ASCE-INDOT
STRUCTURAL SUBCOMMITTEE
MEETING NO. 38 MINUTES
December 13, 2007

The meeting was called to order at 1:05 pm by Steve Weintraut. Those in attendance were:

Anne Rearick	INDOT, Structural Services
Greg Klevitsky	INDOT, Structural Services
Naveed Burki	INDOT, Structural Services
Tony Uremovich	INDOT, Structural Services
Ron McCaslin	INDOT, Structural Services
Bill Dittrich	INDOT, Program Development
Mike McCool	Beam Longest & Neff, LLC.
Mike Obergfell	USI Consultants, Inc.
Mike Wenning	American Structurepoint, Inc.
Burleigh Law	HNTB Corp.
Steve Weintraut	Butler, Fairman and Seufert, Inc.
Michael Matel	Butler, Fairman and Seufert, Inc.

In addition to the attendees, these minutes will be sent to the following:

George Snyder	INDOT, Structural Services
Chris Hill	Prestress Services
Jim Reilman	INDOT, Construction Management
Tony Zander	INDOT, Materials and Tests Division
Keith Hoernschmeyer	Federal Highway Administration
Jason Yeager	Gohman Asphalt Company
Dick O'Connor	RQAW Corporation

A meeting agenda had previously been distributed and the following items were discussed:

1. The September 6, 2007, meeting minutes were approved as written, and have been placed on the INDOT website.

2. The adhesive specification, which was presented at the last meeting by Mike Obergfell, is currently being reviewed by the INDOT Materials Management Office. This specification will be presented to the INDOT Standards Committee for approval in January 2008.

3. Tony Uremovich is currently working on a design memo which will address the effects of torsion on the amount of reinforcing steel required in the hammerhead portion of the pier. When Tony is completed, he will e-mail the information to the group to review before the next meeting.

4. The subject of bridge-deck crack control with the application of the "Z" factor was discussed. Mike Wenning passed out the following design policies:

    - Indiana Design Manual Section 62-1.07
    - AASHTO LRFD, 3rd Edition, Section 5.7.3.4
    - AASHTO LRFD, 4rd Edition, Section 5.7.3.4

All the members in the group agreed that Indiana Design Manual Section 62-1.07 was incorrect and needed to be totally rewritten. It was also felt that the AASHTO formulas which addressed crack control in the bridge deck were not correct.

Mike McCool passed out a design memorandum from West Virginia which addressed this subject (Attachment No. 1). Mike and Steve Weintraut also informed the group of a seminar that Professor Robert Frosch of Purdue University presented at the AASHTO T-10 meeting this past fall which addressed this subject. For crack control in a bridge deck, it was felt that the spacing of the reinforcing steel was more critical and appeared to be what controlled. It was pointed out that the area of reinforcing steel provided did not have much significance with regards to crack control. Using the "Z" factor for the basis of this design was considered to be incorrect. It was suggested that 8-inch reinforcing spacing be used as a standard bridge-deck spacing for both mats of steel in each direction. Anne Rearick asked that a formal proposal be presented to her with regards to this subject. She asked that the proposal identify specific sections of the Indiana Design Manual where revisions are required. Mike McCool volunteered to make this proposal.

5. In Meeting No. 35, the group discussed and formulated ideas to revise the current pavement-ledge detail at the end bent. Tony Uremovich will put together a final detail that incorporates the ideas presented at that meeting and send it out to the group for review and comment.

6. The revised detail for the mild reinforcing steel, which is placed around the bottom strands in the precast concrete I-beams and girders has been presented to the INDOT Standards Committee. Tony Uremovich is currently waiting on approval from the appropriate parties before this detail can be incorporated into the Indiana Design Manual.

7. Details for the precast, prestressed, concrete Hybrid Bulb-T beams were presented at the last meeting. It was reported that these details have also been forwarded to the appropriate parties for approval. It was asked that these beams be incorporated into the beam-selection chart for designers to use when selecting the appropriate beam for a specific span range.

8. Concrete deck overhang design for precast concrete Bulb-T beams was discussed. There appears to be an inconsistency between AASHTO LRFD, 3rd Edition, Section 4.6.2.1.6, and Indiana Design Manual Section 61-5.02(01) with regards to the design section for negative moment. Both references agree that the design negative moment is computed at a distance of 1/3 of the beam flange width from the center of the support. But, AASHTO also stipulates that this distance not exceed 15 inches from the support. Tony Uremovich will report back to the group if the Indiana Design Manual is consistent with AASHTO on this subject.

9. The subgroup, which is working on addressing the designer's responsibility for incorporating construction loading into the project's design, has met several times. The subgroup is nearly complete with the formulation of the general notes which will be placed on the plans that address construction loading. Anne Rearick will present these general notes to a group of contractors for their review.

10. It was identified in the last meeting that there appeared to be inconsistencies between Indiana Design Manual Section 67-1.01(05) items 2 and 3. Steve Weintraut passed out a proposed revision to this section (Attachment No. 2). The question of whether or not the longitudinal forces transmitted from the superstructure to the substructure are resisted by the passive earth pressure behind the integral end bent and approach slab was discussed. It was pointed out that there are many projects, which have been built, where the design of the concrete-wall pier on a single row of piles has relied on the passive earth pressure behind the integral end bent to resist this longitudinal force. These wall piers are flexible and have performed well in the field. Anne Rearick asked members of the group to e-mail her detailed summaries which address this subject for her to review.

11. LRFD training for designers was briefly discussed. It was felt that Eriksson Technologies would be contacted to present this seminar. Mike McCool will make this contact and obtain information on the different formats in which to present this training.

12. An agenda item for the next meeting will be “Tolerance for Cambers on Bulb-T Beams”. If the actual cambers in the field vary from the design cambers of the beam, problems arise since the beams have such wide top flanges and are relatively long. It was pointed out that it would be advantageous if the cambers of the beams could be measured before the beams are unloaded from the delivery trucks.

The next meeting for the INDOT Structural Subcommittee is scheduled for 9:00 am on February 7, 2008, in a room to be determined.

This meeting was adjourned at 3:30 p.m.

Respectfully submitted,
BUTLER, FAIRMAN and SEUFERT, INC.

Michael Matel, P.E.
mmatel@bfsengr.com

MM:lm

Attachments

ATTACHMENT No. 1

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
Division of Highways
1900 Kanawha Boulevard East • Building Five • Room 110
Charleston, West Virginia 25305-0430 • 304/558-3505

Joe Manchin III
Governor

November 9, 2005

MEMORANDUM

TO: All District Engineers/Managers
All District Construction Engineers
All District Bridge Engineers
Mr. Richard Genthner, Materials Division
Federal Highway Administration
DDA, DDC, DDE, DDI, DDR, DDT

FROM: Greg Bailey
DD and PC

SUBJECT: Standard Cast-in-Place Concrete Bridge Decks

The West Virginia Division of Highways adopted the AASHTO LRFD Bridge Design Specifications as our governing design specification in 1998. Subsequent to adopting these specifications, we developed and issued design guidance including drawings concerning the concrete thickness, reinforcement amounts, and reinforcement placement for cast-in-place reinforced concrete bridge decks.

A significant number of bridges have been constructed using the design guidance with no apparent problems. However, due to recently observed longitudinal cracking on bridge decks under construction and some decks open to traffic we are initiating an effort to study the cause and significance of these cracks. We are, therefore, issuing the attached revised design guidance that is to be used on all cast-in-place concrete bridge decks. All field and design personnel should carefully review this guidance. Particular attention should be directed to the "Design Guidance Limitations" and its affect on active projects. Field personnel are asked to please note the limits on construction loads and form support projection into the concrete slab.

This guidance is effective immediately and is to be used on all design projects and all projects advertised for construction after the date of this memorandum. Projects under construction contract prior to the date of this memorandum will be investigated on a case by case basis. The proposed deck to be constructed on projects under construction, will require the approval of the Director of Contract Administration Division and the Director of Engineering Division. Deck designs utilizing the previous guidance shall not be constructed or incorporated into design projects after the date of this memorandum without the approval of the Deputy State Highway Engineer - Development.

These changes are to be considered interim guidance until the above described study is completed. The issuance of these interim guidelines should not be construed as an indication of design or constructability errors in relation to the previous guidance.

All design and construction personnel shall comply with the attached deck design guidance effective immediately. Questions concerning the implementation of this guidance on projects should be handled through the normal, current approval process. The normal approval process should be followed on both design and construction projects.

Questions concerning this deck design guidance should be directed to Mr. Greg Bailey, Acting Director of Engineering Division at (304) 558-2885.

Thank you for your cooperation in this matter.

GLB:m

Attachment

cc: DD, PC, CP, HP, HD, CH, CC

DESIGN GUIDANCE LIMITATIONS

1. Bridge decks shall have the following construction load limitations:

   a. No construction equipment with an axle load greater than 20,000 lbs. (20 kips) shall be permitted on the slab at any time.

   b. No construction equipment or loads that are not required to complete the slab, parapets, railing, overlay, lighting, or other appurtenances shall be allowed on the bridge deck.

2. The "Maximum Effective Slab Length" for decks utilizing the Design Guidance shall be as follows:

   a. 11' – 7½" for 8" slab without overlay
   b. 11' – 3" for 7½" slab with 2" overlay

3. Maximum Effective Slab Length greater than the above limits shall require the designer to submit proposed design to the Director of Engineering Division for approval. The design shall be based on the following criteria:

   a. Deck Thickness > $\frac{\text{Effective Span Length}}{18}$

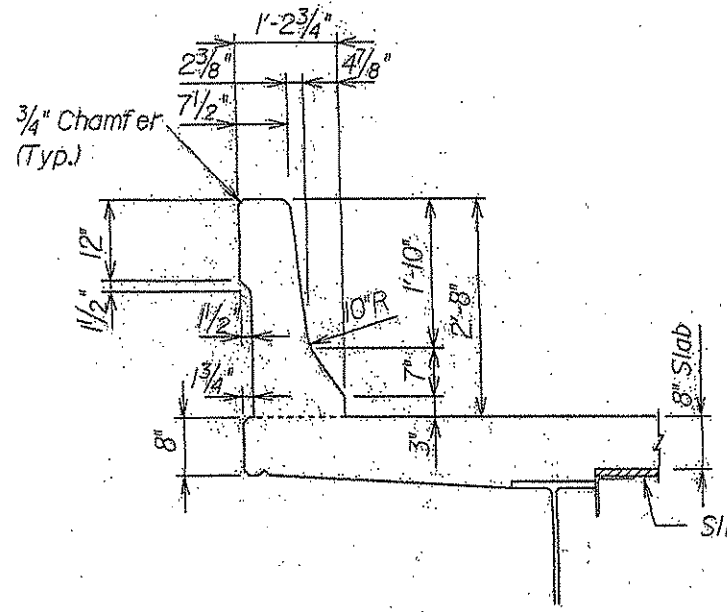
      Note: Deck Thickness shall be Nominal Thickness minus ¼" for monolithic decks and shall be the initial slab thickness for decks including a two (2") overlay.

   b. The minimum Area of Reinforcement, in each direction, shall be 0.6% of the gross concrete area. This reinforcement shall be equally divided between the top and bottom layer of steel.

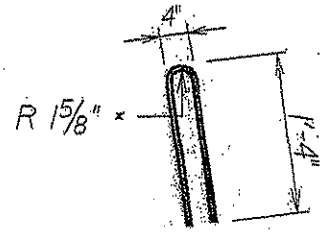
   c. Two (2") inches of cover shall be provided on the top layer of reinforcement in the initial slab for all decks with two (2") inch overlay.

   d. All other sections of the LRFD must be satisfied.

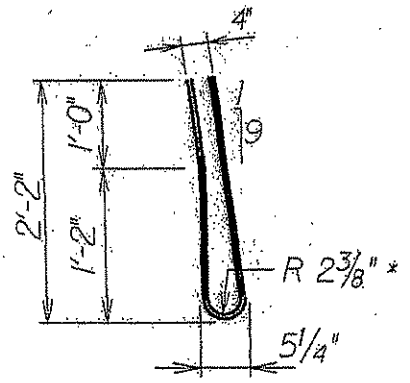
   e. Reinforcement details shown account for the 1% steel requirement in the negative moment region for steel bridges per Article 6.10.1.7 of the LRFD code. Additional steel in the negative moment region will be required for concrete bridges.



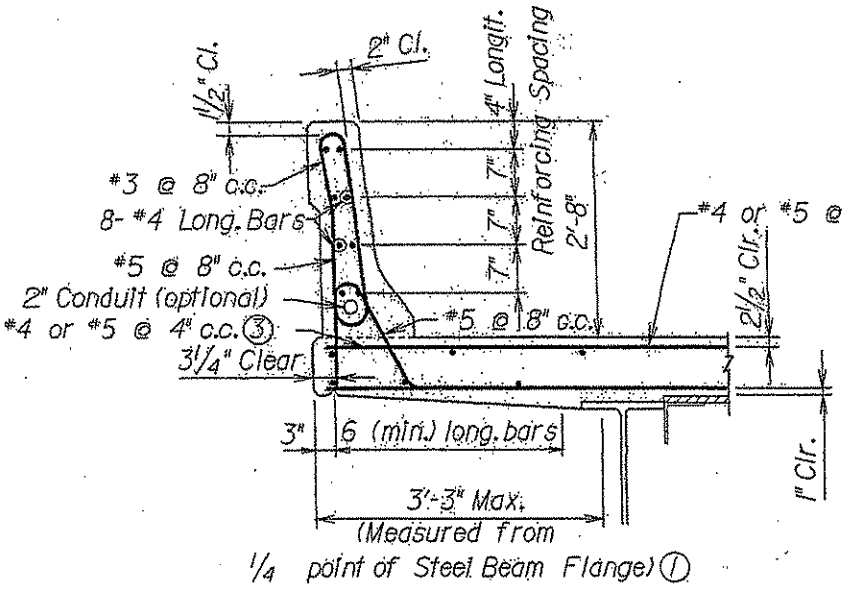
CONCRETE BRIDGE BARRIER FOR CONVENTIONAL DECKS



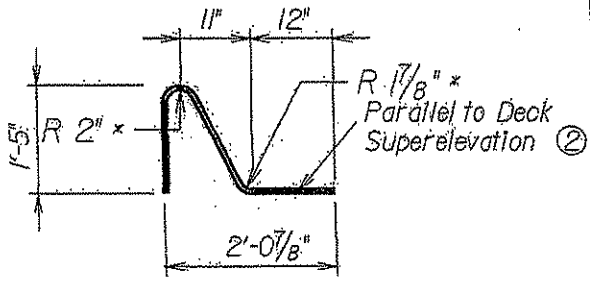
HAIRPIN #3 BAR (TOP)



HAIRPIN #5 BAR (BOTTOM)



BARRIER REINFORCING



TIE #5 BAR

NOTES:

① For concrete beams, deck cantilever is to be measured as per AASHTO.

② Parapet and required reinforcing steel shall be constructed plumb. Bend horizontal leg in the Tie bar as necessary to match deck superelevation.

③ For slab cantilevers longer than 3'-3", transverse overhang reinforcing shall be designed in accordance with AASHTO LRFD Design Code.

④ This sheet is to be worked with the LRFD deck sheet.

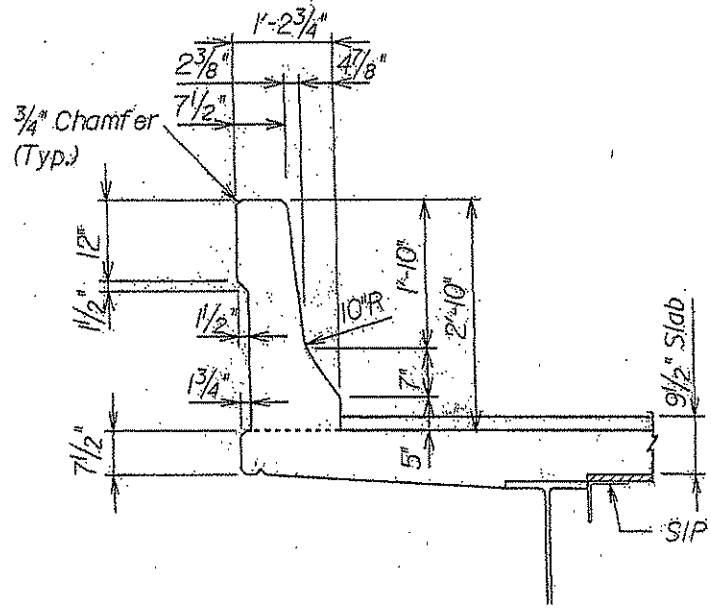
* Inside Radius

W. VA. DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
ENGINEERING DIVISION

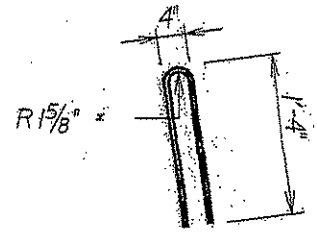
2'-8" TYPE F BRIDGE BARRIER AND REINFORCING

SHEET 1 OF 3

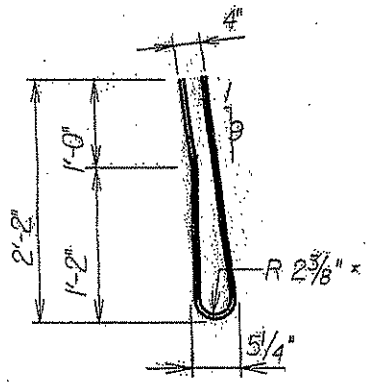
11-07-05

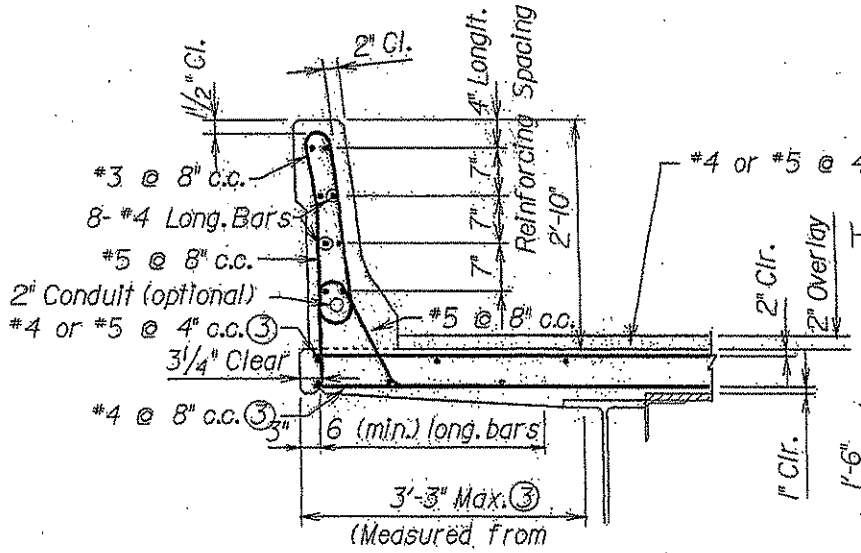


CONCRETE BRIDGE BARRIER FOR DECKS WITH A DUAL PROTECTION SYSTEM



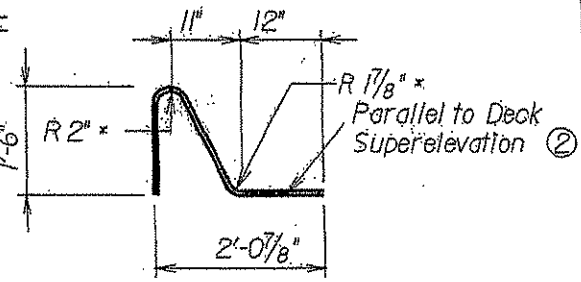
HAIRPIN #3 BAR (TOP)





BARRIER REINFORCING

HAIRPIN #5 BAR (BOTTOM)



TIE #5 BAR

NOTES:

① For concrete beams, deck cantilever is to be measured as per AASHTO.

② Parapet and required reinforcing steel shall be constructed plumb. Bend horizontal leg in the Tie bar as necessary to match deck superelevation.

③ For slab cantilevers longer than 3'-3", transverse overhang reinforcing shall be designed in accordance with AASHTO LRFD Design Code.

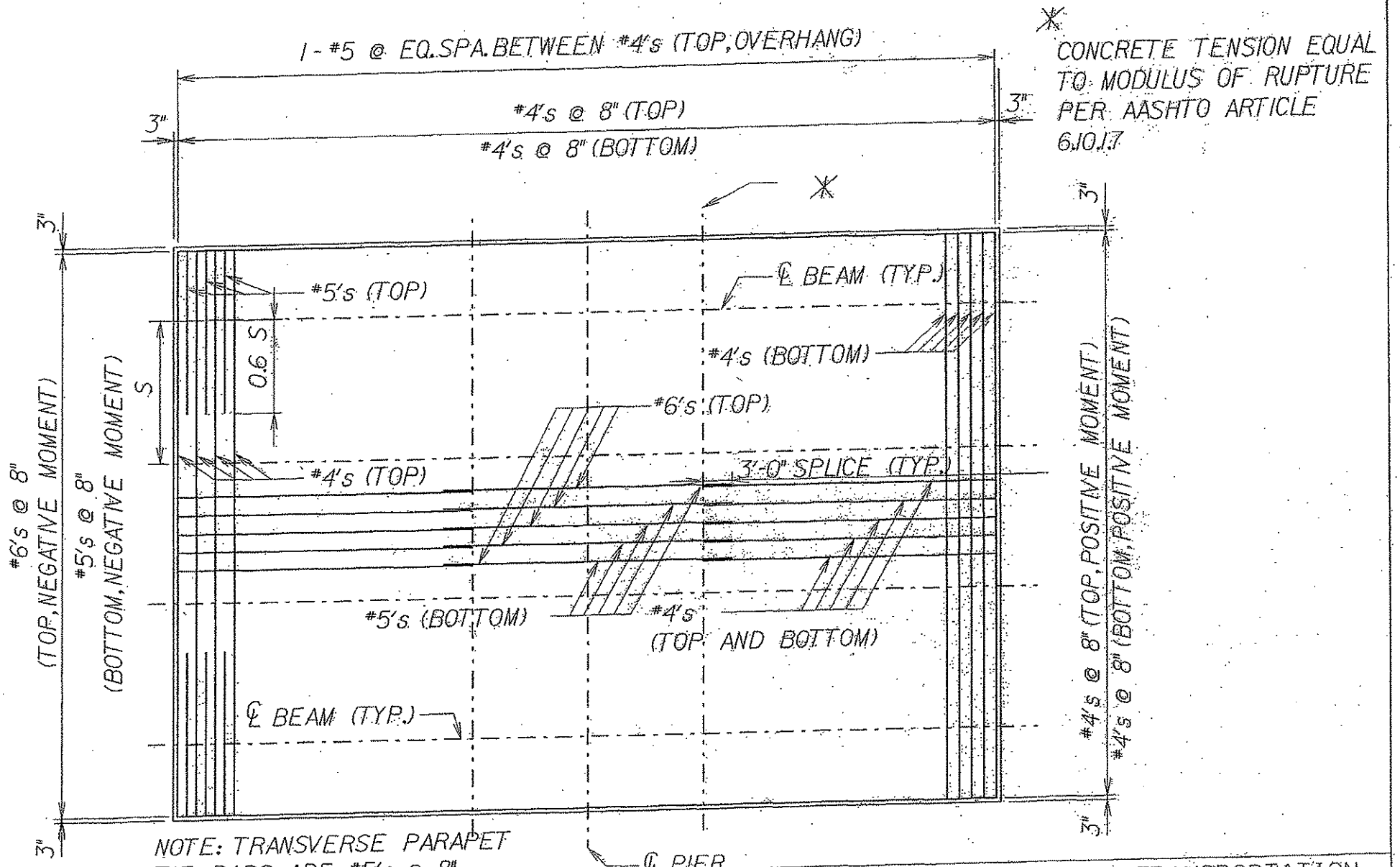
④ This sheet is to be worked with the LRFD deck sheet.

11-07-05

* Inside Radius

W. VA. DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
ENGINEERING DIVISION

2'-8" TYPE F DUAL SYSTEM BRIDGE BARRIER AND REINFORCING



* CONCRETE TENSION EQUAL TO MODULUS OF RUPTURE PER AASHTO ARTICLE 6.10.1.7

NOTE: TRANSVERSE PARAPET TIE BARS ARE #5's @ 8".

TRANSVERSE COMBO RAIL TIE BARS ARE #4's @ 12".

W. VA. DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
ENGINEERING DIVISION

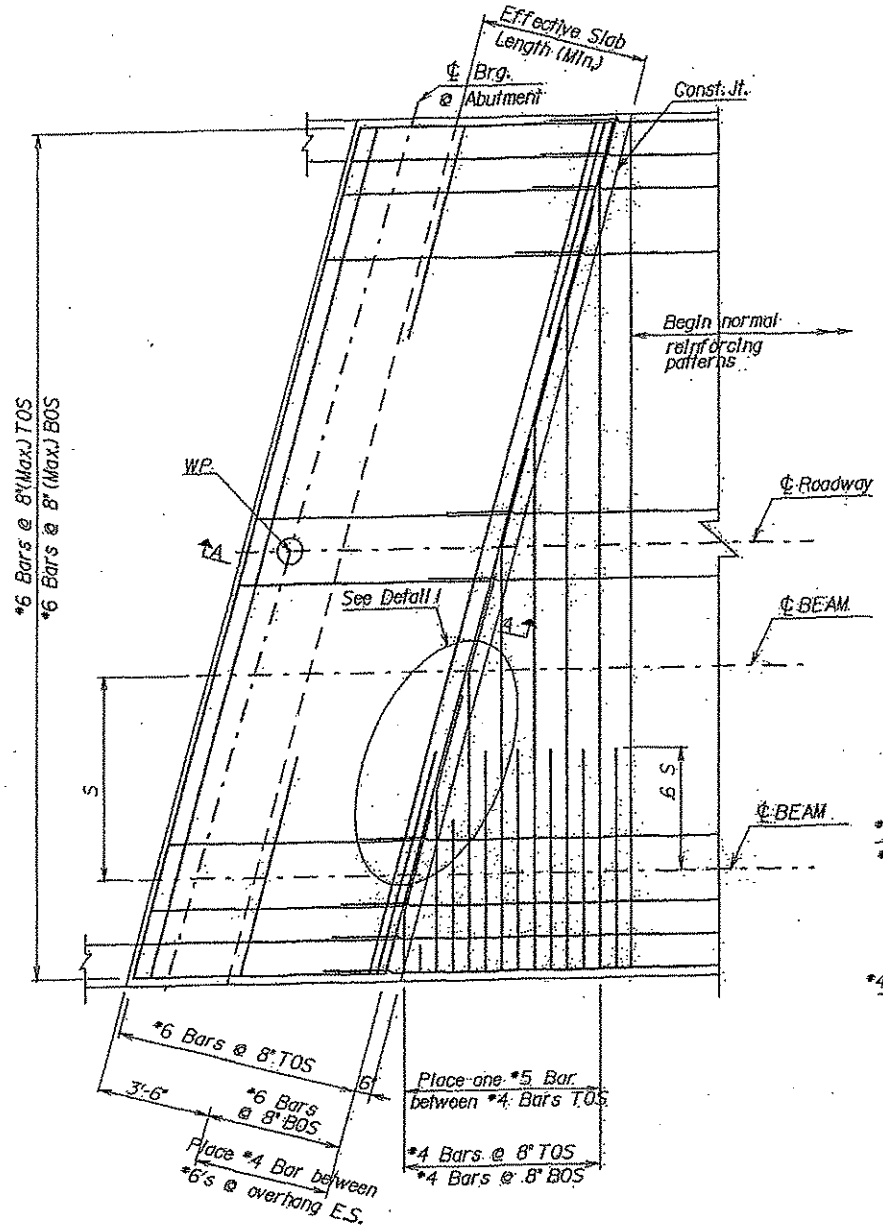
EMPIRICAL DECK

DWG. NO.

SHEET 3 OF 3

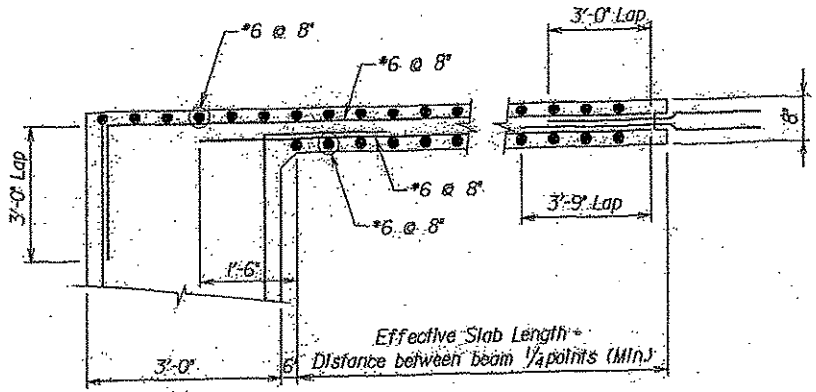
11-07-05

PROJECT NUMBERS		DISTRICT	COUNTY	SHEET NO.	TOT
STATE	FEDERAL				

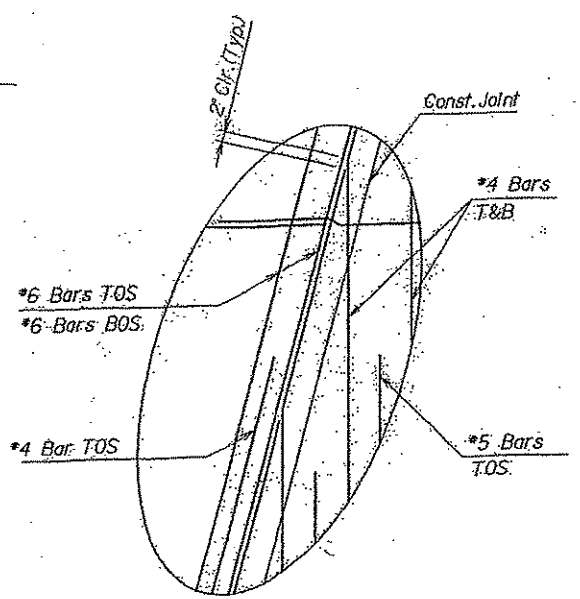


PLAN

Integral/semi-integral (shown)
Skewed jointed slab (similar)



SECT A-A



DETAIL 1

NOTE:
Details shown are for all deck end-zone reinforcing except jointed slabs with skews less than 25°.

ABBREVIATIONS:
TOS—Top of Slab
BOS—Bottom of Slab
T&B—Top & Bottom
ES—Each Side

NO.	REVISION	DATE:	B
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W. VA. DEPARTMENT OF HIGHWAYS
ENGINEERING DIVISION

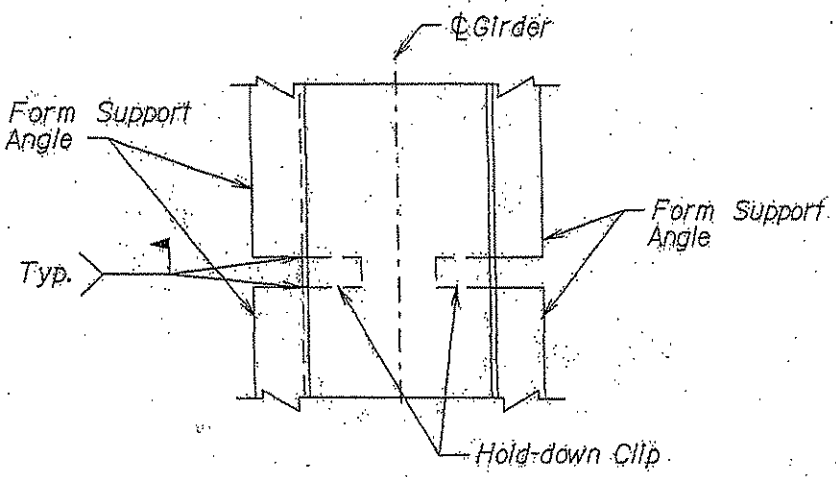
DESIGNED	DATE
DRAWN	
CHECKED	
REVIEWED	

11-07-05

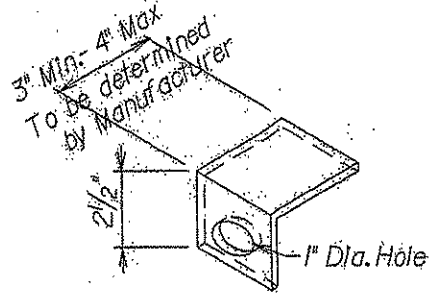
SLAB END ZONE REINFORCING

SHEET OF
BRIDGE NO.

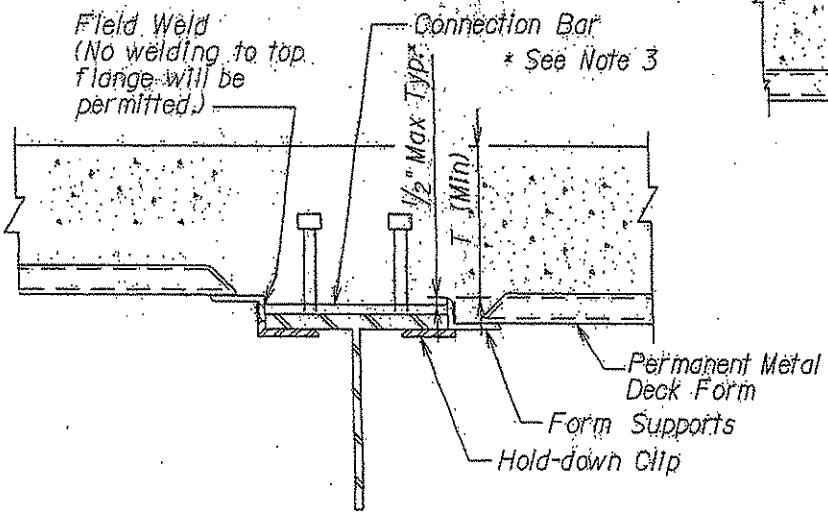
WEST VIRGINIA DIVISION OF HIGHWAYS
HAUNCH DETAIL AND STAY-IN-PLACE FORM DETAILS



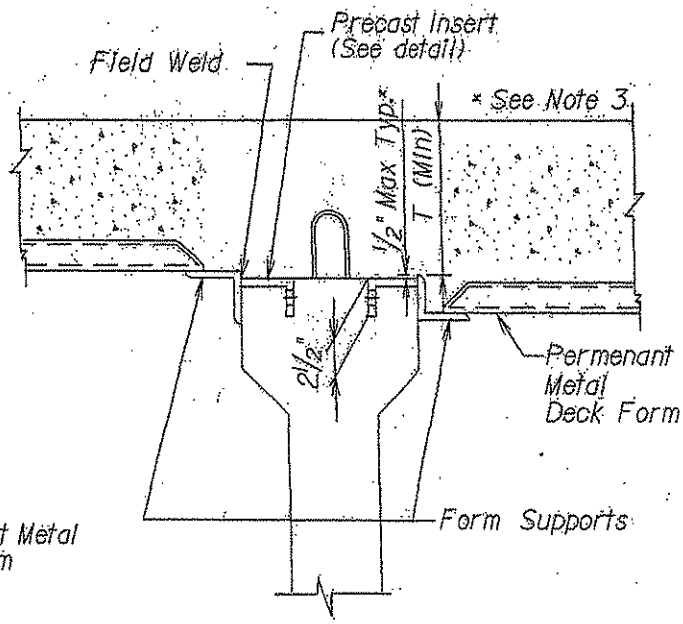
PLAN
STEEL BEAM



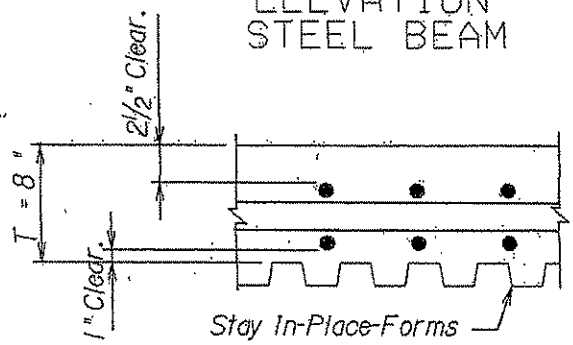
PRECAST INSERT



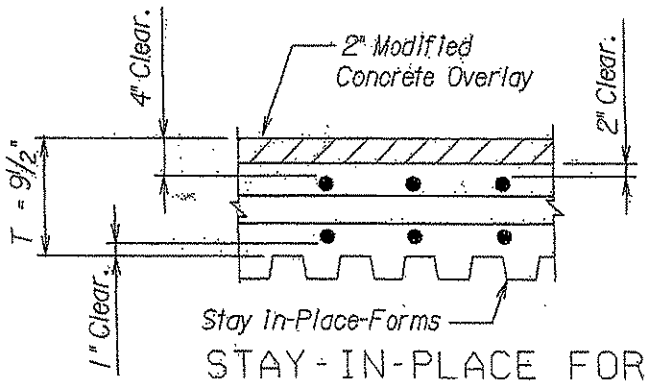
ELEVATION
STEEL BEAM



ELEVATION
PRESTRESSED I BEAM



STAY-IN-PLACE FORM
(WITHOUT OVERLAY)



STAY-IN-PLACE FORM
(WITH 2" OVERLAY)

Notes:

1. For the purpose of estimating the quantity of Class K or H Concrete in the flutes of permanent metal deck forms assume a uniform thickness of one inch over the area of the stay-in-place forms. The width used shall be measured from edge of flange to edge of flange.

2. The steel haunch detail shown is only applicable to composite design.

3. The form supports shall not protrude into the deck more than ½" above the top of the connection bar or precast insert nor shall it interfere with the nominal slab thickness.

11-07-05

ATTACHMENT No. 2

67-1.01(05) Superstructure and Interior Substructure Design Criteria

Although the ends of the superstructure are monolithically attached to integral end bents, the rotation permitted by the piles is sufficiently high, and the attendant end moment sufficiently low, to justify the assumption of a pinned-end condition for design. The following design assumptions shall be considered.

1. Ends. The ends of the superstructure are free to rotate and translate longitudinally.
2. Passive Earth Pressure. The restraining effect of passive earth pressure behind the end bents shall **may** be neglected when considering superstructure longitudinal force distribution to the interior piers.
3. Interior Pile Bents. All longitudinal forces from the superstructure are generally disregarded when designing an interior pile bent or a thin wall pier on a single row of piles. The longitudinal forces transmitted from the superstructure to the substructure are assumed to be resisted by the passive earth pressure behind integral or semi-integral end bents and approach slab. The friction between the approach slab and the subgrade may also be considered to provide resistance to these forces.
4. Shears/Moments. Force effects in the cap beam may be determined on the basis of a linear distribution of vertical pile reactions. For minimum reinforcement, the cap should be treated as a structural beam.

67-1.01(06) End Bent Details

Integral end bents may be constructed using either of the following methods.

1. Method A. The superstructure beams are placed on and attached directly to the end bent piling. The entire end bent is then poured at the same time as the superstructure deck. This is the preferred method.
2. Method B. The superstructure beams are set in place and anchored to the previously castin-place end