10-1 GENERAL INFORMATION AND DEFINITIONS

This section discusses general background information and definitions for preparing bridge and structure plans for submittal to the City of Peoria.

A. General Definitions

1. **AASHTO** – American Association of State Highway and Transportation Officials.
2. **ADMP** – Area Drainage Master Plan
3. **ADOT** – Arizona Department of Transportation.
4. **ASD** – Allowable Stress Design (WSD – Working Stress Design)
5. **Delamination** – Concrete that has lost its bond with the steel reinforcing. It is typically caused by the corrosion of the reinforcing. It has a “hollow” sound when dragging a heavy chain across the surface.
6. **F-shape barrier** – The results of computer and full-scale tests of barriers with various profile configurations that were labeled A through F. The “F” barrier was chosen by ADOT. 32” high is the standard. Steep grades or elevated roadways may require the 42” high barrier.
7. **Inventory Rating** – Inventory rating is the capacity rating for the vehicle type used in the rating that will result in a load level which can safely utilize an existing structure for an indefinite period of time. Inventory load level approximates the design load level for normal service conditions.
8. **Load Rating** – Load rating analysis of bridges is performed to determine the live load that structures can safely carry. When a bridge is not able to safely carry the legal loads allowed, it is posted for its reduced capacity.
9. **Low Volume Roads** – Streets with an Average Daily Traffic (ADT) volume below 400 vehicles per day.
10. **LFD** – Load Factor Design.
11. **LRFD** – Load and Resistance Factor Design.
13. **Operating Rating** – Operating rating will result in the absolute maximum permissible load level to which the structure may be subjected for the vehicle type used in the rating. This rating determines the capacity of the bridge for occasional use. Allowing unlimited numbers of vehicles to subject the bridge to the operating level will compromise the bridge life.
14. **Reference Chord** – A straight line from the centerline of bearing of abutment #1 to abutment #2 at the construction centerline of the bridge.
15. **Skew** – This is the angle between a line normal to the bridge reference chord and the cross-road or waterway centerline. The normal line is drawn by rotating 90 degrees counter-clockwise while looking upstation. An angle from the normal to the other road or waterway centerline which is counter-clockwise is a left skew. An angle which is clockwise is a right skew.

16. **Spalling** – concrete that has come loose typically from impact damage.

17. **Thalweg** – The low point of a channel that the scour depth is measured from.

18. **Transformed section properties** – A method of calculating the moment of inertia in an AASHTO prestressed I-Girder that results in a more economical section. However it reduces the reserve capacity of the girder if needed in the future.

**B. Bridge Length Definition**

A bridge is defined as:

A structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between under copings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening. Refer to Figure 10.1.
FIGURE 10.1

If spacing is less than half of the pipe diameter and the distance D is more than 20 feet, this is classified as a structure. D is measured along the roadway centerline.

Opening distance is measured along the roadway centerline.

PIPE CROSSING

BOX CULVERT
C. **Structure Name**

Peoria structure names shall incorporate the street name or trail/park name along with the type of crossing or structure. A number shall be added after the name when there is more than one structure with the same street name and type of crossing.

Example:  Thunderbird Road Pipe Crossing – 1  
Thunderbird Road Pipe Crossing – 2

Table 10.1 is presented as guidance.

<table>
<thead>
<tr>
<th>TERM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRIDGE</td>
<td>The term “bridge” is usually reserved for structures over water courses.</td>
</tr>
<tr>
<td>BOX CULVERT</td>
<td>A structure carrying a roadway over various features such as trails or waterways.</td>
</tr>
<tr>
<td>PIPE CROSSING</td>
<td>A structure allowing water to pass below a public roadway.</td>
</tr>
<tr>
<td>PEDESTRIAN OVERPASS</td>
<td>A structure carrying a pedestrian walkway over a roadway.</td>
</tr>
<tr>
<td>PEDESTRIAN UNDERPASS</td>
<td>A structure carrying a pedestrian walkway under a roadway.</td>
</tr>
<tr>
<td>PEDESTRIAN BRIDGE</td>
<td>A structure carrying a pedestrian walkway over a waterway.</td>
</tr>
</tbody>
</table>

**TABLE 10.1**

D. **Construction Permit Requirements**

1. In accordance with Chapter 1, Section L of the Infrastructure Development Guidelines the City of Peoria requires an off-site permit to encroach within the City of Peoria public rights-of-way and easements.

2. Prior to approval of any structure plans and the issuance of a permit by the City of Peoria, confirmation must be provided that the construction plans for structures over waterways have been submitted to, coordinated with, approved and permitted by other agencies as required. Such agencies include, but not limited to, the Maricopa Flood Control District and the U.S. Army Corps of Engineers.

3. Lighting and electrical plans for structures must be reviewed for approval and permitting by Building Safety.

4. Shop Drawings shall be reviewed and approved by the Engineer of Record. A final copy shall be submitted to the City of Peoria Engineering Department.

5. A permit will not be issued until all of the documents and plans for the structure have been submitted for review and approved.

E. **Utilities on Structures**

1. During the preliminary phase of the design process the City of Peoria Engineering Department shall be contacted in order to determine the needs for future City water and
wastewater lines, traffic interconnect, and the size and number of conduits needed to accommodate existing and future City facilities.

2. Gas line attachment and placement shall be subject to review and approval by the City of Peoria Engineering Department.

3. Utility hangers shall be approved by the City of Peoria Engineering Department.

4. Conduits - Size and number of conduits are subject to change pending City of Peoria Engineering Department review. All new bridges shall at a minimum include the following types of conduits:
   a. 2" diameter conduit for bridge lighting conduit
   b. 4 - 1 ¼" diameter for signal interconnect conduit to be carried under the structure.
   c. Conduit placement as requested by utility companies to accommodate existing and future facilities.
   d. Additional conduits for future use to be determined by the City.

10-2 CITY OF PEORIA SPECIFICATIONS

This section lists and discusses the design and construction specifications to be used for bridges and structures in the City of Peoria. Section 10-3 provides a more detailed discussion of design standards of practice required on plans submitted for a permit.

A. Peoria Structure Requirements

1. All new structures starting design after October 1, 2007 shall follow the specifications of 10-2.C

2. Bridge widenings, rehabilitations, and other design work on existing structures that were designed with the AASHTO Standard Specifications may continue to use the specifications of 10-2.B with approval from the City of Peoria Engineering Department.

B. Peoria Design Specifications until October 1, 2007

1. The City of Peoria has adopted the use of the most current version of the following design guidelines:
   b. The current ADOT Bridge Practice Guidelines.
   c. The City of Peoria Design and Submittal Standards for Bridges and Structures.
   d. The current ADOT Standard Specifications for Road and Bridge Construction.
   e. The current ADOT Bridge standard details.

2. Columns and drilled shafts (includes abutment shafts) shall be designed with Load Factor Design (LFD).
3. Abutment stem walls, abutment footings, pier caps, wing walls and retaining walls shall be designed with Allowable Stress Design (ASD).

C. Peoria Design Specifications for New Structures after October 1, 2007

1. The City of Peoria shall follow the ADOT Bridge Design Guidelines (LRFD); the latest AASHTO LRFD Bridge Design Specifications and Interims; and the latest ADOT Bridge Group standard details. The standard ADOT box culverts, pipe crossings, and other buried structures are exempt from following the LRFD guidelines until 2010 or as directed by the City of Peoria Engineering Department.

a. When using LRFD, the load factors for permanent loads typically have two values, a maximum value and a minimum value. When analyzing a structure it will often be necessary to use both values. The objective is to envelope the maximum load effects on various elements for design. A box culvert structure illustrates the use of both values. When determining the moment in the top slab of the culvert the maximum load factor is used with vertical earth loads, while the minimum load factor is used on the lateral or horizontal earth loads. The situation reverses when determining the moments in the wall of the culvert. A minimum load factor is used on the vertical earth loads and a maximum value is used on the horizontal earth loads.

b. Designers must ensure the structure has been checked for adequacy in carrying all appropriate load combinations at any possible construction stage. For example, a high abutment should be checked for any permissible construction case in addition to the final condition. The abutment may be completely constructed prior to placement of the beams (a case which maximizes the horizontal earth pressure load with a minimum of vertical load) or the abutment could be constructed such that the superstructure is completed prior to backfilling. This latter case would maximize vertical load without horizontal earth pressure load. Designers should investigate both cases.

D. Pre-fabricated Structures. (i.e. Con/Span)

Pre-fabricated (pre-fab) structures shall follow the design and submittal guidelines in this document. The HS 25 vehicle loading shall be used prior to implementing LRFD. It shall be the responsibility of the pre-fab engineer to incorporate the site conditions, bridge geotechnical and bridge hydraulic reports into the design of the structure before submitting to the City for approval. See Section 10-4 for submittal requirements of vehicular and pedestrian pre-fab structures.

E. Pedestrian Bridges

The AASHTO Pedestrian Bridge Specification is the only specification devoted to the design of pedestrian bridges and should be used at all times. It references all other applicable Codes and Specifications. Mixing of basic design specifications is highly discouraged because of conflicting requirements. At the time of writing of this document, only Allowable Stress Design (ASD) and Load Factor Design (LFD) shall be used with this guide until AASHTO releases the LRFD version.

1. All pedestrian bridges shall be designed according to the AASHTO Guide Specifications for Design of Pedestrian Bridges. All pre-fabricated structures shall conform to the AASHTO specifications. Fiber Reinforced Polymer (FRP) pedestrian bridges will be allowed after publication of the anticipated AASHTO guidelines.
2. The design shall employ features throughout with corrosion prevention second only to structural considerations. The design shall anticipate the need for water and debris to quickly dissipate from all surfaces of the structure. Special attention shall be directed toward all aspects of proper materials selection and adherence to proper materials application.

3. For pedestrian bridges, in addition to the pedestrian live load, design for a maintenance vehicle (or emergency vehicle, i.e. ambulance) live load equivalent to an H-5 truck for deck widths from 6 to 10 feet, and an H-10 truck for wider decks. The vehicle load is not applied at the same time as the pedestrian load. Use of the dynamic load allowance (impact) is not required with the maintenance vehicle. Where appropriate, additional live loads should be considered. Additional live loads might include: bridge inspection or snooper loads on bridges with large overhangs. If construction equipment or maintenance equipment can or will operate adjacent to retaining walls and abutments, a live load surcharge should be incorporated into the design.
4. All of the concentrated or wheel loads shall be placed so as to produce the maximum stress in each member being analyzed. Critical stresses need be calculated assuming there is only one vehicle on the bridge at any given time. Assumptions that vehicles only travel down the center of the bridge or that the vehicle load is a uniform line load will not be allowed. The wheel load shall be 1'-0 from the face of the rail or curb.

5. Vehicle loads do not need to be designed for if vehicular access is physically restricted.

6. Equestrian structures shall be checked for the H-10 loading, or as directed by the City of Peoria Engineering Department.


8. For tubular structures, any attachment, including electrical wiring, signs, signals, etc., shall be strapped to the bridge. In no case shall holes be tapped into the tubular members of the structure for attachments.

9. It shall be the responsibility of the pre-fab engineer to incorporate the site conditions, bridge geotechnical and bridge hydraulic reports into the design of the structure before submitting to the City for approval.

10. Structure numbers shall be assigned to each pedestrian bridge. See Figure 10.3.

F. Construction Standards

The order in which the construction documents govern shall be as follows:

1. Supplemental Agreements.


3. Project Plans.

4. ADOT Bridge Standard Drawings.

5. ADOT Standard Specifications for Road and Bridge Construction.

MAG Specifications shall not be used unless otherwise specified in agreement or special provisions. Excavation and backfill are separate bid items in the ADOT Standard Specifications.

10-3 PEORIA DESIGN PRACTICE AND STANDARDS FOR SUBMITTALS

This section discusses the typical design requirements and standards to be addressed on the plans submitted to the City of Peoria for a permit.

A. Typical Requirements of Structures in the City of Peoria

1. All structures should be designed with ease of maintenance in mind. For example, deck joints shall be required on all applicable structures to keep water, rocks and debris off of the bearing seat. Drainage features shall be designed to prevent erosion damage around the abutments and approach slabs.
2. Structures shall be designed for a minimum 75 year life. For example, structures shall be designed with self-protection measures such as sloped surfaces to prevent water from ponding and penetrating.

3. All structures shall be designed to meet current City of Peoria aesthetics requirements. See Section 10-5.

4. All roadway structures shall be designed for a 25 psf future wearing surface and for a future raised median on designated arterial streets. A ½” wearing surface shall be deducted from the deck thickness for design of all structural components on all vehicular bridges.

5. Section properties shall be based on gross area of members for cast-in-place post-tensioned members. Section properties shall be based on transformed area of bonded prestressing strand for precast prestressed members. Gross section properties shall be used for deflection calculations and live load distribution for precast prestressed members.

6. Lighting and conduit shall be required for both vehicular and pedestrian traffic on all structures.

7. Buried structures shall be waterproofed.

8. Structure Number

   a. In conjunction with the City of Peoria Structures Maintenance and Management Program each structure is assigned an identification number by the City of Peoria. In the case of twin or parallel structures individual numbers are assigned if there is an open median.

   b. All structures submitted for review by the City shall include the Structure Number on the plan sheets. The Structure Number Form is available for download from the Peoria website.

   c. All new structures shall have its assigned structure number permanently attached as follows: imbed ½”, bridge number and year built, using 1 ½” w X 2” h number impressions on the inside face of the barrier near the abutment or on the abutment in a visible place. It shall be placed 6” from the top or an edge of a concrete barrier, end block, or abutment surface. Location and details to be approved by the City of Peoria Engineering Department.

   ![Figure 10.3](image-url)
d. Structures that do not have the identification markings shown in Figure 10.3 shall have the structure number and year built permanently affixed to the structure. Unless directed otherwise, the structure number, year built and City logo shall be on a circular brass or bronze plate (5" diameter) and shall be bonded with epoxy or otherwise permanently affixed to a vertical surface. Location and details to be approved by the City of Peoria Engineering Department. See Figure 10.4.

![Brass or bronze plate, 3/8" thick, 5" diameter.
Letters shall be 5/16" high, 1/8" wide, 1/32" deep.](image)

Figure 10.4

9. Load Ratings

Load ratings shall be performed on a bridge when one of five events has occurred:

a. The bridge is new and has not been previously rated.

b. The bridge has had a significant alteration that may affect the capacity of the bridge.

c. The bridge has incurred damage that affects the capacity.

d. A key component of the structure has deteriorated such that the previous load rating is no longer valid.

e. A request has been made to permit an overload vehicle to use the bridge.

B. HS-25 Truck Load

HS-25 is the standard design live load until the implementation of LRFD. For the HS-25 loading, "W" in Figure 10.5 shall be 50,000 pounds.
C. Lighting

1. Lighting for roadway and pedestrian walkways shall be included and considered in the design of vehicular structures.

2. Lighting for pedestrians and bicycles shall be considered for both on and below the structure when applicable.

3. The type of lighting fixture and luminaire shall be coordinated with the City.

D. Seismic Design

The Seismic Acceleration Map in AASHTO shall not be used. A map developed for Arizona shall be used for design. It is contained in Report Number FHWA-AZ 92-344. This report may be obtained by contacting ADOT Bridge Technical Section. The City of Peoria falls
under Seismic Performance Category A. Bridges in Seismic Performance Category A do not need to be explicitly designed for seismic forces provided that certain minimum requirements are provided.

1. The connection between the superstructure to the substructure shall be designed to resist a horizontal seismic force in each restrained direction equal to 0.20 times the tributary weight.

2. Structures shall provide minimum bearing seat dimension at the expansion end of girders.

3. No special design requirements for foundations and abutments.

E. Deck Width

The width of a structure is actually determined by traffic and roadway considerations such as the number and size of traffic lanes, the size of shoulders and the type of guardrail to be used. All of the previously mentioned items are not under the influence of the bridge engineer. The bridge width matches the roadway features.

1. For urban locations where MAG or ADOT Type A guardrail and curb is used, the bridge width will equal the width of the approach roadway (Type A guardrail lines up with the edge of the shoulder).

2. For rural locations where MAG or ADOT Type B guardrail is used, the bridge is widened 2’ on each side so the bridge barrier will line up with the guardrail (Type B guardrail is offset 2’ beyond the edge of the shoulder).

See 10-3.L for the bike lane and sidewalk.

F. Length

The bridge length is bound by certain constraints and must be determined by the bridge engineer. Coordination must take place with existing drainage reports and ADMP's, which shall be discussed in the Bridge Hydraulics Report. The Bridge Geotechnical Report shall also be considered.

G. Slope Paving

2:1 slope is the maximum slope to be used without slope paving. However, slope paving may be required for 2:1 slopes per the Bridge Geotechnical Report. If slope paving is required, SD 2.05 shall be used. However, the slope paving required is more than what is shown in the detail. See Figure 10.6 for an example of the required limits of slope paving.
H. **Wing walls**

It is Peoria’s policy to end the wing walls 8’ beyond the theoretical catch point where the abutment slope meets the wing wall.

I. **Bank Protection**

At water crossings, the Bridge Hydraulics Report and Bridge Geotechnical Report will give recommendations for scour and bank protection at the abutments. Consideration should be given to avoid using concrete aprons (slope paving) for bank protection, since the paving can be undermined.

J. **Separation Barriers**

A 32” F-Shape barrier shall be used to separate a sidewalk and vehicular traffic. A separation barrier shall be required on structures with posted speeds of 45 mph or greater. With the use of a separation barrier, the sidewalk on the structure will not be raised. It will be at the same elevation as the deck. The sidewalk drainage will need to be considered when transitioning back to a raised sidewalk beyond the structure.

K. **Concrete Barrier Termination Location**

Concrete barriers shall terminate at the end of the approach slab (or anchor slab) or at the end of the wing wall – whichever is the greatest distance.

L. **Sidewalks and Bike Lanes**

Sidewalks on structures shall match the sidewalk width approaching the structure. The bridge width between edge barriers shall be the roadway width and the sidewalk width plus the separation barrier width. If bike lanes are provided on the roadway cross-section
approaching the structure, the bridge shall provide the same cross-section unless other measures to cross the structure are provided. Any deviation shall be approved by the City of Peoria Engineering Department.

M. Canal Crossings

Consideration shall be given to spanning the canal and the maintenance roads. The intent is to eliminate hazards (blunt barrier ends) created from having the maintenance roads and City roads at the same grade. Design requirements for crossings must be obtained from canal owners with appropriate coordination with the canal owner.

N. Deck Drainage

Bridge decks shall be watertight and all of the deck drainage shall be carried to the ends of the bridge and discharged into appropriate facilities on natural ground at the bridge ends. Vertical profiles shall accommodate drainage requirements. For the case of long structures or unusual geometry, the deck drainage will be evaluated for approval by the City of Peoria Engineering Department.

1. Water flowing downgrade in the roadway gutter section shall be intercepted and not permitted to run onto the bridge.

2. The use of deck drains on vehicular structures into the waterway below shall be avoided. Decks draining into waterways shall only be considered on bridge widenings where the use is in place and existing conditions may limit options.

3. Where a sidewalk of equal elevation is separated from the traffic lanes by a barrier, consideration shall be given to the required drainage collection at the bridge ends during the design stages.

4. The cross slope of the deck shall be a 2% minimum slope. In cases where the existing roadway does not meet the 2% minimum cross slope, the roadway shall be tapered to match the bridge cross slope.

O. Safety

1. Guardrail systems shall meet NCHRP 350 Test Level III (TL-3) criteria. Low-volume roads shall also use TL-3 end terminals and attenuators.
   a. Approved guardrail end terminals are the ET-PLUS and the SRT-350 by Trinity Industries (TL-3). For the ET-PLUS end terminal, the length of need begins from the third post.

2. Attenuator devices shall be redirecting and meet Test Level III criteria.
   a. The approved attenuator is the TRACC (TL-3) attenuator by Trinity Industries.

3. Concrete bridge barriers shall be a minimum of TL-4. ADOT barrier and deck details shall be used. Other barrier and deck systems may be permitted with appropriate test documentation and approval from the City of Peoria Engineering Department.
   a. The approved concrete barriers are the 32“ F-shape (TL-4) and the 42” F-shape (TL-5).
   b. The approved bridge barrier on low volume roads is the steel two-tube rail (TL-4) per the ADOT railing details.
4. Thrie-beam details shall be used to transition from rigid barrier to flexible barrier.

P. Waterproofing

Buried concrete structures shall be waterproofed with a product approved by the City of Peoria Engineering Department. Landscaping irrigation over buried structures shall be cause for special consideration of protection from the effects of water penetration over the life of the structure.

Q. Deck Joints

When an asphalt overlay is placed on a structure, consideration should be given to raising the deck joint and concrete closure pour to match the elevation of the overlay surface.

The opening width for temperature ranges shall be shown on the plans similar to the following table:

<table>
<thead>
<tr>
<th>Mean Temperature Correction Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp (F)</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>90</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>70</td>
</tr>
<tr>
<td>60</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>30</td>
</tr>
</tbody>
</table>

Table 10.2

1. **Strip seals.** The neoprene seal shall be supplied continuous full length without any splices. Typically used for high skews and for movement ratings greater than that for compression seals. Shall not be used for Movement Ratings greater than 4”.

2. **Compression seals.** The guard angles and cellular seal shall be one piece, without splices, for lengths 60 feet or less. For lengths over 60 feet or phase construction, guard angles and cellular seal may be two pieces butted together at the roadway crown or another location away from drainage.

   a. It has been an issue in the past that contractors have had difficulty installing the seals in openings (e_{min}) that are less than 60% of the nominal seal dimension.

   b. For e_{min} = 60% of nominal seal dimension is easy to install.

   c. For example: for a 3 X 3 seal, to install the seal for installation widths less than 1 ¾ “, special equipment is required or it is required that the seal be pre-installed in the guard angles before arriving in the field. The downside of using a greater installation width is that it pushes the compression seal closer to its expansion limits.

   d. Also please note that the temperature referred to is that of the structure, not the air temperature.
e. Solutions:

(1). Try a different size seal.

(2). Install the seal at a temperature for 60% gaps.

(3). Pay to Install correctly.

(4). Install a temporary seal in two pieces and replace in the next cool season.

3. Installation of compression seals. Table 10.3 is an example of the design steps for a 3 X 3 compression seal for a post-tensioned box girder bridge. The following example uses the current ADOT joint details at the time of writing this document and is intended as an aid for compression seal design and acceptance for structures in the City of Peoria:

<table>
<thead>
<tr>
<th>Task</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Find the contributory span length along the bridge construction centerline.</td>
<td>- Please note that in a 3 span continuous structure the center of no movement will be closer to the pier with the shorter columns.</td>
</tr>
<tr>
<td>Find the total temperature movement (30°F – 100°F in Peoria). 30°F temperature rise and 40°F temperature fall.</td>
<td></td>
</tr>
<tr>
<td>Find the creep and shrinkage movement.</td>
<td></td>
</tr>
<tr>
<td>Multiply the Temperature and Shrinkage movement by the COSINE of the skew to find the perpendicular distance.</td>
<td></td>
</tr>
<tr>
<td>Look up the compression seal information in the ADOT standards.</td>
<td>- Given and always constant for 3 X 3:</td>
</tr>
<tr>
<td></td>
<td>- Movement Rating (Mr) = 1 3/8&quot;</td>
</tr>
<tr>
<td></td>
<td>- e = 1 7/8&quot;</td>
</tr>
<tr>
<td>Minimum width of seal is 1 7/8&quot; – (1 3/8&quot; / 2) = 1.188&quot;. The maximum is 2.563&quot;. The seal will not work outside of this range.</td>
<td></td>
</tr>
<tr>
<td>Find the temperature rise: (30°F/70°F) X total temperature movement. Round up – when added to 1.188&quot; this gives the installation width at 70°F.</td>
<td></td>
</tr>
<tr>
<td>Subtracting the temperature rise from the installation width will give the minimum gap width and should be above 1.188&quot;. (This does not include the post-tensioning long term shrinkage which has not occurred yet.)</td>
<td></td>
</tr>
<tr>
<td>Adding the temperature fall [(40°F/70°F) X the total temperature movement] and the long term post-tensioning shrinkage to the installation width will give the maximum gap width, which should be less than 2.563&quot;. Therefore the seal works.</td>
<td></td>
</tr>
<tr>
<td>For further refining, the minimum gap width will be set at 1 ¼&quot; at 100°F for a 3 X 3 seal.</td>
<td></td>
</tr>
<tr>
<td>Total temperature movement divided by 7 (30°F – 100°F) will give the change per every 10°F.</td>
<td></td>
</tr>
<tr>
<td>Add the change to 1 ¼&quot; to find the gap width for each 10°F temperature change.</td>
<td></td>
</tr>
<tr>
<td>This sets the seal at the minimum gap end of the compression seal; it ensures that the seal will not get too close to its expansion limit at 30°F or less. This is ideal.</td>
<td></td>
</tr>
</tbody>
</table>

Table 10.3
R. **Determination of Thalweg Policy**

a. Find the approximate slope of the thalweg. See Figure 10.8.

b. For each shaft location (A, B, C, D) find the corresponding elevation along the thalweg slope line by determining where it intersects at a right angle as shown in the diagram.

c. Subtract the given scour depth from the thalweg slope line elevation corresponding to each shaft location. This will give the depth of soil removed from the shaft for the scour design.

![Figure 10.8](image)

**10-4 SUBMITTAL CHECKLISTS STRUCTURES**

All submitted bridge and structure plans shall conform to the following:

A. **General Submittal Requirements for Developers and City projects**

Developers shall submit a Bridge Selection Report (BSR) when public funds are involved; otherwise, the BSR is not required.

1. **Bridge Hydraulic Report** - Scour analysis must be completed for “design flood” and “check flood for scour” cases. See the AASHTO LRFD Specifications.

2. **Geotechnical Report** - At least one boring per foundation unit - more as required by AASHTO. Depth and location of borings shall follow requirements by AASHTO.

3. **Bridge Selection Report** - At least three types of structures shall be evaluated in the Bridge Selection Report.

4. Quantity calculations and estimated costs.
5. Survey to establish topographic mapping; locate significant features; define width and profile of canal or channel; and to establish ties to section corners, benchmarks, etc.

6. Cross sections, if needed for earthwork volumes calculations.

7. Hard and electronic copies of all non-MAG and non-ADOT standards.


9. Electronic submittal of plans in City of Peoria format for final submittal.

10. Calculations.

5. **Minimum Plan Requirements**

   In general, the bridge sheets shall be arranged as shown below:

   1. General Plan
   2. Location Plan
   3. General Notes and Approximate Quantities Table
   4. Bank Protection Sheets
   5. Foundation Layout
   6. Abutments
   7. Piers
   8. Bearings
   9. Girder Layout and Elevation
   10. Girder Details
   11. Deck and Approach Slab Details
   12. Pour Sequence and Negative Moment Reinforcing Details
   13. Screed Elevations at tenth points
   14. Foundation Data Sheets

6. **Specific Requirements for General Notes and Approximate Quantities Table.**

   1. For repair work or replacement, a description of the original project and all modifications with construction dates shall be given on this sheet.

   2. For LRFD projects, the Design Specifications shall refer to the latest LRFD Specifications and the Loading Class shall be HL-93. Load ratings shall use the LRFD Method.
3. Minimum Requirements for a Prestressed Concrete Bridge

GENERAL NOTES:
Dead Load – Dead Load allowance of 25 pounds per square foot for wearing surface.
The Bridge Design has an assumed dead load of 16 pounds per square foot for the stay-in-place deck forms and additional concrete needed for Deck Option.
Loading Class – HS25-44
Composite Design – Dead load carried by girders only. Girders are designed with transformed section properties.
Seismic Performance Category A (Acc = x.xxg).
Inventory Rating HS – xx.xx
Operating Rating HS – xx.xx
All concrete shall be Class “S” unless noted otherwise.
Reinforcing steel shall conform to ASTM Specification A615. All reinforcing shall be furnished as Grade 60.
All bends and hooks shall meet the requirements of AASHTO Article 8.23. All bend dimensions for reinforcing steel shall be out-to-out of bars. All placement dimensions for reinforcing steel shall be to center of bars unless noted otherwise.
All Reinforcing steel shall have 2 inch clear cover unless noted otherwise.
Stresses:
    Superstructure except barriers…fc = 4500psi
    Deck                          fc = 1400psi
    Barriers……………………………fc = 4000psi
    Abutments and Piers……………fc = 3500 psi
    Drilled Shafts……………………f'c = 3500psi
    Grade 60 transverse deck reinf……fs = 20000psi
    All other Grade 60 reinf. Steel……fs = 24000psi
    Prestressing steel………………..f's = 270000psi
(1/2” diameter 7-wire Low Relaxation Strand)
Barriers shall be constructed after spans have taken dead load deflection. Barriers shall not be slip formed.
Chamfer all exposed corners ¾” unless noted otherwise.
Dimensions shall not be scaled from drawings.
The cost of stay-in-place forms is incidental to the cost of deck concrete. Approximate deck concrete quantities are based on the removal forms option. No payment will be made for any additional concrete necessary for the stay-in-place metal deck forming system.
Structure Number: xxxx
STANDARDS LIST:
Bridge group SD Drawings: SD 1.01, SD 1.02, etc.

ADDITIONAL NOTES FOR STEEL BRIDGES

WELDING CODE:
All welding shall conform to the requirements of the American Welding Society.
ANSI/AASHTO/AWS D1.5-02 Bridge Welding Code.

STEEL CVN IMPACT TEST NOTE:
Main span truss components including top chords, bottom chords verticals, diagonals, lateral braces, gusset and connection plates shall meet the Longitudinal Charpy V-Notch Impact Values, Specified in Section 604-2.01 of ADOT Standard Specifications.
Steel A36…………………………….f's = 20000psi
Structural Steel Grade 50W………..f's = 27000psi
Structural steel shall be Weathering Class ASTM A709 Grade 50W.
All bolts shall conform to ASTM Specification A325. All bolts, nuts and washers shall be Type III corrosion resistant weathering steel grade.
All bolted connections shall be Type X (Thread excluded from shear plane).
4. **Minimum Requirements for a Concrete Box Culvert (OR Retaining Wall)**

**GENERAL NOTES:**
Loading Class – HS25-44
Seismic Performance Category A (Acc = x.xxg).

Inventory Rating HS – xx.xx
Operating Rating HS – xx.xx

All concrete shall be Class “S” unless noted otherwise.
Reinforcing steel shall conform to ASTM Specification A615. All reinforcing shall be furnished as Grade 60.

All bends and hooks shall meet the requirements of AASHTO Article 8.23. All bend dimensions for reinforcing steel shall be out-to-out of bars. All placement dimensions for reinforcing steel shall be to center of bars unless noted otherwise.

All Reinforcing steel shall have 2 inch clear cover unless noted.

**Stresses:**
- Concrete................. f'c = 3500 psi
- Grade 60 reinforcing steel... fs = 24000 psi

**Barriers shall be constructed after spans have taken dead load deflection. Barriers shall not be slip formed.**

Chamfer all exposed corners ¾” unless noted otherwise.
Dimensions shall not be scaled from drawings.
Structure Number: xxxx

5. **Minimum Requirements of an Approximate Quantities Table**

<table>
<thead>
<tr>
<th>APPROXIMATE QUANTITIES</th>
<th>STRUCT. EXCAV. C.Y.</th>
<th>STRUCT. BKFILL. C.Y.</th>
<th>CLASS “S” CONCRETE F’C = 3500 PSI C.Y.</th>
<th>CLASS “S” CONCRETE F’C = 4500 PSI C.Y.</th>
<th>REINF. STEEL LBS.</th>
<th>AASHTO TYPE VI MOD. GIRDERS L.F.</th>
<th>60” DIA. DRILLED SHAFTS IN SOIL L.F.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abutment #1</td>
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<td>Pier #1</td>
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<td>Abutment #2</td>
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<td><strong>AS-BUILT</strong></td>
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</tbody>
</table>

Deck Joint Assembly
- (3 X 3 Compression Seal): L.F.
- 32” F-Shape Concrete Barrier: L.F.
- Slope Paving: S.F.
- Approach Slab: S.F.
- Fixed Cable Restrainers: Ea.
- Expansion Cable Restrainers: Ea.
7. **Plan Submittals for Capital Division Projects**

Due to the complexity and expense of larger structures, the City shall require that the standard submittal stages of 30%, 60% and 90% be adhered to. This allows time for City review and comments, as well as finalization of geotechnical and drainage reports and their incorporation into the plans and design.

**Typical Submittal Stages**

**30% Submittal**
- General Plan
- Bridge Selection Report
- Detailed Cost Estimate
- Final Bridge Geotechnical Report
- Final Bridge Hydraulics Report

**60% Submittal**
- 60% Bridge Plans
- Superstructure completed
- Boring logs completed
- Substructure started
- Draft Bridge Special Provisions
- Detailed Cost Estimate including all bid items and units costs
- 60% Design Calculations

**90% Submittal**
- 90% Bridge Plans
- Final Special Provisions
- Final Cost Estimate
- Final Design Calculations

**100% Submittal**
- All project components as listed above, revised per 90% review comments. Structural calculations signed and sealed (assumed to be final).

**Final Submittal**
- Signed and sealed mylars of Project Plans and electronic files of all plans in City of Peoria format.
- Signed and sealed hard copy of construction Special Provisions accompanied by the electronic file in the City of Peoria accepted format.
- Record of QC review.

10-5 **AESTHETICS**

Structures addressed in this section include the following: bridges, retaining walls, traffic barriers, safety and pedestrian rails, lighting and fencing. The design of visible parts of the structures plays an important role in the aesthetic experience of the driver.
A minimum of 2% of the total structure cost shall be used towards aesthetic treatment to the structure upon review and approval by City Engineering Staff.

The City of Peoria has adopted the following 10 guidelines:

A. Select appearance standards for structures in accordance with the classification of the roadway.

<table>
<thead>
<tr>
<th>PARKWAY</th>
<th>PRINCIPAL ARTERIAL</th>
<th>MINOR STREETS</th>
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</thead>
<tbody>
<tr>
<td>HIGH STANDARDS</td>
<td>MODERATE STANDARDS</td>
<td>MINIMAL STANDARDS</td>
</tr>
<tr>
<td>(ECONOMICAL)</td>
<td></td>
<td>(ECONOMICAL)</td>
</tr>
</tbody>
</table>

B. Integrate roadway structures with one another, with the adjacent landscape, and with the characteristics of the local area or community in which they are placed.

1. Incorporate local materials, color, landscaping or symbols to make the roadway more responsive to the local community.

2. Consider integrating lighting with adjacent terrain and vegetation.

3. Bridges and retaining walls should retain the existing vegetation and adjacent earthworks.

4. Design roadway structures as an integrated system – reduce the number of elements where possible. Combine wall and safety handrail design. Combine light standard and wall design. Standard Details should be avoided, except for required safety features.

C. Locate fill-reducing structures such as bridges or walls where aesthetic impacts of large cut/fill areas are unacceptable.

1. Install bridges rather than culverts when economics allow to maintain an open channel space or to reduce the undesirable appearance of large earthwork.

D. Consider the proportion of the structure in relation to the size of the space it is situated in.

1. Avoid structures that would appear too large. (For example, use twin structures rather than one large single structure.)

E. All structures shall be of bold, simple form.

1. Overall shape should be simple.

2. Should give appearance of strength and solid form.

3. Avoid use of angular, triangular or pointed forms – only when the intent is to attract the attention of the driver. These structures will appear “hard”.

4. Curvilinear or rounded structures will appear “soft” – this is more desirable.

F. Select the color of the finish to meet the aesthetic objectives of the structure.

1. Create a color scheme for a route in its entirety.

2. Blend structures into the background landscape.

3. Alternatively, contrast structural landmarks with background landscapes.
4. Color additives to concrete are preferred over painted concrete.

G. Provide a textured finish to visible structures to avoid large blank faces.
   1. Provide textured surfaces or finishes to large flat surfaces in the view of motorists.
   2. Finish should respond to materials and texture type of local landscape or theme.
   3. Use City logos or symbols.

H. Design structures to be of unified visual character within a local area or route.
   1. Design unity is gained from repetitive use of materials, textures and color.
   2. Design all custom elements with the same idea of unity.
   3. Choose a dominant form and repeat through structure.
   4. Use subordinate elements as design accents.

I. Include accent elements in the design of significant structures.
   1. Use accents to contrast the components of a structure to draw the eye of the motorist.
   2. Avoid too many accents. This will lead to confusion.
   3. Examples include: entrance pillars at bridges, handrail elements, caps on retaining walls.

J. Design roadway structures in concurrence with the guidelines for each type of structure.
   1. Bridges
      a. Design of traffic barriers on a bridge should give a visual clue that the driver is on a bridge.
      b. Handrails and barriers will be the most visual vertical elements on the bridge.
      c. Separated structures should be designed similar.
      d. Bridges should be simple and bold.
      e. Lighting – consider low glare, uplighting that is integrated with the structure.
      f. Design accent features at entrance points and midpoints.
      g. Slope paving, maintenance, and landscaping.
   2. Retaining walls
      a. Integrate walls with adjacent structure(s).
      b. Custom design walls to suit the adjacent land, features and vegetation.
      c. The location of the wall shall not detract from the visual aesthetics of the roadway. Walls should not dominate the field of vision of a driver.
3. Traffic barriers
   a. Keep at a minimum required for safety.
   b. Consider custom features.

4. Hand rails
   a. Consider shapes that are pleasing to touch.
   b. Should be an Integral design with each structure – do not use standard detail for all structures (They can appear as though they were an add-on or after-thought – railings should be integral with the structure).

5. Fencing
   a. Avoid the use of chain link fence. Do not use a standard.

6. Light Poles
   a. Custom shapes should be used. Do not use a standard.

This document is adopted and modified from the Manual of Aesthetic Design Practice of British Columbia.

10-6 COMMENTARY

10-3 For roadways on deep fill material, 25’ approach slabs shall be considered.

10-3.A.8 The identification number is for the purposes of inspection and inventory. Any structure identified as meeting the definition of a “bridge” and accepted into the City’s inventory must be regularly inspected by the City of Peoria. The condition reports are compiled by the City and the federal government. Structures identified by the condition reports as being deficient and functionally obsolete structures are to be maintained by the City are eligible for federal rehabilitation or replacement funds.

10-3.A.9 The legal gross vehicle weight is 80,000 pounds; 20,000 pounds on a single axle; and 34,000 pounds on a tandem axle. For further information, see the FHWA website explaining the Federal Bridge Formula B (BFB).

10-3.O NCHRP Report 350 establishes six test levels (TLs) for longitudinal barriers:

TL-1, TL-2, and TL-3 require successful tests of an 820-kg car impacting a barrier at 20 degrees, and a 2,000-kg pickup truck impacting a barrier at 25 degrees, at speeds of 50 km/h, 70 km/h, and 100 km/h, respectively.

TL-4 adds an 8,000-kg single-unit truck at 15 degrees and 80 km/h to the TL-3 matrix; TL-5 substitutes a 36,000-kg tractor/van trailer for the single-unit truck. TL-6 substitutes a 36,000-kg tractor/tank trailer.
The TRACC attenuator has lower maintenance and upkeep costs. MCDOT has approved the TRACC attenuator.

The ADIEM attenuators shall be avoided adjacent to pedestrian traffic. The ADIEM attenuators can be easily damaged by kicking. They also require more maintenance on a periodic basis.

MCDOT has approved only the ET-PLUS (formerly the ET-2000) and the SRT-350 guardrail end terminals for use.

MCDOT requires TL-3 end terminals even on low-volume roads.

CONSTRUCTION NOTES
For AASHTO girder bridges at fixed piers, the pier diaphragm must be shown on the plans as being poured monolithic with the deck pour. There have been cases where the girders “pull out” from the diaphragms at fixed piers not poured monolithic.