APPENDIX K. RECOMMENDED BRIDGE DESIGN GUIDE

Secondary Route Bridge Design Plan Guidelines

Introduction

Background

Approximately 7000 Michigan roadway bridges are owned by local agencies, and nearly 90% of these are managed by county highway agencies. Most local agency bridges are smaller structures that carry lower traffic volumes; about 60% of local agency bridges are single span structures less than 50 ft long, and average fewer than 1000 vehicles per day. About 70% of these structures have deck widths no greater than 40 ft.

Over half of these bridges were built prior to 1980, while one-fourth were built prior to 1960. This advancing age leads to increasing maintenance concerns. 17% have superstructures and substructures rated less than satisfactory, and in the near future, many of these bridges will require replacement.

MDOT has a variety of standard plans and details readily available for its structures. However, these existing plans are not always best suited for local agency use. As many MDOT bridges are built for higher traffic volume roads, they tend to be wider and longer than the typical local agency bridge, and may use girder types meant for larger spans.

To address this concern, this document provides a set of bridge plans meant to facilitate construction of new structures suitable for local agency use. The designs specifically address common local agency road, span, and site conditions, to enable development of low cost, low maintenance, readily constructible bridges.

The purpose of the plans is to provide design guidance. These plans are not meant to prescribe MDOT standards or requirements, but represent recommendations for design. They are meant to be used as templates for the designer, where some information can be used as-is, while other portions of the plans must be customized and developed by the engineer for the specific structure considered. Due to the variability of local site conditions, the plans address superstructure details only. Even here, not all elements can be used without adjustment, as local conditions will impact the design. Such details must be addressed by suitable engineering professionals.

These plans were developed over a two year period based on input from a variety of sources, including MDOT bridge engineers, local agencies, designers, and contractors. They represent recommendations for best practices that are suitable for local agency use.

Anticipated benefits from implementing the bridge plans include reduced design and construction uncertainties; bridges that are simpler and faster to design and construct; improved quality control; and lower life cycle costs.

Design Considerations

In general, a desirable structure is cost effective, constructible, functional, durable, and aesthetically appropriate. However, a large number of factors will influence bridge selection which are beyond the scope of this document to address.

Some general site concerns include topography, horizontal and vertical road alignments, required horizontal and vertical clearances, the presence of utilities, and potential pedestrian traffic.

Foundation design is a major component, but requirements vary greatly from one site to another. Other design considerations include potential for settlement, the presence of groundwater, the possibility for future bridge widening, and the need for a shallow or deep foundation. Additional geotechnical and foundation-related design items include how end and side slope overall stability, the abutment and wing wall design, construction staging, and required skew angle of the bridge.

Hydraulic concerns occur both on the bridge, in terms of how deck drainage is handled, as well as below the bridge. The latter includes various issues of consideration including the presence of a waterway and required clearance; possible channel drift; the passage of debris and possible pier obstruction for some foundation types; and possible scour of the foundation.

Construction concerns will also influence the bridge design. Prime among these is the availability and cost of the desired materials and workforce, though other concerns include the available space on-site and access to the site for personnel and equipment. How the construction will impact detoured traffic also bears consideration.

Bridge Type Selection

Design guidance provided by this document is summarized in the following steps:

1) Determine acceptable superstructure depth.
2) Estimate costs.
3) Consider alternatives.
4) Select bridge.
5) Prepare plans.

1) Determine acceptable superstructure depth.

Necessary clearances are generally determined from a hydraulic analysis for bridges spanning waterways, or vertical clearance requirements for bridges spanning roadways. Once required clearances are determined and corresponding allowable bridge girder depths found, Table 1 or Figure 1 can be consulted to select initial bridge types that meet the required girder depth limit. The girder depths presented in Table 1 and Figure 1 are based on the girder spacing, material strengths, and other assumptions described in the plan set accompanying this document.

Table 1. Typical Beam Depth Requirements

	Beam Depth (in) by Bridge Type					
Span (ft)	Bulb Tee	SBB	SSBB	Steel	Timber	Fold Plate
20		17	17	14	14	20
30		21	17	14*	16	20
40		21	17	14*	20	22
50		21	17	21		28
60		21	21	33		31
70	36	27	21			35
80	36	33	27			
90	42	39	27			
100	48	39	33			
110	48	48	39			

*Although these depths are reasonably achievable, a minimum girder depth of 21" for steel is recommended for these span lengths.

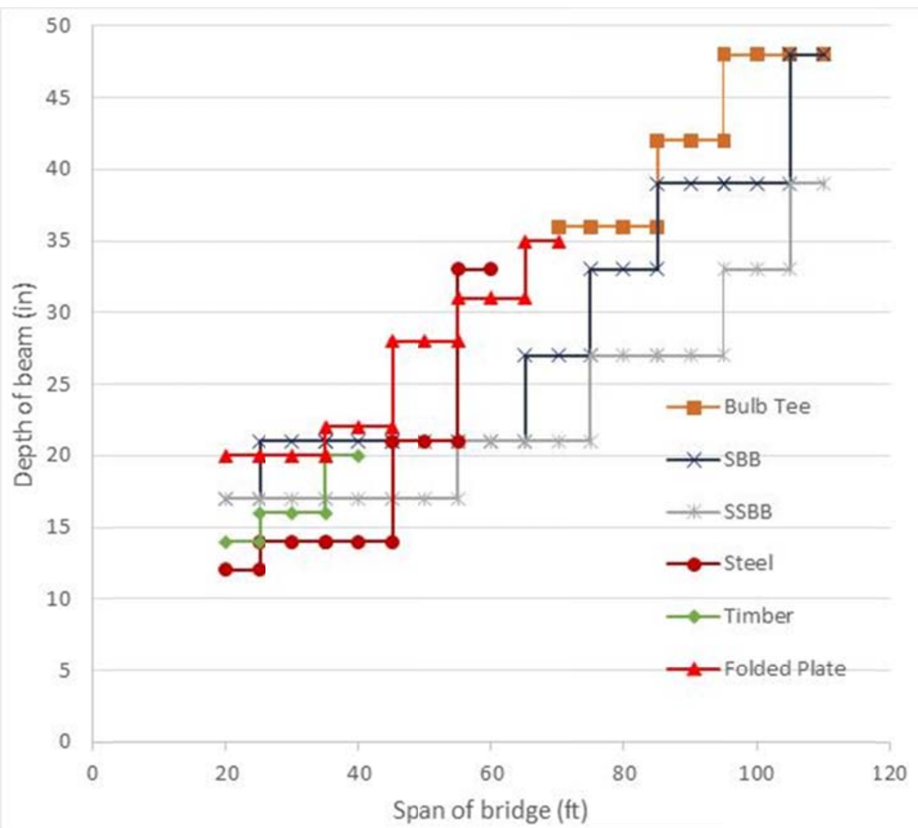


Figure 1. Typical Beam Depth Requirements for Bridge Types. Note a minimum beam depth of 21" is recommended for steel girders spanning 30' or more, while a minimum depth of 14" is recommended for girders spanning 20'.

Table 1 and Figure 1 present girder depth only. In addition to girder depth, the deck and beam haunch must be considered to determine total bridge depth. Recommended deck thickness (including wearing surface) is 9" for spread box beam (SBB), bulb-tee, and steel girder bridges; 6" for side by side box beams (SSBB), and 8" for folded plate type steel tub-beam bridges. A beam haunch is typically provided and adds additional variable depth, depending on bridge slope and capacity requirements. Typical haunch depths range from 1-4”. The timber bridge depths provided are based on the assumption of a slab-bridge (i.e. a single deck spanning in the traffic direction) rather than a girder-deck configuration. This depth shown does not include an additional wearing surface. Culvert structures, not appearing on Figure 1, are not easily comparable as they often have a variable beam depth and may arch over the gap, providing more clearance than a typical prismatic girder bridge. Thus, these should be considered when structures shown in Figure 1 cannot meet depth requirements or if they can provide a more economic option.

<u>2) Estimate costs.</u>

Costs are highly variable and depend on local conditions. Specific estimates can be obtained from the engineer and contractor. However, a preliminary estimation of superstructure costs for some bridge types is given in Figure 2. These costs include the construction of all superstructure elements, including beams, deck, diaphragms, and railings. Figure 3 represents an estimate of superstructure costs in addition to substructure costs (abutment and wing wall elements). In the figures, solid lines indicate a 34 ft clear bridge width; top and bottom dashed lines indicate costs for 40 and 30 ft clear widths, respectively. These estimates do not include foundation costs, which are usually substantial. Although foundation cost varies considerably according to site conditions, for a particular site, it is unlikely to vary significantly among the different bridge types shown in the Figures. Assumptions used to estimate these costs are given in MDOT Research Report SPR-1669, which is available on-line. Alternative structure types not appearing on the figures, including folded plate girders, timber, and culverts, are often sold as an assembly for which initial costs can be obtained directly from suppliers.

At the time of publication of this document (March 2018), not including roadway surfacing, traffic control, and other associated costs, prefabricated culverts may be roughly estimated at $350/SF of deck area, while material-only costs (not including installation, traffic control, wearing surface, barriers, substructure and foundation) for folded plate girder superstructures range from approximately $60/SF for spans up to 50’ and $70/SF for spans up to 70’ , while material-only costs of timber superstructures range from approximately $90/SF for a 20’ span to $180/SF for a 40’ span. Note that these costs are rough approximations and should be obtained from the specific manufacturer considered.

Figures 4 and 5 illustrate life cycle cost (LCC) estimates, which account for the costs of expected maintenance over the lifetime of the structure. The LCC includes costs for initial construction, inspection, repair and maintenance, demolition, and replacement. Assumptions used to estimate these costs are given in MDOT Research Report SPR-1669.

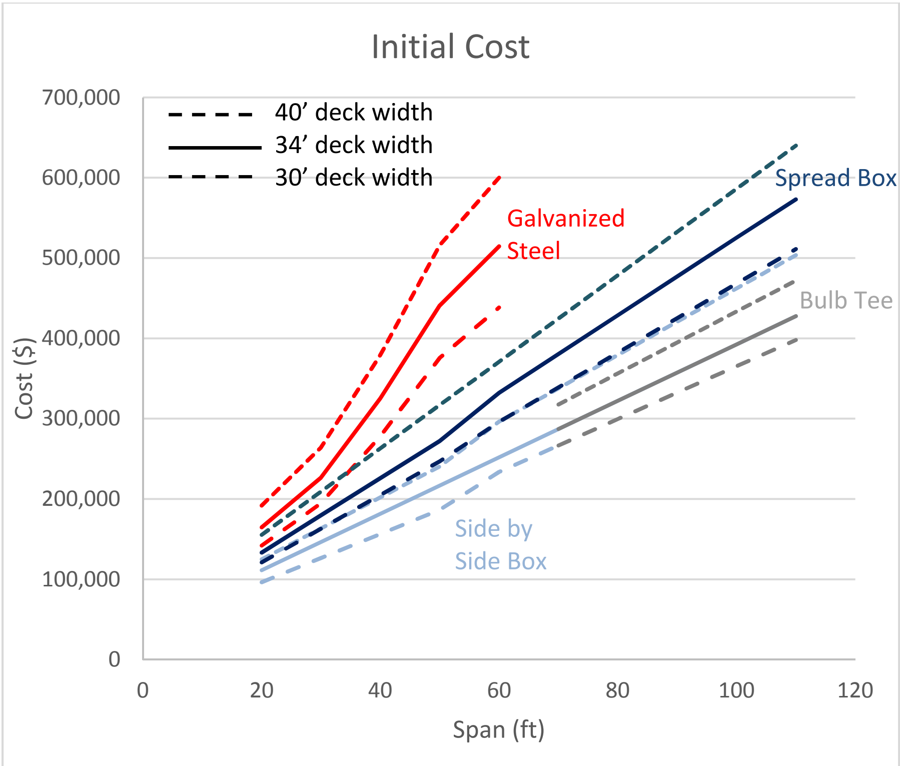


Figure 2. Estimate of Initial Superstructure Cost.

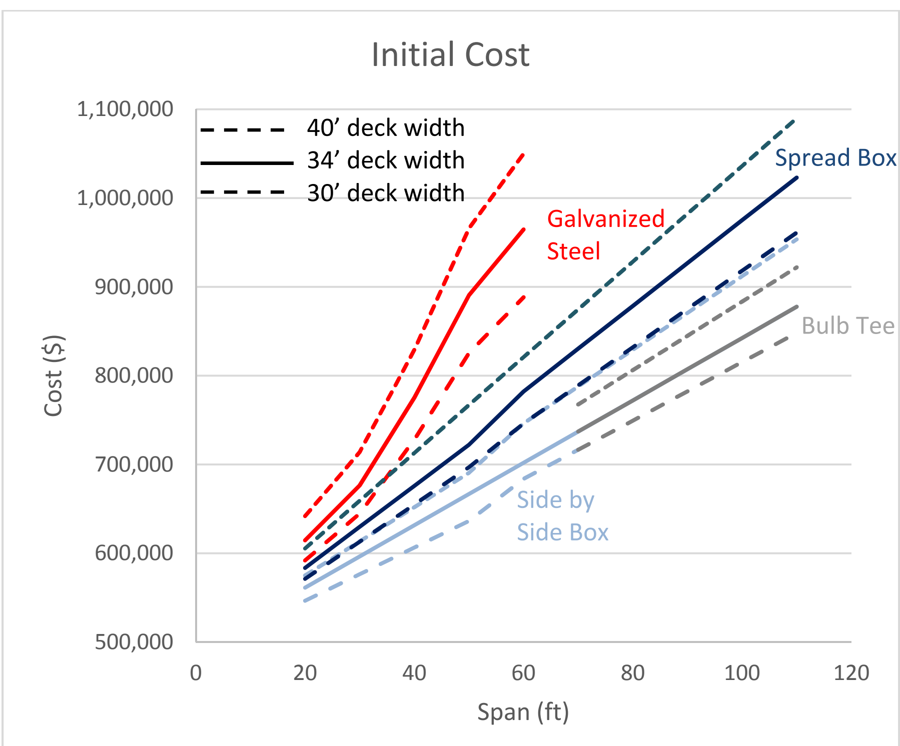


Figure 3. Estimate of Initial Superstructure + Substructure Cost.

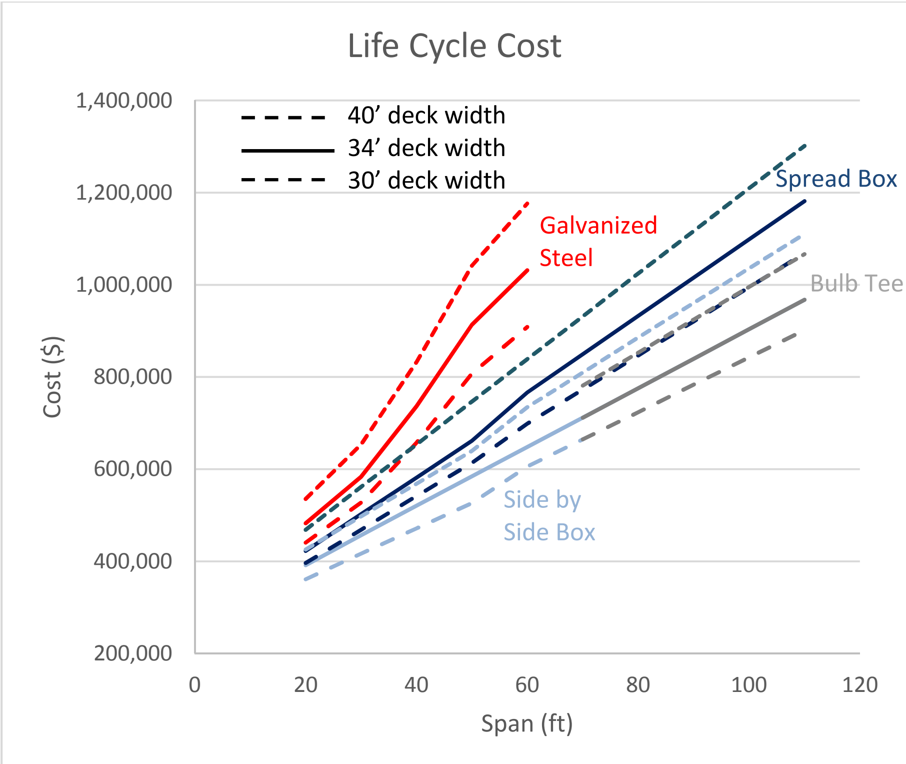


Figure 4. Estimate of Superstructure Life Cycle Costs.

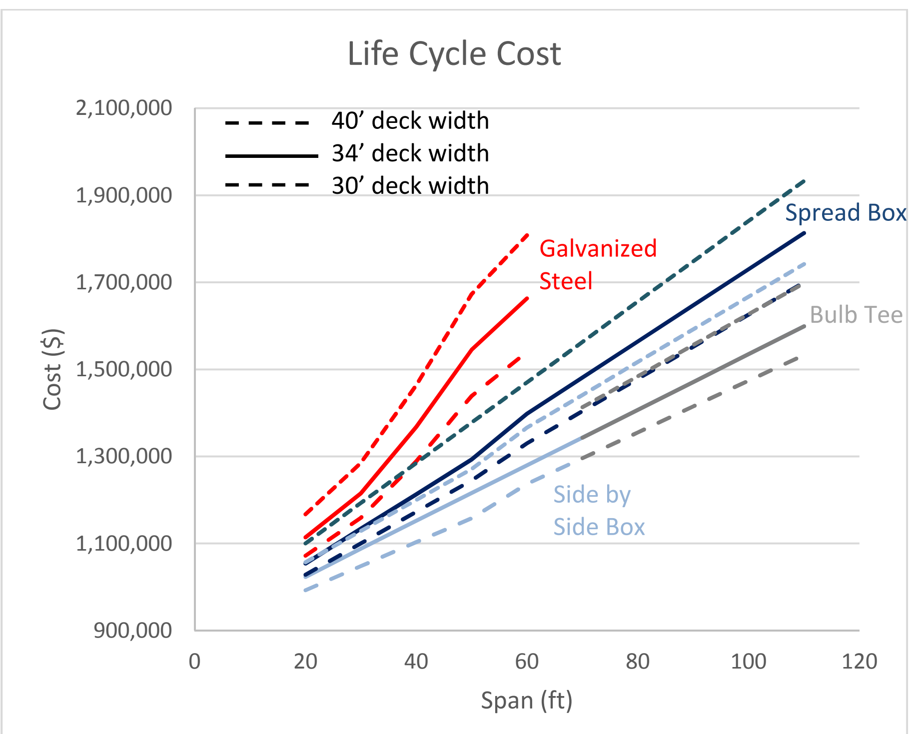


Figure 5. Estimate of Superstructure + Substructure Life Cycle Costs.

3) Consider alternatives.

Some bridge types are better-suited to a particular set of conditions than others. The range of spans and beam depths addressed in this guide are summarized in Table 1. A summary of considerations is given below.

3a) Spread box beam (Fig. 4). Spread box beam bridges are widely familiar and significant experience exists with these structures. Standard sections are readily available from fabricators, and range in size from 12”- 60” in height with widths either 36” or 48” in most cases. These structures are generally well-performing. Design guidance is given for spans from 20 to 110 ft, although longer spans are possible.

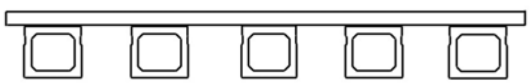


Figure 4. Spread Box Beam Bridge.

3b) Side-by-side box beam (Fig. 5). This system is particularly useful when small beam depths are required and spread boxes or other options cannot meet the required clearance. Appropriate detailing, such as recommended in the accompanying bridge plans, can mitigate potential deck deterioration concerns. Due to the larger number of beams than the spread box design, this tends to be a more expensive alternative. Design guidance is given for spans from 20 to 110 ft.

Figure 5. Side by Side Box Beam Bridge.

3c) Galvanized steel (Fig. 6). Although painting steel girders is possible, to enhance corrosion resistance and lower long term maintenance costs, hot-dip galvanization is recommended for steel girders. Here, a limitation is the size of available galvanization vats, which may commonly accommodate beams up to about 58 ft in length if progressive dipping is used. Such girders offer good long-term maintenance performance and typically lower girder weights than prestressed concrete sections. Design guidance is given for spans from 20 to 60 ft. Within this span range, beam depths commonly range from 21” – 36”, although smaller depths are possible for short spans. To decrease beam depth and weight for longer spans, a cover plate may be used. Generally, steel beams are more expensive compared to concrete beams and require longer lead time for fabrication.

Figure 6. Galvanized Steel Girder Bridge.

3d) Folded plate (Fig. 7). Prefabricated, tub-shaped folded plate steel girders by various manufacturers are available up to about 80 ft. These girders are typically available with a precast concrete deck attached, then the slab/girder system is joined on site by grouted keyways. These systems are often relatively fast to construct and can provide lower dead loads than precast concrete. As with concrete box sections, the section interior is not visible for inspection.

Reasonable beam depths for this system range from about 20” – 36”. Design guidance is available from suppliers.

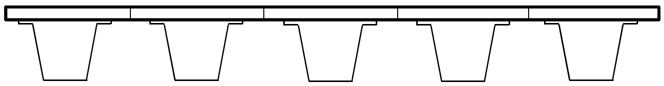


Figure 7. Folded Plate Steel Bridge.

3e) Bulb tee (Fig. 8). Available in relatively larger sections, bulb tees are usually best suited for spans greater than about 70 ft, where these sections are most efficiently used. An advantage of this girder is that its surfaces are exposed and accessible for inspection and maintenance, if needed. Commonly available bulb tees range in depth from 36” – 72”.

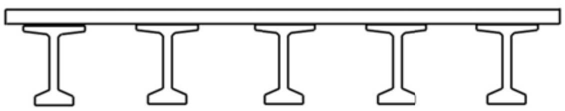


Figure 8. Bulb Tee Bridge.

3f) Timber (Fig. 9). Timber is most applicable to shorter spans, with practical applications potentially up to about 40 ft. These structures are relatively inexpensive, quick and easy to construct, and have high aesthetic quality in natural settings. However, these structures have different mechanisms of deterioration, wearing surface concerns, and maintenance strategies from those of steel and concrete bridges. Timber is recommended for particular consideration on roads with relatively low traffic volumes. Deck thicknesses range from about 14” - 20” for the span range considered. Standard plans are readily available from timber bridge suppliers.

Figure 9. Timber Bridge.

3g) Culvert (Fig. 10). Culverts are well suited for short spans, but may reach up to about 40 ft in multi-cell or special arched configurations. The latter may require a significant change in roadway elevation, however. Culverts may provide clearances that other bridge types cannot. They are often associated with fast installation time and low long term maintenance costs. Various types of culverts are available, including U-shaped (no bottom) and box-shaped, although culverts with bottoms crossing riverbeds often require additional environmental consideration. Prefabricated culverts are available in precast concrete, steel, and aluminum. Cast-in-place options are also possible. Standard plans are readily available from manufacturers.

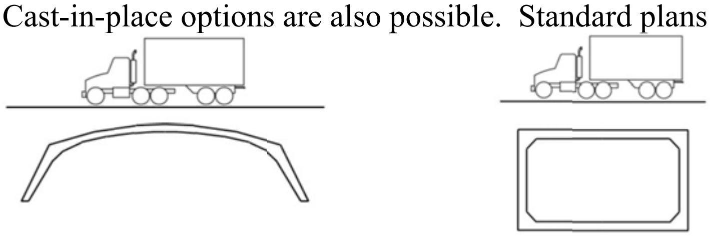


Figure 10. Culverts.

4) Select bridge.

Based on considerations such as those summarized above, along with feedback from an engineer, an appropriate bridge type can be selected. Determining the best choice may also involve a more detailed economic analysis of viable alternatives.

5) Prepare plans.

For culverts, timber, folded plate, or other types of structures for which standard plans exist, regional suppliers of these specific structures can be consulted for guidance. For spread box, side-by-side box, steel, or bulb tee girder bridges, design guidance is provided in the accompanying documents. For these bridge types, a set of superstructure plan templates is available, and are described below.

Bridge Plan Recommendations

Plan Assumptions

The plans provided with this document present design information for simple span structures of three widths and variable lengths in 10’ increments designed to the 7th Edition of the AASHTO LRFD Specifications (2014), but using the HL-93-mod live load. Decks are designed using the strip method, while girder shear design is based on the General Procedure. The designs are valid for skews from 0-30 degrees (i.e. angle of crossing from 60-90 degrees), and satisfy Strength I, Service I and III (for prestressed concrete), Service II (for steel), and Fatigue I limit states, and meet a deflection limit of L/800. Note that these plans are for superstructures only and will require design for the substructure, foundation, and potentially other components as needed.

Clear widths are based on AASHTO 2011 (A Policy on Geometric Design of Highways and Streets), as a function of average daily traffic (ADT). Width requirements are based on design speed (assumed to be 55 MPH) and ADT. Although very low ADT roads (<400) can use a two-lane bridge width of 26’, most local agencies specify a minimum deck width of 30’ to accommodate agricultural equipment; this width assumes two 11’ lanes with 4’ shoulders, and can be used for ADT up to 1500. From ADT of 1500-2000, the minimum bridge width is 34’ (two 11’ lanes and 6’ shoulders); for ADT over 2000, a width of 40’ is specified (12’ lanes and 8’ shoulders). All girder bridges have approximately 2.5’ overhang, except the 30’ clear steel beam bridge (all spans) and the 40’ clear, 110’ span bulb tee, which have approximately 3.5’ overhang, measured from the center of the girder to edge of the deck.

Designs are provided for span lengths in increments of 10’ within the range given in Table 1 shown for each bridge type. For spans between the increments provided, it is generally conservative to use the beam design provided for the upper span increment. It is suggested that both the lower and upper span increment section designs presented are checked for applicability, in order to select a more optimally sized section. Such cases must be verified by the design engineer.

When specifying beam sizes and girder spacing, the plans were prepared to provide a balance between economy and maximizing vertical clearance. The latter is often a critical consideration for Michigan local agency bridges, for which the large majority pass over waterways and must meet design flood flow capacity requirements. Maximizing economy and clearance generally align for side-by-side box beam structures, for which the minimum feasible beam depth is provided based on the material strengths specified. For spread box and bulb tee structures, the most economic sections also generally aligned with those of minimum depth. In a few cases, moving to a slightly larger section allowed widening girder spacing and use of one less beam in the design, resulting in a more economic outcome. These resulted in spread box beam designs with 4-6 beams spaced from approximately 6.9-9.4' and bulb tee designs with 4-5 beams spaced from 7.9-9.4', depending on bridge span and width. For steel girder bridges, cost was directly influenced by girder spacing as a function of girder weight, and final designs used 5-7 beams spaced at approximately 6.3'.

Beam sizes and material strengths are based on commonly available selections. Steel girder sizes range from W14x120 - 36x170 (30x173 heaviest). Spread box beam sizes are 21" x 36" for spans from 20-40' and have a width of 48" and range from depths of 21", 27", 33", 39", and 48" for greater spans. Side by side box beam designs have beam sizes of 17" x 36" for spans from 20-50' and are 48" wide with the same depths given for spread box for longer spans. Bulb tees are 42" x 49" for spans from 70-90' and 48" x 49" for spans from 100-110'.

Steel diaphragms are used throughout, which contractors have often found to be more convenient to install than pouring concrete. No diaphragms are specified for spread box beam bridges, which are not required for the geometries considered.

All bridges have a reinforced concrete composite deck with f'c = 4 ksi, that is 7.5" thick, with an additional 1.5" wearing surface (9" total depth), except for side by side box beam bridges, which have a 4.5" deck thickness with an additional 1.5" wearing surface (6" total depth). For girder design, a beam haunch of 4" is assumed for dead load, but no haunch was included in calculation of composite beam section properties. Decks are reinforced with 60 ksi, #5 bars throughout, where top bars are spaced 12" and bottom bars are spaced 8" on center. All bars are assumed to be epoxy coated.

For prestressed concrete girders, f'c = 7 ksi at release and 8 ksi in service. Prestress tendons are taken as 0.6" nominal diameter low relaxation strands, with ultimate strength 270 ksi. Stirrups are #4, and were designed as 40 ksi steel in 17" and 21" box beam sections in order to meet lap length requirements. Recognizing that the availability of 40 ksi bars is limited, it is common practice to allow the use of 60 ksi bars in construction; however, such changes must be reviewed and approved by the design engineer.

Reactions are supplied on the plans to aid substructure design. Dead loads are given per beam, while live loads are given per AASHTO LRFD design lane. For a particular span and structure type, reactions represent the highest values of the different bridge widths shown in the plans. Caution must be used if referencing reaction values in the tables for beam lengths not corresponding to the span increments shown; in such cases, a more precise analysis is recommended.

Plan Use

Details presented in the plans may be used as a guide, or directly as a template for the bridge designer, where information applicable for the structure considered may be extracted as used if deemed appropriate. Much of the design information presented on the plans, such as some geometric dimensions and material properties, are constant values; these details were designed to be applicable throughout the range of structures considered. Other information is given as a variable which will depend on the specific structure considered and must be input by the designer. Many of the values for these variables may be read from tables given on the plans. However, as the information presented cannot cover all possibilities, modification may be necessary to meet the requirements of a particular site and structure.

Once a given structure type, span, skew, and width is selected, the specific information relevant to those selections can be extracted from the plans, and the remaining information discarded. To avoid confusion during construction, it is important that unused information does not appear on the construction drawings, and that other necessary information, such as that within the title of each sheet, is provided by the designer.

The sheet numbers that are needed for a particular bridge type can be found in the lower right of the sheet title block and are given in Table 2. Each structure is documented with 10-11 sheets, depending on type, as shown below.

Table 2. Sheet Numbers Per Bridge Type.

Sheet Number:	Bridge Type			
Sheet Name	Steel	Spread Box	SBS Box	Bulb Tee
Deck plan & haunch detail	DECK 001	DECK 001	DECK 001	DECK 001
Abutment back wall	DECK 002	DECK 002	n/a	DECK 002
Approach slab	DECK 003	DECK 003	DECK 003	DECK 003
Barrier & end walls	DECK 004	DECK 004	DECK 004	DECK 004
Bridge section	DECK 008	DECK 005	DECK 006	DECK 007
Erection diagram	STEEL 001	SBB 001	SSBB 001	BTB 001
Shear reinforcement	STEEL 002	SBB 002	SSBB 002	BTB 002
Beam sections & strands*	STEEL 004	SBB 003, 004	SSBB 003, 004, 005	BTB 002
Diaphragms	STEEL 003	n/a	n/a	BTB 003
Bearings	BRG 003	BRG 001	BRG 001	BRG 002
Expansion joint	EXPJT 001	EXPJT 001	EXPJT 001	EXPJT 001

*For steel, a deflection diagram is given in place of beam section & strand diagram.

Below, a list of information is provided summarizing what each plan sheet contains, which items are variable parameters that need input from the designer, and any additional explanatory notes. A set of plans where input parameters that are represented as variables are highlighted is given in Appendix A. As the plans also contain multiple selections of details and other generic diagrams not explicitly represented as variables, the highlighted items do not represent all items which must be removed, changed, or modified.

An example of a steel bridge design using the plans is given in Appendix B.

DECK 001: Deck Plan

This sheet is applicable to all structure types.

Contains: Deck plan, haunch detail.

Variable items: Span length (L), out-to-out bridge width (a), angle of crossing, fascia depth (F), haunch detail. Note that the bridge span length is measured between construction reference lines, which are typically taken from the back walls of the abutments; bridge span length is not the same as the beam span length, taken center to center of the bearings.

Select: Haunch detail (for concrete or steel beams), angle of crossing case, deck reinforcement case.

Notes: The left side of the deck plan applies to angles of crossing from 70-90˚, while the right side applies to angles of crossing from 60-70˚. Deck plan should be redrawn to appropriately match the required angle of crossing. Redraw north arrow direction to correspond to correct orientation.

DECK 002: Abutment Backwall

This sheet is applicable to all structure types except side by side box.

Contains: Abutment backwall elevation and section.

Variable items: Backwall width (D).

Select: Backwall type (spread box, steel beam, or bulb tee beam) and fixity (fixed or expansion).

Notes: Aesthetic parapet shown. Alternatives are possible as detailed in MDOT Standard Plan B-25 Series. For concrete girders spanning up to 50’ or steel girders spanning up to 25’, fixed abutments generally may be used. For longer girders, one abutment is generally taken as fixed while the other abutment is an expansion type.

DECK 003: Approach Slab

This sheet is applicable to all structure types.

Contains: plan and section of approach and sleeper slab.

Variable items: Approach slab width (a), angle of crossing.

Select: Plan and section type for approach slab and sleeper slab (HMA or concrete); angle of crossing case.

Notes: Details are limited to angles of crossing 60-90˚. Bridge spans contributing to expansion at an abutment that are less than 50 ft for concrete beam bridges and less than 25 ft for steel beam bridges should refer to MDOT Standard Road Plan No. R-45-1. Approach slab plan should be redrawn to appropriately match the required angle of crossing.

DECK 004: Barrier and End Wall

This sheet is applicable to all structure types.

Contains: Barrier plan, end wall elevation and plan.

Variable items: Barrier length (L_B).

Select: Barrier plan (based on angle of crossing), end wall elevation (for side by side box beam or all other beam types).

Notes: Typical details for aesthetic parapet are shown. Alternatives are possible as detailed in MDOT Standard Plan B-25 Series. The left side of the deck plan applies to an angle of crossing of 90˚, while the right side applies to angles of crossing from 60-89˚. Barrier plan should be redrawn to appropriately match the required angle of crossing. Other options are possible. Post locations to be redrawn to match that needed.

DECK 005: Bridge Section for Spread Box Beams

This sheet is only applicable to a spread box beam bridge. Discard for other bridge types.

Contains: Bridge section, deck section, railing section, beam size and spacing table.

Variable items: Bridge span, out-to-out bridge width (a), clear roadway width (b), half of roadway clear width (c), number of beam bays (d), beam spacing (e), bridge width center-to-center of edge beams (f), beam size (g), center of edge beam to bridge fascia (h), edge of beam to edge of fascia (j).

Select: Bridge span, bridge width.

Notes: Based on a bridge span and width selection, the beam dimension table can be consulted to select an applicable beam size and beam spacing; variables a-j are specified in the selection tables. The selection table is for reference only and should not appear on the construction plans. Beam size and spacing selections may be used for spans less than or equal to the provided span increment. The section should be redrawn to match the beam size, spacing, and number of beams selected. Typical details for an aesthetic parapet are shown. Other options are possible.

DECK 006: Bridge Section for Side by Side Box Beams

This sheet is only applicable to a side by side box beam bridge. Discard for other bridge types.

Contains: Bridge section, deck section, railing section, beam size and spacing table.

Variable items: Bridge span, out-to-out bridge width (a), clear roadway width (b), half of roadway clear width (c), number of beams (d), beam width (e), bridge width center-to-center of edge beams (f), center of edge beam to bridge fascia (g), edge of beam to edge of fascia (h).

Select: Bridge span, bridge width.

Notes: Based on a bridge span and width selection, the beam dimension table can be consulted to select an applicable beam size and beam spacing; variables a-h are specified in the selection tables. The selection table is for reference only and should not appear on the construction plans. Beam size selections may be used for spans less than or equal to the provided span increment. The section should be redrawn to match the beam size, spacing, and number of beams selected. Typical details for an aesthetic parapet are shown. Other options are possible.

DECK 007: Bridge Section for Bulb Tee Girders

This sheet is only applicable to a bulb tee girder bridge. Discard for other bridge types.

Contains: Bridge section, deck section, railing section, beam size and spacing table.

Variable items: Bridge span, out-to-out bridge width (a), clear roadway width (b), half of roadway clear width (c), number of beam bays (d), beam spacing (e), bridge width center-to-center of edge beams (f), beam size (g), center of edge beam to bridge fascia (h), edge of beam to edge of fascia (j).

Select: Bridge span, bridge width.

Notes: Based on a bridge span and width selection, the beam dimension table can be consulted to select an applicable beam size and beam spacing; variables a-j are specified in the selection tables. The selection table is for reference only and should not appear on the construction plans. Beam size and spacing selections may be used for spans less than or equal to the provided span increment. The section should be redrawn to match the beam size, spacing, and number of beams selected. Typical details for an aesthetic parapet are shown. Other options are possible.

DECK 008: Bridge Section for Steel Beams

This sheet is only applicable to a steel beam bridge. Discard for other bridge types.

Contains: Bridge section, deck section, railing section, beam size and spacing table.

Variable items: Out-to-out bridge width (a), clear roadway width (b), half of roadway clear width (c), number of beam bays (d), beam spacing (e), bridge width center-to-center of edge beams (f), beam size (g), center of edge beam to bridge fascia (h).

Select: Bridge span, bridge width.

Notes: Based on a bridge span and width selection, the beam dimension table can be consulted to select an applicable beam size and beam spacing; variables a-h are specified in the selection tables. The selection table is for reference only and should not appear on the construction plans. Beam size and spacing selections may be used for spans less than or equal to the provided span increment. The section should be redrawn to match the beam size, spacing, and number of beams selected. Typical details for an aesthetic parapet are shown. Other options are possible.

SBB 001: Erection Diagram for Spread Box Beams

This sheet is only applicable to a spread box beam bridge. Discard for other bridge types.

Contains: Erection diagram, superstructure reactions, lifting device detail, strand detail table for lifting device.

Variable items: Bridge span (L), angle of crossing (θ), number of beam bays (d), beam spacing (e), bridge width center-to-center of edge beams (f), beam size (g), center of bearing to reference line (X), distance from center of nearest beams to bridge construction centerline (A, B), multiple values within notes, strand size and number for lifting device.

Select: Angle of crossing case, strand size and number for lifting device.

Notes: The left side of the erection plan applies to a 90˚ angle of crossing, while the right side applies to angles of crossing from $60^\circ \leq \theta < 90^\circ$. Erection plan should be redrawn to appropriately match the number of beams and required angle of crossing. Reactions are given per beam for dead load and per lane for live load and are intended to be used to aid substructure design. Values given as: $\boxed{\text{XX}}$ are to be filled in by the designer.

SBB 002: Shear Reinforcement for Spread Box Beams

This sheet is only applicable to a spread box beam bridge. Discard for other bridge types.

Contains: Stirrup plan, slab tie plan, beam section, end block section, beam dimension table.

Variable items: Length of beam (W), number of stirrups near beam center (g), stirrup spacing near beam center (k), total length of stirrup region near beam center (h), number of stirrups in skew-to-normal transition zone (m), total length of stirrup region in skew-to-normal transition zone (n), number of slab ties (s), total length of slab tie region (u), angle of crossing (θ).

Select: Beam size, angle of crossing.

Notes: The left side of the stirrup and slab tie plan applies to a 90˚ angle of crossing, while the right side applies to angles of crossing from $60^\circ \leq \theta < 90^\circ$. Once a spread box beam size is selected, the beam dimension table can be consulted to select appropriate stirrup spacing and slab tie input parameters g-W. The selection table is for reference only and should not appear on the construction plans. The beam plan should be redrawn to appropriately match the angle of crossing.

SBB 003: Spread Box Beam Sections

This sheet is only applicable to a spread box beam bridge. Discard for other bridge types.

Contains: Spread box beam sections.

Variable items: Beam size, strand location and number.

Select: Beam cross-section.

Notes: The required beam section is selected on DECK 005. Then, SBB 004 is consulted to determine the required strand layout. Once the beam size and strand layout is known, the appropriate section can be redrawn with the correct number of strands and placement. Only the beam section(s) used should appear on the construction plans.

SBB 004: Spread Box Beam Strand Layout

This sheet is only applicable to a spread box beam bridge. Discard for other bridge types.

Contains: Strand layout and debonding table, corner blocking detail, beam end detail.

Variable items: Backwall thickness (D), angle of crossing (θ), strand layout and debonding, location of backwall inserts.

Select: Strand layout case (from table).

Notes: The strand/debonding table is consulted for the bridge span and beam size used. The table provides the number of strands per layer, the number of debonding strands, and the length of debonding. The debonding length is given in the format: $(n_1)x_1$, $(n_2)x_2$, ... $n_i(x_i)$, and/or $[n_1]x_1$, $[n_2]x_2$, ... $n_i[x_i]$, where n_i refers to the number of strands debonded and x_i is the debonding length (ft); ( ) refers to strands in the first layer while [ ] refers to strands in the second layer. The selection table is for reference only and should not appear on the construction plans.

SSBB 001: Erection Diagram for Side by Side Box Beams

This sheet is only applicable to a side by side box beam bridge. Discard for other bridge types.

Contains: Erection diagram, superstructure reactions, lifting device detail, strand detail table for lifting device, location of transverse post-tensioning strands.

Variable items: Bridge span (L), angle of crossing (θ), number of beams (d), beam size (e), bridge width edge to edge of exterior beams (f), center of bearing to reference line (X), distance from center of nearest beams to bridge construction centerline (A, B), post-tensioning strand location, multiple values within notes, strand size and number for lifting device.

Select: Angle of crossing case, post tensioning strand locations, size and number for lifting device.

Notes: The left side of the erection plan applies to a 90˚ angle of crossing, while the right side applies to angles of crossing from 60 ˚ ≤ θ < 90˚. Erection plan should be redrawn to appropriately match the number of beams and required angle of crossing. Reactions are given per beam for dead load and per lane for live load and are intended to be used to aid substructure design. Values in the notes given as: $\boxed{\text{XX}}$ are to be filled in by the designer.

SSBB 002: Shear Reinforcement for Side by Side Box Beams

This sheet is only applicable to a side by side box beam bridge. Discard for other bridge types.

Contains: Stirrup plan, slab tie plan, beam section, end block section, beam dimension table.

Variable items: Length of beam (W), number of stirrups near beam center (g), stirrup spacing near beam center (k), total length of stirrup region near beam center (h), number of stirrups in skew-to-normal transition zone (m), total length of stirrup region in skew-to-normal transition zone (n), number of slab ties (s), total length of slab tie region (u), angle of crossing (θ).

Select: Beam size, angle of crossing.

Notes: The left side of the stirrup and slab tie plan applies to a 90˚ angle of crossing, while the right side applies to angles of crossing from 60 ˚ ≤ θ < 90˚. Once a spread box beam size is selected, the beam dimension table can be consulted to select appropriate stirrup spacing and slab tie input parameters g-W. Beam plan should be redrawn to appropriately match the angle of crossing. The selection table is for reference only and should not appear on the construction plans.

SSBB 003 & SSBB 004: Side by Side Box Beam Sections

These sheets are only applicable to a side by side box beam bridge. Discard for other bridge types.

Contains: Side by side box beam sections.

Variable items: Beam size, strand location and number.

Select: beam cross-section.

Notes: The required beam section is selected on DECK 6. Then, SSBB 005 is consulted to determine the required strand layout. Once the beam size and strand layout is known, the appropriate section can be redrawn with the correct number of strands and placement. Only the beam section(s) used should appear on the construction plans.

SSBB 005: Side by Side Box Beam Strand Layout

This sheet is only applicable to a side by side box beam bridge. Discard for other bridge types.

Contains: Strand layout and debonding table, corner blocking detail, post-tensioning details.

Variable items: location of post-tensioning tendon (X), strand layout and debonding, angle of crossing (θ).

Select: Post tensioning detail.

Notes: The strand/debonding table is consulted for the bridge span and beam size used. The table provides the number of strands (all in one layer), the number of debonding strands, and the length of debonding. The debonding length is given in the format: $(n_1)x_1$, $(n_2)x_2$, ... $n_i(x_i)$, where n_i refers to the number of strands debonded and x_i is the debonding length (ft); The post tensioning detail (single or multiple duct) is to be selected based on the requirements determined from the tendon location tables on SSBB 001. Stress pocket and corner blocking details should be redrawn to appropriately match the angle of crossing.

BTB 001: Erection Diagram for Bulb Tee Girder

This sheet is only applicable to a bulb tee girder bridge. Discard for other bridge types.

Contains: Erection diagram, superstructure reactions, lifting device detail, strand detail table for lifting device.

Variable items: Bridge span (L), angle of crossing (θ), number of beam bays (d), beam spacing (e), bridge width center-to-center of edge beams (f), beam size (g), center of bearing to reference line (X), distance from center of nearest beams to bridge construction centerline (A, B), multiple values within notes, strand size and number for lifting device.

Select: Angle of crossing case, strand size and number for lifting device.

Notes: The left side of the erection plan applies to a 90˚ angle of crossing, while the right side applies to angles of crossing from $60^\circ \leq \theta < 90^\circ$. Erection plan should be redrawn to appropriately match the number of beams and required angle of crossing. Reactions are given per beam for dead load and per lane for live load and are intended to be used to aid substructure design.

BTB 002: Bulb Tee Girder Sections

This sheet is only applicable to a bulb tee girder bridge. Discard for other bridge types.

Contains: Bulb tee girder sections, draped strand layout.

Variable items: number of EL05 bars near beam center (c), number of EA04 bars near beam center (c1), left end of beam to center of bearing (E), right end of beam to center of bearing (G), left end beam slope offset (L), right end beam slope offset (L'), left end of beam to pipe sleeves (M), right end of beam to pipe sleeves (N), position of strand hold down points (R), distance, center to center of bearings (T), number of EF03 bars near beam center (g), length of region of EF03 bars (U), vertical position of insert/sleeves (A, B), total beam length (Y).

Select: Beam cross-section.

Notes: The required beam section is selected on DECK 007. Then, BTB 003 is consulted to determine the required strand layout. Once the beam size and strand layout is known, the appropriate section can be redrawn with the correct number of strands and placement. The sole plate tilt table is to be filled in by the designer.

BTB 003: Bulb Tee Girder Strand Layout and Diaphragms

This sheet is only applicable to a bulb tee girder bridge. Discard for other bridge types.

Contains: Strand layout and debonding table, diaphragm details.

Variable items: strand layout and debonding, diaphragm support height (C), center-to-center distance of support bolt holes (B), angle of crossing (θ), vertical position of first (A) diaphragm support bolt.

Select: Diaphragm connection detail, diaphragm plan, concrete insert detail, diaphragm type.

Notes: The strand table is consulted for the bridge span and beam size used. The table provides the number of strands per layer, the number of strands, the number of draped strands, and the height of the draped strands. The draped strand height is given in the format: n_1, (m_1), [e_1]; n_2, (m_2), [e_2];... n_i, (m_i), [e_i], where *i* is the strand layer, n_i refers to the number of draped strands, (m_i) is the height of the strand at midspan, and [e_i] is the height of the strand at the beam end (inches). The diaphragm connection detail, plan, and concrete insert detail is selected based on skew angle (either $\theta \leq 10^\circ$ or $\theta > 10^\circ$). Diaphragm shape type is either an angle (shown in Section A-A) or channel (shown in the Alternate Diaphragm detail). Either alternative diaphragm types may be used, at the preference of the contractor.

STEEL 001: Erection Diagram for Steel Beam

This sheet is only applicable to a steel beam bridge. Discard for other bridge types.

Contains: Erection diagram, superstructure reactions.

Variable items: Bridge span (L), beam span center-to-center of bearings (S), angle of crossing (θ), number of beam bays (d), beam spacing (e), bridge width center-to-center of edge beams (f), beam size (g), center of bearing to reference line (X), distance from center of nearest beams to bridge construction centerline (A, B).

Select: Angle of crossing case.

Notes: The left side of the erection plan applies to a 90˚ angle of crossing, while the right side applies to angles of crossing from 60 ˚ $\leq \theta <$ 90˚. Erection plan should be redrawn to appropriately match the number of beams and required angle of crossing. Reactions are given per beam for dead load and per lane for live load and are intended to be used to aid substructure design. Quantity of structural steel is to be specified by the designer in the construction notes.

STEEL 002: Steel Beam Dimensions and Shear Studs

This sheet is only applicable to a steel beam bridge. Discard for other bridge types.

Contains: Beam elevation and shear stud plan and elevation details, beam dimensions table.

Variable items: Beam length (W), number of shear studs (a), total length of region with studs (b), number of spacings of beam end holes (c), spacing of beam end holes (d), total length of end holes (e), distance from beam end to center of bearing (f).

Select: Beam size, shear stud developer plan.

Notes: Girder size is selected based on bridge span, as given in the Beam dimension table. Shear stud details are selected based on beam size and angle of crossing (based on either a 90˚ angle of crossing or angles of crossing < 90˚). Shear stud plan should be redrawn to appropriately match the required angle of crossing.

STEEL 003: Steel Beam Diaphragm

This sheet is only applicable to a steel beam bridge. Discard for other bridge types.

Contains: Diaphragm details, stiffener detail.

Variable items: Beam spacing (a), number of spaces between holes (# of holes -1) (b); vertical hole spacing (c); total distance between holes (d), diaphragm depth (e), angle of crossing (θ).

Select: Diaphragm size and type (typical, alternate, or both).

Notes: Diaphragm size and fastener hole locations are based on girder type, as given in the Diaphragm dimension table. Section and elevations should be redrawn to match the specified bridge geometry and diaphragm size.

STEEL 004: Deflection Diagram

This sheet is only applicable to a steel beam bridge. Discard for other bridge types.

Contains: Camber diagram, camber value tables.

Variable items: Number of ordinates (a), ordinate spacing (b), length of beam (c), camber values.

Select: Bridge span.

Notes: Based on bridge span, ordinate location and camber values are read from the Ordinate dimension and Theoretical camber tables.

BRG 001: Box Beam Bearing Pads

This sheet is only applicable to a box beam bridge. Discard for other bridge types.

Contains: Bearing plan, bearing section, bearing pad dimension table.

Variable items: Bearing pad width (W), bearing pad length (L), bearing pad thickness (J), number of shim plates (s), number of interior elastomer layers (n), interior elastomer layer thickness (t).

Select: Angle of crossing case, bearing type (fixed or expansion).

Notes: Based on bridge span, bearing pad parameters are read from the Bearing pad dimension table. Plan and section should be redrawn to match the specified beam width, angle of crossing, and bearing pad dimensions.

BRG 002: Bulb Tee Bearing Pads

This sheet is only applicable to a bulb tee bridge. Discard for other bridge types.

Contains: Bearing plan, bearing section, bearing pad dimension table.

Variable items: Bearing pad width (W), bearing pad length (L).

Select: --

Notes: Based on bridge span, bearing pad parameters are read from the Bearing pad dimension table. Plan and section should be redrawn to match the specified beam width and bearing pad dimensions.

BRG 003: Steel Beam Bearing Pads

This sheet is only applicable to a steel beam bridge. Discard for other bridge types.

Contains: Bearing pad and sole plate details, bearing pad dimension table.

Variable items: width of bearing pad (B), sold plate width (D), distance from retainer bolt to center of beam (E), length of bearing pad (G), length of sole plate (H), bearing pad thickness (J), number of shim plates (s), number of interior elastomer layers (n), interior elastomer layer thickness (t), height of side retainer (L), thickness of sole plate (N).

Select: Bearing type (expansion or fixed).

Notes: Based on bridge span, bearing pad parameters are read from the Bearing pad dimension table. Bearing type (expansion or fixed) should match the abutment type, as selected on DECK 002.

EXPJT 001: Expansion Joints

This sheet is applicable to all structure types.

Contains: Expansion joint plan and sections.

Variable items: --

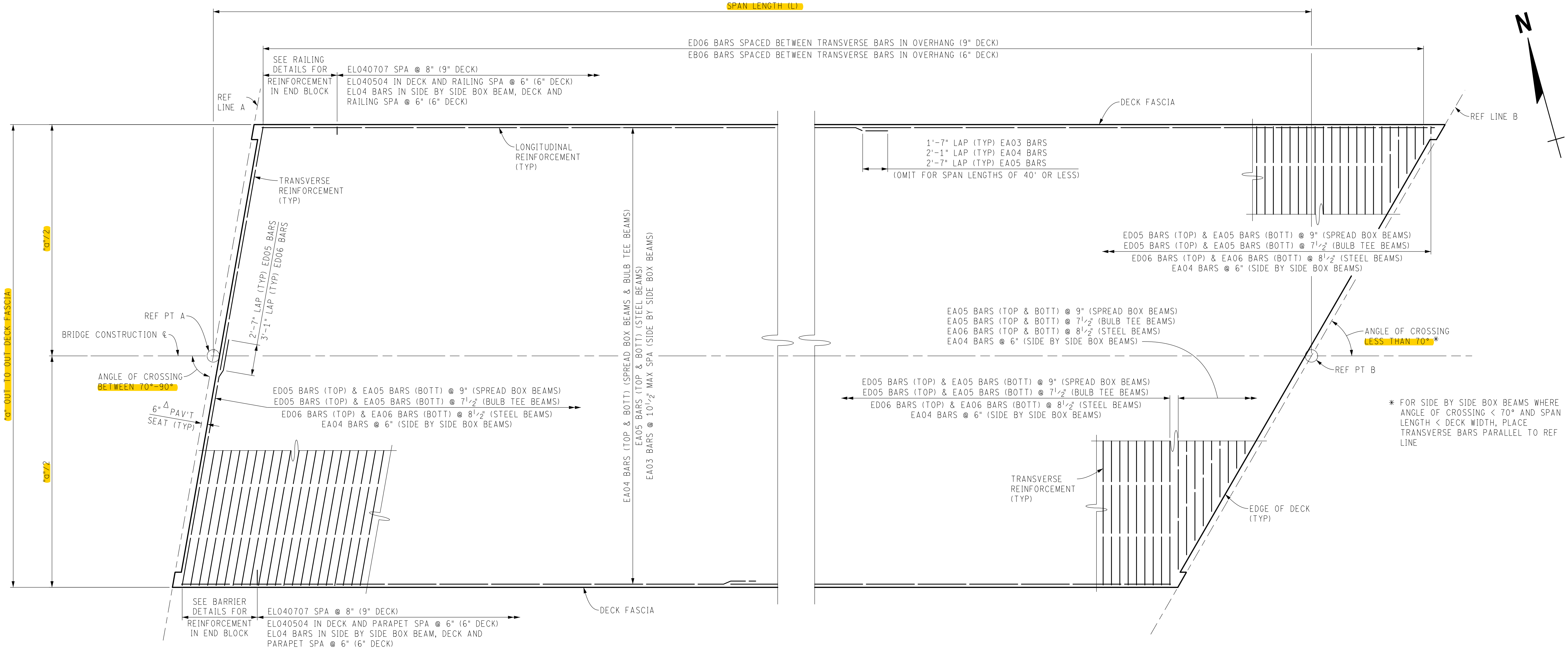
Select: --

Notes: The designer must select an appropriate expansion joint type to accommodate the total bridge movement. These selections are not provided on this sheet.

Values in the table within the Notes section are to be filled in by the designer.

Appendix A: Highlighted Plans

The set of plans in Appendix A has all variable terms highlighted in yellow for identification.

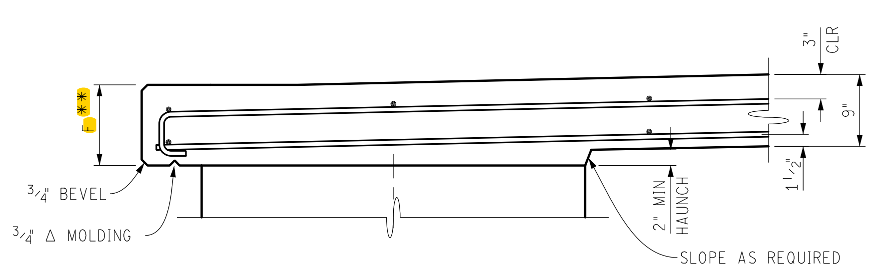


* FOR SIDE BY SIDE BOX BEAMS WHERE ANGLE OF CROSSING < 70° AND SPAN LENGTH < DECK WIDTH, PLACE TRANSVERSE BARS PARALLEL TO REF LINE

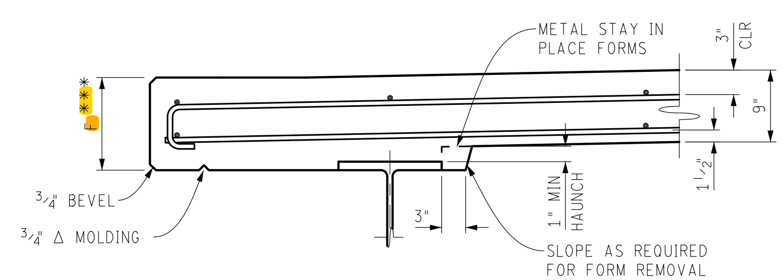
PLAN OF DECK
(ANGLE OF CROSSING 70° OR GREATER)

PLAN OF DECK
(ANGLE OF CROSSING LESS THAN 70°)

Δ 5" FOR SIDE BY SIDE BOX BEAM ONLY



HAUNCH DETAIL
CONCRETE SPREAD BOX BEAMS & BULB TEE BEAMS



HAUNCH DETAIL
STEEL BEAMS

FOR INFORMATION ONLY:

** FASCIA THICKNESS (F) = 9" + HAUNCH + ½" + AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN MINIMUM SLAB THICKNESS AT CURB LINE.

*** FASCIA THICKNESS (F) = 9" + HAUNCH + THICKEST FASCIA BEAM FLANGE + ½" + AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN MINIMUM SLAB THICKNESS AT CURB LINE.

IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

THE ABOVE NOTES ARE FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)

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SUPERSTRUCTURE DETAILS

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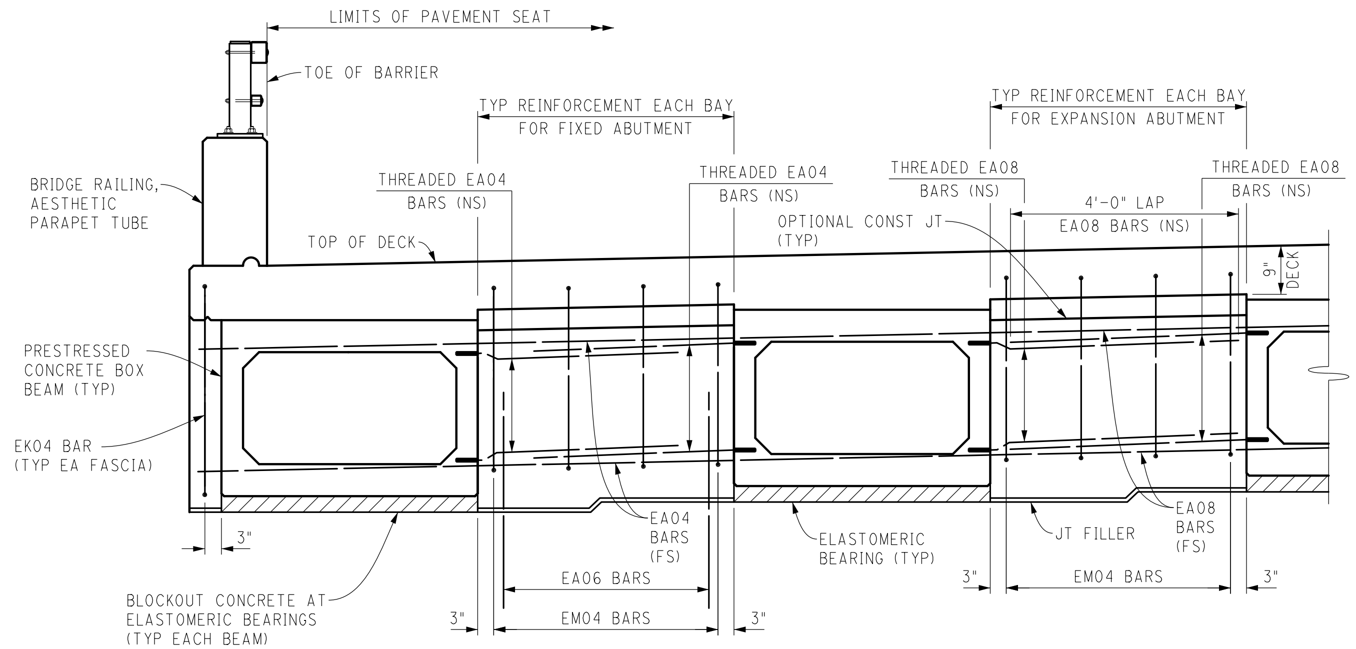
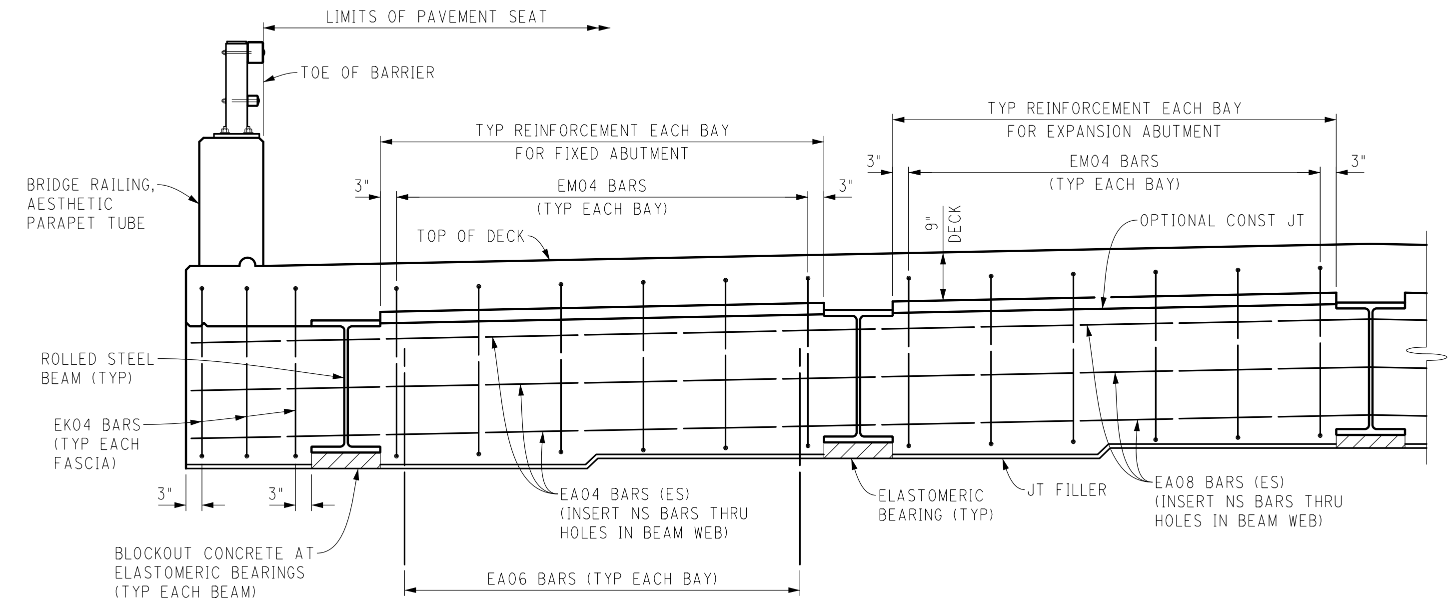
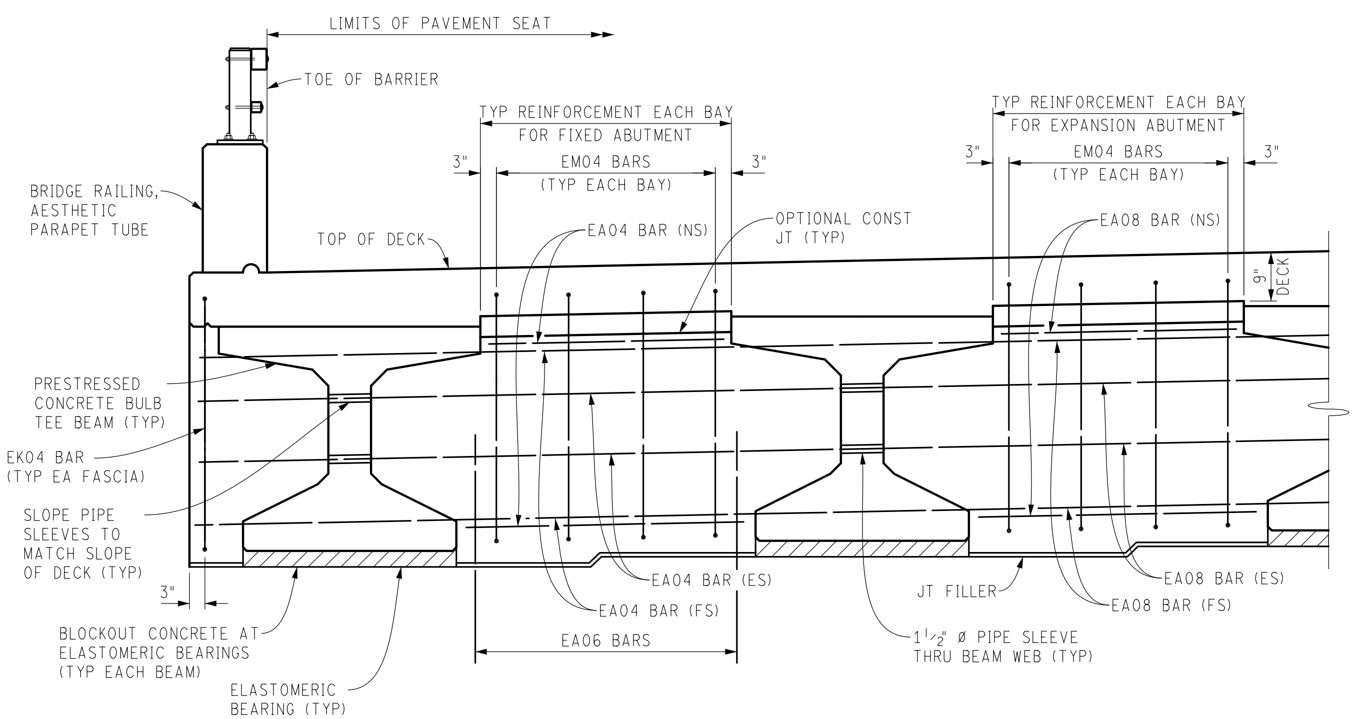


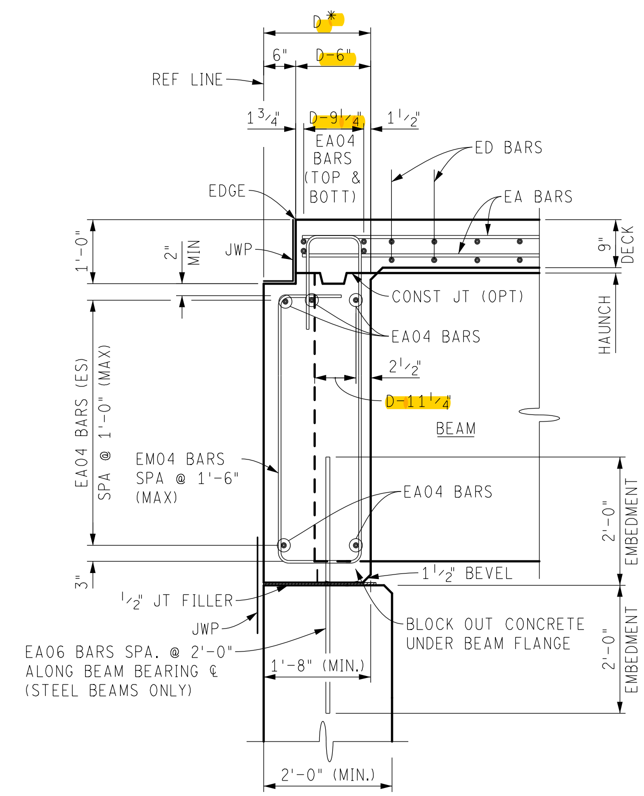
TYPICAL ABUTMENT BACKWALL - SPREAD BOX BEAM



TYPICAL ABUTMENT BACKWALL - ROLLED STEEL BEAM



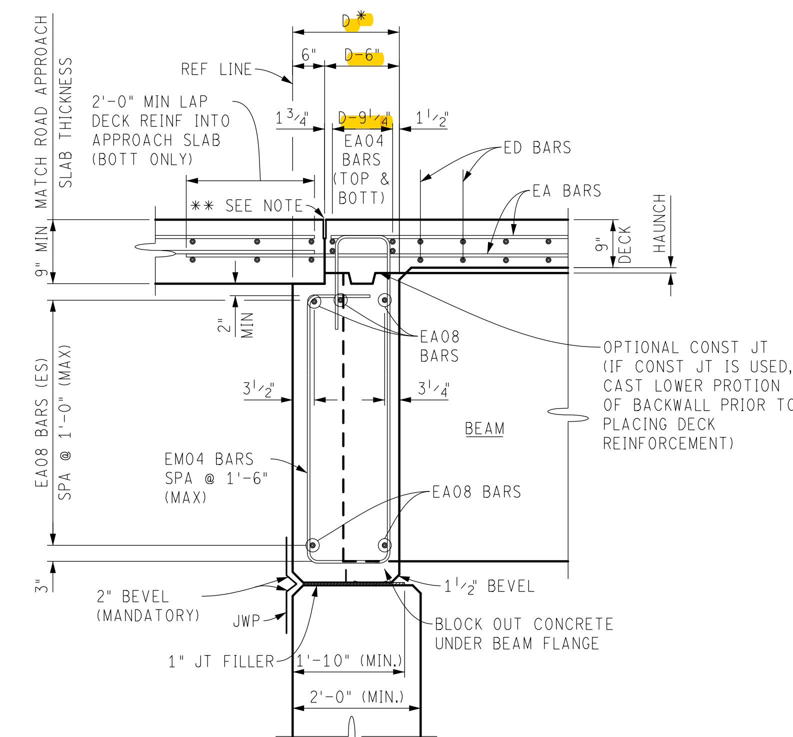
TYPICAL ABUTMENT BACKWALL - BULB TEE BEAM



TYPICAL BACKWALL SECTION (FIXED)

CAST LOWER PORTION OF THE BACKWALL PRIOR TO PLACING DECK REINFORCEMENT. (USE WITH MANDITORY JOINT)

IF A CONSTRUCTION JOINT IS USED, CAST THE LOWER PORTION OF THE BACKWALL PRIOR TO PLACING DECK REINFORCEMENT.



TYPICAL BACKWALL SECTION (EXPANSION)

CAST LOWER PORTION OF THE BACKWALL PRIOR TO PLACING DECK REINFORCEMENT. (USE WITH MANDITORY JOINT)

IF A CONSTRUCTION JOINT IS USED, CAST THE LOWER PORTION OF THE BACKWALL PRIOR TO PLACING DECK REINFORCEMENT.

FOR INFORMATION ONLY:

* THE BACKWALL THICKNESS "D" IS THE GREATER OF:

1) 1'-8" OR THE BEARING DIMENSION PLUS 1/2 THE BEARING WIDTH - (FOR 90° CROSSINGS)

2) 1'-8" OR THE BEARING DIMENSION PLUS THE PRODUCT OF 1/2 FLANGE WIDTH AND COSINE ANGLE OF CROSSING - (FOR SKEWED CROSSINGS)

THE ABOVE NOTES ARE FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.

NOTES:

** IF A CONSTRUCTION JOINT IS NOT USED, THE CONTRACTOR IS TO PROVIDE A SAWED JOINT (1/3 DECK SLAB THICKNESS)" DEEP BY 1/4" WIDE (MINIMUM) IN THE TOP OF SLAB AT TRANSVERSE CONSTRUCTION JOINTS OVER THE BACKWALL. IF A CONSTRUCTION JOINT IS NOT USED, THE JOINT IS TO BE SAWED WITHIN 24 HOURS OF PLACING THE CURING AND IS TO BE FILLED TO 1/2" BELOW TOP OF CONCRETE WITH POLYURETHANE OR POLYURETHANE HYBRID SEALANT.

NS DENOTES NEAR SIDE.

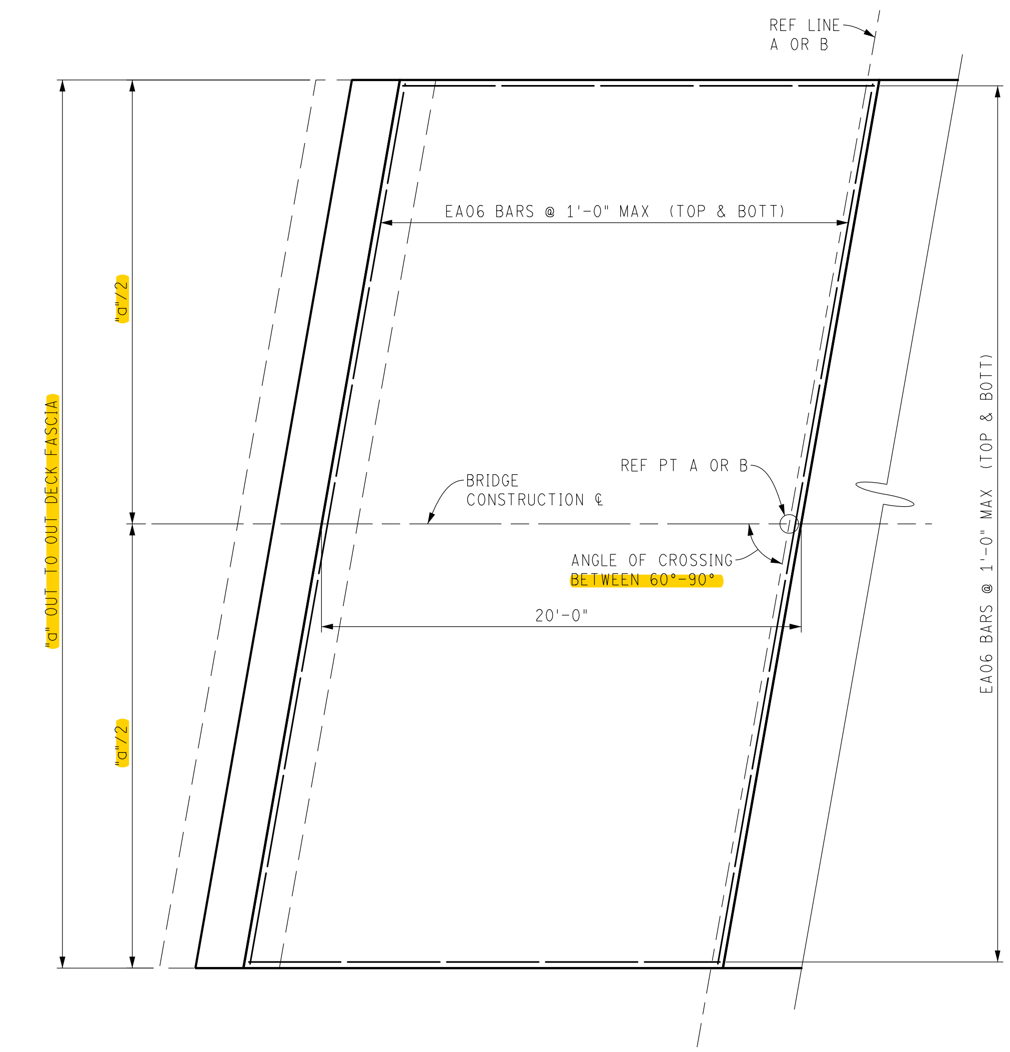
FS DENOTES FAR SIDE.

ES DENOTES EACH SIDE.

JWP DENOTES JOINT WATERPROOFING.

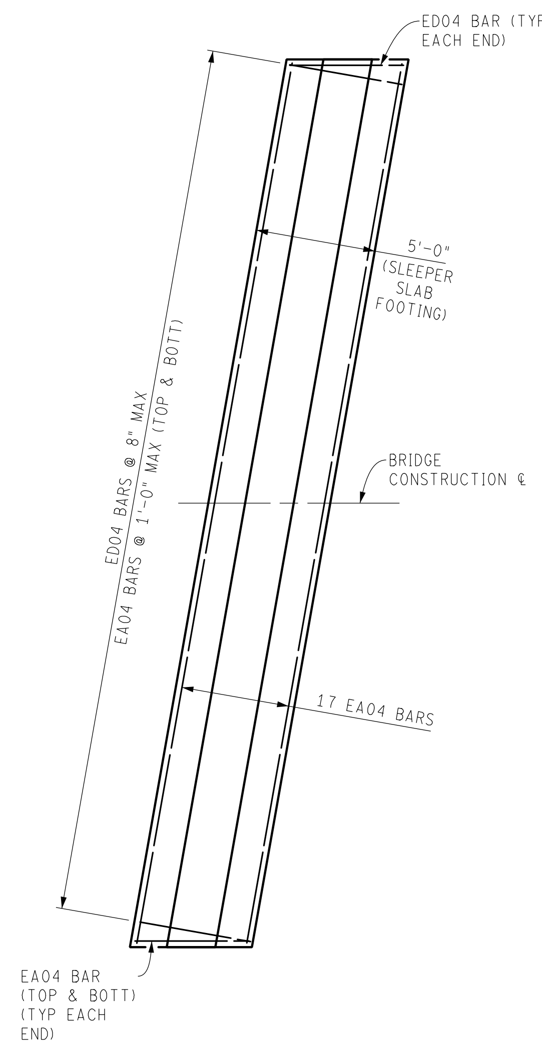
FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

NO SCALE	FILE: Deck_002.dgn	DATE: 05/09/18 DESIGN UNIT: TSC:	CS: JN:	SUPERSTRUCTURE DETAILS	DRAWING: DECK SHEET: 002 SECT



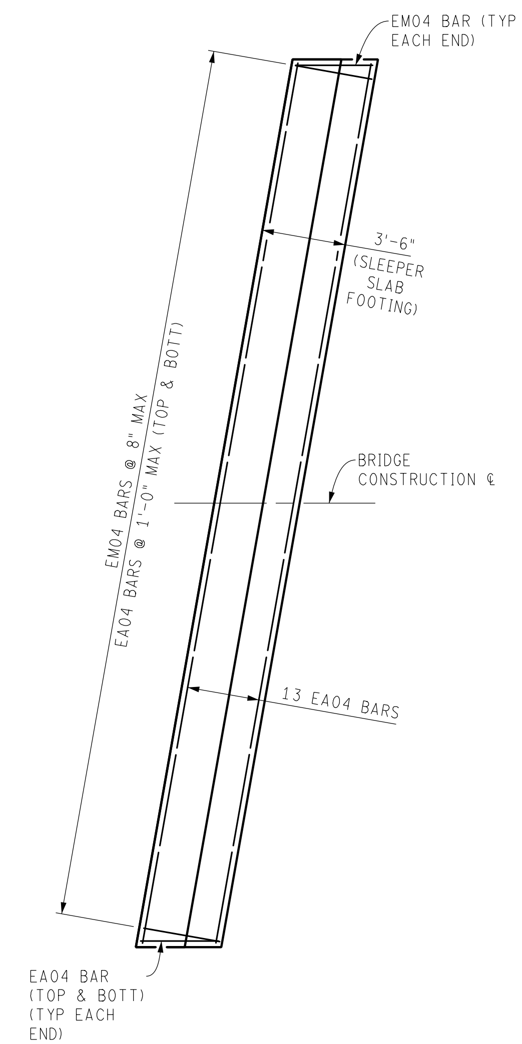
PLAN OF APPROACH SLAB (EXPANSION SIDE)

(ANGLE OF CROSSING 60° OR GREATER)
(SLEEPER SLAB FOR CONCRETE APPROACH SHOWN)



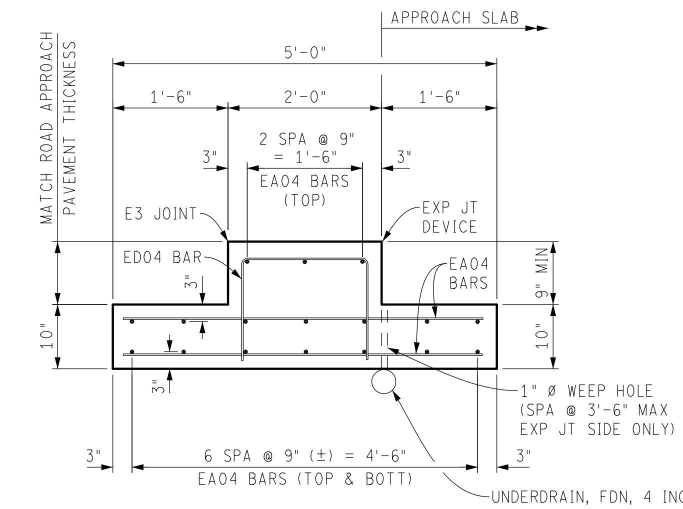
PLAN OF SLEEPER SLAB

(ANGLE OF CROSSING 60° OR GREATER)
(CONCRETE APPROACH)

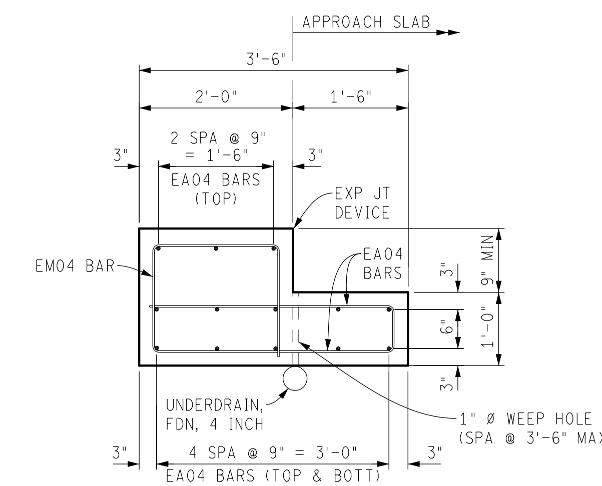


PLAN OF SLEEPER SLAB

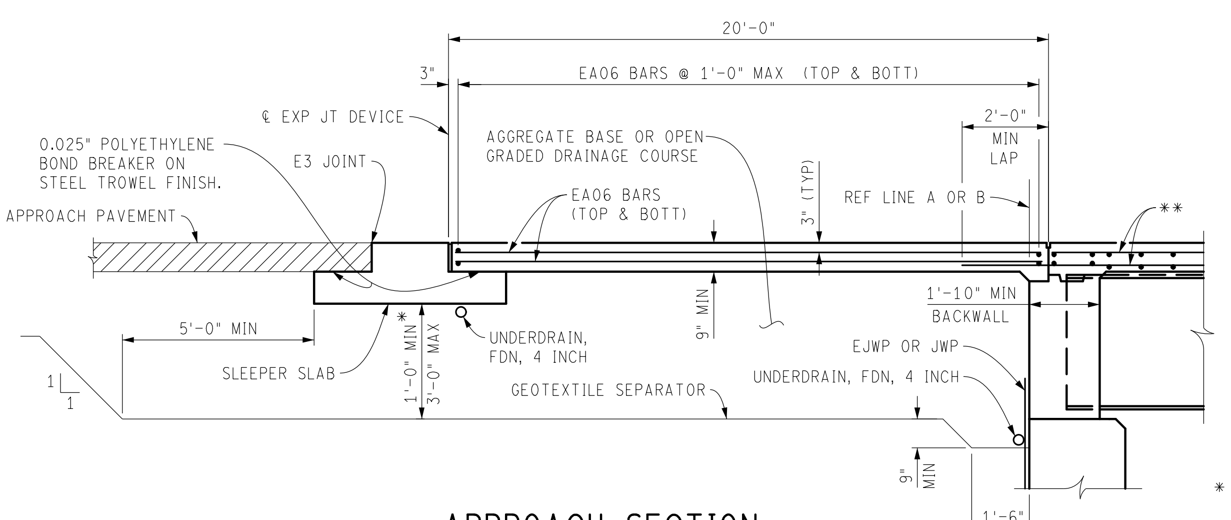
(ANGLE OF CROSSING 60° OR GREATER)
(HMA APPROACH)



SECTION THRU SLEEPER SLAB WITH CONCRETE APPROACH



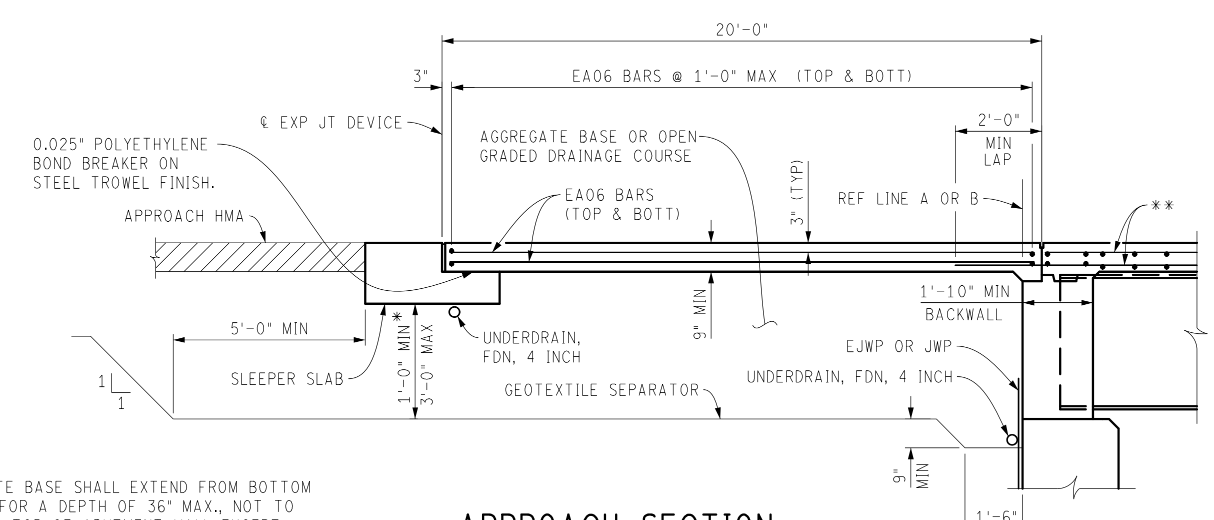
SECTION THRU SLEEPER SLAB WITH HMA APPROACH



APPROACH SECTION

(CONCRETE APPROACH)

* OGDC OR AGGREGATE BASE SHALL EXTEND FROM BOTTOM OF SLEEPER SLAB FOR A DEPTH OF 36" MAX., NOT TO EXTEND BELOW THE TOP OF ABUTMENT WALL EXCEPT WHEN NECESSARY TO PROVIDE A MINIMUM OF 12" BELOW SLEEPER SLAB.



APPROACH SECTION

(HMA APPROACH)

NOTE:

USE APPROACH SLAB DETAILS ON STANDARD PLAN R-45 SERIES WHEN LENGTH OF BRIDGE CONTRIBUTING TO EXPANSION AT AN ABUTMENT IS LESS THAN 50 FEET FOR CONCRETE BEAM BRIDGES, AND LESS THAN 25 FEET FOR ROLLED STEEL BRIDGES.

THE ABOVE NOTE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.

** EA04 BARS (TOP & BOTT)
(FOR SPREAD BOX BEAM)
EA05 BARS (TOP & BOTT)
(FOR STEEL BEAMS)
EA03 BARS (SINGLE LAYER)
(FOR SIDE BY SIDE BOX BEAMS)

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)

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CS:
JN:

SUPERSTRUCTURE DETAILS

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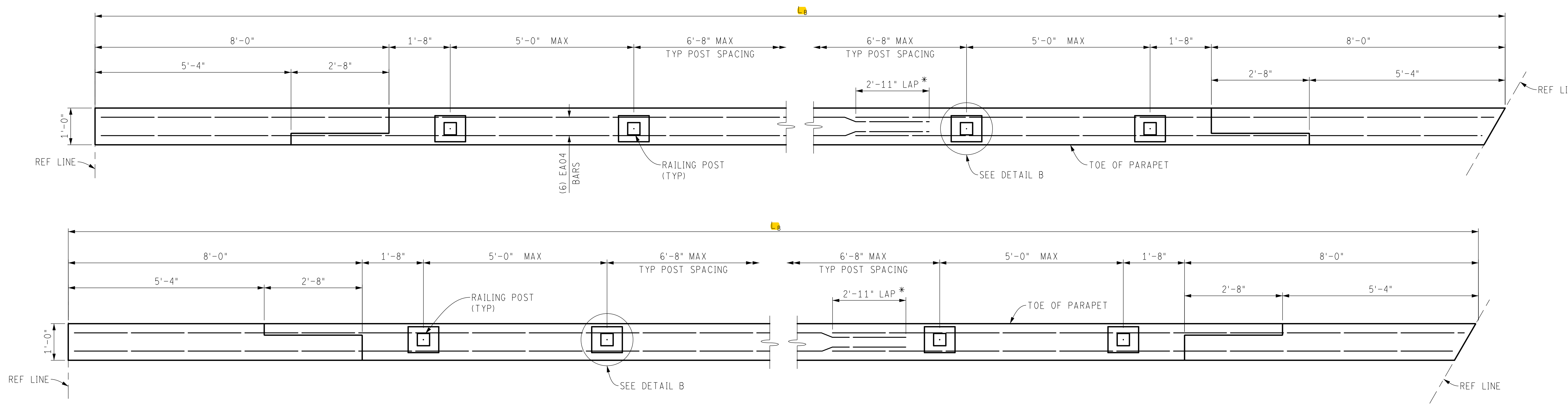


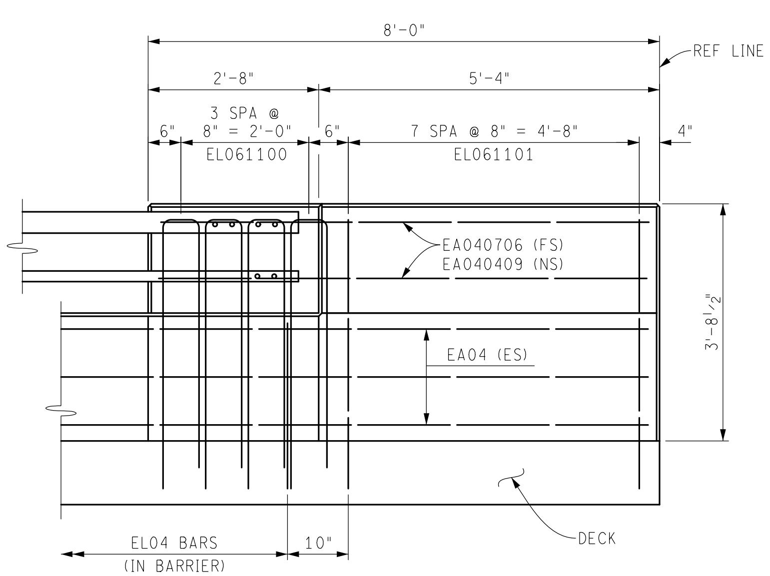
PLAN OF BARRIER

(ANGLE OF CROSSING 90°)
(AESTHETIC PARAPET TUBE)

PLAN OF BARRIER

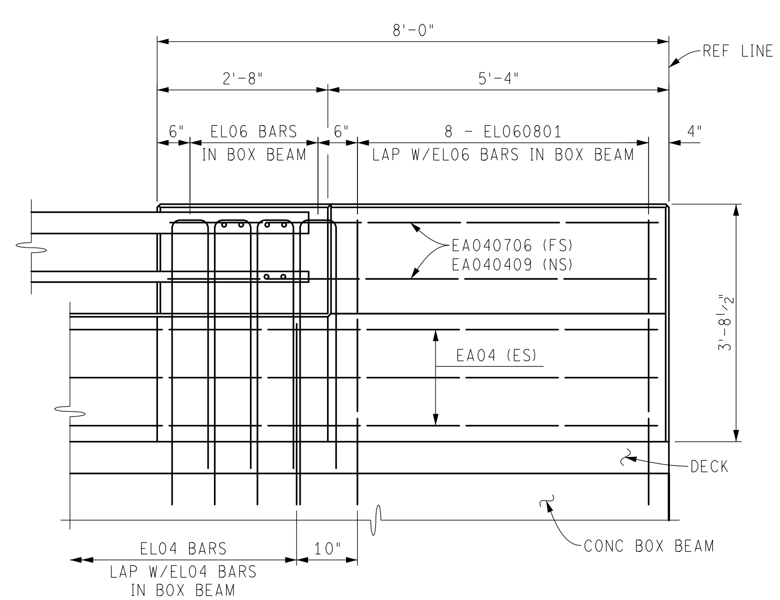
(ANGLE OF CROSSING LESS THAN 90°)
(AESTHETIC PARAPET TUBE)

* OMIT LAP FOR SPANS 40'-0" OR UNDER



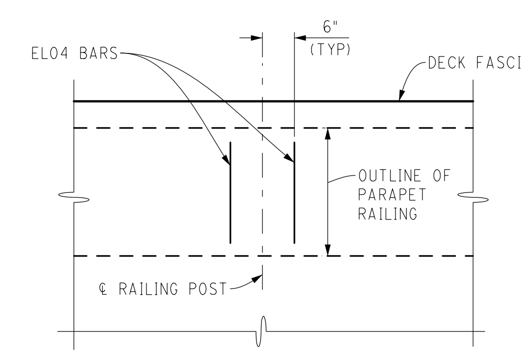
END WALL ELEVATION

(SPREAD BOX BEAM, BULB T BEAM, ROLLED STEEL BEAM)



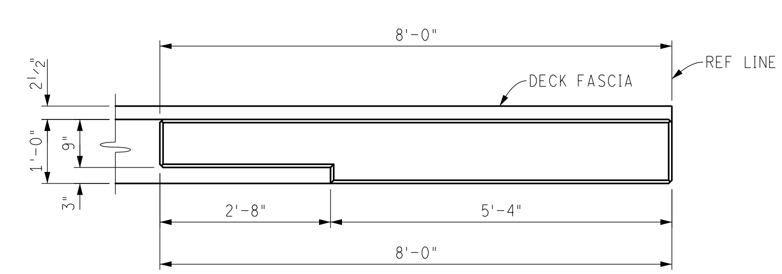
END WALL ELEVATION

(SIDE BY SIDE BOX BEAM)



DETAIL B

PLACE 2 ADDITIONAL EL04 BARS AT EACH RAILING POST AS SHOWN.
ADJUST SPACING OF ADJACENT REINFORCEMENT IF NECESSARY.



END WALL PLAN

NOTES:

ES DENOTES EACH SIDE.

FS DENOTES FAR SIDE.

NS DENOTES NEAR SIDE.

SEE STANDARD PLAN B-25 SERIES FOR ADDITIONAL RAILING DETAILS.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)

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NO SCALE

FILE: Deck_004.dgn

DATE: 05/09/18

DESIGN UNIT:

TSC:

CS:

JN:

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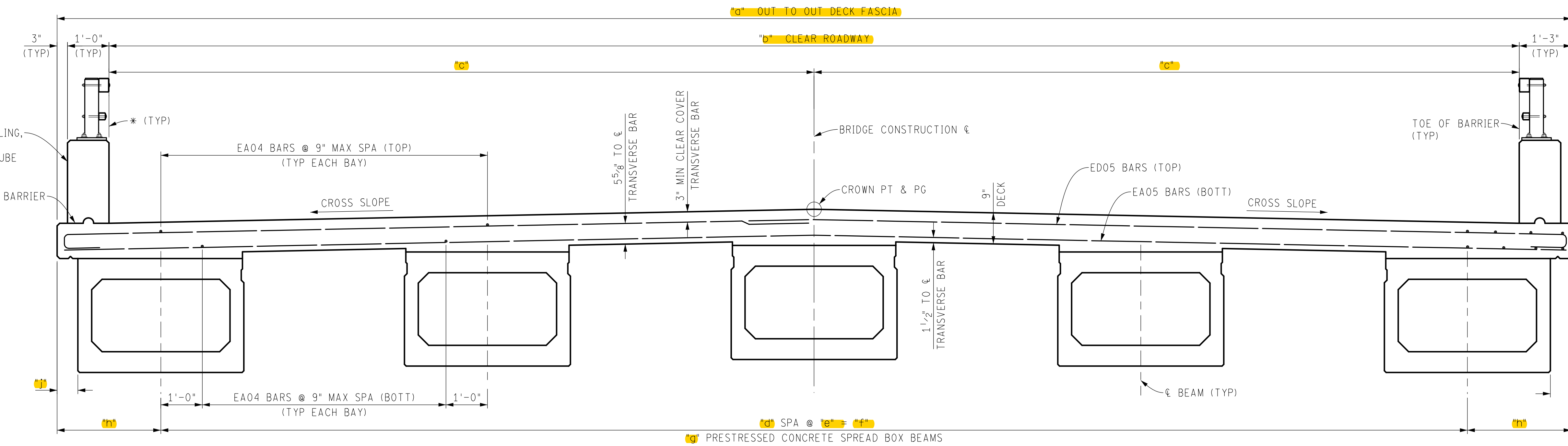
DRAWING DECK 004

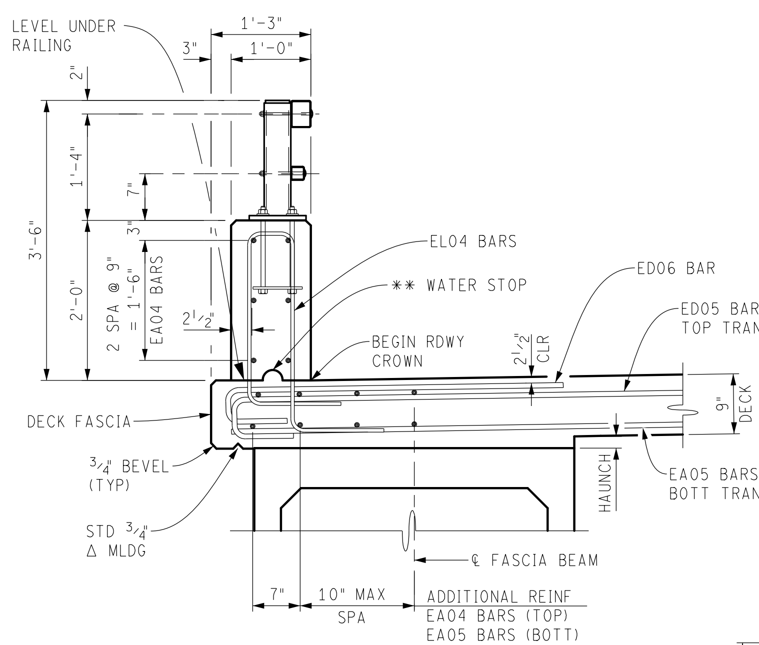
SHEET SECT



* PERPENDICULAR TO PLANE OF SLAB – NORMAL CROWN SECTION AND HIGH SIDE OF SUPERELEVATED SECTIONS

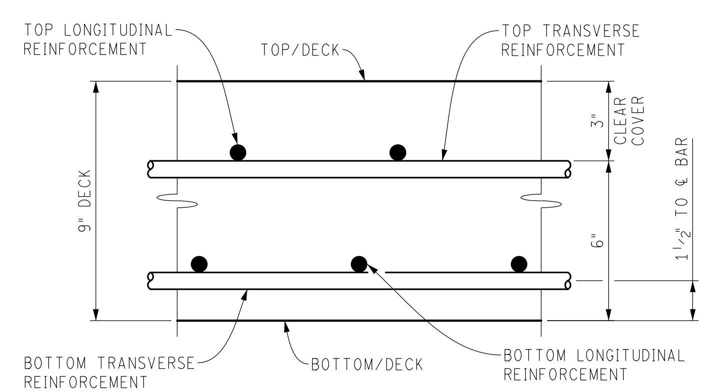
DECK SECTION

(AESTHETIC PARAPET TUBE RAILING SHOWN)



TYPICAL RAILING SECTION

(AESTHETIC PARAPET TUBE RAILING SHOWN)



PARTIAL DECK SECTION

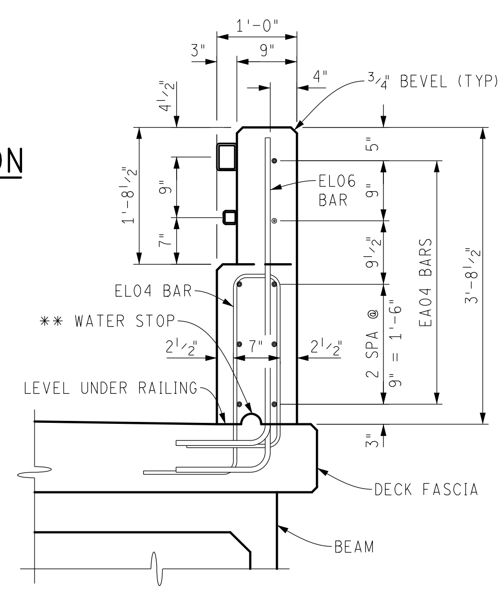
(LOOKING ALONG BRIDGE CONST ℄)

FOR INFORMATION ONLY:

DECK CROSS SECTION IS SHOWN WITH BRIDGE RAILING AESTHETIC PARAPET TUBE. OTHER RAILINGS ARE AVAILABLE. SEE MDOT BRIDGE DESIGN GUIDE.

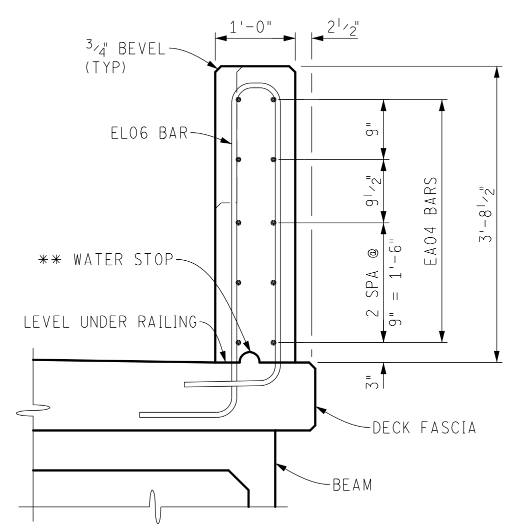
THE ABOVE NOTE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.

** 2" HIGH x 4" LONG (±), FORMING NOT REQUIRED



SECTION AT END WALL

(TUBE CONNECTION AREA)



SECTION AT END WALL

(FULL CONCRETE AREA)

DIMENSION TABLE – 36" WIDE BEAMS

BEAM SPAN (℄ BRG-℄ BRG) (FT)	DIMENSION								
	OUT-TO-OUT "a"	CLR RDWY "b"	"c"	BEAM SPACING "d"	"e"	"f"	BEAM SIZE "g"	"h"	"j"
20	32'-6"	30'-0"	15'-0"	3	9'-2"	27'-6"	17" x 36"	2'-6"	1'-0"
	36'-6"	34'-0"	17'-0"	4	7'-10 1/2"	31'-6"	17" x 36"	2'-6"	1'-0"
	42'-6"	40'-0"	20'-0"	4	9'-4 1/2"	37'-6"	17" x 36"	2'-6"	1'-0"
30	32'-6"	30'-0"	15'-0"	3	9'-2"	27'-6"	21" x 36"	2'-6"	1'-0"
	36'-6"	34'-0"	17'-0"	4	7'-10 1/2"	31'-6"	21" x 36"	2'-6"	1'-0"
	42'-6"	40'-0"	20'-0"	4	9'-4 1/2"	37'-6"	21" x 36"	2'-6"	1'-0"
40	32'-6"	30'-0"	15'-0"	3	9'-2"	27'-6"	21" x 36"	2'-6"	1'-0"
	36'-6"	34'-0"	17'-0"	4	7'-10 1/2"	31'-6"	21" x 36"	2'-6"	1'-0"
	42'-6"	40'-0"	20'-0"	4	9'-4 1/2"	37'-6"	21" x 36"	2'-6"	1'-0"

DIMENSION TABLE – 48" WIDE BEAMS

BEAM SPAN (℄ BRG-℄ BRG) (FT)	DIMENSION								
	OUT-TO-OUT "a"	CLR RDWY "b"	"c"	BEAM SPACING "d"	"e"	"f"	BEAM SIZE "g"	"h"	"j"
50	32'-6"	30'-0"	15'-0"	3	9'-2"	27'-6"	21" x 48"	2'-6"	6"
	36'-6"	34'-0"	17'-0"	4	7'-10 1/2"	31'-6"	21" x 48"	2'-6"	6"
	42'-6"	40'-0"	20'-0"	4	9'-4 1/2"	37'-6"	21" x 48"	2'-6'	6"
60	32'-6"	30'-0"	15'-0"	4	6'-10 1/2"	27'-6"	21" x 48"	2'-6"	6"
	36'-6"	34'-0"	17'-0"	4	7'-10 1/2"	31'-6"	21" x 48"	2'-6"	6"
	42'-6"	40'-0"	20'-0"	5	7'-6"	37'-6"	21" x 48"	2'-6'	6"
70	32'-6"	30'-0"	15'-0"	4	6'-10 1/2"	27'-6"	27" x 48"	2'-6"	6"
	36'-6"	34'-0"	17'-0"	4	7'-10 1/2"	31'-6"	27" x 48"	2'-6"	6"
	42'-6"	40'-0"	20'-0"	5	7'-6"	37'-6"	27" x 48"	2'-6'	6"
80	32'-6"	30'-0"	15'-0"	4	6'-10 1/2"	27'-6"	33" x 48"	2'-6"	6"
	36'-6"	34'-0"	17'-0"	4	7'-10 1/2"	31'-6"	33" x 48"	2'-6"	6"
	42'-6"	40'-0"	20'-0"	5	7'-6"	37'-6"	33" x 48"	2'-6'	6"
90	32'-6"	30'-0"	15'-0"	4	6'-10 1/2"	27'-6"	39" x 48"	2'-6"	6"
	36'-6"	34'-0"	17'-0"	4	7'-10 1/2"	31'-6"	39" x 48"	2'-6"	6"
	42'-6"	40'-0"	20'-0"	5	7'-6"	37'-6"	39" x 48"	2'-6'	6"
100	32'-6"	30'-0"	15'-0"	4	6'-10 1/2"	27'-6"	39" x 48"	2'-6"	6"
	36'-6"	34'-0"	17'-0"	4	7'-10 1/2"	31'-6"	39" x 48"	2'-6"	6"
	42'-6"	40'-0"	20'-0"	5	7'-6"	37'-6"	39" x 48"	2'-6'	6"
110	32'-6"	30'-0"	15'-0"	4	6'-10 1/2"	27'-6"	48" x 48"	2'-6"	6"
	36'-6"	34'-0"	17'-0"	4	7'-10 1/2"	31'-6"	48" x 48"	2'-6"	6"
	42'-6"	40'-0"	20'-0"	5	7'-6"	37'-6"	48" x 48"	2'-6'	6"

NOTES:

DISTRIBUTION STEEL FOR SPREAD BOX BEAMS SHALL BE EQUALLY SPACED SUCH THAT THE DISTANCE BETWEEN THE END BARS AND THE BEAM ℄ DOES NOT EXCEED 1'-0".

FOR SUPERELEVATED SECTIONS REFER TO MDOT DESIGN GUIDES FOR DETERMINING THE CROSS SLOPE.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

NO SCALE

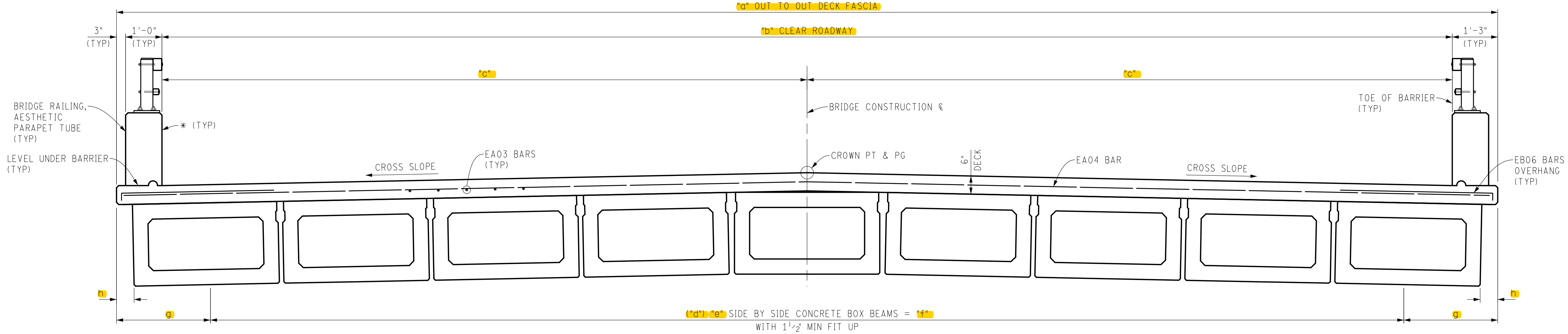
FILE: Deck_SBB_002.dgn

DATE: 05/09/18
DESIGN UNIT:
TSC:

CS:
JN:

SUPERSTRUCTURE DETAILS
SPREAD BOX BEAM

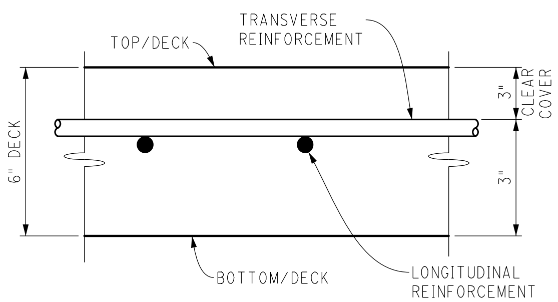
DRAWING	SHEET
DECK	SECT
005	



∗ PERPENDICULAR TO PLANE OF SLAB – NORMAL CROWN SECTION AND HIGH SIDE OF SUPERELEVATED SECTIONS

DECK SECTION

(AESTHETIC PARAPET TUBE RAILING SHOWN)



PARTIAL DECK SECTION

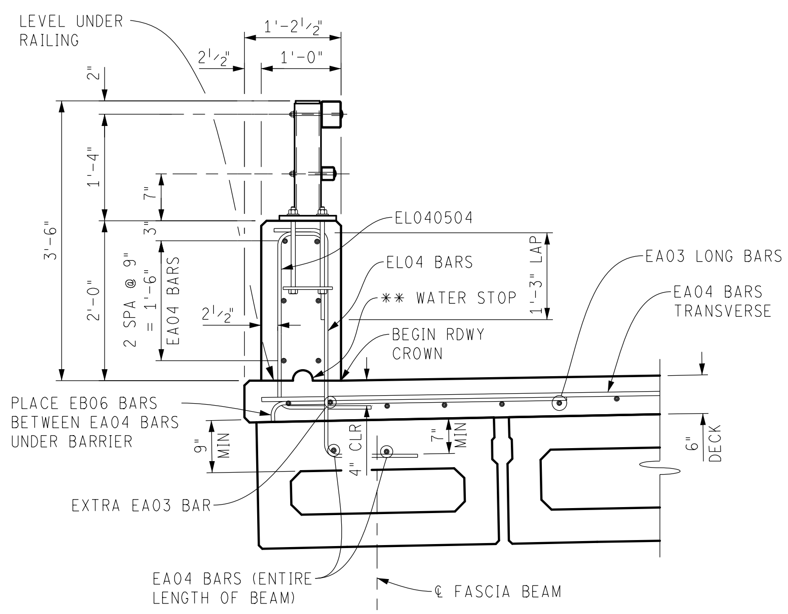
(LOOKING ALONG BRIDGE CONST ℄)

DIMENSION TABLE – 36" WIDE BEAMS

BEAM SPAN (℄ BRG-℄ BRG) (FT)	OUT-TO-OUT "a"	CLR RDWY "b"	"c"	# OF BEAMS "d"	BEAM SIZE "e"	"f"	"g"	"h"
20	32'-6"	30'-0"	15'-0"	9	17 x 36	28'-0"	2'-3"	9"
	36'-6 1/2"	34'-0 1/2"	17'-0 1/4"	10	17 x 36	31'-1 1/2"	2'-8 1/2"	1'-2 1/2"
	42'-6"	40'-0"	20'-0"	12	17 x 36	37'-4 1/2"	2'-6 3/4"	1'-0 3/4"
30	32'-6"	30'-0"	15'-0"	9	17 x 36	28'-0"	2'-3"	9"
	36'-6 1/2"	34'-0 1/2"	17'-0 1/4"	10	17 x 36	31'-1 1/2"	2'-8 1/2"	1'-2 1/2"
	42'-6"	40'-0"	20'-0"	12	17 x 36	37'-4 1/2"	2'-6 3/4"	1'-0 3/4"
40	32'-6"	30'-0"	15'-0"	9	17 x 36	28'-0"	2'-3"	9"
	36'-6 1/2"	34'-0 1/2"	17'-0 1/4"	10	17 x 36	31'-1 1/2"	2'-8 1/2"	1'-2 1/2"
	42'-6"	40'-0"	20'-0"	12	17 x 36	37'-4 1/2"	2'-6 3/4"	1'-0 3/4"
50	32'-6"	30'-0"	15'-0"	9	17 x 36	28'-0"	2'-3"	9"
	36'-6 1/2"	34'-0 1/2"	17'-0 1/4"	10	17 x 36	31'-1 1/2"	2'-8 1/2"	1'-2 1/2"
	42'-6"	40'-0"	20'-0"	12	17 x 36	37'-4 1/2"	2'-6 3/4"	1'-0 3/4"

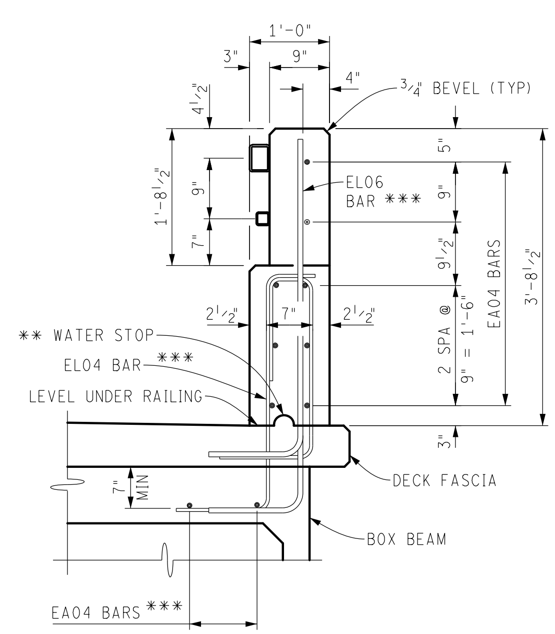
DIMENSION TABLE – 48" WIDE BEAMS

BEAM SPAN (℄ BRG-℄ BRG) (FT)	OUT-TO-OUT "a"	CLR RDWY "b"	"c"	# OF BEAMS "d"	BEAM SIZE "e"	"f"	"g"	"h"
60	33'-9"	31'-3"	15'-7 1/2"	7	21 x 48	28'-9"	2'-6"	1'-0"
	37'-10 1/2"	35'-4 1/2""	17'-8 1/4"	8	21 x 48	32'-10 1/2"	2'-6"	1'-0"
	42'-6"	40'-0"	20'-0"	9	21 x 48	37'-0"	2'-9"	1'-3"
70	33'-9"	31'-3"	15'-7 1/2"	7	21 x 48	28'-9"	2'-6"	1'-0"
	37'-10 1/2"	35'-4 1/2""	17'-8 1/4"	8	21 x 48	32'-10 1/2"	2'-6"	1'-0"
	42'-6"	40'-0"	20'-0"	9	21 x 48	37'-0"	2'-9"	1'-3"
80	33'-9"	31'-3"	15'-7 1/2"	7	27 X 48	28'-9"	2'-6"	1'-0"
	37'-10 1/2"	35'-4 1/2""	17'-8 1/4"	8	27 X 48	32'-10 1/2"	2'-6"	1'-0"
	42'-6"	40'-0"	20'-0"	9	27 X 48	37'-0"	2'-9"	1'-3"
90	33'-9"	31'-3"	15'-7 1/2"	7	27 X 48	28'-9"	2'-6"	1'-0"
	37'-10 1/2"	35'-4 1/2""	17'-8 1/4"	8	27 X 48	32'-10 1/2"	2'-6"	1'-0"
	42'-6"	40'-0"	20'-0"	9	27 X 48	37'-0"	2'-9"	1'-3"
100	33'-9"	31'-3"	15'-7 1/2"	7	33 X 48	28'-9"	2'-6"	1'-0"
	37'-10 1/2"	35'-4 1/2""	17'-8 1/4"	8	33 X 48	32'-10 1/2"	2'-6"	1'-0"
	42'-6"	40'-0"	20'-0"	9	33 X 48	37'-0"	2'-9"	1'-3"
110	33'-9"	31'-3"	15'-7 1/2"	7	39 X 48	28'-9"	2'-6"	1'-0"
	37'-10 1/2"	35'-4 1/2""	17'-8 1/4"	8	39 X 48	32'-10 1/2"	2'-6"	1'-0"
	42'-6"	40'-0"	20'-0"	9	39 X 48	37'-0"	2'-9"	1'-3"



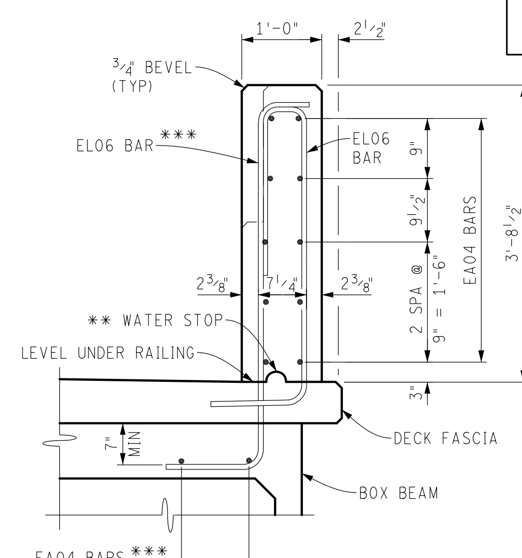
TYPICAL RAILING SECTION

(AESTHETIC PARAPET TUBE RAILING SHOWN)



SECTION AT END WALL

(TUBE CONNECTION AREA)



SECTION AT END WALL

(FULL CONCRETE AREA)

∗∗ 2" HIGH x 4" LONG (±), FORMING NOT REQUIRED

∗∗∗ REINFORCEMENT EMBEDDED AND CAST IN PRESTRESSED CONC BOX BEAM (SEE CONC BOX BEAM DETAIL SHEET)

FOR INFORMATION ONLY:

DECK CROSS SECTION IS SHOWN WITH BRIDGE RAILING AESTHETIC PARAPET TUBE. OTHER RAILINGS ARE AVAILABLE. SEE MDOT BRIDGE DESIGN GUIDE.

THE ABOVE NOTE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.

NOTES:

FOR SUPERELEVATED SECTIONS REFER TO MDOT DESIGN GUIDES FOR DETERMINING THE CROSS SLOPE.

CAMBER FOR FASCIA BEAMS WITH THICKER TOP FLANGE SHALL BE DESIGNED TO MATCH TYPICAL INTERIOR BEAMS AS CLOSE AS POSSIBLE. PRELOADING OF FASCIA OR TYPICAL INTERIOR BEAMS MAY BE REQUIRED IF CHAMBER FROM FINISHED BEAMS VARIES SIGNIFICANTLY.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

NO SCALE

FILE: Deck_SBS_002.dgn

DATE: 05/09/18

DESIGN UNIT:

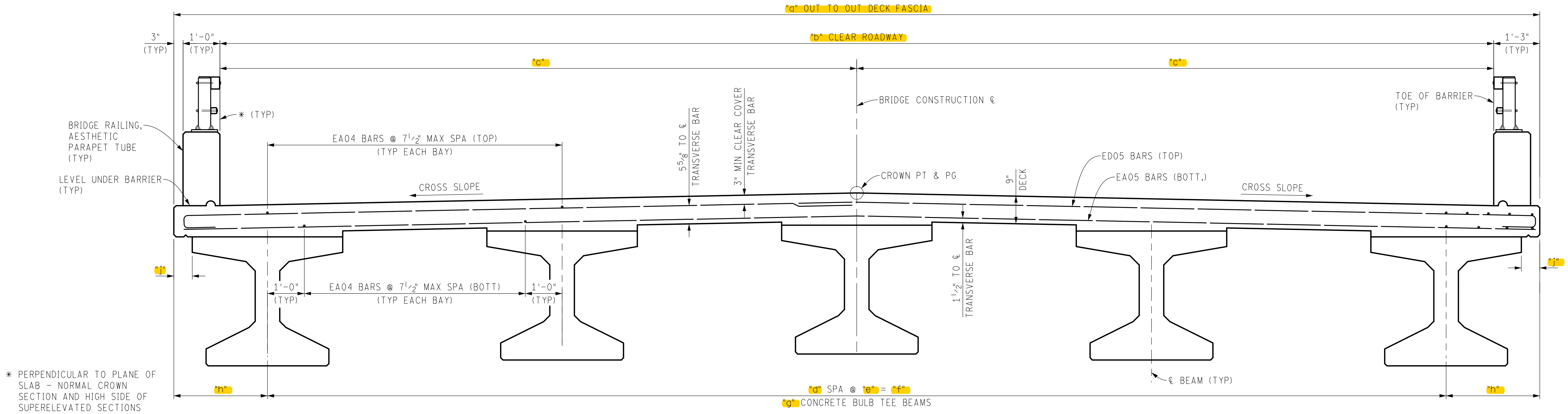
TSC:

CS:

JN:

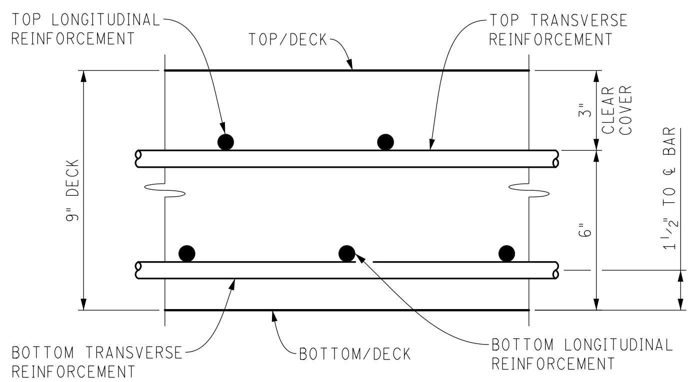
SUPERSTRUCTURE DETAILS
SIDE BY SIDE BOX BEAM

DRAWING: DECK
SHEET: SECT
006



DECK SECTION

(AESTHETIC PARAPET TUBE RAILING SHOWN)

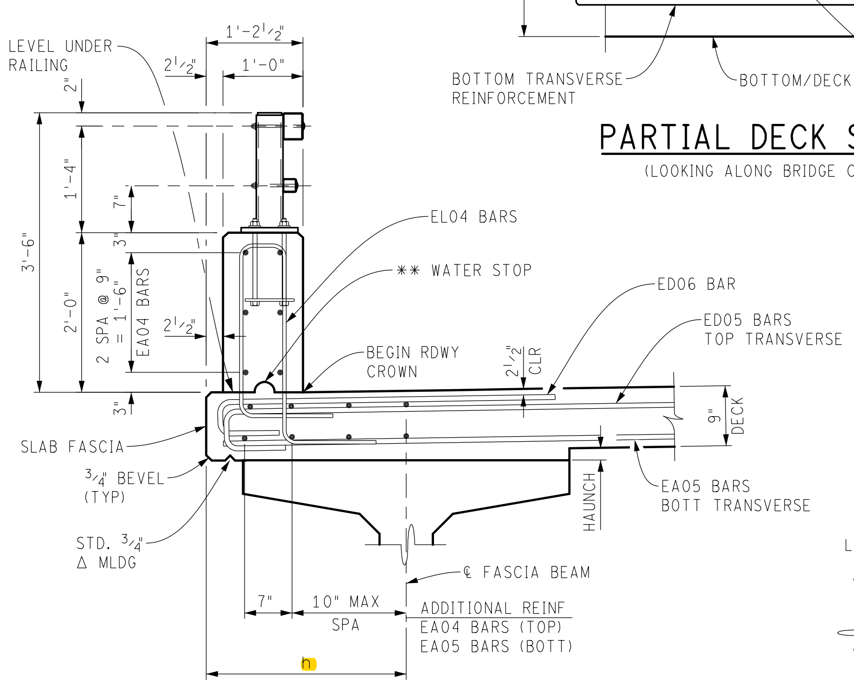


PARTIAL DECK SECTION

(LOOKING ALONG BRIDGE CONST ℄)

BEAM SPAN (℄ BRG-℄ BRG) (FT)	DIMENSION								
	OUT-TO-OUT "a"	CLR RDWY "b"	"c"	BEAM SPACING "d"	BEAM SPACING "e"	BEAM SPACING "f"	BEAM SIZE "g"	"h"	"j"
70	32'-6"	30'-0"	15'-0"	4	6'-10 1/2"	27'-6"	36" x 49"	2'-6"	5 1/2"
	36'-6"	34'-0"	17'-0"	4	7'-10 1/2"	31'-6"	36" x 49"	2'-6"	5 1/2"
	42'-6"	40'-0"	20'-0"	4	9'-4 1/2"	37'-6"	36" x 49"	2'-6'	5 1/2"
80	32'-6"	30'-0"	15'-0"	4	6'-10 1/2"	27'-6"	36" x 49"	2'-6"	5 1/2"
	36'-6"	34'-0"	17'-0"	4	7'-10 1/2"	31'-6"	36" x 49"	2'-6"	5 1/2"
	42'-6"	40'-0"	20'-0"	4	9'-4 1/2"	37'-6"	36" x 49"	2'-6'	5 1/2"
90	32'-6"	30'-0"	15'-0"	4	6'-10 1/2"	27'-6"	42" x 49"	2'-6"	5 1/2"
	36'-6"	34'-0"	17'-0"	4	7'-10 1/2"	31'-6"	42" x 49"	2'-6"	5 1/2"
	42'-6"	40'-0"	20'-0"	4	9'-4 1/2"	37'-6"	42" x 49"	2'-6'	5 1/2"
100	32'-6"	30'-0"	15'-0"	4	6'-10 1/2"	27'-6"	48" x 49"	2'-6"	5 1/2"
	36'-6"	34'-0"	17'-0"	4	7'-10 1/2"	31'-6"	48" x 49"	2'-6"	5 1/2"
	42'-6"	40'-0"	20'-0"	4	9'-4 1/2"	37'-6"	48" x 49"	2'-6'	5 1/2"
110	32'-6"	30'-0"	15'-0"	4	6'-10 1/2"	27'-6"	48" x 49"	2'-6"	5 1/2"
	36'-6"	34'-0"	17'-0"	4	7'-10 1/2"	31'-6"	48" x 49"	2'-6"	5 1/2"
	42'-6"	40'-0"	20'-0"	4	8'-10 1/2"	35'-6"	48" x 49"	3'-6'	1'-5 1/2"

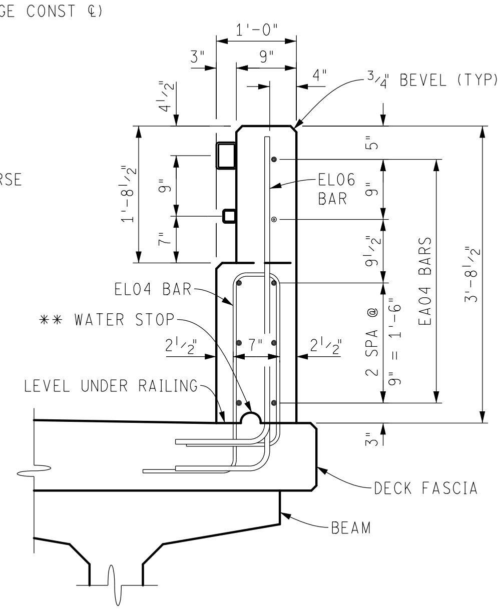
Table: DIMENSION TABLE



TYPICAL RAILING SECTION

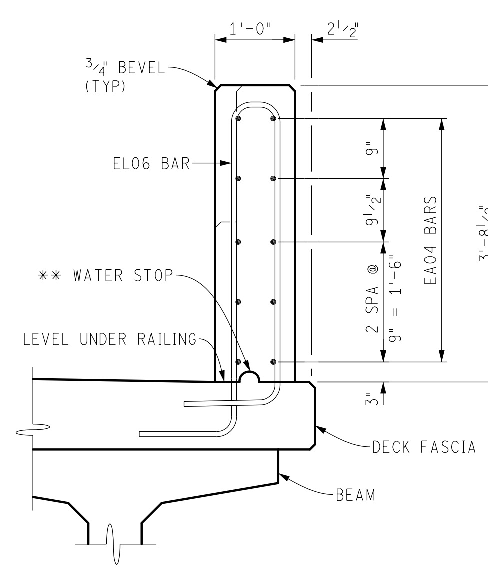
(AESTHETIC PARAPET TUBE RAILING SHOWN)

∗∗ 2" HIGH x 4" LONG (±), FORMING NOT REQUIRED



SECTION AT END WALL

(TUBE CONNECTION AREA)



SECTION AT END WALL

(FULL CONCRETE AREA)

FOR INFORMATION ONLY:

DECK CROSS SECTION IS SHOWN WITH BRIDGE RAILING AESTHETIC PARAPET TUBE. OTHER RAILINGS ARE AVAILABLE. SEE MDOT BRIDGE DESIGN GUIDE.

THE ABOVE NOTE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.

NOTES:

DISTRIBUTION STEEL FOR BULB TEE BEAMS SHALL BE EQUALLY SPACED SUCH THAT THE DISTANCE BETWEEN THE END BARS AND THE BEAM ℄ DOES NOT EXCEED 1'-0".

FOR SUPERELEVATED SECTIONS REFER TO MDOT DESIGN GUIDES FOR DETERMINING THE CROSS SLOPE.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)

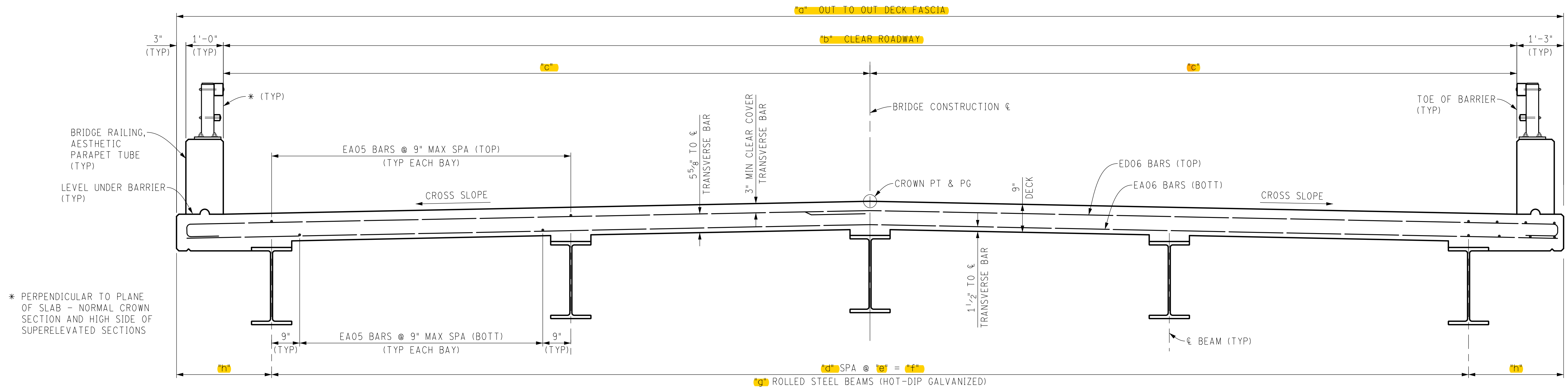
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

NO SCALE

DATE: 05/09/18
DESIGN UNIT:
TSC:
FILE: Deck_BT_002.dgn
CS:
JN:

SUPERSTRUCTURE DETAILS
BULB-TEE BEAM

DRAWING: DECK
SHEET: SECT
007

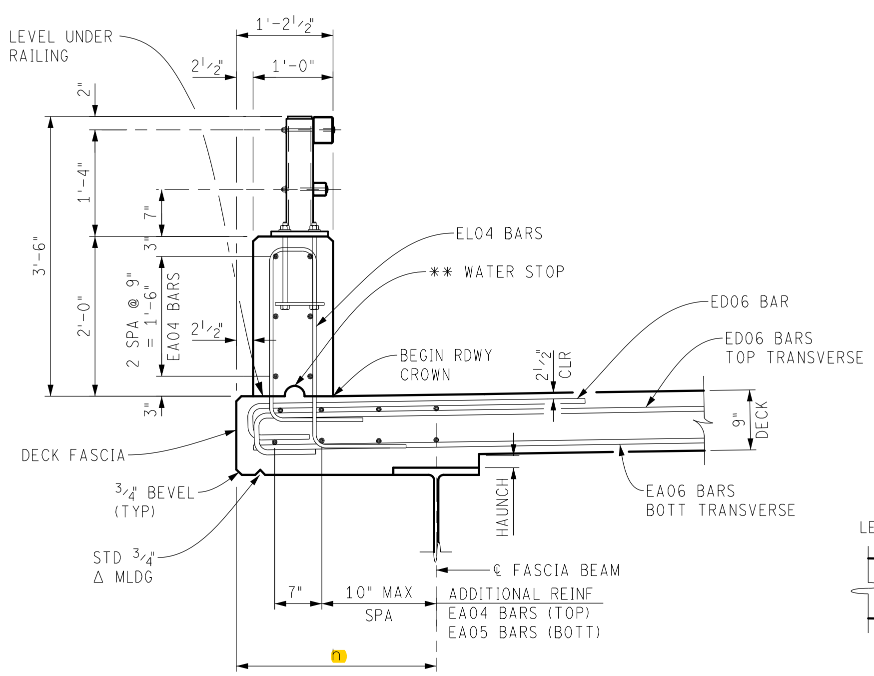


DECK SECTION

(AESTHETIC PARAPET TUBE RAILING SHOWN)

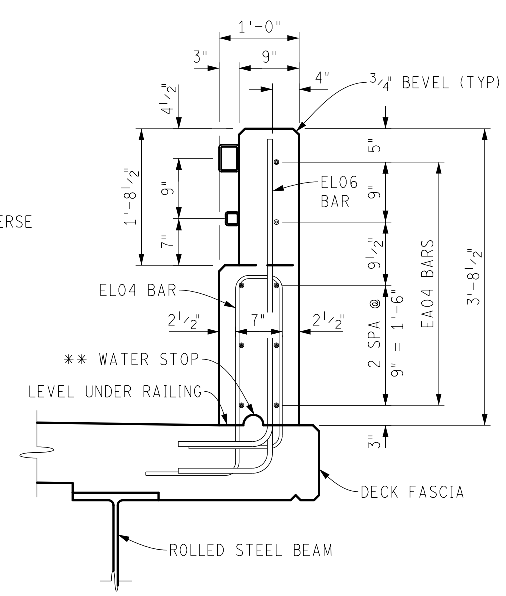
BEAM SPAN (℄ BRG-℄ BRG) (FT)	OUT-TO-OUT "a"	CLR RDWY "b"	"c"	BEAM SPACING "d"	BEAM SPACING "e"	BEAM SPACING "f"	BEAM SIZE "g"	"h"
20	32'-6"	30'-0"	15'-0"	4	6'-4 1/2"	25'-6"	W21 x 93	3'-6"
	36'-6"	34'-0"	17'-0"	5	6'-3"	31'-3"	W21 x 93	2'-7 1/2"
	42'-6"	40'-0"	20'-0"	6	6'-3"	37'-6"	W21 x 93	2'-6"
30	32'-6"	30'-0"	15'-0"	4	6'-4 1/2"	25'-6"	W21 x 93	3'-6"
	36'-6"	34'-0"	17'-0"	5	6'-3"	31'-3"	W21 x 93	2'-7 1/2"
	42'-6"	40'-0"	20'-0"	6	6'-3"	37'-6"	W21 x 93	2'-6"
40	32'-6"	30'-0"	15'-0"	4	6'-4 1/2"	25'-6"	W24 x 117	3'-6"
	36'-6"	34'-0"	17'-0"	5	6'-3"	31'-3"	W24 x 117	2'-7 1/2"
	42'-6"	40'-0"	20'-0"	6	6'-3"	37'-6"	W24 x 117	2'-6"
50	32'-6"	30'-0"	15'-0"	4	6'-4 1/2"	25'-6"	W30 x 173	3'-6"
	36'-6"	34'-0"	17'-0"	5	6'-3"	31'-3"	W30 x 173	2'-7 1/2"
	42'-6"	40'-0"	20'-0"	6	6'-3"	37'-6"	W30 x 173	2'-6"
60	32'-6"	30'-0"	15'-0"	4	6'-4 1/2"	25'-6"	W36 x 170	3'-6"
	36'-6"	34'-0"	17'-0"	5	6'-3"	31'-3"	W36 x 170	2'-7 1/2"
	42'-6"	40'-0"	20'-0"	6	6'-3"	37'-6"	W36 x 170	2'-6"

DIMENSION TABLE



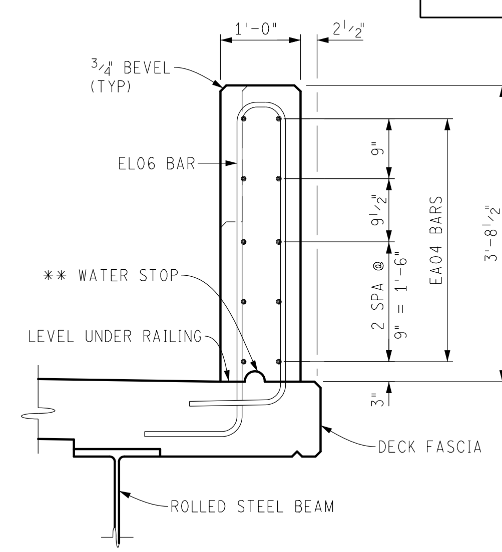
TYPICAL RAILING SECTION

(AESTHETIC PARAPET TUBE RAILING SHOWN)



SECTION AT END WALL

(TUBE CONNECTION AREA)



SECTION AT END WALL

(FULL CONCRETE AREA)

∗∗ 2" HIGH x 4" LONG (±), FORMING NOT REQUIRED

FOR INFORMATION ONLY:

DECK CROSS SECTION IS SHOWN WITH BRIDGE RAILING AESTHETIC PARAPET TUBE. OTHER RAILINGS ARE AVAILABLE. SEE MDOT BRIDGE DESIGN GUIDE.

THE ABOVE NOTE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.

NOTES:

FOR SUPERELEVATED SECTIONS REFER TO MDOT DESIGN GUIDES FOR DETERMINING THE CROSS SLOPE.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

NO SCALE

FILE: Deck_RSB_002.dgn

DATE: 05/09/18

DESIGN UNIT:

TSC:

CS:

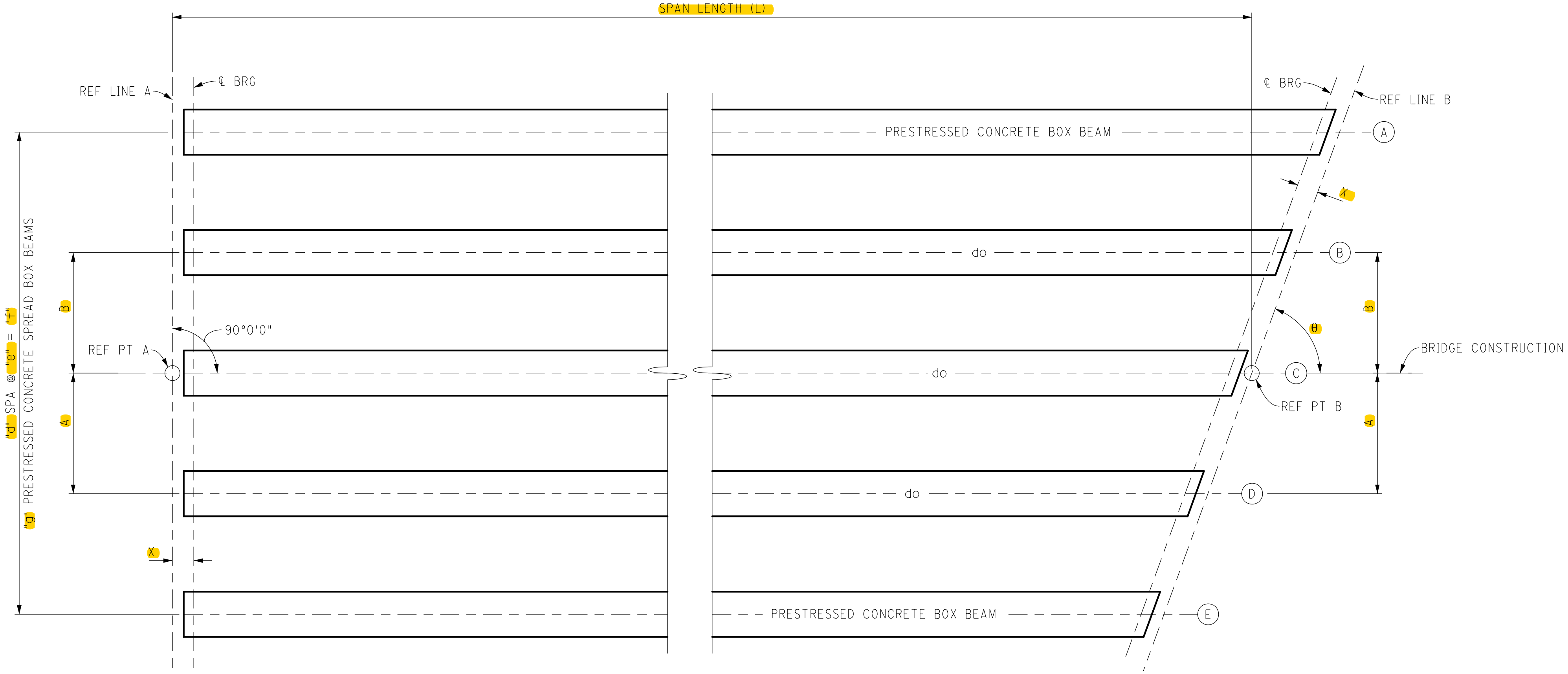
JN:

SUPERSTRUCTURE DETAILS

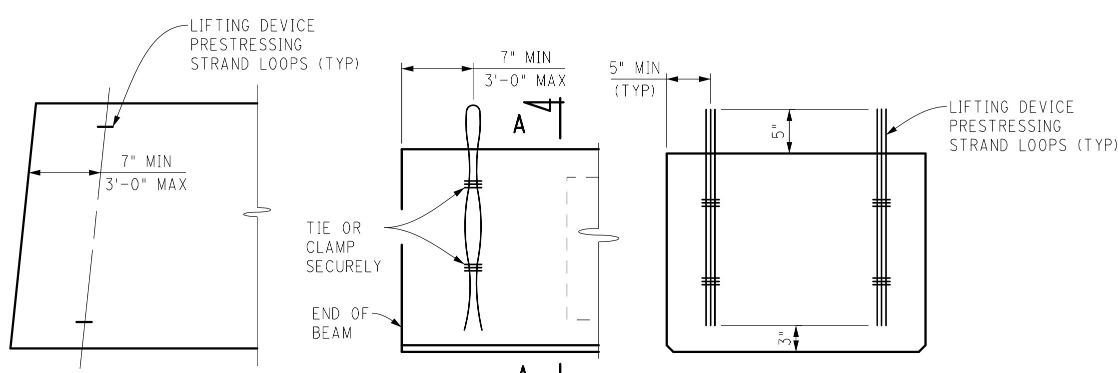
ROLLED STEEL BEAM

DRAWING: DECK

SHEET / SECT: 008



ERECTION DIAGRAM



PLAN ELEVATION SECTION A-A

DETAILS OF LIFTING DEVICE

LIFTING OF BEAM SHALL BE BY EQUAL LOADS TO EACH PAIR OF LIFTING DEVICES.

LIFTING DEVICES SHALL BE REMOVED

FOR INFORMATION ONLY:

THE DESIGN OF THESE STRUCTURES IS BASED ON 1.2 TIMES THE CURRENT AASHTO LRFD BRIDGE DESIGN SPECIFICATION HL-93 LOADING WITH THE EXCEPTION THAT THE DESIGN TANDEM PORTION OF THE HL-93 LOAD DEFINITION SHALL BE REPLACED BY A SINGLE 60 KIP AXLE LOAD BEFORE APPLICATION OF THIS 1.2 FACTOR. THE RESULTING LOAD IS DESIGNATED HL-93 MOD. LIVE LOAD PLUS DYNAMIC LOAD ALLOWANCE DEFLECTION DOES NOT EXCEED 1/800 OF SPAN LENGTH.

A 4" HAUNCH SECTION WAS USED FOR THE LOADING ON ALL BEAMS. THE HAUNCH SECTION WAS NOT INCLUDED IN THE COMPOSITE SECTION PROPERTIES FOR THE DESIGN OF THE BEAMS.

A 9" DECK SECTION WAS USED FOR THE LOADING ON ALL BEAMS. THE EFFECTIVE DECK SECTION IS 7 1/2" AND THE SACRIFICIAL DECK SECTION IS 1 1/2".

THE LONGITUDINAL "EA" BARS IN THE TOP AND BOTTOM FLANGES OF THE BEAMS ARE NOT INCLUDED TO PROVIDE ADDITIONAL CAPACITY.

BEAM DESIGNS DO NOT INCLUDE PRESTRESSING STRANDS IN THE TOP FLANGES.

ALL VERTICAL "ED" STIRRUP BARS SHALL BE GRADE 40 KSI FOR 17" & 21" DEEP BOX BEAMS AND GRADE 60 KSI FOR ALL OTHER BEAM DEPTHS.

"A" & "B" ARE MEASURED FROM BRIDGE CONST ℄ TO ADJACENT BEAM ℄.

THE ABOVE NOTES ARE FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.

☐ VALUES TO BE DETERMINED BY DESIGNER

SERVICE BEAM REACTIONS (KIPS)

BEAM SPAN (℄ BRG-℄ BRG) (FT)	DC	DW	LL+I
20	19	3	103
30	30	4	107
40	40	5	111
50	55	7	115
60	55	5	120
70	74	6	126
80	87	7	132
90	99	8	137
100	111	9	142
110	125	10	147

THIS TABLE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THE FINAL DESIGN DRAWINGS

DC DENOTES SERVICE DEAD LOADS DUE TO BEAM SELF WEIGHT, DECK WEIGHT, & DIAPHRAGMS.

DW DENOTES SERVICE BEAM REACTION DUE TO FUTURE WEARING SURFACE.

LL+I DENOTES SERVICE LIVE LOAD PLUS IMPACT REACTION PER LANE.

PRESTRESSING STRAND LIFTING DEVICES

ESTIMATED BEAM WEIGHT (TONS)	STRAND SIZE	NO. OF STRANDS PER BEAM END
20	3/8"	2
27	7/16"	2
36	1/2"	2
30	3/8"	3
40.5	7/16"	3
54	1/2"	3

THIS TABLE SHOULD INCLUDE ONLY APPLICABLE INFORMATION ON THE FINAL DESIGN DRAWINGS

NOTES:

THE TOP SURFACE OF THE BEAMS SHALL BE INTENTIONALLY ROUGHENED.

THE ESTIMATED BEAM CAMBER AT RELEASE IS XX". THIS CAMBER IS DUE TO PRESTRESS AND DEAD LOAD OF THE BEAM ONLY AND IS MEASURED IN THE ERECTED POSITION.

TOTAL ESTIMATED CHANGE OF LENGTH OF BOTTOM FLANGE AT TRANSFER OF PRESTRESS FORCE IS X".

PRESTRESSING STRANDS SHALL BE GIVEN AN INITIAL PRESTRESS AS FOLLOWS:
0.6" DIA. - 44,000 lbs. PRESTRESS.

THE COMPRESSIVE STRENGTH OF THE CONCRETE AT THE TIME OF PRESTRESSING FORCE RELEASE SHALL NOT BE LESS THAN 7000 psi.

THE COMPRESSIVE STRENGTH OF THE CONCRETE SHALL BE NOT LESS THAN 8000 psi AT 28 DAYS.

THREADING OF REINFORCEMENT AND INSTALLATION INTO CONCRETE INSERTS IS INCLUDED IN THE BID ITEM "PREST CONC BOX BEAM, FURN, XX INCH"

LIFTING DEVICES SHALL BE REMOVED AFTER BEAMS ARE ERECTED. REMOVAL IS INCLUDED IN THE BID ITEM "PREST CONC BOX BEAM, ERECT, XX INCH"

POSITION DOWELS SHALL BE HOT-DIP GALVANIZED ACCORDING TO AASHTO M 232. POSITION DOWELS ARE INCLUDED IN PAYMENT FOR PRESTRESSED CONCRETE BEAMS.

ITEMS CAST INTO THE BEAMS TO FACILITATE BRIDGE CONSTRUCTION (FORMING, FINISHING, ETC.) SHALL BE GALVANIZED OR EPOXY COATED.

PRESTRESSING STRAND SHALL BE 0.6" NOMINAL DIAMETER MEETING THE REQUIREMENTS OF AASHTO M203 (ASTM A416), GRADE 270, LOW RELAXATION STRAND.

COAT THE ENTIRE OUTSIDE AND BOTTOM OF THE FASCIA BEAM USING A MATERIAL SELECTED FROM THE SPECIAL PROVISION FOR CONCRETE SURFACE COATINGS. APPLY THE COATING ACCORDING TO THE SPECIAL PROVISION.

STEEL FOR SOLE PLATES AND OTHER BEARING COMPONENTS SHALL MEET THE REQUIREMENTS OF AASHTO M 270 GRADE 36.

BEAM STIRRUPS, SHALL BE GRADE XX (ksi).

FIELD DRILLING SHALL BE ALLOWED FOR SIGN SUPPORT ANCHORS ONLY. LOCATION OF ANCHORS SHALL BE AS DETAILED ON TRAFFIC & SAFETY SIGN SUPPORT SPECIAL DETAILS. ANY DAMAGE TO THE BEAMS SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE AND APPROVED BY THE ENGINEER.

ALL LONGITUDINAL "EA" BARS IN THE TOP AND BOTTOM FLANGES SHALL BE GRADE 60 KSI.

CONCRETE INSERTS FOR BACKWALLS SHALL BE 1" DIAMETER (AT EXPANSION ABUTMENT) & 1/2" DIAMETER (AT FIXED ABUTMENT): DAYTON SUPERIOR, TYPE B-1 HEAVY OR TYPE B-18: WILLIAMS FORM, TYPE C 12 OR TYPE C -19: MEADOW BURKE, TYPE CT-2 OR TYPE CX-4: OR EQUAL. INSERTS (COIL OR FERRULE) MUST BE ELECTROPLATE GALVANIZED IN ACCORDANCE WITH ASTM B633, SERVICE CONDITION 4. INSERTS SHALL BE CAST WITH THE BEAMS. FIELD INSTALLATION OF INSERTS IS NOT ALLOWED.

ADHESIVE ANCHORS SHALL USE A NON-SHRINK GROUT (WHICH IS CEMENTIOUS) LISTED IN MDOT'S QUALIFIED PRODUCTS LIST.

ITEMS CAST INTO STRUCTURAL PRECAST CONCRETE TO FACILITATE BRIDGE CONSTRUCTION (FORMING, FINISHING, ETC.) SHALL BE GALVANIZED OR EPOXY COATED.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

NO SCALE

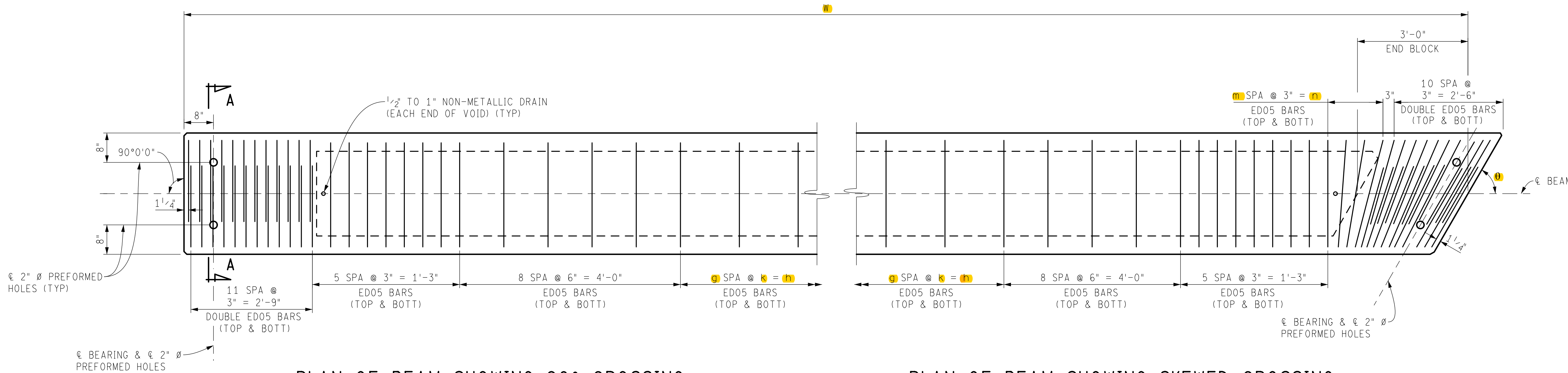
FILE: prest_SBB_001.dgn

DATE: 05/09/18
DESIGN UNIT:
TSC:

CS:
JN:

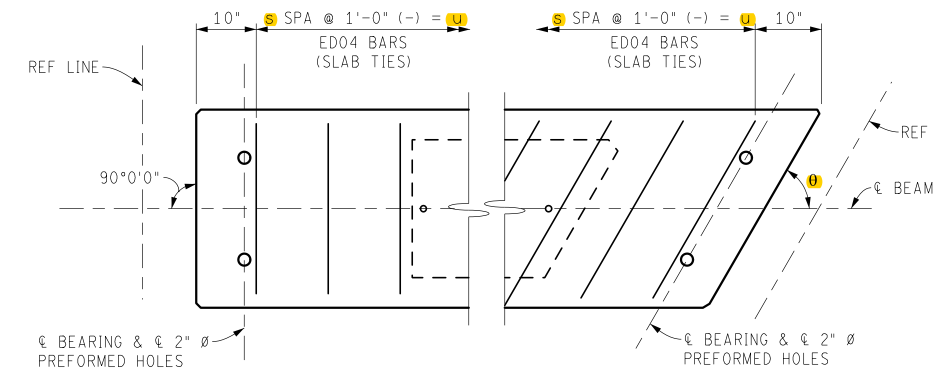
PRESTRESSED BEAM DETAILS
SPREAD BOX BEAM

DRAWING	SHEET
SBB	SECT
001	



PLAN OF BEAM SHOWING 90° CROSSING

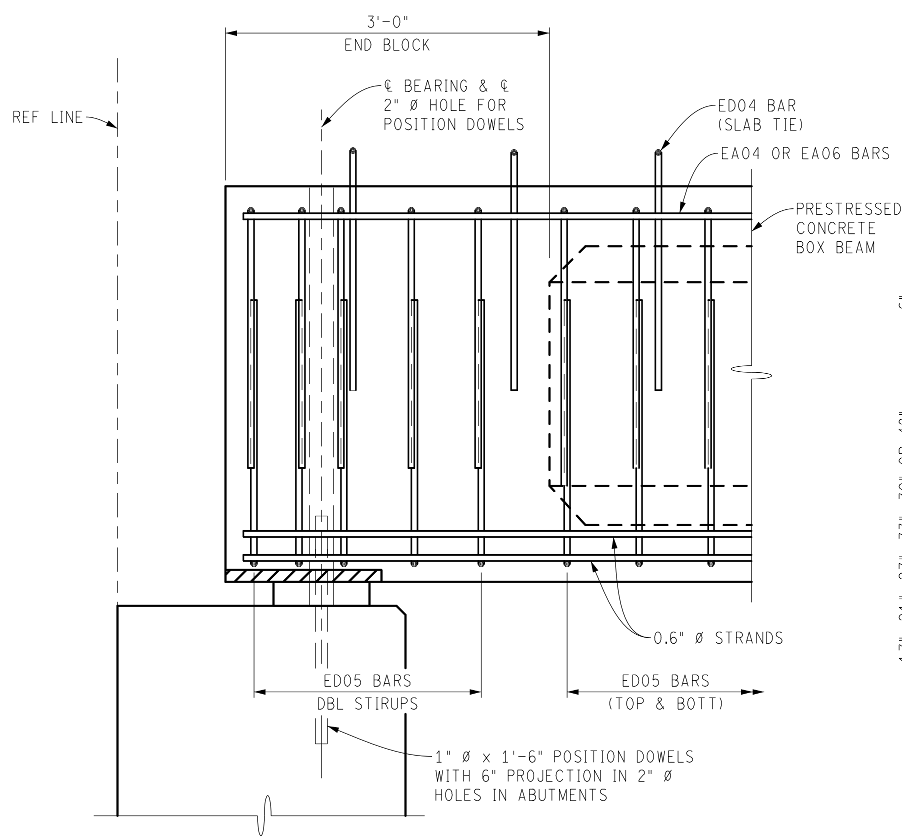
PLAN OF BEAM SHOWING SKEWED CROSSING



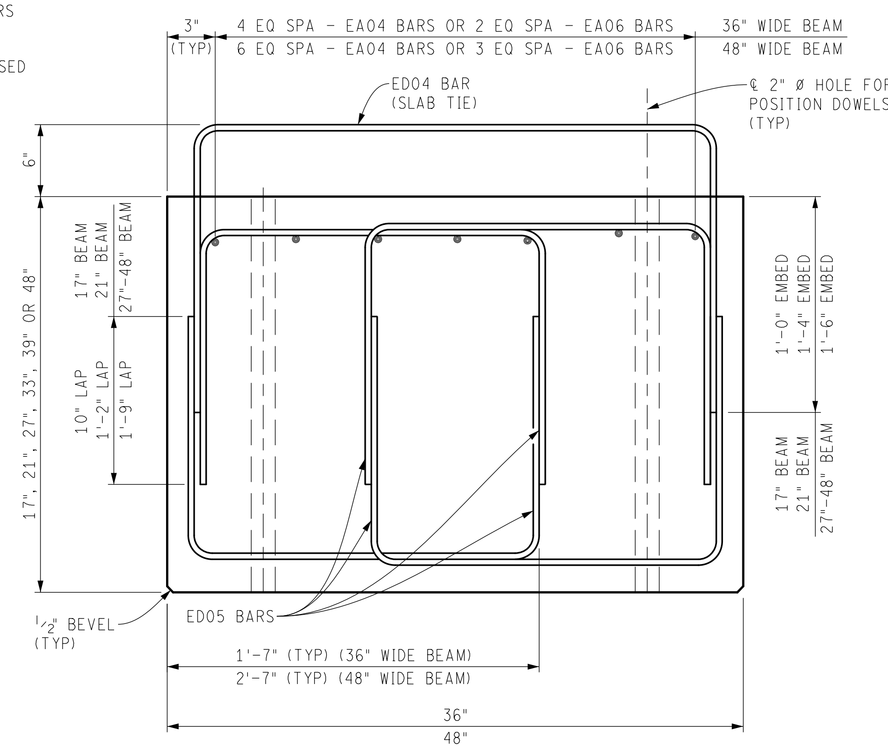
90° CROSSING

SKEWED CROSSING

PLAN OF SLAB TIES



SECTION THRU END BLOCK



SECTION A-A

BEAM DIMENSIONS										
	BEAM SIZE									
	17 x 36	21 x 36		21 x 48		27 x 48	33 x 48	39 x 48		48 x 48
	20' BEAM SPAN	30' BEAM SPAN	40' BEAM SPAN	50' BEAM SPAN	60' BEAM SPAN	70' BEAM SPAN	80' BEAM SPAN	90' BEAM SPAN	100' BEAM SPAN	110' BEAM SPAN
g	7	20	34	47	60	74	87	100	114	95
k	9" (-)	9" (+)	9" (-)	9" (-)	9" (+)	9" (-)	9" (-)	9" (+)	9" (-)	1'-0" (+)
h	5'-1½"	15'-1½"	25'-1½"	35'-1½"	45'-1½"	55'-1½"	65'-1½"	75'-1½"	85'-1½"	95'-1½"
m	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
n	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
s	20	30	40	50	60	70	80	90	100	110
u	19'-8"	29'-8"	39'-8"	49'-8"	59'-8"	69'-8"	79'-8"	89'-8"	99'-8"	109'-8"
W	21'-4"	31'-4"	41'-4"	51'-4"	61'-4"	71'-4"	81'-4"	91'-4"	101'-4"	111'-4"

REPLACE VARIABLES IN BEAM DIMENSIONS WITH VALUES FROM THIS TABLE. THIS TABLE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THE FINAL DESIGN DRAWINGS.

FOR INFORMATION ONLY:

USE HAUNCH REINFORCEMENT WHEN BEAM HAUNCH > 4".

VARIABLES IN BEAM DIMENSIONS TABLE WITH VALUES NOTED "TBD" SHALL BE DETERMINED BY THE DESIGNER BASED ON BEAM END SKEW.

"g" & "h" VALUES SHOWN IN THE BEAM DIMENSIONS TABLE ARE BASED ON 90° CROSSING AND SHALL BE ADJUSTED FOR SKEWED CROSSING.

THE ENDS OF THE BOX BEAMS SHALL BE SKEWED TO BE PARALLEL TO THE REFERENCE LINE.

THE ABOVE NOTES ARE FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

NO SCALE

FILE: prest_SBB_002.dgn

DATE: 05/09/18

DESIGN UNIT:

TSC:

CS:

JN:

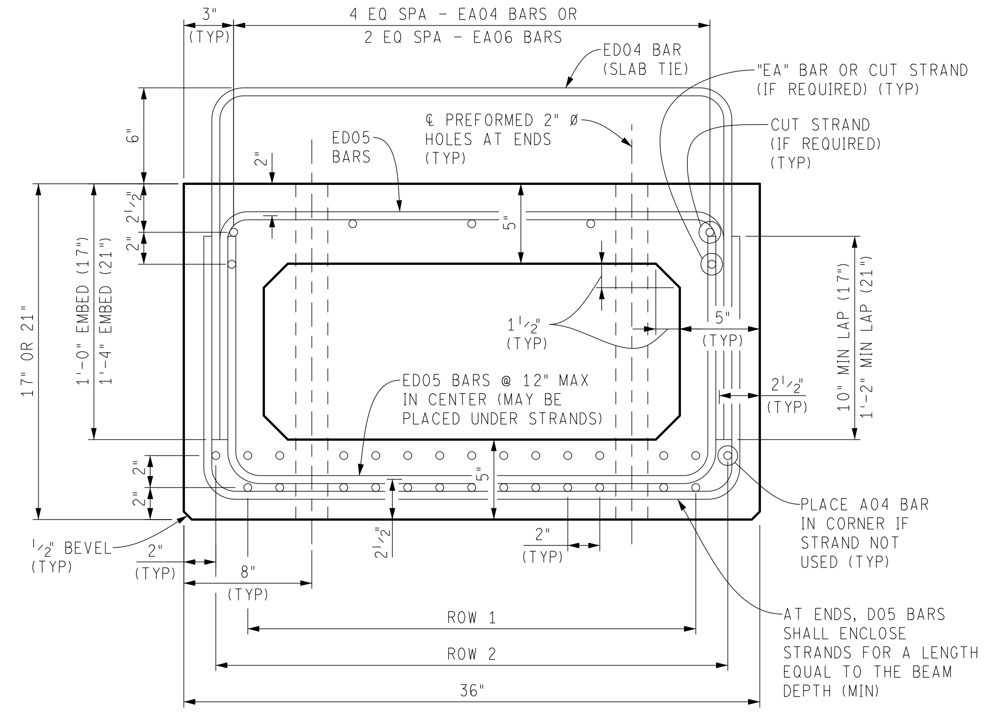
PRESTRESSED BEAM DETAILS

SPREAD BOX BEAM

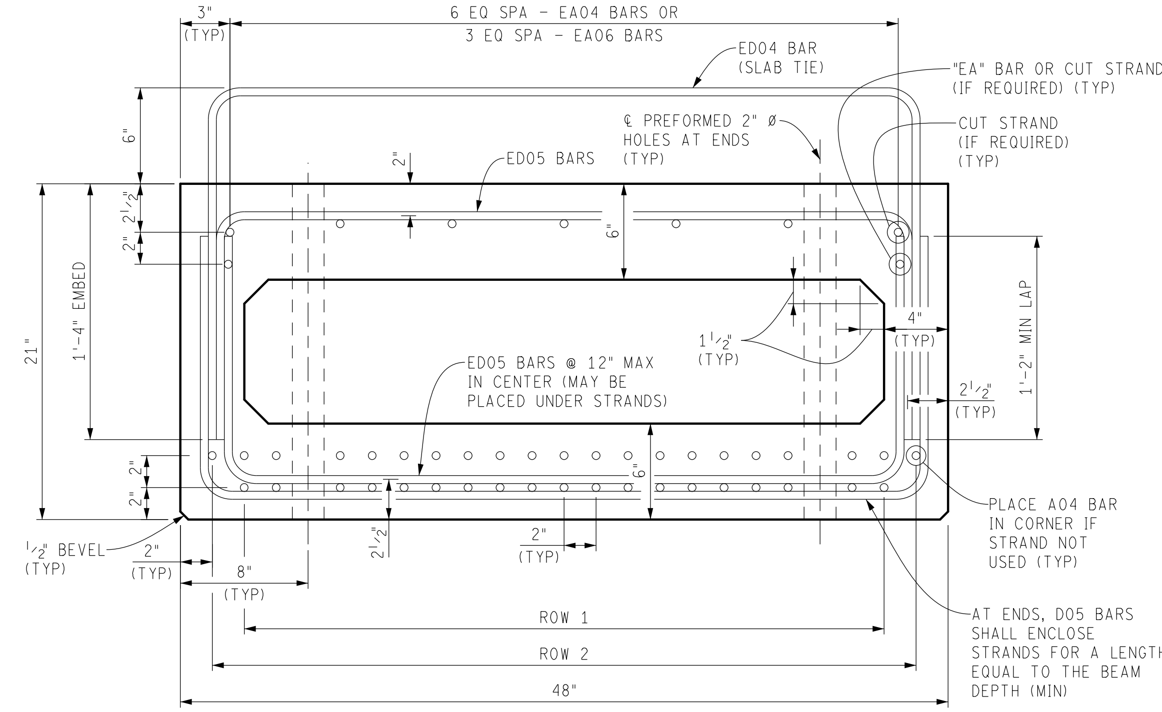
DRAWING SBB 002

SHEET

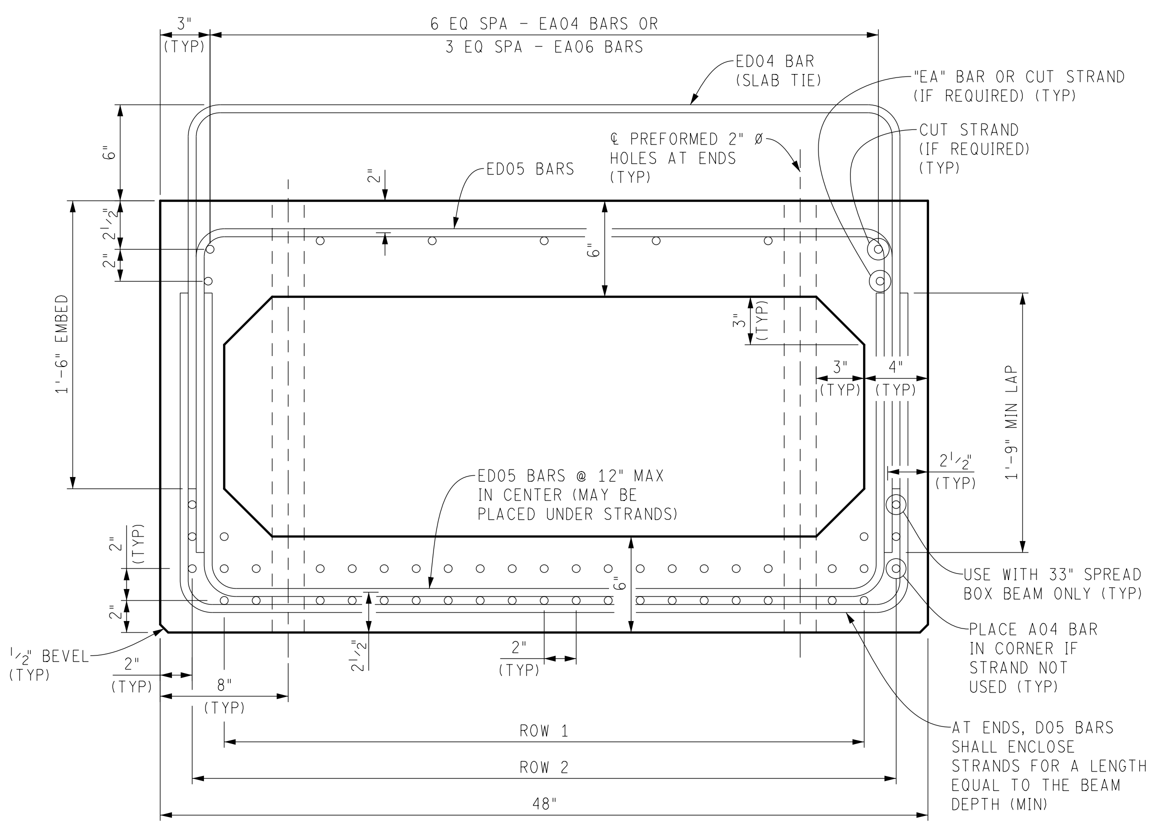
SECT



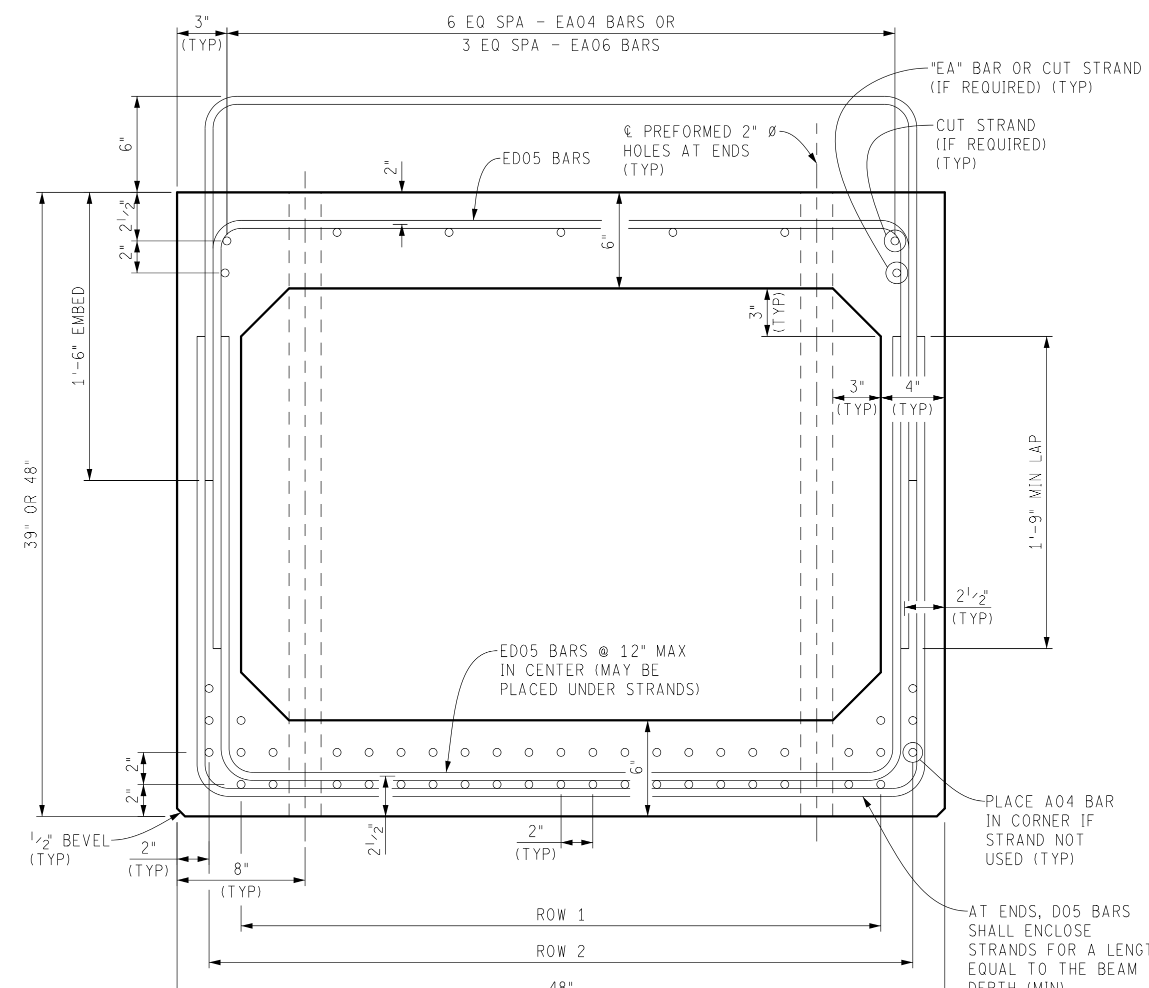
17" X 36" OR 21" X 36" BEAM



21" X 48" BEAM



27" X 48" OR 33" X 48" BEAM



39" X 48" OR 48" X 48" BEAM

NOTES:

SEE DEBONDING TABLE ON DWG "SBB 004" FOR STRAND INFORMATION.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

NO SCALE

FILE: prest_SBB_003.dgn

DATE: 05/09/18
DESIGN UNIT:
TSC:

CS:
JN:

PRESTRESSED BEAM DETAILS
SPREAD BOX BEAM

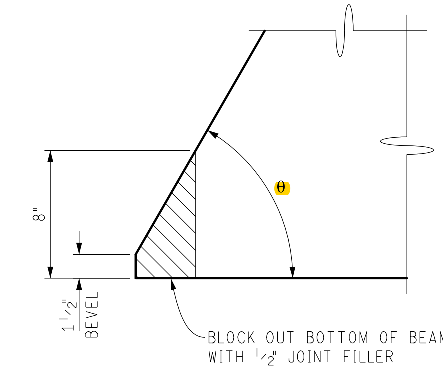
DRAWING	SHEET
SBB	SECT
003	

STRAND/DEBONDING LAYOUT TABLE

BEAM SPAN (℄ BRG-℄ BRG) (FT)	BEAM DIMENSIONS		NO. OF STRANDS					
	H (in)	W (in)	1ST LAYER, 2" FROM BOTTOM	2ND LAYER, 4" FROM BOTTOM	3RD LAYER, 6" FROM BOTTOM	TOTAL NO. OF STRANDS	NO. OF DEBONDING STRANDS	NO. OF DEBONDING STRANDS-(1st LAYER)-[2nd LAYER] DEBONDING LENGTHS (ft)
20	17	36	9	-	-	9	N/A	N/A
30	21	36	11	-	-	11	N/A	N/A
40	21	36	13	5	-	18	4	(2)2, (2)4
50	21	48	19	7	-	26	6	(2)2, (4)4
60	21	48	19	15	-	34	8	(2)2, (4)8, (2)12
70	27	48	19	15	-	34	6	(2)2, (2)4, (2)6
80	33	48	19	15	-	34	6	(2)2, (4)4
90	39	48	19	17	-	36	6	(2)2, (4)4
100	39	48	19	21	6	46	10	(2)12, (2)14, (2)30, [2]12, [2]20
110	48	48	19	21	4	44	10	(2)6, (2)10, (2)12, [2]2, [2]4

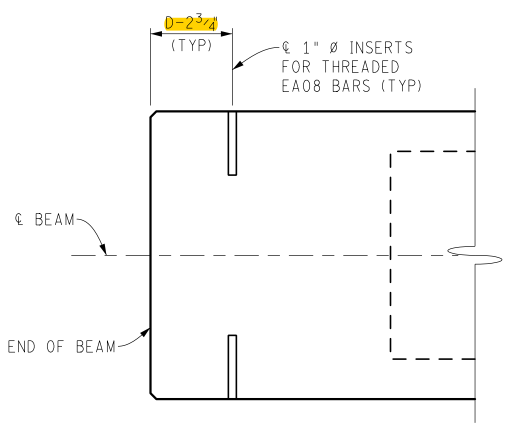
STRAND DEBONDING LENGTH IS MEASURED FROM EACH BEAM END

THIS TABLE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THE FINAL DESIGN DRAWINGS

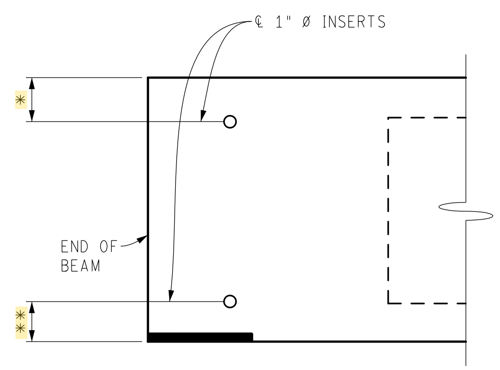


CORNER BLOCKING DETAIL

USE WHEN θ < 70°



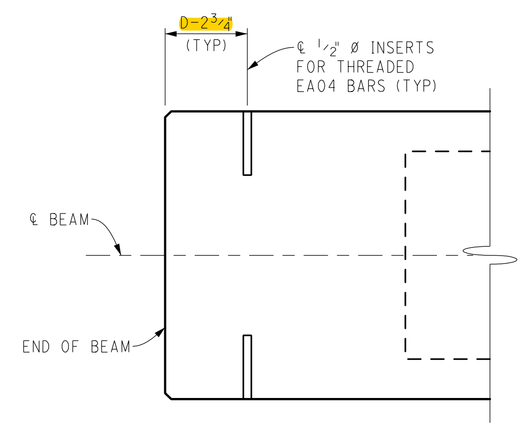
PLAN



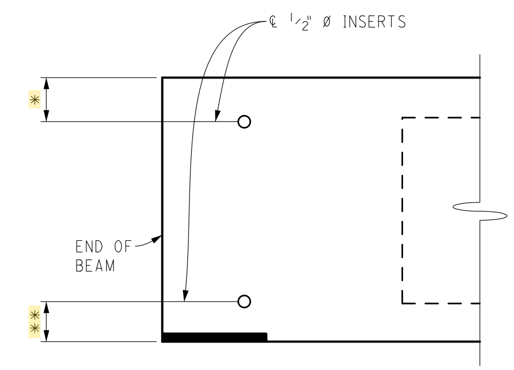
ELEV

INSERT DETAIL @ BEAM END (EXPANSION ABUTMENT)

(SEE DECK 002 FOR BACKWALL DETAILS)



PLAN



ELEV

INSERT DETAIL @ BEAM END (FIXED ABUTMENT)

(SEE DECK 002 FOR BACKWALL DETAILS)

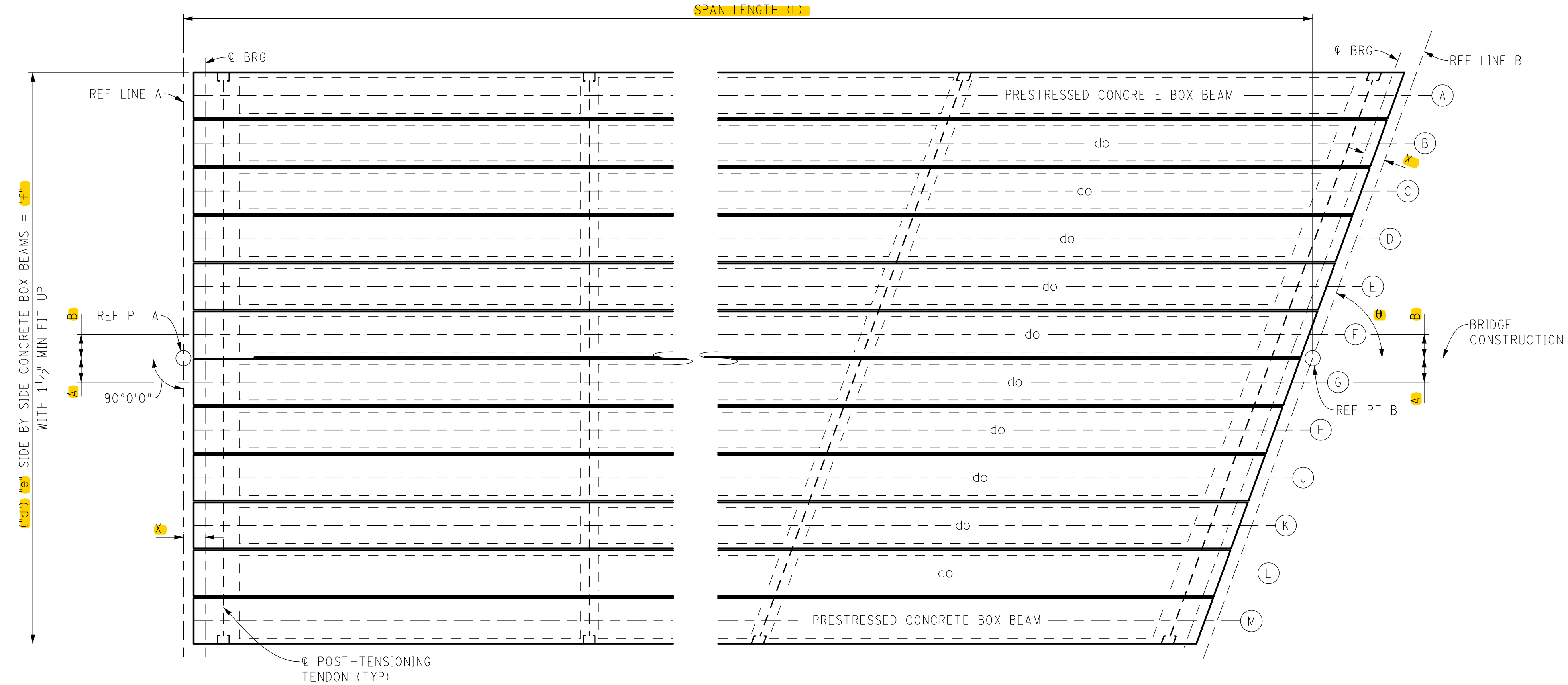
FOR INFORMATION ONLY:

"D" DENOTES BACKWALL THICKNESS.

* PLACE SPREAD BOX BEAM BACKWALL INSERTS AT $3\frac{1}{2}$" OR $5\frac{1}{2}$" DOWN FROM TOP OF BEAM TO AVOID INTERFERENCE WITH STRANDS. ($3\frac{1}{2}$" FOR 21" BEAMS) ($5\frac{1}{2}$" FOR >21" BEAMS)

** PLACE SPREAD BOX BEAM BACKWALL INSERTS AT 5" OR 7" UP FROM BOTTOM OF BEAM TO AVOID INTERFERENCE WITH STRANDS. (5" FOR 21" BEAMS) (7" FOR >21" BEAMS)

THE ABOVE NOTES ARE FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.



ERECTION DIAGRAM

SEE POST TENSIONING TENDON LOCATION TABLE FOR NUMBER AND LOCATION OF DUCTS

POST TENSIONING TENDON LOCATIONS

BEAM SPAN (℄ BRG-℄ BRG)	LOCATIONS	TOTAL
UP TO 50'	1 AT EACH END OF BEAM WITH 2 AT CENTER OF SPAN (11' APART)	4
OVER 50' TO 62'	1 AT EACH END OF BEAM WITH 1 AT CENTER OF SPAN AND 1 AT EACH QUARTER POINT	5
OVER 62' TO 100'	1 AT EACH END OF BEAM WITH 2 AT CENTER OF SPAN (11' APART) AND 1 AT EACH QUARTER POINT	6
OVER 100'	1 AT EACH END OF BEAM WITH 5 EQUALLY SPACED BETWEEN	7
	END OF BEAM LOCATIONS USUALLY 10"± PERPENDICULAR FROM ℄ OF BEARING	

POST TENSIONING FORCE PER DIAPHRAGM / END BLOCK

	FORCE (ALL SITUATIONS)	
	120 KIPS	

THESE TABLES ARE FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THE FINAL DESIGN DRAWINGS

VERTICAL POST TENSIONING TENDON LOCATIONS

BEAM DEPTH	AT EACH LOCATION	TOTAL
17", 21", 27"	1 TENDON AT MID-DEPTH OF BEAM	1
33", 39"	1 AT EACH ⅓ POINT OF BEAM DEPTH	2

SERVICE BEAM REACTIONS (KIPS)

BEAM SPAN (℄ BRG-℄ BRG) (FT)	DC	DW	LL+I
20	11	1	103
30	17	2	107
40	23	2	111
50	37	3	115
60	46	4	120
70	52	5	126
80	63	5	132
90	71	6	137
100	81	7	142
110	95	7	147

THIS TABLE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THE FINAL DESIGN DRAWINGS

DC DENOTES SERVICE DEAD LOADS DUE TO BEAM SELF WEIGHT, DECK WEIGHT, & DIAPHRAGMS

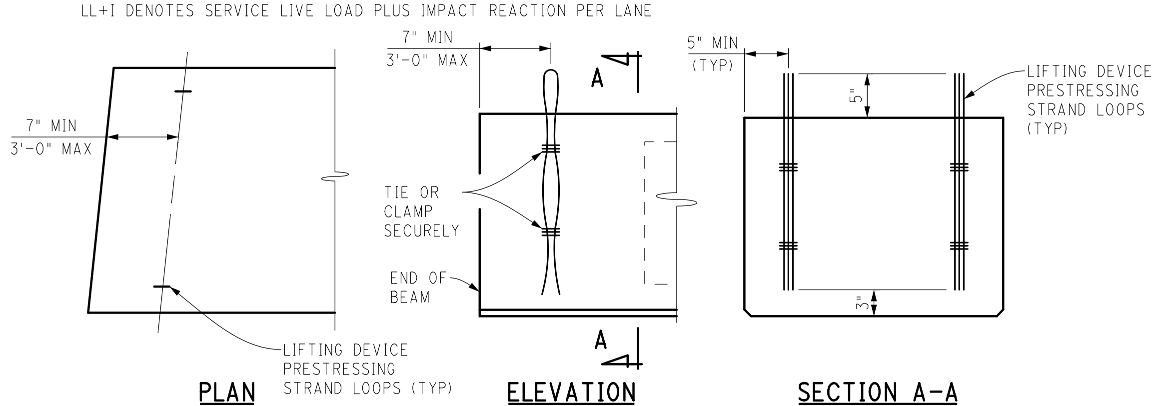
DW DENOTES SERVICE BEAM REACTION DUE TO FUTURE WEARING SURFACE

LL+I DENOTES SERVICE LIVE LOAD PLUS IMPACT REACTION PER LANE

PRESTRESSING STRAND LIFTING DEVICES

ESTIMATED BEAM WEIGHT (TONS)	STRAND SIZE	NO. OF STRANDS PER BEAM END
20	3/8"	2
27	7/16"	2
36	1/2"	2
30	3/8"	3
40.5	7/16"	3
54	1/2"	3

THIS TABLE SHOULD INCLUDE ONLY APPLICABLE INFORMATION ON THE FINAL DESIGN DRAWINGS



DETAILS OF LIFTING DEVICE

LIFTING OF BEAM SHALL BE BY EQUAL LOADS TO EACH PAIR OF LIFTING DEVICES.

LIFTING DEVICES SHALL BE REMOVED.

FOR INFORMATION ONLY:

THE DESIGN OF THESE STRUCTURES IS BASED ON 1.2 TIMES THE CURRENT AASHTO LRFD BRIDGE DESIGN SPECIFICATION HL-93 LOADING WITH THE EXCEPTION THAT THE DESIGN TANDEM PORTION OF THE HL-93 LOAD DEFINITION SHALL BE REPLACED BY A SINGLE 60 KIP AXLE LOAD BEFORE APPLICATION OF THIS 1.2 FACTOR. THE RESULTING LOAD IS DESIGNATED HL-93 MOD. LIVE LOAD PLUS DYNAMIC LOAD ALLOWANCE DEFLECTION DOES NOT EXCEED 1/800 OF SPAN LENGTH.

A 6" DECK SECTION WAS USED FOR THE LOADING ON ALL BEAMS. THE EFFECTIVE DECK SECTION IS 4 1/2" AND THE SACRIFICIAL DECK SECTION IS 1 1/2".

THE LONGITUDINAL "EA" BARS IN THE TOP AND BOTTOM FLANGES OF THE BEAMS ARE NOT INCLUDED TO PROVIDE ADDITIONAL CAPACITY.

BEAM DESIGNS DO NOT INCLUDE PRESTRESSING STRANDS IN THE TOP FLANGES.

ALL VERTICAL "ED" STIRRUP BARS SHALL BE GRADE 40 KSI FOR 17" & 21" DEEP BOX BEAMS AND GRADE 60 KSI FOR ALL OTHER BEAM DEPTHS.

"A" & "B" ARE MEASURED FROM BRIDGE CONST ℄ TO ADJACENT BEAM ℄.

THE ABOVE NOTES ARE FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.

☐ VALUES TO BE DETERMINED BY DESIGNER

NOTES:

THE TOP SURFACE OF THE BEAMS SHALL BE INTENTIONALLY ROUGHENED.

THE ESTIMATED BEAM CAMBER AT RELEASE IS XX". THIS CAMBER IS DUE TO PRESTRESS AND DEAD LOAD OF THE BEAM ONLY AND IS MEASURED IN THE ERECTED POSITION.

THE INITIAL FORCE IN THE TRANSVERSE POST-TENSIONING TENDONS SHALL BE XX LBS EACH.

TOTAL ESTIMATED CHANGE OF LENGTH OF BOTTOM FLANGE AT TRANSFER OF PRESTRESS FORCE IS X".

PRESTRESSING STRANDS SHALL BE GIVEN AN INITIAL PRESTRESS AS FOLLOWS:
0.6" DIA. - 44,000 lbs. PRESTRESS.

THE COMPRESSIVE STRENGTH OF THE CONCRETE AT THE TIME OF PRESTRESSING FORCE RELEASE SHALL NOT BE LESS THAN 7000 psi.

THE COMPRESSIVE STRENGTH OF THE CONCRETE SHALL BE NOT LESS THAN 8000 psi AT 28 DAYS.

LIFTING DEVICES SHALL BE REMOVED AFTER BEAMS ARE ERECTED. REMOVAL IS INCLUDED IN THE BID ITEM "PREST CONC BOX BEAM, ERECT, XX INCH"

POSITION DOWELS SHALL BE HOT-DIP GALVANIZED ACCORDING TO AASHTO M 232. POSITION DOWELS ARE INCLUDED IN PAYMENT FOR PRESTRESSED CONCRETE BEAMS.

ITEMS CAST INTO THE BEAMS TO FACILITATE BRIDGE CONSTRUCTION (FORMING, FINISHING, ETC.) SHALL BE GALVANIZED OR EPOXY COATED.

PRESTRESSING STRAND SHALL BE 0.6" NOMINAL DIAMETER MEETING THE REQUIREMENTS OF AASHTO M203 (ASTM A416), GRADE 270, LOW RELAXATION STRAND.

COAT THE ENTIRE OUTSIDE AND BOTTOM OF THE FASCIA BEAM USING A MATERIAL SELECTED FROM THE SPECIAL PROVISION FOR CONCRETE SURFACE COATINGS. APPLY THE COATING ACCORDING TO THE SPECIAL PROVISION.

STEEL FOR SOLE PLATES AND OTHER BEARING COMPONENTS SHALL MEET THE REQUIREMENTS OF AASHTO M 270 GRADE 36.

BEAM STIRRUPS, SHALL BE GRADE XX (ksi).

FIELD DRILLING SHALL BE ALLOWED FOR SIGN SUPPORT ANCHORS ONLY. LOCATION OF ANCHORS SHALL BE AS DETAILED ON TRAFFIC & SAFETY SIGN SUPPORT SPECIAL DETAILS. ANY DAMAGE TO THE BEAMS SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE AND APPROVED BY THE ENGINEER.

ALL LONGITUDINAL "EA" BARS IN THE TOP AND BOTTOM FLANGES SHALL BE GRADE 60 KSI.

ADHESIVE ANCHORS SHALL USE A NON-SHRINK GROUT (WHICH IS CEMENTIOUS) LISTED IN MDOT'S QUALIFIED PRODUCTS LIST.

ITEMS CAST INTO STRUCTURAL PRECAST CONCRETE TO FACILITATE BRIDGE CONSTRUCTION (FORMING, FINISHING, ETC.) SHALL BE GALVANIZED OR EPOXY COATED.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

NO SCALE

FILE: prest_SBS_001.dgn

DATE: 05/09/18

DESIGN UNIT:

TSC:

CS:

JN:

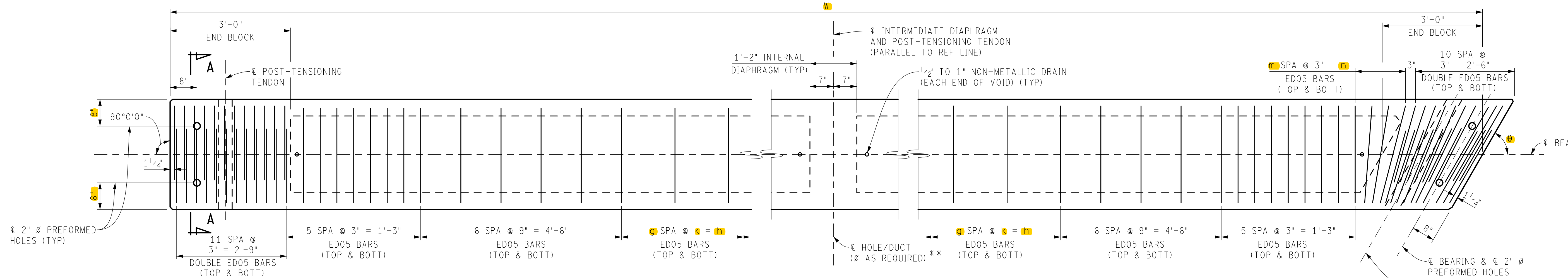
PRESTRESSED BEAM DETAILS

SIDE BY SIDE BOX BEAM

DRAWING SSBB 001

SHEET

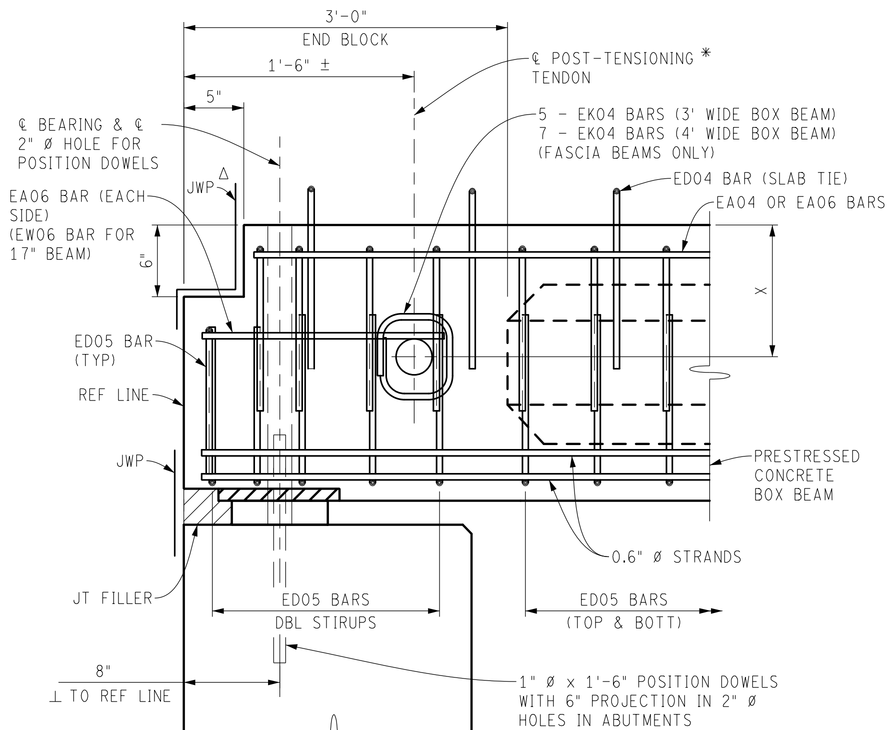
SECT



PLAN OF BEAM SHOWING 90° CROSSING

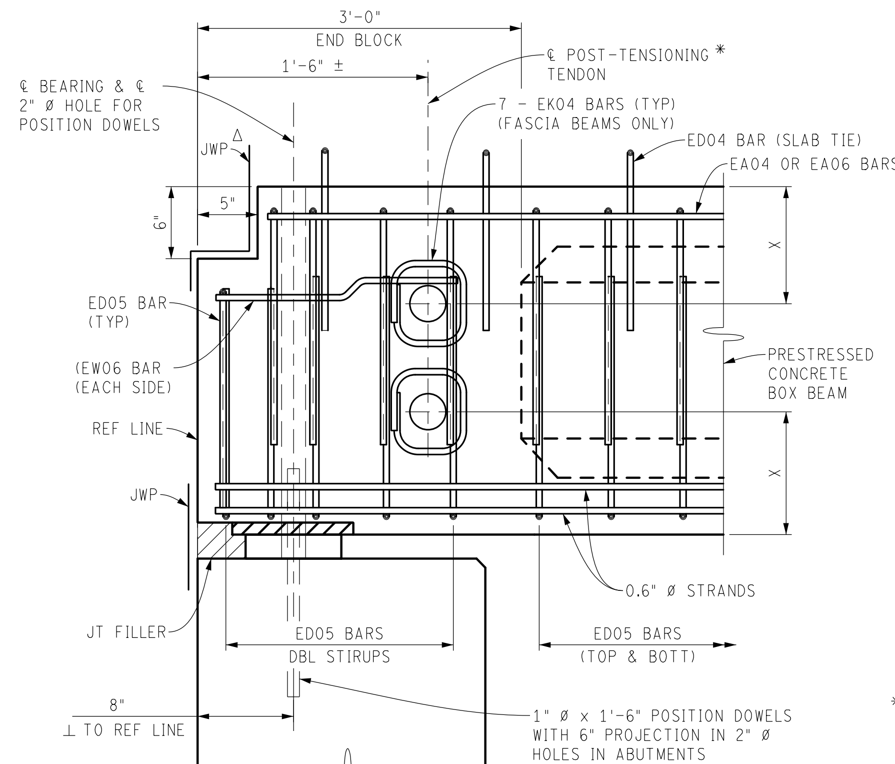
** USE 3" ø, 4" ø, OR 5" ø AS REQUIRED FOR BEAM SIZE AND POST TENSIONING FORCE

PLAN OF BEAM SHOWING SKEWED CROSSING



SECTION THRU END BLOCK

FOR 17", 21" & 27" BOX BEAMS



SECTION THRU END BLOCK

FOR 33" & 39" BOX BEAMS

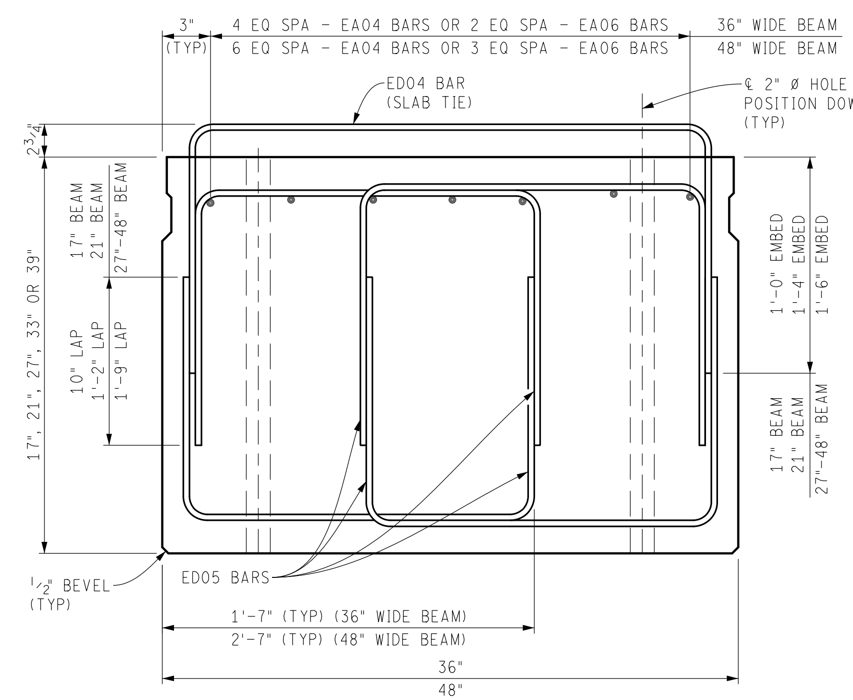
BEAM DIMENSIONS										
	BEAM SIZE									
	17 x 36				21 x 48		27 x 48		33 x 48	39 x 48
	20' BEAM SPAN	30' BEAM SPAN	40' BEAM SPAN	50' BEAM SPAN	60' BEAM SPAN	70' BEAM SPAN	80' BEAM SPAN	90' BEAM SPAN	100' BEAM SPAN	110' BEAM SPAN
g	5	14	24	34	44	54	64	74	84	94
k	10" (-)	1'-0" (+)	1'-0" (+)	1'-0" (+)	1'-0" (+)	1'-0" (+)	1'-0" (+)	1'-0" (+)	1'-0" (+)	1'-0" (+)
h	4'-1 1/2"	14'-1 1/2"	24'-1 1/2"	34'-1 1/2"	44'-1 1/2"	54'-1 1/2"	64'-1 1/2"	74'-1 1/2"	84'-1 1/2"	94'-1 1/2"
m	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
n	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
s	20	30	40	50	60	70	80	90	100	110
u	19'-8"	29'-8"	39'-8"	49'-8"	59'-8"	69'-8"	79'-8"	89'-8"	99'-8"	109'-8"
W	21'-4"	31'-4"	41'-4"	51'-4"	61'-4"	71'-4"	81'-4"	91'-4"	101'-4"	111'-4"

REPLACE VARIABLES IN BEAM DIMENSIONS WITH VALUES FROM THIS TABLE. THIS TABLE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THE FINAL DESIGN DRAWINGS.

Δ AT FIXED ABUTMENT ONLY

FOR "X", SEE DIMENSION TABLE DWG SSBB 005

* SEE POST TENSIONING TENDON LOCATIONS TABLE ON DWG SSBB 001



SECTION A-A

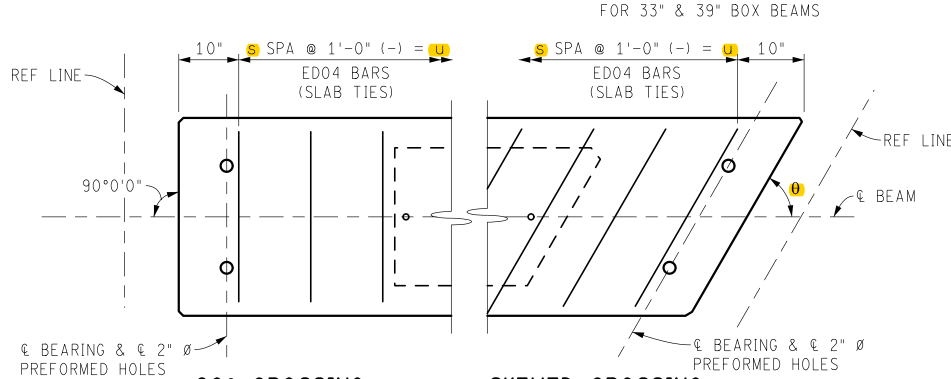
FOR INFORMATION ONLY:

VARIABLES IN BEAM DIMENSIONS TABLE WITH VALUES NOTED "TBD" SHALL BE DETERMINED BY THE DESIGNER BASED ON BEAM END SKEW.

"g" & "h" VALUES SHOWN IN THE BEAM DIMENSIONS TABLE ARE BASED ON 90° CROSSING AND SHALL BE ADJUSTED FOR SKEWED CROSSING.

THE ENDS OF THE BOX BEAMS SHALL BE SKEWED TO BE PARALLEL TO THE REFERENCE LINE.

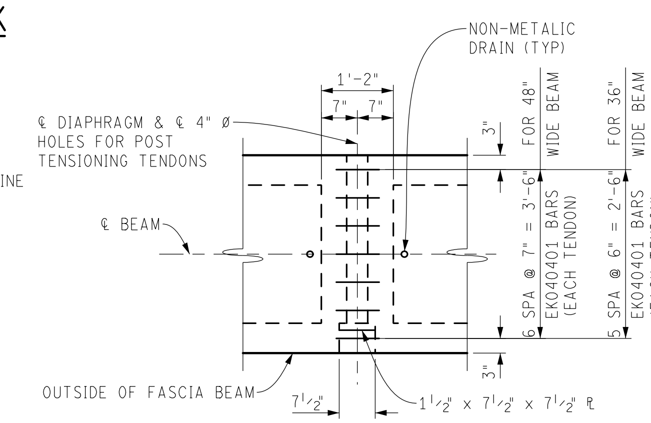
THE ABOVE NOTES ARE FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.



90° CROSSING

SKEWED CROSSING

PLAN OF SLAB TIES



FASCIA BEAM DIAPHRAGM DETAIL

END BLOCK DETAIL SIMILAR

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

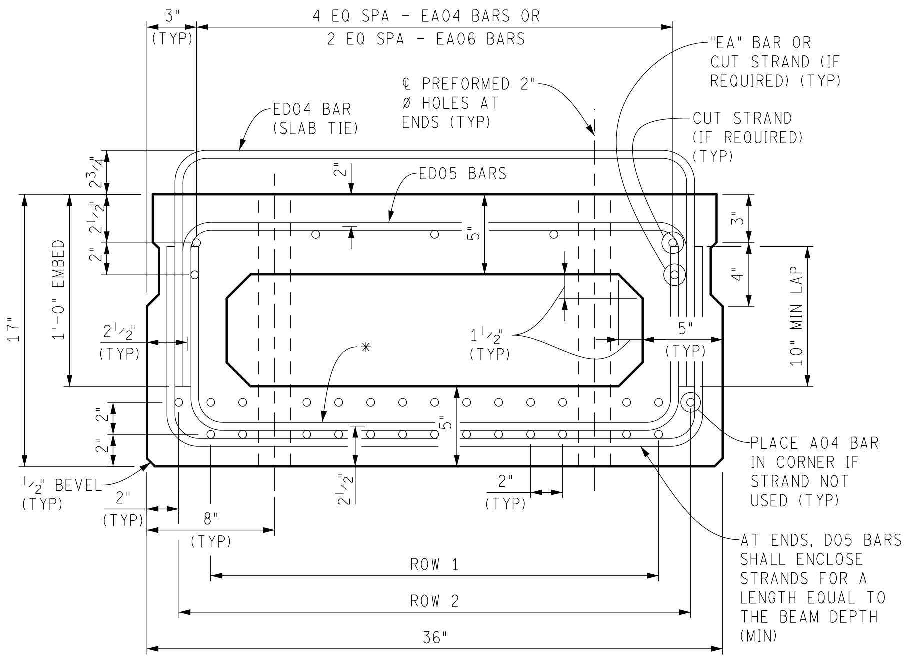
NO SCALE

DATE: 05/09/18
DESIGN UNIT:
TSC:
FILE: prest_SBS_002.dgn

CS:
JN:

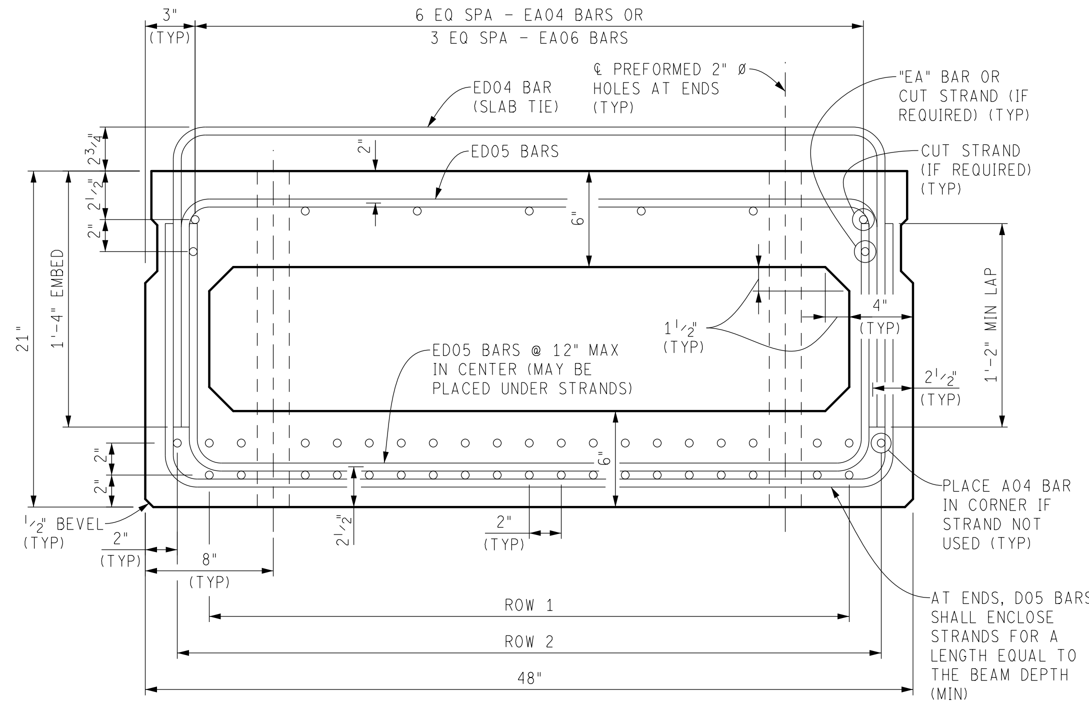
PRESTRESSED BEAM DETAILS
SIDE BY SIDE BOX BEAM

DRAWING SSBB 002
SHEET SECT

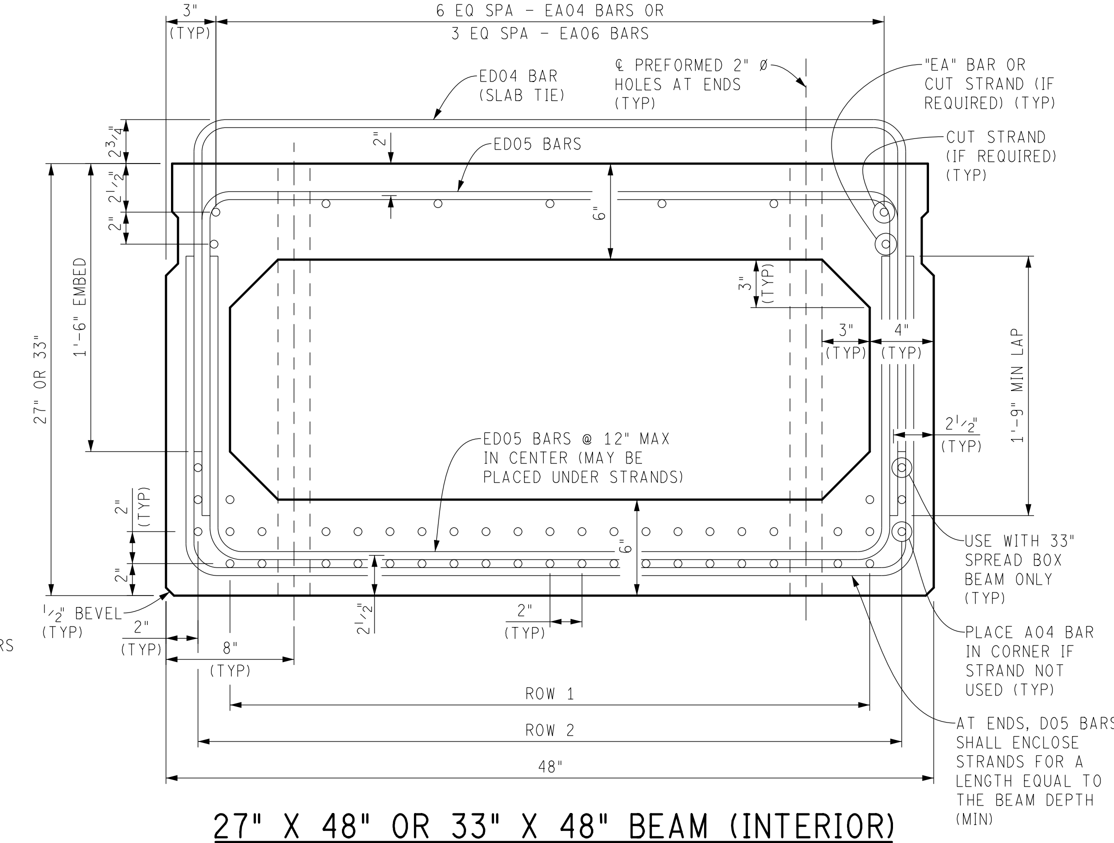


17" X 36" BEAM (INTERIOR)

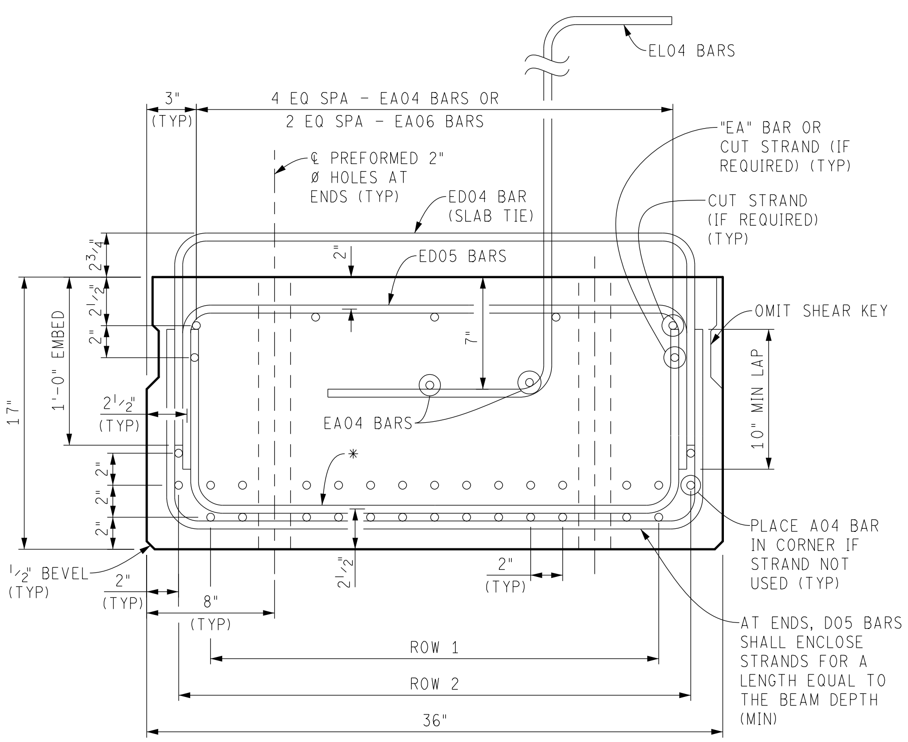
* ED05 BARS @ 12" MAX IN CENTER (MAY BE PLACED UNDER STRANDS)



21" X 48" BEAM (INTERIOR)

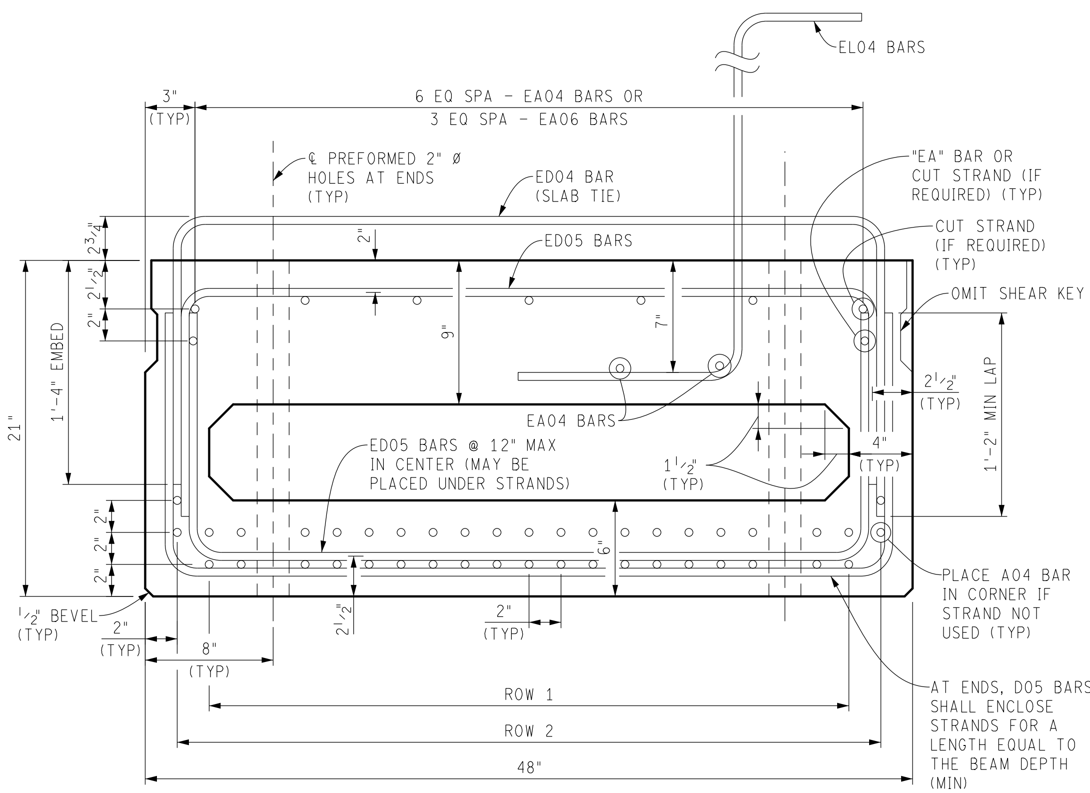


27" X 48" OR 33" X 48" BEAM (INTERIOR)

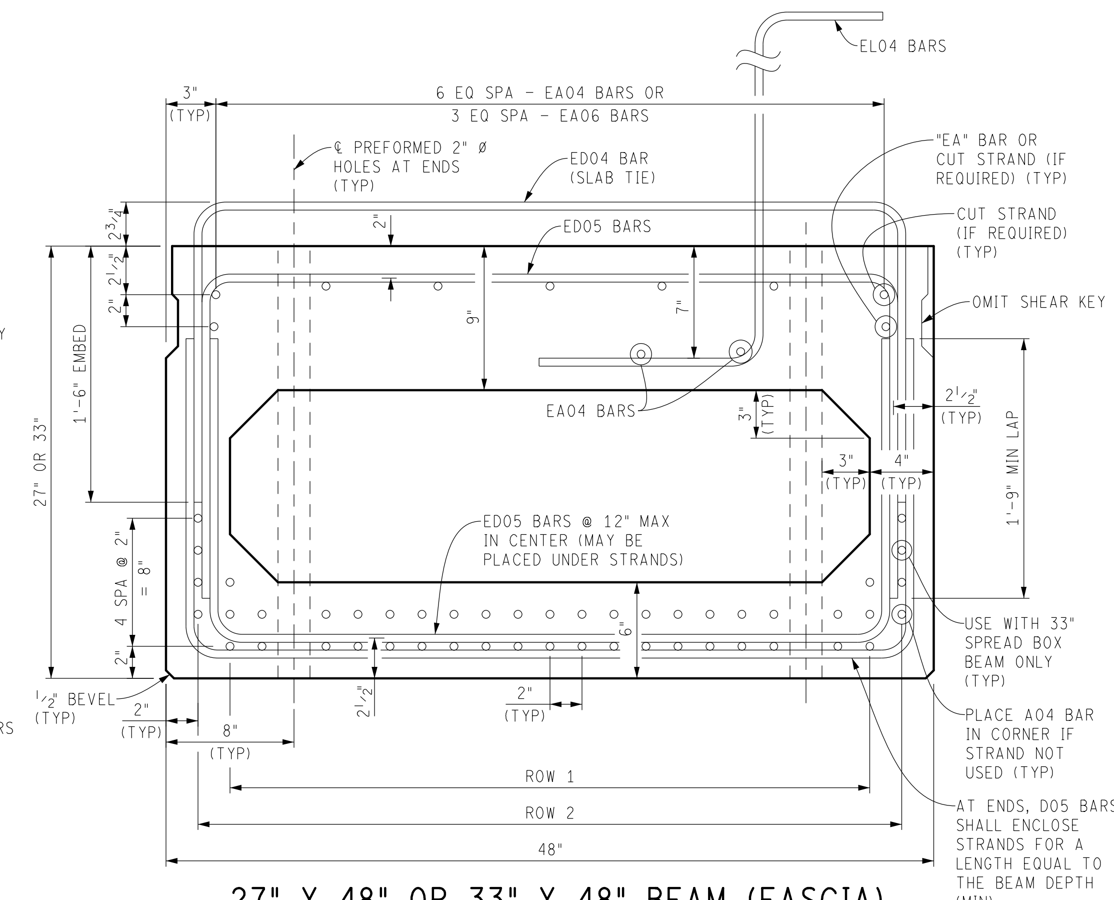


17" X 36" BEAM (FASCIA)

* ED05 BARS @ 12" MAX IN CENTER (MAY BE PLACED UNDER STRANDS)



21" X 48" BEAM (FASCIA)

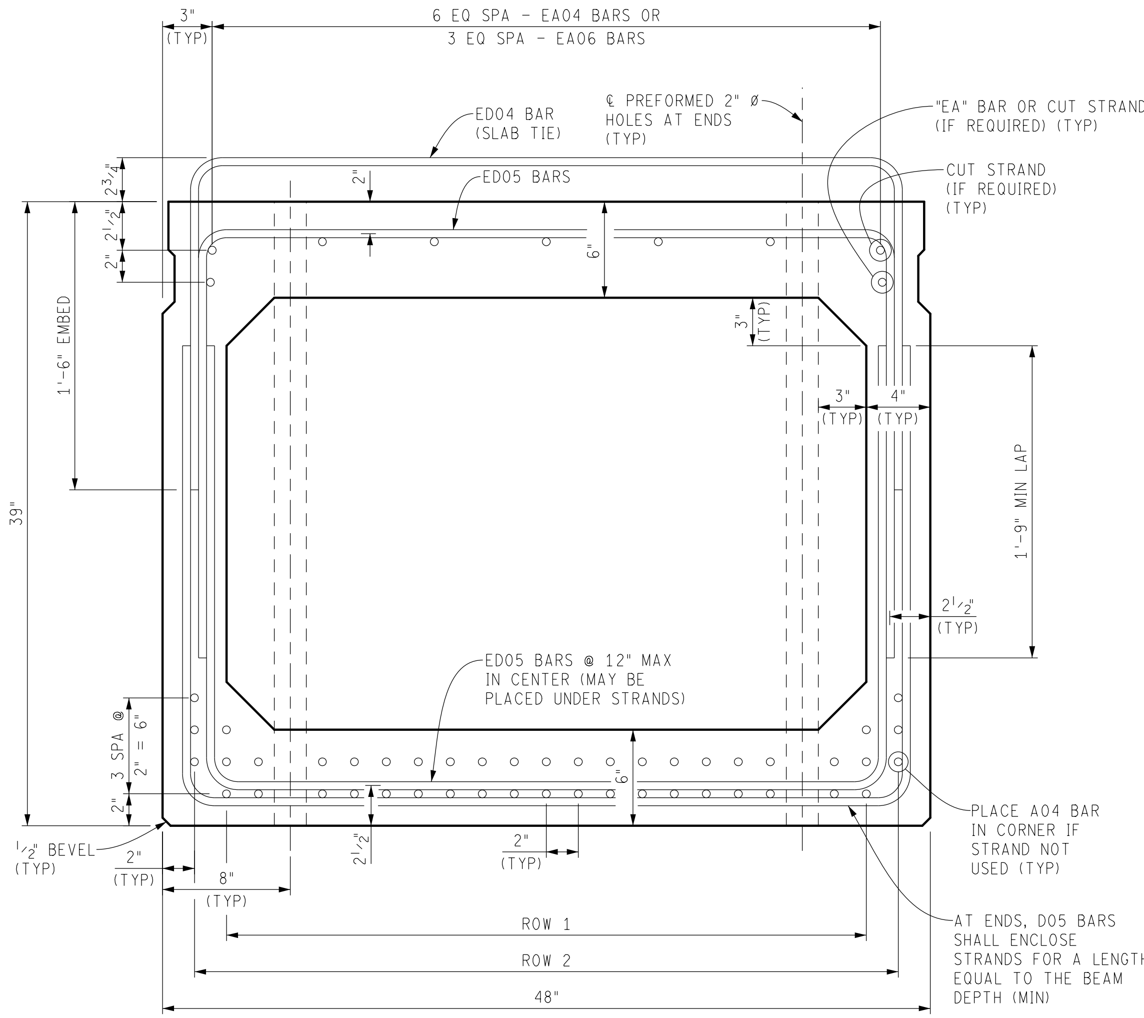


27" X 48" OR 33" X 48" BEAM (FASCIA)

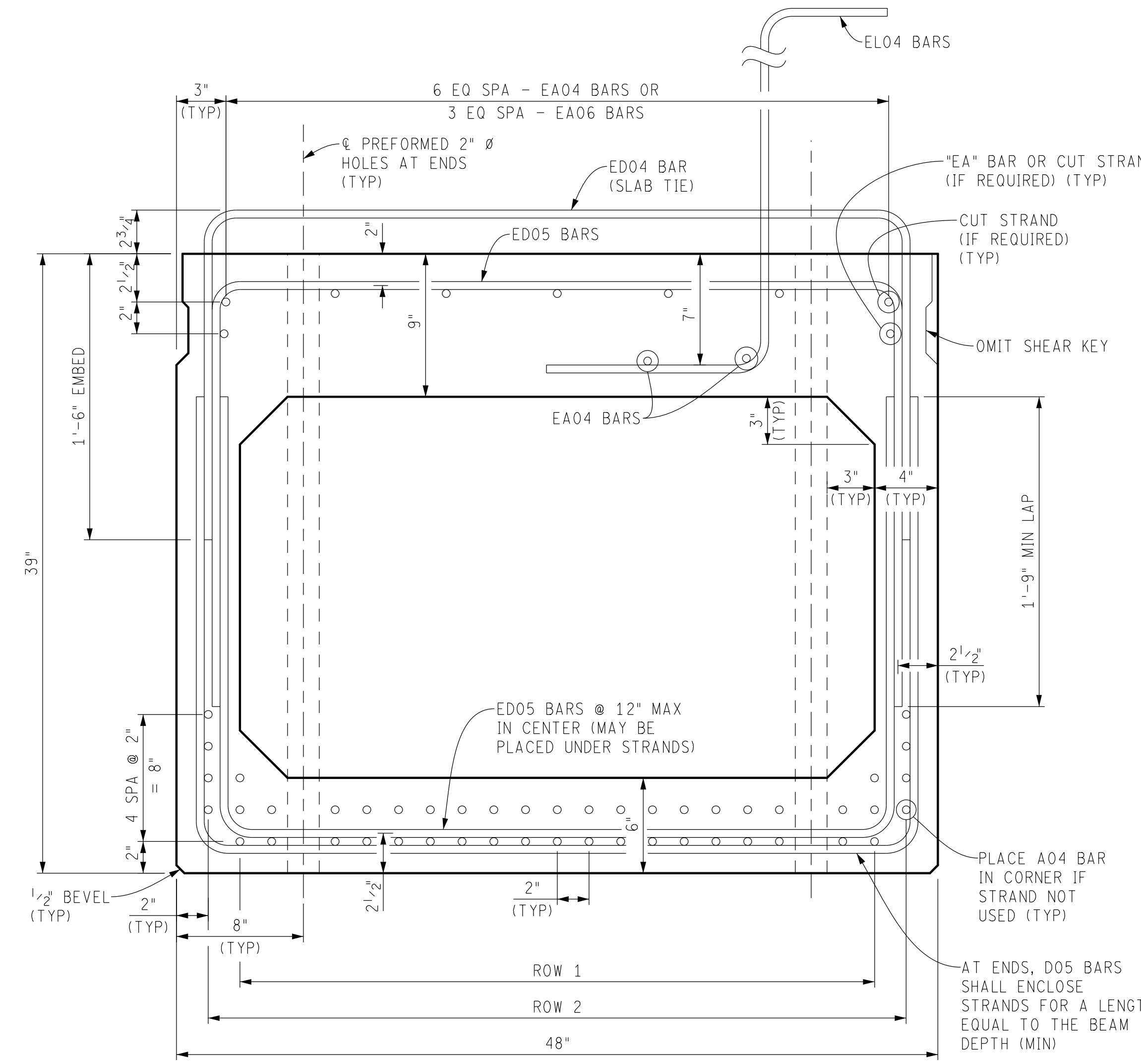
NOTES:

SEE DEBONDING TABLE ON DWG "SSBB 005" FOR STRAND INFORMATION.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)								NO SCALE	DATE: 05/09/18	CS:	PRESTRESSED BEAM DETAILS	DRAWING	SHEET
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION		DESIGN UNIT:	JN:	SIDE BY SIDE BOX BEAM	SSBB	SECT
								FILE: prest_SBS_003.dgn	TSC:			003	



39" X 48" BEAM (INTERIOR)



39" X 48" BEAM (FASCIA)

NOTES:

SEE DEBONDING TABLE ON DWG "SSBB 005" FOR STRAND INFORMATION.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

NO SCALE

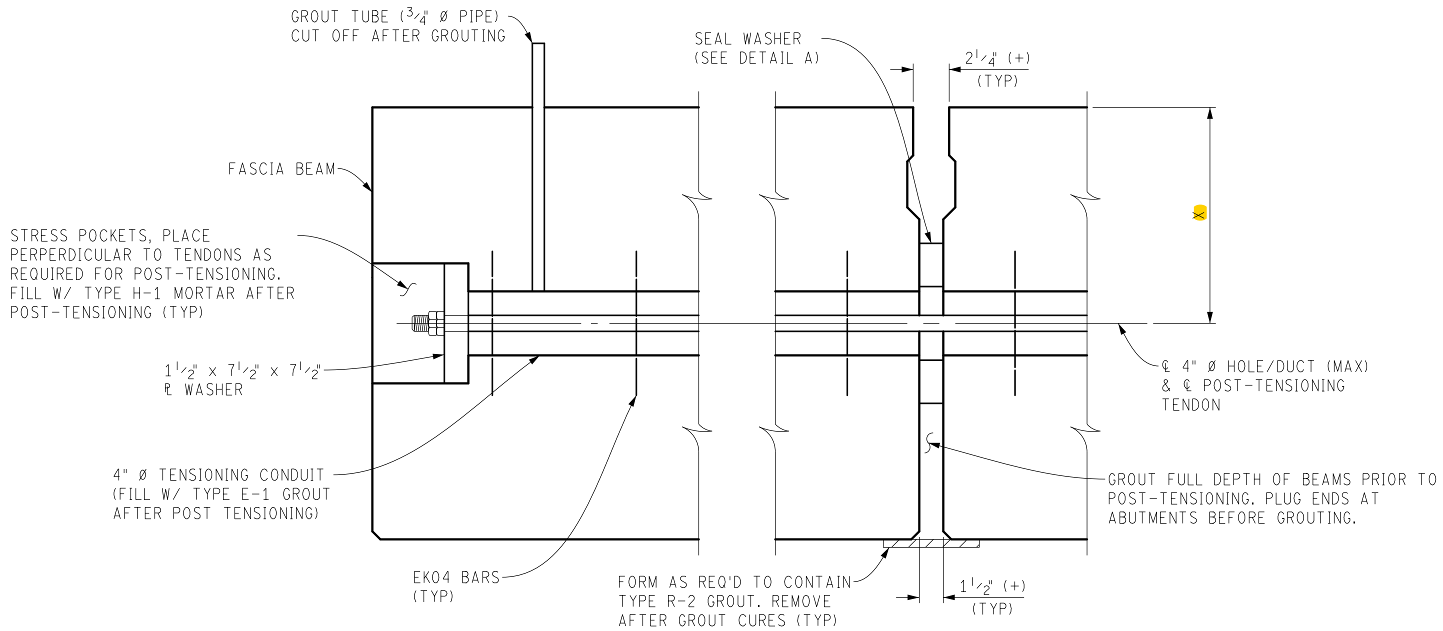
FILE: prest_SBS_004.dgn

DATE: 05/09/18
DESIGN UNIT:
TSC:

CS:
JN:

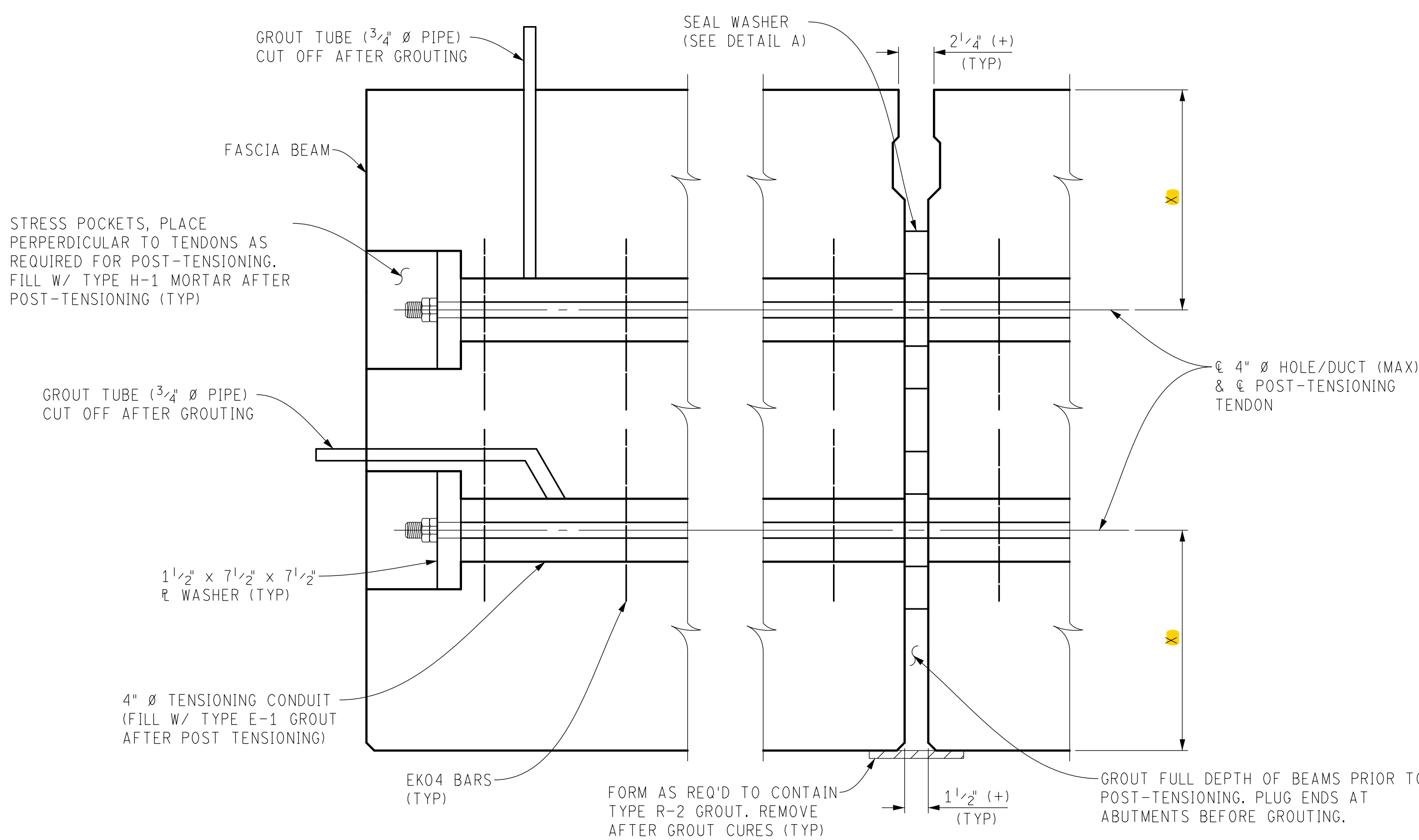
PRESTRESSED BEAM DETAILS
SIDE BY SIDE BOX BEAM

DRAWING	SHEET
SSBB 004	SECT



POST-TENSIONING DETAIL

NOTE: STRESS POCKETS, ANCHOR PLATES AND TENDON COUPLERS SHALL BE AS REQUIRED FOR THE POST-TENSIONING SYSTEM PROVIDED.
(USE FOR 17", 21" & 27" DEEP BEAMS)



POST-TENSIONING DETAIL

NOTE: STRESS POCKETS, ANCHOR PLATES AND TENDON COUPLERS SHALL BE AS REQUIRED FOR THE POST-TENSIONING SYSTEM PROVIDED.
(USE FOR 33" & 39" DEEP BEAMS)

STRAND/DEBONDING LAYOUT TABLE

BEAM SPAN (℄ BRG-℄ BRG) (FT)	BEAM DIMENSIONS		NO. OF STRANDS					
	D (in)	W (in)	1ST LAYER, 2" FROM BOTTOM	2ND LAYER, 4" FROM BOTTOM	3RD LAYER, 6" FROM BOTTOM	TOTAL NO. OF STRANDS	NO. OF DEBONDING STRANDS	NO. OF DEBONDING STRANDS-(1st LAYER)-[2nd LAYER] DEBONDING LENGTHS (ft)
20	17	36	7	–	–	7	–	–
30	17	36	7	–	–	7	–	–
40	17	36	9	–	–	9	–	–
50	17	36	13	3	–	16	2	(2)2
60	21	48	20	–	–	20	2	(2)2
70	21	48	19	11	–	30	6	(2)2, (4)4
80	27	48	19	9	–	28	2	(2)2
90	27	48	19	17	–	36	6	(2)2, (2)4, (2)10
100	33	48	19	15	–	34	4	(2)2, (2)4
110	39	48	19	15	–	34	2	(2)4

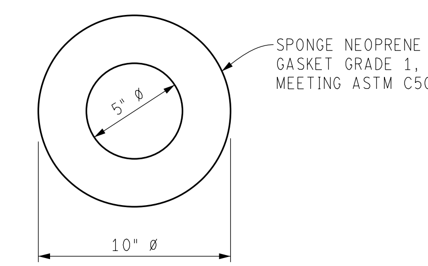
THIS TABLE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THE FINAL DESIGN DRAWINGS

STRAND DEBONDING LENGTH IS MEASURED FROM EACH BEAM END

DIMENSION TABLE

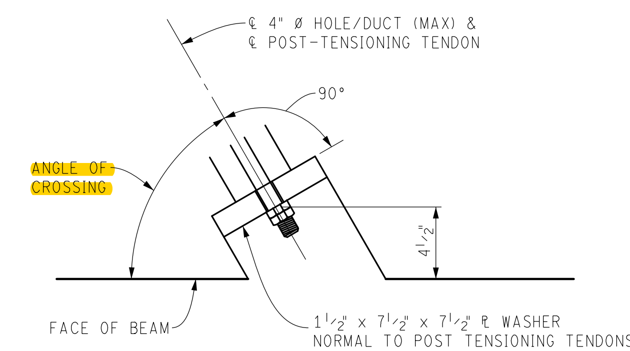
BEAM DEPTH (in)	"X"
17	8 1/2"
21	10 1/2"
27	1'-1 1/2"
33	11"
39	1'-1"

THIS TABLE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THE FINAL DESIGN DRAWINGS

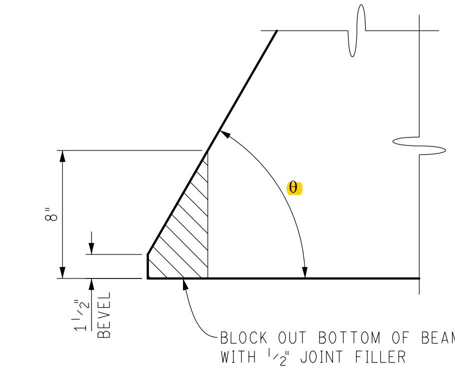


DETAIL A

2 1/2" THICK SEAL WASHER



TOP VIEW STRESS POCKET



CORNER BLOCKING DETAIL

USE WHEN θ < 70°

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

NO SCALE

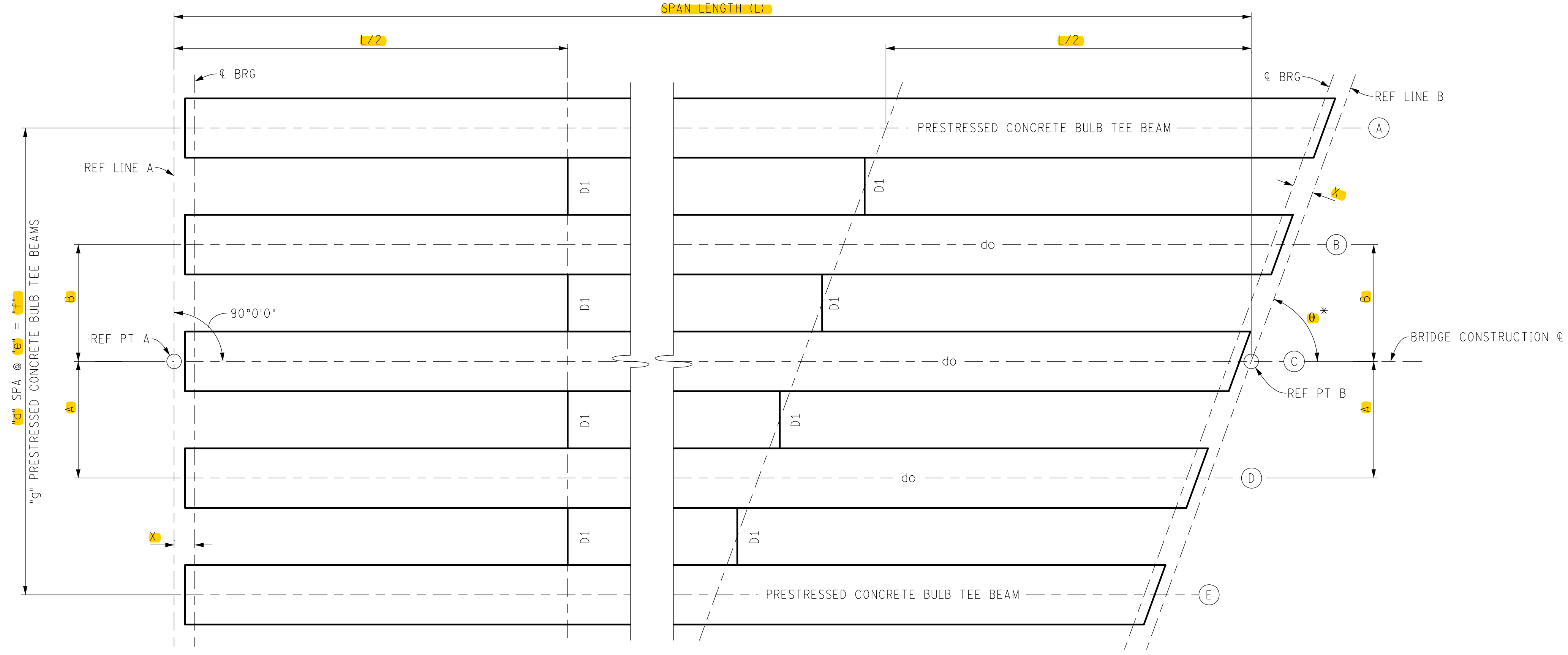
FILE: prest_SBS_005.dgn

DATE: 05/09/18
DESIGN UNIT:
TSC:

CS:
JN:

PRESTRESSED BEAM DETAILS
SIDE BY SIDE BOX BEAM

DRAWING: SSBB
SHEET: 005
SECT



* FOR ANGLE OF CROSSING ≥ 80°, DIAPHRAGMS SHALL BE INLINE. FOR ANGLE OF CROSSING < 80°, DIAPHRAGMS SHALL BE STAGGERED.

ERECTION DIAGRAM

SERVICE BEAM REACTIONS (KIPS)			
BEAM SPAN (℄ BRG-℄ BRG) (FT)	DC	DW	LL+I
70	86	9	126
80	98	10	132
90	115	11	137
100	130	13	142
110	140	14	147

THIS TABLE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THE FINAL DESIGN DRAWINGS

DC DENOTES SERVICE DEAD LOADS DUE TO BEAM SELF WEIGHT, DECK WEIGHT, & DIAPHRAGMS

DW DENOTES SERVICE BEAM REACTION DUE TO FUTURE WEARING SURFACE

LL+I DENOTES SERVICE LIVE LOAD PLUS IMPACT REACTION PER LANE

PRESTRESSING STRAND LIFTING DEVICES						
BEAM DEPTH (INCHES)	NUMBER OF STRANDS AND SIZE					
	3 - 1/2"	3 - 0.6"	4 - 1/2"	4 - 0.6"	6 - 1/2" △	6 - 0.6" △
	BEAM WEIGHT (TONS)					
36	32	39	41	49	64	78
42	39	47	49	60	78	94
48	45	54	57	68	90	108

THIS TABLE SHOULD INCLUDE ONLY APPLICABLE INFORMATION ON THE FINAL DESIGN DRAWINGS

△ DOUBLE LOOPS WITH 3 STRANDS EACH

NOTES:

CONCRETE INSERTS FOR INTERMEDIATE DIAPHRAGMS SHALL BE 7/8" DIAMETER; DAYTON SUPERIOR, TYPE B-1 HEAVY OR TYPE B-18; WILLIAMS FORM, TYPE C 12 OR TYPE C -19; MEADOW BURKE, TYPE CT-2 OR TYPE CX-4; OR EQUAL. INSERTS (COIL OR FERRULE) MUST BE ELECTROPLATE GALVANIZED IN ACCORDANCE WITH ASTM B633, SERVICE CONDITION 4. INSERTS SHALL BE CAST WITH THE BEAMS. FIELD INSTALLATION OF INSERTS IS NOT ALLOWED.

CONCRETE INSERTS FOR BACKWALLS SHALL BE 1" DIAMETER (AT EXPANSION ABUTMENT) & 1/2" DIAMETER (AT FIXED ABUTMENT); DAYTON SUPERIOR, TYPE B-1 HEAVY OR TYPE B-18; WILLIAMS FORM, TYPE C 12 OR TYPE C -19; MEADOW BURKE, TYPE CT-2 OR TYPE CX-4; OR EQUAL. INSERTS (COIL OR FERRULE) MUST BE ELECTROPLATE GALVANIZED IN ACCORDANCE WITH ASTM B633, SERVICE CONDITION 4. INSERTS SHALL BE CAST WITH THE BEAMS. FIELD INSTALLATION OF INSERTS IS NOT ALLOWED.

ALL STEEL FOR DIAPHRAGMS SHALL BE COATED ACCORDING TO SUBSECTION 716 OF THE STANDARD SPECIFICATIONS AND SHALL BE HOT-DIPPED GALVANIZED.

THE ESTIMATED BEAM CAMBER AT RELEASE IS XX". THIS CAMBER IS DUE TO PRESTRESS AND DEAD LOAD OF THE BEAM ONLY AND IS MEASURED IN THE ERECTED POSITION.

THE ESTIMATED CHANGE OF LENGTH OF BOTTOM FLANGE AT TRANSFER OF PRESTRESS FORCE IS XX".

PRESTRESSING STRANDS SHALL BE GIVEN AN INITIAL PRESTRESS AS FOLLOWS:
0.6" DIA. - 44,000 lbs. PRESTRESS.

TOTAL ESTIMATED CHANGE OF LENGTH OF BOTTOM FLANGE AT TRANSFER OF PRESTRESS FORCE IS X".

LIFTING DEVICES SHALL BE REMOVED AFTER BEAMS ARE ERECTED. REMOVAL IS INCLUDED IN THE BID ITEM "PREST CONC BULB-TEE BEAM, ERECT, XX INCH BY XX INCH".

USE NON-DEFORMED STEEL RODS IN ACCORDANCE WITH AASHTO M 270 GRADE 36 AND HOT-DIP GALVANIZED IN ACCORDANCE WITH AASHTO M 111, AS POSITION DOWELS FOR PRECAST BEAMS.

THE COMPRESSIVE STRENGTH OF THE CONCRETE AT THE TIME OF PRESTRESSING FORCE RELEASE SHALL NOT BE LESS THAN 7000 psi.

THE COMPRESSIVE STRENGTH OF THE CONCRETE SHALL BE NOT LESS THAN 8000 psi AT 28 DAYS.

ITEMS CAST INTO THE BEAMS TO FACILITATE BRIDGE CONSTRUCTION (FORMING, FINISHING, ETC.) SHALL BE GALVANIZED OR EPOXY COATED.

PRESTRESSING STRAND SHALL BE 0.6" NOMINAL DIAMETER MEETING THE REQUIREMENTS OF AASHTO M203 (ASTM A416), GRADE 270, LOW RELAXATION STRAND.

BEAM STEEL REINFORCEMENT, INCLUDING STIRRUPS, SHALL BE GRADE 60 (KSI).

ANY HOLES CAST OR FORMED IN THE BEAM SHALL BE FILLED WITH NON-SHRINKING GROUT.

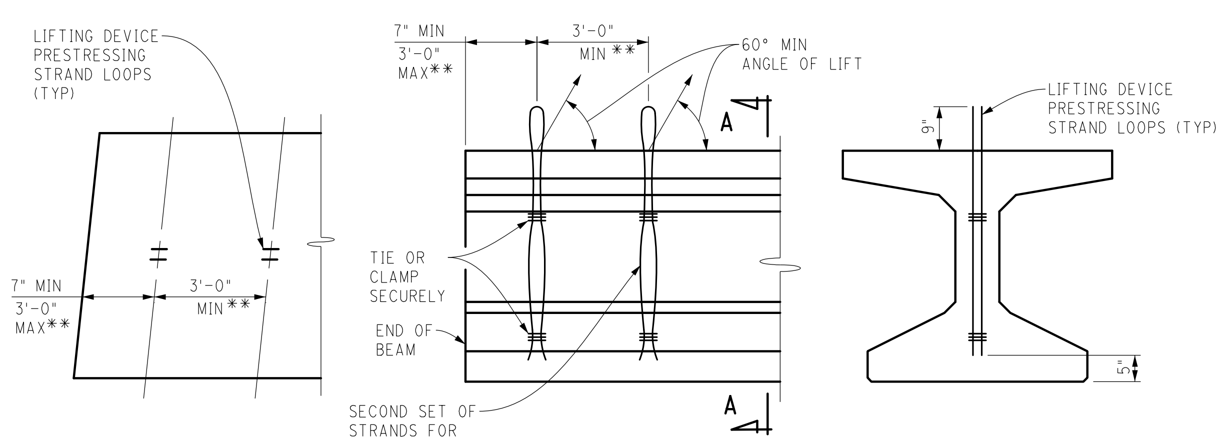
THE OUTER 6" OF THE TOP SURFACE OF THE BEAM SHALL BE FABRICATED TO A SMOOTH TROWEL FINISH, AND THEN COATED WITH A BOND BREAKER AS SPECIFIED IN SECTION 708 OF THE STANDARD SPECIFICATIONS.

COAT ALL BEAMS EXCEPT BEAM TOPS USING A MATERIAL SELECTED FROM THE SPECIAL PROVISION FOR CONCRETE SURFACE COATINGS. APPLY THE COATING ACCORDING TO THE SPECIAL PROVISION. SEE AESTHETIC DETAILS FOR ADDITIONAL DETAILS.

STEEL FOR DIAPHRAGMS, SOLE PLATES, AND OTHER BEARING COMPONENTS SHALL MEET THE REQUIREMENTS OF AASHTO M270 GRADE 36.

COST OF PIPE SLEEVES IS INCLUDED IN THE BID ITEM "PREST CONC BULB-TEE BEAM, FURN, XX INCH BY XX INCH".

ITEMS CAST INTO STRUCTURAL PRECAST CONCRETE TO FACILITATE BRIDGE CONSTRUCTION (FORMING, FINISHING, ETC.) SHALL BE GALVANIZED OR EPOXY COATED.



PLAN

ELEVATION

SECTION A-A

DETAILS OF LIFTING DEVICE

LIFTING OF BEAM SHALL BE BY EQUAL LOADS TO EACH PAIR OF LIFTING DEVICES.

LIFTING DEVICES SHALL BE REMOVED.

** INCREASE AS REQUIRED TO MAKE BEAM LATERALLY STABLE DURING HANDLING.

FOR INFORMATION ONLY:

THE DESIGN OF THESE STRUCTURES IS BASED ON 1.2 TIMES THE CURRENT AASHTO LRFD BRIDGE DESIGN SPECIFICATION HL-93 LOADING WITH THE EXCEPTION THAT THE DESIGN TANDEM PORTION OF THE HL-93 LOAD DEFINITION SHALL BE REPLACED BY A SINGLE 60 KIP AXLE LOAD BEFORE APPLICATION OF THIS 1.2 FACTOR. THE RESULTING LOAD IS DESIGNATED HL-93 MOD. LIVE LOAD PLUS DYNAMIC LOAD ALLOWANCE DEFLECTION DOES NOT EXCEED 1/800 OF SPAN LENGTH.

A 4" HAUNCH SECTION WAS USED FOR THE LOADING ON ALL BEAMS. THE HAUNCH SECTION WAS NOT INCLUDED IN THE COMPOSITE SECTION PROPERTIES FOR THE DESIGN OF THE BEAMS.

A 9" DECK SECTION WAS USED FOR THE LOADING ON ALL BEAMS. THE EFFECTIVE DECK SECTION IS 7 1/2" AND THE SACRIFICIAL DECK SECTION IS 1 1/2".

THE LONGITUDINAL "EA" BARS IN THE TOP AND BOTTOM FLANGES OF THE BEAMS ARE NOT INCLUDED TO PROVIDE ADDITIONAL CAPACITY.

BEAM DESIGNS DO NOT INCLUDE PRESTRESSING STRANDS IN THE TOP FLANGES.

"A" & "B" ARE MEASURED FROM BRIDGE CONST ℄ TO ADJACENT BEAM ℄.

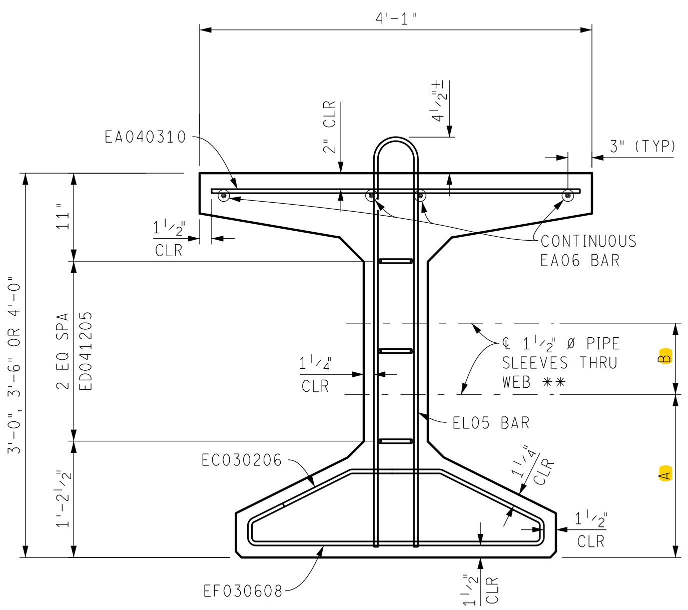
THE ABOVE NOTES ARE FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.

VALUES TO BE DETERMINED BY DESIGNER

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

NO SCALE

FILE: prest_BT_001.dgn	DATE: 05/09/18	CS:	PRESTRESSED BEAM DETAILS	DRAWING BTB 001
	DESIGN UNIT:	JN:	BULB-TEE BEAM	SHEET SECT
	TSC:			

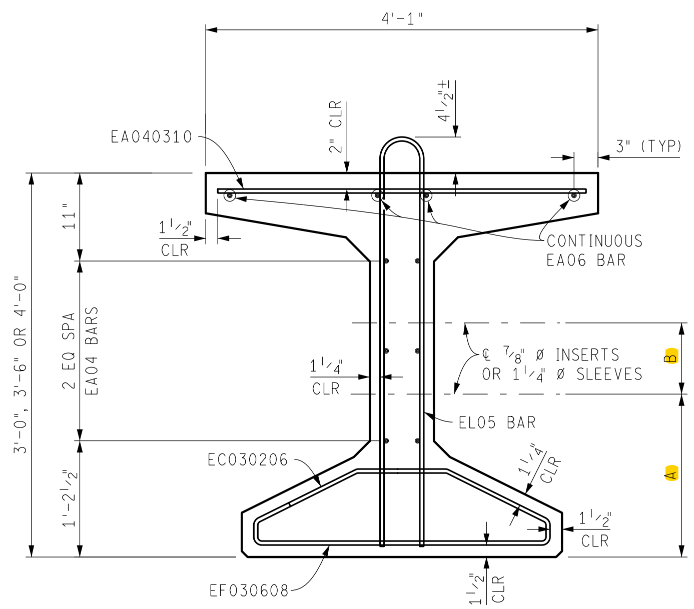


SECTION A-A

SHOWING REINFORCEMENT LAYOUT AT END SECTION

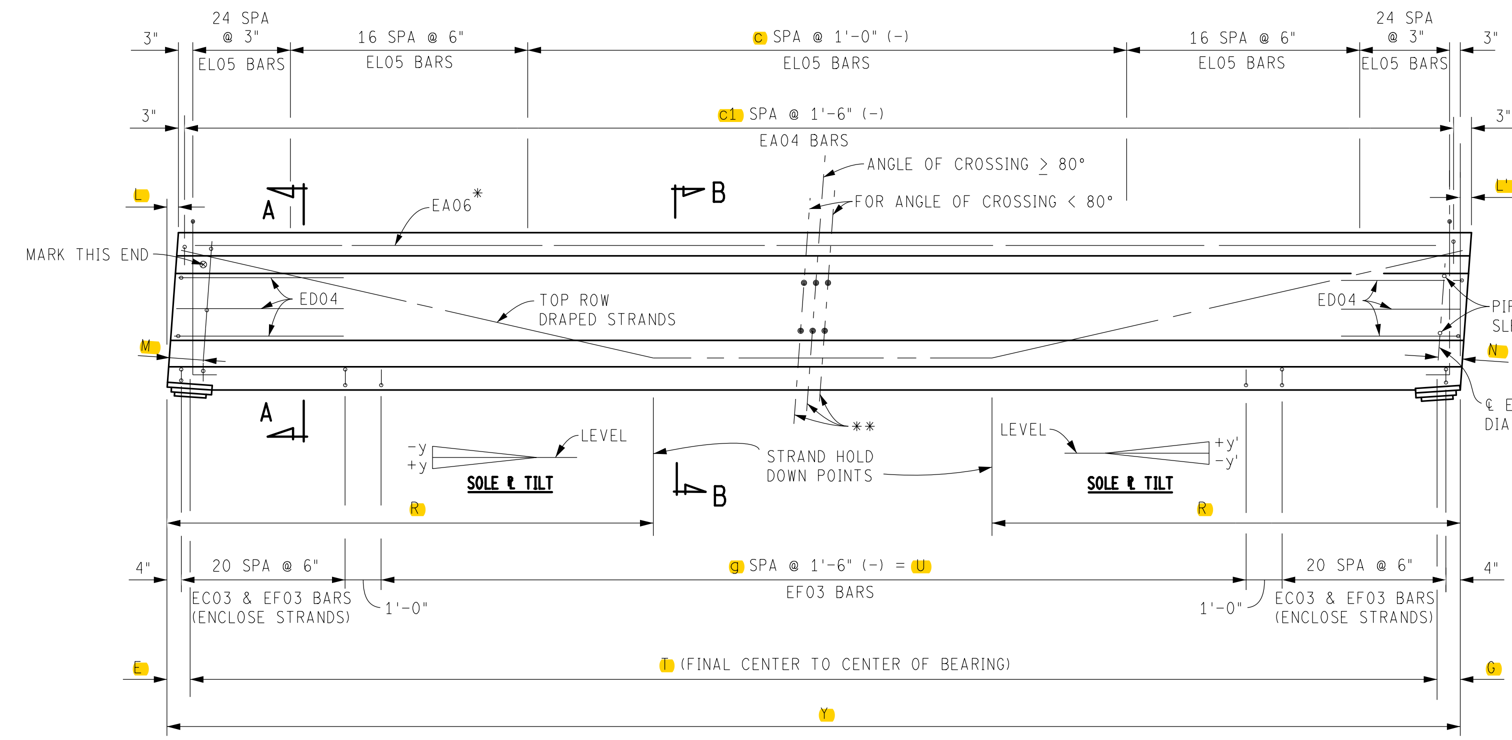
✱ REMOVE BLOCKOUT IN FORM IF REQUIRED FOR COMPRESSION FORCES OR BEAM STABILITY

✱✱ SLOPE PIPE SLEEVES TO MATCH SLOPE OF REINFORCEMENT IN BACKWALL



SECTION B-B

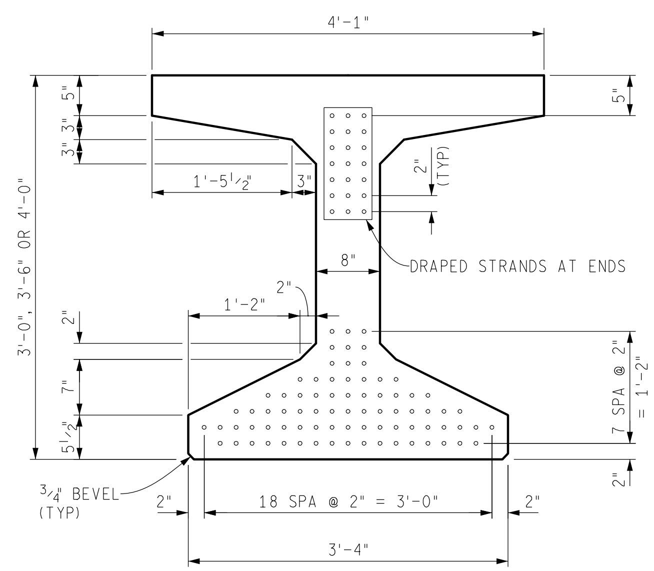
SHOWING REINFORCEMENT LAYOUT AT MIDSPAN



ELEVATION

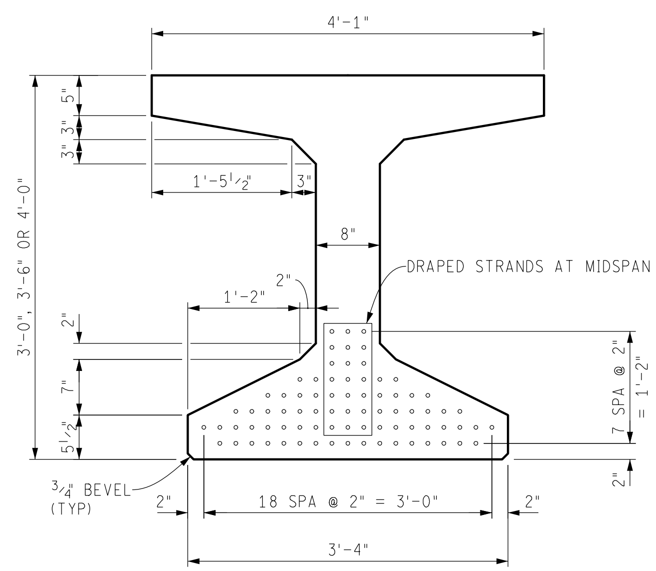
✱ BAR LENGTH = Y-3"

✱✱ ℄ INTERMEDIATE DIAPHRAGM & ℄ INSERTS (EXTERIOR BEAM) & ℄ PIPE SLEEVES (INTERIOR BEAM) OMIT FERRULE LOOP INSERTS ON OUTSIDE OF FASCIA BEAMS



SECTION A-A

SHOWING STRAND ARRANGEMENT AT END SECTION



SECTION B-B

SHOWING STRAND ARRANGEMENT AT MIDSPAN

BEAM DIMENSIONS					
BEAM SPAN (℄ BRG-℄ BRG)	70'	80'	90'	100'	110'
BEAM DEPTH	36"	36"	42"	48"	48"
c	42	52	62	72	82
c1	47	53	60	67	73
E	7"	$7^{1}/_{2}$"	8"	8"	$8^{1}/_{2}$"
g	32	39	45	52	59
G	7"	$7^{1}/_{2}$"	8"	8"	$8^{1}/_{2}$"
L ✱✱✱	TBD	TBD	TBD	TBD	TBD
L' ✱✱✱	TBD	TBD	TBD	TBD	TBD
M ǂ	TBD	TBD	TBD	TBD	TBD
N ǂ	TBD	TBD	TBD	TBD	TBD
R	28	32	36	40	44
T	70'-0"	80'-0"	90'-0"	100'-0"	110'-0"
U	47'-4"	57'-4"	67'-4"	77'-4"	87'-4"
Y	71'-2"	81'-3"	91'-4"	101'-4"	111'-5"
APPROX WEIGHT (TONS)	32	36.6	43.4	50.8	55.8

✱✱✱ FORMING DIMENSION. IF L OR L' IS COMPUTED TO BE BETWEEN -1/2" & +1/2" USE L=0 OR L'=0.

ǂ MEASURED ALONG BEAM ℄.

SOLE ℞ TILT TABLE		
BEAM LINE	SPAN 1	
	ABUT A	ABUT B
	y	y'
BEAMS A-E		

FOR INFORMATION ONLY:

TILT SOLE PLATE AS REQUIRED WHEN THE CALCULATED BEVEL EXCEEDS 1%.

SOLE PLATE TILT TO BE DETERMINED BY THE DESIGNER TAKING INTO CONSIDERATION BEAM CAMBER AND BRIDGE PROFILE.

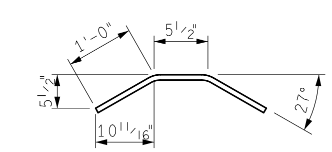
USE HAUNCH REINFORCEMENT WHEN BEAM HAUNCH > 3".

FOR DIMENSIONS "A" & "B", SEE DWG "BTB 003".

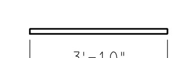
VARIABLES IN BEAM DIMENSIONS TABLE WITH VALUES NOTED "TBD" SHALL BE DETERMINED BY THE DESIGNER BASED ON THE ACTUCAL BEAM LENGTH.

"L" & "L'" IN BEAM DIMENSIONS TABLE ARE DETERMINED BASED ON BEAM PROFILE AND BEAM CAMBER.

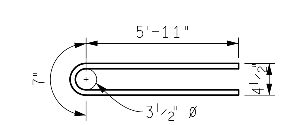
THE ABOVE NOTES ARE FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.



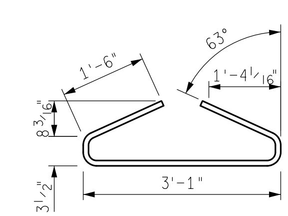
EC030206 BAR



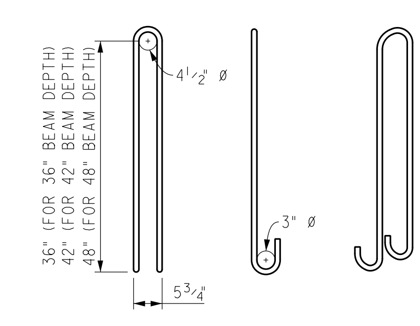
EA040310 BAR



ED041205 BAR



EF030608 BAR



EL05 BAR

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)

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PRESTRESSED BEAM DETAILS

BULB-TEE BEAM

DRAWING BTB 002

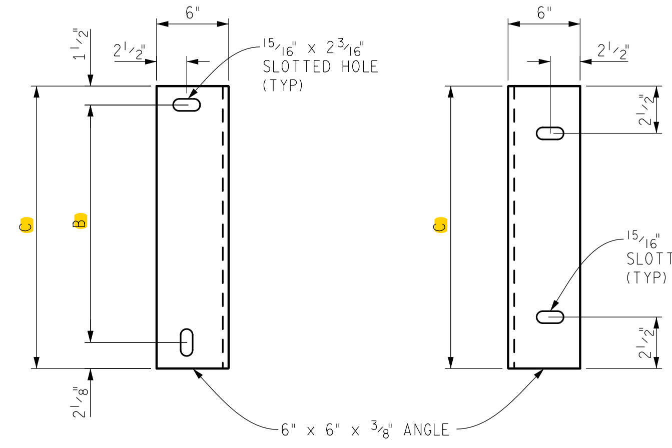
SHEET

SECT

STRAND/DEBONDING LAYOUT TABLE

BEAM SPAN (℄ BRG-℄ BRG) (FT)	BEAM DIMENSIONS D (in)	BEAM DIMENSIONS W (in)	NO. OF STRANDS: 1ST LAYER, 2" FROM BOTTOM	2ND LAYER, 4" FROM BOTTOM	3RD LAYER, 6" FROM BOTTOM	4TH LAYER, 8" FROM BOTTOM	TOTAL NO. OF STRANDS	NO. OF DRAPED STRANDS	NO. OF DRAPED STRANDS- (HEIGHT AT MIDSPAN) - [HEIGHT AT END] (IN) **
70	36	49	17	11	-	-	28	3	3,(4),[31]
80	36	49	17	19	3	-	39	6	3,(4),[29]; 3,(6),[31]
90	42	49	17	19	3	2	41	8	3,(4),[25]; 3,(6),[35]; 2,(8),[37]
100	48	49	17	19	7	-	43	6	3,(4),[41]; 3,(6),[43]
110	48	49	17	19	15	3	54	12	3,(2),[31]; 3,(4),[39]; 3,(6),[41]; 3,(8),[43]

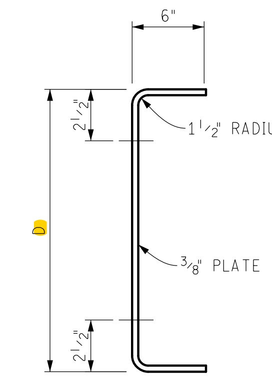
** MEASURED FROM BOTTOM OF BEAM



ALONG BEAM

ALONG DIAPHRAGM

DIAPHRAGM SUPPORT

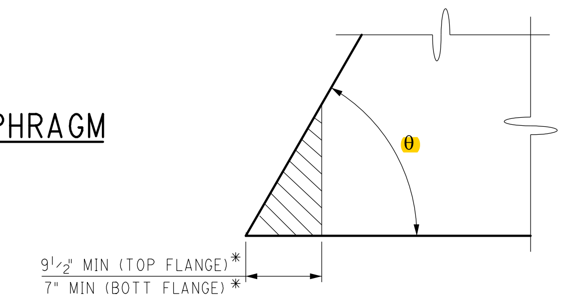


ALTERNATE DIAPHRAGM

DIMENSION TABLE

BEAM HEIGHT	A	B	C	D
36"	1'-$5^1/_{16}$"	$5^3/_8$"	9"	12"
42"	1'-$5^1/_{16}$"	$11^3/_8$"	1'-3"	15"
48"	1'-$5^1/_{16}$"	1'-$5^3/_8$"	1'-9"	18"

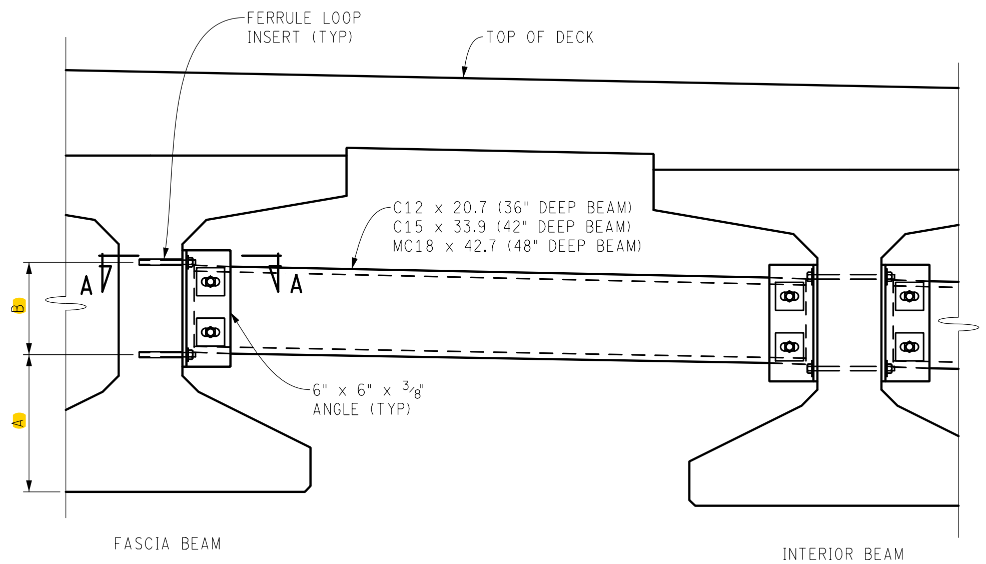
THIS TABLE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THE FINAL DESIGN DRAWINGS



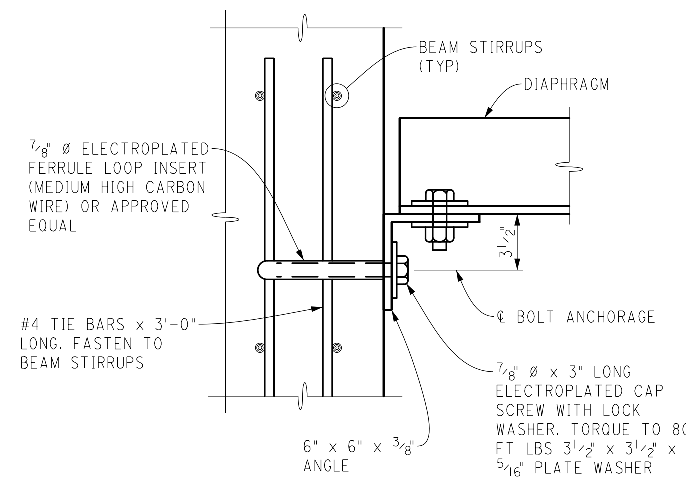
FLANGE CLIP DETAIL

USE WHEN θ < 60°

* CLIP CAN BE INCREASED TO ℄ OF BEAM

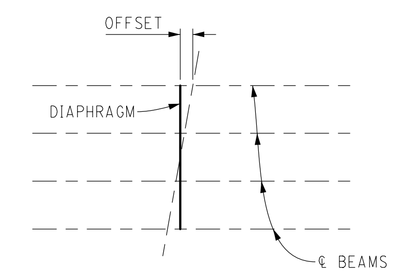


INTERMEDIATE DIAPHRAGM (D1) ELEVATION

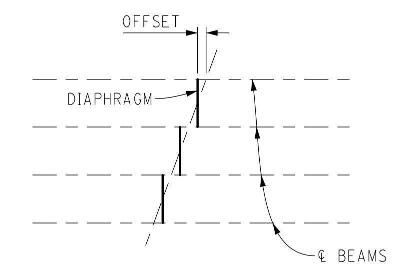


SECTION A-A

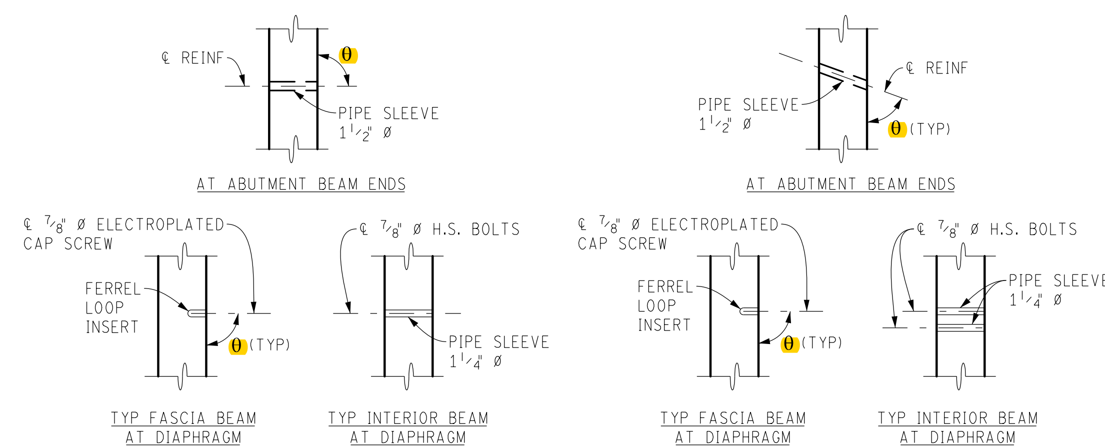
(FASCIA BEAMS)



PLAN FOR SKEW ANGLE ≤ 10°



PLAN FOR SKEW ANGLE > 10°



SKEW ANGLE ≤ 10°

(FOR A CONTINUOUS LINE OF DIAPHRAGMS)

SKEW ANGLE > 10°

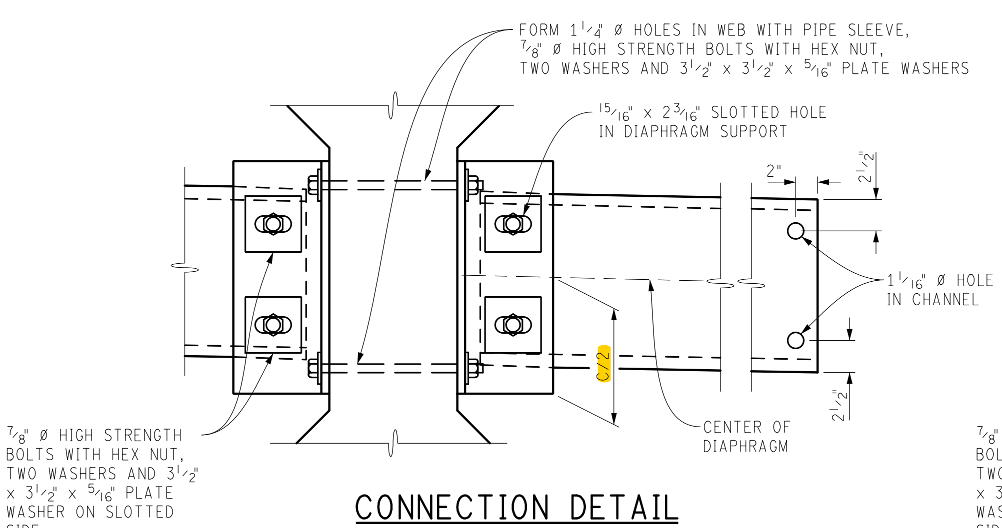
(FOR STAGGERED DIAPHRAGMS)

CONCRETE INSERT DETAILS

CONTINUOUS HOLES IN BEAM WEB SHALL BE AS SHOWN ABOVE.

OMIT INSERTS ON OUTSIDE OF FASCIA BEAMS.

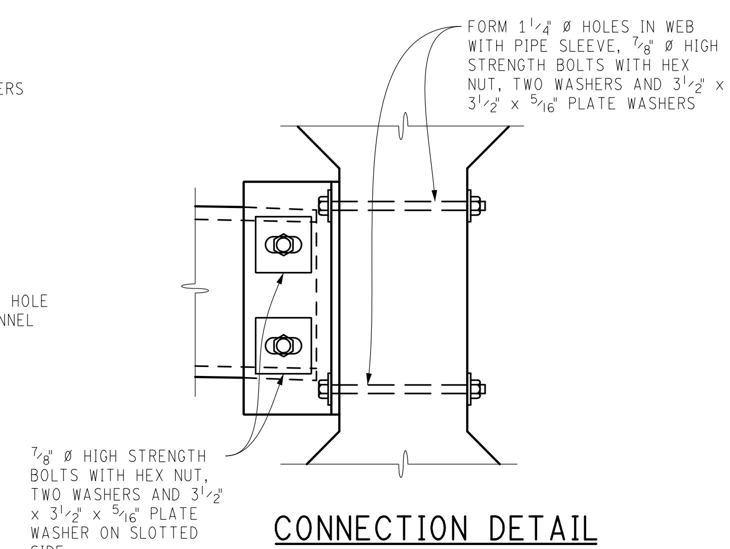
SLOPE INSERTS AND HOLES IN BEAM WEBS TO MATCH SLOPE OF DECK.



CONNECTION DETAIL

(INTERIOR BEAMS)

(FOR A CONTINUOUS LINE OF DIAPHRAGMS)



CONNECTION DETAIL

(INTERIOR BEAMS)

(FOR DIAPHRAGMS WITH SKEW ANGLES >10°)

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

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FILE: prest_BT_003.dgn

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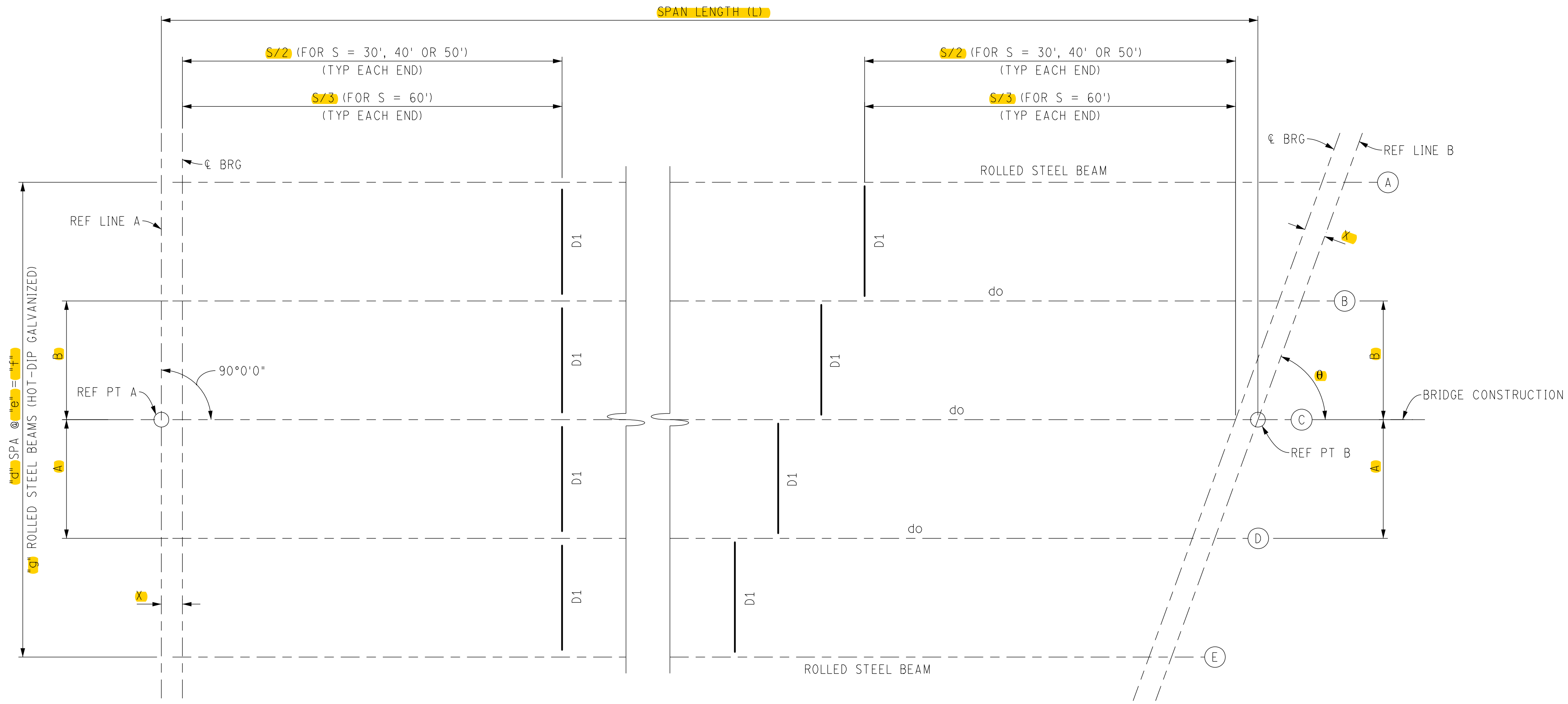
PRESTRESSED BEAM DETAILS

BULB-TEE BEAM

DRAWING	SHEET
BTB	SECT
003	



ERECTION DIAGRAM

FOR θ = 70° TO 90°

ERECTION DIAGRAM

FOR θ < 70°

SERVICE BEAM REACTIONS (KIPS)			
BEAM SPAN (℄ BRG-℄ BRG) (FT)	DC	DW	LL+I
20	13	2	103
30	19	3	107
40	25	3	111
50	31	4	115
60	37	4	120

THIS TABLE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THE FINAL DESIGN DRAWINGS

DC DENOTES SERVICE DEAD LOADS DUE TO BEAM SELF WEIGHT, DECK WEIGHT, & DIAPHRAGMS

DW DENOTES SERVICE BEAM REACTION DUE TO FUTURE WEARING SURFACE

LL+I DENOTES SERVICE LIVE LOAD PLUS IMPACT REACTION PER LANE

"S" = BEAM SPAN (℄ BRG - ℄ BRG)

FOR INFORMATION ONLY:

THE DESIGN OF THESE STRUCTURES IS BASED ON 1.2 TIMES THE CURRENT AASHTO LRFD BRIDGE DESIGN SPECIFICATION HL-93 LOADING WITH THE EXCEPTION THAT THE DESIGN TANDEM PORTION OF THE HL-93 LOAD DEFINITION SHALL BE REPLACED BY A SINGLE 60 KIP AXLE LOAD BEFORE APPLICATION OF THIS 1.2 FACTOR. THE RESULTING LOAD IS DESIGNATED HL-93 MOD. LIVE LOAD PLUS DYNAMIC LOAD ALLOWANCE DEFLECTION DOES NOT EXCEED 1/800 OF SPAN LENGTH.

PLACE DIAPHRAGMS PARALLEL TO REF LINES.

NO INTERMEDIATE DIAPHRAGMS REQUIRED FOR 20' SPANS.

"A" & "B" ARE MEASURED FROM BRIDGE CONST ℄ TO ADJACENT BEAM ℄.

THE ABOVE NOTES ARE FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.

NOTES:

FIELD CONNECTIONS SHALL BE BOLTED WITH 3/4" Ø HIGH STRENGTH BOLTS (EXCEPT AS NOTED).

ALL HOLES SHALL BE 13/16" Ø FOR 3/4" Ø H.S. BOLTS.

SHEAR DEVELOPERS SHALL BE 3/4" DIAMETER STUDS.

THE BEAMS SHALL BE CAMBERED WITH ORDINATES AS SHOWN ON THE CAMBER DIAGRAM. HEATING IS TO BE USED, IF NECESSARY, TO PROVIDE THE CAMBER WITHIN THE TOLERANCE SPECIFIED IN THE AWS SPECIFICATIONS. THE CAMBER SHOWN IS TO BE MEASURED WITH THE BEAM LYING ON IT'S SIDE.

ALL STRUCTURAL STEEL SHALL BE HOT-DIPPED GALVANIZED ACCORDING TO THE STANDARD SPECIFICATIONS.

STRUCTURAL STEEL SHALL CONFORM TO AASHTO M270, GRADE 50, OR AASHTO M270, GRADE 50W. AASHTO M270, GRADE 36, STEEL MAY BE USED IN LIEU OF THESE STEELS FOR THE DIAPHRAGMS (EXCEPT CONNECTION PLATES).

FIELD CONNECTIONS SHALL BE BOLTED WITH 3/4" HIGH-STRENGTH BOLTS (EXCEPT AS NOTED).

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NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

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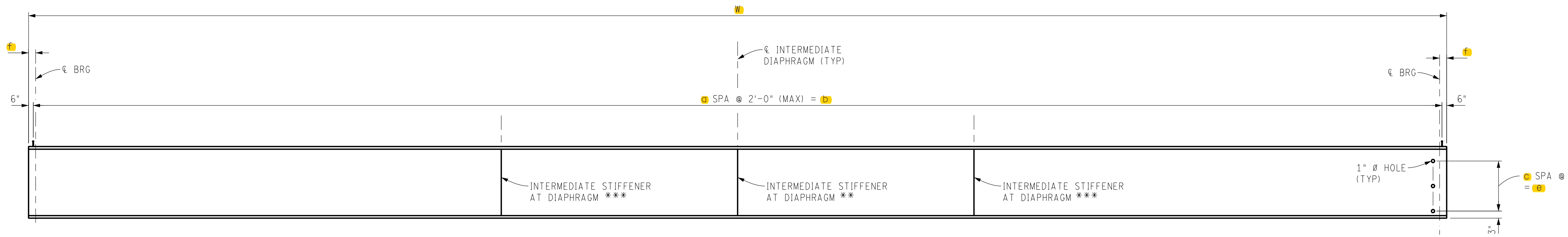
STRUCTURAL STEEL DETAILS

ROLLED STEEL BEAM

DRAWING	SHEET
STEEL	SECT
001	



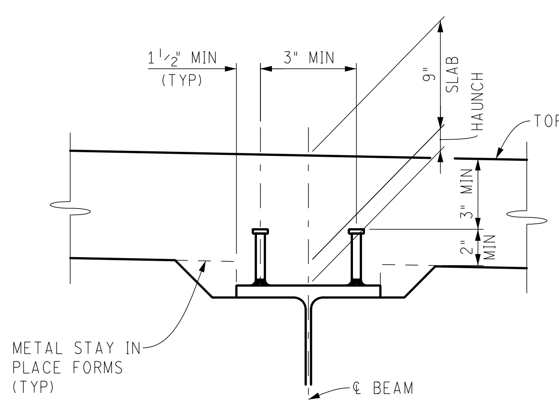
BEAM ELEVATION

** FOR 30', 40' OR 50' SPANS

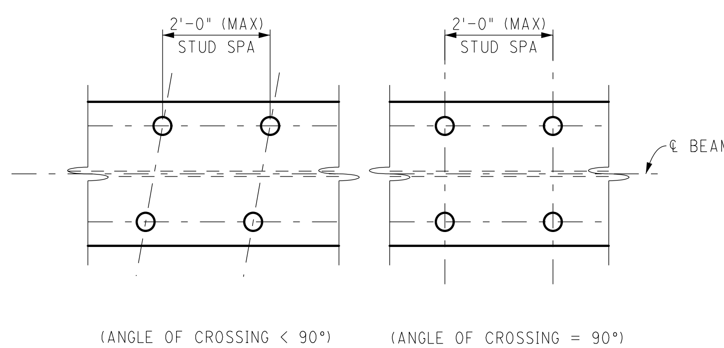
*** FOR 60' SPAN

BEAM DIMENSION TABLE								
BEAM SPAN (℄ BRG-℄ BRG)	BEAM TYPE	a	b	c	d	e	f	w
20'	W21 x 93	11	20'-2"	2	7 1/2"	1'-3"	7"	21'-2"
30'	W21 x 93	16	30'-2"	2	7 1/2"	1'-3"	7"	31'-2"
40'	W24 x 117	21	40'-3"	2	9"	1'-6"	7 1/2"	41'-3"
50'	W30 x 173	26	50'-5"	2	12"	2'-0"	8 1/2"	51'-5"
60'	W36 x 170	31	60'-5"	3	10"	2'-6"	8 1/2"	61'-5"

THIS TABLE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THE FINAL DESIGN DRAWINGS



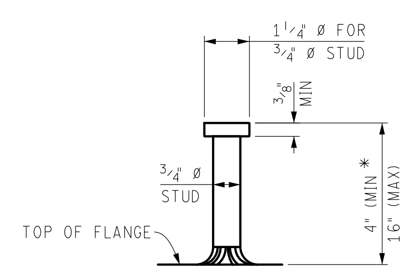
SECTION



PLAN

ROWS OF STUDS SHALL BE SET PARALLEL TO TRANSVERSE REINFORCEMENT.

SHEAR STUD DEVELOPER DETAILS



DETAIL OF STUD

* INCREASE LENGTH OF STUD AS NEEDED TO MAINTAIN 2" MINIMUM PENETRATION OF STUD INTO DECK SLAB. (1" INCREMENTS)

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

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FILE: steel_002.dgn

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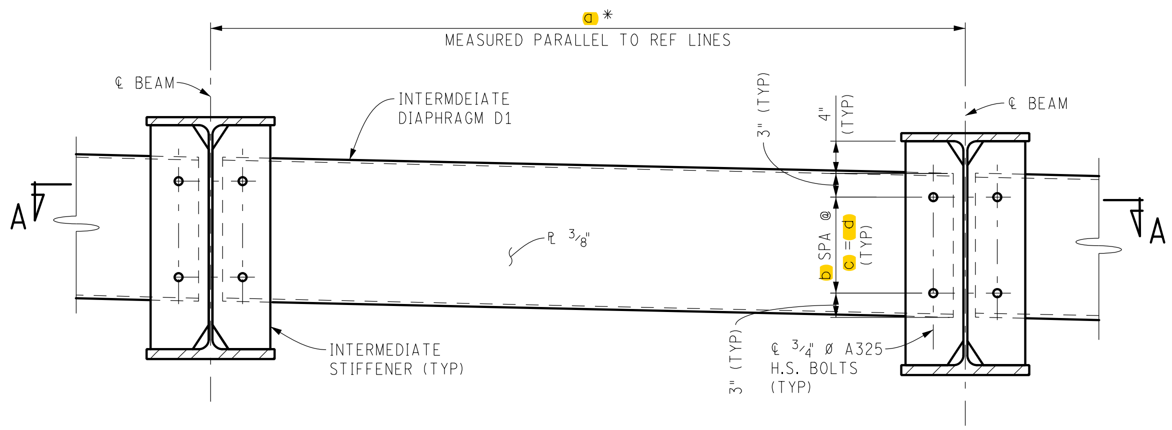
STRUCTURAL STEEL DETAILS

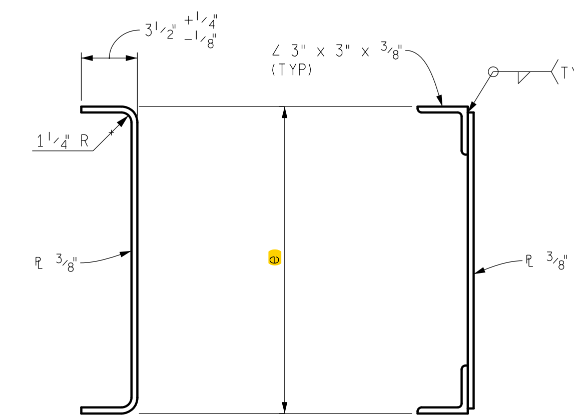
ROLLED STEEL BEAM

DRAWING	SHEET
STEEL	SECT
002	



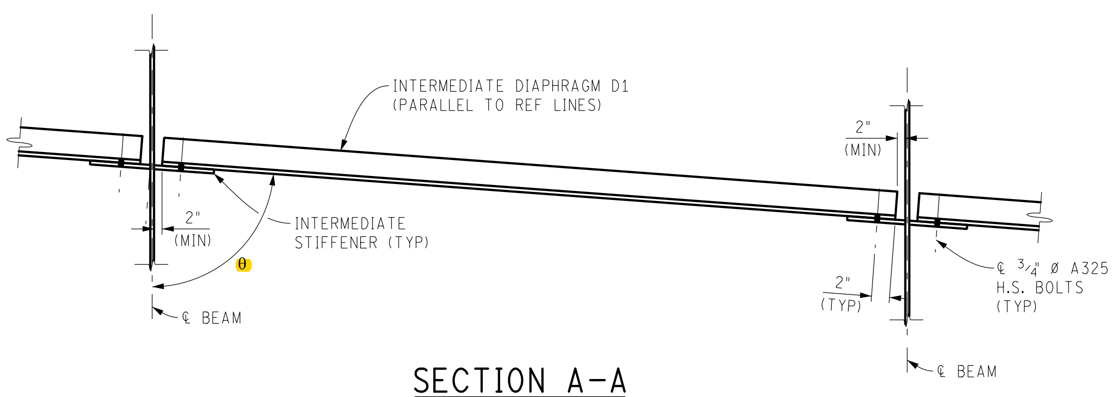
INTERMEDIATE DIAPHRAGM D1 ELEVATION

* "a" SHALL BE DETERMINED BASED ON ACTUAL BRIDGE SKEW



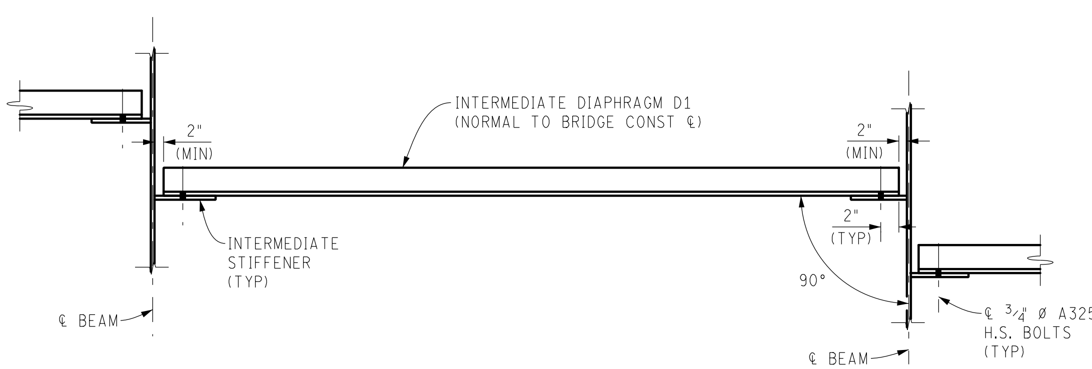
ALTERNATE

TYPICAL INTERMEDIATE DIAPHRAGM



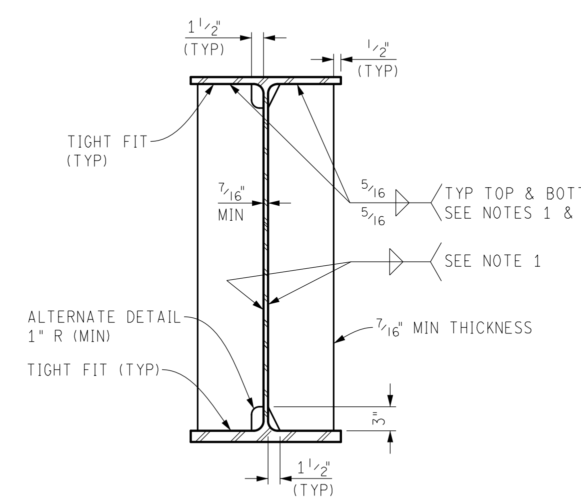
SECTION A-A

FOR ANGLE OF CROSSING 70° TO 90°



SECTION A-A

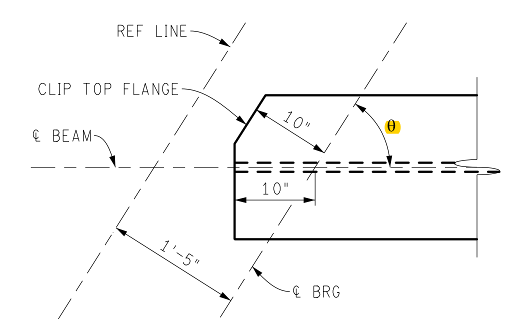
FOR ANGLE OF CROSSING < 70°



INTERMEDIATE TRANSVERSE STIFFENER DETAIL @ CROSSFRAME

BOLT HOLES NOT SHOWN FOR CLARITY

NOTE 1: STOP WELD 1/4" SHORT OF CORNER CLIPS
NOTE 2: WRAP WELD AROUND OUTSIDE EDGE



TOP FLANGE CLIP DETAIL

BASED ON ABUTMENT AND BEARING GEOMETRY

DIAPHRAGM DIMENSION TABLE

BEAM SPAN (℄ BRG TO ℄ BRG) (FT)	BEAM TYPE	b	c	d	e
20	W21 x 93	–	–	–	–
30	W21 x 93	2	2″	4″	10″
40	W24 x 117	3	2″	6″	12″
50	W30 x 173	4	3″	12″	18″
60	W36 x 170	6	3″	18″	24″

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FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

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FILE: steel_003.dgn

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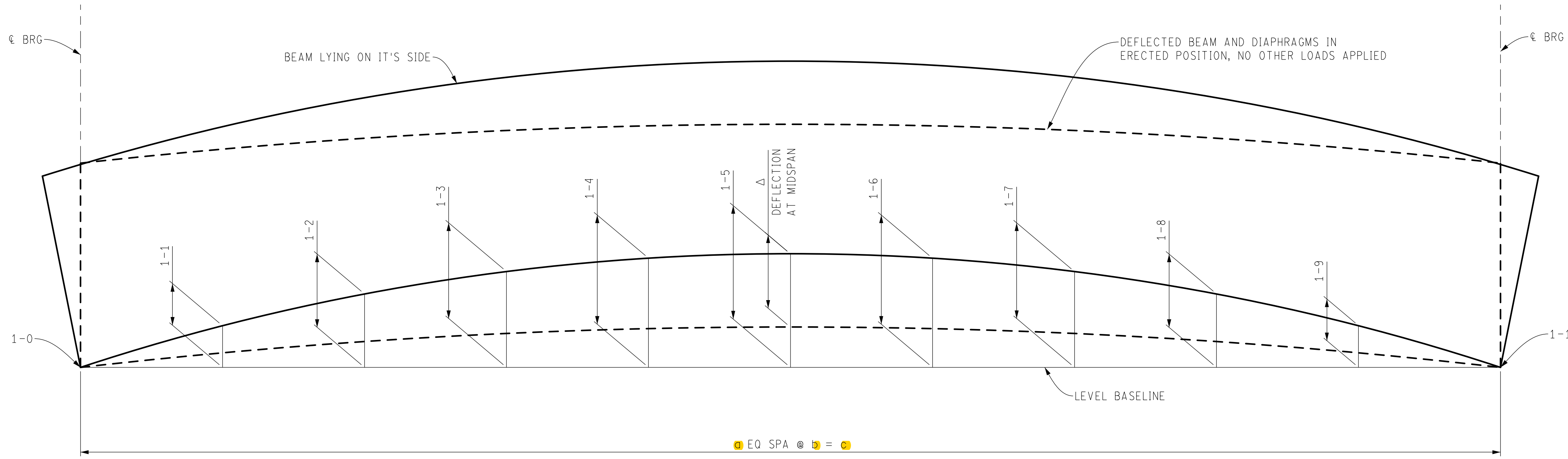
STRUCTURAL STEEL DETAILS
ROLLED STEEL BEAM

DRAWING: STEEL 003
SHEET
SECT



CAMBER DIAGRAM

ORDINATE DIMENSION TABLE

BEAM SPAN (℄ BRG-℄ BRG)	BEAM TYPE	a	b	c
20′	W21 x 93	10	2′	20′
30′	W21 x 93	10	3′	30′
40′	W24 x 117	10	4′	40′
50′	W30 x 173	10	5′	50′
60′	W36 x 170	10	6′	60′

THEORETICAL CAMBER TABLE *

BEAM	BEAM SPAN (℄ BRG-℄ BRG)	CAMBER ORDINATES (in)										
		1-0	1-1	1-2	1-3	1-4	1-5	1-6	1-7	1-8	1-9	1-10
W21 x 93	20′	0	0	0	0	0	0	0	0	0	0	0
W21 x 93	30′	0	0.08	0.15	0.20	0.24	0.25	0.24	0.20	0.15	0.08	0
W24 x 117	40′	0	0.15	0.28	0.39	0.46	0.48	0.46	0.39	0.28	0.15	0
W30 x 173	50′	0	0.17	0.33	0.45	0.52	0.55	0.52	0.45	0.33	0.17	0
W36 x 170	60′	0	0.30	0.56	0.76	0.90	0.94	0.90	0.76	0.56	0.30	0

* CAMBER TABLE VALUES ONLY ACCOUNT FOR BEAM DEFLECTION DUE TO BEAM SELF WEIGHT, DECK & HAUNCH WEIGHT, DIAPHRAGMS AND BARRIERS. ADJUSTMENTS TO THE VALUES SHALL BE MADE TO ACCOUNT FOR THE ROADWAY PROFILE.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

NO SCALE

FILE: steel_004.dgn

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DESIGN UNIT:
TSC:

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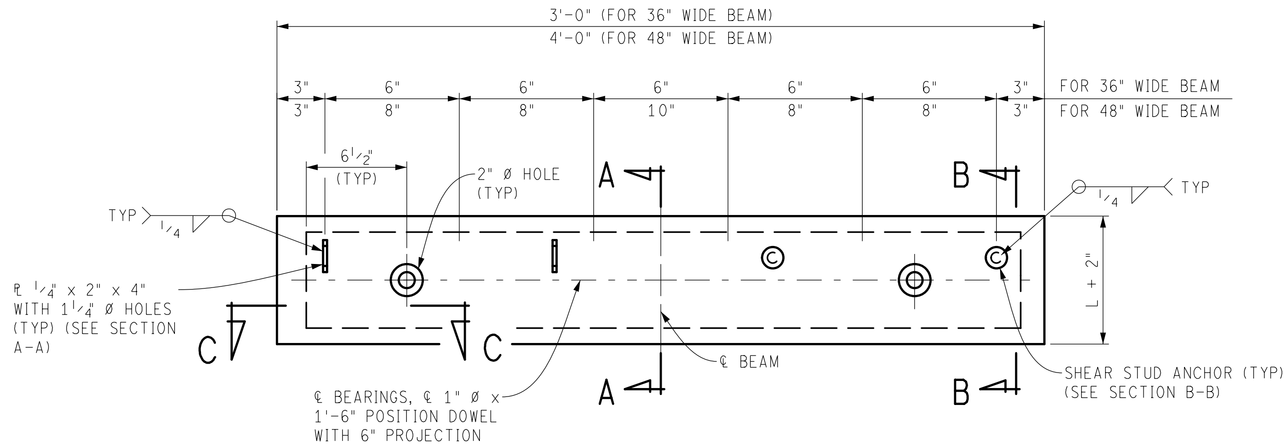
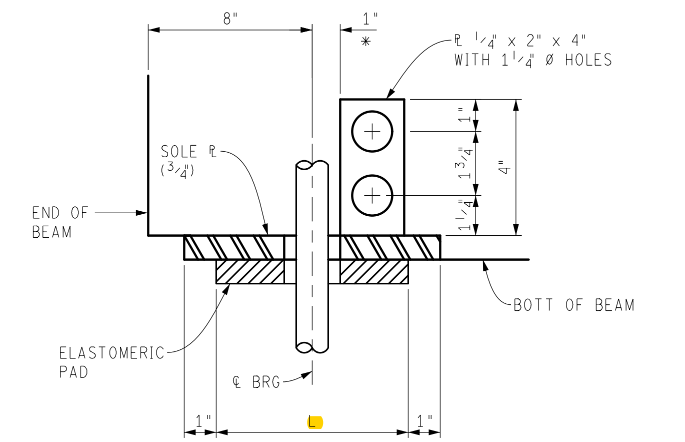
STRUCTURAL STEEL DETAILS
ROLLED STEEL BEAM

DRAWING STEEL 004
SHEET SECT

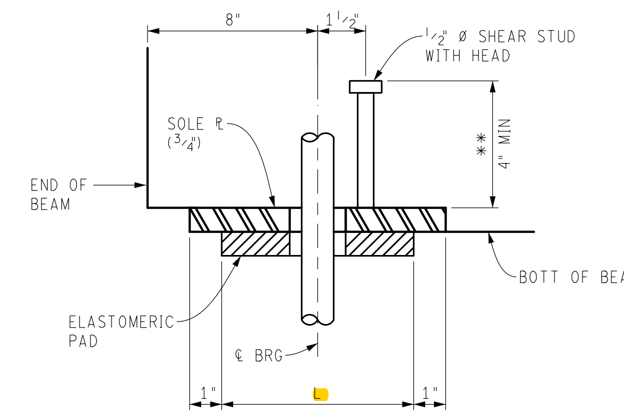


PLAN OF SOLE PLATE



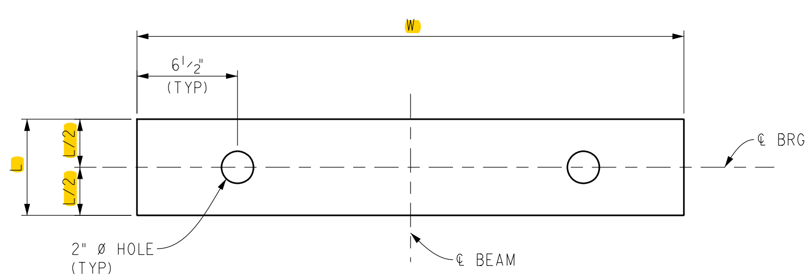
SECTION A-A

* 0" FOR L = 4"

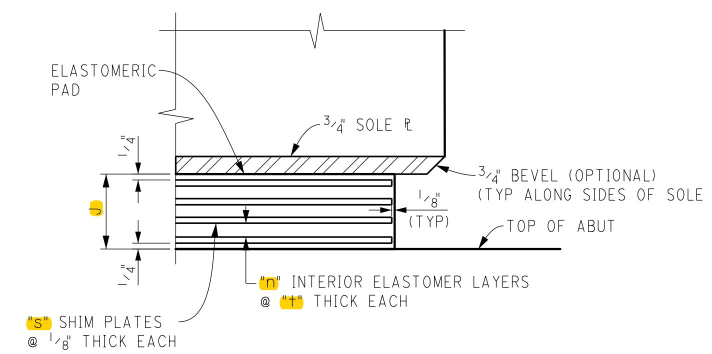


SECTION B-B

** EXTEND SHEAR STUDS ABOVE HIGHEST ROW OF STRANDS WITHOUT INTERFERENCE TO REINFORCEMENT



PLAN OF ELASTOMERIC PAD



SECTION C-C

FOR INFORMATION ONLY:

ELASTOMERIC BEARINGS FOR BEAM SPANS 20' AND 30' ARE PLAIN PADS WITH NO SHIMS PLATES.

TILT SOLE PLATE AS REQUIRED WHEN THE CALCULATED BEVEL EXCEEDS 1%.

SOLE PLATE TILT TO BE DETERMINED BY THE DESIGNER TAKING INTO CONSIDERATION BEAM CAMBER AND BRIDGE PROFILE.

THE ABOVE NOTES ARE FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.

SPREAD BOX BEAM BEARING DIMENSION TABLE

BEAM SPAN (℄ BRG-℄ BRG) (FT)	W	L	J	s	n	t
20	2'-9"	4"	1"	0	0	0"
30	2'-9"	4"	1"	0	0	0"
40	2'-9"	6"	1¼"	2	1	½"
50	3'-9"	7"	1½"	2	1	¾"
60	3'-9"	7"	1½"	2	1	¾"
70	3'-9"	7"	1⅞"	3	2	½"
80	3'-9"	7"	2⅛"	3	2	⅝"
90	3'-9"	8"	2⅛"	3	2	⅝"
100	3'-9"	9"	2⅜"	3	2	¾"
110	3'-9"	9"	2⅜"	3	2	¾"

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SIDE BY SIDE BOX BEAM BEARING DIMENSION TABLE

BEAM SPAN (℄ BRG-℄ BRG) (FT)	W	L	J	s	n	t
20	2'-9"	4"	1"	0	0	0"
30	2'-9"	4"	1"	0	0	0"
40	2'-9"	6"	1½"	2	1	¾"
50	2'-9"	6"	1½"	2	1	¾"
60	3'-9"	7"	1½"	2	1	¾"
70	3'-9"	7"	2⅛"	3	2	⅝"
80	3'-9"	7"	2⅛"	3	2	⅝"
90	3'-9"	8"	2⅛"	3	2	⅝"
100	3'-9"	9"	2⅜"	3	2	¾"
110	3'-9"	9"	2⅜"	3	2	¾"

THIS TABLE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THE FINAL DESIGN DRAWINGS

NOTES:

BLOCK OUT CONCRETE AT ELASTOMERIC BEARINGS.

TILT SOLE PLATE AS REQUIRED WHEN THE CALCULATED BEVEL EXCEEDS 1%.

POSITION DOWELS SHALL BE HOT-DIP GALVANIZED ACCORDING TO AASHTO M 232. POSITION DOWELS ARE INCLUDED IN PAYMENT FOR PRESTRESSED CONCRETE BEAMS.

STEEL FOR SOLE PLATES AND OTHER BEARING COMPONENTS SHALL MEET THE REQUIREMENTS OF AASHTO M 270 GRADE 36. SOLE PLATES ARE REQUIRED IN ALL BEAM ENDS.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)							
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NO SCALE

FILE: prest_SBB_005.dgn

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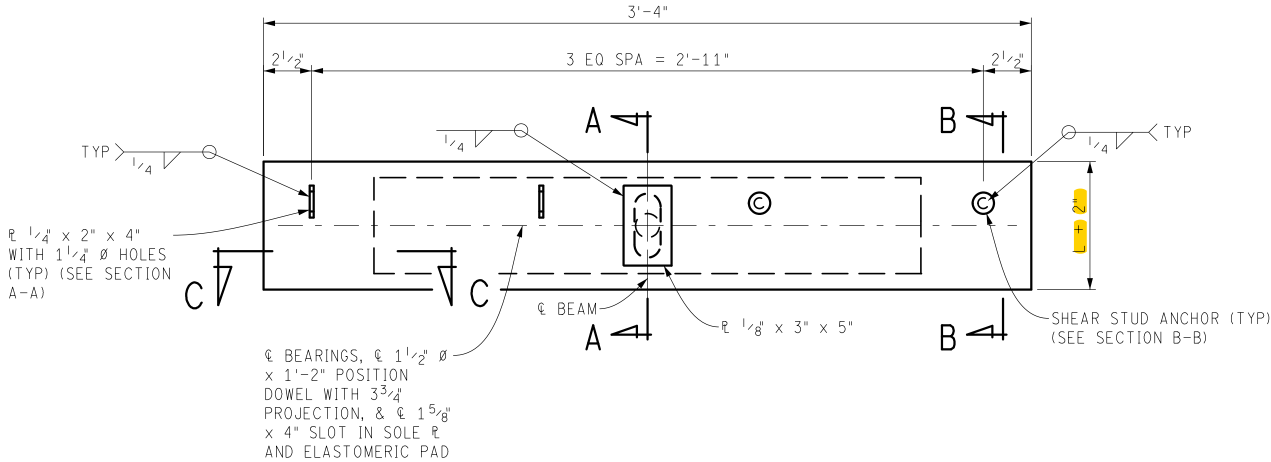
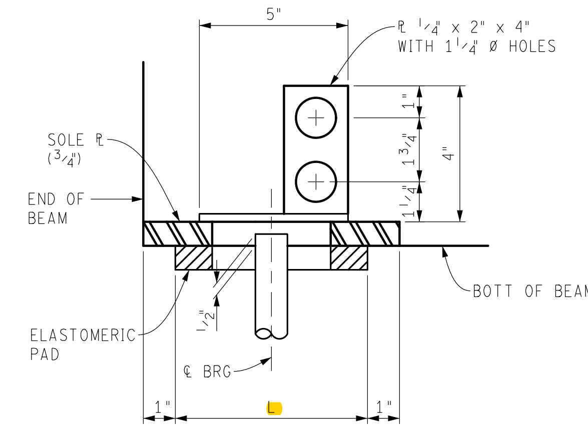
PRESTRESSED BOX BEAM BEARING DETAILS

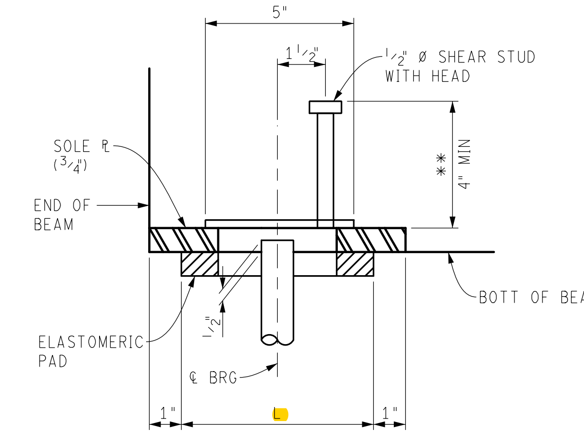
DRAWING	SHEET
BRG	SECT
001	



PLAN OF SOLE PLATE

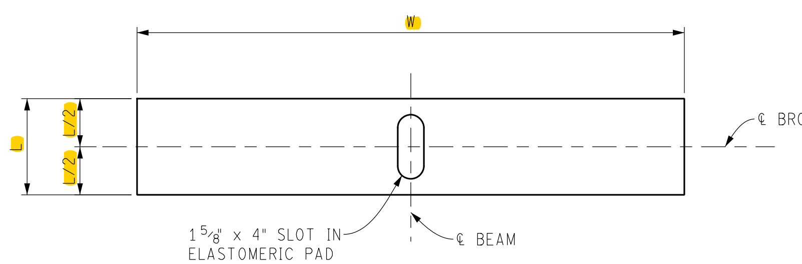


SECTION A-A

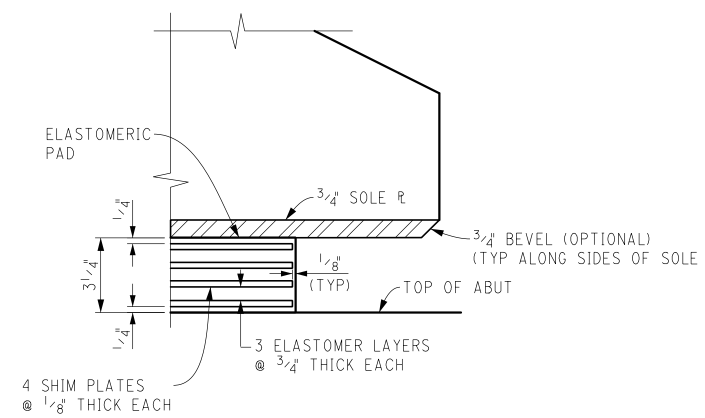


SECTION B-B

** EXTEND SHEAR STUDS ABOVE HIGHEST ROW OF STRANDS WITHOUT INTERFERENCE TO REINFORCEMENT



PLAN OF ELASTOMERIC PAD



SECTION C-C

DIMENSION TABLE		
BEAM SPAN (℄ BRG-℄ BRG) (FT)	W	L
70	2'-0"	1'-0"
80	2'-0"	1'-1"
90	2'-0"	1'-2"
100	2'-1"	1'-2"
110	2'-0"	1'-3"

THIS TABLE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THE FINAL DESIGN DRAWINGS

NOTES:

BLOCK OUT CONCRETE AT ELASTOMERIC BEARINGS.

POSITION DOWELS SHALL BE HOT-DIP GALVANIZED ACCORDING TO AASHTO M 232. POSITION DOWELS ARE INCLUDED IN PAYMENT FOR PRESTRESSED CONCRETE BEAMS.

STEEL FOR SOLE PLATES AND OTHER BEARING COMPONENTS SHALL MEET THE REQUIREMENTS OF AASHTO M 270 GRADE 36. SOLE PLATES ARE REQUIRED IN ALL BEAM ENDS.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)

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FILE: prest_BT_004.dgn

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DESIGN UNIT:

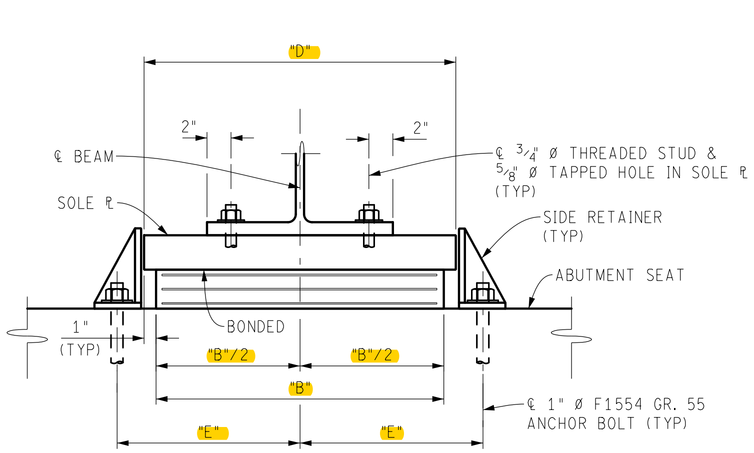
TSC:

CS:

JN:

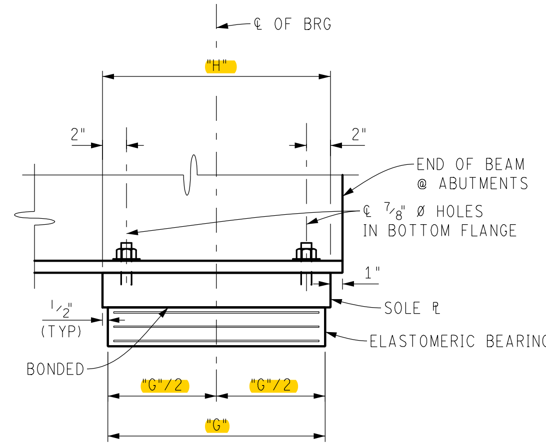
PRESTRESSED BULB-TEE BEAM BEARING DETAILS

DRAWING	SHEET
BRG	SECT
002	



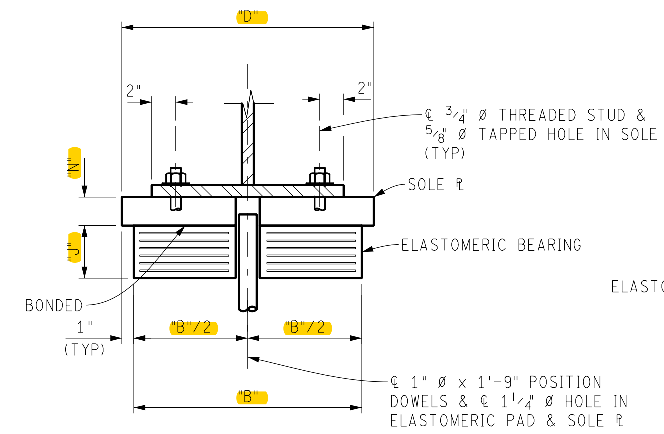
ELASTOMERIC
EXPANSION BEARING

END VIEW

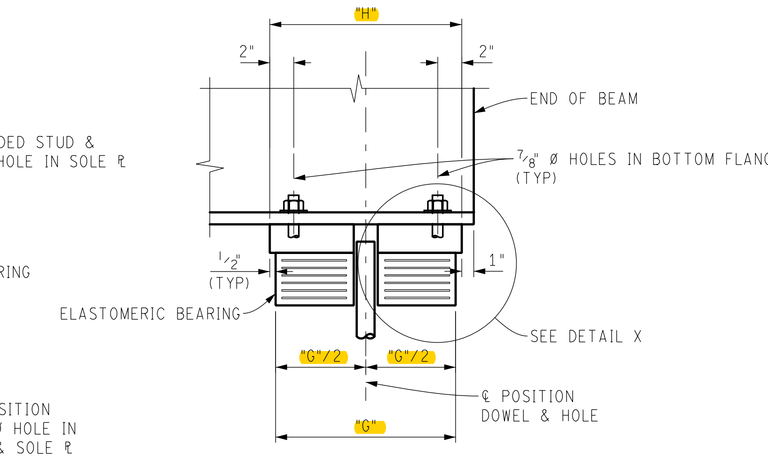


ELASTOMERIC
EXPANSION BEARING

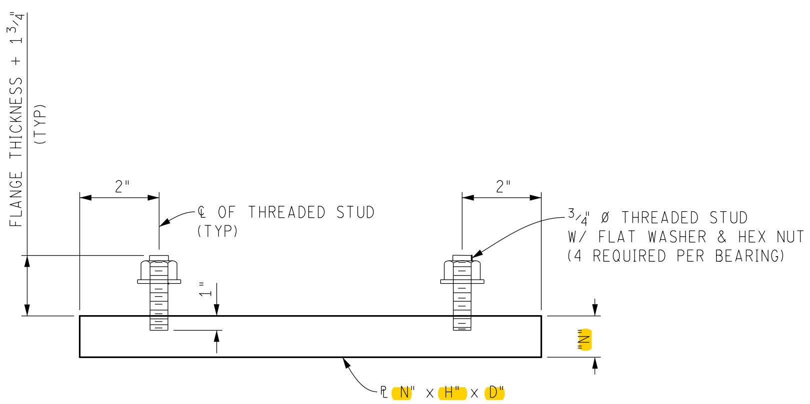
SIDE VIEW



END VIEW



SIDE VIEW

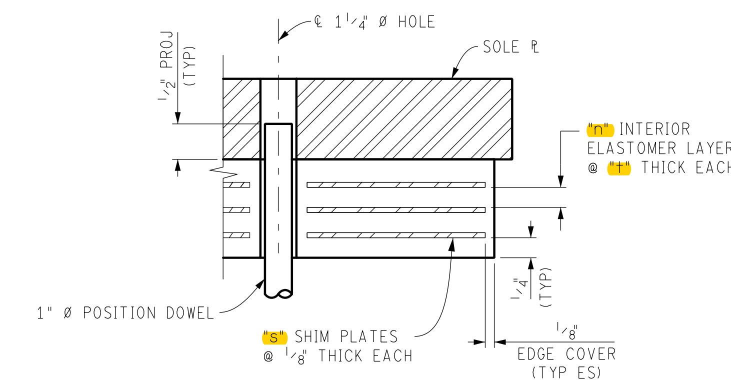


SOLE PLATE DETAILS

SIDE VIEW

BEARING ASSEMBLY DIMENSIONS												
BEAM SPAN (℄ BRG-℄ BRG) (FT)	BEAM SIZE	B	D	E	G	H	J	s	n	t	L	N
20	W21 x 93	8"	10"	7 1/4"	11"	12"	1"	0	0	0"	3"	1 1/2"
30	W21 x 93	8"	10"	7 1/4"	11"	12"	1"	0	0	0"	3"	1 1/2"
40	W24 x 117	15"	17"	10 3/4"	12"	13"	2 3/8"	3	2	3/4	4 7/8"	2"
50	W30 x 173	15"	17"	10 3/4"	14"	15"	2 3/8"	3	2	3/4"	4 7/8"	2"
60	W36 x 170	15"	17"	10 3/4"	14"	15"	2 3/8"	3	2	3/4	4 7/8"	2"

THIS TABLE IS FOR INFORMATION
ONLY AND SHOULD NOT BE INCLUDED
ON THE FINAL DESIGN DRAWINGS



DETAIL X

ELASTOMERIC BEARING DETAILS - FIXED

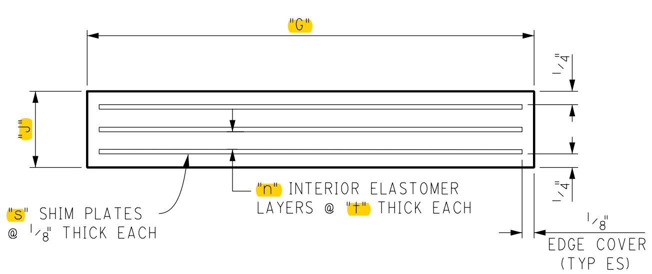
FOR INFORMATION ONLY:

FOR SINGLE SPAN STRUCTURES 25'-0" OR LESS IN LENGTH, ALLOWANCE FOR EXPANSION IS NOT REQUIRED IN THE DESIGN OF THE ELASTOMERIC BEARING PADS.

ELASTOMERIC BEARINGS FOR BEAM SPANS 20' AND 30' ARE PLAIN PADS WITH NO SHIMS PLATES.

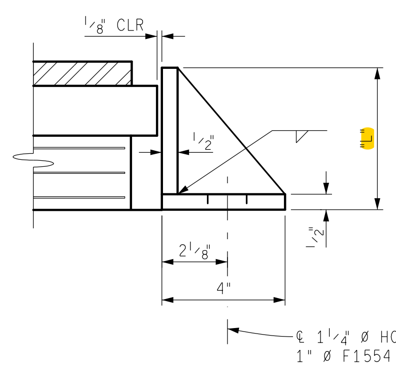
SOLE PLATES ARE TO BE BEVELED WHEN THE CALCULATED BEVEL IS GREATER THAN 0.5%.

THE ABOVE NOTES ARE FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.

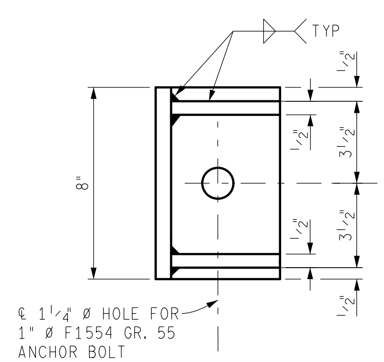


ELASTOMERIC BEARING DETAILS

SIDE VIEW

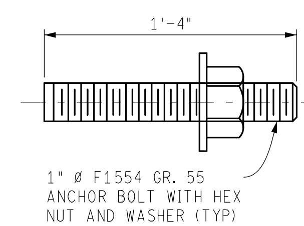


ELEVATION

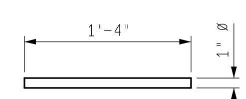


PLAN

SIDE RETAINER



ANCHOR BOLT DETAIL



POSITION
DOWEL DETAIL

NOTES:

ES DENOTES EACH SIDE.

USE NON-DEFORMED STEEL RODS IN ACCORDANCE WITH AASHTO M 270 GRADE 36 AND HOT-DIP GALVANIZED IN ACCORDANCE WITH AASHTO M 111, AS POSITION DOWELS FOR PRECAST BEAMS.

STEEL FOR SOLE PLATES AND OTHER BEARING COMPONENTS SHALL MEET THE REQUIREMENTS OF AASHTO M 270 GRADE 36.

ANCHOR BOLT LENGTHS SHOWN ARE MINIMUM. BOLTS LONGER THAN THAT SHOWN MAY BE FURNISHED AT NO ADDITIONAL COST. ANCHOR BOLTS AND POSITION DOWELS SHALL BE GALVANIZED ACCORDING TO MDOT STANDARD SPECIFICATION 707.03.C.16.

ANCHOR BOLTS SHALL CONFORM TO SECTION 908.15.

ANCHOR BOLTS SHALL BE INSTALLED AFTER BEAMS ARE ERECTED IN PLACE.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)

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FILE: steel_005.dgn

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TSC:

CS:

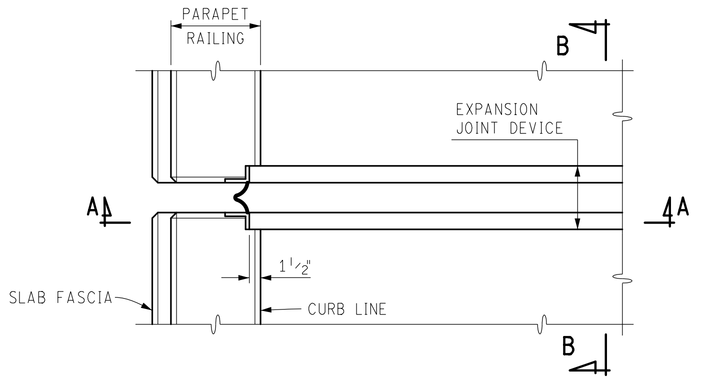
JN:

ROLLED STEEL BEAM BEARING DETAILS

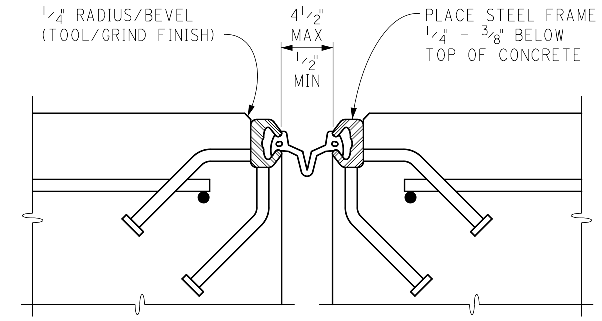
DRAWING BRG

SHEET SECT

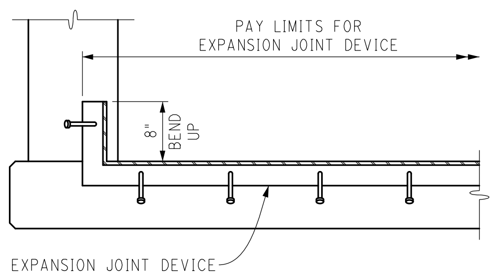
003



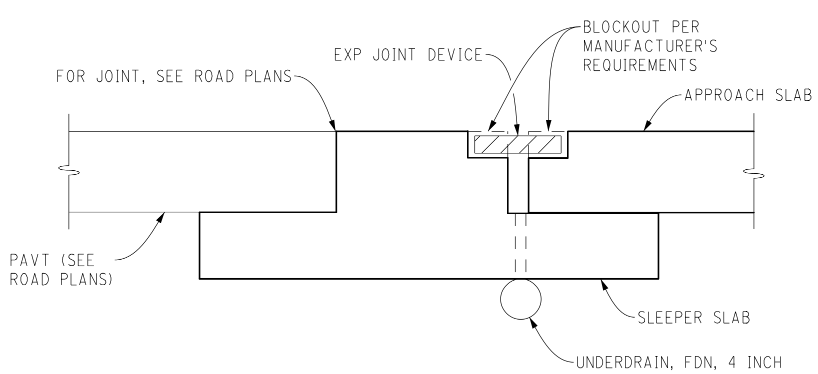
PLAN AT FLUSH MOUNT PARAPET RAILING



SECTION THROUGH EXPANSION JOINT



SECTION A-A



SECTION B-B

NOTES:

JOINT TYPES

THE EXPANSION JOINT DEVICE SHALL BE OF A TYPE THAT INCLUDES A CONTINUOUS NEOPRENE (OR EQUIVALENT) SEAL ACROSS THE DECK. UNLESS OTHERWISE NOTED ON THE PLANS, THE CONTRACTOR HAS THE OPTION OF USING ANY OF THE DEVICES LISTED BELOW:

DEVICE	MANUFACTURER
WABO STRIP SEAL - TYPE M	WATSON-BOWMAN & ACME, INC.
WABO STRIP SEAL - TYPE A	WATSON-BOWMAN & ACME, INC.
STEELFLEX-SSA2	D.S. BROWN
STEELFLEX-SSCM	D.S. BROWN
ONFLEX 40 SS	STRUCTURAL RUBBER PRODUCTS CO.
ONFLEX 40 SSA	STRUCTURAL RUBBER PRODUCTS CO.

THE MODEL OF THE JOINT TYPE SELECTED SHALL BE SUITABLE TO ACCOMMODATE THE TOTAL MOVEMENT NOTED ON THE PLANS.

COMPLETE WORKING DRAWINGS OF ALL DETAILS OF FABRICATION OF THE EXPANSION JOINT DEVICE SHALL BE SUBMITTED FOR REVIEW IN ACCORDANCE WITH STANDARD SPECIFICATION 104.02. THIS REQUIREMENT IS WAIVED FOR EXPANSION JOINT DEVICES FOR WHICH A SET OF STANDARD INSTALLATION DETAILS HAS BEEN APPROVED. STANDARD INSTALLATION DETAILS CAN BE OBTAINED FROM THE DESIGN DIVISION.

FABRICATION AND INSTALLATION

REMOVE SHIPPING BOLTS PRIOR TO PLACEMENT OF CONCRETE.

THE EXPANSION JOINT SHALL BE SHOP FABRICATED TO CONFORM TO THE CONTOUR OF THE BRIDGE DECK, BARRIERS, ETC. IT SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS SUBJECT TO NOTES HEREIN AND THE APPROVAL OF THE ENGINEER.

TIE DECK REINFORCING STEEL TO STEEL FRAME ANCHORS TO MAXIMUM EXTENT PRACTICABLE WITHOUT DAMAGING GALVANIZED OR EPOXY COATINGS.

THE TOP OF THE EXPANSION JOINT DEVICE SHALL BE SET $\frac{1}{4}$" - $\frac{3}{8}$" BELOW THE CONCRETE SLAB (PAVEMENT).

THE STEEL ANCHORAGE FOR STRIP SEAL GLANDS SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH SUBSECTION 707.03C.17 OF THE STANDARD SPECIFICATIONS.

THE AREA OF THE STEEL ANCHORAGE AND SEALING GLAND WHICH WILL BE IN CONTACT WITH A SEALANT, OR LUBRICANT-ADHESIVE SHALL BE CLEANED WITH TOLUENE OR OTHER APPROVED SOLVENT.

IN THE EVENT THAT SPLICING IS REQUIRED OF THE SEALING GLAND, IT SHALL BE SPLICED BY AN APPROVED METHOD (SUCH AS COLD VULCANIZATION) BY A TRAINED REPRESENTATIVE OF THE MANUFACTURER.

DETAILS AT CURBS OR BARRIERS

THE DETAILS ON THIS SHEET SHOW AN APPROVED MEANS OF TERMINATING THE EXPANSION JOINT DEVICE AT CURBS OR BARRIERS. VARIATIONS OR ALTERNATIVE SCHEMES WILL BE CONSIDERED AND MAY BE USED IF APPROVED BY THE ENGINEER.

MATERIALS

THE COST OF ALL MATERIALS AND LABOR REQUIRED FOR PROPER INSTALLATION OF THE EXPANSION JOINT AND THE TERMINAL ASSEMBLIES AT THE CURBS, SIDEWALKS, OR BARRIERS IS INCLUDED IN THE PAYMENT FOR THE EXPANSION JOINT DEVICE.

STRUCTURE NUMBER	ANGLE OF CROSSING TO NEAREST 10°	LOCATION OF JOINT	MIN. TOT. TRAVEL ALONG CENTERLINE OF BRIDGE	REQUIRED LENGTH OF EXPANSION JOINT DEVICE
		SLEEPER SLAB AT ABUT A OR B		

FOR INFORMATION ONLY:

EXPANSION JOINTS ARE NOT REQUIRED WHEN LENGTH OF BRIDGE CONTRIBUTING TO EXPANSION AT AN ABUTMENT IS LESS THAN 50 FEET FOR CONCRETE BEAM BRIDGES AND LESS THAN 25 FEET FOR ROLLED STEEL BRIDGES.

THE ABOVE NOTE IS FOR INFORMATION ONLY AND SHOULD NOT BE INCLUDED ON THIS SHEET.

FINAL ROW PLAN REVISIONS (SUBMITTAL DATE:)

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

NO SCALE

FILE: expjt_001.dgn

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DESIGN UNIT:

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CS:

JN:

EXPANSION JOINT DETAILS

DRAWING: EXPJT 001

SHEET: SECT