REQUEST FOR PROPOSALS

UTAH DEPARTMENT OF TRANSPORTATION

I-15 CORE

Project No. MP-I15-6(178)245

PART 1: GENERAL PROVISIONS

RFP
June 16, 2009

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14. Structures

14A. General

Conduct all work necessary to meet the requirements of this section, and satisfy all functional needs and characteristics of the Work, including bridges, culverts, walls, and sign supports.

14B. Standards

Design and construct the structures in accordance with the requirements of the standards listed by priority in Table 14B-1.

14B - 1. Prioritization Table

TABLE 14B - 1
STANDARDS FOR STRUCTURES

Priority	*Author or Agency*	*Title*
1	UDOT	Special Provisions Included in Exhibit A
2	UDOT	*Supplemental Specifications to 2008 Standard Specifications for Road and Bridge Construction*
3	UDOT	*2008 Standard Specifications for Road and Bridge Construction* *Supplemental Drawings to 2008 Standard Drawings for Road and Bridge Construction*
4	UDOT	*2008 Standard Drawings*
5	AASHTO	*AASHTO Load Resistance Factor Design (LRFD) Bridge Design Specifications* (Customary U.S. Units)
6	AASHTO	*Guide Specification for LRFD Seismic Bridge Design*
7	AASHTO	*Standard Specifications for Highway Bridges*
8	AASHTO	*Guide Specifications for Horizontally Curved Steel Girder Highway Bridges*
9	AASHTO	*A Policy on Geometric Design of Highways and Streets*
10	AASHTO	*Guide Specifications for Design and Construction of Segmental Concrete Bridges*
11	AASHTO	*Guide Specifications for Design of Pedestrian Bridges*
12	AASHTO	*Guide Design Specifications for Bridge Temporary Works*
13	AASHTO	*Standard Specifications for Highway Signs, Luminaries and Traffic Signals,*
14	AASHTO / AWS	*Bridge Welding Code*, D1.5M/D1.5: 2002
15	AASHTO	*Guide Manual for Condition Evaluation and Load Resistance Factor Rating (LRFR) of Highway Bridges*
16	AREMA	*Manual for Railway Engineering*
17	UPRR	*Guideline for Design and Construction of Grade Separation Underpass Structures*

14C. Requirements

Except as noted below, provide all new structural components necessary for a complete and functional system that meets the following performance requirements:

- Provide functionality, durability, ease of maintenance, safety, and aesthetics
- Design all permanent structures for a 75-year service life per AASHTO and in accordance with seismic requirements
- Provide a surface smoothness for bridge decks and approach slabs in accordance with Standard Specification 01452 (Pavement Smoothness)

South of the Provo Center Street interchange, the existing bridges may be widened and rehabilitated. Design and construct widened and rehabilitated bridges for a 25-year service life and in accordance with AASHTO seismic requirements.

14C - 1. Design Criteria

Design structures in accordance with AASHTO *LRFD Bridge Design Specifications*, except as otherwise noted herein. In addition, design structures carrying, adjacent to, or over railroad tracks in compliance with the requirements of the American Railway Engineering and Maintenance-of-Way Association (AREMA) and other railroad-specific requirements.

In all retaining wall designs, address internal stability, external stability, liquefaction, and seismic loading.

14C - 2. Loads and Forces

Provide all structures that comply with the structure loads and forces in the AASHTO LRFD Bridge Design Specifications or the AASHTO design specification applicable to the structure type.

- Live Loads: HL-93.
- Dead Loads: Add a unit dead load of 35 pounds per square foot (psf) to all bridge structures for future overlays.
- Wearing Surface: Include a 0.5-inch initial sacrificial wearing surface;
- Load Rating: Load-rate all bridges using methods described in the AASHTO *Guide Manual for Condition Evaluation and Load Resistance Factor Rating of Highway Bridges.* All structures shall have a final inventory-load rating greater than or equal to 1.00 for HL-93 loads. Place both inventory and operating ratings on the first sheet of the bridge Situation and Layout Sheet.
- Uplift: Proportion the bridge spans to avoid uplift at supports due to non-seismic loads. Account for the presence of uplift at the ends of all continuous girders, particularly with light rolled beams or short end spans.
- Thermal Forces: Design for moderate-climate temperature ranges in accordance with AASHTO *LRFD Bridge Design Specifications.*
- Earthquake Response: Design all bridges for seismic forces resulting from an earthquake response corresponding to 7 percent exceedance in 75 years in accordance with the AASHTO *Guide Specification for LRFD Seismic Bridge Design.* Check critical and essential bridges for collapse for seismic forces resulting form an earthquake response corresponding to 3 percent exceedance in 75 years.

14C - 3. UDOT Structure Numbers

Obtain from the Department Structures Division a UDOT structure number for each permanent bridge, retaining wall, overhead sign structure, and major drainage structure such as a box culvert or headwall. Modifications of existing structures also require a new UDOT drawing

number. Cast the structure number into the structure concrete in accordance with standard Department details.

14C - 4. Plan Organization and Content

Provide structure design plans that comply with the following:

- Provide all design details necessary to construct the structure, including conduit, inserts, and attachments, the location of lighting fixtures attached to the structure, and approach slab drains. For structures where design details are developed and provided by a supplier (such as mechanically stabilized earth [MSE] retaining walls and structural plate arches), include the supplier's design drawings as part of the final structure plan set.
- Use the standard Department Structures Division border and title block on all plan sheets. Replace the State Bridge Engineer signature with the signature of the Design-Builder's Structure Design Manager. Supplier-detailed drawings included in the final plan set may use the supplier's border and title block.
- Provide Situation and Layout plan sheets for all bridges, box culverts and rigid frame drainage structures, retaining walls, and noise walls. Provide Situation and Layout plan sheets that meet the requirements in the "Situation and Layout Sheet Requirement Check List" included in Part 6—Engineering Data.
- Separate the structure plan sheets from all other discipline sheets in the plan set and organize them by UDOT structure number.
- When corridor standard plans are used to replace details typically included in the structure plan set, include the applicable corridor standard plan sheets with each structure plan set and list them in the Index of Sheets on the Situation and Layout Sheet.
- Include in the bridge plan set a soil-boring location plan and the soil-boring logs used in the geotechnical design of the bridge.
- Organize the plan sheets in the bridge plan set in the general order of construction.
- Include in the final retaining wall plan set a location plan showing the location of all retaining walls pertaining to the structure number. Include for each individual retaining wall the situation and layout plans prepared by the designer and the detailed drawings prepared by the wall supplier. Include aesthetic treatment in supplier drawings.
- Place as-built quantities on the first sheet of the Structure Situation and Layout for End-of-Project submittals.

14C - 5. Design Calculations

14C - 5.1. Organization

Organize the final design calculations and independent review calculations as follows:

- Title page with bridge number, bridge name, "Design Calculations" or "Independent Review Calculations," designer's name and professional engineer (PE) stamp
- Table of contents
- Signed and stamped Design QC/QA Certification Forms for Structures

- Seismic Strategy Memorandum
- List of any deviations from Project design criteria
- The appropriate code references, as necessary
- References to computer programs, with appropriate code section indicated
- Computer documentation, including program name, vendor, version, and release date
- Bridge Load Rating Report and calculations

14C - 5.2. Paper and Numbering

For handwritten calculations (both handwritten and computer-generated) and sketches, use standard letter-sized paper.

Number all pages with a numbering scheme that covers the entire set of calculations for each volume.

14C - 6. Materials

14C - 6.1. Concrete

Structural Components: For concrete in structural components, meet the following minimum requirements:

- Cast-in-Place Concrete: Class AA(AE) in compliance with Standard Specification 03310 (Structural Concrete)
- Precast Concrete: Class AA(AE) in compliance with Standard Specification 03310 (Structural Concrete); Type III cement may be used.
- Prestressed Concrete: Class AA(AE) in compliance with Standard Specification 03412 (Prestressed Concrete).
- Bridge Decks and Approach Slabs: Class AA(AE) in compliance with Standard Specification 03310 (Structural Concrete).
- Filling Postholes of Post-and-Panel Noise Walls: Class B(AE).
- Piles, Drilled Shafts, and Slope Protection: Class A(AE).
- All Other Bridge, Box Culvert, Wall, and Barrier Components: Class AA(AE).

Concrete Decks: Use Department AA (AE) concrete with the following additional requirements as outlined in this section.

- Fly Ash and or Silica Fume are traditionally acceptable by the Department as pozzolans used for cement replacement. Use of other pozzolans require Approval by the Department prior to mix design submittal. Limit the use of silica fume to 5 percent of total weight of cementitious material.
- Limit the water-to-cementitious material ratio to 0.4.
- Limit concrete shrinkage to 500 microstrain based on ASTM C490, "Determination of length of Change of hardened Cement Paste, Mortar, and Concrete".

Sealing:

- Seal all bridge columns, bent caps, abutment seats, and parapets in compliance with Standard Specification 03392 (Penetrating Concrete Sealer).

Strength:

- Minimum Specified Concrete Strengths in compliance with Standard Specifications 02861 (Precast Retaining/Noise Walls), 03055 (Portland Cement Concrete), 03310 (Structural Concrete), and 03412 (Prestressed Concrete)
- Maximum Specified Concrete Strengths for Design:
  - Cast-in-place: f'c = 5 ksi
  - Pre-stressed: f'c = 10 ksi.
  - Lightweight: f'c = 5 ksi

14C - 6.2. Prestressing Steel

For prestressing steel in structural components, meet the following requirements for minimum spacing of prestressing steel strands:

- For 0.6-inch strands: 2 inches
- For 0.5-inch strands: 1.75 inches

Use low-relaxation strand meeting AASHTO M203 Grade 270 from plants certified by the Precast/Prestressed Concrete Institute (PCI).

Design prestressed concrete members using AASHTO losses and without transforming reinforcing or prestressing steel.

Debonding of prestressing strands is allowed; however, do not debond more than 25 percent of the total strands or more than 40 percent in any row.

14C - 6.3. Post-Tensioning Steel

For post-tensioning steel in new structural components, provide corrosion protection consisting of grout-filled galvanized or nonmetallic ducts; use a prepackaged grout that contains a minimum of 5 percent silica fume by weight of cementitious materials.

Unbonded and external tendons may be used on rehabilitation projects with the Department's Approval.

14C - 6.4. Reinforcing Steel

For reinforcing bars in structural components, meet the following requirements:

- Use reinforcing steel conforming to AASHTO M31 (Fy=60 ksi), except as noted below.
- For substructure elements, including internal bent caps where design load will exceed elastic limits and where plastic hinges may form, use steel deformed bars conforming to ASTM Designation A706.

- Use bars that are uncoated corrosion resistant, hot-dip galvanized after fabrication, or epoxy-coated, per Standard Specification 03211 (Reinforcing Steel and Welded Wire), except for bars used in caissons or piles.
- For minimum concrete cover, comply with AASHTO LRFD Bridge Design Specifications, except as follows:
  - For concrete exposed to weather, use a minimum cover of 2 inches with an allowable construction tolerance of (+) 0.25 inch.
  - In decks that do not use an initial concrete bridge deck overlay (2 inches), use a minimum cover of 2.5 inches to top bars with an allowable construction tolerance of (+) 0.25 inch.
  - In decks that do use an initial concrete bridge deck overlay (2 inches), use a minimum cover of 1.5 inches to top bars with an allowable construction tolerance of (+) 0.25 inch.
  - For bridge decks that require grinding, use a minimum cover of 2.5 inches after grinding.

14C - 6.5. Structural Steel

- For structural steel, use AASHTO M270, Grade 36, Grade 50, or Grade 70 and paint in accordance with Standard Specification 05120 (Structural Steel). Weathering steel may be used over a stream with a vertical clearance greater than 8 feet over moving water, with a vertical clearance greater than 8 feet over the design water surface elevations and with a vertical clearance greater than 10-foot over stagnant sheltered water. Ensure that the girders can air-dry from any water spray or high-water events.
- The maximum change in thickness or gross cross-sectional area of any web or flange plate at any splice is a factor of two.
- Use the welding details and requirements shown on "Steel Details" included in Part 6—Engineering Data. When using unpainted weathering steel, paint girder ends and expansion bearings a minimum of 1.5 times the girder depth; and provide drip plates at the low side of all deck expansion joints for all girders and at the high side of all abutments and bents for exterior girders.

14C - 6.6. Steel Plate Size Parameters

The minimum plate dimensions for new structural steel are as follows:

- Thickness of any steel girder flange plate: 1 inch
- Thickness of any steel plate or shape to which shear studs are welded: 0.5 inch
- Thickness of any girder stiffener or web plate: 0.375 inch
- Minimum width of any girder flange: 10 inches
- Bottom flange of steel plate girders: Constant width per frame

Provide shear connectors that penetrate at least 3 inches into the slab and are not less than 3 inches from the top of the slab. Do not place shear studs on splice plates, except to comply with AASHTO minimum spacing requirements. Extend shear studs the full

length of the girders and support diaphragms to help transfer seismic forces to the supports.

On new structures, do not use cover plates, pins, or hangers.

Do not field-weld to girders without Department approval, except for bearing sole plates.

Provide steel diaphragms at the centerline bearing of abutments.

For structural steel field splices, use direct-tension indicator washers; follow Standard Specification 05120 (Structural Steel).

For all miscellaneous steel items, permanently cast into structural concrete elements, use either galvanized stainless steel or approved coatings.

14C - 7. Bridges

14C - 7.1. Bridge Geometry

Cut-and-Fill Slopes: Limit the steepness of all cut-and-fill slopes adjacent to bridges to 1.5:1 (horizontal:vertical). Slopes 2:1 and steeper require concrete slope protection. For new bridges, place a 2-foot level area between the top of slope and the front of the abutments to facilitate inspection access.

Horizontal Clear Spans: At a minimum, provide the clear span shown in Part 5—Contract Drawings, "Structure Span and Clearance and Typical Sections."

Vertical Clearances: At a minimum, provide the following vertical clearances for all new structures:

- Highway grade separations: As shown in Part 5—Contract Drawings, "Structure Span and Clearance and Typical Sections."
- Bridges over railroads: 23.50 feet
- Nonredundant structural elements at highway and railroad grade separations, including post tensioned (P/T) bent caps: An additional 1.00 feet
- Pedestrian overpass structures: 17.50 feet
- Bridges over rivers: Provide a 2.0-foot minimum freeboard clearance at Q_{50} or provide 1.0-foot minimum freeboard clearance at Q_{100}, whichever is greater.

Bridge Supports: Protect all bridge supports from vehicular collision as required by AASHTO LRFD Bridge Design Specification. When determining the required horizontal distance between a roadside barrier and bent columns and caps, account for barrier deflection and the potential for trucks with a high center-of-gravity to lean over the barrier, as described in the AASHTO Roadside Design Guide.

Curved Bridges: Design horizontally curved bridges in accordance with the AASHTO Guide Specifications for Horizontally Curved Highway Bridges. Where practical, locate supports radially for curved structures.

Bridge Skew: Where practical, design the bridge with a maximum bridge skew less than or equal to 30 degrees. Bridges skewed more than 45 degrees require either a finite element or grillage method of analysis.

Bridges with Median Parapet: Where a bridge includes a median parapet, provide a longitudinal joint in the center of the median parapet to separate the cross-section into two bridges.

14C - 7.2. Bridge Type

The following bridge types may be used:

- Prestressed concrete I-girders with a cast-in-place concrete deck
- Structural steel I-girders with a cast-in-place concrete deck

The Department uses large quantities of salt and de-icing chemicals in the winter, which accelerate corrosion of bridge structures; address this concern in bridge design and construction.

Incorporate as few deck expansion joints as possible. Make bridges continuous over supports, and use integral or semi-integral abutments wherever possible. When expansion joints are required, locate them at supports.

14C - 7.3. Seismic Requirements

Perform all seismic design of bridges in accordance with the *Guide Specification for LRFD Seismic Bridge Design.*

The following defininitions and criteria apply to all bridges:

Earthquake Response Critical Bridge

Definition – Operational with little or no damage after the design seismic event.

Seismic Design Criteria – Provide critical bridges that meet the criteria in the *Guide Specification for LRFD Seismic Bridge Design* requiring the bridge to be Fully Operational for the seismic forces resulting from the earthquake response corresponding to 7 percent exceedance in 75 years.

Fully Operational shall mean:

- Inelastic response may not occur resulting in reinforcement yielding and yielding of structural steel. Only minor spalling of cover concrete may occur.
- The extent of damage shall be sufficiently limited such that the structure can remain open and be restored essentially to its pre-earthquake condition without replacement of reinforcement or replacement of structural members.
- Areas of damage must be visible and easily accessible. Repairs shall not require closure.
- The structure shall remain open with all lanes of traffic.

Check critical bridges for collapse from the earthquake response corresponding to 3 percent exceedance in 75 years.

Earthquake Response Essential Bridge

Definition – Bridges that must remain open to emergency traffic immediately after a seismic event and must be repairable after the design seismic event, and non-conventional bridges as defined by C3.1 of the *Guide Specification for LRFD Seismic Bridge Design.*

Seismic Design Criteria – Provide critical bridges that meet the criteria in the *Guide Specification for LRFD Seismic Bridge Design*, requiring the bridge to be Repairable for the seismic forces resulting from the earthquake response corresponding to 7 percent exceedance in 75 years. Check critical bridges for collapse from the earthquake response corresponding to 3 percent exceedance in 75 years.

Repairable shall mean:

- Inelastic response may occur resulting in concrete cracking, reinforcement yielding, minor spalling of cover concrete, and minor yielding of structural steel.
- The extent of damage should be sufficiently limited such that the structure can remain open and be restored essentially to its pre-earthquake condition without replacement of reinforcement or replacement of structural members.
- Areas of damage should be visible and easily accessible. Repairs should not require closure.
- The structure shall remain open to emergency traffic.

Earthquake Response Non-critical/Non-essential Bridges

Definition – All non-critical and non-essential bridges.

Seismic Design Criteria –Provide non-critical, and non essential bridges that meet the criteria in the *Guide Specification for LRFD Seismic Bridge Design* for life safety for the seismic forces resulting from the earthquake response corresponding to 7 percent exceedance in 75 years.

Bridge Definitions

The following bridges are classified as Critical Bridges

- Bridges over or under 500 East in American Fork
- Bridges over or under 800 North in Orem
- Bridges over or under Center Street in Provo
- Bridges over or under Draper Lane in Provo

The following bridges are classified as Essential Bridges

- Non-standard bridges

All other bridges are classified as Non-critical and non-essential bridges
Develop a seismic strategy for each bridge type. Include descriptions of expected damage, the locations of plastic hinging, the redistribution of forces, the mobilization of backfills, and the function of bearings, as appropriate.

14C - 7.4. Inspection Access

All bridge superstructures, expansion joints, backwalls, enclosed compartments, and bearings shall be accessible for long-term inspection by direct viewing. All expansion joints shall be accessible for direct viewing from the underside of the joint. For expansion joints at abutments, provide inspector access between the end diaphragm and the backwall to allow inspection of the backwall and the underside of the expansion joint by direct viewing.

All open-framed superstructures shall be accessible with walkways or ladders, or by use of a snooper truck. When the bridge crosses a river or railroad tracks or cannot be reached by a 25-foot ladder, provide clearances for the snooper truck. Provide a cable anchorage system to facilitate inspections when elements subject to inspection cannot be accessed using a 25-foot ladder. When the snooper truck is to be used for inspection, the total height of the parapet and fencing must be 10 feet or less.

Box girders with an inside depth of 5 feet or more require access through the box girder for interior inspection. In all box girders, provide an opening that is at least 3 feet by 3 feet, has a hinged metal door that swings into the box girder, and has a removal bolt for locking. Where required, provide a method of ladder support for inspection access. Prevent public access behind the diaphragms on seat-type abutments. Use a chain link type fence between the exterior girders and cheek walls with an access gate that has a removal bolt for locking.

14C - 7.5. Bridge Components

Bridge Parapets. Provide bridge parapets that are in compliance with roadway requirements. Use a 42-inch-high, single-slope parapets on bridges and approach slabs. Height shall be measured from top of bridge deck overlay to top of parapet. Transition to roadway barriers on the roadway section, not on the approach slabs. On bridges over railroads, provide chain link fence that is in compliance with railroad standards. The minimum height of the fence shall be 8 feet from top of deck overlay or sidewalk for curved top, or 10 feet from top of deck overlay or sidewalk for a straight top. Use fencing details from the Department Structures Division's Design and Detailing Standards, Standard Drawing FG6, "Chain Link Fence." Provide one 3-inch and one 1.5-inch spare conduit in each outside parapet on all bridges. For bridges that carry mainline I-15 traffic, a minimum test level criteria will be TL-4. For all other, use a minimum test-level criteria of TL-3 for bridge and approach railings (parapets). All parapets and pedestrian railings shall be designed in accordance with AASHTO LRFD.

Approach Slabs: At the end of each bridge, provide an approach slab that is at least 25 feet long (measured along the control line of the bridge), is the same width as the bridge deck, and extends over the abutment wingwalls. Make allowance for settlement between the approach slab and wingwall, providing a minimum gap of 5 inches between the top of the wingwall and the approach slab. Provide for expansion and contraction at the approach slab to pavement interface. Use a sleeper slab and a joint type that accommodates the maximum anticipated movement times 1.5. For single span bridges use a joint that accommodates the movement of the entire bridge, assuming the full movement may occur at the joint at either end. For the sleeper slab configuration, provide a bottom slab width of 5.0 feet. For skews at the approach slab to pavement interface greater than 20 degrees, and where the roadway pavement structural section surface is Portland Cement Concrete Pavement, provide a stepped joint or other means of preventing lateral movement of the approach slab due to expansion and contraction. When a stepped joint is used, match step widths to those defined by Standard Drawing PV-2.

Deck Systems. Bridge decks shall conform to the following:

- Bridge constructed in a staging area and moved into its final position:
  - 8-inch cast-in-place concrete deck in staged construction area.
  - Provide 2.5 inches of clear cover for top mat of reinforcing steel.
  - Provide 1 inch of clear cover for bottom mat of reinforcing steel.
  - Empirical deck design is not allowed.
  - Provide a thin-bonded polymer overlay.
- Full-Depth Precast Concrete Deck Panels
  - 8.75 inches (including a grinding allowance of 0.25 inches, for a final thickness of not less than 8.5 inches) full depth precast concrete deck panels.
  - Provide 2.75 inches of clear cover for top mat of reinforcing steel (before grinding).
  - Provide 1 inch of clear cover for bottom mat of reinforcing steel.
  - Provide longitudinal post-tensioning of precast panels.
    Provide a thin-bonded polymer overlay.
- Partial Depth composite precast concrete deck panels:
  - Partial depth precast concrete deck panels;
  - Total deck thickness (panels + structural deck) is 8 inches or greater;
  - Provide 2.5 inches of clear cover for top mat of reinforcing steel.
  - Provide 1 inch of clear cover for bottom mat of reinforcing steel.
  - Provide a thin-bonded polymer overlay.
- Cast-in-place concrete deck:

- Provide a minimum deck thickness of 8 inches. Include a minimum depth of 0.5 inches as a scarification wearing surface or use an initial bridge deck overlay (2 inches).
- Do not use stay-in-place metal deck forms without Approval of the Department.
- Provide a thin-bonded polymer overlay

- Additional Requirements:
  - The interface between the deck and approach slab requires a formed construction joint.
  - Provide a superstructure that will allow for future deck replacement with minimal impact on cross-traffic and without adversely affecting the superstructure.
  - Provide a complete and detailed deck replacement plan for each bridge type that allows the deck to be completely removed and replaced with minimal impacts.

Drain Pipes: Paint drain pipes to match the color of the adjacent structural members.

Expansion Joints: Where possible, avoid or minimize expansion joints. Eliminate expansion joints in bridges shorter than 360 feet, unless the bridge is skewed more than 30 degrees. Use only strip seal, modular or steel finger joints for expansion joints other than those occurring at the sleeper slab or for sleeper slab expansion joint movements in excess of 2.5 inches. In the design and location of joints, provide for maintenance accessibility and future replacement. Do not use aluminum joints. Design modular joints for high-cycle fatigue loading.

Deck Overlays: Provide a thin-bonded polymer overlay on all concrete bridge decks. Extend overlays to include approach slabs.

Concrete Deck Overlays: Cure all concrete overlays in accordance with the requirements for bridge decks in Standard Specification 03390 (Concrete Curing). Meet the following requirements for concrete overlays:

- Follow the "Guidelines for Bonded Concrete Overlays," TB-007P, American Concrete Pavement Association.
- Use only shot-blasting for preparing the concrete surface for an overlay.
- Apply an epoxy bonding agent within 6 inches of the edge of each overlay placement, including vertical surfaces, prior to overlay placement.
- Do not place the concrete overlay when the evaporation rate exceeds 0.1 $lb/ft^2/hr$.
- Seal any cracking greater than or equal to 0.02 inch wide that occurs prior to opening to traffic, using a high molecular weight methacrylate (HMWM) sealer.
- Sound the deck for any delaminations.
- Remove and replace any delaminated areas.
- Make rectangular repair areas not less than 3 feet on each side and not closer than 3 feet to other repair areas.

- The basis of overlay acceptance is two passing bond tests of 300 psi per ACI 503R-93, Appendix A, representative of the overlay area.
- Do not permit traffic on the finished overlay surface until after completion of the wet cure as noted above.
- Do not use any power-driven tools heavier than a 15-pound chipping hammer adjacent to the new overlay prior to the end of the full curing period for any section.
- Remove and replace any improperly cured overlay.

Use a thin-bonded polymer overlay. For interstate bridges use a thin-bonded polymer Type I overlay. Use a thin-bonded polymer Type II overlay for non-interstate bridges. Apply the overlay on the concrete deck after grinding. Extend overlay to include approach slabs.

For bridges constructed and moved into place where the operation of moving the bridge either requires the bridge to be supported more than 36 inches from the staged support point, or if tensile stresses may occur during the movement or setting of the bridge, apply the Polymer overlay within 30 Days of setting the bridge in its final location, as an exception to the dates in the Standard Specifications.

Limit live load deflections to 1/1000 of span length for bridges that carry pedestrian traffic and 1/800 for all other bridges. Do not use steel box girders with an inside depth less than 5 feet as fracture-critical members.

For graffiti protection, provide flange guards on all steel and concrete exterior girders that are accessible without a ladder to prevent pedestrian access along the exterior girders. Install steel plate flange guards on exterior steel plate girders where necessary. Provide steel guard plates or concrete guard blocks to the tops of exterior concrete girder bottom flanges flatter than 45 degrees.

All personnel grouting post-tensioning ducts must be American Segmental Bridge Institute (ASBI) or PCI -certified as a grouting technician.

Do not place utilities on structures unless no reasonable alternative exists. Utilities placed on structures require Department Approval and design by a Utah-licensed Professional Engineer. If Utilities must be placed on a structure: hide them from view; provide expansion connections in each Utility that will accommodate the design movments of the bridges; and do not attach Utilities to the visible exterior of the superstructure.

Design and locate bearings to provide for maintenance accessibility and future replacement. Elastomeric bearings are the preferred type. For sole plates, provide a minimum thickness of 0.75 inch. At expansion bearings, do not permit the edge of the sole plate to slide past the edge of the elastomeric pad. Provide at least 6 inches of cover between anchor bolts and the edge of the concrete pedestal. Reinforce pedestals taller than 3 inches. Seismic isolation bearings conforming to AASHTO Guide Specifications

for Seismic Isolation Design are acceptable if their use does not increase the number of joints required on a structure.

The Department will accept drop caps or internal caps, but prefers integral caps when concrete box section systems are used. The use of integral steel pier caps is not permitted without Department Approval. The Department will Approve the use of integral steel pier caps only when no other alternative exists; if they are used, provide interior inspection access. Protect pier caps and columns from weathering steel staining during construction.

Unless a bridge is skewed more than 30 degrees, use integral or semi-integral abutments for structures up to 360 feet long. Do not use MSE walls to support abutments; use wingwalls at all abutments.

Provide concrete slope protection for all bridges with spill-through abutments, except where riprap is required for hydraulic reasons. Make slope protection consistent with the aesthetic plan and in accordance with details in the "Concrete Slope Protection" Drawing in Part 6—Engineering Data.

Use approved deep foundations per the geotechnical performance specifications.

14C - 7.6. Maintenance Plan

Provide a maintenance plan for each bridge type used, as follows:

- Describe routine maintenance procedures as well as items specific to all components of the bridge type.
- Include a detailed list of all maintenance and rehabilitation work, and the number of times each procedure is to be anticipated over the 75-year structure life (itemized by the year in which the procedure is to be performed).
- Make the items on this maintenance list the same as those that would be used for life-cycle costs.

14C - 8. Walls

14C - 8.1. Retaining Walls

Approved Wall Systems

The following wall systems are acceptable for use as permanent retaining walls on the Project:

- Department-approved mechanically stabilized earth (MSE) wall systems;
- Cast-in-place concrete retaining walls; and
- Soil-nail walls.
- Prefabricated Modular Gravity Wall (PMGW) Systems.

Other Wall Systems

The following wall systems are acceptable only when the approved wall systems will not meet design requirements:

- Concrete cribwall: Not allowed within 50 feet of bridges
- Wire-enclosed riprap (gabions) of limited height: At stream banks only

The approved and other wall systems are acceptable provided that the wall can accommodate the anticipated total and differential settlements for the life of the structure.

Do not use binwalls or permanent wire-face wall systems.

General

Address slope maintenance above and below the wall in the retaining wall layout. At retaining wall ends, where possible, provide returns into the retained fill or cut.

Provide surface and subsurface drainage in compliance with drainage requirements. Provide a system to intercept or prevent surface water from entering behind walls.

Where access is open to the public, provide a pedestrian railing or a 6-foot fence at the top of walls.

Provide a minimum clear distance of three feet between precast wall panels or blocks and bridge abutments. Place concrete slope protection between the wall and abutment.

Seismic Requirements

Comply with Part 3, Section 5 (Geotechnical) for seismic design criteria.

Wall Characteristics

MSE Walls: Comply with Part 3, Section 5 (Geotechnical).

Cast-in-Place Concrete Walls: Design and construct cast-in-place concrete walls in accordance with AASHTO *LRFD Bridge Design Specifications*. Account for differential settlement in the construction joint spacing. Account for global stability as described in the geotechnical performance specifications.

Soil Nail Walls: Comply with Part 3, Section 5 (Geotechnical).

Concrete Cribwalls: May be used when other wall types will not meet design requirements. Provide concrete coping at top of wall.

Wire Enclosed Riprap (Gabion) Walls: Acceptable for use adjacent to streams only when other wall types cannot meet all design requirements. Height is limited to 15 feet unless Approved by the Department.

Temporary Retaining Walls: Bear sole responsibility for the type, material, performance, and safety of temporary retaining structures. Design temporary structures supporting excavations or embankments, such as sheeting or bracing, by a a Utah-licensed Professional Engineer in accordance with AASHTO *LRFD Bridge Construction Specifications (Section 3)* to meet all requirements of the State and the U.S. Occupational

Safety and Health Administration (OSHA). The Department reserves the right for oversight review of these structures.

14C - 8.2. Noise Walls

Design and construct noise walls in accordance with AASHTO *Guide Specifications for Structural Design of Sound Walls*. Design noise walls for an 80-mph wind with additional 30-mph gusts. Meet final constructed tolerances of 0.25 inch in 10 feet for level and plumb. Use wall types that have been successfully used in geo-technically similar locations and environmental conditions.

14C - 8.3. Components

Construct panels of reinforced masonry blocks, bricks or concrete. Do not allow bricks to come in contact with soil. Use a cap for brick and masonry block. Panels may be cast-in-place or precast. When using concrete panels, use full-height panels. On bridges jointed from longitudinal structural elements, use cast-in-place concrete panels. Design and construct panels for ease of replacement and/or repair.

Use reinforced concrete, pre-stressed pile, or galvanized steel H-pile posts.

Use foundations of posts set in concrete, caissons, or cast-in-place or precast reinforced concrete footings. Place the bottom of all spread footing foundations a minimum of 3 feet below finished grade. Uncoated reinforcing steel may be used for caissons.

14C - 9. Sign, Signal, and Lighting Structures

Design and construct structures for signs, signals, advanced traffic management systems (ATMSs), variable message signs (VMSs), and lighting in accordance with Department Standard Drawings and AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

For loadings, consider the natural period of vibration from vortex shedding and upward wind pressures from passing trucks. Use Fatigue Category I for overhead sign structures and lighting supports taller than 98 feet; use Fatigue Category II for all other structures.

Use galvanized structural steel tubing for overhead sign structures.

Use drilled shafts to support overhead and cantilever sign structures. Use only cast-in-place retaining walls to provide vertical support for sign and lighting foundations. Isolate sign and lighting loads from all other wall systems.

Make connections with A325 bolts. Make shop splices and base connections with full-penetration butt welds. Galvanize all connection hardware. Strengthen structural tubing at electrical connection openings.

Do not mount signs on bridges unless no alternative exists.

Provide sign structures located in snow storage areas that can withstand the loads imposed by plowed and compacted snow without permanent deformation.

14C - 10. Drainage Structures

Design and construct all drainage structures in accordance with AASHTO *LRFD Bridge Design Specifications*.

14D. Submittals

14D - 1. Submittal Table

Insert submittals identified in text.

Submit the following to the Department:

14D - 2. Initial Project Submittals

- List of computer software used in structural design
- Project structure design criteria

14D - 3. Review Submittals

- Plans and special provisions with aesthetic treatments
- Design checklists
- Completed Design Certification Forms per Department Structures Design Quality Plan
- Documentation verifying completion of independent review
- Foundation recommendations Memos

14D - 4. Release for Construction Submittals

- Sealed Plans and special provisions with aesthetic treatments
- Shop drawings; reviewed and signed by the engineer who sealed the bridge design plans
- Formwork and shoring drawings (sealed)

14D - 5. Final Design Submittals

- Sealed Plans and specifications with aesthetic treatments (hard copy and electronic files (.pdf)
- Sealed final design calculations
- Sealed independent review calculations
- Documentation of computer software verification
- Sealed bridge load ratings
- Sealed Maintenance Plan for each bridge type
- Sealed Seismic Strategy Memorandum for each bridge
- Sealed Detailed Deck Replacement Plan
- Electronic files of Plans (MicroStation) and specifications (Microsoft Word)

14D - 6. End-of-Project Submittals

- As-Built Plans (hard copy Adobe Acrobat – PDF format, and electronic MicroStation files)

- All field changes and field change calculations organized by structure
- Final approved shop drawings