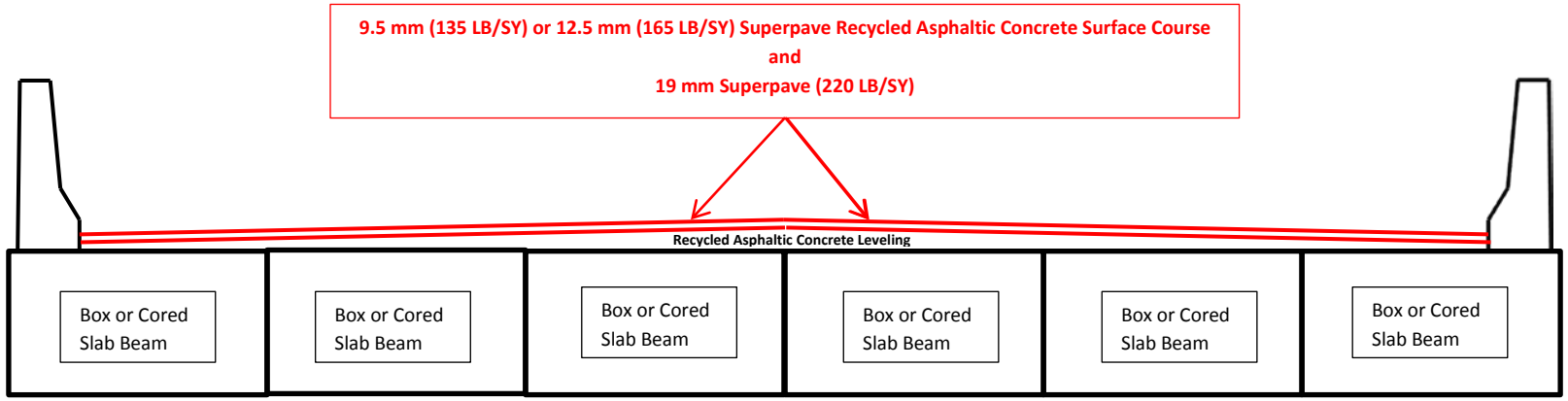
PSC Box Beam and PSC Cored Slab Beam Bridges Common Item and Quantity Errors

These two bridge types are being used frequently on Low Impact Bridge Program (LIBP) projects and some other bridge replacement projects. With both types the bridge deck and approach slabs are leveled and overlaid with recycled asphaltic concrete. For bridge decks with a crown such as a bridge on a tangent section leveling is used to create the crown. These types have been in GDOT Letting since January 2016 but are still relatively new to Roadway Designers designing the projects and Roadway Designers providing QC and QA reviews of project deliverables. Previously the minimum recycled asphaltic concrete thickness at the gutter line (face of barrier) was 1.5-inches and the previous version of this guide was based on that thickness. This minimum thickness at the gutter line has been changed to 3.5-inches. Often errors exist in the plan set and submittal package with these projects submitted for Field Plan Reviews and Programmed Construction Cost Estimate updates. These errors have been undiscovered even with projects advertised for letting. A general schematic is provided below followed by a section with common errors. Additional pages have annotated bridge plan drawings.



Common Errors:

- Both the Recycled Asphaltic Concrete Leveling, 19 mm Superpave (if specified) and Surface Course (9.5 mm or 12.5 mm Superpave) for bridge deck and approach slabs are not accounted for in the Summary of Quantities/Cost Estimate.

- Recycled Asphaltic Concrete quantity for bridge deck and approach slabs is incorrectly based on pavement being all Surface Course material.

- Recycled Asphaltic Concrete Surface Course for bridge deck and approach slabs is accounted for in Summary of Quantities/Cost Estimate but the Leveling is not.

- Approach slab specified is Standard 9017R which is not correct.

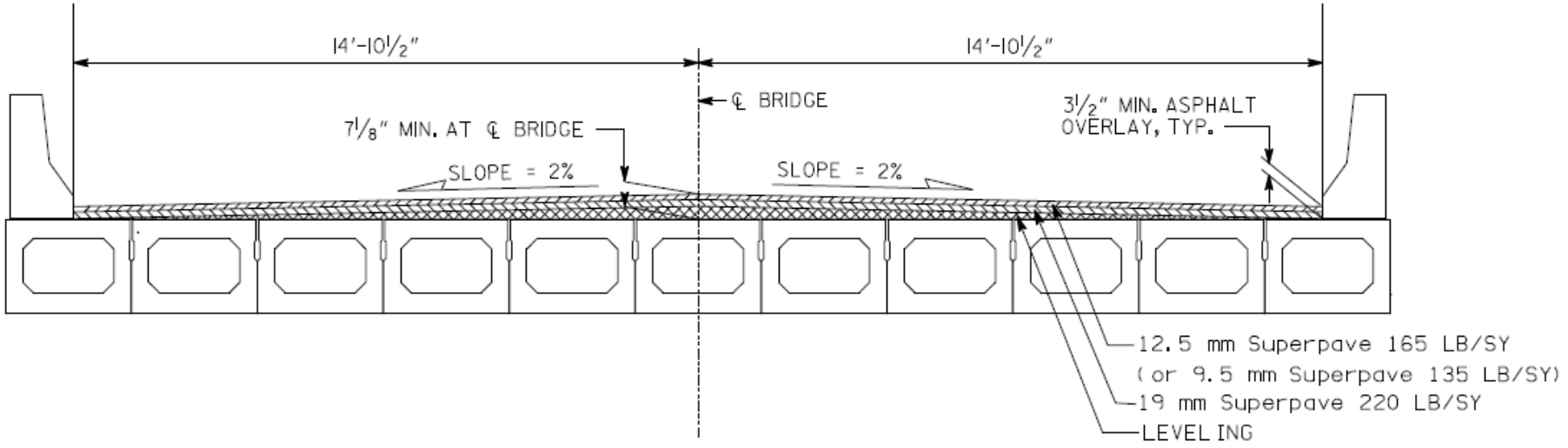
  - The Low Impact Bridge Program Manual online at http://www.dot.ga.gov/PartnerSmart/DesignManuals/BridgeandStructure/LIBP%20Manual.pdf includes the following:

    Approach Slab Standard 9017P has been the typical standard used on LIBP projects. However, SPECIAL DETAIL sheets 9017P-SD and 9017Q-SD (for the 30 ft and 20 ft approach lengths, respectively) have been created to provide a Modified Detail "A" to address the use of asphalt overlay on the approach slabs for LIBP projects. Please contact Carol Kalafut at ckalafut@dot.ga.gov for access to this standard until the original standards have been updated and approved by FHWA. (Approach slabs 9017M, can still be used for walls tied to a bridge and 9017K if curb and gutter are present.)

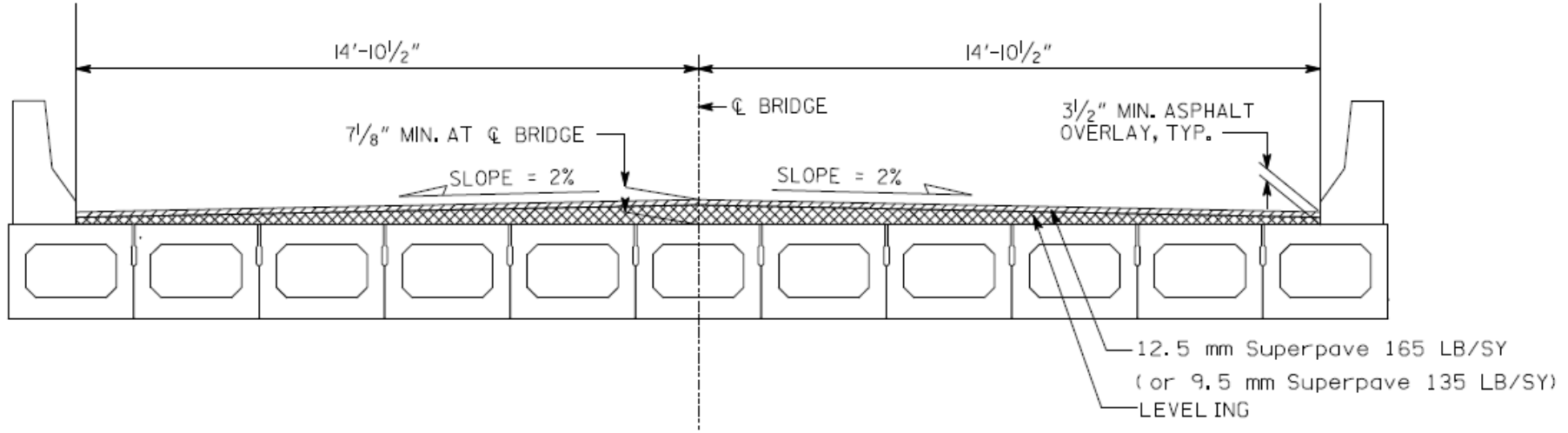
- Pavement Markings in the Summary of Quantities/Cost Estimate for the approach slabs and bridge deck are Preformed Plastic. They should not be Preformed Plastic since the surface is not concrete. They should be the same material (Thermoplastic or Paint) that is being used on the roadway.

Two Approaches for Leveling and Overlay on the Bridge Deck and Approach Slabs to Develop a Normal Crown Section

Preferred method is to specify a 2-inch layer (220 LB/SY) of 19 mm Superpave below the Surface Course. This should allow for ease of construction with the roadway paving as LIBP projects typically use an off-site detour with the road closed during construction.

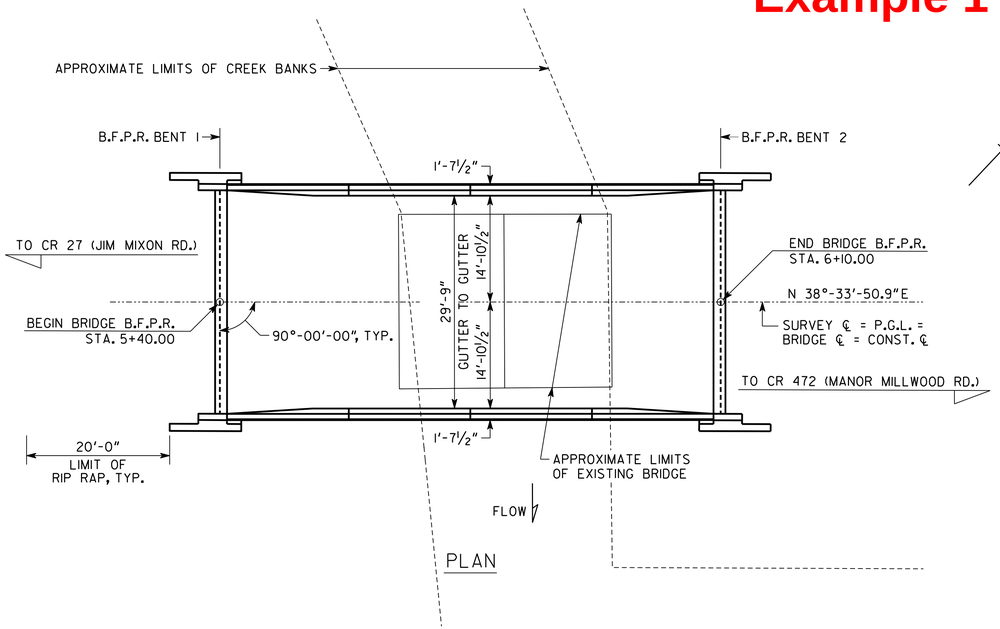


Alternate method does not include a 19 mm Superpave layer.



Example 1 - PSC Box Beam Bridge

P.I. NO. 0015738



PLAN

N.

Bridge is on a tangent alignment

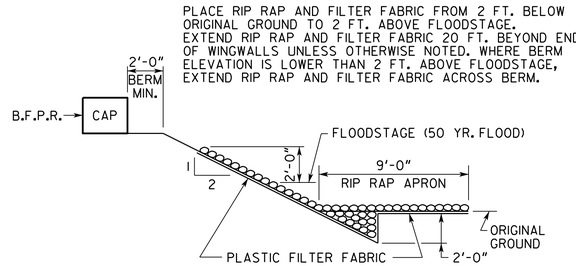
300 FT. V.C.

+0.9624% -1.3326%

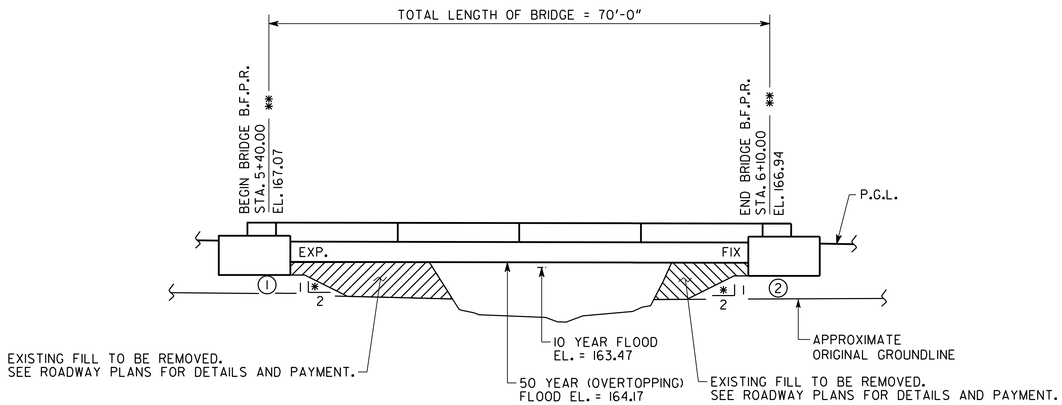
PVI STA. = 5+75.32
PVI EL. = 167.91

VERTICAL CURVE DATA

PLACE RIP RAP AND FILTER FABRIC FROM 2 FT. BELOW ORIGINAL GROUND TO 2 FT. ABOVE FLOODSTAGE. EXTEND RIP RAP AND FILTER FABRIC 20 FT. BEYOND END OF WINGWALLS UNLESS OTHERWISE NOTED. WHERE BERM ELEVATION IS LOWER THAN 2 FT. ABOVE FLOODSTAGE, EXTEND RIP RAP AND FILTER FABRIC ACROSS BERM.



RIP RAP DETAIL
(NO SCALE)



ELEVATION

NOTES:

1. ALL BENTS ARE PARALLEL.
2. END BENT PILES NOT SHOWN.
* 3. SLOPE NORMAL TO END BENT.
** 4. STATIONS AND ELEVATIONS ARE ALONG PROFILE GRADE LINE AT THE INTERSECTION OF PROFILE GRADE LINE AND B.F.P.R.

EXISTING BRIDGE SERIAL NO. 299-5018-0

EXISTING BRIDGE I.D. NO. 299-00032X-001.58N

PROJECT P.I. NO. 0015738

BRIDGE NO. 1

GEORGIA
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION-OFFICE OF BRIDGES AND STRUCTURES

PLAN AND ELEVATION

LIBP - CR 32 (CAMP BRANCH ROAD) OVER GREASY BRANCH

WARE COUNTY 0015738

SCALE: 1" = 10'-0" (UNLESS OTHERWISE NOTED) JULY 2018

DESIGNED KRS CHECKED KNT REVIEWED DLC/SKG
DRAWN KRS DESIGN GROUP EJC APPROVED WMD

DRAWING NO. 35-0001

BRIDGE SHEET 1 OF 10

REVISIONS BY DATE

1 INCH WHEN PRINTED FULL SIZE

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PSC Box Beam Bridge Span

Example 1 PSC Box Beam Bridge

GDOT | P.I. NO. 0015738

BRIDGE CONSISTS OF

1 - 70'-0" PSC 27" BOX BEAM SPAN ---------- SPECIAL DESIGN

2 - PSC PILE END BENTS ---------- SPECIAL DESIGN

4 - END POST AND GUARDRAIL ATTACHMENT DETAIL ------- GA. STD. 3054 (9-30-02)
(L = 4'-0"; W = 1'-1"; H = 2'-11 1/2")

SQUARE PRESTRESSED CONCRETE PILES ---------- GA. STD. 3215 (2-22-84)

BAR BENDING DETAILS ---------- GA. STD. 3901 (8-69)

TYPICAL FILL DETAIL AT END OF BRIDGE ---------- GA. STD. 9037 (9-99)

DRAINAGE DATA

DRAINAGE AREA ---------- 17.2 SQ MILES

FLOOD FREQUENCY	TOTAL DISCHARGE	MEAN VELOCITY	AREA OF OPENING UNDER FLOODSTAGE	BACKWATER
10 YEAR	1,010 CFS	4.50 FPS	225 SQ FT	0.67 FT
50 YEAR OVERTOPPING	1,687 CFS	6.07 FPS	278 SQ FT	1.55 FT

TRAFFIC DATA

ADT = 250 (2040)

DESIGN SPEED ---------- 55 MPH

UTILITIES

NO UTILITIES ON BRIDGE

GENERAL NOTES

SPECIFICATIONS - GEORGIA STANDARD SPECIFICATIONS, 2013 EDITION, AND 2016 SUPPLEMENTAL SPECIFICATIONS AS MODIFIED BY CONTRACT DOCUMENTS.

REINFORCING STEEL - PLACE AND TIE ALL REINFORCING STEEL IN ACCORDANCE WITH THE GEORGIA DOT SPECIFICATIONS. DO NOT WELD REINFORCING STEEL. MAINTAIN 2" MINIMUM CLEARANCE ON ALL REINFORCEMENT UNLESS OTHERWISE NOTED.

CHAMFER - CHAMFER ALL EXPOSED CONCRETE EDGES 3/4" UNLESS OTHERWISE NOTED.

TRAFFIC CONTROLS - ROAD TO BE CLOSED DURING BRIDGE CONSTRUCTION. SEE ROADWAY PLANS FOR DETOUR, TRAFFIC CONTROLS AND TRAFFIC CONTROL PAYMENT.

EXISTING BRIDGE PLANS - ORIGINAL BRIDGE PLANS ARE NOT AVAILABLE.

WAITING PERIOD - NONE REQUIRED.

PLAN DRIVING OBJECTIVE - SEE SUBSTRUCTURE DETAILS.

DRIVING RESISTANCE - DETERMINE DRIVING RESISTANCE FOR PILES USING DYNAMIC PILE TESTING IN ACCORDANCE WITH SPECIAL PROVISION 520. DYNAMIC PILE TESTING SHALL BE REQUIRED FOR EACH TEST PILE.

DYNAMIC PILE TESTING - PERFORM PILE TESTING USING THE PILE DRIVING ANALYZER (PDA) IN ACCORDANCE WITH SPECIAL PROVISION SECTION 523. NOTIFY THE GEOTECHNICAL BUREAU OF THE GEORGIA DOT OFFICE OF MATERIALS AND TESTING AT 404-608-4720 TWO WEEKS PRIOR TO DRIVING PILES.

WAVE EQUATION - PERFORM WAVE EQUATION ANALYSIS (WEAP) IN ACCORDANCE WITH SPECIAL PROVISION 520. PROVIDE RESULTS OF THE WEAP TO THE GEOTECHNICAL BUREAU OF THE GEORGIA DOT OFFICE OF MATERIALS AND TESTING FOR REVIEW AND APPROVAL TWO WEEKS PRIOR TO DRIVING PILES.

PILOT HOLES - DRILL A 24" DIAMETER PILOT HOLE TO A MINIMUM ELEVATION OF 150.00 AT BENT 1 FOR EACH PILE.

GENERAL NOTES - CONTINUED

TEST PILES - DRIVE TEST PILES AT THE FOLLOWING LOCATIONS:

ONE 18 IN SQ PSC X 21 FT AT BENT 1 RT
ONE 18 IN SQ PSC X 21 FT AT BENT 2 LT

SMOOTH DOWEL BARS - PLACE SMOOTH DOWEL BARS IN FORMED 3" DIAMETER X 12" DEEP HOLES AND GROUT IN PLACE SIMILAR TO ANCHOR BOLTS, SEE SUB-SECTION 501.3.05.B.3 OF THE GEORGIA DOT SPECIFICATIONS. STIRRUPS MAY BE SHIFTED SLIGHTLY TO CLEAR FORMED HOLES.

WELDING - ALL WELDING ON GEORGIA DOT PROJECTS SHALL BE PERFORMED BY CERTIFIED WELDERS THAT HAVE IN THEIR POSSESSION A CURRENT WELDING CERTIFICATION CARD ISSUED BY THE OFFICE OF MATERIALS AND TESTING. USE ONLY E70XX (EXCLUDING E7014 AND E7024) LOW HYDROGEN ELECTRODES FOR MANUAL SHIELDED METAL ARC WELDING.

BRIDGE REMOVAL - REMOVE EXISTING BRIDGE AS PER SUB-SECTION 540.3.05 OF THE GEORGIA DOT SPECIFICATIONS.

SALVAGE MATERIAL - NO MATERIAL REMOVED FROM THE EXISTING STRUCTURE SHALL BE SALVAGED FOR USE BY THE GEORGIA DOT.

INCIDENTAL ITEMS - INCLUDE THE COST INCIDENTAL TO THE WORK THAT IS NOT SPECIFICALLY COVERED BY THE GEORGIA STANDARD SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS AND/OR SPECIAL PROVISIONS IN THE OVERALL BID SUBMITTED. THIS INCLUDES THE COST OF WATERPROOFING, JOINT FILLERS AND OTHER INCIDENTAL ITEMS NECESSARY TO COMPLETE THE WORK.

JOINTS IN OVERLAY - WITHIN 24 HOURS AFTER THE OVERLAY IS PLACED MAKE A 1/2 INCH WIDE BY 3/4 INCH DEEP SAW CUT OVER EACH EXPANSION JOINT LOCATION AND SEAL WITH RUBBERIZED ASPHALT IN ACCORDANCE WITH SECTION 407 OF THE GEORGIA DOT SPECIFICATIONS. INCLUDE COST OF RUBBERIZED ASPHALT IN THE OVERALL BID SUBMITTED.

WATERPROOFING MEMBRANE - INSTALL AN APPROVED BRIDGE DECK WATERPROOFING MEMBRANE IN ACCORDANCE WITH SECTION 533 OF THE GEORGIA DOT SPECIFICATIONS AND THE MANUFACTURER'S RECOMMENDATIONS. TURN MEMBRANE 4 INCHES UP AT FACE OF EACH BARRIER AND EXTEND MEMBRANE 18 INCHES PAST BEGIN AND END OF BRIDGE. SEE QPL-22 FOR APPROVED WATERPROOFING MATERIALS.

GROUT - FILL ALL SHEAR KEYS WITH 5,000 PSI 3 DAY STRENGTH GROUT AS PER SECTION 506 OF THE GEORGIA DOT SPECIFICATIONS. CURE GROUT A MINIMUM OF 5 DAYS BEFORE CASTING CONCRETE BARRIERS. IN LIEU OF MIXING MORTAR ON SITE, PRE-MIXED BAG MORTAR MEETING THE REQUIREMENTS IN SECTION 506 MAY BE USED. PREPACKAGED MATERIAL MUST MEET THE REQUIREMENTS OF ASTM C1107/C1107M-14A AND INCLUDE ALUMINUM POWDER. INCLUDE COST OF GROUT IN THE PRICE BID FOR "PSC BOX BEAMS".

DESIGN DATA

SPECIFICATIONS ---------- AASHTO LRFD 7TH EDITION, 2014
(DESIGNED FOR SEISMIC PERFORMANCE ZONE 1, SDI = 0.140)

DESIGN VEHICLE LIVE LOAD ---------- HL-93

FUTURE PAVING ALLOWANCE ---------- 30 LBS PER SQ FT

CONCRETE: BARRIER ---------- CLASS D, f'_c = 4,000 PSI
PSC BEAMS ---------- CLASS AAA, f'_c = 6,000 PSI
PSC BEAM ALLOWABLE TENSION ---------- 465 PSI
SUBSTRUCTURE ---------- CLASS A, f'_c = 3,000 PSI

REINFORCEMENT STEEL: ---------- GRADE 60, f_y = 60,000 PSI

PRETENSIONING STRANDS: ---------- f'_s = 270,000 PSI

SUMMARY OF QUANTITIES

PAY ITEM NUMBER	QUANTITY	UNIT	PAY ITEM
500-2100	136	LF	CONCRETE BARRIER
500-3101	31	CY	CLASS A CONCRETE
507-0027	750	LF	PSC BOX BEAMS, 27 IN, BR NO - 1
511-1000	5592	LB	BAR REINF STEEL
511-3000	LUMP	LS	SUPERSTR REINF STEEL, BR NO - 1 (1616)
520-2218	125	LF	PILING, PSC, 18 IN SQ
520-3218	2	EA	TEST PILE, PSC, 18 IN SQ
520-4218	1	EA	LOAD TEST, PSC, 18 IN SQ (IF REQD)
520-5000	61	LF	PILOT HOLES
523-1100	2	EA	DYNAMIC PILE TEST
533-0010	244	SY	BRIDGE DECK WATERPROOFING MEMBRANE, METHOD A
540-1101	LUMP	LS	REMOVAL OF EXISTING BR, STA NO - 5+80
603-2024	576	SY	STN DUMPED RIP RAP, TP 1, 24 IN
603-7000	576	SY	PLASTIC FILTER FABRIC

Bridge Quantities Do Not Include the Recycled Asphaltic Concrete or Tack Coat for the Leveling and Overlay of the Bridge Deck

BRIDGE NO. 1

GEORGIA
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION-OFFICE OF BRIDGES AND STRUCTURES

GENERAL NOTES
LIBP - CR 32 (CAMP BRANCH ROAD)
OVER GREASY BRANCH
WARE COUNTY 0015738

DRAWING NO. 35-0002
BRIDGE SHEET 2 OF 10
NO SCALE JULY 2018
DESIGNED KRS | CHECKED KNT | REVIEWED DLC/SKG
DRAWN KRS | DESIGN GROUP EJC | APPROVED WMD

DATE | REVISIONS | BY

1 INCH WHEN PRINTED FULL SIZE

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AW 3986

7/3/2018

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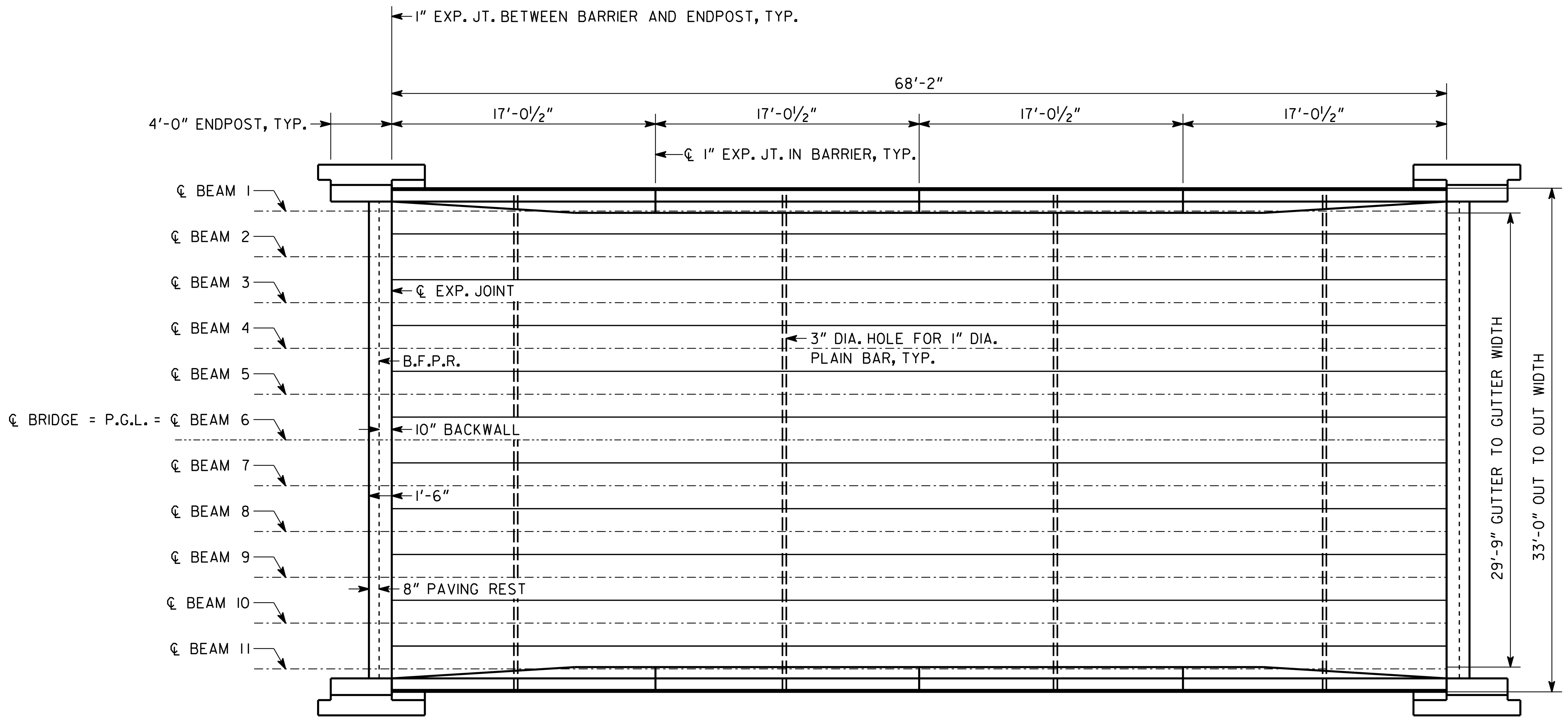
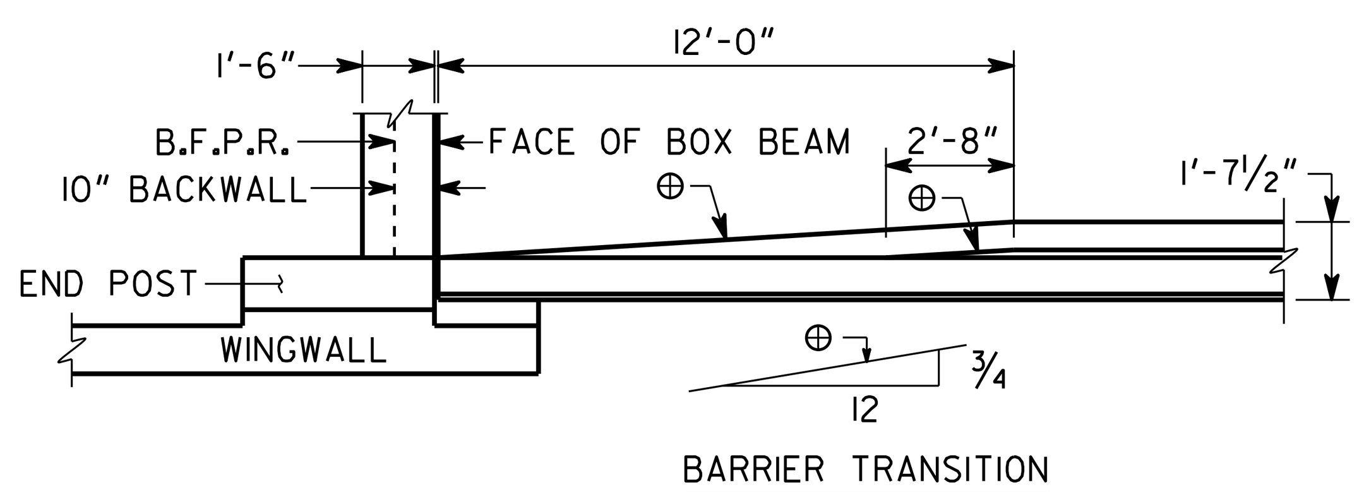
Example 1 PSC Box Beam Bridge

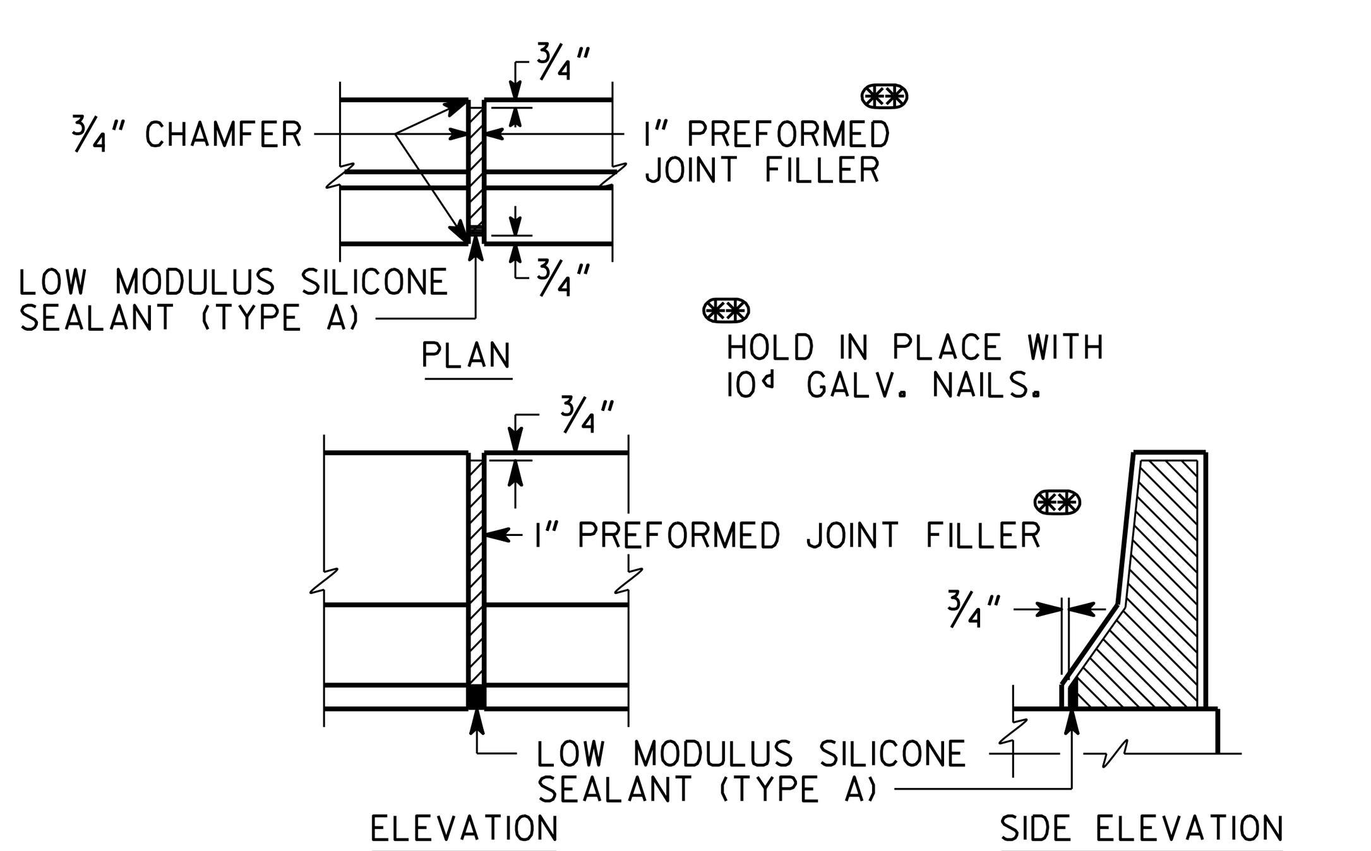


TYPICAL END SPAN



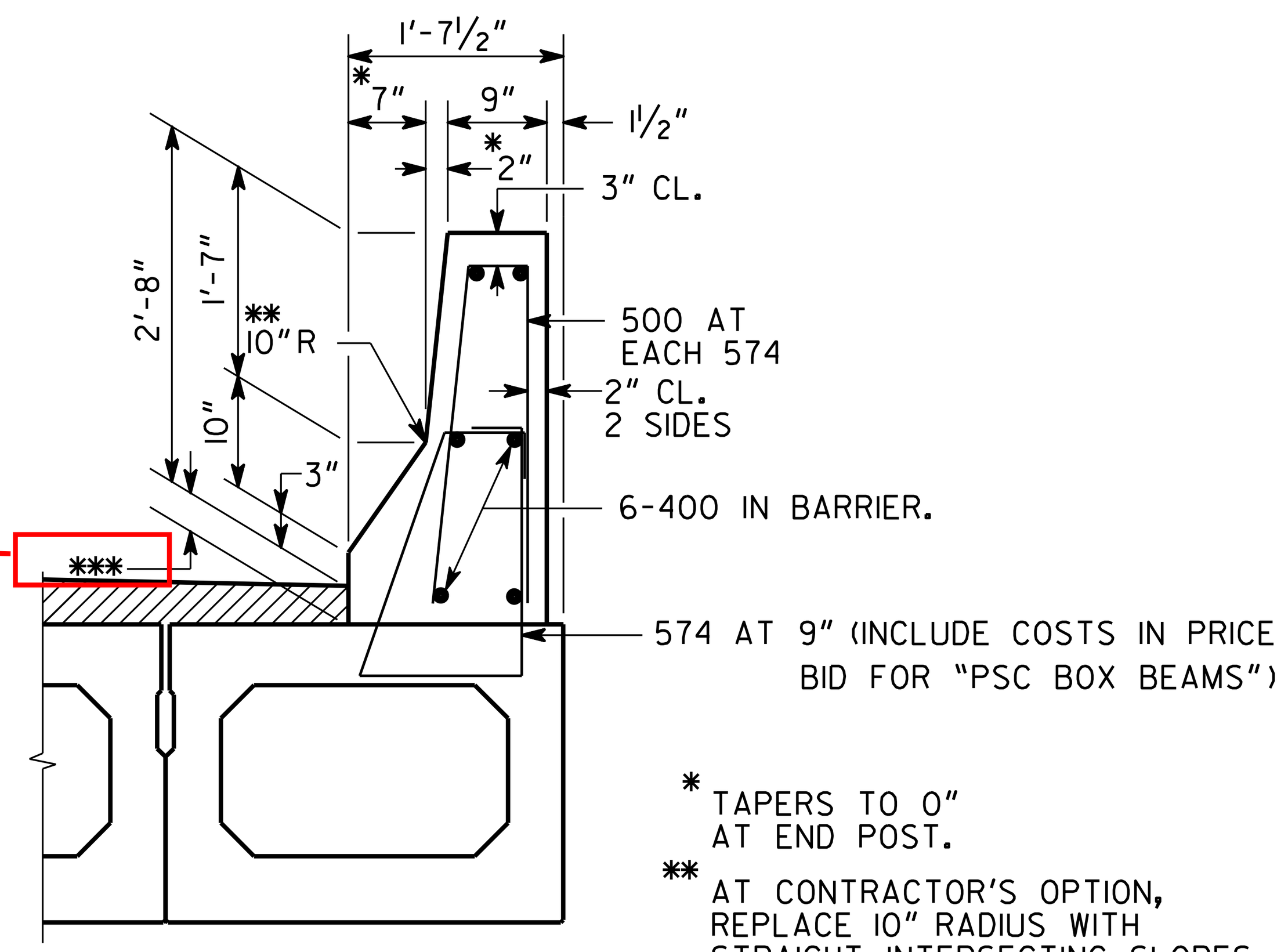
BARRIER TRANSITION DETAIL

SCALE: ¼" = 1'-0"



DETAILS OF 1" EXPANSION JOINT IN BARRIER

SCALE: ½" = 1'-0"



BARRIER DETAIL

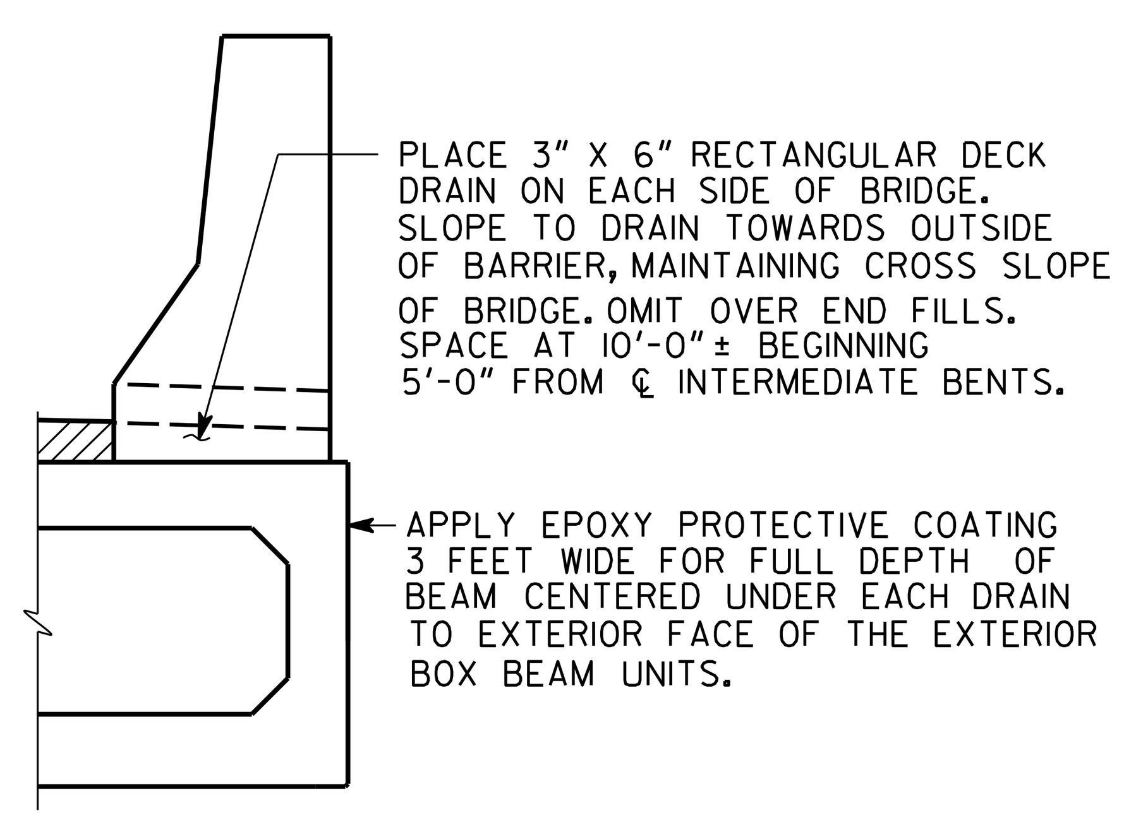
SCALE: ¾" = 1'-0"

* TAPERS TO 0" AT END POST.

** AT CONTRACTOR'S OPTION, REPLACE 10" RADIUS WITH STRAIGHT INTERSECTING SLOPES.

*** VARY DIMENSION TO ACCOUNT FOR BEAM CAMBER SO TOP OF BARRIER FOLLOWS ROADWAY PROFILE. 3½" MIN. FOR ASPHALT OVERLAY.

Minimum Overlay Thickness at Gutter Line/Face of Barrier



BARRIER DRAIN DETAIL

SCALE: ¾" = 1'-0"

NOTES:

1. SEE BOX BEAM DETAILS SHEETS FOR LOCATIONS OF HOLES FOR 1" DIA. PLAIN BAR.
2. CAST BARRIER AFTER ALL KEYS HAVE BEEN FILLED WITH MORTAR FOR A MINIMUM OF 5 DAYS
3. BARRIER EXPANSION JOINTS MAY BE SHIFTED SLIGHTLY TO AVOID 574 BARS CAST IN BEAMS.

SUPERSTRUCTURE QUANTITIES

ITEM	SPAN	SPAN LENGTH	
		70'-0"	N/A
LUMP - SUPERSTR. REINF. STEEL, LBS.	END	1616	N/A
	INTERMEDIATE	N/A	N/A

BRIDGE NO. 1

GEORGIA DEPARTMENT OF TRANSPORTATION

ENGINEERING DIVISION-OFFICE OF BRIDGES AND STRUCTURES

DECK PLAN

LIBP - CR 32 (CAMP BRANCH ROAD) OVER GREASY BRANCH

WARE COUNTY 0015738

NO SCALE (UNLESS OTHERWISE NOTED) JULY 2018

REVISIONS	DATE	BY

DRAWING NO. 35-0003

BRIDGE SHEET 3 OF 10

DESIGNED KRS | CHECKED KNT | REVIEWED DLC/SKG
DRAWN ASA/JAC | DESIGN GROUP EJC | APPROVED WMD

P.I. NO. 0015738

1 INCH WHEN PRINTED FULL SIZE

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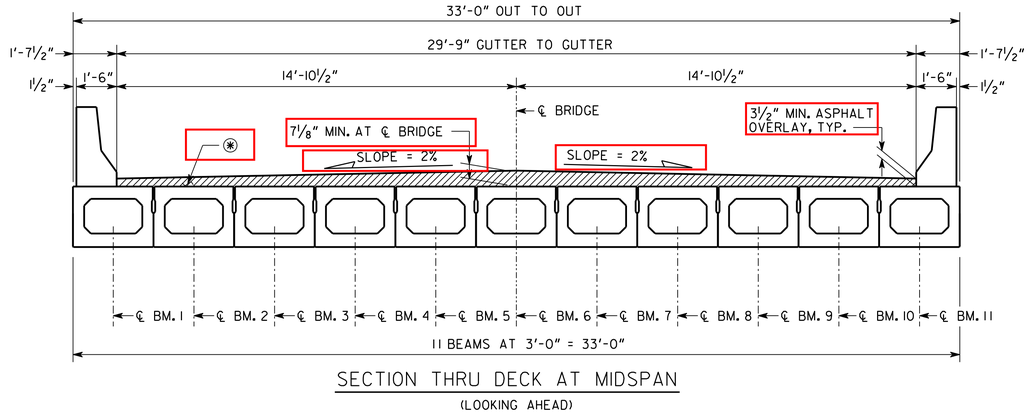
LAST UPDATED: APRIL 18, 2018

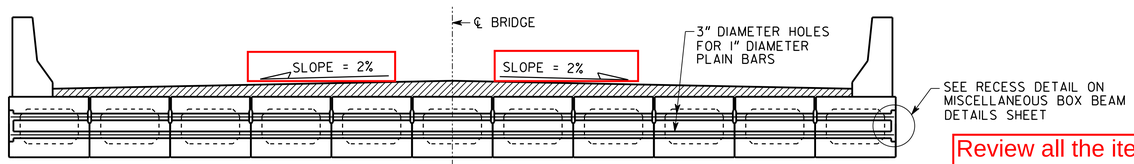
Example 1 PSC Box Beam Bridge

P.I. NO. 0015738



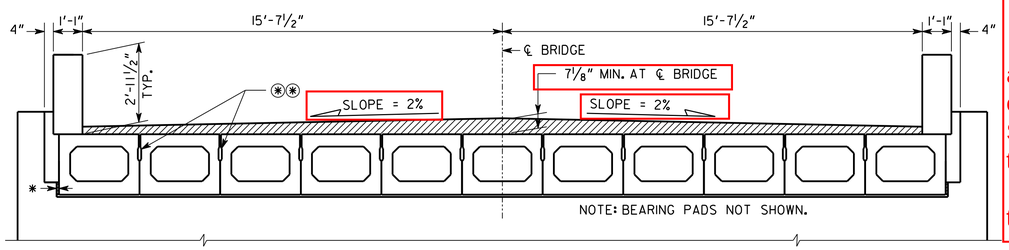
SECTION THRU DECK AT MIDSPAN

(LOOKING AHEAD)

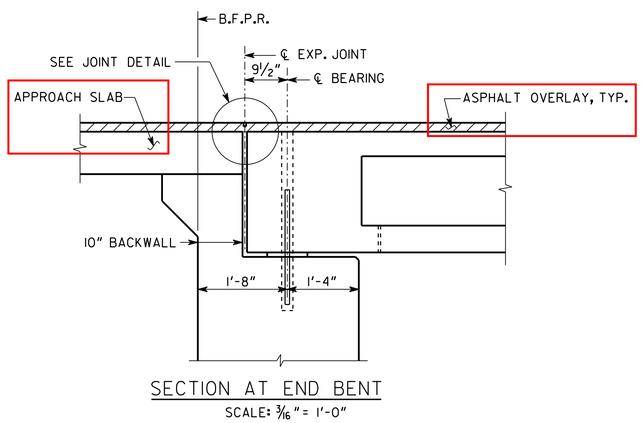


SECTION THRU DECK AT DIAPHRAGM RODS

(LOOKING AHEAD)

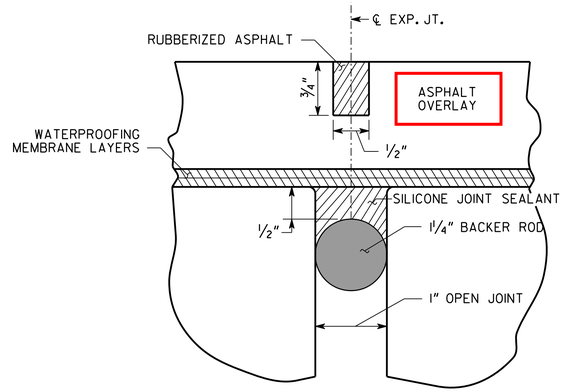


SECTION THRU DECK AT END BENT



SECTION AT END BENT

SCALE: 3/16" = 1'-0"



JOINT DETAIL

NO SCALE

Review all the items outlined in red.

Notice that the cross slope for this tangent alignment bridge is 2.0% (2.5% has been used on some projects). Since the bridge deck is leveled and overlaid the approach slabs are also leveled and overlaid. See the End Bent Joint Detail.

Roadway cross sections way have to account for cross slope transition to meet the bridge cross slope.

The Recycled Asphaltic Concrete Surface Course used on the bridge and approach slabs is the same as the roadway and should have the same spread rate. Typically this is either 135 LB/SY for 9.5 mm Superpve which is 1.25-inch thick or 165 LB/SY for 12.5 mm Superpave which is 1.5-inch thick. The preferred method is to use a 2-inch layer of 19 mm Superpave (220 LB/SY) between the Surface Course and leveling. In this case Leveling is used from the top surface of the Box Beams to the bottom of the 19 mm Superpave with the leveling creating the cross slope.

This project uses 9.5 mm Superpave thus after accounting for the 19 mm Superpave layer the leveling thickness using the minimum overlay thicknesses specified this 0.25-inch thick at the gutter line and 3.875-inch thick at the CL.

NOTES:

⊛ ASPHALT OVERLAY, TYP. SEE ROADWAY PLANS FOR DETAILS AND PAYMENT.

⊛⊛ FILL ALL KEYS FULL AND CONTINUOUS AS PER STANDARD SPECIFICATION 506, TYP. INCLUDE COST OF MATERIALS AND WORK IN PRICE BID FOR "PSC BOX BEAMS".

✱ 1" PREFORMED JOINT FILLER BETWEEN EXTERIOR BOX BEAM AND KEEPER BLOCK, TYP.

BRIDGE NO. 1

GEORGIA

DEPARTMENT OF TRANSPORTATION

ENGINEERING DIVISION-OFFICE OF BRIDGES AND STRUCTURES

DECK SECTIONS

LIBP - CR 32 (CAMP BRANCH ROAD) OVER GREASY BRANCH

WARE COUNTY 0015738

DRAWING NO. 35-0004

BRIDGE SHEET 4 OF 10

SCALE: 3/8" = 1'-0" (UNLESS OTHERWISE NOTED) JULY 2018

DESIGNED KRS | CHECKED KNT | REVIEWED DLC/SKG

DRAWN ASA/JAC | DESIGN GROUP EJC | APPROVED WMD

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1 INCH WHEN PRINTED FULL SIZE

DATE | REVISIONS | BY

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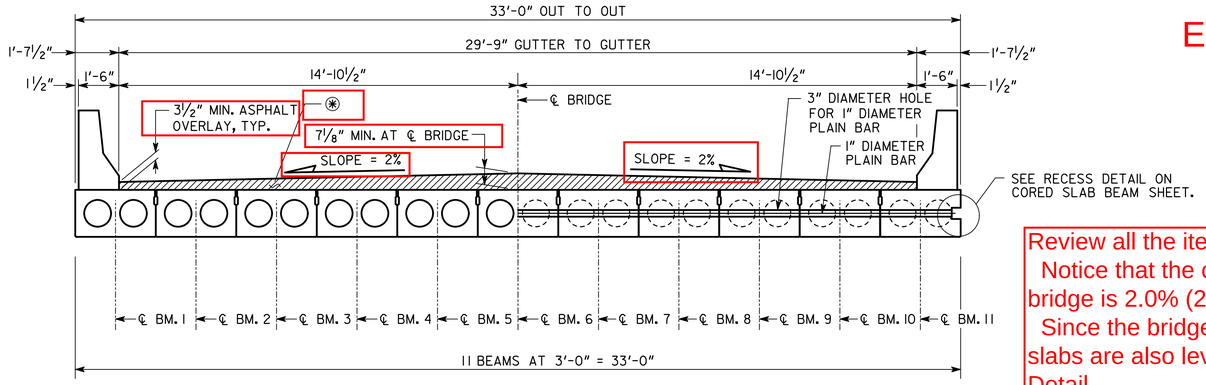
LAST UPDATED: APRIL 18, 2018

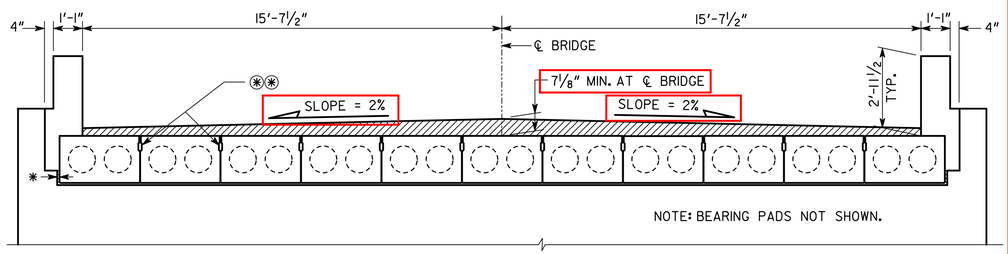
Example 2 PSC Cored Slab Beam Bridge

P.I. NO. 0015739



HALF-SECTION THRU DECK
LOOKING AHEAD

HALF-SECTION THRU DIAPHRAGM
LOOKING AHEAD



SECTION THRU END BENT
LOOKING AHEAD

Review all the items outlined in red.

Notice that the cross slope for this tangent alignment bridge is 2.0% (2.5% has been used on some projects).

Since the bridge deck is leveled and overlaid the approach slabs are also leveled and overlaid. See the End Bent Joint Detail.

Roadway cross sections may have to account for cross slope transition to meet the bridge cross slope.

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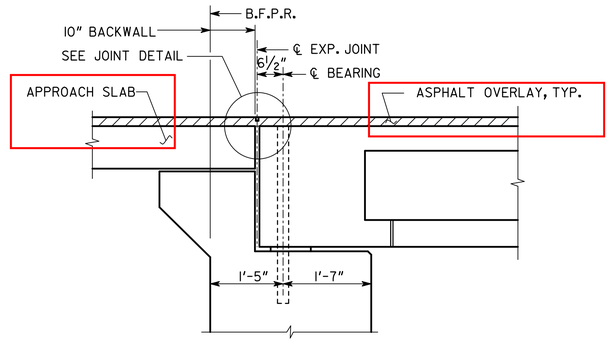
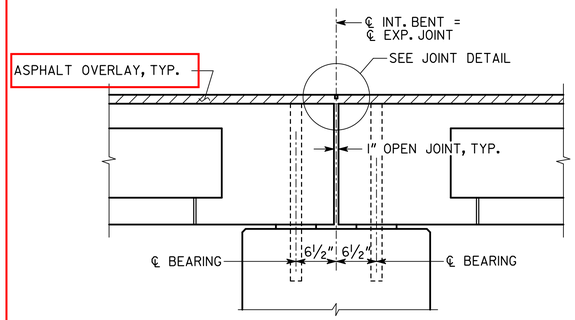
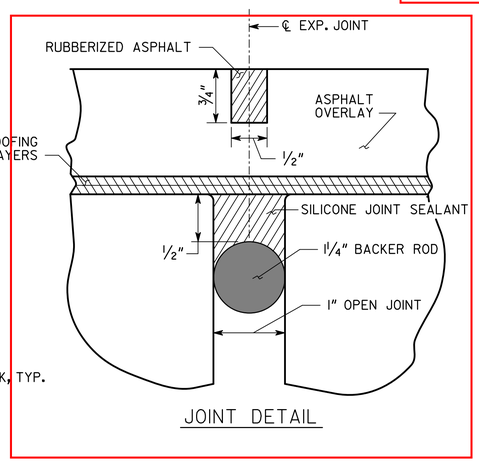
This project uses 9.5 mm Superpave thus after accounting for the 19 mm Superpave layer the leveling thickness using the minimum overlay thicknesses specified this 0.25-inch thick at the gutter line and 3.875-inch thick at the CL.



SECTION AT END BENT



SECTION AT INTERMEDIATE BENT



JOINT DETAIL

NOTES:

⊛ ASPHALT OVERLAY, TYP. SEE ROADWAY PLANS FOR DETAILS AND PAYMENT.

⊛⊛ FILL ALL KEYS FULL AND CONTINUOUS AS PER STANDARD SPECIFICATION 506, TYP. INCLUDE COST OF MATERIALS AND WORK IN PRICE BID FOR "PSC CORED SLAB BEAMS".

✱ 1" PREFORMED JOINT FILLER BETWEEN EXTERIOR CORED SLAB BEAM AND KEEPER BLOCK, TYP.

BRIDGE NO. 1

GEORGIA
DEPARTMENT OF TRANSPORTATION
ENGINEERING DIVISION-OFFICE OF BRIDGES AND STRUCTURES

DECK SECTION
LIBP - CR 32 (CAMP BRANCH ROAD)
OVER GREASY BRANCH TRIBUTARY
WARE COUNTY 0015739

NO SCALE MAY 2018

DESIGNED JH-D/MRC | CHECKED NAW | REVIEWED DLC/SKG
DRAWN JH-D/MRC | DESIGN GROUP DDF | APPROVED WMD

DRAWING NO. 35-0004
BRIDGE SHEET 4 OF 9

REVISIONS | DATE | BY

1 INCH WHEN PRINTED FULL SIZE

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