



Florida Department of Transportation

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STRUCTURES DESIGN BULLETIN C10-04

DATE: May 19, 2010

TO: District Directors of Production, District Design Engineers, District Structures Design Engineers, District Construction Engineers, District Prestress Engineers, Ghulam Mujtaba, Dave Sadler

FROM: Robert Robertson, P.E., State Structures Design Engineer

COPIES: Brian Blanchard, Lora Hollingsworth, Steve Plotkin

SUBJECT: Implementation Plan for Squaring the Ends of Florida-I Beams, Reorientation of Bearing Pads and the Elimination of Permanent Support Diaphragms in Concrete Girder Bridges.

This Structures Design Bulletin (SDB) outlines the plan for implementing the reorientation of bearing pads, squaring the ends of Florida-I Beams and eliminating permanent concrete diaphragms at supports for Florida-I Beam bridges using simple spans.

REQUIREMENTS

The following are policy changes which will affect all new Florida-I Beam (FIB) bridge designs:

- a) Square the FIB ends on skewed bridges.
- b) Orient the bearing pads perpendicular to the center line of the beam.
- c) Eliminate permanent support diaphragms on all FIB bridges except where significant lateral loads are present (ship impact, wave forces, etc.). The need for diaphragms in these areas will be evaluated as part of the design.
- d) Include edge beams at all deck expansion joints.
- e) Protect the ends of exposed prestress strands in FIBs with an epoxy layer.
- f) Eliminate the requirement for Florida-I Beam bridges to be designed for jacking and removal of bearings.
- g) The need for end diaphragms for widening projects will be evaluated on a case by case basis.
- h) For any projects in which diaphragms are eliminated, temporary beam bracing during construction per Structures Design Bulletin C10-01 is required.

Changes described herein will affect the FDOT Structures Manual, Design Standards, and Standard Specifications. Revisions to the affected publications and standards are in progress and will be

implemented by a second bulletin to be issued by July 1, 2010. Existing standards will remain in place to support AASHTO girder designs.

COMMENTARY

Squaring the Florida-I Beam ends on skewed bridges simplifies the beam fabrication and will lead to cost savings. Squaring the beam ends and the bearing pads also enhances the beam stability during construction.

Eliminating the permanent support diaphragms will eliminate a construction phase, saving construction time and costs. It is expected that routine jacking of bridges and replacement of bearing pads will not be necessary in the future, so design requirements for jacking and removal of bearings is not necessary.

Attachment 'A' (Example Details) may be used to assist in preliminary design and cost estimating.

BACKGROUND

The effects of these upcoming changes are to improve stability for prestressed concrete girders and to simplify girder end details to be more efficient and economical. Girders are more stable when placed on bearing pads which are perpendicular to the girder centerline than if placed on bearing pads which are skewed in relation to the girder centerline. By requiring that bearing pads and girders are squared, a potential source of instability is eliminated. And, although diaphragms or bracing are important for stability during construction, permanent diaphragms contribute little to stability of a completed bridge. Eliminating permanent concrete diaphragms in favor of temporary construction bracing will result in substantial construction time and cost savings, without a significant adverse effect on safety or reliability of the completed structure.

Squaring the ends of girders and bearing pads such that the centerlines of each in the longitudinal direction of the bridge are in-line simplifies the detailing of the girder ends and makes construction more efficient and economical, both at the site and during girder fabrication. The fabrication and use of double-beveled bearing plates will no longer be necessary, and it may be feasible to decrease the amount of splitting reinforcement required.

In order to accommodate certain site constraints, it is vital that the designer have the ability to skew the substructure in relation to the superstructure. This can still be accomplished by skewing both the girder and bearing pad in relation to the substructure. This is different than current and past practice in that the bearing pad would not be in line with the substructure.

Permanent concrete diaphragms for prestressed concrete girder bridges were phased out of standard construction practice in Texas more than twenty years ago, so it has been proven that bridges can be constructed and maintained successfully without permanent concrete diaphragms. In discussion with Texas DOT it was confirmed that there have not been any detrimental effects due to the elimination of concrete diaphragms in these types of structures. In addition, NCHRP Research Report 592 concluded that end diaphragms have negligible effect on the moment and shear distribution factors.

End diaphragms do support the free edges of slabs between girders at discontinuities such as bridge expansion joints. For this reason, an edge beam will be required to stiffen the slab at any free edges. The edge beam will cost significantly less than the diaphragm and can be cast monolithically with the slab.

Concrete end diaphragms also protect the prestressing strands at the ends of precast concrete girders. With the absence of diaphragms, strand protection will be accomplished by coating the beam ends with an epoxy layer.

In addition, diaphragms are occasionally used to facilitate jacking of prestressed concrete bridges for the replacement of bearing pads. Due to improved pad fabrication procedures, improved design requirements and quality control procedures, bearing pad performance has improved and should not need replacement. For the few bridges for which jacking will be necessary, the minimal additional cost associated with jacking a bridge without a diaphragm is negligible when compared to the savings associated with elimination of permanent concrete end diaphragms.

There may be some cases such as widening projects or projects with large lateral loads for which diaphragms and/or skewed end beams are required. The evaluation of exceptions for these projects is left to the District Structures Design Engineer.

IMPLEMENTATION

The changes detailed in this bulletin will be used on all Design-Bid-Build projects having a design start date on or after the date of this bulletin.

The changes detailed in this bulletin could be used on design-build projects having a Technical Proposal due date on or after the date of this bulletin. Design-build projects which have already submitted Technical Proposals as of the date of this bulletin may incorporate this bulletin as a cost saving proposal.

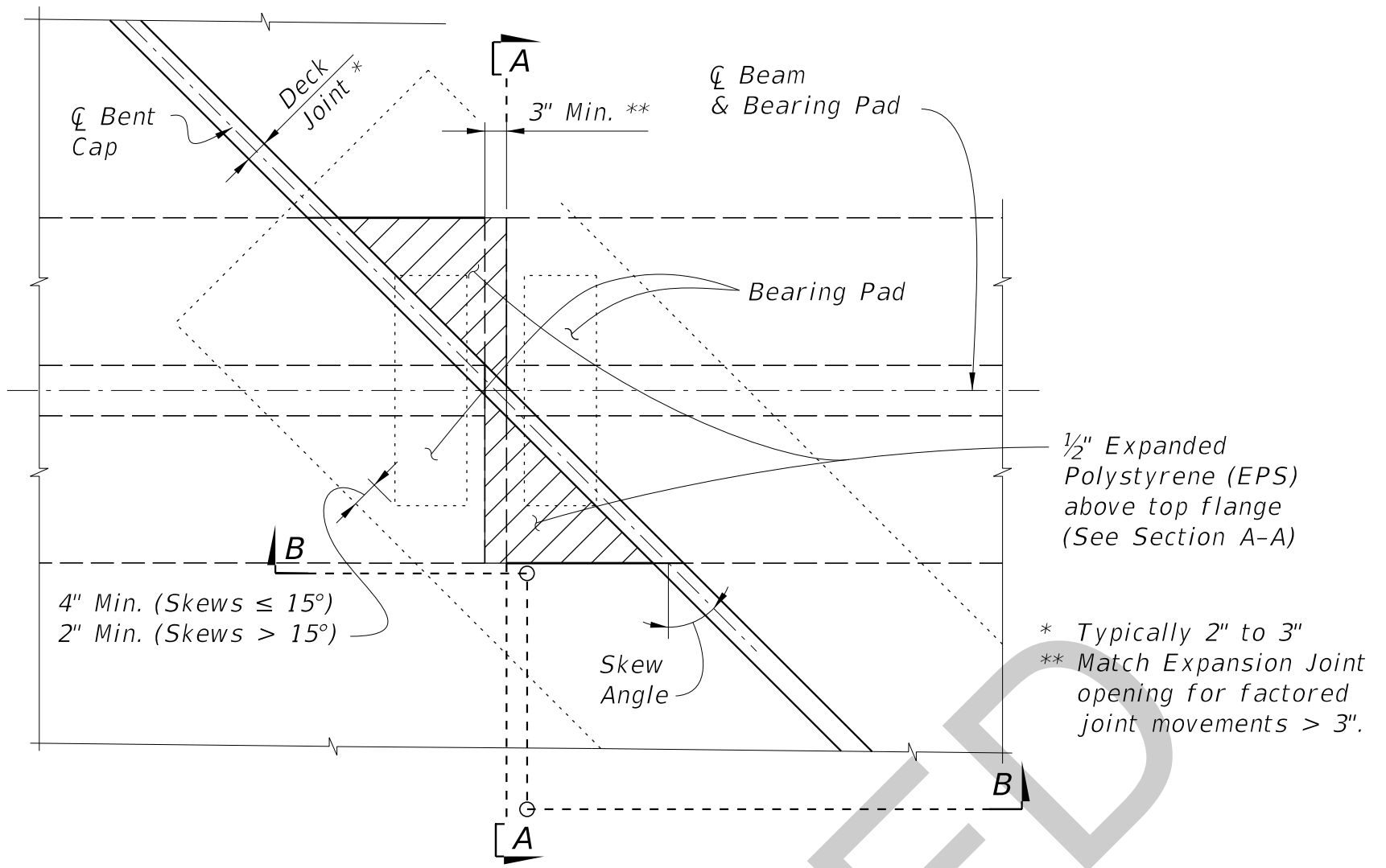
No redesign of on-going projects is required as a result of this bulletin, but districts may elect to revise present or completed designs at their discretion. Any bridge designed prior to the issuance of the revised Design Standards will require the Engineer of Record to complete the design.

CONTACT

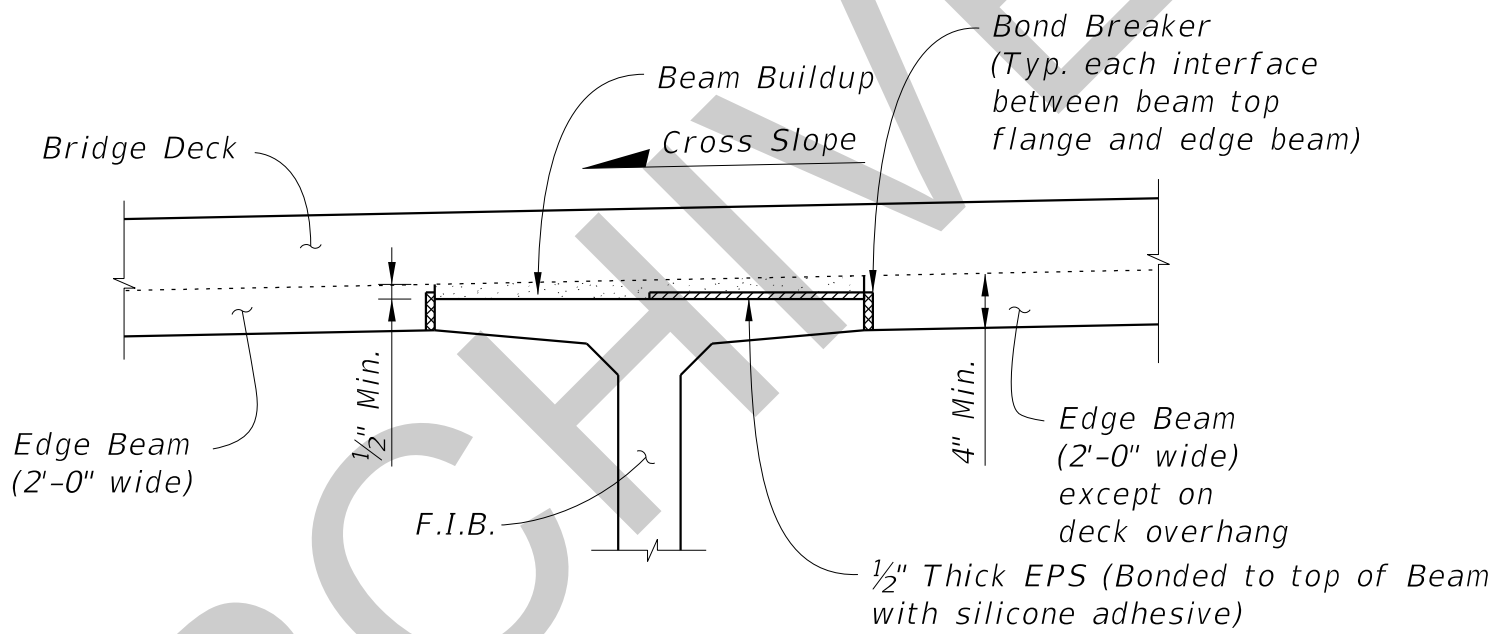
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ATTACHMENT A

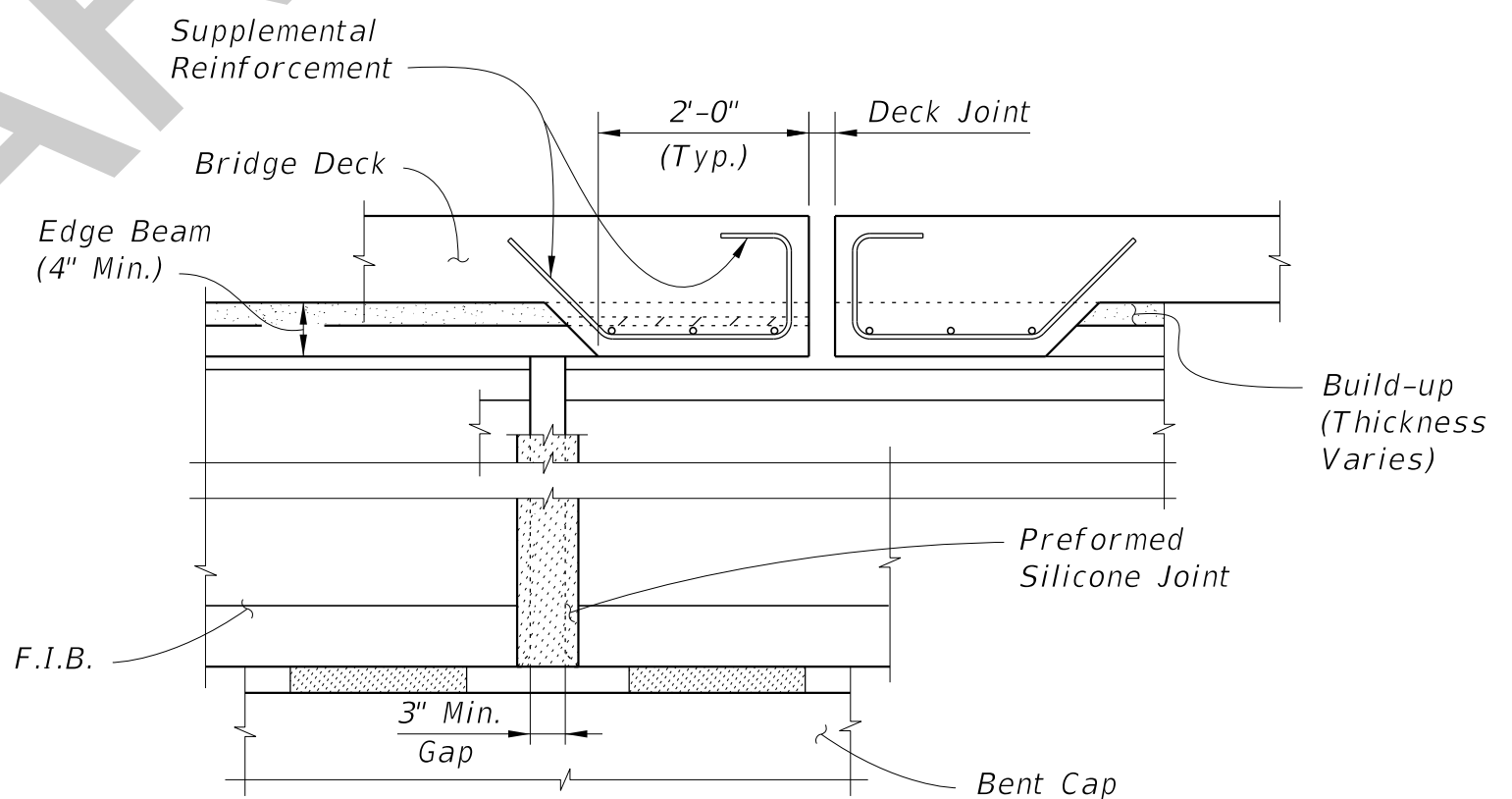
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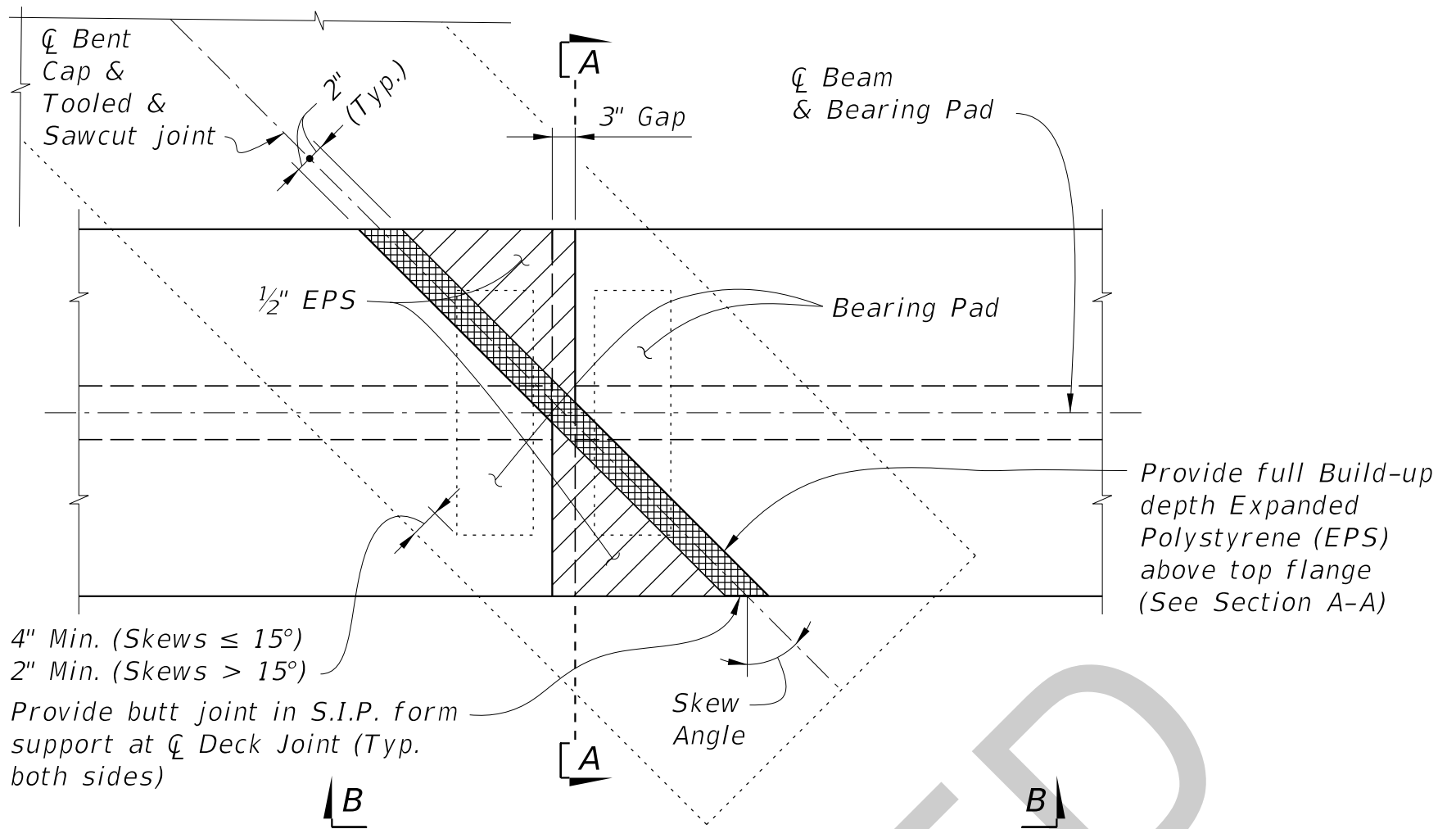
EXPANSION JOINT AT INTERIOR SUPPORT



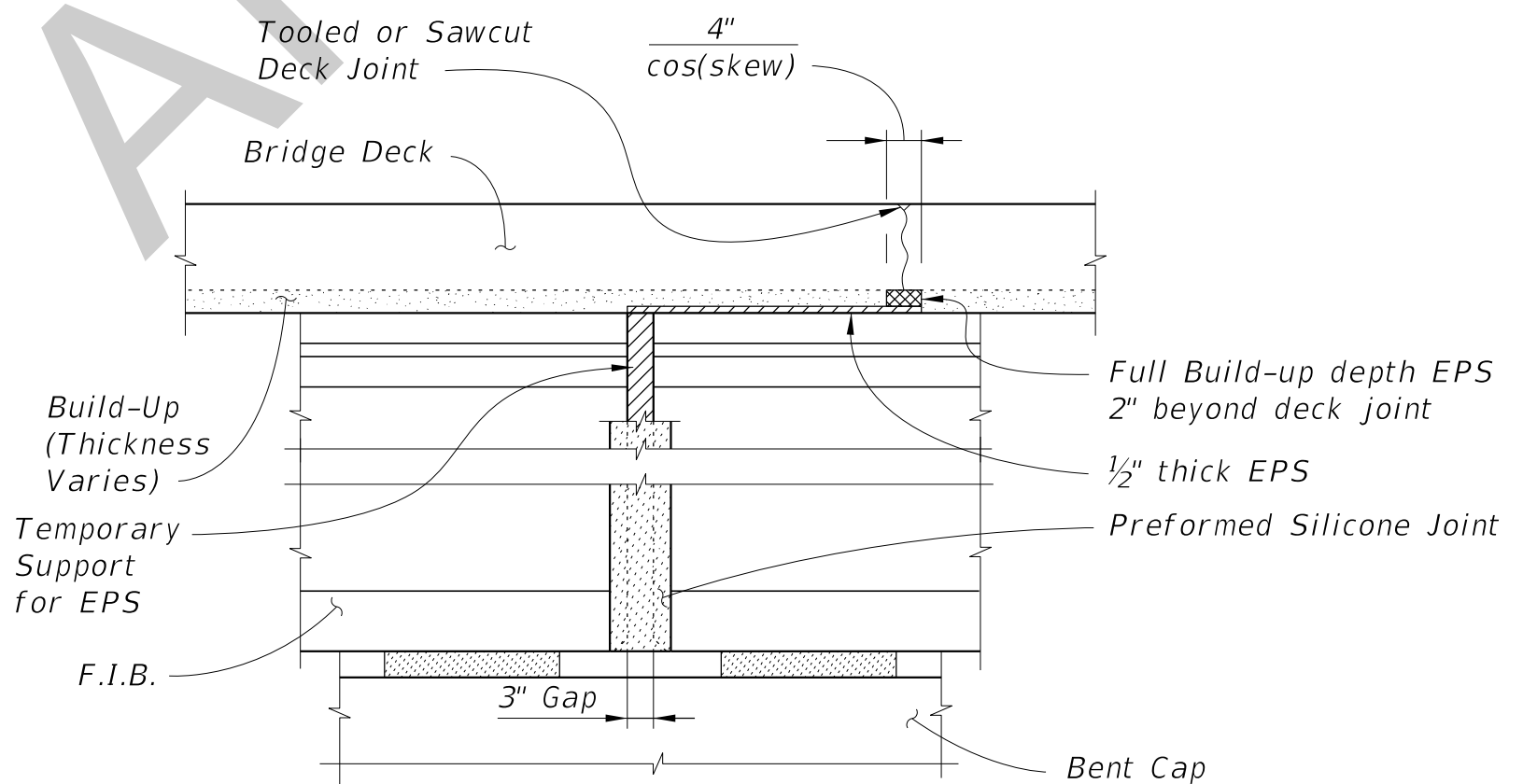
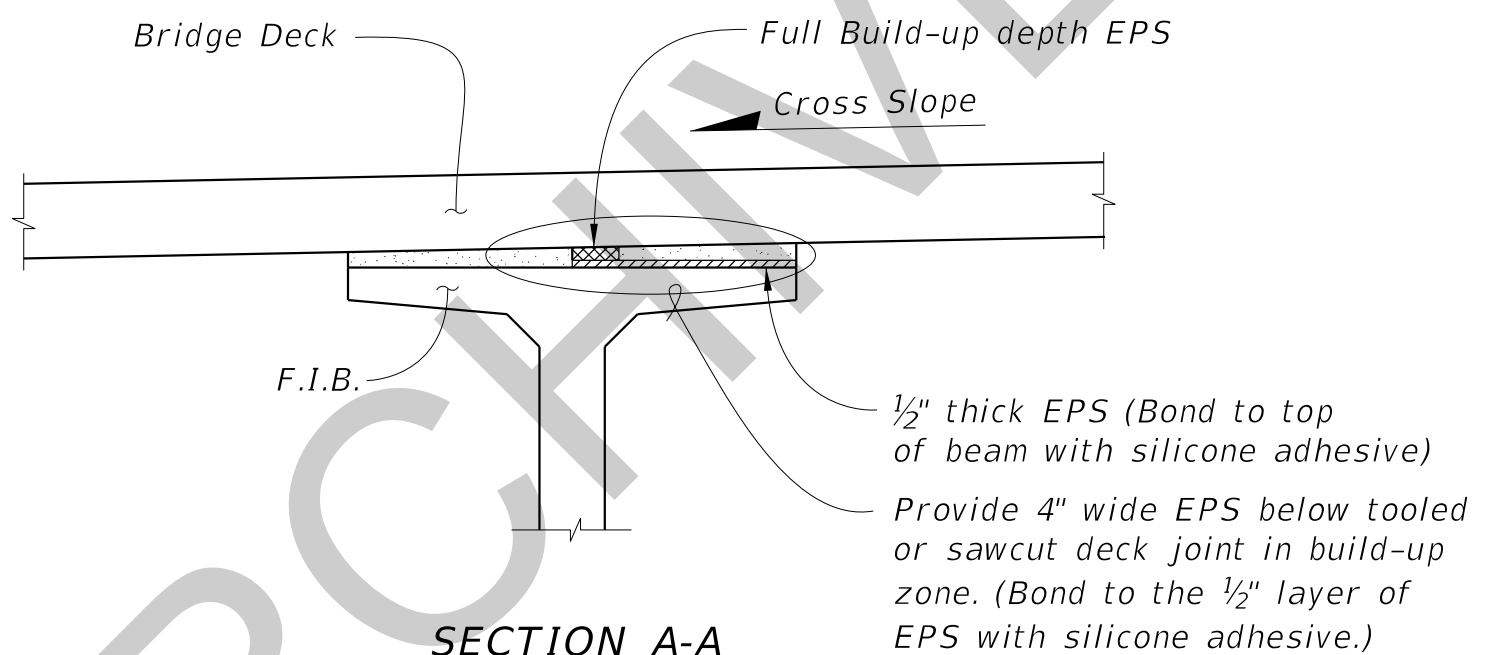
**SECTION A-A
TYPICAL AT EXPANSION JOINT**

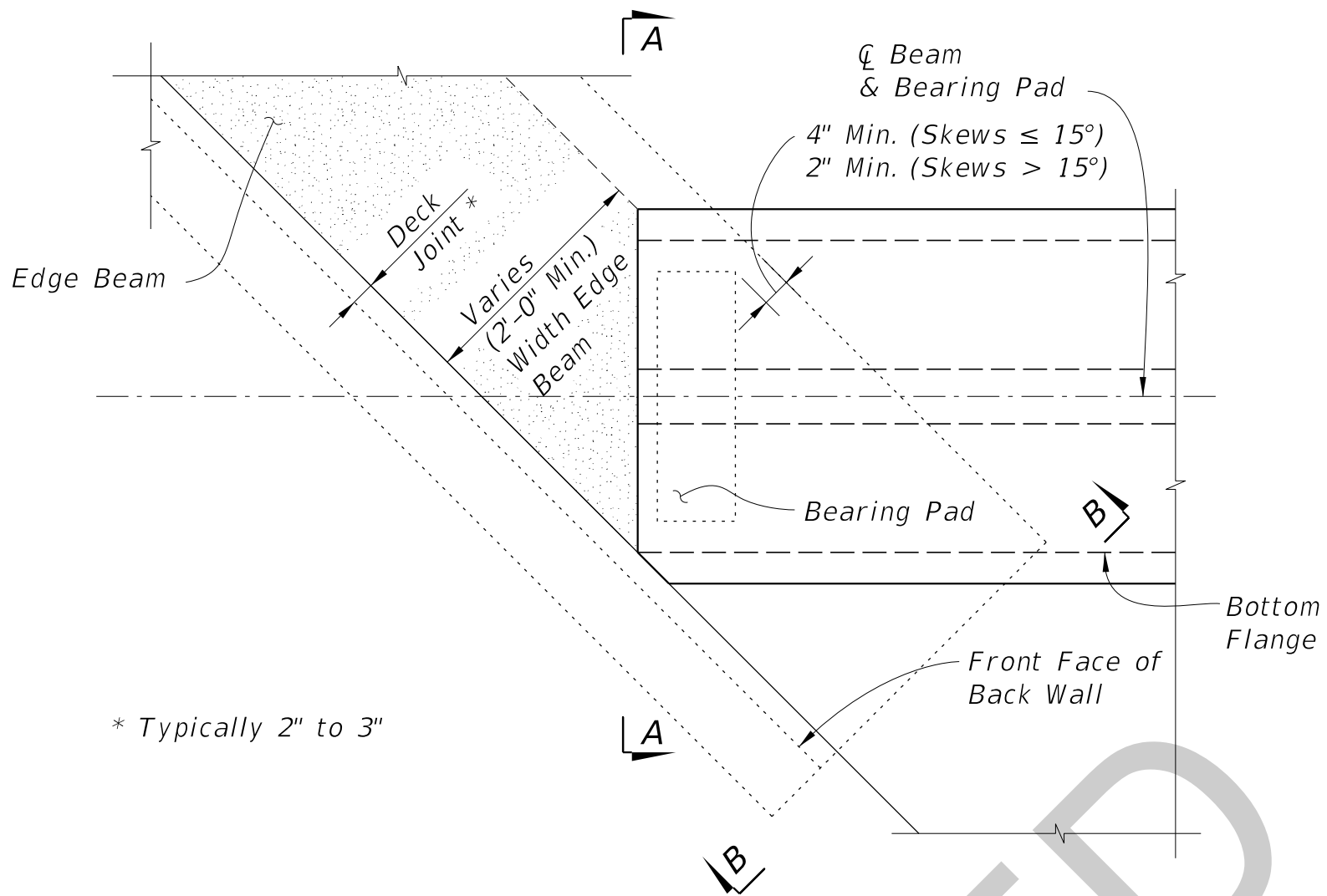


**VIEW B-B
ELEVATION OF DISCONTINUOUS DECK
AT EXPANSION JOINT
(Deck Reinforcement Not Shown for Clarity)**

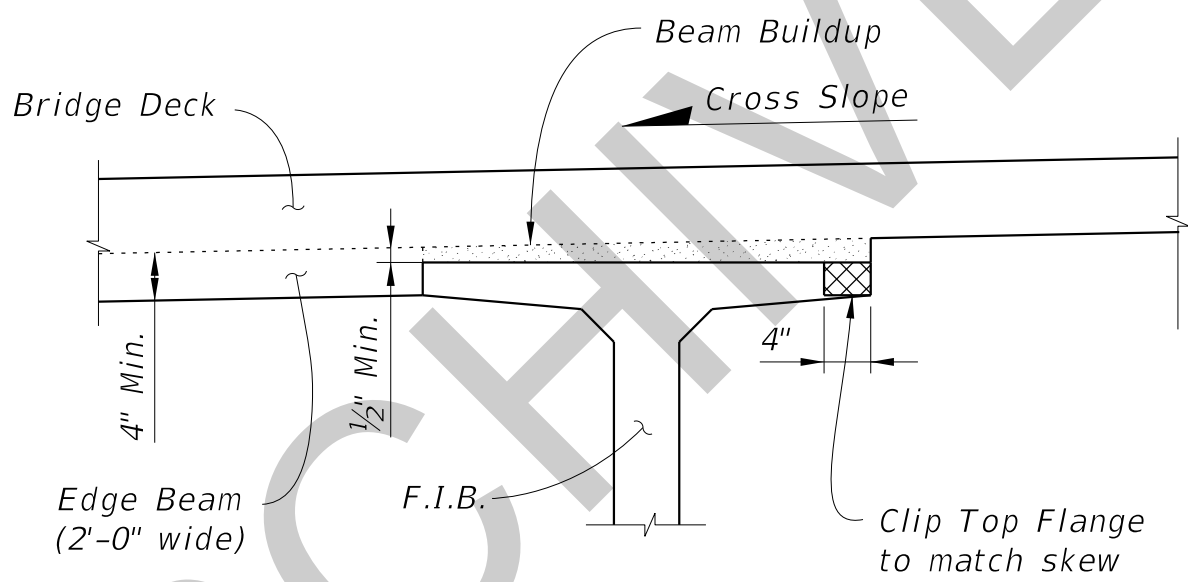


CONTINUOUS DECK AT INTERIOR SUPPORT
 (Bridge Deck Not Shown For Clarity)

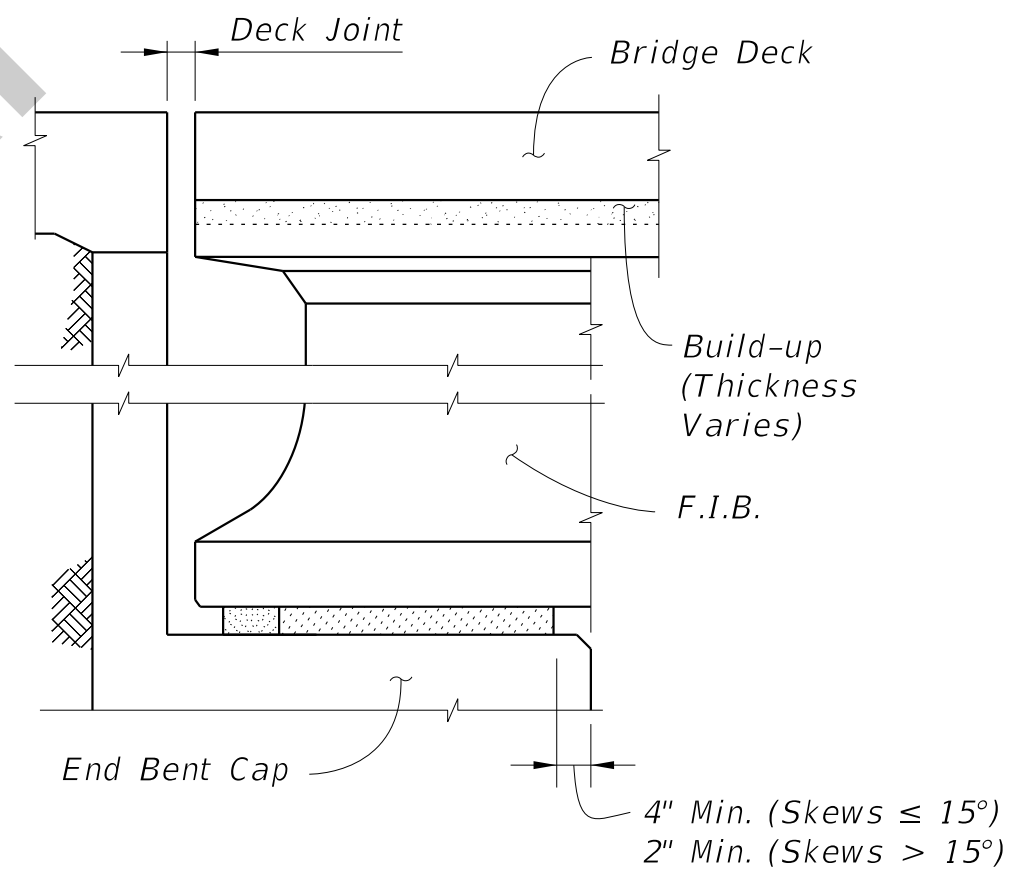




EXPANSION JOINT AT END BENT
 (Bridge Deck Not Shown For Clarity)



SECTION A-A
TYPICAL AT END BENT EXTERIOR BEAM



VIEW B-B
ELEVATION AT END BENT EXTERIOR BEAM