STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

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GOVERNOR

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MEMORANDUM TO: Project Engineers
Project Design Engineers

FROM: G. R. Perfetti, P. E.
State Bridge Design Engineer

DATE: July 11, 2005

SUBJECT: BOX BEAM GUIDELINES

General

The Structure Design Unit shall consider the use of box beam girder bridges for locations where they are more economical than any other structure type. This policy memorandum presents the design and detailing guidelines for box beam bridges.

Box beams shall be detailed to the dimensions and section properties shown in Figure 6-127, and are to be designed for prestressing with straight strands. For approximate span length limits see Design Manual Figure 11-3. Specify high strength concrete only in spans where required by design. Box beams shall be constructed in a side-by-side layout, similar to the current practice with cored slab bridges.

Box beams may be used for skews between 60^{o} and 120^{o}, and on grades up to 4%. Box beams may be set on caps with a slope of 2% or less. When box beams are used on vertical curves, the 2'-8" (813mm) minimum dimension from the top of the wearing surface to the top of the barrier rail must be maintained.

The attached standards were developed for the use of a concrete overlay. For projects requiring an asphalt overlay, the standards will have to be slightly modified.

Design

For those projects requiring top-down construction or for projects with span arrangements that permit top-down construction, design the box beam units for top-down construction loads. For box beam bridges where none of the span lengths exceed 55'-0" (16.76m) the top-down

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construction loads may be approximated with an HS-25 loading. However, for bridges where any of the spans exceed 55'-0" (16.76m), design all box beam units for the anticipated construction loads, such as operating and travelling crane loads. Refer to the EDS memorandum on Box Beam Design for analysis of crane loads.

When the Structure Recommendations specify a box beam bridge, the Roadway Project Engineer should recommend an overall (out-to-out) structure width that is an even 3'-0" (914mm) increment. When the Structure recommendations do not show the overall width to an even 3' increment but it is determined that box beams are the preferred structure type, the Structure Project Engineer shall increase the recommended out-to-out dimension to the next even 3'-0" (914mm) increment and inform the Roadway project Engineer of the necessary adjustment. See the form letters available via the Structure Design web page.

The camber and dead load deflection shall be shown for all box beam spans in the following manner:

Camber (Girder alone in place) =_____ ↑
Deflection due to Concrete Overlay =_____ ↓
Final camber (or deflection) =_____ ↑or ↓

Cambers and dead load deflections shall be shown for the girder alone in place, and for deflections due to wearing surface. Do not include deflections due to the rail or the future wearing surface in the deflection due to concrete overlay.

All deflections and cambers shall be shown to the nearest sixteenth of an inch (mm). The camber and deflection at the time of erection is calculated based on "A Rational Method for Estimating Camber and Deflection in Precast Prestressed Members" as published in the PCI Journal, Volume 22, No. 1. This method applies multipliers to the initial camber and deflection to arrive at the camber at the time of erection. For this method, an average erection time of 28 days after casting is assumed and 65% of the camber is achieved by erection time.

For concrete overlays, show the dimensions for the minimum overlay thickness at mid-span and the overlay thickness at centerline bearing on the Typical Section. Indicate that the overlay thickness at centerline bearing is based on the predicted deflection due to concrete overlay.

The use of level, unreinforced pads is preferred. The pads shall be designed in accordance with the AASHTO Standard or LRFD Specifications. In general, use 6" (150 mm) by 5/8 inch (16 mm) pads as a minimum and provide 1¼ " (32 mm) ϕ holes in fixed end bearing pads and 2½" (64 mm) ϕ holes in expansion end bearing pads for #8 (#25) dowels. Dowels shall be 2'-3" (685 mm) long set 1'-0" (300 mm) into the concrete cap. Do not apply epoxy protective coating to the bent caps of prestressed concrete box beam structures.

Detailing

The expansion joints shall be evazote joints with elastomeric concrete. If the thickness of the overlay at the rail is 4 ½" or more, detail a minimum concrete overlay thickness of 2 ¼" below a 2 ½" X 5 ½" blockout. If the thickness of the overlay at the rail is less than 4 ½", detail a full-depth blockout.

The barrier rail shall be placed such that there is a 1" offset from the edge of the exterior unit to the exterior face of the barrier rail. The barrier rail shall be attached to the exterior units by casting reinforcing steel into the exterior units and pouring the barrier rail after the units are post-tensioned, but prior to placement of the concrete overlay.

When required, a minimum sidewalk width of 5'-0" (1500mm) or 5'-6" (1650mm) shall be used unless otherwise recommended. Place the sidewalk and parapet so the offset from the edge of the exterior unit to the exterior face of the parapet is 1" (25mm). See the attached Figure 6-128. If the overall width is not in an even 3'-0" increment, increase the sidewalk width as necessary and inform the Roadway Project Engineer of any adjustment so the guardrail location, where necessary, can be adjusted accordingly.

Eight standard drawings are available and should be used in plan development.

- PCBB1 – 3'-0" x _'-_" Prestressed Concrete Box Beam Unit
- PCBB2 – 3'-0" x 2'-3" Prestressed Concrete Box Beam Unit
- PCBB3 – 3'-0" x 2'-3" Prestressed Concrete Box Beam Unit
- PCBB4 – 3'-0" x 2'-9" Prestressed Concrete Box Beam Unit
- PCBB5 – 3'-0" x 2'-9" Prestressed Concrete Box Beam Unit
- PCBB6 – 3'-0" x 3'-3" Prestressed Concrete Box Beam Unit
- PCBB7 – 3'-0" x 3'-3" Prestressed Concrete Box Beam Unit
- PCBB8 – 3'-0" x _'-_" Prestressed Concrete Box Beam Unit

Standards PCBB1 and PCBB8 shall be used in combination with Standards PCBB2-7.

The standard drawings provide general details. Some modifications or adjustments will be required to suit a particular structure. The barrier rails are detailed for a 3½" (90mm) concrete wearing surface measured at the gutter line at mid-span. The barrier rail reinforcing details should be modified where the concrete wearing surface exceeds the depth shown on the standard details. For use of a one or two bar metal rail, see Figure 6-130. The overlay shall be placed after the barrier rails have been constructed and have cured. Longitudinal joints in the overlay shall not be permitted, except where required for staged construction. Place the following note on the plans:

> ***"Placement of the concrete overlay shall occur after casting the concrete rail [parapet]. For Concrete Wearing Surface see Special Provisions."***

Detail the transverse joints on box beam bridges with evazote joints that incorporate the standard elastomeric concrete filled blockout. In addition, detail a backwall at the end bents.

Where debonded strands are required, indicate the strands to be debonded on Standard Drawings PCBB2, PCBB4, or PCBB6. Place the following note on the Standard Drawing:

> ***Bond shall be broken on strands as shown for the specified length from each end of the box beam. See Standard Specifications Article 1078-7.***

For the use of box beams at a corrosive site, see Section 12-13.

<u>Diaphragms</u>

Diaphragms shall be detailed along the skew and shall be located 8 feet from the ends in addition to the following locations:

- At the center of spans up to 60 feet (18.29 m),
- At third points of span lengths between 60 feet (18.29 m) and 85 feet (25.91 m), and
- At quarter points of span lengths over 85 feet (25.91 m).

June 21, 2005

See Figure 6-129. A pair of 2" (50 mm) ϕ holes, for the post-tensioning strands, shall be formed through the diaphragm and shall be located symmetrically about the mid-height of the box beam section. The post-tensioning strand shall be seven wire, high strength Grade 270, 0.6" (15.24 mm) ϕ, low-relaxation strands. The anchorage recess for the post-tensioning assembly shall be grouted as shown on the Standard Drawings.

This policy is effective with the October 2005 letting. The Standard Drawings are available via the network drive and Structure Design Web Page. The Design Manual will be revised at a later date.

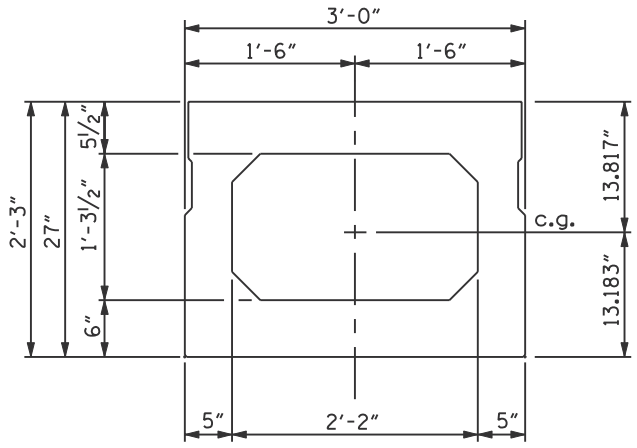
Attachments

Standard Drawings PCBB1, PCBB2, PCBB3, PCBB4, PCBB5, PCBB6, PCBB7, PCBB8, PCBBSM1, PCBBSM2, PCBBSM3, PCBBSM4, PCBBSM5, PCBBSM6, PCBBSM7, & PCBBSM8

Design Manual Figures 6-127, 6-128, 6-129, 6-130, 6-127SM, 6-128SM, 6-129SM & 6-130SM

GRP/GM/snj

cc: R. V. Keith, P. E., with attachments
R. A. Raynor, P. E., with attachments
T. S. Drda, P.E., FHWA, with attachments
E. C. Powell, Jr., P. E., Attn: R. Hancock, P. E., with attachments
J. Emerson, P. E., with attachments
D. R. Henderson, P. E., with attachments
J. A. Bennett, P. E., with attachments



27" BOX BEAM

AREA: 574.2 in.^{2}
3.9875 ft.^{2}

WEIGHT: 3.9875 X 150 = 598 lbs/ft.

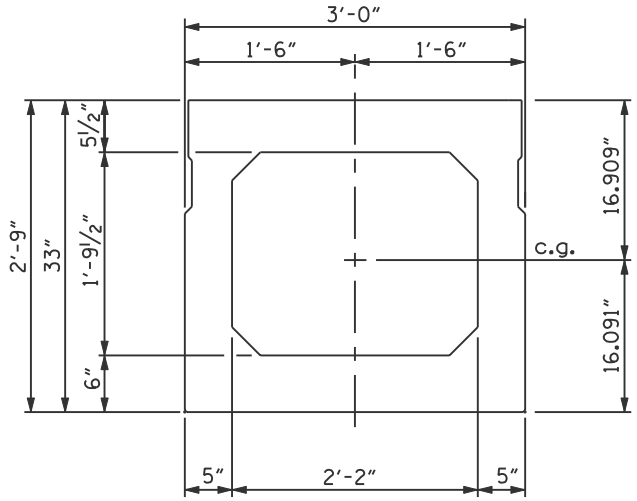
I = 51019 in.^{4}

C_T = 13.817 in.

C_B = 13.183 in.

S_T = 3692 in.^{3}

S_B = 3870 in.^{3}



33" BOX BEAM

AREA: 634.2 in.^{2}
4.4042 ft.^{2}

WEIGHT: 4.4042 X 150 = 661 lbs/ft.

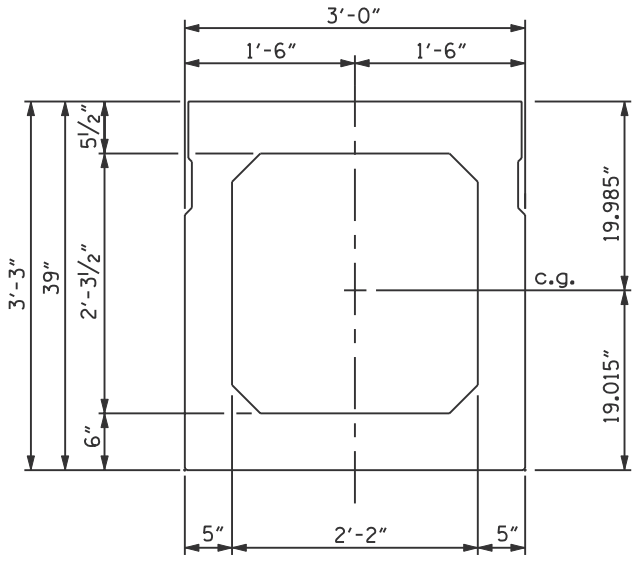
I = 86519 in.^{4}

C_T = 16.909 in.

C_B = 16.091 in.

S_T = 5117 in.^{3}

S_B = 5377 in.^{3}



39" BOX BEAM

AREA: 694.2 in.^{2}
4.8208 ft.^{2}

WEIGHT: 4.8208 X 150 = 723 lbs/ft.

I = 133426 in.^{4}

C_T = 19.985 in.

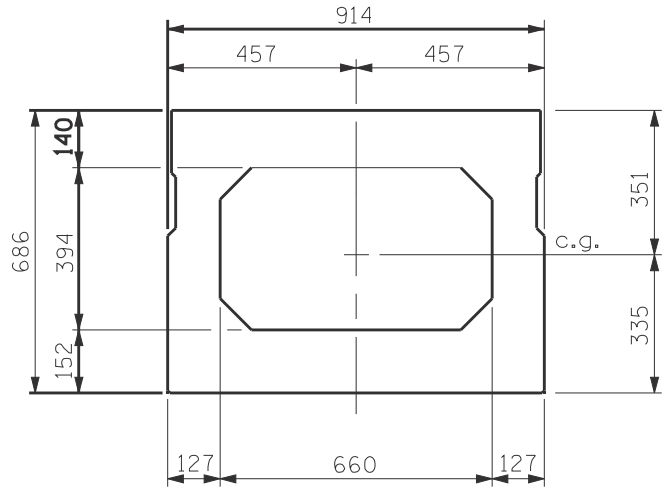
C_B = 19.015 in.

S_T = 6676 in.^{3}

S_B = 7017 in.^{3}

DIMENSIONS, AREA & DESIGN DATA OF PRESTRESSED CONCRETE BOX BEAMS

FIGURE 6 – 127



686mm BOX BEAM

AREA: 370,451 mm^2
0.370 m^2

WEIGHT: 0.370 X 23.6 = 8.732 kN/m

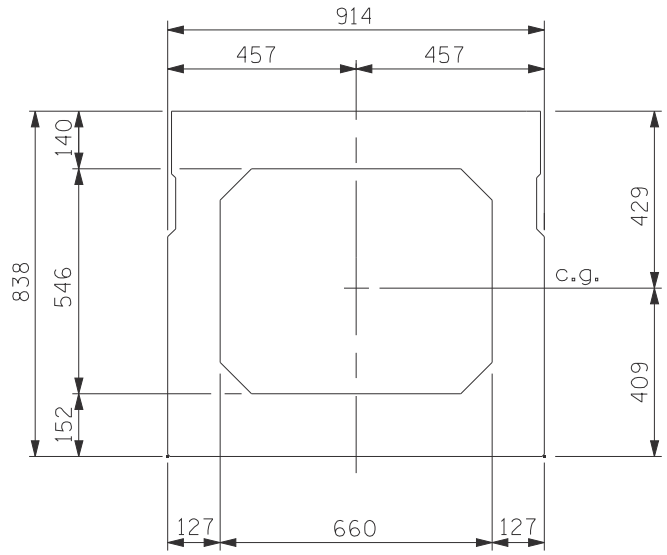
I = 21.24 X 10^9 mm^4

C_T = 351mm

C_B = 335mm

S_T = 60.50 X 10^6 mm^3

S_B = 63.42 X 10^6 mm^3



838mm BOX BEAM

AREA: 409,161 mm^2
0.409 m^2

WEIGHT: 0.409 X 23.6 = 9.652 kN/m

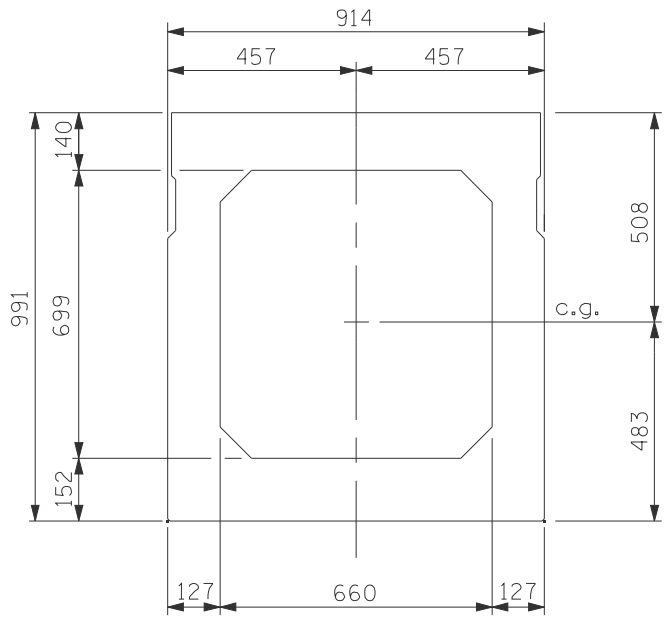
I = 36.01 X 10^9 mm^4

C_T = 429mm

C_B = 409mm

S_T = 83.85 X 10^6 mm^3

S_B = 88.11 X 10^6 mm^3



991mm BOX BEAM

AREA: 447,870 mm^2
0.448 m^2

WEIGHT: 0.448 X 23.6 = 10.573 kN/m

I = 55.54 X 10^9 mm^4

C_T = 508mm

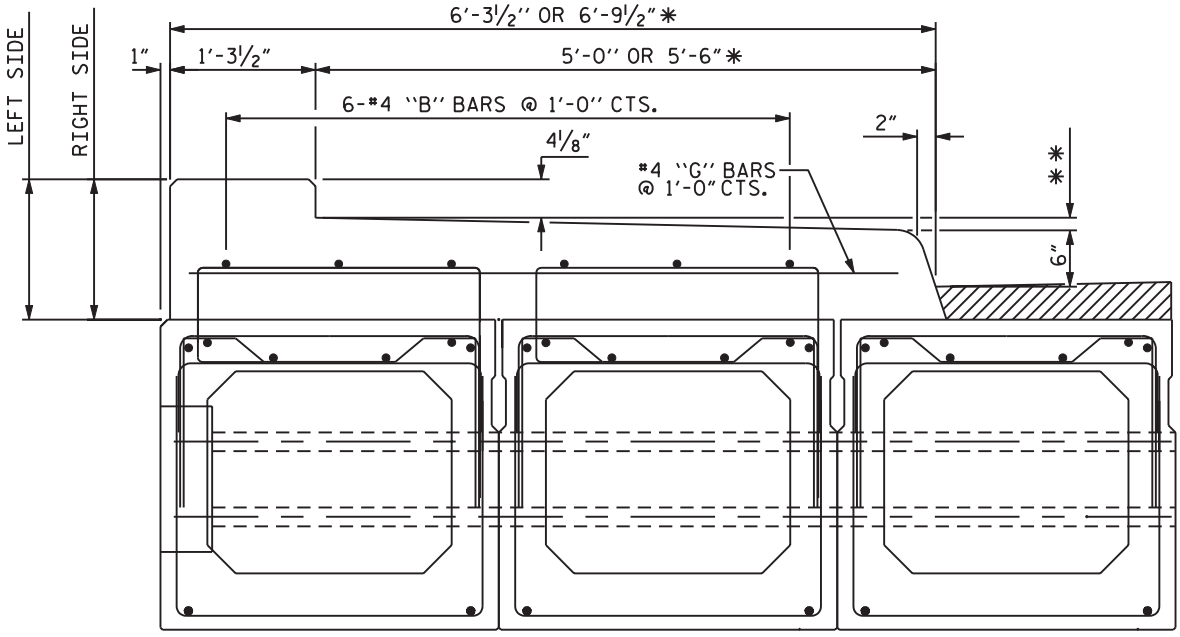
C_B = 483mm

S_T = 109.40 X 10^6 mm^3

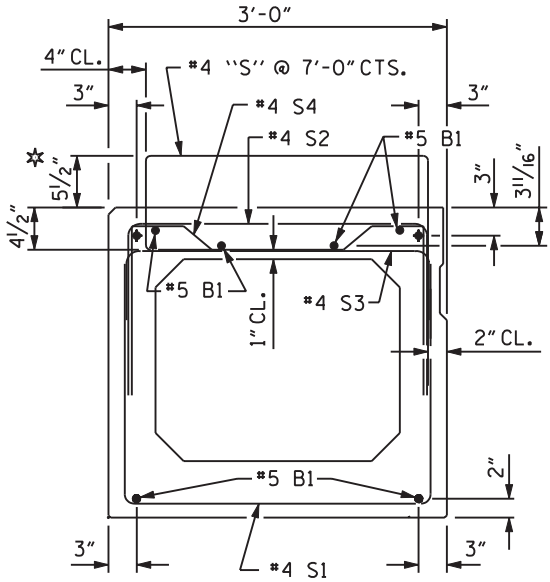
S_B = 114.99 X 10^6 mm^3

DIMENSIONS, AREA & DESIGN DATA OF PRESTRESSED CONCRETE BOX BEAMS

FIGURE 6 – 127

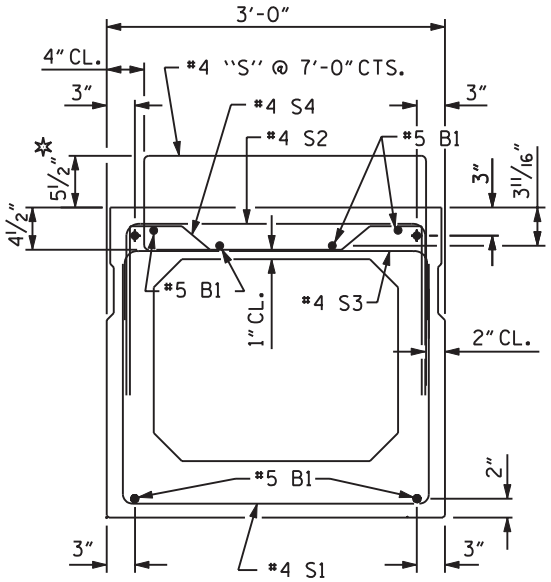


SECTION THROUGH SIDEWALK



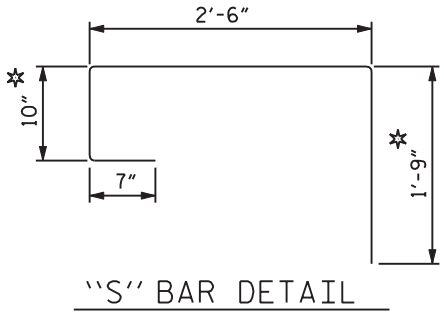
EXTERIOR SLAB SIDEWALK SECTION

STRAND LAYOUT NOT SHOWN
(EXTERIOR SLAB SECTION)



INTERIOR SLAB SIDEWALK SECTION

STRAND LAYOUT NOT SHOWN
(INTERIOR SLAB SECTION ADJACENT
TO EXTERIOR SLAB SECTION)



"S" BAR DETAIL

** 1 ¼" FOR 5'-0" SIDEWALK OR 1 ⅜" FOR 5'-6" SIDEWALK.

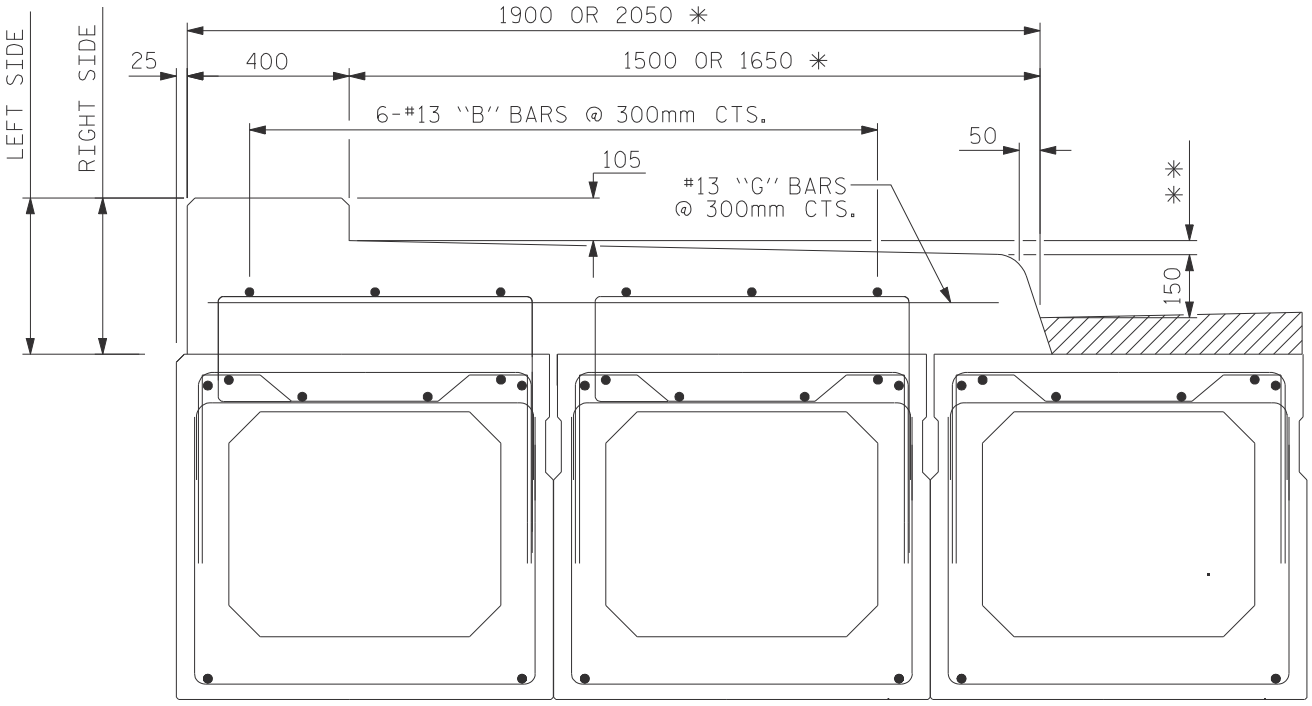
* SIDEWALK WIDTH MAY BE INCREASED AS NECESSARY TO PROVIDE AN OVERALL STRUCTURE WIDTH THAT IS AN EVEN 3 FOOT INCREMENT.

✲ BASED ON 3½" WEARING SURFACE. ADJUST ACCORDINGLY.

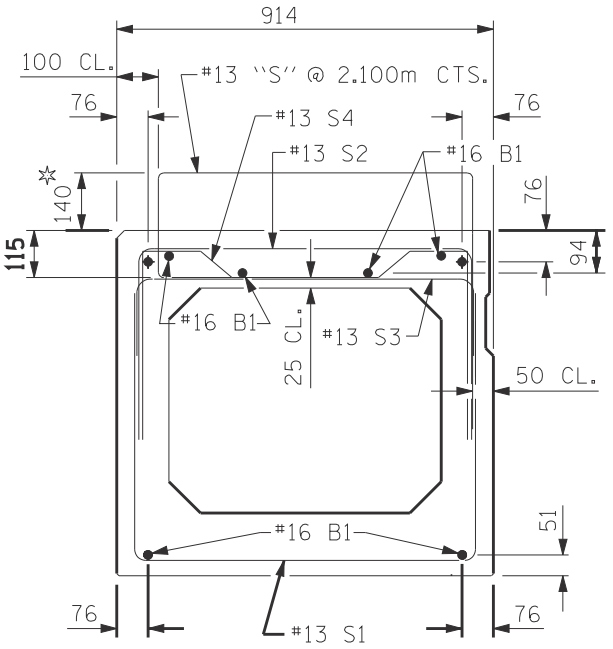
NOTE ON PLANS:
GROOVED CONTRACTION JOINTS ½" IN DEPTH, SHALL BE TOOLED IN ALL EXPOSED FACES OF SIDEWALK IN ACCORDANCE WITH ARTICLE 825-10(B) OF THE STANDARD SPECIFICATIONS. THE CONTRACTION JOINTS SHALL BE LOCATED AT A SPACING OF 8 FEET TO 10 FEET BETWEEN EXPANSION JOINTS. NO CONTRACTION JOINTS WILL BE REQUIRED FOR SEGMENTS LESS THAN 10 FEET IN LENGTH.

SIDEWALK ON BOX BEAMS

FIGURE 6 – 128

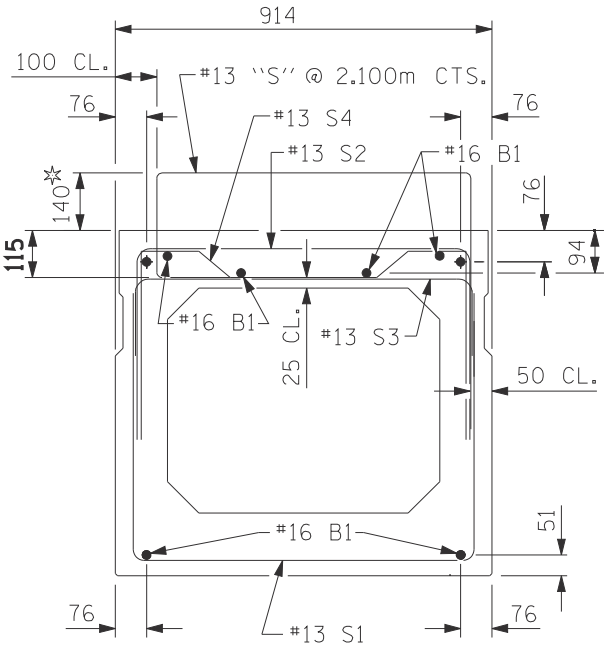


SECTION THROUGH SIDEWALK



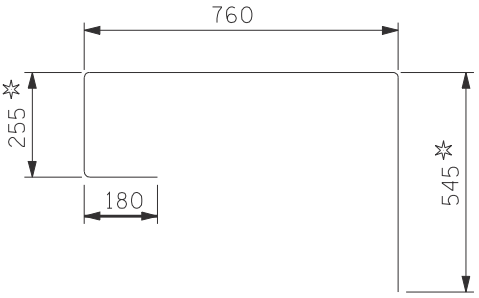
EXTERIOR SLAB SIDEWALK SECTION

STRAND LAYOUT NOT SHOWN
(EXTERIOR SLAB SECTION)



INTERIOR SLAB SIDEWALK SECTION

STRAND LAYOUT NOT SHOWN
(INTERIOR SLAB SECTION ADJACENT
TO EXTERIOR SLAB SECTION)



"S" BAR DETAIL

✳✳ 30mm FOR 1500mm SIDEWALK OR 35mm FOR 1650mm SIDEWALK.

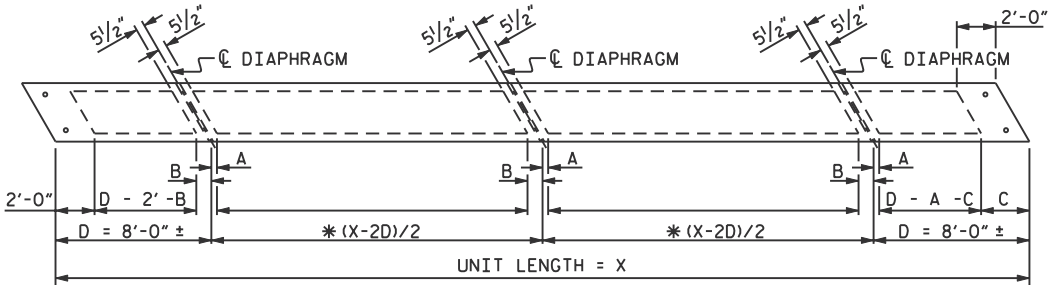
✳ SIDEWALK WIDTH MAY BE INCREASED AS NECESSARY TO PROVIDE AN OVERALL STRUCTURE WIDTH THAT IS AN EVEN 914mm INCREMENT.

✲ BASED ON 89mm WEARING SURFACE. ADJUST ACCORDINGLY.

NOTE ON PLANS:
GROOVED CONTRACTION JOINTS 12mm IN DEPTH, SHALL BE TOOLED IN ALL EXPOSED FACES OF SIDEWALK IN ACCORDANCE WITH ARTICLE 825-10(B) OF THE STANDARD SPECIFICATIONS. THE CONTRACTION JOINTS SHALL BE LOCATED AT A SPACING OF 2.4 METERS TO 3.5 METERS BETWEEN EXPANSION JOINTS. NO CONTRACTION JOINTS WILL BE REQUIRED FOR SEGMENTS LESS THAN 3.5 METERS IN LENGTH.

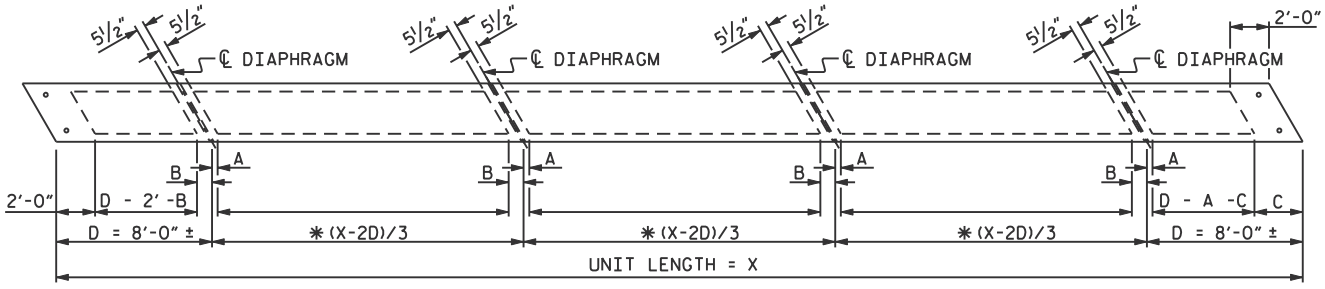
SIDEWALK ON BOX BEAMS

FIGURE 6 - 128



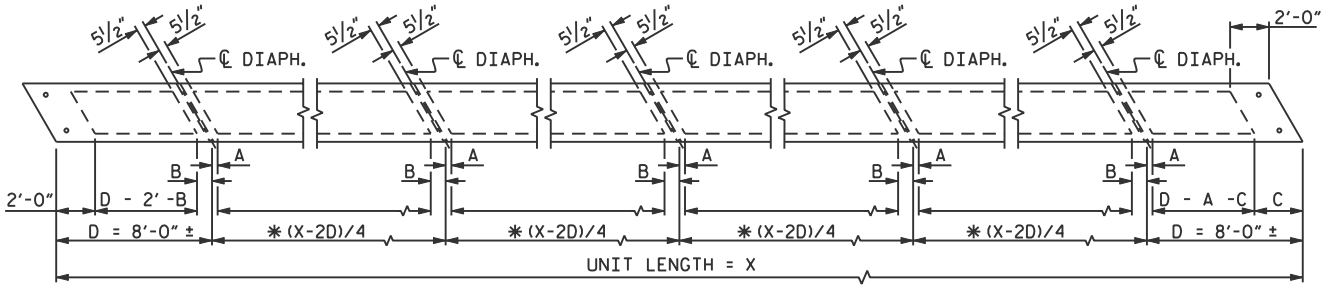
PLAN OF BOX BEAM UNIT - SPAN ''_''

FOR SPAN LENGTHS ≤ 60'



PLAN OF BOX BEAM UNIT - SPAN ''_''

FOR SPAN LENGTHS > 60' AND ≤ 85'



PLAN OF BOX BEAM UNIT - SPAN ''_''

FOR SPAN LENGTHS > 85'

A = 5½"/SIN (SKEW) - 5"/ABS [TAN (SKEW)]
B = 5½"/SIN (SKEW) + 5"/ ABS [TAN (SKEW)]
C = 2' + .8333'/ABS [TAN (SKEW)]

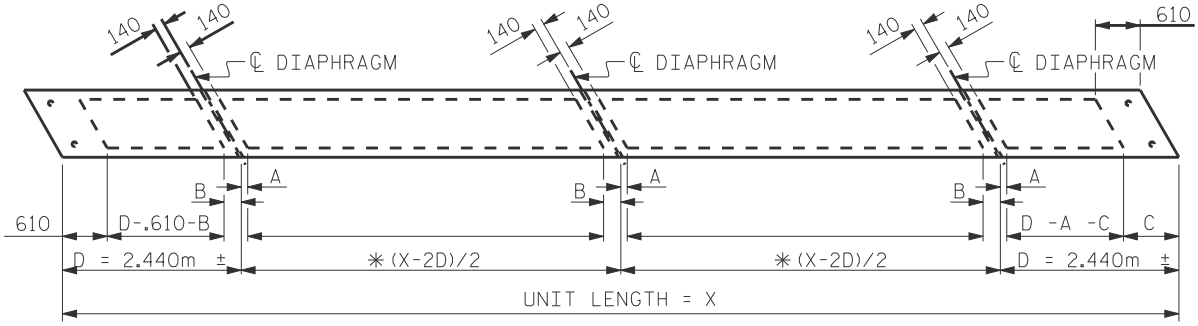
ABS = ABSOLUTE VALUE

*ROUND TO THE NEAREST INCH

NOTE: DIMENSIONS ARE TO THEORETICAL ACUTE CORNERS AND DO NOT ACCOUNT FOR ANY CHAMFERS THAT MAY BE REQUIRED.

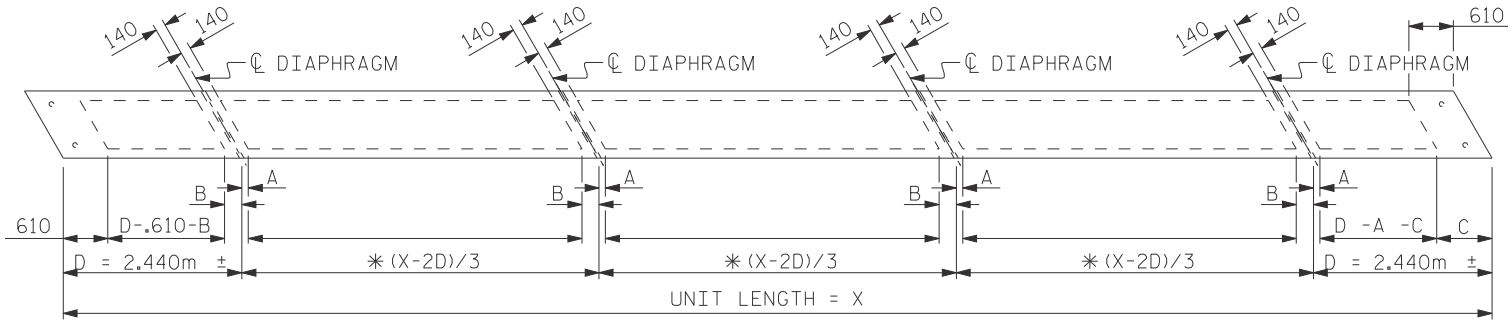
PLAN VIEW OF BOX BEAM SUPERSTRUCTURE UNITS

FIGURE 6 – 129



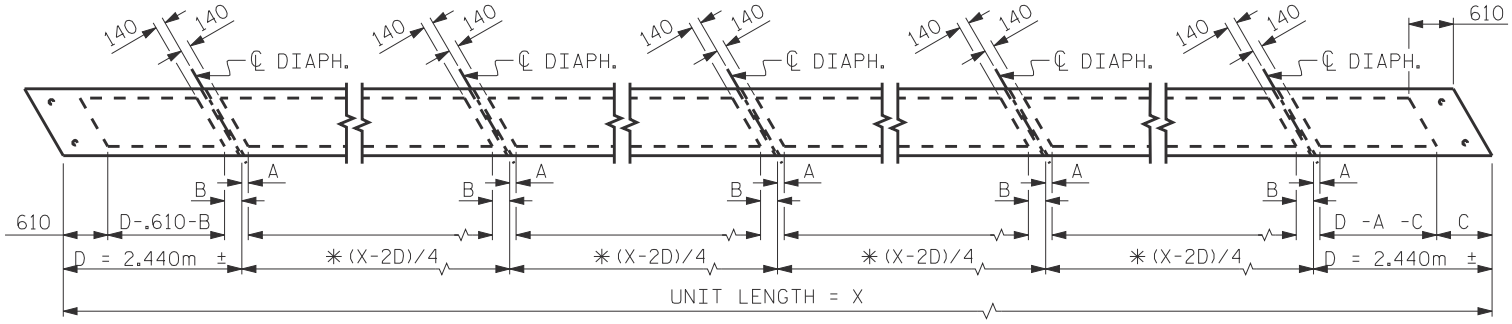
PLAN OF BOX BEAM UNIT - SPAN ``_''

FOR SPAN LENGTHS ≤ 18.29m



PLAN OF BOX BEAM UNIT - SPAN ``_''

FOR SPAN LENGTHS > 18.29m AND ≤ 25.9lm



PLAN OF BOX BEAM UNIT - SPAN ``_''

FOR SPAN LENGTHS > 25.9lm

✳ ROUND TO THE NEAREST INCH

A = .140/SIN (SKEW) - .127/ABS [TAN (SKEW)]

B = .140/SIN (SKEW) + .127/ ABS [TAN (SKEW)]

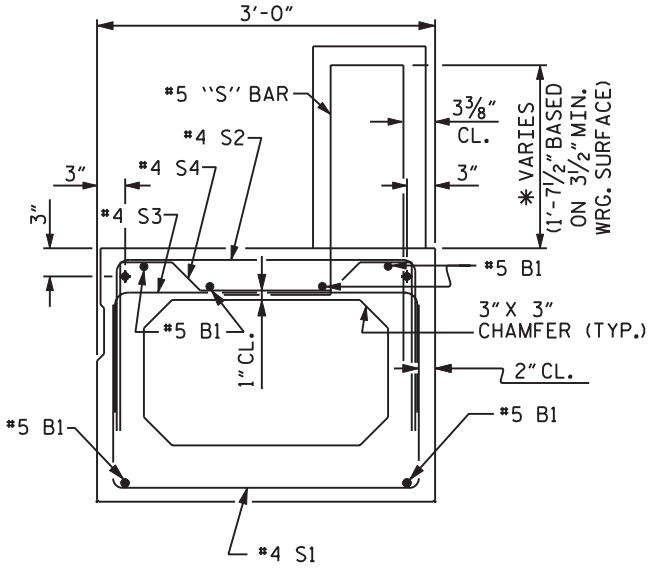
C = .610 + .254/ABS [TAN (SKEW)]

ABS = ABSOLUTE VALUE

NOTE: DIMENSIONS ARE TO THEORETICAL ACUTE CORNERS AND DO NOT ACCOUNT FOR ANY CHAMFERS THAT MAY BE REQUIRED.

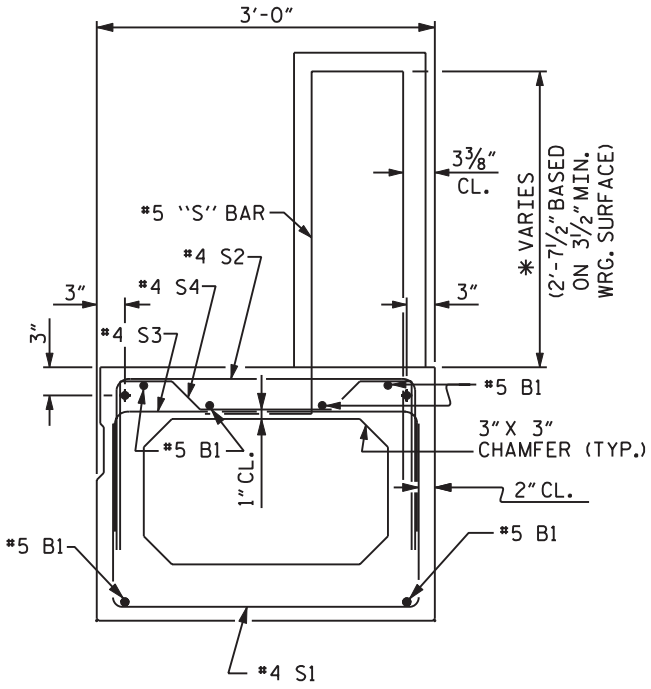
PLAN VIEW OF BOX BEAM SUPERSTRUCTURE UNITS

FIGURE 6 - 129



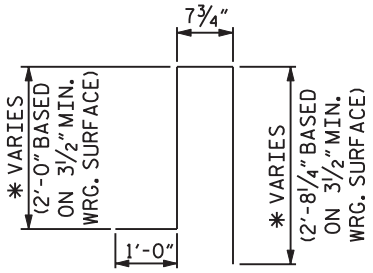
EXTERIOR BOX BEAM SECTION-
ONE BAR METAL RAIL

(STRAND LAYOUT NOT SHOWN)

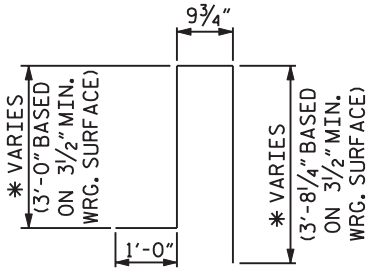


EXTERIOR BOX BEAM SECTION-
TWO BAR METAL RAIL

(STRAND LAYOUT NOT SHOWN)



"S" BAR DETAIL-
ONE BAR METAL RAIL



"S" BAR DETAIL-
TWO BAR METAL RAIL

ONE AND TWO BAR METAL RAILS ON BOX BEAMS

FIGURE 6 – 130

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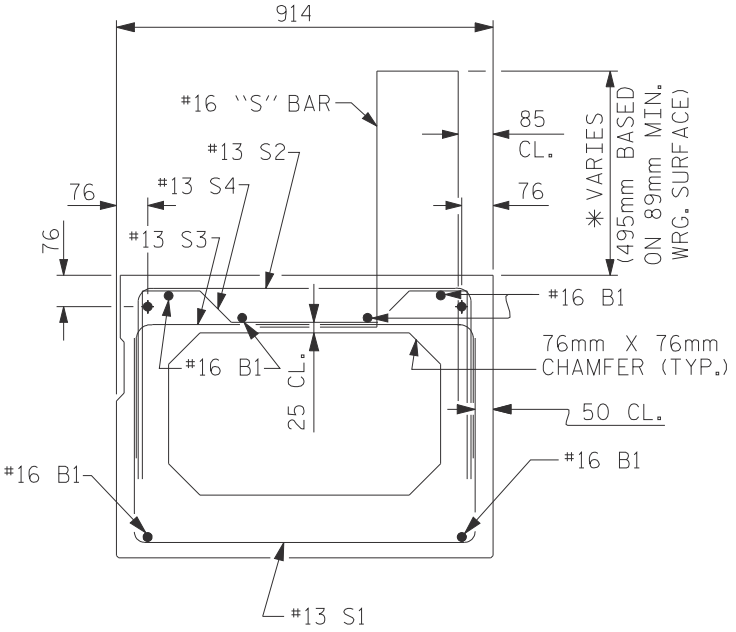
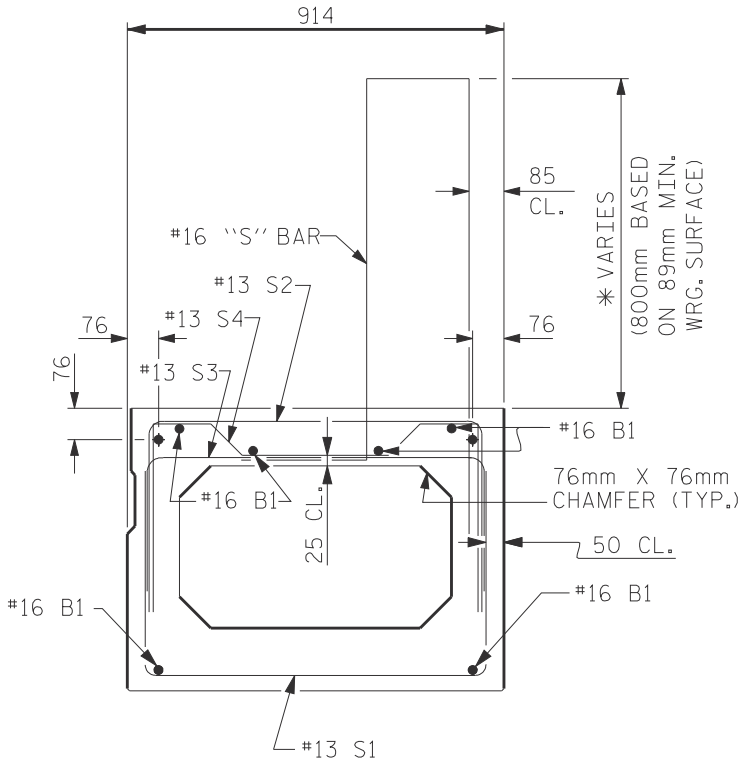


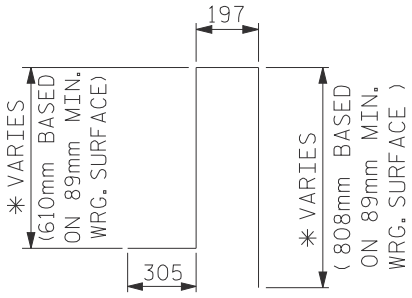
EXTERIOR BOX BEAM SECTION-
ONE BAR METAL RAIL

(STRAND LAYOUT NOT SHOWN)

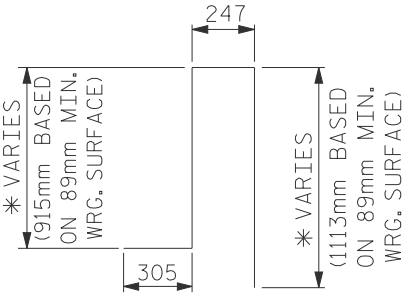


EXTERIOR BOX BEAM SECTION-
TWO BAR METAL RAIL

(STRAND LAYOUT NOT SHOWN)



"S" BAR DETAIL-
ONE BAR METAL RAIL



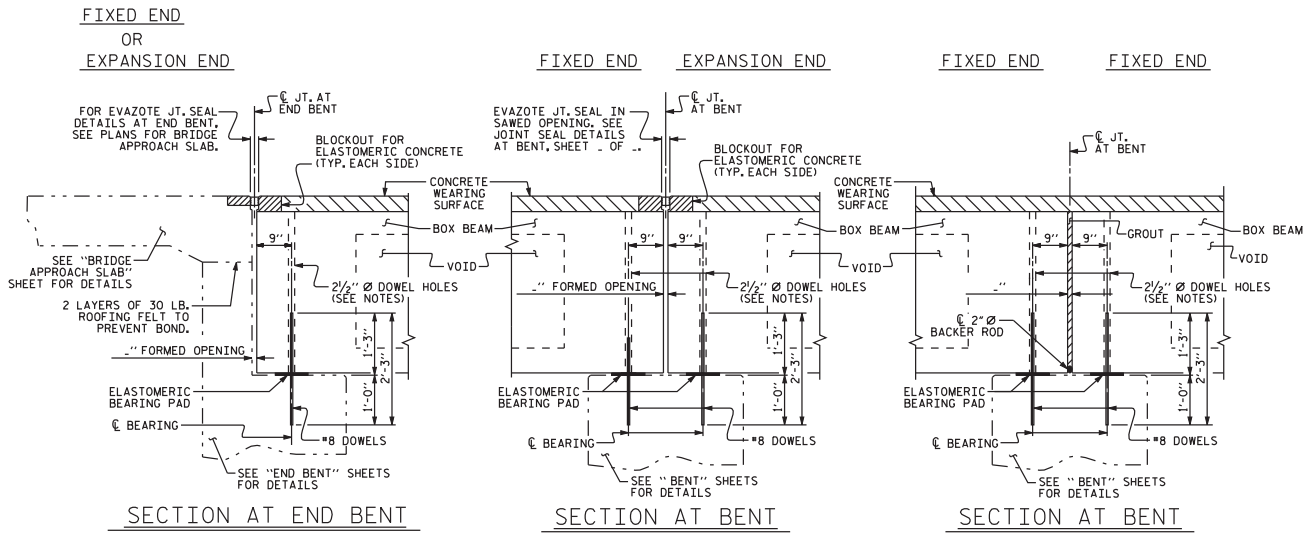
"S" BAR DETAIL-
TWO BAR METAL RAIL

ONE AND TWO BAR METAL RAILS ON BOX BEAMS

FIGURE 6 – 130

TYPICAL SECTION

* BASED ON PREDICTED FINAL CAMBER AND THEORETICAL GRADE LINE ELEVATIONS



NOTES

ALL PRESTRESSING STRANDS SHALL BE 7-WIRE LOW RELAXATION GRADE 270 STRANDS AND SHALL CONFORM TO AASHTO M203 EXCEPT FOR SAMPLING REQUIREMENTS WHICH SHALL BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.

ALL REINFORCING STEEL CAST WITH THE BOX BEAM SECTIONS SHALL BE GRADE 60 AND SHALL BE INCLUDED IN THE UNIT PRICE BID FOR PRESTRESSED CONCRETE BOX BEAMS.

RECESSES FOR TRANSVERSE STRANDS SHALL BE GROUTED AFTER THE TENSIONING OF THE STRANDS.

THE 2½" Ø DOWEL HOLES AT FIXED ENDS OF BOX BEAM SECTIONS SHALL BE FILLED WITH NON-SHRINK GROUT. THE 2½" Ø DOWEL HOLES AT EXPANSION ENDS OF BOX BEAM SECTIONS SHALL BE FILLED WITH JOINT SEALER MATERIAL TO 1½" ABOVE THE TOP OF DOWELS AND THEN FILLED WITH GROUT.

THE JOINT SEALER MATERIAL SHALL CONFORM TO THE REQUIREMENTS OF TYPE SL LOW MODULUS SILICONE SEALANT. THE 2" Ø BACKER ROD SHALL CONFORM TO THE REQUIREMENTS OF TYPE M BOND BREAKER. SEE SECTION 1028 OF THE STANDARD SPECIFICATIONS.

THE TRANSFER OF LOAD FROM THE ANCHORAGES TO THE BOX BEAM UNIT SHALL BE DONE WHEN THE CONCRETE HAS REACHED A COMPRESSIVE STRENGTH OF NOT LESS THAN ___ PSI.

ALL REINFORCING STEEL IN BARRIER RAILS AND CONCRETE WEARING SURFACE SHALL BE EPOXY COATED.

PRESTRESSING STRANDS SHALL BE CUT FLUSH WITH THE BOX BEAM UNIT ENDS.

APPLY EPOXY PROTECTIVE COATING TO BOX BEAM UNIT ENDS.

VERTICAL GROOVED CONTRACTION JOINTS, ½" IN DEPTH, SHALL BE TOOLED IN ALL EXPOSED FACES OF THE BARRIER RAIL AND IN ACCORDANCE WITH ARTICLE 825-10(B) OF THE STANDARD SPECIFICATIONS. A VERTICAL CONTRACTION JOINT SHALL BE LOCATED AT EACH THIRD POINT BETWEEN BARRIER RAIL EXPANSION JOINTS. ONLY ONE CONTRACTION JOINT IS REQUIRED AT MIDPOINT OF BARRIER RAIL SEGMENTS LESS THAN 20 FEET IN LENGTH AND NO CONTRACTION JOINTS ARE REQUIRED FOR THOSE SEGMENTS LESS THAN 10 FEET IN LENGTH.

FOR EVAZOTE JOINT SEALS, SEE SPECIAL PROVISIONS.

THE NOMINAL UNCOMPRESSED SEAL WIDTH OF THE EVAZOTE JOINT SEAL SHALL BE _____ AT BENT NO. __.

PLACEMENT OF THE CONCRETE WEARING SURFACE SHALL OCCUR AFTER CASTING THE CONCRETE RAIL. THE COST OF THE REINFORCING STEEL CAST WITH THE CONCRETE WEARING SURFACE SHALL BE INCLUDED IN THE UNIT PRICE BID FOR CONCRETE WEARING SURFACE. FOR CONCRETE WEARING SURFACE, SEE SPECIAL PROVISIONS.

FOR ELASTOMERIC CONCRETE, SEE SPECIAL PROVISIONS.

THE LOCATION OF THE VOID DRAINS MAY BE SHIFTED SLIGHTLY WHERE NECESSARY TO CLEAR PRESTRESSING STRANDS OR TRANSVERSE REINFORCING STEEL.

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

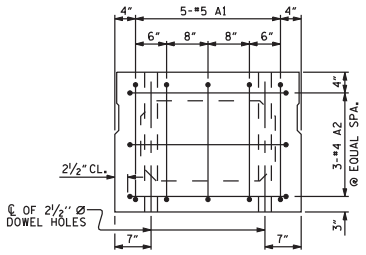
STANDARD

3'-0" X _'-_" PRESTRESSED CONCRETE BOX BEAM UNIT

ASSEMBLED BY :		DATE :
CHECKED BY :		DATE :
DRAWN BY : TLA 5/05	ADDED 7/11/05R	
CHECKED BY : GM 6/05	REV. 5/1/06R	KMM/GM

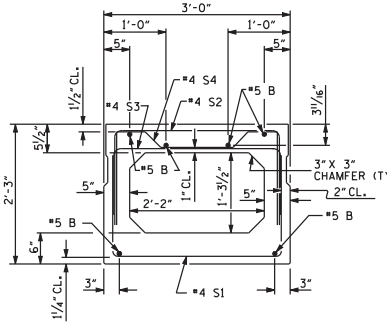
REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			
2			4			TOTAL SHEETS

STD. NO. PCBB1



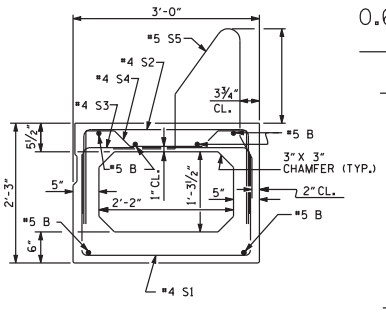
END ELEVATION

SHOWING PLACEMENT OF #5 & #4 "A" BARS AND LOCATION OF DOWEL HOLES. (INTERIOR BOX BEAM SECTION SHOWN-EXTERIOR SECTION SIMILAR EXCEPT SHEAR KEY LOCATION. STRAND LAYOUT NOT SHOWN.)



INTERIOR BOX BEAM SECTION

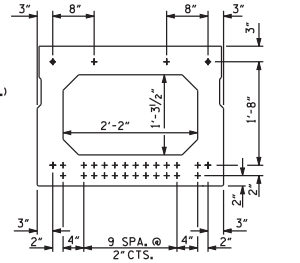
(STRAND LAYOUT NOT SHOWN)



EXTERIOR BOX BEAM SECTION

(STRAND LAYOUT NOT SHOWN)

0.6" Ø LOW RELAXATION STRAND LAYOUT



TYPICAL STRAND LOCATION

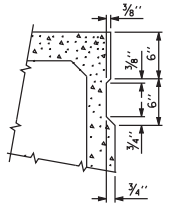
(__ STRANDS REQUIRED)

(INTERIOR BOX BEAM SECTION SHOWN-EXTERIOR SECTION SIMILAR EXCEPT SHEAR KEY LOCATION)

DEBONDING LEGEND

● FULLY BONDED STRANDS

GRADE 270 STRANDS	
	0.6" Ø L.R.
AREA (SQUARE INCHES)	0.217
ULTIMATE STRENGTH (LBS. PER STRAND)	58,600
APPLIED PRESTRESS (LBS. PER STRAND)	43,950



SHEAR KEY DETAIL

NOTE: OMIT SHEAR KEY ON OUTSIDE FACE OF EXTERIOR BOX BEAMS.

END VIEW

(SHOWING #4 "S" BARS IN END OF BEAM)

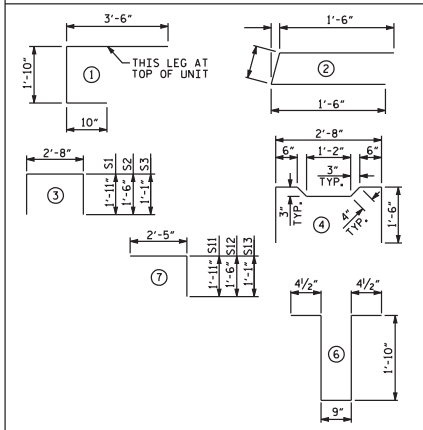
CHAMFER DETAIL

SHOWING 6" VOID CHAMFER

DETAIL "B"

EXTERIOR UNIT SHOWN, INTERIOR UNIT SIMILAR EXCEPT OMIT #5 S5 BARS. "B" BARS AND "A" BARS NOT SHOWN.

BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT

BILL OF MATERIAL FOR ONE BOX BEAM SECTION

				EXTERIOR UNIT		INTERIOR UNIT	
BAR	NUMBER	SIZE	TYPE	LENGTH	WEIGHT	LENGTH	WEIGHT
A1	10	#5	1	6'-2"	64	6'-2"	64
A2		#4	2				
B		#5	STR				
K1		#4	6	5'-2"		5'-2"	
K2		#4	STR				
S1		#4	3	6'-6"		6'-6"	
S2		#4	3	5'-8"		5'-8"	
S3		#4	3	4'-10"		4'-10"	
S4		#4	4	5'-10"		5'-10"	
S11		#4	7	4'-4"		4'-4"	
S12		#4	7	3'-11"		3'-11"	
S13		#4	7	3'-6"		3'-6"	
✱ S5		#5	5			--	--
REINFORCING STEEL					LBS.		LBS.
✱EPOXY COATED REINF. STEEL					LBS.		
--- P.S.I. CONCRETE					CU. YDS.		CU. YDS.
0.6" Ø L.R. STRANDS					No.		No.

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

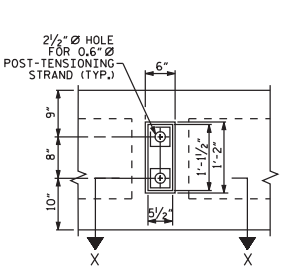
STANDARD
3'-0" X 2'-3"
PRESTRESSED CONCRETE
BOX BEAM UNIT
SPAN "_"

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			

STD. NO. PCBB2

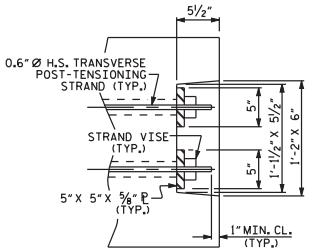
ASSEMBLED BY :	DATE :
CHECKED BY :	DATE :
DRAWN BY : TLA 5/05	ADDED 7/11/05
CHECKED BY : GM 6/05	REV. 5/1/06R TLA/GM

EXTERIOR UNIT SHOWN, INTERIOR UNIT SIMILAR EXCEPT OMIT #5 S5 BARS.
FOR LOCATION OF DIAPHRAGMS, SEE PLAN OF SPANS.
FOR REINFORCING STEEL IN DIAPHRAGMS, SEE DIAPHRAGM DETAILS.

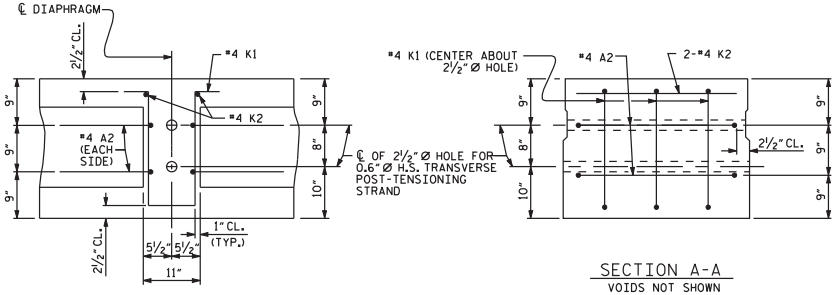


VIEW Y-Y

SHOWING ELEVATION VIEW OF GROUTED RECESS



DETAIL "C"



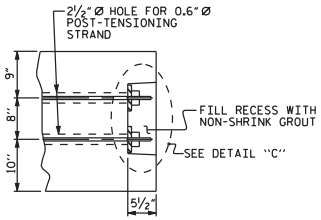
SECTION D-D

SECTION A-A

VOIDS NOT SHOWN

DOUBLE DIAPHRAGM DETAILS

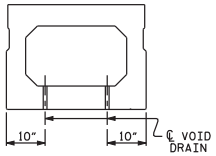
#4 "S" BARS NOT SHOWN. #4 "S" BARS MAY BE SHIFTED SLIGHTLY TO CLEAR 2" Ø HOLE.



PART SECTION AT RECESS

SHOWING PLAN VIEW OF GROUTED RECESS

GROUTED RECESS DETAIL AT END OF POST-TENSIONED STRANDS OF EXTERIOR BOX BEAM



SECTION B-B

VOID DRAIN DETAILS

(DIMENSIONS SHOWN ARE TYPICAL FOR EACH VOID)

DEAD LOAD DEFLECTION AND CAMBER			
	3'-0" x 2'-3"		
	0.6" Ø L.R. STRAND		
	SPAN "A"	SPAN "B"	SPAN "C"
CAMBER (BEAM ALONE IN PLACE)			
DEFLECTION DUE TO CONCRETE WEARING SURFACE			
FINAL CAMBER			

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

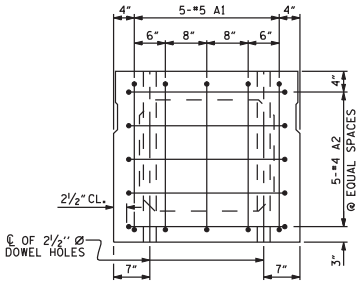
STANDARD

3'-0" X 2'-3" PRESTRESSED CONCRETE BOX BEAM UNIT

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			

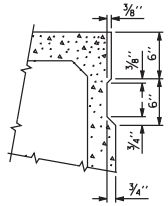
STD. NO. PCBB3

ASSEMBLED BY :	DATE :
CHECKED BY :	DATE :
DRAWN BY : TLA 5/05	ADDED 7/11/05 REV. 5/1/06 TLA/GM
CHECKED BY : GM 6/05	



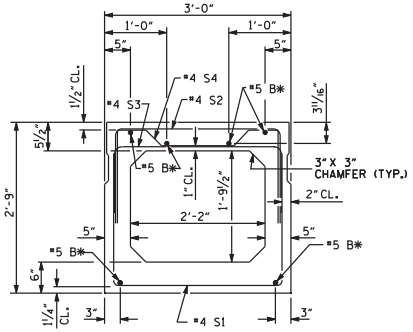
END ELEVATION

SHOWING PLACEMENT OF #5 & #4 "A" BARS AND LOCATION OF DOWEL HOLES. (INTERIOR BOX BEAM SECTION SHOWN-EXTERIOR SECTION SIMILAR EXCEPT SHEAR KEY LOCATION. STRAND LAYOUT NOT SHOWN.)



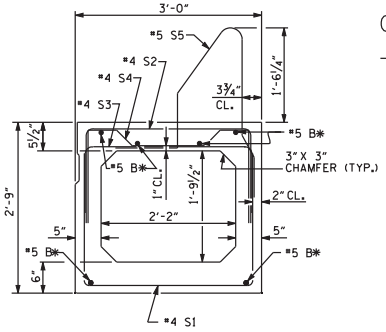
SHEAR KEY DETAIL

NOTE: OMIT SHEAR KEY ON OUTSIDE FACE OF EXTERIOR BOX BEAMS.



INTERIOR BOX BEAM SECTION

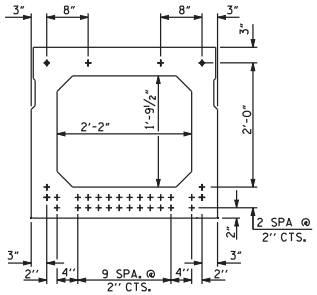
(STRAND LAYOUT NOT SHOWN)



EXTERIOR BOX BEAM SECTION

(STRAND LAYOUT NOT SHOWN)

0.6" Ø LOW RELAXATION STRAND LAYOUT



TYPICAL STRAND LOCATION

(✱ STRANDS REQUIRED)

(INTERIOR BOX BEAM SECTION SHOWN-EXTERIOR SECTION SIMILAR EXCEPT SHEAR KEY LOCATION)

DEBONDING LEGEND

● FULLY BONDED STRANDS

GRADE 270 STRANDS	
	0.6" Ø L.R.
AREA (SQUARE INCHES)	0.217
ULTIMATE STRENGTH (LBS. PER STRAND)	58,600
APPLIED PRESTRESS (LBS. PER STRAND)	43,950

DELETE IF NOT REQUIRED

END VIEW

(SHOWING #4 "S" BARS IN END OF BEAM)

DELETE IF NOT REQUIRED

DETAIL "B"

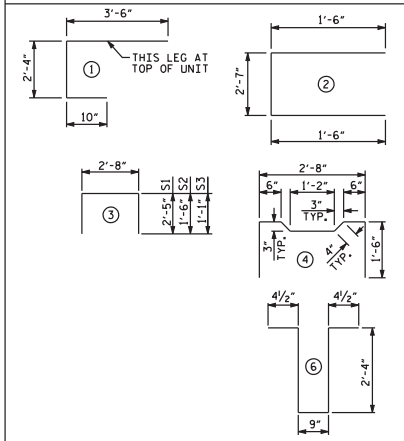
EXTERIOR UNIT SHOWN, INTERIOR UNIT SIMILAR EXCEPT OMIT #5 S5 BARS. "B" BARS AND "A" BARS NOT SHOWN.

USE FOR SKEWS UNDER 75° OR OVER 105°

CHAMFER DETAIL

SHOWING 6" VOID CHAMFER

BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT

BILL OF MATERIAL FOR ONE BOX BEAM SECTION

				EXTERIOR UNIT		INTERIOR UNIT	
BAR	NUMBER	SIZE	TYPE	LENGTH	WEIGHT	LENGTH	WEIGHT
A1	10	#5	1	6'-8"	70	6'-8"	70
A2		#4	2	5'-7"		5'-7"	
B*		#5	STR				
K1		#4	6	6'-2"		6'-2"	
K2		#4	STR	2'-7"		2'-7"	
S1		#4	3	7'-6"		7'-6"	
S2		#4	3	5'-8"		5'-8"	
S3		#4	3	4'-10"		4'-10"	
S4		#4	4	5'-10"		5'-10"	
✱ S5		#5	5			--	--
REINFORCING STEEL					LBS.		LBS.
✱ EPOXY COATED REINF. STEEL					LBS.		
--- P.S.I. CONCRETE					CU. YDS.		CU. YDS.
0.6" Ø L.R. STRANDS				No.		No.	

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

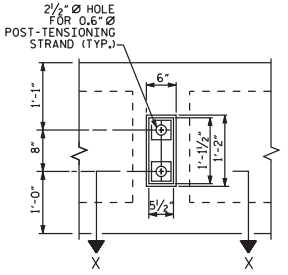
3'-0" X 2'-9" PRESTRESSED CONCRETE BOX BEAM UNIT SPAN "_"

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			

STD. NO. PCBB4

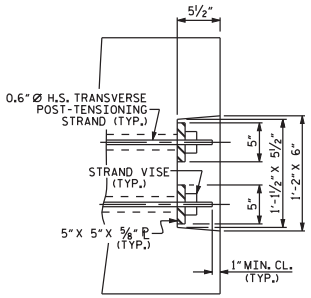
ASSEMBLED BY :	DATE :
CHECKED BY :	DATE :
DRAWN BY : TLA 5/05	ADDED 7/11/05
CHECKED BY : GM 6/05	REV. 5/1/06 TLA/GM

EXTERIOR UNIT SHOWN, INTERIOR UNIT SIMILAR EXCEPT OMIT #5 S5 BARS.
FOR LOCATION OF DIAPHRAGMS, SEE PLAN OF SPANS.
FOR REINFORCING STEEL IN DIAPHRAGMS, SEE DIAPHRAGM DETAILS.



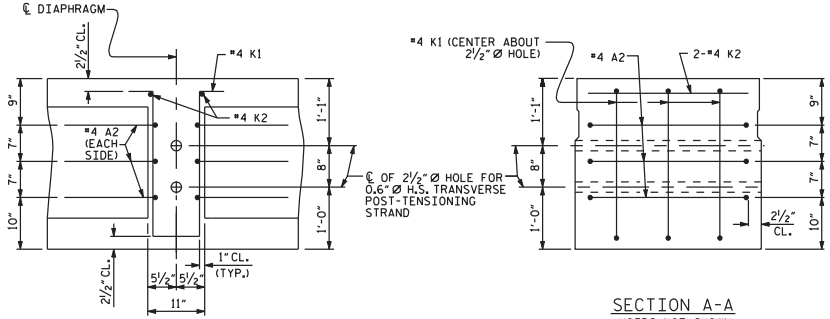
VIEW Y-Y

SHOWING ELEVATION VIEW OF GROUTED RECESS



DETAIL "C"

PLAN



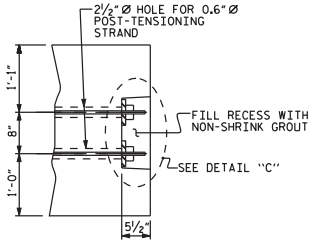
SECTION D-D

SECTION A-A

VOIDS NOT SHOWN

DOUBLE DIAPHRAGM DETAILS

#4 "S" BARS NOT SHOWN. #4 "S" BARS MAY BE SHIFTED SLIGHTLY TO CLEAR 2" Ø HOLE.

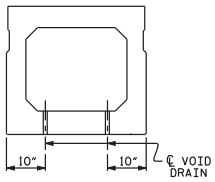


PART SECTION AT RECESS

SECTION X-X

SHOWING PLAN VIEW OF GROUTED RECESS

GROUTED RECESS DETAIL AT END OF POST-TENSIONED STRANDS OF EXTERIOR BOX BEAM



SECTION B-B

PART PLAN

VOID DRAIN DETAILS

(DIMENSIONS SHOWN ARE TYPICAL FOR EACH VOID)

DEAD LOAD DEFLECTION AND CAMBER			
	3'-0" x 2'-9"		
	0.6" Ø L.R. STRAND		
	SPAN "A"	SPAN "B"	SPAN "C"
CAMBER (BEAM ALONE IN PLACE)			
DEFLECTION DUE TO CONCRETE WEARING SURFACE			
FINAL CAMBER			

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

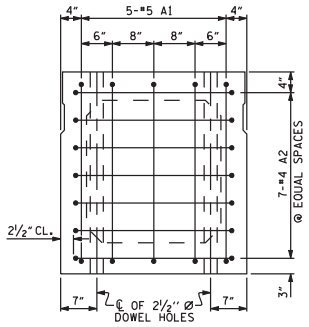
STANDARD

3'-0" X 2'-9" PRESTRESSED CONCRETE BOX BEAM UNIT

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			

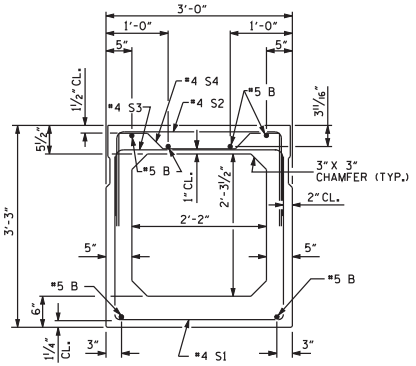
STD. NO. PCBB5

ASSEMBLED BY :	DATE :
CHECKED BY :	DATE :
DRAWN BY : TLA 5/05	ADDED 7/11/05
CHECKED BY : GM 6/05	REV. 5/1/06 TLA/GM



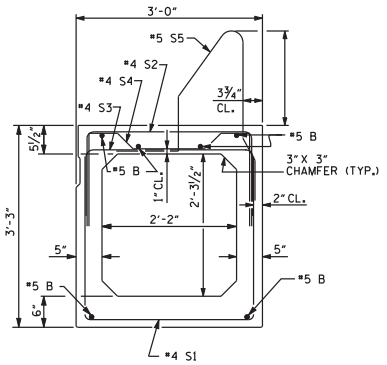
END ELEVATION

SHOWING PLACEMENT OF #5 & #4 "A" BARS AND LOCATION OF DOWEL HOLES. (INTERIOR BOX BEAM SECTION SHOWN-EXTERIOR SECTION SIMILAR EXCEPT SHEAR KEY LOCATION. STRAND LAYOUT NOT SHOWN.)



INTERIOR BOX BEAM SECTION

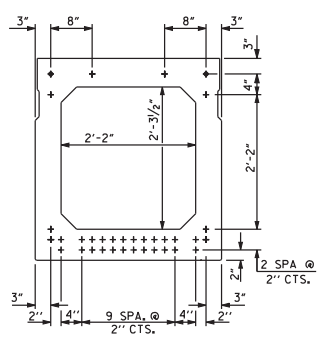
(STRAND LAYOUT NOT SHOWN)



EXTERIOR BOX BEAM SECTION

(STRAND LAYOUT NOT SHOWN)

0.6" Ø LOW RELAXATION STRAND LAYOUT



TYPICAL STRAND LOCATION

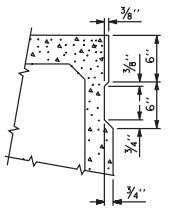
(__ STRANDS REQUIRED)

(INTERIOR BOX BEAM SECTION SHOWN-EXTERIOR SECTION SIMILAR EXCEPT SHEAR KEY LOCATION)

DEBONDING LEGEND

● FULLY BONDED STRANDS

GRADE 270 STRANDS	
	0.6" Ø L.R.
AREA (SQUARE INCHES)	0.217
ULTIMATE STRENGTH (LBS. PER STRAND)	58,600
APPLIED PRESTRESS (LBS. PER STRAND)	43,950



CHAMFER DETAIL

SHOWING 6" VOID CHAMFER

SHEAR KEY DETAIL

NOTE: OMIT SHEAR KEY ON OUTSIDE FACE OF EXTERIOR BOX BEAMS.

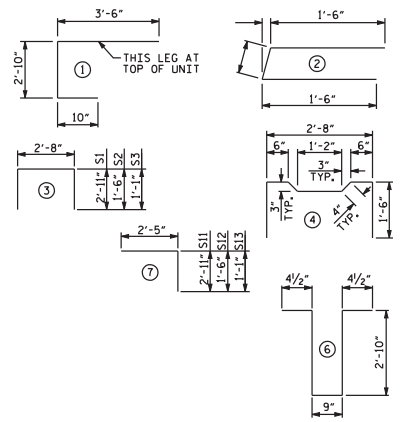
END VIEW

(SHOWING #4 "S" BARS IN END OF BEAM)

DETAIL "B"

EXTERIOR UNIT SHOWN, INTERIOR UNIT SIMILAR EXCEPT OMIT #5 S5 BARS. "B" BARS AND "A" BARS NOT SHOWN.

BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT

BILL OF MATERIAL FOR ONE BOX BEAM SECTION

				EXTERIOR UNIT		INTERIOR UNIT	
BAR	NUMBER	SIZE	TYPE	LENGTH	WEIGHT	LENGTH	WEIGHT
A1	10	#5	1	7'-2"	75	7'-2"	75
A2		#4	2				
B		#5	STR				
K1		#4	6	7'-2"		7'-2"	
K2		#4	STR				
S1		#4	3	8'-6"		8'-6"	
S2		#4	3	5'-8"		5'-8"	
S3		#4	3	4'-10"		4'-10"	
S4		#4	4	5'-10"		5'-10"	
S11		#4	7	5'-4"		5'-4"	
S12		#4	7	3'-11"		3'-11"	
S13		#4	7	3'-6"		3'-6"	
* S5		#5	5			--	--
REINFORCING STEEL					LBS.		LBS.
*EPOXY COATED REINF. STEEL					LBS.		
--- P.S.I. CONCRETE					CU. YDS.		CU. YDS.
0.6" Ø L.R. STRANDS					No.		No.

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

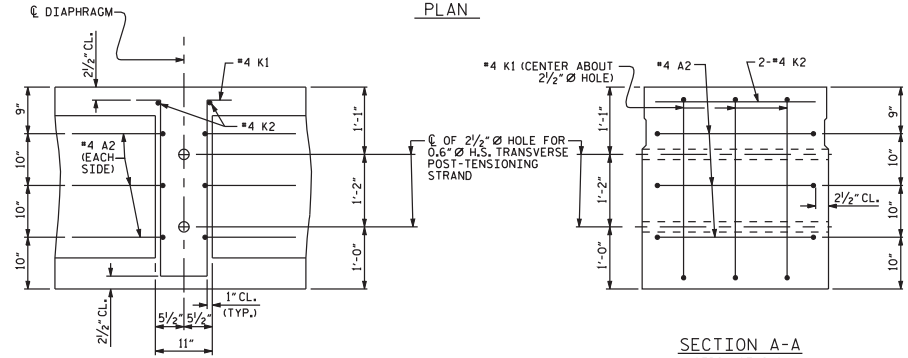
STANDARD
3'-0" X 3'-3" PRESTRESSED CONCRETE BOX BEAM UNIT SPAN "_"

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			

STD. NO. PCBB6

ASSEMBLED BY :	DATE :
CHECKED BY :	DATE :
DRAWN BY : TLA 5/05	ADDED 7/11/05
CHECKED BY : GM 6/05	REV. 5/1/06 TLA/GM

EXTERIOR UNIT SHOWN, INTERIOR UNIT SIMILAR EXCEPT OMIT #5 S5 BARS.
FOR LOCATION OF DIAPHRAGMS, SEE PLAN OF SPANS.
FOR REINFORCING STEEL IN DIAPHRAGMS, SEE DIAPHRAGM DETAILS.

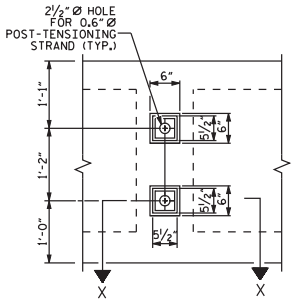


SECTION D-D

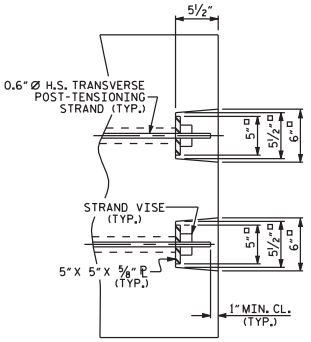
SECTION A-A
VOIDS NOT SHOWN

DOUBLE DIAPHRAGM DETAILS

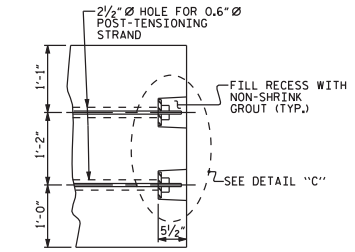
#4 "S" BARS NOT SHOWN. #4 "S" BARS MAY BE SHIFTED SLIGHTLY TO CLEAR 2" Ø HOLE.



VIEW Y-Y
SHOWING ELEVATION VIEW OF GROUTED RECESS



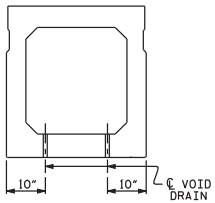
DETAIL "C"



PART SECTION AT RECESS

SECTION X-X
SHOWING PLAN VIEW OF GROUTED RECESS

GROUTED RECESS DETAIL AT END OF POST-TENSIONED STRANDS OF EXTERIOR BOX BEAM



SECTION B-B

PART PLAN

VOID DRAIN DETAILS

(DIMENSIONS SHOWN ARE TYPICAL FOR EACH VOID)

DEAD LOAD DEFLECTION AND CAMBER			
	3'-0" x 3'-3"		
	0.6" Ø L.R. STRAND		
	SPAN "A"	SPAN "B"	SPAN "C"
CAMBER (BEAM ALONE IN PLACE)			
DEFLECTION DUE TO CONCRETE WEARING SURFACE			
FINAL CAMBER			

ASSEMBLED BY :	DATE :
CHECKED BY :	DATE :
DRAWN BY : TLA 5/05	ADDED 7/11/05
CHECKED BY : GM 6/05	REV. 5/1/06 TLA/GM

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

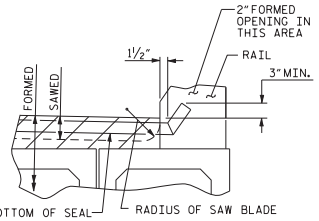
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

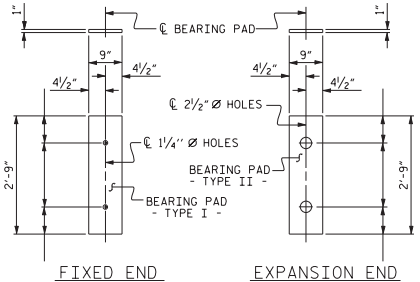
3'-0" X 3'-3" PRESTRESSED CONCRETE BOX BEAM UNIT

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			

STD. NO. PCBB7



SECTION A-A



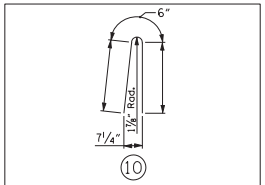
FIXED END
(TYPE I - _ REQ'D)

EXPANSION END
(TYPE II - _ REQ'D)

ELASTOMERIC BEARING DETAILS

ELASTOMER IN ALL BEARINGS SHALL BE 60 DUROMETER HARDNESS.

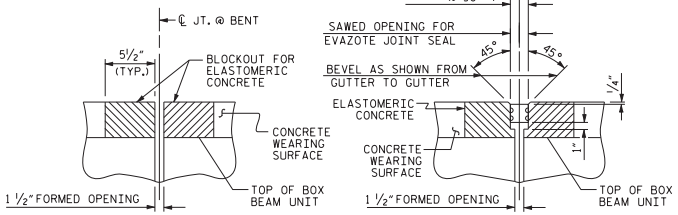
BOX BEAM UNITS REQUIRED			
	NUMBER	LENGTH	TOTAL LENGTH
SPAN A			
SPAN B			
SPAN C			
TOTAL		——	



BAR TYPE

BAR DIMENSIONS ARE OUT TO OUT

BILL OF MATERIAL FOR CONCRETE BARRIER RAIL									
BAR	BARS PER SPAN					TOTAL NO.	SIZE	TYPE	LENGTH	WEIGHT
	SPAN A	SPAN B	SPAN C							
✳B							#5	STR		
✳B							#5	STR		
✳B							#5	STR		
✳S6							#5	10		
✳EPOXY COATED REINFORCING STEEL LBS.										
CLASS AA CONCRETE CU.YDS.										
TOTAL LIN. FT. OF CONCRETE BARRIER RAIL										

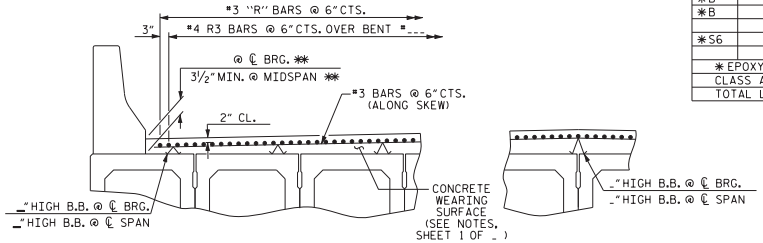


SECTION C-C
EVAZOTE JOINT SEAL
(PRE-SAWED ELASTOMERIC CONCRETE DIMENSIONS)

SECTION C-C
EVAZOTE JOINT SEAL

JOINT SEAL DETAILS AT BENT

(SHOWING FULL DEPTH BLOCKOUT)



REINFORCING FOR CONCRETE WEARING SURFACE

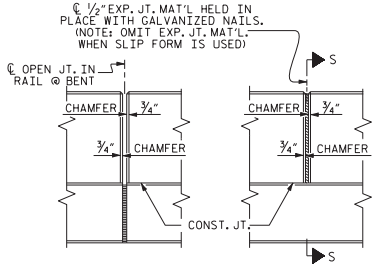
✳✳ BASED ON PREDICTED FINAL CAMBER AND THEORETICAL GRADE LINE ELEVATIONS

GROOVING BRIDGE FLOORS	
APPROACH SLABS	SQ.FT.
BRIDGE DECK	SQ.FT.
TOTAL	SQ.FT.

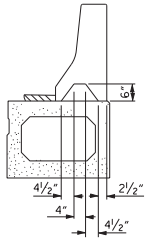
SPLICE LENGTH CHART	
BAR SIZE	EPOXY COATED
#3	1'-3"
#4	1'-8"

ELASTOMERIC CONCRETE	
BENT NO.	ELASTOMERIC CONCRETE ✳ (CU. FT.)
1	
2	
TOTAL	

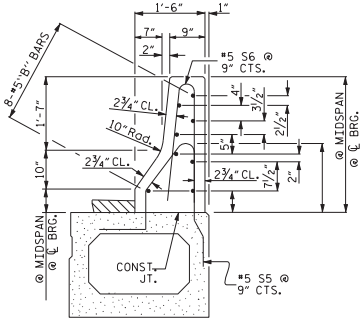
✳ BASED ON THE MINIMUM BLOCKOUT SHOWN.



ELEVATION AT EXPANSION JOINTS



SECTION S-S
AT DAM IN OPEN JOINT
(THIS IS TO BE USED ONLY WHEN SLIP FORM IS USED)



SECTION THRU RAIL

PLAN SHOWING CONCRETE WEARING SURFACE REINFORCING STEEL

BILL OF MATERIAL FOR CONCRETE WEARING SURFACE					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
✳R1		#3	STR		
✳R2		#3	STR		
✳R3		#4	STR	20'-0"	
✳EPOXY COATED REINFORCING STEEL LBS.					
CONCRETE WEARING SURFACE SQ. FT.					

BARRIER RAIL DETAILS

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD
3'-0" X _'-_"
PRESTRESSED CONCRETE
BOX BEAM UNIT DETAILS

ASSEMBLED BY :	DATE :
CHECKED BY :	DATE :
DRAWN BY : TLA 5/05	ADDED 7/11/05R
CHECKED BY : GM 6/05	REV. 5/1/06RR TLA/GM

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			

STD. NO. PCBB8

NOTES

ALL PRESTRESSING STRANDS SHALL BE 7-WIRE LOW RELAXATION GRADE 270 STRANDS AND SHALL CONFORM TO AASHTO M203M EXCEPT FOR SAMPLING REQUIREMENTS WHICH SHALL BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.

ALL REINFORCING STEEL CAST WITH THE BOX BEAM SECTIONS SHALL BE GRADE 420 AND SHALL BE INCLUDED IN THE UNIT PRICE BID FOR PRESTRESSED CONCRETE BOX BEAMS.

RECESSES FOR TRANSVERSE STRANDS SHALL BE GROUTED AFTER THE TENSIONING OF THE STRANDS.

THE 64mm Ø DOWEL HOLES AT FIXED ENDS OF BOX BEAM SECTIONS SHALL BE FILLED WITH NON-SHRINK GROUT. THE 64mm Ø DOWEL HOLES AT EXPANSION ENDS OF BOX BEAM SECTIONS SHALL BE FILLED WITH JOINT SEALER MATERIAL TO 38mm ABOVE THE TOP OF DOWELS AND THEN FILLED WITH GROUT.

THE JOINT SEALER MATERIAL SHALL CONFORM TO THE REQUIREMENTS OF TYPE SL LOW MODULUS SILICONE SEALANT. THE 51mm Ø BACKER ROD SHALL CONFORM TO THE REQUIREMENTS OF TYPE M BOND BREAKER. SEE SECTION 1028 OF THE STANDARD SPECIFICATIONS.

THE TRANSFER OF LOAD FROM THE ANCHORAGES TO THE BOX BEAM UNIT SHALL BE DONE WHEN THE CONCRETE HAS REACHED A COMPRESSIVE STRENGTH OF NOT LESS THAN ____ MPa.

ALL REINFORCING STEEL IN BARRIER RAILS AND CONCRETE WEARING SURFACE SHALL BE EPOXY COATED.

PRESTRESSING STRANDS SHALL BE CUT FLUSH WITH THE BOX BEAM UNIT ENDS.

APPLY EPOXY PROTECTIVE COATING TO BOX BEAM UNIT ENDS.

VERTICAL GROOVED CONTRACTION JOINTS, 12mm IN DEPTH, SHALL BE TOOLED IN ALL EXPOSED FACES OF THE BARRIER RAIL AND IN ACCORDANCE WITH ARTICLE 825-10(B) OF THE STANDARD SPECIFICATIONS. A VERTICAL CONTRACTION JOINT SHALL BE LOCATED AT EACH THIRD POINT BETWEEN BARRIER RAIL EXPANSION JOINTS. ONLY ONE CONTRACTION JOINT IS REQUIRED AT MIDPOINT OF BARRIER RAIL SEGMENTS LESS THAN 6.1m IN LENGTH AND NO CONTRACTION JOINTS ARE REQUIRED FOR THOSE SEGMENTS LESS THAN 3.5m IN LENGTH.

FOR EVAZOTE JOINT SEAL, SEE SPECIAL PROVISIONS.

THE NOMINAL UNCOMPRESSED SEAL WIDTH OF THE EVAZOTE JOINT SEAL SHALL BE _____ AT BENT NO. __.

PLACEMENT OF THE CONCRETE WEARING SURFACE SHALL OCCUR AFTER CASTING THE CONCRETE RAIL. THE COST OF THE REINFORCING STEEL CAST WITH THE CONCRETE WEARING SURFACE SHALL BE INCLUDED IN THE UNIT PRICE BID FOR CONCRETE WEARING SURFACE. FOR CONCRETE WEARING SURFACE, SEE SPECIAL PROVISIONS.

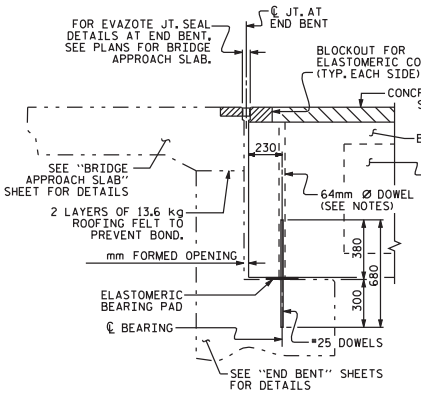
FOR ELASTOMERIC CONCRETE, SEE SPECIAL PROVISIONS.

LOCATION OF THE VOID DRAINS MAY BE SHIFTED SLIGHTLY WHERE NECESSARY TO CLEAR PRESTRESSING STRANDS OR TRANSVERSE REINFORCING STEEL.

TYPICAL SECTION

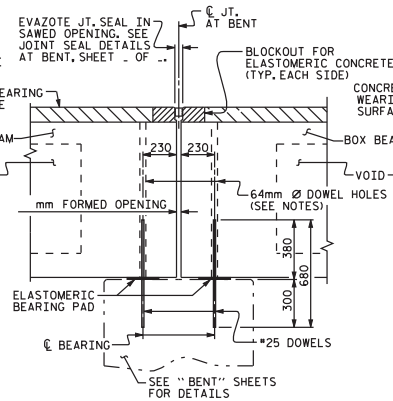
*BASED ON PREDICTED FINAL CAMBER AND THEORETICAL GRADE LINE ELEVATIONS

FIXED END
OR
EXPANSION END



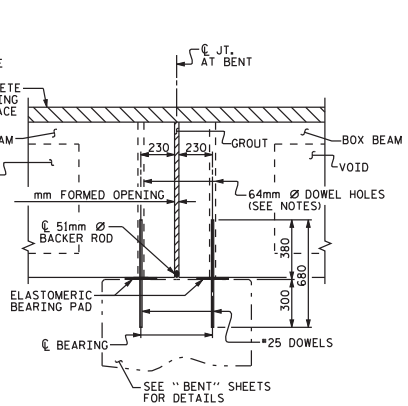
SECTION AT END BENT

FIXED END EXPANSION END



SECTION AT BENT

FIXED END FIXED END



SECTION AT BENT

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

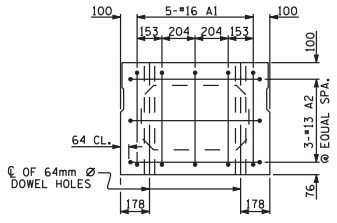
914mm X mm
PRESTRESSED CONCRETE
BOX BEAM UNIT

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			

ASSEMBLED BY :	DATE :
CHECKED BY :	DATE :
DRAWN BY : TLA 5/05	ADDED 7/11/05R
CHECKED BY : GM 6/05	REV. 5/1/06R KMM/GM

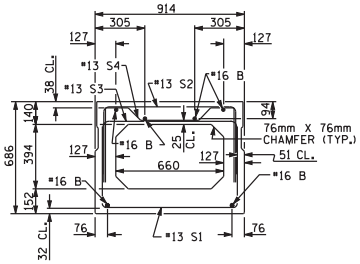
$$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

STD. NO. PCBB1SM



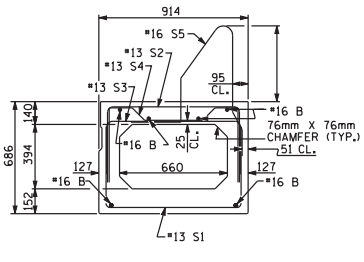
END ELEVATION

SHOWING PLACEMENT OF #16 & #13 "A" BARS AND LOCATION OF DOWEL HOLES. (INTERIOR BOX BEAM SECTION SHOWN-EXTERIOR SECTION SIMILAR EXCEPT SHEAR KEY LOCATION. STRAND LAYOUT NOT SHOWN.)



INTERIOR BOX BEAM SECTION

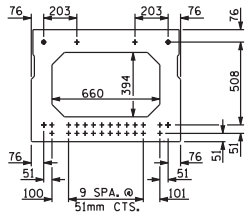
(STRAND LAYOUT NOT SHOWN)



EXTERIOR BOX BEAM SECTION

(STRAND LAYOUT NOT SHOWN)

15.24mm Ø LOW RELAXATION STRAND LAYOUT



TYPICAL STRAND LOCATION

(__ STRANDS REQUIRED)

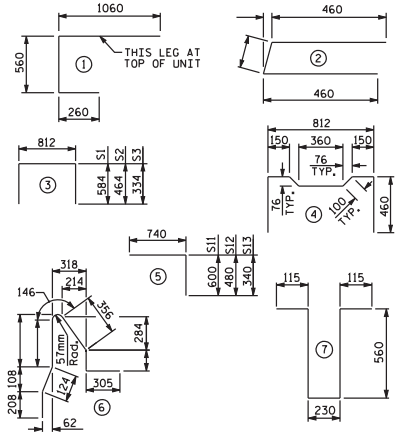
(INTERIOR BOX BEAM SECTION SHOWN-EXTERIOR SECTION SIMILAR EXCEPT SHEAR KEY LOCATION)

DEBONDING LEGEND

● FULLY BONDED STRANDS

GRADE 270 STRANDS	
	15.24mm Ø L.R.
AREA (mm^2)	140.00
ULTIMATE STRENGTH (KN PER STRAND)	260.7
APPLIED PRESTRESS (KN PER STRAND)	195.5

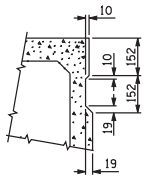
BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT

BILL OF MATERIAL FOR ONE BOX BEAM SECTION

				EXTERIOR UNIT		INTERIOR UNIT	
BAR	NUMBER	SIZE	TYPE	LENGTH	WEIGHT	LENGTH	WEIGHT
A1	10	#16	1	1880	29	1880	29
A2		#13	2				
B		#16	STR				
K1		#13	7	1580		1580	
K2		#13	STR				
S1		#13	3	1980		1980	
S2		#13	3	1740		1740	
S3		#13	3	1480		1480	
S4		#13	4	1780		1780	
S11		#13	5	1340		1340	
S12		#13	5	1220		1220	
S13		#13	5	1080		1080	
✱ S5		#16	6			--	--
REINFORCING STEEL					kg		kg
✱ EPOXY COATED REINF. STEEL					kg		
--- MPa CONCRETE					CU. METERS		CU. METERS
15.24mm Ø L.R. STRANDS					No.		No.



END VIEW

(SHOWING #13 "S" BARS IN END OF BEAM)

SHEAR KEY DETAIL

NOTE: OMIT SHEAR KEY ON OUTSIDE FACE OF EXTERIOR BOX BEAMS.

CHAMFER DETAIL

SHOWING 150mm VOID CHAMFER

DETAIL "B"

EXTERIOR UNIT SHOWN, INTERIOR UNIT SIMILAR EXCEPT OMIT #16 S5 BARS. "B" BARS AND "A" BARS NOT SHOWN.

PLAN OF BOX BEAM

EXTERIOR UNIT SHOWN, INTERIOR UNIT SIMILAR EXCEPT OMIT #16 S5 BARS. FOR LOCATION OF DIAPHRAGMS, SEE PLAN OF SPANS. FOR REINFORCING STEEL IN DIAPHRAGMS, SEE DIAPHRAGM DETAILS.

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD
914mm X 686mm
PRESTRESSED CONCRETE
BOX BEAM UNIT

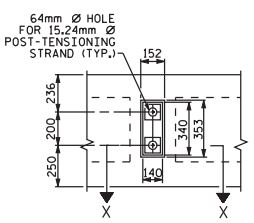
SPAN "_"

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			

ASSEMBLED BY :	DATE :
CHECKED BY :	DATE :
DRAWN BY : TLA 5/05	ADDED 7/8/05
CHECKED BY : GM 6/05	REV. 5/1/06R TLA/GM

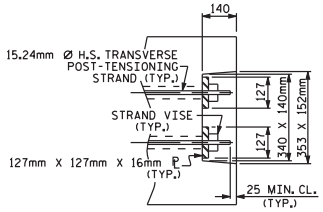
$$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$$$
$$$$$USERNAME$$$$

STD. NO. PCBB2SM



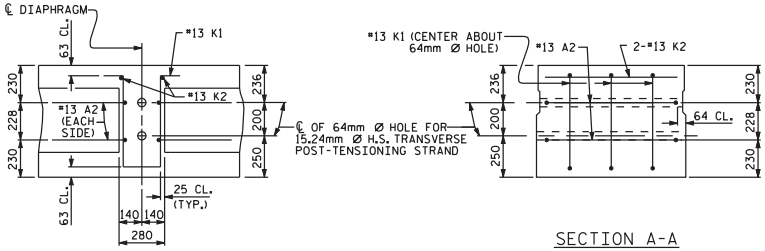
VIEW Y-Y

SHOWING ELEVATION VIEW OF GROUTED RECESS



DETAIL "C"

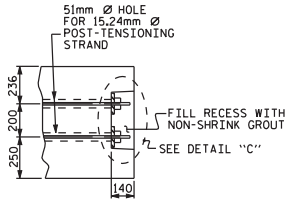
PLAN



SECTION D-D

SECTION A-A

VOIDS NOT SHOWN



PART SECTION AT RECESS

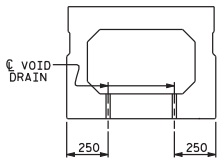
SECTION X-X

SHOWING PLAN VIEW OF GROUTED RECESS

DOUBLE DIAPHRAGM DETAILS

*13 "S" BARS NOT SHOWN. *13 "S" BARS MAY BE SHIFTED SLIGHTLY TO CLEAR 51mm Ø HOLE.

GROUTED RECESS DETAIL AT END OF POST-TENSIONED STRANDS OF EXTERIOR BOX BEAM



SECTION B-B

PART PLAN

VOID DRAIN DETAILS

(DIMENSIONS SHOWN ARE TYPICAL FOR EACH VOID)

DEAD LOAD DEFLECTION AND CAMBER			
	914mm x 686mm		
	15.24mm Ø L.R. STRAND		
	SPAN "A"	SPAN "B"	SPAN "C"
CAMBER (BEAM ALONE IN PLACE)			
DEFLECTION DUE TO CONCRETE WEARING SURFACE			
FINAL CAMBER			

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

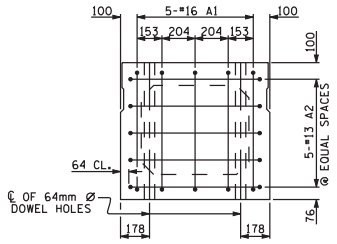
914mm X 686mm
PRESTRESSED CONCRETE
BOX BEAM UNIT

ASSEMBLED BY :	DATE :
CHECKED BY :	DATE :
DRAWN BY : TLA 5/05	ADDED 7/8/05
CHECKED BY : GM 6/05	REV. 5/1/06 TLA/GM

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			

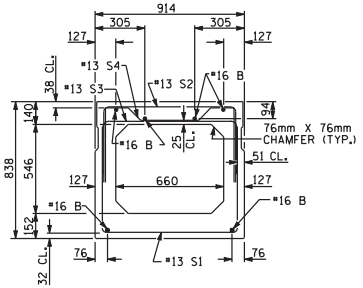
$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

STD. NO. PCBB3SM



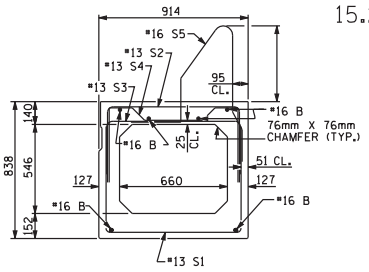
END ELEVATION

SHOWING PLACEMENT OF #16 & #13 "A" BARS AND LOCATION OF DOWEL HOLES. (INTERIOR BOX BEAM SECTION SHOWN-EXTERIOR SECTION SIMILAR EXCEPT SHEAR KEY LOCATION. STRAND LAYOUT NOT SHOWN.)



INTERIOR BOX BEAM SECTION

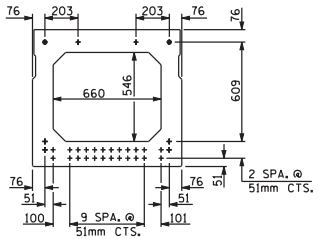
(STRAND LAYOUT NOT SHOWN)



EXTERIOR BOX BEAM SECTION

(STRAND LAYOUT NOT SHOWN)

15.24mm Ø LOW RELAXATION STRAND LAYOUT



TYPICAL STRAND LOCATION

(_ STRANDS REQUIRED)

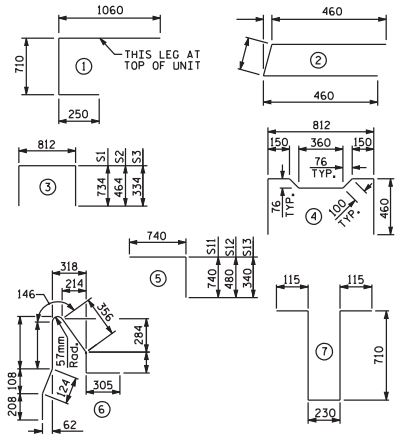
(INTERIOR BOX BEAM SECTION SHOWN-EXTERIOR SECTION SIMILAR EXCEPT SHEAR KEY LOCATION)

DEBONDING LEGEND

● FULLY BONDED STRANDS

GRADE 270 STRANDS	
	15.24mm Ø L.R.
AREA (mm^2)	140.00
ULTIMATE STRENGTH (KN PER STRAND)	260.7
APPLIED PRESTRESS (KN PER STRAND)	195.5

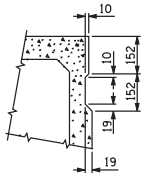
BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT

BILL OF MATERIAL FOR ONE BOX BEAM SECTION

				EXTERIOR UNIT		INTERIOR UNIT	
BAR	NUMBER	SIZE	TYPE	LENGTH	WEIGHT	LENGTH	WEIGHT
A1	10	#16	1	2020	31	2020	31
A2		#13	2				
B		#16	STR				
K1		#13	7	1880		1880	
K2		#13	STR				
S1		#13	3	2280		2280	
S2		#13	3	1740		1740	
S3		#13	3	1480		1480	
S4		#13	4	1780		1780	
S11		#13	5	1480		1480	
S12		#13	5	1220		1220	
S13		#13	5	1080		1080	
✱ S5		#16	6			--	--
REINFORCING STEEL					kg		kg
✱ EPOXY COATED REINF. STEEL					kg		
--- MPa CONCRETE					CU. METERS		CU. METERS
15.24mm Ø L.R. STRANDS					No.		No.



SHEAR KEY DETAIL

NOTE: OMIT SHEAR KEY ON OUTSIDE FACE OF EXTERIOR BOX BEAMS.

END VIEW

(SHOWING #13 "S" BARS IN END OF BEAM)

CHAMFER DETAIL

SHOWING 150mm VOID CHAMFER

DETAIL "B"

EXTERIOR UNIT SHOWN, INTERIOR UNIT SIMILAR EXCEPT OMIT #16 S5 BARS. "B" BARS AND "A" BARS NOT SHOWN.

PLAN OF BOX BEAM

EXTERIOR UNIT SHOWN, INTERIOR UNIT SIMILAR EXCEPT OMIT #16 S5 BARS.
FOR LOCATION OF DIAPHRAGMS, SEE PLAN OF SPANS.
FOR REINFORCING STEEL IN DIAPHRAGMS, SEE DIAPHRAGM DETAILS.

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD
914mm X 838mm
PRESTRESSED CONCRETE
BOX BEAM UNIT

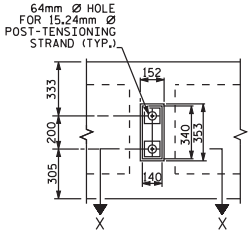
SPAN "_"

ASSEMBLED BY :	DATE :
CHECKED BY :	DATE :
DRAWN BY : TLA 5/05	ADDED 7/8/05
CHECKED BY : GM 6/05	REV. 5/1/06R TLA/GM

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			

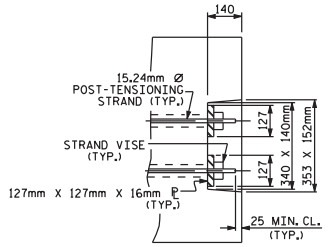
$$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

STD. NO. PCBB4SM



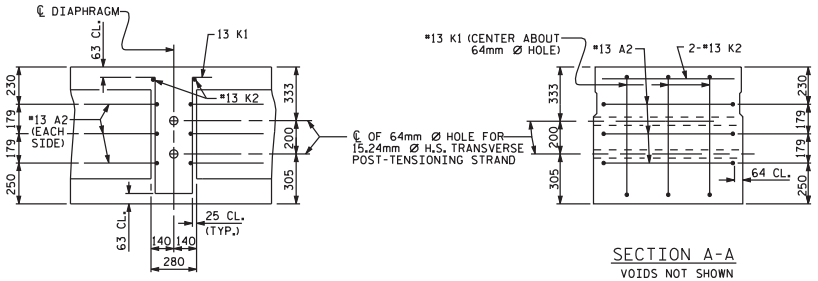
VIEW Y-Y

SHOWING ELEVATION VIEW OF GROUTED RECESS



DETAIL "C"

PLAN



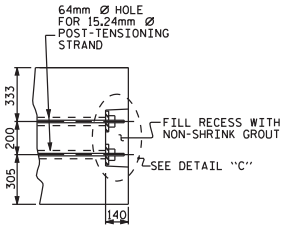
SECTION D-D

SECTION A-A

VOIDS NOT SHOWN

DOUBLE DIAPHRAGM DETAILS

*13 "S" BARS NOT SHOWN. *13 "S" BARS MAY BE SHIFTED SLIGHTLY TO CLEAR 51mm Ø HOLE.

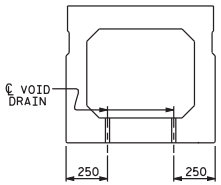


PART SECTION AT RECESS

SECTION X-X

SHOWING PLAN VIEW OF GROUTED RECESS

GROUTED RECESS DETAIL AT END OF POST-TENSIONED STRANDS OF EXTERIOR BOX BEAM



SECTION B-B

PART PLAN

VOID DRAIN DETAILS

(DIMENSIONS SHOWN ARE TYPICAL FOR EACH VOID)

DEAD LOAD DEFLECTION AND CAMBER			
	914mm x 838mm		
	15.24mm Ø L.R. STRAND		
	SPAN "A"	SPAN "B"	SPAN "C"
CAMBER (BEAM ALONE IN PLACE)			
DEFLECTION DUE TO CONCRETE WEARING SURFACE			
FINAL CAMBER			

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

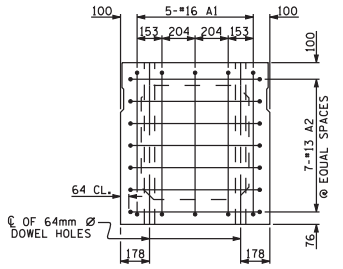
914mm X 838mm
PRESTRESSED CONCRETE
BOX BEAM UNIT

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			

ASSEMBLED BY :	DATE :
CHECKED BY :	DATE :
DRAWN BY : TLA 5/05	ADDED 7/8/05
CHECKED BY : GM 6/05	REV. 5/1/06 TLA/GM

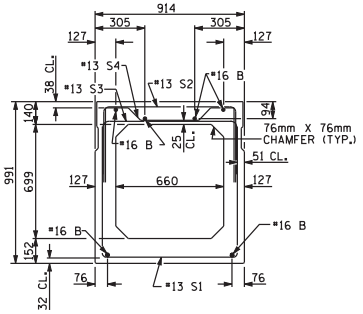
$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

STD. NO. PCBB5SM



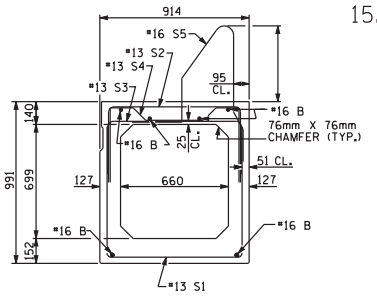
END ELEVATION

SHOWING PLACEMENT OF #16 & #13 "A" BARS AND LOCATION OF DOWEL HOLES. (INTERIOR BOX BEAM SECTION SHOWN-EXTERIOR SECTION SIMILAR EXCEPT SHEAR KEY LOCATION. STRAND LAYOUT NOT SHOWN.)



INTERIOR BOX BEAM SECTION

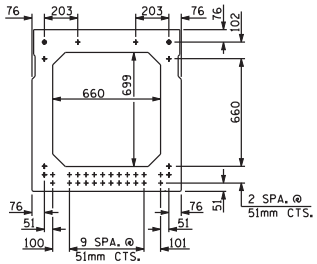
(STRAND LAYOUT NOT SHOWN)



EXTERIOR BOX BEAM SECTION

(STRAND LAYOUT NOT SHOWN)

15.24mm Ø LOW RELAXATION STRAND LAYOUT



TYPICAL STRAND LOCATION

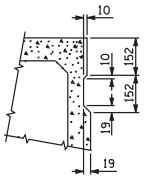
(__ STRANDS REQUIRED)

(INTERIOR BOX BEAM SECTION SHOWN-EXTERIOR SECTION SIMILAR EXCEPT SHEAR KEY LOCATION)

DEBONDING LEGEND

● FULLY BONDED STRANDS

GRADE 270 STRANDS	
	15.24mm Ø L.R.
AREA (mm^2)	140.00
ULTIMATE STRENGTH (KN PER STRAND)	260.7
APPLIED PRESTRESS (KN PER STRAND)	195.5



SHEAR KEY DETAIL

NOTE: OMIT SHEAR KEY ON OUTSIDE FACE OF EXTERIOR BOX BEAMS.

CHAMFER DETAIL

SHOWING 150mm VOID CHAMFER

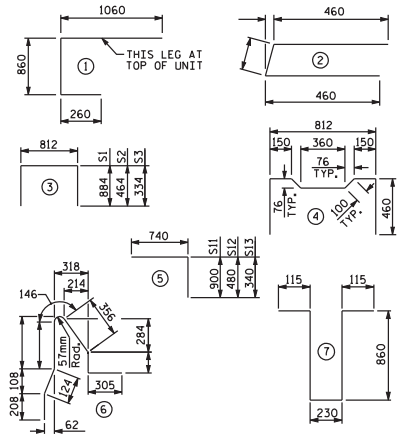
END VIEW

(SHOWING #13 "S" BARS IN END OF BEAM)

DETAIL "B"

EXTERIOR UNIT SHOWN. INTERIOR UNIT SIMILAR EXCEPT OMIT #16 S5 BARS. "B" BARS AND "A" BARS NOT SHOWN.

BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT

BILL OF MATERIAL FOR ONE BOX BEAM SECTION

BAR	NUMBER	SIZE	TYPE	EXTERIOR UNIT LENGTH	EXTERIOR UNIT WEIGHT	INTERIOR UNIT LENGTH	INTERIOR UNIT WEIGHT
A1	10	#16	1	2180	34	2180	34
A2		#13	2				
B		#16	STR				
K1		#13	7	2180		2180	
K2		#13	STR				
S1		#13	3	2580		2580	
S2		#13	3	1740		1740	
S3		#13	3	1480		1480	
S4		#13	4	1780		1780	
S11		#13	5	1640		1640	
S12		#13	5	1220		1220	
S13		#13	5	1080		1080	
✱ S5		#16	6			--	--
REINFORCING STEEL					kg		kg
✱ EPOXY COATED REINF. STEEL					kg		
--- MPa CONCRETE					CU. METERS		CU. METERS
15.24mm Ø L.R. STRANDS					No.		No.

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD
914mm X 991mm PRESTRESSED CONCRETE BOX BEAM UNIT

SPAN "_"

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			

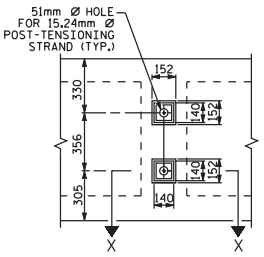
PLAN OF BOX BEAM

EXTERIOR UNIT SHOWN, INTERIOR UNIT SIMILAR EXCEPT OMIT #16 S5 BARS.
FOR LOCATION OF DIAPHRAGMS, SEE PLAN OF SPANS.
FOR REINFORCING STEEL IN DIAPHRAGMS, SEE DIAPHRAGM DETAILS.

ASSEMBLED BY :	DATE :
CHECKED BY :	DATE :
DRAWN BY : TLA 5/05	ADDED 7/8/05
CHECKED BY : GM 6/05	REV. 5/1/06R TLA/GM

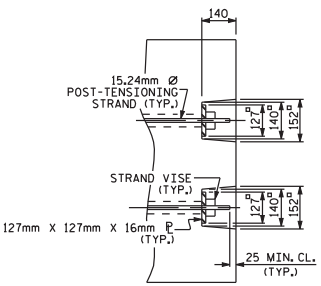
$$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

STD. NO. PCBB6SM



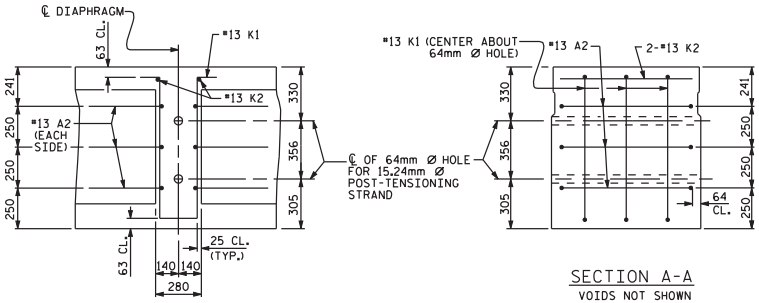
VIEW Y-Y

SHOWING ELEVATION VIEW OF GROUTED RECESS



DETAIL "C"

PLAN



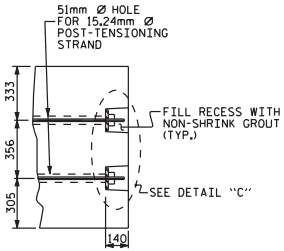
SECTION D-D

SECTION A-A

VOIDS NOT SHOWN

DOUBLE DIAPHRAGM DETAILS

#13 "S" BARS NOT SHOWN. #13 "S" BARS MAY BE SHIFTED SLIGHTLY TO CLEAR 51mm Ø HOLE.

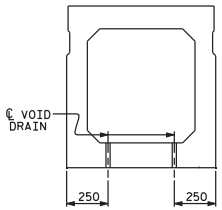


PART SECTION AT RECESS

SECTION X-X

SHOWING PLAN VIEW OF GROUTED RECESS

GROUTED RECESS DETAIL AT END OF POST-TENSIONED STRAND OF EXTERIOR BOX BEAM



SECTION B-B

PART PLAN

VOID DRAIN DETAILS

(DIMENSIONS SHOWN ARE TYPICAL FOR EACH VOID)

DEAD LOAD DEFLECTION AND CAMBER			
	914mm x 991mm		
	15.24mm Ø L.R. STRAND		
	SPAN "A"	SPAN "B"	SPAN "C"
CAMBER (BEAM ALONE IN PLACE)			
DEFLECTION DUE TO CONCRETE WEARING SURFACE			
FINAL CAMBER			

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

914mm X 991mm
PRESTRESSED CONCRETE
BOX BEAM UNIT

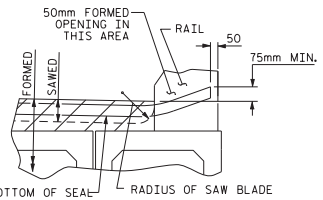
USE .0014 X SCALE FOR PE SEAL

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			

ASSEMBLED BY :	DATE :
CHECKED BY :	DATE :
DRAWN BY : TLA 5/05	ADDED 7/8/05
CHECKED BY : GM 6/05	REV. 5/1/06 TLA/GM

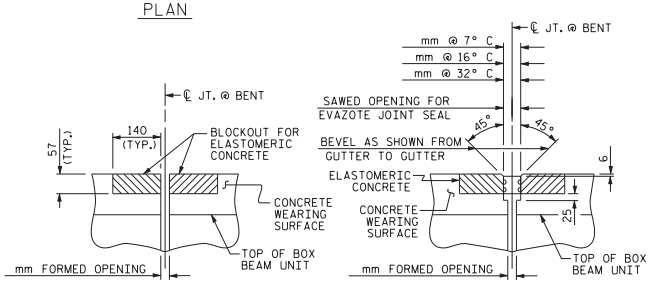
$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$$$$
$$$$USERNAME$$$$

STD. NO. PCBB7SM



SECTION A-A

PLAN



SECTION C-C
EVAZOTE JOINT SEAL
(PRE-SAWED ELASTOMERIC CONCRETE DIMENSIONS)

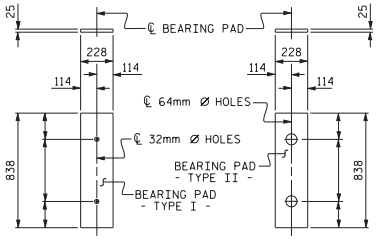
SECTION C-C
EVAZOTE JOINT SEAL

JOINT SEAL DETAILS AT BENT

(SHOWING PARTIAL DEPTH BLOCKOUT)

ELASTOMERIC CONCRETE	
BENT NO.	ELASTOMERIC CONCRETE * (CU. m)
1	
2	
TOTAL	

* BASED ON THE MINIMUM BLOCKOUT SHOWN.

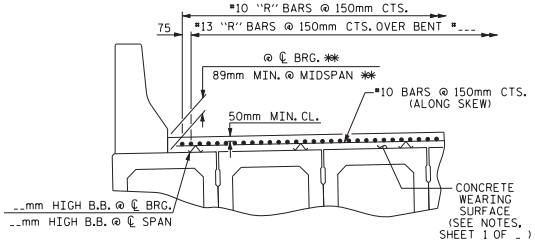


FIXED END
(TYPE I - _ REQ'D)

EXPANSION END
(TYPE II - _ REQ'D)

ELASTOMERIC BEARING DETAILS

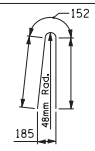
ELASTOMER IN ALL BEARINGS SHALL BE 60 DUROMETER HARDNESS.



REINFORCING FOR CONCRETE WEARING SURFACE

** BASED ON PREDICTED FINAL CAMBER AND THEORETICAL GRADE LINE ELEVATIONS

BOX BEAM UNITS REQUIRED			
	NUMBER	LENGTH	TOTAL LENGTH
SPAN A			
SPAN B			
SPAN C			
TOTAL		———	



(10)

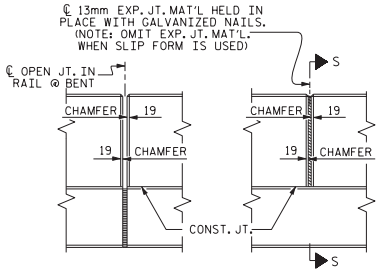
BAR TYPE

BAR DIMENSIONS ARE OUT TO OUT

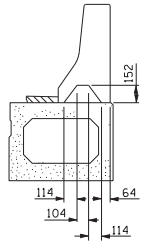
BILL OF MATERIAL FOR CONCRETE BARRIER RAIL								
BAR	BARS PER SPAN				TOTAL NO.	SIZE	TYPE	LENGTH	WEIGHT
	SPAN A	SPAN B	SPAN C						
*B						#16	STR		
*B						#16	STR		
*B						#16	STR		
*S6						#16	10		
*EPOXY COATED REINFORCING STEEL kg									
CLASS AA CONCRETE CU. METERS									
TOTAL LENGTH OF CONCRETE BARRIER RAIL METERS									

GROOVING BRIDGE FLOORS	
APPROACH SLABS	SQ.METER
BRIDGE DECK	SQ.METER
TOTAL	SQ.METER

SPLICE LENGTH CHART	
BAR SIZE	EPOXY COATED
#10	390
#13	510

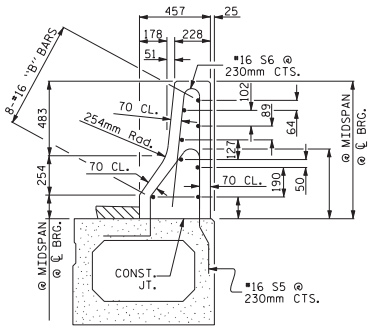


ELEVATION AT EXPANSION JOINTS



SECTION S-S

AT DAM IN OPEN JOINT (THIS IS TO BE USED ONLY WHEN SLIP FORM IS USED)



SECTION THRU RAIL

BARRIER RAIL DETAILS

PLAN SHOWING CONCRETE WEARING SURFACE REINFORCING STEEL

BILL OF MATERIAL FOR CONCRETE WEARING SURFACE					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
*R1		#10	STR		
*R2		#10	STR		
*R3		#13	STR	6100	
*EPOXY COATED REINFORCING STEEL kg					
CONCRETE WEARING SURFACE SQ. METERS					

PROJECT NO. _____

_____ COUNTY

STATION: _____

SHEET _ OF _

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

914mm X ___mm
PRESTRESSED CONCRETE
BOX BEAM UNIT DETAILS

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			

ASSEMBLED BY :	DATE :
CHECKED BY :	DATE :
DRAWN BY : TLA 5/05	ADDED 7/11/05R
CHECKED BY : GM 6/05	REV. 5/1/06RR TLA/GM

STD. NO. PCBB8SM