PREFACE

This Design Manual is prepared to describe the differences between the 2004 version of the Ohio Department of Transportation Bridge Design Manual dated July 20, 2018 and the requirements of the Ohio Turnpike & Infrastructure Commission. All information listed in this manual shall be used in lieu of that contained in the ODOT Bridge Design Manual. Only the differences are listed in this manual. If no alternative information is listed, the information in the ODOT Bridge Design Manual is to be used.

102 PREPARATION OF PLANS

Plans shall be developed in AutoCAD with details in model space, "plan sheet" is produced in paper space to half size sheet - 11"x17" pdf using dwgtopdf driver. Layout is to be set so LTSCALE of 0.5 plots properly.

Reports are to be provided in pdf format – with the pages formatted to 8 ½" x 11" portrait orientation. Where absolutely necessary to include required information at a reasonable scale, 11"x17" landscape sheets are permitted – but only where necessary. Any reports not in accordance with this requirement, including pages in some other size or standard pages in landscape format will be rejected.

Details are to be drawn to scale, but scales are not to be indicated on bridge plan sheet. Scales are to be generally accepted scales (for example: 1" = 20', 1" = 40', ¼" = 1'-0", ¾" = 1'-0", etc. – not 1" =27.5', 1/6" = 1'-0", etc.)

Scale of details can be distorted for clarity sake, i.e., for beam elevation details, the height of the beam can be drawn to an exaggerated scale with respect to the length for clarity of details. Width of the deck slab can be exaggerated with respect to the length for clarity. When placing reinforcing steel in a detail (slab, elevation, section, etc.), the line depicting the bar does not have to be drawn exactly to scale depicting the 2" clearance dimension, the distance between the object line and the reinforcing bar line is to be distorted so the lines don't "bleed" together.

102.1 BRIDGE DESIGN, CHECK AND REVIEW REQUIREMENTS

Prior to all submittals, the plan sheets are to be CHECKED by a person different than the MAKER to verify that the information contained on the plan sheet is accurate and appropriate.

OTIC reviews are not to be utilized by the consultant as part of your quality control process. These reviews are being performed to verify a general conformance to scope, not to check all the contents of the bid package. If you are deviating from any scope item, a standard drawing, a special provision, the ODOT L&D or ODOT BDM for any reason, indicate in your transmittal letter the nature of the deviation and your justification. If you did deviate and a comment is not made, this does not automatically mean that the deviation is accepted. Our intent is not to look at and verify every item during our reviews. If we make a comment, it is intended that comment applies to all similar situations in the plans. For instance, if we comment on the General Plan and the Slab Plan that you have misidentified the roadway name but didn't comment on that same incorrect roadway name on the framing plan doesn't mean you don't need to correct the roadway name there or any other instance that it is incorrectly noted.

102.2 MANUAL DRAFTING STANDARDS

This entire section shall be omitted

102.3 – COMPUTER AIDED DRAFTING STANDARDS

Refer to the *Ohio Turnpike and Infrastructure Commission CADD Standards* document.

102.5 – TITLE BLOCK

Omit all and replace with the following.

Utilize OTIC provided AutoCAD template: acad-OTIC.dwt

All submittals are to be provided in electronic format only – plan documents, reports, bid forms and engineer's estimates in pdf format. In addition, all drawing files are to be submitted in AutoCAD dwg format and Estimated Quantities Worksheet/Engineer's Estimates are to be submitted in Microsoft Excel format.

All bridge structures shall be referenced by their designated Ohio Turnpike Milepost Number, such as **MP 96.9**

The correct Structure File Number (SFN) shall be shown in the Existing Structure Block and Title blocks for the existing and proposed structures respectively.

If a new SFN is required for a proposed structure, contact the Office of Structural Engineering, Inventory Section

It is the Designer's responsibility to contact and confirm the correct SFN with the appropriate

office. For more information on the Structure File Number, refer to the Structure Inventory

website at *http://www.dot.state.oh.us/sfn/inventory*.

102.6 ESTIMATED QUANTITIES

With the exception of common bid items, such as Field Office, Maintenance of Traffic, etc., plan quantities shall be listed separately for each bridge structure in an Estimated Quantities sheet in the bridge plans and summarized in the General Summary.

102.7 STANDARD DRAWINGS

In addition to the provisions of BDM 102.7, the following additions shall be followed:

Current Ohio Turnpike Standard Drawings are available on the Ohio Turnpike website

Use current Ohio Department of Transportation standard drawings unless otherwise instructed. SBR-1-20 is NOT to be used. SBR-1-13 is to be used.

If a deviation from a current ODOT or OTIC standard drawing is required or contemplated, before it can be used, provide justification to the OTIC Project Manager and get approval. Don't simply assume that if no comment is made during review it is okay to use.

102.9 SPECIAL PROVISIONS

The Commission has developed Special Provisions which shall be used where applicable to modify the requirements of the Ohio Department of Transportation Construction and Material Specifications. In all cases, the Commission's Special Provisions govern over the corresponding CMS.

Special Provisions are designated as such **SP 516A**, not **SP516A**, not **SP516 A**, not **SP 516 A**.

103 COMPUTER PROGRAMS

Omit all and replace with the following:

103.1 GEOMETRIC PROGRAMS

AutoCAD Civil 3D

103.2 DESIGN PROGRAMS

MERLIN DASH – Beam and Girder Analysis and Design (PC)

BOXCAR – Box Culvert Structural Analysis (PC)

DESCUS – Curved Girder (PC)

CONSPAN – Prestressed Concrete Beam (PC)

RISA 3D – Structural Analysis (PC)

RC-Pier – Concrete Substructure Analysis and Design (PC)

PSBEAM – Prestressed Concrete Beam (PC)

103.3 HYDRAULIC ENGINEERING PROGRAMS

HEC-2 or HEC-RAS – Computations of Water Surface Profiles in Open Channels (PC)

HY7 (WSPRO) – Water Surface Profiles (PC)

HY8 – Culvert Hydraulics (PC)

HEC-12 – Pavement Drainage (PC)

HYDRA V3.2 (PC)

103.4 GEOTECHNICAL ENGINEERING PROGRAMS

PICAP – Pile Capacity (PC)

SHAFT – Drilled Shafts (PC)

COM624P – Lateral Loading of Piles and Drilled Shafts (PC)

WEAP – Wave Equation Analysis of Pile Driving (PC)

STABL – Slope Stability Analysis (PC)

SPW911 – Sheet Pile Design and Analysis (PC)

Driven – Pile Capacity (PC)

105 BRIDGE PLAN SHEET ORDER

Omit all and replace with the following:

A set of completed bridge plans shall conform to the following order:

1. General Plan and Profile
2. General Notes
3. Estimated Quantities
4. Phase Construction Details
5. Substructure Repair Details
6. Abutments
7. Piers
8. Framing Plan
9. Superstructure Details
10. Deck Slab Plan
11. Deck Details
12. Bearing Details
13. Deck Elevations
14. Reinforcing Steel List

SECTION 200 – PRELIMINARY DESIGN

201 STRUCTURE TYPE STUDY

201.1 GENERAL

If a Structure Type Study is included as part of the project scope, it is to be performed as part of the pre-preliminary phase of the project, when potentially a bridge or site inspection is conducted.

202.2.3.1 SPREAD FOOTINGS

Spread footings shall be designed in accordance with the AASHTO Standard Specifications for Highway Bridges, 17th Edition.

204 SUBSTRUCTURE INFORMATION

204.4 ABUTMENTS SUPPORTED ON MSE WALLS

When conditions are appropriate, the use of MSE walls to shorten bridge spans and eliminate embankment slopes is acceptable. MSE wall supported abutments shall be supported on piling regardless of the proximity of bedrock to the MSE wall foundation. The Commission will not permit the use of spread footing supported abutments on MSE walls because of their susceptibility to loss of bearing caused by erosion during the service life of the structure. Piles require a minimum 15-foot embedment below the MSE wall. If rock exists within the minimum embedment depth, the piles shall be placed in pre-bored holes that extend a minimum of 5-ft into bedrock. The pre-bored holes shall be backfilled with Class QC Misc. concrete up to the top of the leveling pad elevation after pile installation.

Refer to Sections 201.2.6, 202.2.3 and 204.6.2 for the staged review requirements for MSE walls. Consult the Commission's Bridge and Structures Engineer for additional design recommendations.

204.6 RETAINING WALLS

Perform a wall justification in accordance with Section 1404 of the ODOT Location and Design Manual, Volume Three. Generally, the justification compares the practicality, constructability and economics of the various types of retailing walls listed below:

A. Cast-in-place reinforced concrete

B. Precast concrete

C. Tied-back

D. Adjacent drilled shafts

E. Sheet piling

F. H-piling with lagging

G. Cellular (Block, Bin or Crib)

H. Soil nail

I. Mechanically Stabilized Earth (MSE)

Refer to SS840 for accredited MSE wall systems. Modular block wall systems or wall systems that utilize geogrid reinforcements shall not be permitted.

205 SUPERSTRUCTURE INFORMATION

205.1 TYPE OF STRUCTURES

The types of superstructure generally used in Ohio consist of cast-in-place concrete slabs, prestressed concrete box or I-beams, and steel beams or welded plate girders. Normally shallow abutments and spill-thru slopes will be used. The type of superstructure used should be selected on the basis of economy as well as appearance. For special conditions where other types of superstructures may be considered, consult the Commission's Bridge and Structures Engineer for recommendations prior to initiating the design.

205.3 CONCRETE SLABS

Cast-in-place concrete slab type structures are not permitted to be considered for use on any Commission structure.

205.4 PRESTRESSED CONCRETE BOX BEAMS

Prestressed concrete box beam type structures are not permitted to be considered for use on any Commission structure.

205.8 INTEGRAL DESIGN

The limitations previously discussed are basically for steel superstructures. If a concrete superstructure is being proposed, longer structure lengths may be investigated. During preliminary design, consult the Commission's Bridge and Structures Engineer for recommendations on a specific site that exceeds the prescribed limits.

205.9 SEMI-INTEGRAL DESIGN

Spread footings may be appropriate for semi-integral abutments but settlement should be evaluated. Consult the Commission's Bridge and Structures Engineer for recommendations during preliminary design

The limitations previously discussed are basically for steel superstructures. If a concrete superstructure is being proposed, longer structure lengths may be investigated. During preliminary design, consult the Commission's Bridge and Structures Engineer for recommendations on a specific site that exceeds the prescribed limits.

207 BRIDGE GEOMETRICS

207.1 VERTICAL CLEARANCE

The "Required Minimum" and "Actual Minimum" Vertical Clearances and their locations shall be shown on the Preliminary Structure Site Plan, Section 201.2.2. The "Actual Minimum" Vertical Clearance is the minimum overhead clearance provided by the design plans.

A. For new and reconstructed grade separation structures over the mainline roadway, the “Required Minimum” Vertical Clearance shall not be less than 15’-6”.

B. For new and reconstructed mainline grade separation structures, the “Required Minimum” Vertical Clearance shall not be less than the existing Vertical Clearance.

209 MISCELLANEOUS

209.5 APPROACH SLABS

Approach slabs shall be used on all Ohio Turnpike Mainline and Ramp bridges. Approach slabs shall be used on all non-mainline and ramp bridges where a stub-type abutment is utilized and on rehabilitation projects where an approach slab was provided on a cellular type abutment.

209.5.1 STANDARD DRAWING – AS-1

Standard Drawing AS-1 shall be used on all structures requiring an approach slab except those structures where a integral or semi-integral abutment is utilized.

209.5.1.1 NOT UTILIZED

209.5.1.2 NOT UTILIZED

209.5.2 NOT UTILIZED

209.7.2 LOGO AND LETTERING POLICY

Lettering, logos, symbols, flags, etc. shall not be placed on a bridge without prior approval of the Chief Engineer. Generally costs associated with design, placement and maintenance of such, if approved, will be solely borne by the entity responsible for the request for placement.

209.13 SIGN SUPPORTS

Sign supports shall not be placed on any bridge structure.

SECTION 300 – DETAIL DESIGN

301 GENERAL

301.2 DETAIL DESIGN REVIEW SUBMISSIONS

The detail design shall be submitted during the 30 percent submittal (preliminary plans) and 90 percent submittal (final plans). The 30 percent plan submittal shall include the following:

- Typical Section of Existing and Proposed Approach Roadway including cross slope and superelevation
- Typical Section of Existing and Proposed Bridge including cross slope
- Horizontal and vertical geometry thru project limits
- Tie in elevations at approach roadway
- Benchmarks
- Minimum vertical clearance
- Title sheet with location map, sheet index, standard drawings and supplemental specifications
- Construction Phasing Details (if applicable)
- MOT plans
- MOT notes
- Detour plans
- General Plan and Profile sheet basically complete and checked
- Substructure Repair Details (patching and crack repair)
- Abutment Slab Details (geometry only)
- Deck Slab Plan (geometry only)
- Transverse Slab Details (geometry only)
- Survey Point File (.txt file)
- Engineer's Estimate of Probable Construction Cost

It is expected that all submitted information has been checked and is in accordance with ***Plan Requirements for Ohio Turnpike Bridge Projects*** (with emphasis on that the CADD requirements are adhered to)

The 90 percent submittal shall include the following:

- All plans are complete including quantities and have been checked
- List of Special Provisions to include in bid package
- Estimated Quantities Worksheet
- Engineer's Estimate of Probable Construction Cost
- AutoCAD Files

The intent of the final plan submittal is for OTIC staff to review the contract documents for completeness, accuracy and conformance to Ohio Turnpike requirements. After the documents have been reviewed, comments will be provided to the consultant with the expectation that the

consultant will revise the documents and submit the final documents. The submittal of the final contract documents is expected to be prior to the consultant's final completion date.

301.3 DESIGN METHODS

Ohio Turnpike and Infrastructure Commission bridge designs are to be developed in general conformance with the latest edition of the American Association of State Highway and Transportation Officials' Standard Specifications for Highway Bridges (AASHTO), including all interims. Exceptions to AASHTO standards are documented in this Manual. Bridges designed within the limitations placed on the various superstructure types by AASHTO and this Manual can be considered as "typical" or "normal" in that these designs make use of empirical formulae and methods rather than more refined analysis methods.

The Strength Design Method (i.e. Load Factor Design) is preferred over the Service Load Design Method (i.e. Allowable or Working Stress Design). If a designer determines that an existing superstructure is structurally deficient based on the Service Load Design Method, the designer shall re-analyze the structure based on the Strength Design Method before opting for a total superstructure replacement.

When site conditions require the use of a superstructure type that exceeds the recommended limits set forth by AASHTO and/or this Manual, a special design method may be required using either a two-dimensional or three-dimensional model and some type of numerical analysis to solve the model. When this occurs, the designer should place a note in the General Notes section of the detail construction plans listing the type of model used, method of analysis and assumptions made during the design. Examples of special design methods include grillage, finite element, finite strip and classical plate solutions.

301.4 LOADING REQUIREMENTS

All bridge structures shall be designed for an HS20 loading or the alternate military loading, whichever produces the greatest stresses and live load deflections, unless otherwise stated in this manual.

All bridges shall be designed for NO future wearing surface.

All steel structures shall be designated as Case I or Case II as defined by AASHTO for fatigue design.

301.4.3.2 EXISTING STRUCTURES

Seismic vulnerability of a structure shall be considered for rehabilitation projects requiring complete deck or superstructure replacements. New substructure units shall be designed in accordance with AASHTO Standard Specification 8.18.2.

301.5.5 BAR LIST

Bar lists shall include the following:

1. Bar Mark
2. Number of bars required
3. Overall length required of the bar

4. Total Weight for each bar mark
5. Column for type of bar:
    a. 1. "ST" for straight
    b. 2. "Number" assigned to
    c. 3. "Numbered Bent Bar Detail"
    d. 4. "Number" and "Series" for series bars

Dimensions are defined by letters A through Z associated with the “Numbered Bent Bar Detail” showing position of letters.

Spiral reinforcing shall also be included in the detail plan's bar list. The following information shall be shown on the bar list:

1. A. Core diameter
2. B. Pitch
3. C. Mark
4. D. Number
5. E. Height
6. F. Weight
7. G. Plan note for spiral bars

A sample bar list is provided in Figure 302.

Other Reinforcing Bar requirements:

a. No duplicate bars are permitted within a structure element – abutment, pier, slab, etc. Duplicate bar is a bar that is the same size, length and shape within the same structure element – Rear Abutment, Pier 1, Deck Slab. Duplicate bars are permitted in separate structure elements – Rear Abutment / Forward Abutment
b. Straight bars not in a series are to be rounded to nearest 3”, making sure requirements for bar clearance and bar laps are met.
c. Bent bars TOTAL lengths are to be rounded to the nearest inch.
d. The degree of accuracy for spacing of reinforcing bars shall be to the nearest half inch.
e. The spacing of reinforcing bars is to be provided in inches for spacing less than and equal to 12” and in feet and inches for spacing greater than 12”.
f. All reinforcing bars are to be “placed” once, preferably in a plan or elevation view and then are referenced in subsequent views or sections. The “placing” of the bar provides the number of bars, the bar callout, the spacing of the bar, the total length of the placement of the bars and then if necessary the position of the bar (TOP/BOTTOM/NEAR FACE/FAR FACE). For example, in the SLAB PLAN, the call out of deck bars would be 148-S501 BARS @ 6 ½” = 79’-7 ½” (TOP). In the TYPICAL DECK SECTION, the same bars would simply be referenced as S501.
g. Where subsequent bars lap (in a continuous pour) or match (thru a construction joint), only the spacing of the first placed bar is given. The lapped bars are to be called out as

lapping the first placed bar (example – 24-A502 BARS TO LAP A501 BARS (TOP) or 24-A502 BARS TO MATCH A501 bars (TOP))

302 SUPERSTRUCTURE

302.1 GENERAL CONCRETE REQUIREMENTS

302.1.1 CONCRETE DESIGN ALLOWABLES

The following concrete strengths (f'c) shall be assumed for design purposes:

A. Substructure Concrete (Class QC1)

1. Load Factor Design ..... 4.0 ksi
2. Service Load Design ..... Unit stress = 0.33 x 4.0 ksi = 1.3 ksi

B. Superstructure Concrete (Type HP4)

1. Load Factor Design ..... 4.5 ksi
2. Service Load Design ..... Unit stress = 0.33 x 4.5 ksi = 1.5 ksi

C. Drilled Shaft Concrete (Class QC4 or QC5)

1. Load Factor Design ..... 4.0 ksi
2. Service Load Design ..... Unit stress = 0.33 x 4.0 ksi = 1.3 ksi

302.1.2 SELECTION OF CONCRETE FOR BRIDGE STRUCTURES

The following concrete types may be specified for substructure concrete:

A. Class QC1 Concrete

B. Class QC1 Concrete with QC/QA

C. Class QC3 Special Concrete

D. Class QC4 Mass Concrete

302.1.3.2 FUTURE WEARING SURFACE

All bridges shall be designed for NO future wearing surface (FWS).

302.1.4 CONCRETE DECK PROTECTION

302.1.4.1 TYPES

A. Epoxy Coated Reinforcing Steel - CMS 709.00

B. Minimum concrete cover of 2½ inches

C. Type HP4 Concrete

D. Drip Strips

E. SP 536 Concrete Weatherproofing

302.1.4.3 SEALING OF CONCRETE SURFACES SUPERSTRUCTURE

Specifications for sealing material are defined in SP 536. Concrete surfaces shall be sealed with an approved concrete weatherproofing sealer as follows:

A. The top exposed surface of all deck slabs
B. The fascia of all deck slabs including the underside to the first beam
C. The exposed surfaces of all bridge sidewalks

All bridge parapets shall be sealed with a combination non-epoxy sealer and curing compound as soon as practical after placement.

302.2.2 CONCRETE DECK DESIGN

The concrete deck design shall be in conformance with AASHTO, latest edition, and additional requirements in this Manual. The design live load shall be HS20 for all decks.

For continuous slabs on three or more supports a continuity factor of 0.80 shall be applied to the simple span bending moments for both live load and dead load.

See Figures 312 & 313 for an illustration of a method of design for a reinforced concrete deck slab.

Upon completing the concrete deck design from the example shown in Figure 312 & 313, or similar method, the designer should assure any cantilevered deck overhang will not over stress the initial deck design due to the dead load and the greater live load of either the vehicle wheel loads or the railing live loads. See relevant AASHTO sections for live load application requirements. See example Figures 315 & 316.

Transverse spacing of the top and bottom reinforcing in a deck design shall meet section 302.2.4.2.

Provide additional transverse and longitudinal reinforcing steel in the bottom of the deck slab overhang. In the transverse direction, provide #4 bars spaced at 2 times the transverse bar spacing used in the interior bays. In the longitudinal direction, provide #5 bars spaced at 12” maximum. The clear cover measured to the transverse bars shall be 1 ½”.

302.4.1.5.a PRIMARY COATING SYSTEMS

The Commission's primary system is a 3 coat system, either IZEU (new steel) or OZEU (existing steel).

302.4.1.6 STEEL PIER CAP

Steel pier caps are non-redundant, fracture critical members. In general, structure designs that require stringers to be continuous through, and in the same plane with a steel pier cap or cross beam, should be avoided if at all possible.

302.4.3.2 FRACTURE CRITICAL

Designs which incorporate fracture critical members, as defined in Section 2, Definitions, of the AASHTO/AWS D1.5, Chapter 12 Fracture Control Plan are not permitted under any circumstances.

303 SUBSTRUCTURE

303.1.1 SEALING OF CONCRETE SURFACES, SUBSTRUCTURE

Specifications for the sealer are defined in SP 536, Concrete Weatherproofing. All exposed surfaces of the substructure shall receive a non-epoxy sealer.

306 EXPANSION DEVICES

306.1 GENERAL

Expansion devices should provide a total seal against penetration and moisture. Standard bridge drawings are available for expansion devices for typical bridge superstructure types. Expansion devices as shown in the standard bridge drawings and their support systems are designed for an HS20 loading with 100% impact. Special expansion devices including finger joints and modular joints and their support systems shall also be designed for an HS20 loading with 100% impact.

For fabricated steel expansion devices, the designer should specify the type of steel required. Type of steel should be included as a plan note if requirements in the plans are not covered by a

selected standard bridge drawing. To protect steel expansion devices, metallizing of the exposed surfaces with a 100% zinc coating shall be specified. Standard bridge drawings define the requirements for metallizing. The design agency will need to develop plan notes for special expansion devices, such as finger joints and modular joints. Use the note for shop-applied metallizing located in the appendix as a guideline.

306.1.1 PAY ITEM

Strip seals, except as specifically listed in this section, shall be paid for as Item SP 533. Compression seals shall be included in pay Item SP 533A.

The plans shall clearly show what components are included with the expansion devices for payment.

As an example, cross frames, which are field welded to both the superstructure girders and the expansion devices, are part of the 513 structural steel item. The seal is considered part of the expansion device and shall be included in the SP 533 pay item.

306.1.2 EXPANSION DEVICES WITH SIDEWALKS

On structures with sidewalks, the expansion devices shall be the same type as furnished for main bridge deck expansion joint. Sidewalk details for standard expansion devices (strip seals) are shown on the standard drawings. For non-standard devices, a curb plate and sidewalk cover plate will be required. The curb and sidewalk plates should be separated at the interface of the sidewalk and curb. See details on Standard Drawing DJ-3 for sidewalk plates.

306.2.6 STEEL SLIDING PLATE ENDDAMS, RETIRED STANDARD DRAWING SD-1-69

The use of steel sliding plate enddams are not permitted under any circumstances.

306.2.8 TOOTH TYPE, FINGER TYPE OR NON-STANDARD SLIDING PLATE EXPANSION DEVICES

The use of finger or sliding plate type expansion devices are not permitted under any circumstances.

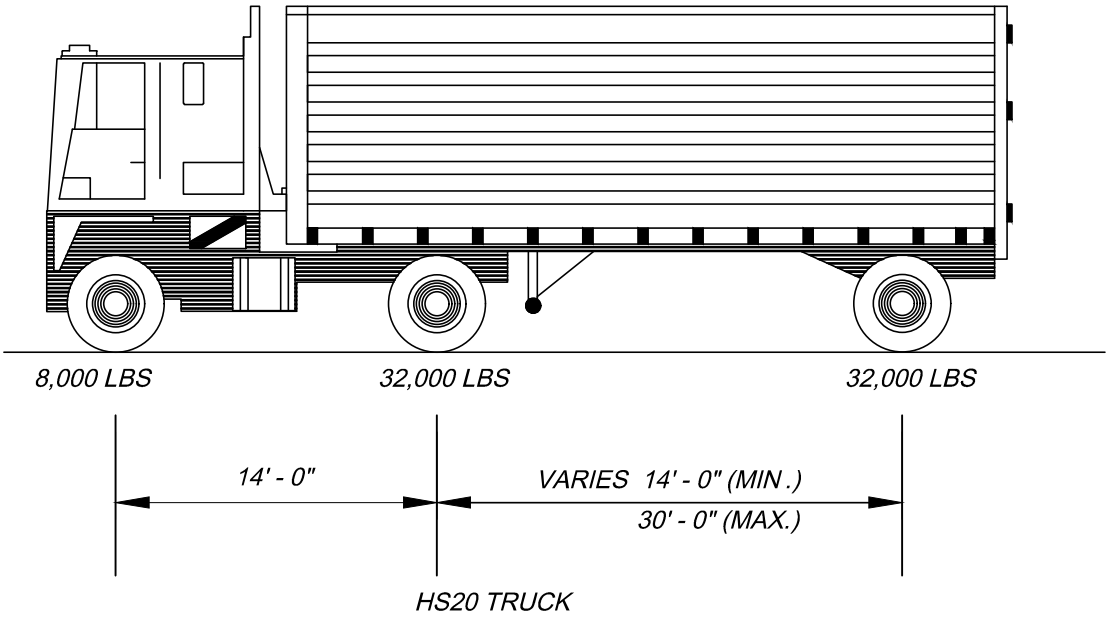
307 BEARINGS

307.1 GENERAL

The Commission’s policy is, whenever possible, use laminated elastomeric bearings.

Justification, including design calculations showing elastomeric bearings will not be adequate for the structure, must be available. When specialized bearings, such as pot, disc or spherical, are required, detail notes shall be included in the contract plans. A plan note for pot bearings is provided in the appendix and may require modification by the designer based on the specific structure. If a cost evaluation shows that either spherical or disc bearings could be competitive against pot bearings, those bearings should be included in the plans and special notes developed.

For specialized bearings, the designer's detail plan notes shall require the contractor to coordinate the required substructure bearing seat elevations or dimensions with the selected bearing manufacturer. A note is available in Section 700.



HS20 LANE LOADING

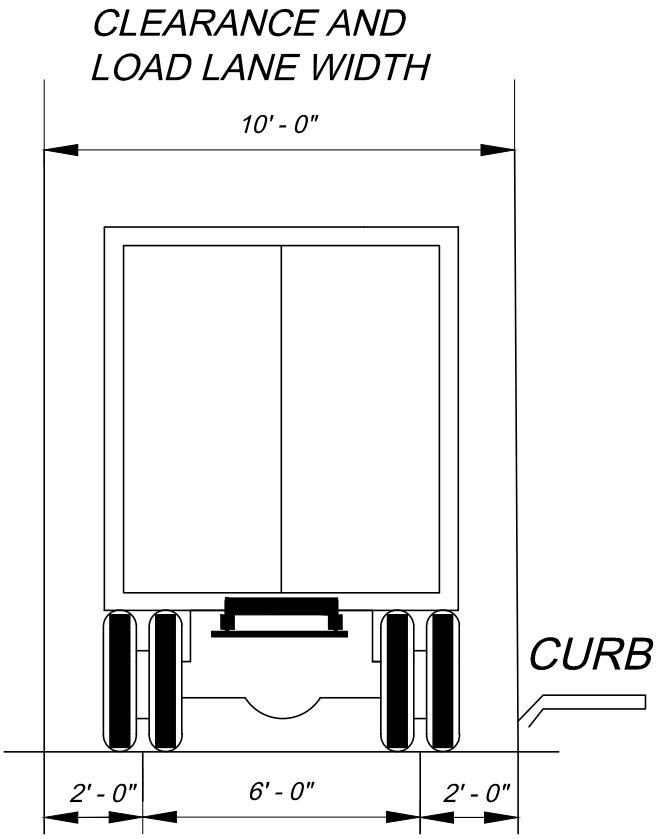
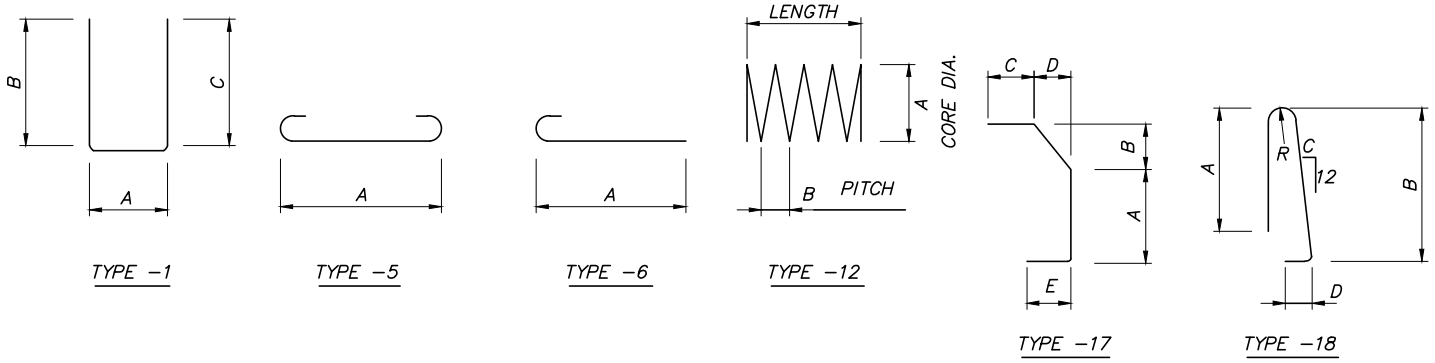


Figure 301

MARK	NUMBER			LENGTH	WEIGHT	TYPE	D I M E N S I O N S						
	REAR	FWD	TOTAL		(LBS.)		A	B	C	D	E	R	INC.
PIERS													
SP401	1		1	28 '–3"	373	12	2' – 4"	0' – 4 ½"					
SP402		1	1	13' – 3"	175	12	2' – 4"	0' – 4 ½"					
P501	14		14	7' – 6"	110	5	6' – 4"						
P502		12	12	7' – 9"	97	STR							
P601	17		17	20' – 0"	511	STR							
P602		15	15	5' – 10"	131	6	5' – 2"						
	2	2	4	7' – 6"				2' – 5"	2' – 5"				
P603	SER	SER	SER	TO	285	1	2' – 1"	TO	TO				0'–1"
	of 6	of 6	of 6	8' – 4"				2' – 10"	2' – 10"				
DP601	28		28	2' – 9"	116	STR							
DP602		16	16	3' – 3"	78	STR							
				TOTAL	1876								
ABUTMENT													
A401	8	8	16	10' – 5"	112	1	0'–11"	4' – 10 ¼"	4'–10 ¼"				
A402	4	4	8	10' – 0"	53	STR							
A501	12	12	24	12' – 0"	300	STR							
A502		7	7	10' – 9"	78	6	10 ' –2"						
A601	16		16	28' – 3"	679	STR							
A602		16	16	8' – 5"	203	1	1'–0"	5' – 9"	2' – 0"				
				TOTAL	1425								
SUPERSTRUCTURE													
S401			610	30'–0"	12224	STR							
S402			61	13' – 3"	540	STR							
S501			530	41' – 6"	22941	STR							
S502			466	5' – 11"	2876	18	2' – 2"	2' – 5"	0'–1 1/4"	0'–7 1/2"		0'–2 1/8"	
S801			240	3' – 8"	2350	17	0' – 9"	0'–8 1/2"	0' – 9"	0'–6"	0'–10 1/2"		
S802			16	8' – 4"	356	1	1' – 0 "	5' – 9"	2' – 0"				
				TOTAL	41287								



THE BAR SIZE NUMBER IS SPECIFIED ON THE PLANS IN THE BAR MARK COLUMN. THE FIRST DIGIT WHERE THREE DIGITS ARE USED. AND THE FIRST TWO DIGITS WHERE FOUR ARE USED. INDICATES THE BAR SIZE NUMBER. FOR EXAMPLE, P601 IS A NO.6 BAR. BAR DIMENSIONS SHOWN ARE OUT TO OUT UNLESS OTHERWISE NOTED. "STD." WRITTEN IN PLACE OF A DIMENSION INDICATES A STANDARD BEND AT THE END OF THE BAR.

ALL REINFORCING STEEL TO BE EPOXY COATED

Figure 302

TENSION SPLICES (in.) ③						
BAR	EPOXY				NON – EPOXY	
LOCATION	TOP ②		OTHER		TOP ②	OTHER
CLR. / SIZE	①		①			
4	35	33	31	23	28	20
5	43	41	38	29	36	26
6	52	49	46	35	43	31
7	66	62	58	44	54	39
8	87	82	76	59	71	51
9	110	104	97	74	90	64
10	139	132	123	94	115	82
11	171	162	151	116	141	101

NOTES:

1. FOR EPOXY BARS WITH COVER LESS THAN *$3d_b$ OR CLEAR SPACING BETWEEN BARS LESS THAN *$6d_b$ (8.25.23)

2. TOP BARS REFERS TO THE ONLY TOP ROW OF REINFORCEMENT.

3. FOR BARS SPACED LATERALLY AT LEAST 6 INCHES ON CENTER WITH AT LEAST 3 INCHES CLEAR COVER MEASURED IN THE DIRECTION OF THE SPACING. REDUCE VALUE BY 20% (x0.80) (8.25.3.1), BUT NOT LESS THAN 12" PER 8.32.3.1

4. VALUES SHOWN ARE FOR CLASS "C" LAP WITH f'c = 4,000 P.S.I. AND Fy = 60,000 P.S.I. (8.32.3.2)

* BAR DIAMETER

Figure 303

TENSION SPLICES (in.) ③						
BAR	EPOXY				NON – EPOXY	
LOCATION	TOP ②		OTHER		TOP ②	OTHER
CLR. / SIZE	①		①			
4	35	33	31	23	29	20
5	43	41	38	29	36	26
6	52	49	46	35	43	31
7	62	59	55	42	51	36
8	82	77	72	55	67	48
9	103	98	91	70	85	61
10	131	124	116	89	108	77
11	161	153	142	109	133	95

NOTES:

1. FOR EPOXY BARS WITH COVER LESS THAN *$3d_b$ OR CLEAR SPACING BETWEEN BARS LESS THAN *$6d_b$ (8.25.23)

2. TOP BARS REFERS TO THE ONLY TOP ROW OF REINFORCEMENT.

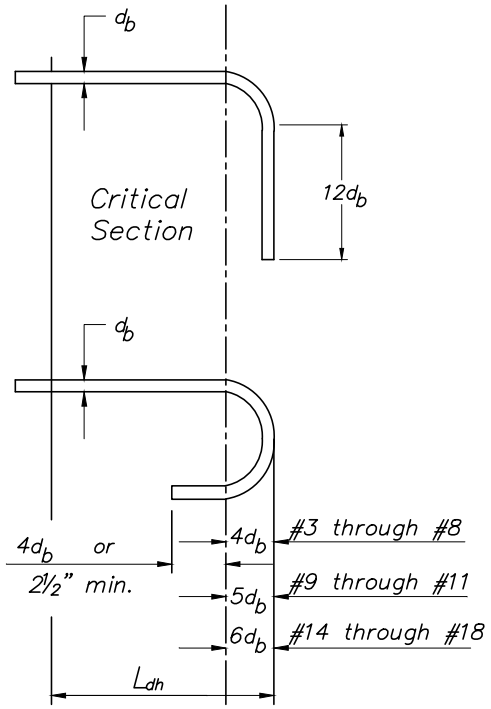
3. FOR BARS SPACED LATERALLY AT LEAST 6 INCHES ON CENTER WITH AT LEAST 3 INCHES CLEAR COVER MEASURED IN THE DIRECTION OF THE SPACING. REDUCE VALUE BY 20% (x0.80) (8.25.3.1), BUT NOT LESS THAN 12" PER 8.32.3.1

4. VALUES SHOWN ARE FOR CLASS "C" LAP WITH f'c = 4,500 P.S.I. AND Fy = 60,000 P.S.I. (8.32.3.2)

* BAR DIAMETER

Figure 303A

DEVELOPMENT LENGTH FOR EPOXY COATED STANDARD HOOKS IN TENSION ⑤			
BAR NO.	MOD. FACTOR / BASIC LENGTH, Lhb	CONCRETE COVER ①	TIES FOR STIRRUPS ②
		8.29.3.2	(8.29.3.3) (8.29.4)
		0.7	0.8
4	10	8	10
5	12	10	12
6	14	12	13
7	17	14	16
8	19	16	18
9	21	18	20
10	24	20	23
11	27	23	26
14	32	--	--
18	43	--	--



HOOKED – BAR DETAILS FOR DEVELOPMENT OF STANDARDHOOKS.

COMPRESSION LAP SPLICES 8.32.4 ④		
BAR NO.	STANDARD	WITHIN SPIRALS ③
4	15	12
5	19	14
6	23	17
7	26	20
8	30	23
9	34	25
10	38	29
11	42	32

1. FOR NO.11 BARS AND SMALLER WITH NOT LESS THAN 2 1/2. IN COVER ON SIDE OF HOOK AND 2 IN. OVER END OF HOOK. (8.29.3.2)

2. FOR NO.11 BARS AND SMALLER ENCLOSED WITHIN TIES OR STIRRUPS SPACED NO GREATER THAN 3d ALONG DEVELOPMENT LENGTH.

3. BRIDGE DESIGN MANUAL (3.3.3.2.1) CALLS FOR A 1/2" DIAMETER SPIRAL BAR WITH A 4 ½" PITCH FOR 36" DIAMETER COLUMNS WITH LIMITED RATIO OF ACTUAL AXIAL LOAD TO AXIAL LOAD CAPACITY. COLUMNS SO REINFORCED MAY BE CONSIDERED TO CONFORM TO THE LATERAL REINFORCEMENT REQUIREMENTS OF AASHTO 1989 SPECIFICATION 8.18.2.2.

4. COMPRESSION LAP SPLICES WITHIN TIES MAY BE MULTIPLIED BY 0.83 PER AASHTO 8.32.4.1, BUT IN NO CASE LESS THAN 12 INCHES.

DEVELOPMENT LENGTH FOR REINFORCING STEEL (in.)											
BAR NO.	BAR TYPE	TENSION REINFORCEMENT ③								COMPRESSION	
		EPOXY						NON – EPOXY		MIN. LENGTH	WITHIN SPIRAL
		② TOP BARS		OTHER BARS		WITHIN SPIRAL		② TOP	OTHER		
	AASHTO SECTION	8.25.2.1 8.25.2.3	8.25.2.1 8.25.2.3	8.25.2.3	8.25.2.3	8.25.2.3 8.25.3.3	8.25.2.3 8.25.3.3	8.25.2.1	8.25.1	8.26.1	8.26.2.2
	MOD. FACTOR / BASIC LENGTH	① 1.4 (1.5) ≤ 1.7	1.4 (1.15)	① 1.5	1.15	① 1.5 (.75)	1.15 (.75)	1.4	1.0	1.0	(.75)
4	12	20	19	18	14	14	12	17	12	9	7
5	15	26	24	23	17	17	13	21	15	12	9
6	18	31	29	27	21	20	16	25	18	14	11
7	23	39	37	34	26	26	20	32	23	17	12
8	30	51	48	45	34	34	26	42	30	19	14
9	38	65	61	57	44	43	33	53	38	21	16
10	48	82	78	72	55	54	42	67	48	24	18
11	59	101	95	89	68	67	51	83	59	27	20
14	81	137	130	121	93	91	70	113	81	32	24
18	104	177	168	156	120	117	90	146	104	43	32

(SEE NOTES FIG. 306)

Figure 305

NOTES:

1. FOR EPOXY COATED BARS WITH COVER LESS THAN * $3d_b$ OR CLEAR SPACING BETWEEN BARS LESS THAN *$6d_b$. (8.25.2.3)

2. TOP BARS REFERS TO ONLY TOP ROW OF REINFORCEMENT.

3. FOR BARS SPACED LATERALLY AT LEAST 6 INCHES ON CENTER WITH AT LEAST 3 INCHES CLEAR COVER MEASURED IN THE DIRECTION OF THE SPACING. REDUCE VALUE BY 20% (x0.80)(8.25.3.1), BUT NOT LESS THAN 12 INCHES PER (8.25.4)

4. BRIDGE DESIGN MANUAL SECTION 3.3.3.2.1 CALLS FOR A ½" DIAMETER SPIRAL BAR WITH A 4 ½" PITCH FOR 36" DIAMETER COLUMNS WITH LIMITED RATIO OF ACTUAL AXIAL LOAD TO ALLOWABLE AXIAL LOAD CAPACITY. COLUMNS SO REINFORCED MAY BE CONSIDERED TO CONFORM TO THE LATERAL REINFORCEMENT REQUIREMENTS OF AASHTO 1989 SPECIFICATION. SECTION 8.18.2.2, SPIRAL REINFORCEMENT.

5. FOR BARS IN COMPRESSION MINIMUM DEVELOPMENT LENGTH SHALL BE ≥ 8" (8.26)

6. VALUES SHOWN ARE FOR CLASS "C" LAP WITH f'c = 4,000 P.S.I AND Fy = 60,000 P.S.I. (8.32.3.2)

* BAR DIAMETER

DEVELOPMENT LENGTH FOR REINFORCING STEEL (in.)											
BAR NO.	BAR TYPE	TENSION REINFORCEMENT ③								COMPRESSION	
		EPOXY						NON – EPOXY		MIN. LENGTH	WITHIN SPIRAL
		② TOP BARS		OTHER BARS		WITHIN SPIRAL		② TOP	OTHER		
	AASHTO SECTION	8.25.2.1 8.25.2.3	8.25.2.1 8.25.2.3	8.25.2.3	8.25.2.3	8.25.2.3 8.25.3.3	8.25.2.3 8.25.3.3	8.25.2.1	8.25.1	8.26.1	8.26.2.2
	MOD. FACTOR / BASIC LENGTH	① 1.4 (1.5) ≤ 1.7	1.4 (1.15)	① 1.5	1.15	① 1.5 (.75)	1.15 (.75)	1.4	1.0	1.0	(.75)
4	12	20	19	18	14	14	12	17	12	9	7
5	15	26	24	23	17	17	13	21	15	11	8
6	18	31	29	27	21	20	16	25	18	13	10
7	22	37	35	33	25	25	19	30	22	16	12
8	28	48	46	42	33	32	24	40	28	18	13
9	36	61	58	54	41	40	31	50	36	20	15
10	45	77	73	68	52	51	39	64	45	23	17
11	56	95	90	84	64	63	48	78	56	25	19
14	76	129	122	114	87	86	66	106	76	30	23
18	98	167	158	148	113	111	85	138	98	40	30

(SEE NOTES FIG. 306A)

Figure 305A

NOTES:

1. FOR EPOXY COATED BARS WITH COVER LESS THAN *$3d_b$ OR CLEAR SPACING BETWEEN BARS LESS THAN *$6d_b$. (8.25.2.3)

2. TOP BARS REFERS TO ONLY TOP ROW OF REINFORCEMENT.

3. FOR BARS SPACED LATERALLY AT LEAST 6 INCHES ON CENTER WITH AT LEAST 3 INCHES CLEAR COVER MEASURED IN THE DIRECTION OF THE SPACING. REDUCE VALUE BY 20% (x0.80)(8.25.3.1), BUT NOT LESS THAN 12 INCHES PER (8.25.4)

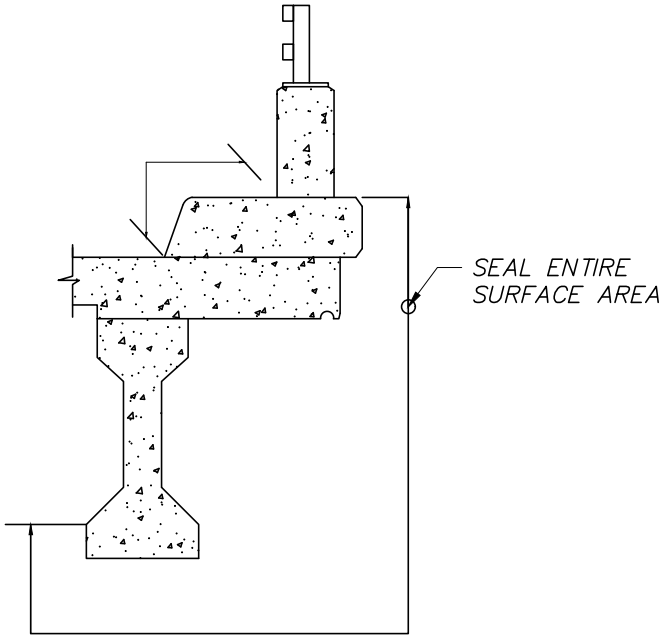
4. BRIDGE DESIGN MANUAL SECTION 3.3.3.2.1 CALLS FOR A ½" DIAMETER SPIRAL BAR WITH A 4 ½" PITCH FOR 36" DIAMETER COLUMNS WITH LIMITED RATIO OF ACTUAL AXIAL LOAD TO ALLOWABLE AXIAL LOAD CAPACITY. COLUMNS SO REINFORCED MAY BE CONSIDERED TO CONFORM TO THE LATERAL REINFORCEMENT REQUIREMENTS OF AASHTO 1989 SPECIFICATION. SECTION 8.18.2.2, SPIRAL REINFORCEMENT.

5. FOR BARS IN COMPRESSION MINIMUM DEVELOPMENT LENGTH SHALL BE ≥ 8" (8.26)

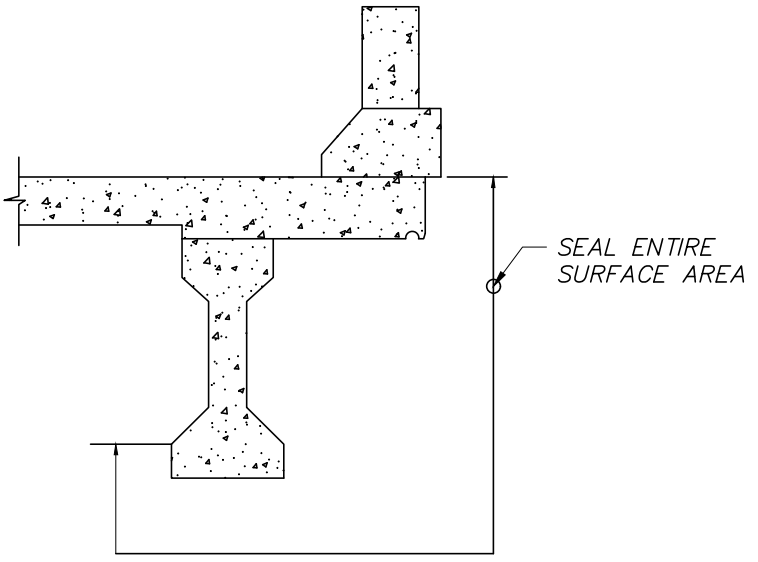
6. VALUES SHOWN ARE FOR CLASS "C" LAP WITH f'c = 4,500 P.S.I AND Fy = 60,000 P.S.I. (8.32.3.2)

* BAR DIAMETER

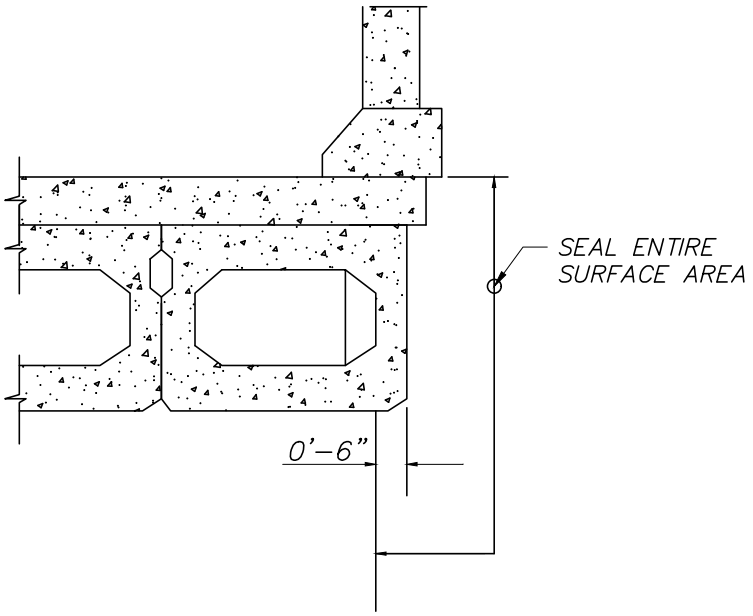
Figure 306A



CONCRETE DECKS WITH CURBS,
SIDEWALKS AND PARAPET



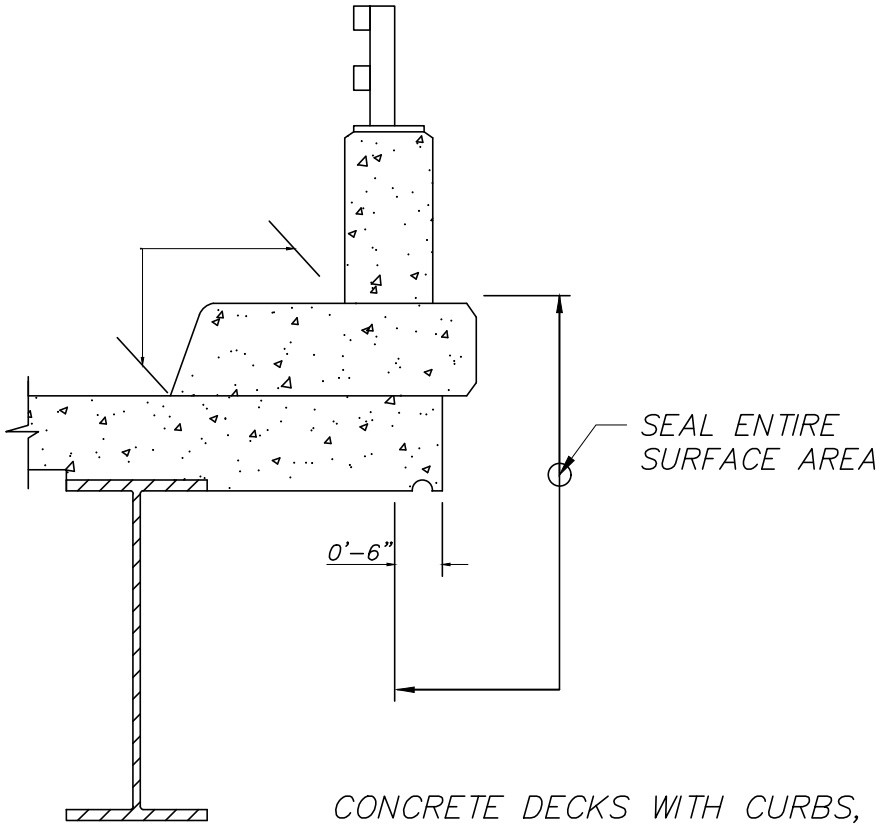
CONCRETE DECKS WITH
DEFLECTOR PARAPET



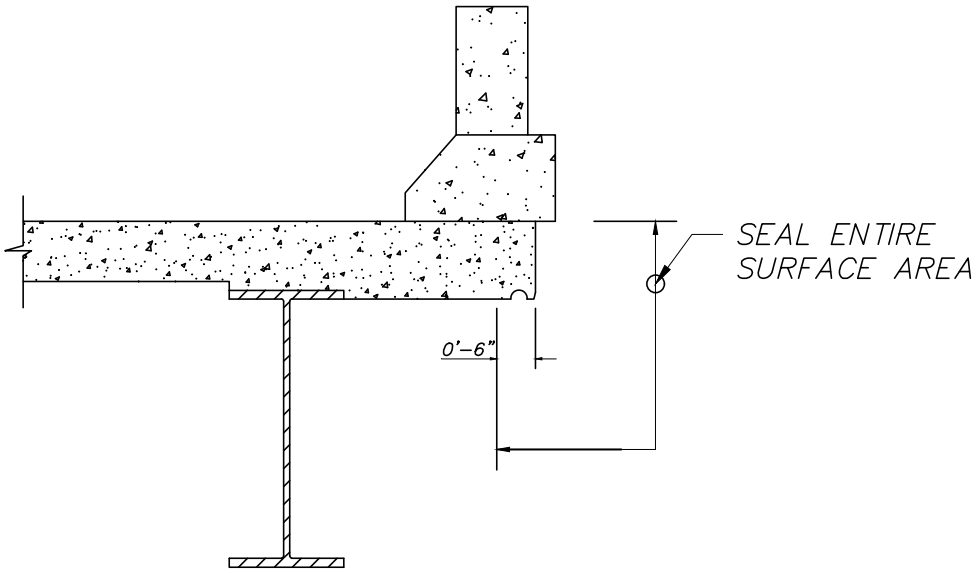
PRESTRESSED BOX BEAM DECK
WITH DEFLECTOR PARAPET

SEALING OF CONCRETE SURFACES, SUPERSTRUCTURE

Figure 310



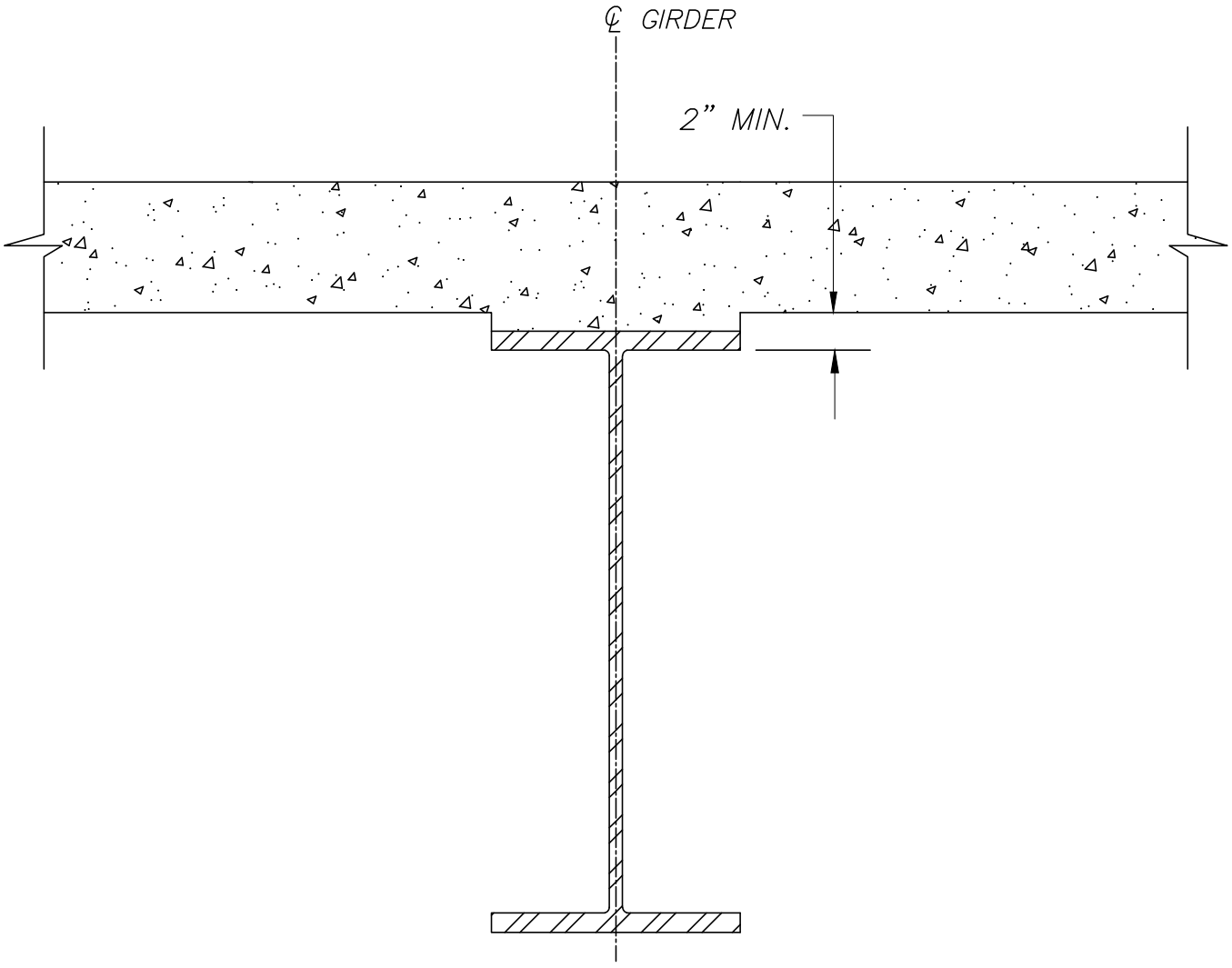
CONCRETE DECKS WITH CURBS,
SIDEWALKS AND PARAPET



CONCRETE DECKS WITH
DEFLECTOR PARAPET

SEALING OF CONCRETE SURFACES, SUPERSTRUCTURE

Figure 311



TYPICAL CONCRETE DECK HAUNCH DETAIL

(COMPOSITE AND NON – COMPOSITE STEEL BEAMS/GIRDERS)
(SHEAR STUDS NOT SHOWN)

Figure 317

(NOT USED)

Figure 317A