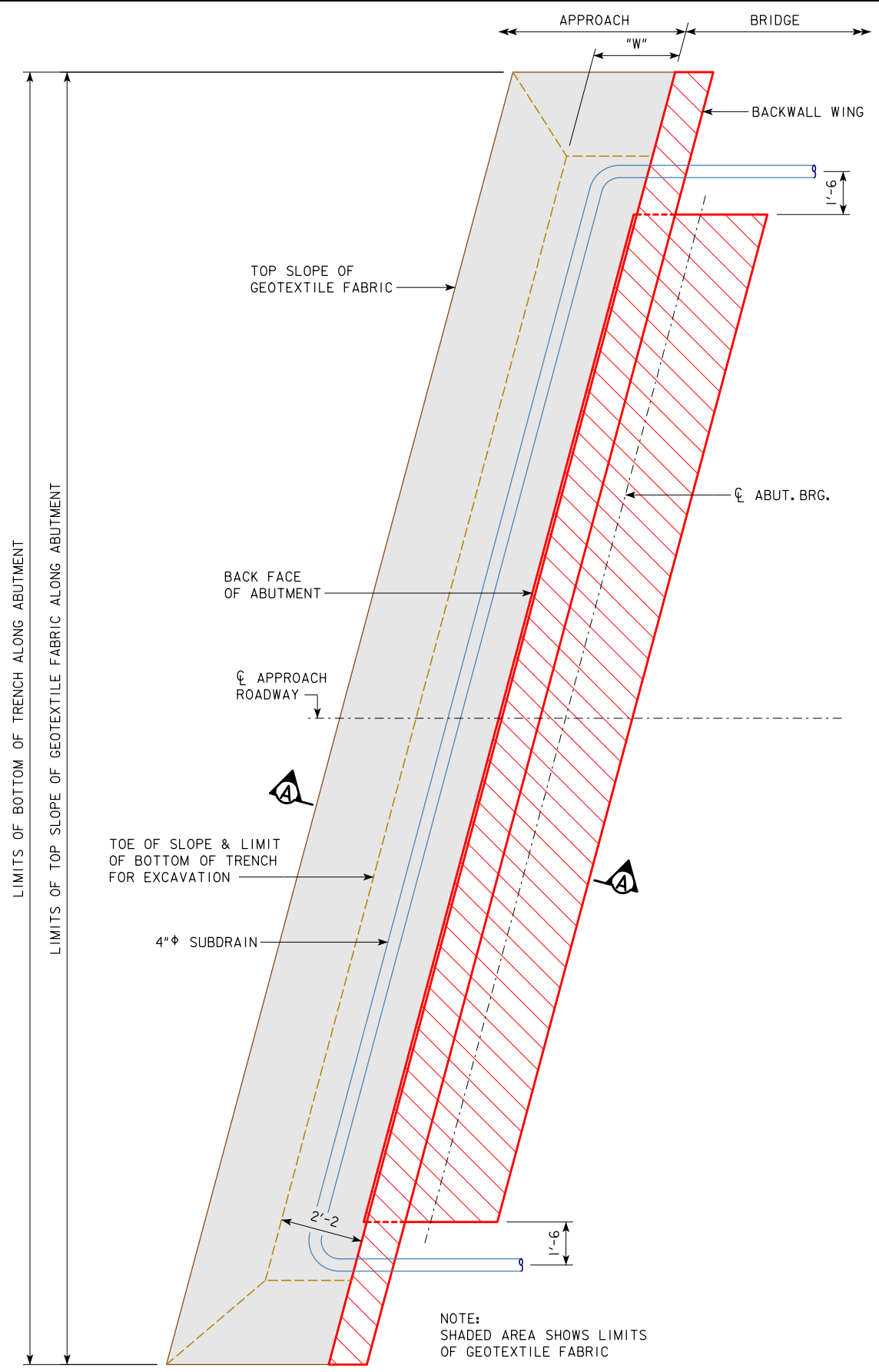
THE COST OF WATER REQUIRED FOR FLOODING, SUBDRAINS, POROUS BACKFILL, FLOODABLE BACKFILL, AND GEOTEXTILE FABRIC FURNISHED AT THE BRIDGE ABUTMENTS SHALL BE INCLUDED IN THE CONTRACT UNIT PRICE BID FOR STRUCTURAL CONCRETE OR PRECAST BRIDGE ABUTMENT.

### NOTE:

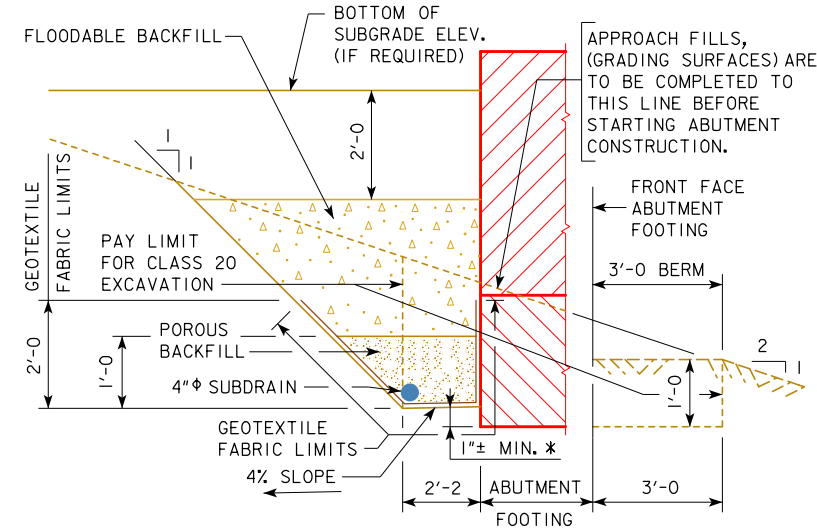
SUBDRAIN SHALL SLOPE DOWNWARD 2% FROM CL APPROACH ROADWAY WHEN OUTLETTING BOTH SIDES OF THE ABUTMENT.

SUBDRAIN SHALL SLOPE DOWNWARD 2% FROM HIGH END WHEN OUTLETTING AT ONE END OF THE ABUTMENT.

THE GEOTEXTILE FABRIC SHALL BE IN ACCORDANCE WITH ARTICLE 4196.01, B, 6 OF THE STANDARD SPECIFICATIONS. IF THE ENGINEERING FABRIC IS LAPPED THE LAPS SHALL BE A MINIMUM OF ONE FOOT IN LENGTH, SHINGLE FASHION WITH UP SLOPE LAP PIECE ON TOP AND STAPLED FOR CONTINUITY.



**SKewed Abutment Plan**  
(SKEWED RIGHT AHEAD SHOWN, SKEWED LEFT AHEAD AND 0° SKEW SIMILAR)



**SECTION A-A**  
**BACKFILL DETAILS**

NOTE: GEOTEXTILE FABRIC WILL BE ATTACHED TO FACE OF ABUTMENT FOOTING AND BACKWALL WINGS.

\* DIMENSION VARIES DUE TO 2% SUBDRAIN SLOPE.

NOTE: SEE SUBDRAIN DETAILS SHEET FOR DETAILS NOT SHOWN ON THIS SHEET WHICH ARE PERTINENT TO THIS STRUCTURE.

LATEST REVISION DATE	 APPROVED BY BRIDGE ENGINEER		
		STANDARD DESIGN - 24'-0 ROADWAY, SINGLE SPAN <b>CONCRETE BOX BEAM BRIDGES</b>	
		DECEMBER, 2016	
<b>ABUTMENT BACKFILL DETAILS</b> <b>CONCRETE WINGS</b>		<b>B24-70-16</b>	