STRUCTURES
PERFORMANCE SPECIFICATION

1.0 INTRODUCTION

The Design Builder shall design and construct permanent structures such as permanent bridges (except the cable-stayed main span unit), retaining walls, box culvert drainage structures, and any major sign structures in accordance with the criteria established in this Structures Performance Specification.

The completed structure shall provide functionality, durability, ease of inspection and maintenance, safety, and pleasant aesthetics.

2.0 STANDARDS AND REFERENCES

The design and construction of structures shall be in accordance with this Structures Performance Specification and the relevant requirements of the following standards, unless otherwise stipulated in this performance specification. Standards and references specifically cited in the body of the Structures Performance Specification establish requirements that shall have precedence over all others. Should the requirements in any standard conflict with those in another, the standard highest on the list shall govern. Listed under references are guidelines that the Design-Builder may use in addressing the requirements as the Design-Builder sees fit. It is the Design-Builder's responsibility to obtain clarification of any unresolved ambiguity prior to proceeding with design or construction. Items listed as standards or references in this Structures Performance Specification shall be the most recent version available at the time of issuance of the Scope of Services Package.

2.1 STANDARDS

A) Special Provisions for the Project;

B) AASHTO LRFD Bridge Design Specifications, Third Edition, 2004;

C) AASHTO LRFD Bridge Construction Specifications, Second Edition, 2004;

D) AASHTO A Policy on Geometric Design of Highways and Streets, Fifth Edition, 2004;

E) AASHTO/AWS D1.5 Bridge Welding Code, 2002 with 2003 Interim;

F) AASHTO Guide Manual for Condition Evaluation and Load and Resistance Factor Rating (LRFR) of Highway, Bridges 2003;

G) AASHTO Standard for Overhead Sign Design;

H) AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals, 4th Editions with Interims;

I) LA DOTD Standard Specifications for Roads and Bridges, 2000 Edition;

J) LA DOTD Special Provisions and Supplemental Specifications; and

K) FHWA Hydraulic Engineering Circular No. 21 "Design of Bridge Deck Drainage."

2.2 REFERENCES

A) Final Partial Preliminary Plans East Approach;

B) Final Partial Preliminary Plans West Approach;

C) The Environmental Documents for the Project;

D) LA DOTD Bridge Design Manual, Fourth English Edition including memorandums and any revisions issued by the State Bridge Engineer prior to date of the Scope of Services Package;

E) AASHTO Guide Specifications for Horizontally Curved Highway Bridges, 2003;

F) AASHTO Guide Design Specifications for Bridge Temporary Works, 1995;

G) LA DOTD Standard Plans and Standard Bridge Details;

H) LA DOTD MSEW Design Guide, Pavement and Geotechnical Design Section;

I) Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Design and Construction Guidelines, FHWA Demonstration Project 82 Ground Improvement, FHWA-SA-96-071, current edition;

J) Corrosion/Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, FHWA Demonstration Project 82 Ground Improvement, FHWA-SA-96-072, current edition;

K) Geosynthetic Design and Construction Guidelines, FHWA HI-95-038, current edition;

L) NCHRP 445, Forces on Highway Bridges;

M) ACI 305 R-99, Hot Weather Concreting;

N) ACI 207.1 R-99, Mass Concrete;

O) FHWA NHI-001, Hydraulic Engineering Circular Manual 18; and

P) NCHRP Report 489, Design of Highway Bridges for Extreme Events, 2003.

3.0 REQUIREMENTS

3.1 DESIGN PARAMETERS

3.1.1 General

The Project shall be designed and detailed using the customary English. Plans shall be prepared in accordance with the LA DOTD Bridge Design Manual, Chapter 1. Final Plans shall be sealed by a Louisiana-Licensed Professional Engineer. All submittals and submittal requirements shall be as per the Contract Documents.

3.1.2 Foundation Design

Maximum pile load demands shall be determined using the AASHTO Standard Specifications for Highway Bridges, Seventeenth Edition, using service load combinations. The capacity of pile foundations shall be determined by using the FHWA software “Driven”. Minimum pile design safety factors shall be in accordance with Chapter 6 of the LA DOTD’s Bridge Design Manual. The structural capacity of the foundation elements shall be designed per LRFD Specifications for all LRFD load combinations.

The effects of scour shall be considered with all load combinations except for extreme event provisions allowed by NCHRP 489. Scour determination shall be done for each pier exposed to stream flow using FHWA NHI 01-001, HEC-18 Manual as guideline, likewise other related manuals shall apply. The forces due to stream pressure shall include the effects of debris.

3.1.3 Loads and Forces

For the determination of load factors, the following variables shall be used.

η_D = 1.05
η_I = 1.05
η_R = 1.05 all others
1.0 Box Girder with multiple webs

3.1.3.1 Dead Loads

Add 25 psf unit dead load for a future wearing surface to all bridge structures. Metal stay in place forms may be used on this project. If these forms are used, the additional dead load due to the stay in place forms shall be included in the design of the structure.

The top ¼" of the roadway concrete slab shall be considered non-structural and shall be accounted for as dead load.

3.1.3.2 Live Loads

Bridges shall be designed for HL-93 vehicular live load. For fatigue use ADT 23,000, 0.15 trucks.

3.1.3.3 Thermal Forces

The uniform temperature ranges shall be calculated using Procedure B as specified in the LRFD Bridge Design Specifications.

3.1.3.4 Earthquake

The seismic performance category for all structures shall be Zone 1. The importance classification for all bridges shall be Critical.

3.1.3.5 Vessel Collision

Design for vessel collision shall consider water levels up to an elevation of 56.1 feet NGVD with a discharge flow of 1,500,000 cfs based on the U.S. Army Corps of Engineers Project Design Flood dated November 1986. The Importance Classification for vessel collision is critical. The acceptable annual frequency of collapse shall be equal to or less than 0.01 in 100 years (AF=0.0001).

3.1.3.6 Stream Pressure

Design for Stream Pressure based on a design high water elevation of 56.1 feet NGVD with discharge flow of 1,500,000 cfs based on the U.S. Army Corps of Engineers project Design Flood dated November 1986

The forces shall include the effects of debris in accordance with NCHRP 445.

3.1.4 Materials

As a minimum, all materials shall satisfy the requirements listed in Parts VIII, IX, and X of the LA DOTD Standard Specifications.

All materials not meeting Contract requirements will be addressed through the Non-Conformance Report procedures as outlined in the Contract Documents.

3.1.5 Corrosion Protection

The Design-Builder shall provide for review and approval by LA DOTD a detailed Corrosion Control Plan including material selection modeling process and estimates of life-cycle costs, to assure the stated service lives for the structural elements of the bridges. Cathodic protection is not required.

For post-tensioned bridges, the Corrosion Protection Plan shall include specific detailed provisions for post-tensioning tendons corrosion protection. The plan shall specify corrosion allowances and outline detailed provisions with regards to reinforcing steel and structural steel protection. In regards to concrete performance, the plan shall assess the effects on concrete permeability, corrosion thresholds, corrosion rate, impacts on cracked concrete, time-to-repair and provide recommendations on the use of calcium nitrate, silica fume, sealers, membranes, reinforcing coatings, increased cover, corrosion inhibitors, etc.

3.1.6 Plans

Plans shall be prepared in accordance with the LA DOTD Bridge Design Manual, Chapter 1, Final Plans and be sealed by a Louisiana-Licensed Professional Engineer. All submittals and submittal requirements shall be as per the Contract Documents.

3.1.7 Aesthetics

At a minimum, bridge aesthetics shall meet the requirements of the LA DOTD Bridge Design Manual Chapter 3, Bridge Aesthetics. If weathering steel is used, the requirements listed in NCHRP, Report 314 should be followed. See the Project Special Provision “Aesthetics” for additional requirements.

3.2 BRIDGES

3.2.1 Geometry

The minimum typical section of the approach structures to the cable-stayed main span crossing the Mississippi River shall consist of two 11 foot travel lanes, two eight foot outside shoulders, and any appropriate traffic barriers.

The typical section all other structures shall consist of two ~~12’-0”~~ 11 foot travel lanes and two 8~~’-0”~~ foot shoulders with a constant cross slope. The bridge geometry and details, especially at the transition between the cable stayed main span and the high level approaches, shall provide for future widening of the bridges from a two lane structure to a four lane structure, if a two lane option is chosen. Refer to the Roadway Performance Specifications for additional information and details.

Low member elevations and vertical and horizontal clearances shall be as per the LA DOTD Bridge Design Manual, Chapter 3 Normal Highway Clearances and Chapter 3, Bridge Finish Grade Elevation for debris prone areas.

3.2.2 Type

Bridge type will not be restricted to those traditionally used by the LA DOTD. Other types and components may be used, but will be allowed only if they have been accepted for general use by other United States transportation authorities and the Design-Builder can demonstrate that its design of the bridge type and components will perform according to these specifications.

Experimental bridge types, timber bridges, masonry bridges, and structural plate arches are not permitted. Pre-cast concrete flat slab bridges will not be allowed without a reinforced structural concrete overlay and transverse post-tensioning.

The Design-Builder shall minimize the number of expansion joints through the use of continuous superstructure units.

For concrete segmental bridges, the principal tensile stress in the girder webs shall be limited to 3.5 square root f'c under AASHTO LRFD Bridge Design Specifications Load Combination, Service State III.

3.2.3 Inspection Access

All bridge superstructures, joints, and bearings shall be designed so as to provide easy access for long term inspection. See the Maintenance and Inspection Performance Specification for details.

3.2.4 Railroad Coordination

The agreement between the LA DOTD and the railroad and corresponding aerial photography and the Big Cajun layout plan are attached and incorporated at Appendix A to this Structures Performance Specification and the terms of such agreement shall be complied with by the Design-Builder.

The Design-Builder shall design and construct an elevated grade separation for existing spur track at approximate station 362+25 and the future railroad spur track in to Big Cajun 2 electric power plant at approximate station 357+12.32. The elevated grade separation bridge structure shall have a minimum vertical clearance of 26 feet from top of rail to low elevation of the bridge superstructure and a minimum horizontal clearance of 25 feet from existing track center-line to face of obstruction ~~up~~ down-station and 40 feet from existing track center-line to face of obstruction ~~down~~ up-station from the existing spur track. At approximate station 357+12.32, the minimum vertical clearance shall be 23.5 feet from top of rail to low elevation of the bridge superstructure and a minimum horizontal clearance of not less than 25 feet from center line to face of obstruction.

3.2.5 Mass Concrete

Mass concrete is defined as a structural concrete placement with the least dimension of the placed element of 48 inches. For mass concrete, the allowable cement type shall be Type II Portland cement, Type IP Portland-pozzolan cement, or Type IS portland blast-furnace slag cement. Placement meeting the requirements of mass concrete shall satisfy the temperature limitations of LA DOTD Standard Specifications for Road and Bridge Construction Section 901.11(b)(1). The cement, or combination of cement and fly ash or ground iron blast-furnace slag, shall be certified to generate a heat of hydration of not more than 70 calories/ gram at 7 days. Mass Concrete shall be in accordance with ACI 207.1 R-96, Mass Concrete.

3.2.6 Hot Weather Concrete

Hot weather concrete shall be in accordance with ACI 305 R-99 Hot Weather Concreting.

3.2.7 Hurricane Preparedness

The Design-Builder shall have a plan to address securing and protection of the project site during a hurricane event. The Design-Builder shall provide a copy of the plan within 90 days of NTP to LA DOTD for review and comment.

3.2.8 Components

3.2.8.1 Traffic Railing Barrier and Pedestrian Fencing

The traffic railing barrier Bridge railing shall be a cast-in-place concrete combination bicycle/pedestrian vertical wall barrier conforming to a TL-4 crash level and accommodate bicycle use on the roadway shoulder. Railing height shall be 54-inches to accommodate bicyclist.

3.2.8.2 Approach Slabs

The Design-Builder shall provide a 40'-0" long approach slab at the end of each bridge in accordance with the LA DOTD Bridge Design Manual.

3.2.8.3 Decks

A) Decks shall be of concrete with a minimum designed deck thickness of seven inches. Pre-tensioned, pre-cast concrete deck forms may be used provided that a minimum of four inches of cast in place deck thickness is provided over the pre-cast deck forms.

B) Open or filled grating decks and orthotropic decks are not permitted.

C) Decks shall meet the rideability requirements as listed in Project Special Provision "Bridge Deck Rideability".

3.2.8.4 Deck Joints

The Design-Builder shall use only strip seal or steel finger joints. Modular joints, sliding plate joints, Compression seals, and silicone seals are not permitted. Open joints may be provided for concrete superstructures for joint openings of 3" maximum. Design and location of joints shall be such so as to provide for maintenance accessibility and future replacement. LA DOTD has a standard detail for strip seal joints. Aluminum joints are not permitted. Finger plate joints shall be hot dipped galvanized.

Provisions shall be made to accommodate bicycles on the shoulders.

3.2.8.5 Post-Tensioning Superstructures

All post-tensioning details and grouting operations shall be in accordance with the Project Special Provision.

3.2.8.6 Structural Steel

Structural steel members shall be weathering steel. The design and details for preventing staining of concrete by weathering steel shall be in accordance with the LA DOTD Bridge Design manual, Chapter 5, Subsection for guidelines for Weathering Steel Design.

All bolted steel connections shall use Direct Tension Indicators.

3.2.8.7 Bearings

Design and location of bearings shall provide for maintenance accessibility and future replacement. Elastomeric bearings are preferred.

3.2.8.8 Pier Caps

The type of pier cap shall be consistent with the bridge system and aesthetic strategy proposed for the corridor.

3.2.8.9 Abutments

Front slopes shall be 3:1 (H:V) or flatter.

3.2.8.10 Slope Protection

Slope protection shall be in accordance with the details contained in the LA DOTD's Bridge Design Manual, Chapter 6, Embankment protection and shall be consistent with the bridge hydraulic analysis and permits.

3.2.8.11 Foundations

Foundations shall be designed in accordance with Geotechnical Performance Specification.

Spread footings, timber piles, and auger cast piles for bridge structure foundations are not permitted. No exposed steel piles will be allowed above ground elevation. Timber piles shall not extend above the ground water elevation. Timber piles shall meet the requirements listed in LA DOTD Standard Specifications for Roads and Bridges Section 804.

3.2.8.12 Drainage

The deck drainage shall be based on hydrologic analysis and satisfy all permit requirements. Deck drains shall extend a minimum of 12 inches below the bottom of steel girders. This requirement is not applicable to concrete girders.

The deck drainage shall be in accordance with FHWA Hydraulic Engineering Circular no. 21 "Design of Bridge Deck Drainage".

3.2.8.13 Bridge Lighting

See the Project Performance Specification for Inspection, Maintenance and Construction Requirements for provisions for future bridge lighting and inspection/ maintenance lighting requirements.

3.3 RETAINING WALLS

Retaining walls shall be designed in accordance with Geotechnical Performance Specification.

The Design-Builder shall have sole responsibility for the type, material, performance, and safety of temporary retaining structures. Temporary retaining structures are walls used during construction only and are not in place at the end of construction.

3.3.1 Geometry

Retaining wall layout shall address slope maintenance above and below the wall. Design and construction shall consider surface and subsurface drainage. A system shall be provided to intercept or prevent surface water from entering behind walls.

3.3.2 Type

Wall types shall have successfully been used under similar geotechnical and environmental conditions.

Exposed metal walls including bin walls and sheet pile walls, recycled material walls, timber walls, or walls utilizing geofabrics will not be permitted for permanent retaining walls.

3.4 WILDLIFE CROSSINGS

See the Environmental Mitigation and Compliance Performance Specification for the numbers, sizes, and locations of wildlife crossings. All structures shall be designed in accordance with AASHTO LRFD Bridge Design Specifications.

3.5 MAJOR DRAINAGE STRUCTURES

Major drainage structures shall be designed in accordance with AASHTO LRFD Bridge Design Specification.

3.6 SIGN STRUCTURES

Sign structures and supports shall be designed in accordance with the LA DOTD's Bridge Design Manual, Chapter 10, Permanent Signing and the latest edition of the AASHTO Standard specifications of Structural Supports of Highway Signs, Luminaries and Traffic Signals.

The Design-Builder shall provide designs for the overhead sign structures. The LA DOTD preferred standard sign details based on a 4 chorded pipe box truss are available for reference.