

I-10 CALCASIEU RIVER BRIDGE



BRIDGE HEIGHT SPECIAL STUDY

S.P. No. 700-10-0115
F.A.P. No. BR-10-1(212)29

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prepared by

HNTB



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1. INTRODUCTION

1.1. Study Purpose

The purpose of this study is to examine alternative “In-Between” bridge profiles identified through the Public Involvement phase of the proposed project to replace the I-10 Bridge over the Calcasieu River in Lake Charles, Louisiana. This report compares hypothetical alternatives against high and mid-level replacement bridge profiles previously considered for this project in order to more accurately respond to public comments about the project.

During the public involvement process for the Calcasieu River Bridge replacement, the DOTD solicited public comment regarding the appropriate height of the I-10 bridge replacement and realignment. This study provides the results of a preliminary evaluation of a third In-Between Level bridge profile. The purpose of this study is to provide local stakeholders with information needed to determine whether this In-Between profile should be considered further. The evaluation included:

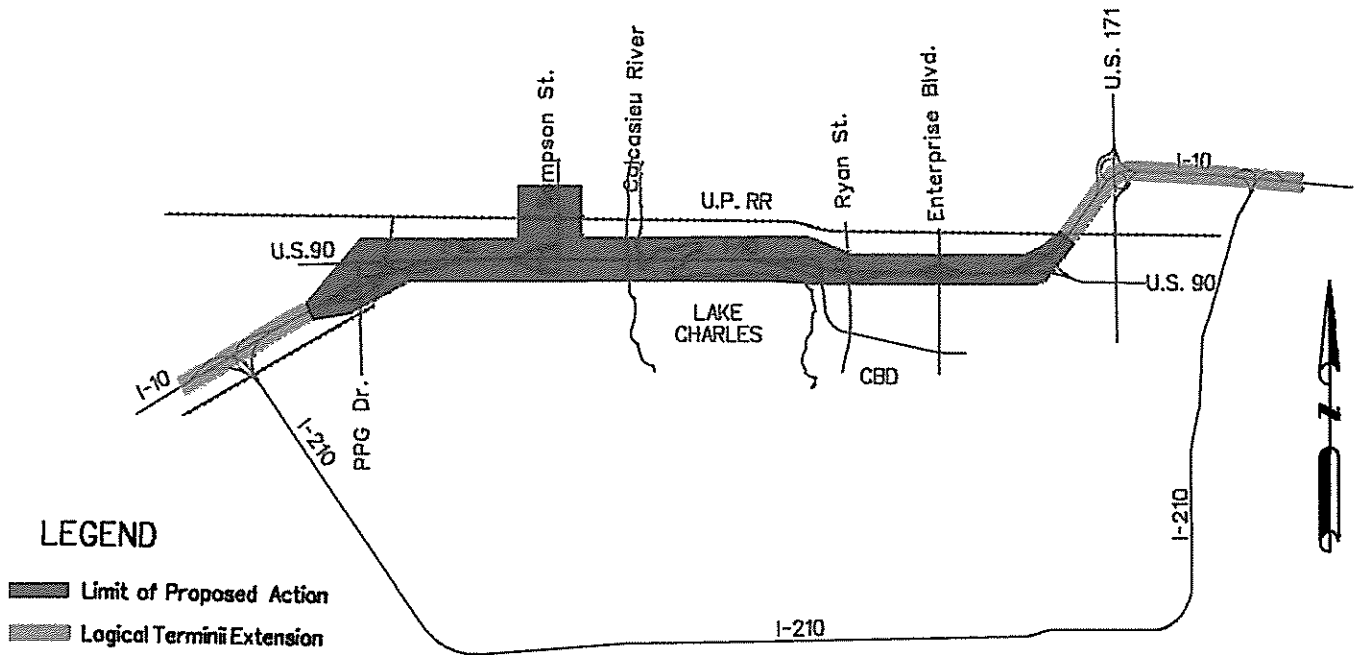
- Comparison of construction costs of Mid-Level, High-Level and In-Between Alternatives,
- Comparison of road user costs for Mid-Level, High-Level, and In-Between Alternatives, and
- Comparison of safety considerations for the Mid-Level, High-Level, and In-Between Bridge Levels.

This report is prepared to fully address inquiries raised during the public involvement phase of the project.

1.2. Project History

In 1999, the Federal Highway Administration (FHWA) in cooperation with the Louisiana Department of Transportation and Development (LaDOTD) initiated consideration of the proposed project to replace the existing 50-plus year old Interstate-10 (I-10) bridge over the Calcasieu River connecting Lake Charles and Westlake, Louisiana, and to improve the bridge approaches and nearby interchanges. The proposed project area is illustrated on Figure 1-1.

**Figure 1-1
PROJECT AREA**



In early 2000, LaDOTD retained HNTB Corporation to perform an engineering and environmental feasibility study for the proposed project. As part of the feasibility study, HNTB prepared six Technical Memoranda and one Comprehensive Report to document the results of the feasibility study and identify alternatives meriting further study. The feasibility study examined numerous project alternatives for replacement of the existing high-level bridge (135' vertical clearance for ship traffic) with different bridge profiles and heights. The engineering and feasibility study was completed in 2002 and concluded that replacement of the existing bridge with a lower level bridge (73' vertical clearance), identified here as the "Mid-Level" bridge profile, or a high-level bridge (118' to 125' vertical clearance), identified here as the "High-Level" bridge profile, was feasible and should be progressed. The feasibility study identified the "Mid-Level" bridge profile preliminarily identified as the most advantageous alternative for achievement of the project purpose, cost effectiveness, and minimization of adverse impacts.

After the completion of the feasibility studies in 2002, a humanitarian organization with supply vessels requiring higher than 73' vertical clearance located in the upper Calcasieu River.

Assessment of the environmental impact of the proposed project in the form of an Environmental Assessment (EA) was initiated in 2002 in compliance with NEPA. The NEPA process included solicitation of public comment and involvement in the design of the proposed project. The humanitarian organization challenged the conclusion that a lower Mid-Level bridge profile would be adequate to accommodate on-going shipping needs.

Due to these events, completion of the EA was delayed pending re-evaluation of the 2001 Marine Use Study examining the transportation and port use needs of upriver shipping interests, and consideration of the need for additional investigation of required replacement bridge vertical clearance, in light of new upstream shipping interests, to adequately address public concerns.

A Supplemental Port Use Study was conducted and released in March 2006. Following release of this study, the LaDOTD convened a meeting with the local Metropolitan Planning Organization (MPO) to consider ratification of the study findings. This vote was scheduled to occur at the November 30, 2006, Lake Charles Urbanized Area MPO Transportation Policy Committee Meeting. However, at that meeting, the Mayor of Lake Charles and other community members proposed the feasibility of an "In-Between" alternative, i.e., a 100' vertical clearance bridge profile alternative, in comparison to previously identified alternatives and the vote was tabled. In response to that proposal, this study analyzing the requested In-Between profile(s) for comparative construction costs, level of service, and safety considerations has been performed.

Discovery of potential contamination within the proposed Right-of-Way also required suspension of the normal EA process pending further delineation of the site by the Responsible Party. Resolution is expected the fourth quarter of 2007. At that point, the EAs for the Calcasieu Bridge Replacement and for the "companion" Sampson Street Interchange project will be completed.

Table 1-1 below provides a summary of all studies addressing issues and considerations relevant to selection of the height of the Calcasieu River Bridge replacement conducted to date.

Table 1-1
SUMMARY OF STUDIES ADDRESSING REPLACEMENT OF THE
CALCASIEU RIVER BRIDGE AND MODIFICATION OF APPROACHES

Item	Date	Description	Purpose
1	May 2001	Marine Use Study	Determine feasibility of bridge replacement including evaluation of appropriate bridge profile; included close coordination with Coast Guard; mid-level and high-level bridges were deemed feasible
2	May 2002	Comprehensive Preliminary Alternatives Report	Summary of findings of engineering and environmental technical studies conducted to determine feasibility of the project
3*	January 2003	Letter report discussing impacts of a high level bridge vs. a mid-level bridge	Preliminary evaluation of the feasibility of a high-level bridge profile alternative
4	March 2004	Pre-Draft EA I-10 Calcasieu 6.1 Mile Corridor (HNTB internal draft)	Perform an EA for replacement of the Calcasieu River Bridge and modification of bridge approaches in compliance with NEPA
5	May 2004	Letter report (e-mail format) presenting six different profile alternatives for a potential high level bridge	Develop geometric design of additional alternatives for high-level bridge replacement
6	January 2006	Sampson Street Interchange Engineering Design Report (HNTB internal draft)	Evaluate stand-alone interchange compatibility with mid or high-level bridge; develop preliminary horizontal and vertical geometric design for selected bridge height alternative; investigate how project can be phased with interchange first and bridge second
7	January 2006	Pre-Draft EA for Sampson Street Interchange (HNTB internal draft)	Perform a stand-alone EA for Sampson Street interchange; identify a preferred alternative that would be compatible with mid-level or high-level bridge
8	March 2006	Port Use Study (by BKI)	Investigate existing and potential upriver navigation needs to determine feasibility and desirability of mid-level bridge.
9	May 2006	Truck Operations Study (HNTB internal draft)	Evaluate suitability of bridge profile alternatives for anticipated local and commercial travel demand (which includes at least 12% tractor trailers)

*Attached in Appendix A as Figure A-2.

1.3 Scope of this Study

This study provides 1) a summary of replacement bridge profile alternatives considered to date, in comparison to hypothetical (In-Between) profiles developed following the November 30, 2006 Lake Charles Urbanized Area MPO Transportation Policy Committee Meeting, and 2) a preliminary evaluation of the construction costs, road user needs and costs, and safety for the bridge profiles.

This summary report presents the following evaluations for the Mid-Level, High-Level, and In-Between bridge profile alternatives considered:

- Summary of all profiles considered and the advantages and disadvantages associated with each based on geometric standards and guidelines,
- Construction cost comparisons based on updated bridge tabulations, and
- Road User Cost Comparisons based on travel time costs, accident/incident costs, and time lost due to delays caused by inadequate capacity and/or accidents.

2. BRIDGE PROFILE ALTERNATIVES

2.1. Summary Overview of Bridge Profile Alternatives

During the feasibility, engineering, and environmental assessments of the proposed project, LaDOTD design standards and criteria, marine use study findings, preliminary technical studies, and input from the public and cooperating agencies was used to develop and evaluate the feasibility of bridge profile alternatives of various heights.

Design criteria for project construction is provided in Table A-1 of Appendix A. The project design criteria culminates AASHTO and LaDOTD standards and have been refined as the project progressed, with the latest revisions in 2004. The I-10 corridor through Lake Charles and Westlake is considered an urban freeway. Therefore, design speeds of 60 mph to 70 mph are acceptable for the I-10 mainline although 70 mph is desirable.

The bridge profile alternatives developed from 2001 to 2004 and selected for additional study have been categorized as Mid-Level (vertical clearance of 73') or High-Level (vertical clearance ranging between 118' and 125'). See Figure A-1 for Mid-Level profiles and Figures A-2 through A-8 for High-Level profiles. The existing bridge profile is provided for reference with the other proposed profiles (Figures A-1 thru A-12) as the background. The additional profiles in between Mid-Level and High-Level developed for this study are based on a vertical clearance ranging between 90' and 100' are shown on Figures A-9 thru A-12. See Section 2.2 for more information on the In-Between profiles.

The bridge alternatives were developed using the following criteria developed through initial studies:

- 4.3' NGVD average annual high water elevation
- 200' horizontal clearance for river channel at approximately Sta. 3948+00 to 3500+00 for Centerline 3 (offset 150' from existing centerline)
- Alternative 1 Typical section - 6 thru lanes with 1 auxiliary lane each direction (approximately 73.5' width each direction)
- Main Span Structure depth of 11'
- Bridge Cross slope of 2.5%

Figure 2-1 represents a plan view schematic of the proposed Calcasieu River Bridge as discussed in this report.

Figure 2-1
PLAN VIEW SCHEMATIC
OF PROPOSED I-10 CALCASIEU RIVER BRIDGE

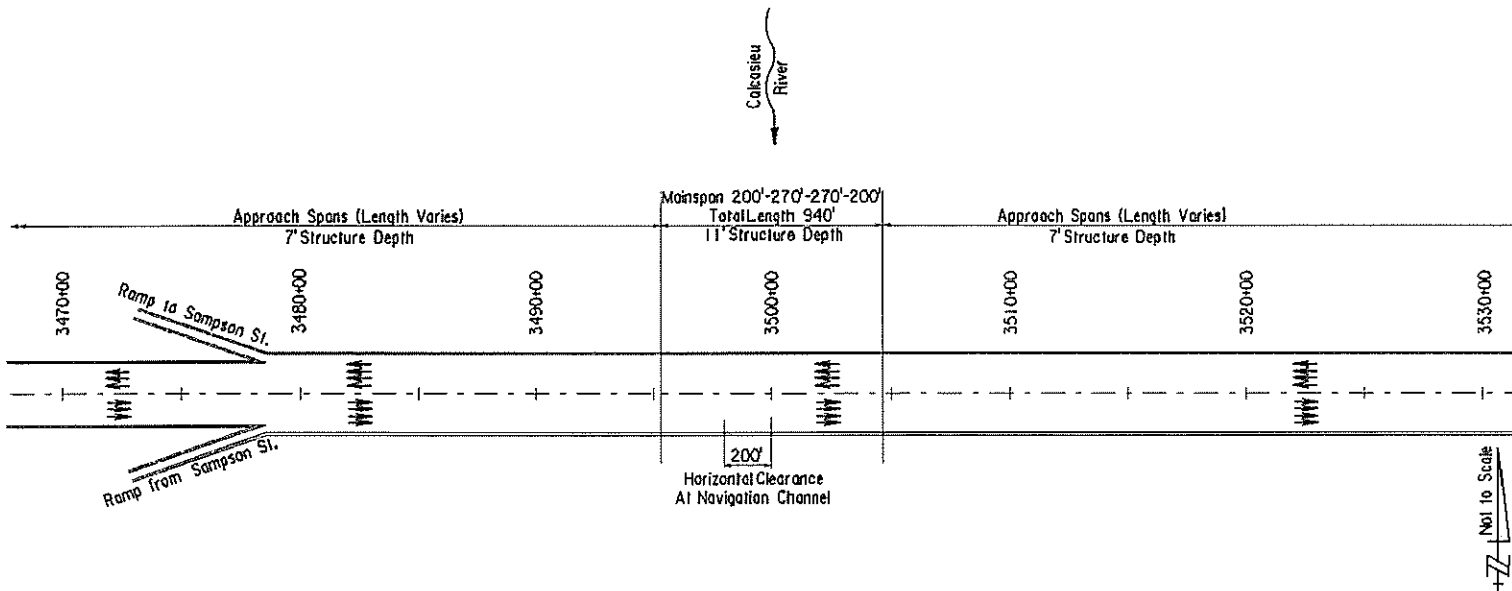


Table 2-1 provides a matrix summarizing the alternatives developed and evaluated in comparison to these criteria. The existing bridge profile computes to design speed of 50 mph based on today's standards and has a vertical clearance of 135' from 8' mean sea level (MSL). The profile of the existing river bridge is included on this matrix for reference. The existing bridge was also initially considered for frontage road use but was eliminated as an alternative primarily due to constructability and maintenance issues.

Table 2-1
SUMMARY MATRIX OF PROFILE ALTERNATIVES

	Profile Alternative	Vertical Clearance* (ft.)	Aprox. Length of Bridge** (ft.)	Design Speed*** (mph)	West Approach Grade (%)	East Approach Grade (%)	Date Submitted to DOTD	Recommended to Move Forward (Y/N, year)	ADVANTAGES	DISADVANTAGES	NOTES	FIGURE in Appendix A
EXISTING	Existing	135	6,620	50	3.80	-5.00	2001	N, 2002		High cost to rehabilitate 50+ year old structure Construction phasing at Sampson St. interchange not feasible	Existing bridge profile alternative analyzed for frontage road use during initial studies.	A1 - A10
MID-LEVEL	Mid Level #1	73	6,620	70	3.00	-3.00	2001	N, 2002	Minimal length of bridge Desirable design speed Desirable grade	Developed for free flow directional interchange at Sampson St. Interchange which was eliminated for further study because it is not conducive to phased construction. More impacts to right of way Higher costs involved with directional ramps		A1
	Mid Level #2	73	7,250	70	2.70	-2.70	2001 Revised 2004	Y, 2002	Desirable design speed Desirable grade Ideal for phased construction at Sampson Lower profile at Sampson ramp tie-ins on westside of river Least costly	"Hump" in profile not most desirable configuration due to change in acceleration rates for drivers.	Used for Sampson St. studies	A1-A10
	Mid Level #3	73	7,560	70	1.65	-3.00	2001	N, 2002	Desirable design speed	Most conducive with Mike Hooks alternative for Sampson which was eliminated for further study due to environmental impacts (i.e. hazardous waste site & displacements) and engineering factors. More difficult for Sampson St. Ramps to tie in at higher elevation Longer bridge, more costly		A1
HIGH LEVEL	High Level A	120	9,600	70	3.00	-3.00	2003	N, 2003	Desirable grade Desirable design speed	Higher costs for piers & longer bridge approaches Construction phasing difficult for Sampson St. interchange More speed reductions than mid-level due to higher grades	Designed to go over Sampson St. instead of under like the other high level bridges.	A2
	High Level #1	125	7,400	70	4.90	-4.90	2004	N, 2004	Desirable design speed	Steep grades (desirable is less than 4%) More difficult for Sampson St. Ramps to tie in at higher elevation Higher costs for piers More speed reductions than mid-level due to higher grades		A3
	High Level #2	125	7,410	70	5.00	-5.00	2004	N, 2004	Desirable design speed	Steep grades (desirable is less than 4%) More difficult for Sampson St. Ramps to tie in at higher elevation Higher costs for piers More speed reductions than mid-level due to higher grades		A4
	High Level #3	125	6,940	60	4.18	-5.00	2004	N, 2004		Steep grades (desirable is less than 4%) More difficult for Sampson St. Ramps to tie in at higher elevation Minimal design speed Higher costs for piers More speed reductions than mid-level due to higher grades		A5
	High Level #4	125	7,030	60	4.50	-4.50	2004	N, 2004		Steep grades (desirable is less than 4%) More difficult for Sampson St. Ramps to tie in at higher elevation Minimal design speed Higher costs for piers More speed reductions than mid-level due to higher grades		A6
	High Level #5	118	7,210	70	4.65	-5.00	2004	N, 2004	Desirable design speed	Steep grades (desirable is less than 4%) More difficult for Sampson St. Ramps to tie in at higher elevation Higher costs for piers More speed reductions than mid-level due to higher grades		A7
	High Level #6	118	6,960	60	3.84	-4.60	2004	Y, 2004		Steep grades (desirable is less than 4%) More difficult for Sampson St. Ramps to tie in at higher elevation Minimal design speed More speed reductions than mid-level due to higher grades	Used for Sampson St. studies	A8
	IN-BETWEEN	In Between #1	100	7,250	60	3.00	-3.50	2007	Not considered	Desirable grade	More difficult for Sampson St. Ramps to tie in at higher elevation Higher costs for piers More speed reductions than mid-level due to higher grades		A9
In Between #2		98	7,790	70	3.00	-3.00	2007	Not considered	Desirable design speed	More difficult for Sampson St. Ramps to tie in at higher elevation Higher costs for piers More speed reductions than mid-level due to higher grades		A10
In Between #3		90	7,720	70	2.70	-2.70	2007	Not considered	Desirable grade Desirable design speed	More difficult for Sampson St. Ramps to tie in at higher elevation Higher costs for piers		A11
In Between #4		90	7,480	70	2.70	-3.00	2007	Not considered	Desirable grade Desirable design speed	More difficult for Sampson St. Ramps to tie in at higher elevation Higher costs for piers		A12

These profiles are selected in this special study for further analysis of geometrics, construction costs, road user costs, and safety. Analysis presented in the text following this chapter is based on five Alternatives.

*Vertical Clearance as noted for proposed bridge profiles are based on the average annual high water elevation of 4.3' NGVD. The vertical clearance for existing bridge profile is based on 8.0' mean sea level (MSL).
**Approximate bridge lengths were calculated based on the existing bridge embankment heights for west bridge approach (22') and east bridge approach (18'). Also, note that lengths have been rounded to nearest 10 feet.
***Design Speeds shown are for main span and are based on DOTD guidelines set in project Design Criteria for [Crest: K = 435 (70 mph), 282 (60 mph)].

Mid-Level Profiles

The three proposed Mid-Level profile alternatives depicted in Figure A-1 of Appendix A were first developed in the "Preliminary Line & Grade Technical Memorandum" (2001). The three profiles were developed based on the traffic and port use needs of the Lake Charles and Westlake areas (i.e. vertical and horizontal clearance and structure depth) as follows:

- 70 mph design speed
- 3% max grades
- 73' vertical clearance above 4.3' NGVD

Alternative Profile #1 passes under proposed elevated diamond or free flow interchange at Sampson Street, and results in the shortest bridge length of all the alternatives. However, this geometry impairs the opportunity for phased construction at Sampson Street interchange. Alternative Profile #2 passes under elevated diamond Sampson Street interchange and then rises to create a "hump" before descending back to grade level. This allows for phased construction at the interchange. Alternative Profile #3 was developed to accommodate Mike Hooks alternative for Sampson Street interchange. Under this alternative for the interchange, Sampson Street is realigned with Mike Hooks Road to the south of I-10 mainline at a skew angle. This results in vertical clearance over the proposed interchange closer to mainline channel and creates a longer profile on west side of river.

Due to the constructability issues at Sampson Street, Alternative Profile #2 (along with the elevated diamond configuration for Sampson Street interchange) was identified as meriting further study as it was most conducive to a phased construction approach at Sampson Street. As stated above, this profile is characterized by a "hump" passing over existing Sampson Street and under the proposed elevated diamond interchange. This allows the river bridge profile to remain low which minimizes costs and allows for interchange ramps to tie into the mainline with flatter grades and shorter structures, while still accommodating vertical clearances over/under the roadways. Based on these factors, this profile was identified by HNTB as recommended for further design and refinement in the "Comprehensive Preliminary Alternatives Report" (2002). LaDOTD concurred with this recommendation.

Over the course of the EA process, this profile was revised using slightly flatter grade of 2.7%, which is considered the most favorable Mid-Level profile alternative.

High Level Profiles

The High-Level profiles were developed based on public input received in 2002 & 2003. The first High-Level profile presented to LaDOTD was based on the following conditions:

- 70 mph design speed
- 3% grades on the approaches
- 120' vertical clearance above 4.3' NGVD

As illustrated on Figure A-2 in Appendix A and explained in the letter report from HNTB to LaDOTD dated January 30, 2003, this profile was significantly longer on either side of the river than the Mid-Level profile alternatives and passed over the proposed elevated Sampson St interchange, resulting in many potential adverse impacts including: 1) reduction of speeds based on long critical lengths of grade, 2) special consideration for phased construction due to higher ramps needed at Sampson St. interchange, 3) increased construction costs, and 4) detrimental community cohesion & visual impacts especially on the east side of the river near public beach and downtown area.

Based on these evaluations, subsequently six additional High-Level profile alternatives were developed with steeper grades in order to minimize bridge length and impacts. These profiles were based on the following:

- 60 mph or 70 mph design speeds,
- Grades ranging between 3.8% and 5%
- 11' structure depth, and
- 118'-125' vertical clearance above 4.3' NGVD

These additional six High-Level profile alternatives are provided in Appendix A, Figures A-3 through A-8.

2.2. New "In-Between" Bridge Profile Alternatives

Four new In-Between bridge profile alternatives have been developed for this study. The In-Between profiles are provided in Appendix A, Figures A-9 thru A-12. The In-Between bridge profiles have vertical clearance above the Mid-level bridge and lower than the high-level bridge profiles. In-Between Alternative Profile #1 (see Figure A-9) retains the bridge length limits of the Mid-Level Alternative Profile #2 to allow the mainline to pass below proposed elevated Sampson St. interchange with a vertical clearance of 100' above the main channel's 4.3' NGVD.

The parameters for In-Between Alternative Profile #1 are:

- 60 mph design speed
- 3.0% grade east approach and a 3.5% west approach
- 11' structure depth, and
- 100' vertical clearance above 4.3' NGVD

In-Between Profile Alternative #2 (see Figure A-10) is similar to the In-Between Profile Alternative #1, except the bridge length limits on the east end extend beyond Mid-level Profile #2. This allows for a desirable 3.0% grade for both east and west approaches although it lengthens the bridge limits by more than 500'. The design speed for the main span of In-Between Profile Alternative #2 is increased to 70 mph, which requires a large "K" factor and results in a minor change in vertical clearance to 98' above 4.3' NGVD.

Based on input from DOTD following the draft review of this report, two additional in-between alternatives have emerged for analysis and are included in this final report. These alternatives, In-Between Alternatives #3 and #4, were developed using a vertical clearance of 90' above 4.3' NGVD and a design speed of 70 mph. Also, it is noted that the PVI's have been shifted to optimize grades on the west and east approaches while maintaining vertical clearance at railroad grade separation on west side of the Calcasieu River.

The In-Between Alternative #3 (see Figure A-11) uses a 2.7% grade for the west approach and a 2.7% for the east approach. Similarly, In-Between Alternative #4 (see Figure A-12) incorporates a 2.7% grade for the west approach with a 3.0% grade for the east approach. As a result, the bridge lengths of these alternatives are relatively equivalent (7750' vs. 7720'), longer than In-Between Alternative #1, and shorter than In-Between Alternative #2.

3. PROPOSED I-10 CALCASIEU RIVER BRIDGE CONSTRUCTION COST COMPARISONS

3.1. Bridge Structure Type Considerations

The proposed 1.4 mile mid level mainline bridge structure consists of a 200' – 270' – 270' – 200' steel trapezoidal box girder unit for the navigation span and a combination of 135' and 125' precast prestressed concrete bulb tee type approach spans. The mainline navigation span and portions of the mainline approach spans consists of an eight (8) lane bridge having an out-to-out deck width of 148.5'. Portions of the mainline approach spans consists of a six (6) lane bridge having an out-to-out deck width of 124.5'. The proposed mainline bridge substructure consists of reinforced concrete piers with cap beams, columns and pile supported concrete footings. The project will require more than one (1) million square feet of highway bridge structures.

Additional information on the proposed mainline bridge and the other bridge types studied for this project may be found in the submitted "Preliminary Bridge Studies Technical Memorandum"

3.2. Bridge Unit Costs

Unit costs for the bridge studies were determined from the Louisiana Department of Transportation and Development (LDOTD) "LDOTD Bid Item Weighted Unit Prices" 2nd Quarter 2007 and other recently completed similar bridge projects in Louisiana and around the United States, especially in the South.

The bridge unit costs are based on previously designed bridges similar to the structure types discussed herein. Bridge unit costs per square foot of deck for the bridges were determined for each listed structure type. The probable bridge unit costs per square foot provided herein include mobilization and miscellaneous costs of about 20%. The bridge unit cost per square foot estimates and assumptions used can be found in Appendix B.

The Appendix B bridge unit costs were derived assuming variable bridge pier heights for each proposed profile alternate studied. The unit superstructure costs were kept the same, while the unit substructure quantities and costs changed based on the assumed average pier heights for each profile alternate. The assumed mainline bridge average pier height summary is shown in Table 3-1:

**Table 3-1
 I-10 CALCASIEU RIVER BRIDGE
 AVERAGE PIER HEIGHT SUMMARY**

PROFILE OPTION	NAVIGATION VERTICAL CLEARANCE LENGTH (FT)	MAIN SPAN PIER HEIGHT (FT)	APPROACH 135' SPAN AVG PIER HEIGHT (FT)	APPROACH 125' SPAN AVG PIER HEIGHT (FT)
Mid-Level	73	71	60	35
In-Between #1	100	96	80	45
In-Between #2	98	96	82	53
In-Between #3	90	87	72	41
In-Between #4	90	87	72	41
High-Level #6	118	116	90	45
High-Level A	120	116	82	-

Option Description:

Mid Level Bridge profile with 73 feet navigation vertical clearance & 2.7 % max. grades.
 In Between Bridge profile #1 with 100 feet navigation vertical clearance & 3.5 % max. grades.
 In Between Bridge profile #2 with 98 feet navigation vertical clearance & 3.0 % max. grades.
 In Between Bridge profile #3 with 90 feet navigation vertical clearance & 2.7 % max. grades.
 In Between Bridge profile #4 with 90 feet navigation vertical clearance & 3.0 % max. grades.
 High Level Bridge profile #6 with 118 feet navigation vertical clearance & 4.6 % max. grades.
 High Level Bridge profile A with 120 feet navigation vertical clearance & 3.0 % max. grades.

3.3. I-10 Calcasieu River Bridge Total Estimate of Probable Costs

The mainline bridge total probable costs are determined by applying the computed square foot costs to the estimated bridge deck square foot for each profile alternate. The mainline bridge total probable cost for each profile alternate is shown in Table 3-2:

**Table 3-2
I-10 CALCASIEU RIVER BRIDGE
PROFILE OPTION COST SUMMARY
(Assumes 20% Mobilization and Miscellaneous)***

PROFILE OPTION	NAVIGATION VERTICAL CLEARANCE (FT)	TOTAL BRIDGE LENGTH (FT)	MAIN SPAN 148.5' WIDTH LENGTH (FT)	APPROACH SPAN 124.5' WIDTH LENGTH (FT)	APPROACH SPAN 148.5' WIDTH LENGTH (FT)	MAIN SPAN UNIT COST \$/SQ FT	APPROACH SPAN AVG UNIT COST \$/SQ FT	TOTAL BRIDGE COST IN MILLIONS	
Mid-Level	73	7,250	940	3,083	3,227	221	117	\$ 132	M
In-Between #1	100	7,250	940	3,083	3,227	235	129	\$ 144	M
In-Between #2	98	7,790	940	3,063	3,787	235	133	\$ 158	M
In-Between # 3	90	7,720	940	3,095	3,685	230	124	\$ 148	M
In-Between #4	90	7,480	940	3,095	3,445	230	124	\$ 144	M
High-Level #6	118	6,960	940	2,944	3,076	247	134	\$ 145	M
High-Level A	120	9,600	940	4,035	4,625	247	144	\$ 206	M

Option Description:

- Mid Level Bridge profile with 73 feet navigation vertical clearance & 2.7 % max. grades.
- In Between Bridge profile #1 with 100 feet navigation vertical clearance & 3.5 % max. grades.
- In Between Bridge profile #2 with 98 feet navigation vertical clearance & 3.0 % max. grades.
- In Between Bridge profile #3 with 90 feet navigation vertical clearance & 2.7 % max. grades.
- In Between Bridge profile #4 with 90 feet navigation vertical clearance & 3.0 % max. grades.
- High Level Bridge profile #6 with 118 feet navigation vertical clearance & 4.6 % max. grades.
- High Level Bridge profile A with 120 feet navigation vertical clearance & 3.0 % max. grades.

*Note that the total bridge costs listed in this table refer to new construction of an I-10 Calcasieu River Bridge crossing only. These costs include the mainline lanes, but do not include cost for ramps until they connect to the mainline river bridge, improvements at Sampson Street interchange, improvements along I-10 west & east of river bridge, or removal of existing river bridge. Furthermore these estimated construction costs are based on 2007 prices and not the date of actual construction.

4. ROAD USER COST COMPARISONS BETWEEN MID-LEVEL, IN-BETWEEN, AND HIGH-LEVEL BRIDGE PROFILE ALTERNATIVES

This section summarizes the analysis of delay and road user costs associated with the alternative bridge profiles for I-10 over the Calcasieu River. Preliminary research did not yield an accepted standard practice for analyzing alternative bridge profiles from a road user cost perspective. Therefore, the work zone delay estimation software QuickZone was utilized to determine the impact of increasing the profile of the structure, as it relates to capacity reductions, and in turn calculate the resultant delay and road user cost parameters for each scenario. All profiles were not modeled completely, but the following four profile scenarios should provide enough information to calculate the anticipated relative delay and cost differences between each profile;

1. A Mid-Level profile with grades of 2.70% and a 73 ft vertical clearance,
2. An In-Between profile with grades of 3.00% and -3.50% and a 100 ft vertical clearance,
3. An In-Between profile with grades of 2.70% and -2.70%/3.00% and a 90 ft vertical clearance, and
4. A High-Level profile with grades of 3.84% and -4.60% and a 120 ft vertical clearance.

The analysis shows that as the profile of the structure increases in height, delay and road user costs rapidly increase due to capacity reductions associated with the upgrade effect on vehicles.

4.1. QuickZone Background

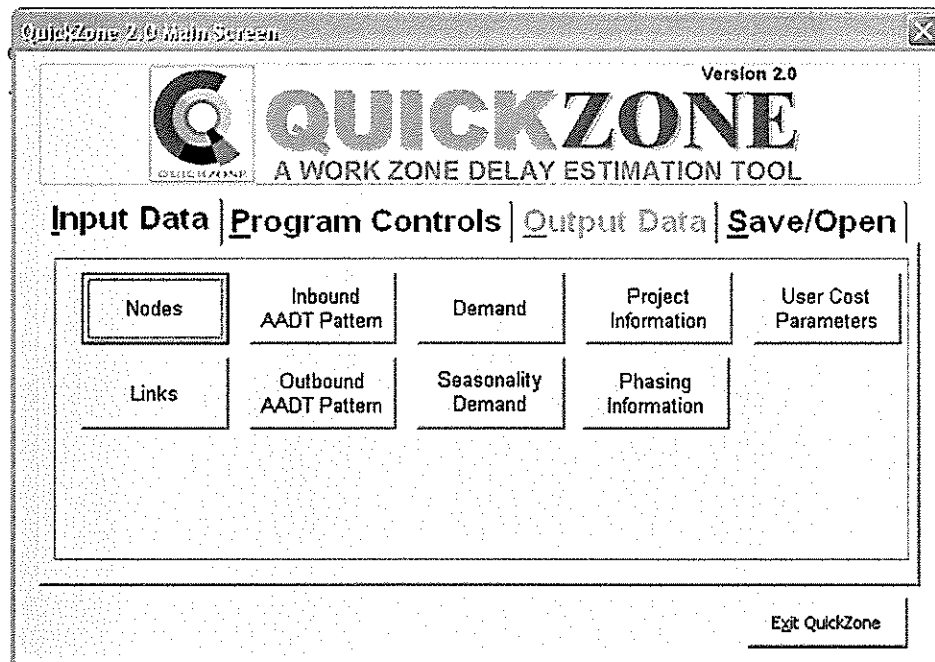
QuickZone was developed by the Federal Highway Administration to provide estimates of delay within work zones. It is a Microsoft Excel-based program, which makes it user friendly and allows for quick problem set up. A master control dialog sheet is used for navigation between the four major modules: Input Data, Program Controls, Output Data, and Save/Open. The four essential components of QuickZone are:

1. Network Data – Describing the mainline facility under construction as well as adjacent alternatives in the travel corridor;
2. Project Data – Describing the plan for work zone strategy and phasing, including capacity reductions resulting from work zones;
3. Travel Demand Data – Describing patterns of pre-construction corridor utilization; and

4. Corridor Management Data – Describing various congestion mitigation strategies to be implemented in each phase, including estimates of capacity changes from these mitigation strategies.

QuickZone analyzes construction delays, queues, and associated user costs due to construction zones or lane drops. It does so by using a conservation of flow algorithm that takes into account the reductions in capacity associated with construction activities. This connectivity between capacity reductions and road user costs made the software an attractive option for calculating the impact of the varying bridge profiles, since it is logical that increasing grades reduces capacity.

Figure 4-1
QUICKZONE INTERFACE



4.2. Capacity Reduction Methodology

Before QuickZone models could be constructed, a method for calculating corresponding capacity decreases due to the grade for each alternative was needed. The annual average daily traffic (AADT), peak hour factor (PHF), number of lanes, free flow speed (FFS), and heavy vehicle percentage were known. Furthermore, travel demand modeling previously performed for the project concluded that different bridge profiles would not impact demand, so the AADT remained constant. Percentage of trucks was 12%, FFS was 70mph.

In light of the above information, the theoretical capacity of the structure was determined using the Highway Capacity Manual (HCM) 2000.

A design FFS of 70mph, as shown in Exhibit 23-3 in the HCM, coupled with a capacity threshold in the proximity of Level of Service (LOS) E results in a maximum capacity of 2,400 passenger cars per lane per hour (pc/ln/hr).

With a maximum capacity per lane per hour of 2,400, the hourly volume was found by solving for V in equation 23-2 in the HCM, as follows:

$$v_p = \frac{V}{PHF \times N \times f_{HV} \times f_p} \quad \text{HCM Equation 23-2}$$

v_p = 15 min passenger – car equivalent flow rate (pc / h / ln)

V = hourly volume (veh / hr)

PHF = peak – hour factor

N = number of lanes

f_{HV} = heavy – vehicle adjustment factor, and

f_p = driver population factor

In order to solve for the hourly volume, the heavy vehicle factor must be determined. The heavy vehicle factor is dependent upon the percentage of heavy vehicles and grade of the roadway, and is calculated from Equation 23-3 in the HCM as follows:

$$f_{HV} = \frac{1}{1 + P_T(E_T - 1) + P_R(E_R - 1)} = \frac{1}{1 + P_T(E_T - 1)} \quad \text{HCM Equation 23-3}$$

E_T, E_R = passenger – car equivalents for trucks / buses and recreational vehicles (RVs) in the traffic stream

P_T, P_R = proportion of trucks / buses and RVs in the traffic stream

f_{HV} = heavy – vehicle adjustment factor

It was assumed that no recreational vehicles were included in the traffic stream. The E_T factor is dependent upon the combination of grade level and grade length for each bridge profile. Table 4-1 shows the E_T for the Mid-Level (73'), In-Between (100'), In-Between (90') and High-Level (120') bridges, as determined from Exhibit 23-9 in the HCM. The west-half of the bridge has a different grade than the east-half of the bridge for the In-Between and High-Level bridges, hence the change in the E_T value.

Table 4-1
PASSENGER-CAR EQUIVALENTS FOR TRUCKS/BUSES (E_T)

Alternative	Vertical Clearance (ft.)	Grade Along Profile	Length	E _T
Mid-Level	73'	2.70%	0.64	1.5
		-2.70%	0.57	1.5
In-Between #1 & #2	100'	3.00%	0.65	1.5
		-3.50%	0.57	2.0
In-Between #3 & #4	90'	2.70%	0.66	1.5
		-3.00%	0.60	1.5
High-Level	120'	3.84%	0.60	2.0
		-4.60%	0.50	2.0

Inserting E_T into Equation 23-3 for both of the grades in the four bridge alternatives yields the heavy vehicle factor due to grade and percentage trucks for the alternatives. Table 4-2 shows the heavy vehicle factor for the four alternatives.

Table 4-2
HEAVY VEHICLE FACTOR

	Vertical Clearance (ft.)	Grade Along Profile	Heavy Vehicle Factor (F _{hv})
Mid-Level	73'	2.70%	0.943
		-2.70%	0.943
In-Between #1 & #2	100'	3.00%	0.943
		-3.50%	0.893
In-Between #3 & #4	90'	2.70%	0.943
		-3.00%	0.943
High-Level	120'	3.84%	0.893
		-4.60%	0.893

The heavy vehicle factor, number of lanes, peak hour factor, and commuter population values were then substituted into Equation 23-2. The commuter population was assumed to be 1.0, or mostly commuter traffic. The following equations show the calculations for the four alternatives.

$$mid - level \rightarrow 2,400 = \frac{V_{mid,2.7\%}}{0.90 \times 4 \times 0.943 \times 1} = 8,148veh/hr$$

$$inbetween_{\#1\&\#2} \rightarrow 2,400 = \frac{V_{inb,3.5\%}}{0.90 \times 4 \times 0.893 \times 1} = 7,716veh/hr$$

$$inbetween_{\#3\&\#4} \rightarrow 2,400 = \frac{V_{inb,3.5\%}}{0.90 \times 4 \times 0.943 \times 1} = 8,148veh/hr$$

$$high - level \rightarrow 2,400 = \frac{V_{high,4.6\%}}{0.90 \times 4 \times 0.893 \times 1} = 7,716veh/hr$$

Using the hourly volume, veh/hr/lane can be determined by dividing the above volumes by the number of lanes. Acceleration lanes are proposed in each direction. The lanes are long enough to cover the majority of the structure so it is assumed that the acceleration lanes essentially make the structure an eight-lane bridge. Therefore the above volumes were divided by a factor of 4 to determine the lane capacities. Table 4-3 shows the eastbound and westbound lane capacities that were utilized in QuickZone.

Table 4-3
LANE CAPACITIES (Veh/hr/ln)

	Vertical Clearance (ft.)	Grade Along Profile	Direction	Lane Capacity (veh/hr/ln)
Mid-Level	73'	2.70%	EB	2,037
		-2.70%	WB	2,037
In-Between #1 & #2	100'	3.00%	EB	2,037
		-3.50%	WB	1,929
In-Between #3 & #4	90'	2.70%	EB	2,037
		-3.00%	WB	2,037
High-Level	120'	3.84%	EB	1,929
		-4.60%	WB	1,929

4.3. QuickZone Modeling

The network was constructed utilizing QuickZone Network Editor, Version 0.2. A high resolution bitmap file was imported into the program. The length of the bridge was known, which helped to check the grid scale in the Network Editor. Once the correct grid spacing was determined, the network could be built. Nodes were established first, at any point of merge or diverge along the new bridge and at the beginning and end of the grade along the bridge. As illustrated in Figures 4-2 and 4-3, the limits of the grade section of the bridge are between Nodes 4 through 12. Node 9 represents the peak of the bridge. The river span of the bridge is between Nodes 8 and 12.

Links were established between nodes. Link properties included number of lanes, length, FFS, and jam density. For this project, three different link types were used: mainline, work zone, and none (ramps).

Once the network was built, the file was ported to QuickZone, Version 2.0. The program is used to code all of the capacity inputs, demand patterns, economic costs, and work zone plans.

(120') profiles were input as construction zones because, in this analysis only, they are dissimilar exclusively in capacity differences due to grade.

The capacities per lane for the Mid-Level (73') profile are considered the baseline as shown within Table 4-3. The In-Between (100'), In-Between (90') and High-Level (120') profile capacities were input into QuickZone in the Phasing Information section as link capacity reductions, where applicable.

In the absence of detailed monthly or seasonal traffic data, inbound and outbound AADT patterns were normalized so that Monday through Friday were equal in relative daily traffic. Hourly percentages of the AADT were normalized as well. Saturday and Sunday were kept at their default values for this project. Seasonality of demand was also assumed to be a non-factor for this analysis.

Demand for each link, as reflected by the AADT, was coded for each direction and link of the mainline bridge and the four ramps within the study area. QuickZone translates AADT into hourly volumes, utilizing the demand characteristics assumed with the project.

The QuickZone program requires the following traffic inputs to calculate the User Cost parameters that ultimately are used to estimate cost due to delay. These include the following:

- Trip purposes - assumed to be 40% for business trips and 60% for personal trips.
- Trip type - assumed to be 40% local trips and 60% for inter-city trips.

With the above inputs entered QuickZone uses data from the National Compensation Survey – (*Compensation Cost Trend Statistics: Employer Cost for Employee Compensation, U.S. Department of Labor, Bureau of Labor Statistics, <http://www.bls.gov/ncs/ect/home.htm>*), to calculate the following parameters to apply to the anticipated traffic:

- Average Vehicle Occupancy Levels – Passenger Cars (2.05 people), Trucks (1.14 people)
- Average cost per vehicle-hr of delay - Passenger Cars (\$24.26), Trucks (\$23.58)

Figure 4-2
NODES AND LINKS USED WITH QUICKZONE
(With Aerial Photography Background)

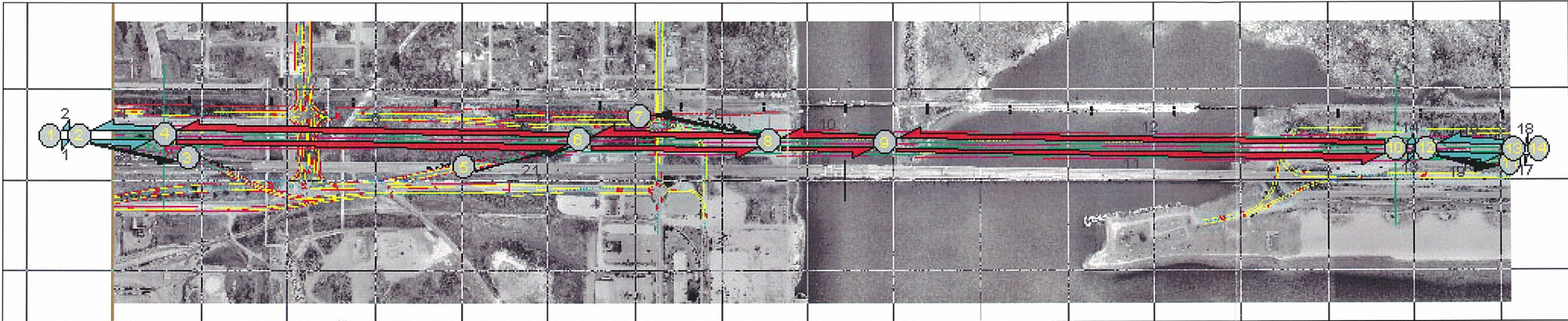
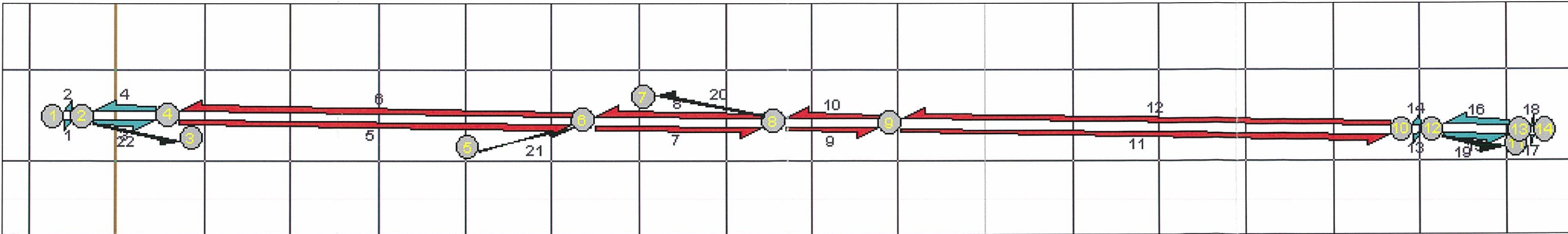


Figure 4-3
NODES AND LINKS USED WITH QUICKZONE
(Without Aerial Photography Background)



4.4. Grade Alternatives

As previously discussed, longer and steeper grade profiles were defined as capacity-reducing construction phases. Each higher-grade phase was coded in accordance with corresponding capacities per link, as determined from HCM methods. The construction zone was defined as links 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14. Of these links, the span crossing the river, with four lanes, was defined as 11, 12, 13, and 14. The per lane capacities for each profile alternatives as shown within Table 4-3 were utilized.

4.5. Results

Table 4-4 illustrates the output from the QuickZone modeling. Variables include total weekly maximum queue in miles, weekly delay in vehicle-hours, and user delay in minutes. Caution shall be used as these numbers are relative results based on anticipated operational decreases due to different grades and lengths. The results indicate the following:

- The In-Between (90') profile yields the same results as the Mid-Level (73') profile. This is because the Heavy Vehicle Factor (Exhibit 23-9, Highway Capacity Manual) obtained is the same for both profiles. The statistical data available is not precise enough for a computed difference. However it is reasonable to conclude that the delays for the In-Between (90') profile will be greater than that of the Mid-Level (73') profile and less than the In-Between (100') profile.
- The In-Between (100') profile yielded an approximate 51% increase in queue length and vehicle-hours of delay per week and a 61% increase in delay minutes per week over the Mid-Level (73') profile.
- The High-Level (120') profile indicates an approximate 165% increase in queue length, a 214% increase in vehicle-hours of delay per week, and 203% increase in delay minutes per week, over the Mid-Level (73') profile.

Table 4-4
PER WEEK OUTPUT FROM QUICKZONE

	Queue	Mainline Delay		Queue Relative Difference compared to Mid- Level (miles)	Delay Relative Difference compared to Mid- Level (veh-hr)	Delay Relative Difference compared to Mid- Level (minutes)
	Max	Total	Max			
	Combined	Delay	User Delay			
	Miles per wk	Vehicle- Hours per wk	Minutes per wk			
Mid-Level (73')	1.93	11664	9.16	0.0%	0.0%	0.0%
Effect of Grade EB	0.94	5679	4.45			
Effect of Grade WB	0.99	5985	4.71			
In-Between #1 & #2 (100')	2.92	17649	14.71	51%	51%	61%
Effect of Grade EB	0.94	5679	4.45			
Effect of Grade WB	1.98	11970	10.26			
In-Between #3 & #4 (90')	1.93	11664	9.16	0.0%	0.0%	0.0%
Effect of Grade EB	0.94	5679	4.45			
Effect of Grade WB	0.99	5985	4.71			
High Level (120')	5.12	36663	27.71	165%	214%	203%
Effect of Grade EB	3.14	24693	17.45			
Effect of Grade WB	1.98	11970	10.26			

Table 4-5 shows the comparison of road user costs (RUC) between the alternatives. Again, caution shall be used as these numbers are relative results based on anticipated profile operational decreases due to different grades and lengths and the RUC is based on accepted national defaults. The results indicate the following:

- The In-Between (90') profile yields the same results as the Mid-Level (73') profile. This is due to the Heavy Vehicle Factor obtained for both alternatives from Exhibit 23-9 of the Highway capacity manual is the same. The statistical data available is not precise enough for a computed difference. However it is reasonable to conclude that the road user cost for the In-Between (90') profile will be greater than that of the Mid-Level (73') profile and less than the In-Between (100') profile.
- The In-Between (100') profile yielded an approximate 39% (\$115,535 per wk) increase in RUC per week than that that of the Mid-level (73') profile.
- The High-Level profile (120') indicates an approximate 166% (\$492,419 per wk) increase in RUC per week than that of the Mid-Level (73') profile.

**Table 4-5
 PER WEEK ROAD USER COSTS FOR ALTERNATIVES**

	Road User Cost Due to Delay			
	Mainline		Total Dollars per wk	Relative Difference compared to Mid-Level
	Car Dollars per wk	Trucks Dollars per wk		
Mid-Level (73')	\$261,156	\$34,614	\$295,770	0.0%
Effect of Grade EB	\$127,146	\$16,852		
Effect of Grade WB	\$134,010	\$17,762		
In-Between #1 & #2 (100')	\$363,170	\$48,135	\$411,305	39%
Effect of Grade EB	\$127,146	\$16,852		
Effect of Grade WB	\$236,024	\$31,283		
In-Between #3 & #4 (90')	\$261,156	\$34,614	\$295,770	0.0%
Effect of Grade EB	\$127,146	\$16,852		
Effect of Grade WB	\$134,010	\$17,762		
High Level (120')	\$695,947	\$92,242	\$788,189	166%
Effect of Grade EB	\$459,923	\$60,959		
Effect of Grade WB	\$236,024	\$31,283		

4.6. Limitations of Analysis

There are a number of limitations in this analysis that should be noted:

- The truck acceleration profiles used to develop the Highway Capacity Manual methodology may be dated. Contemporary trucks have horsepower to weight ratios superior to those in existence when the Highway Capacity Manual was written in the mid 1980s to early 1990s. This probably results in more conservative delay predictions.
- For this analysis, demand relationships were assumed to be uniform across days of the week, time of day, and seasonal periods. Therefore, more precise measurements would result from further inclusion of these relationships.
- More precise cost estimates may be performed through research of cost of travel time and travel demand characteristics specific to the project area.

In light of the above limitations, this analysis reports relative percent difference between scenarios in place of more specific reporting of actual values for delay and road user cost variables.

5. SAFETY, SPEED REDUCTION AND ACCIDENT RATES

It is known that traffic streams operate differently based on the particular features of the roadway such as the number and width of lanes, size of shoulders, number of interchanges, and in the case of bridges or mountains, steep grades. This chapter will take a closer look at the affect that steep grades have on the traffic stream similar to that within Chapter 4 but instead with emphasis on the anticipated safety ramifications for each of the I-10 Calcasieu Bridge Profile Alternatives.

As a driver approaches the beginning of a bridge, he/she and the rest of the traffic stream are all traveling at the roadway natural free flow speed (FFS), usually between 65-70 mph for interstate roadways. As the traffic stream enters the bridge the effect of the incline (gravity) begins to act on all vehicles and each vehicle has to exert more energy to maintain its desired speed. Most vehicles within this traffic stream will have no problems maintaining its desired speed, however some vehicles will not. The resultant is the potentially dangerous relationship passenger cars and heavy trucks have as they traverse mountainous areas or in this case the proposed I-10 Calcasieu River Bridge.

To analyze the potential of this safety hazard, the anticipated speed reductions of heavy vehicles need to be determined. The following two methods were chosen to determine the speed reductions: 1) the AASHTO method as outlined on pages 236-242 of the AASHTO Green Book (2004), and 2) a micro simulation traffic modeling software called Vissim.

The AASHTO Method has been adopted by many traffic engineers and agencies as the method to determine the critical lengths of grades (the length and grades at which truck speeds decrease by greater than 10 mph). Modern day trucks have horsepower to weight ratios superior to those in use when the AASHTO speed reduction data was collected in the mid 1980s to early 1990s and therefore the results shown within this chapter will be used to validate the Vissim results and should be considered conservative.

The Vissim Method utilizes a micro-simulation modeling software that allows traffic engineers to enter in more project specific traffic and geometric information such as; traffic volumes, number of lanes, varying truck weight/horsepower ratios, and horizontal and vertical geometry. With more specific information and updated truck performance curves, a more realistic approximation of the speed reductions than that of the AASHTO method can be obtained.

Results of both methods can be found within Table 5-1 below.

**Table 5-1
 SPEED REDUCTION FROM TRUCK OPERATIONS STUDY**

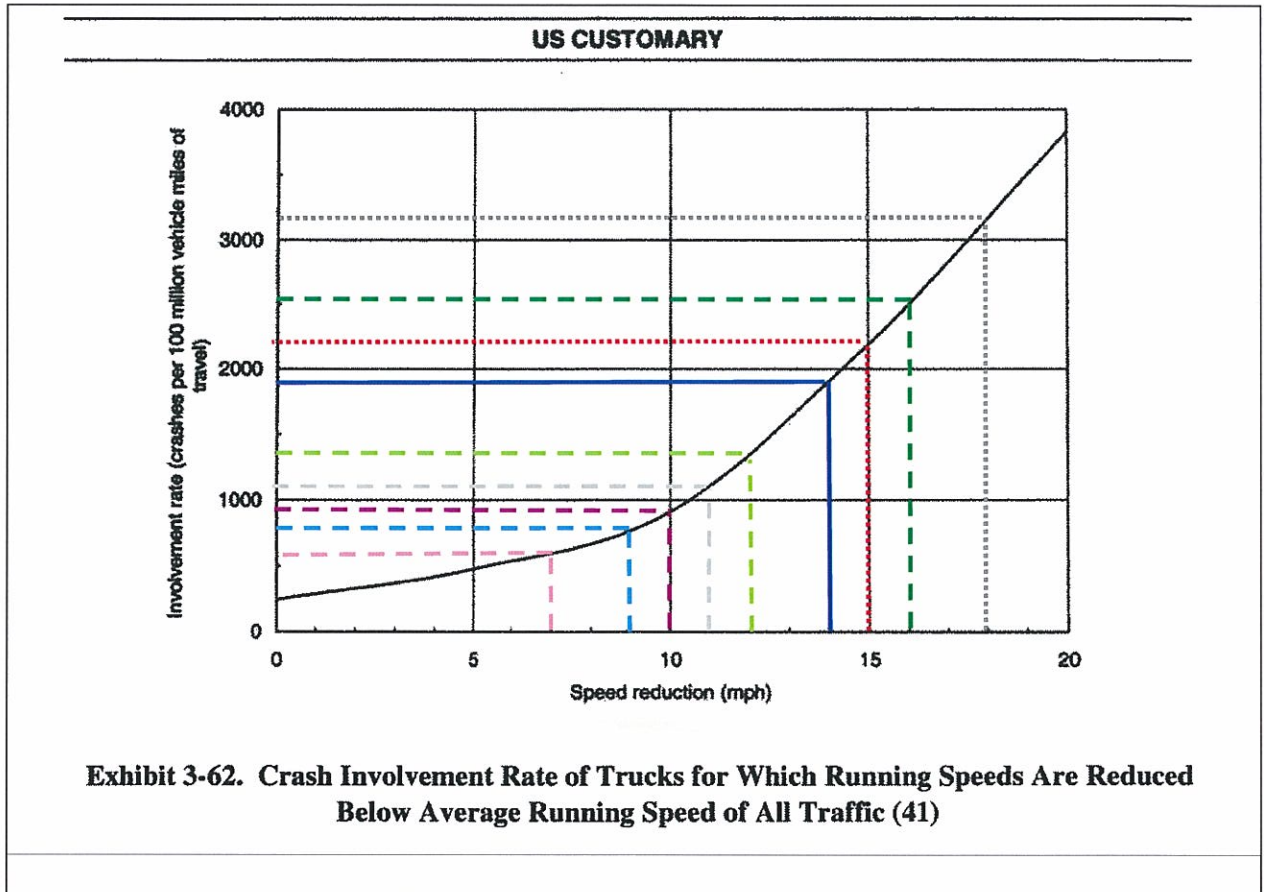
Alternative	Vertical Clearance (ft.)	Approach	Grade (%)	Total Speed Reduction (AASHTO method) (mph)	Total Speed Reduction (VISSIM Model)* (mph)
Mid-Level #2	73	West	3.0/0.7/2.7	15	7
		East	2.7	14	9
In-Between Level #1& #2	100/98	West	3	18	11
		East	3	18	12
			3.5	21	14
In-Between Level #3 & #4	90	West	2.7	15	10
		East	2.7	15	11
			3	14**	10**
High-Level #6	120	West	3.84	23	14
		East	4.6	24	16

* These speed reductions are less than those obtained from the AASHTO method. This is contributed to AASHTO uses a conservative weight/power ratio of (200lb/hp) for determination of speed reduction.

** These speed reductions are less than the 90 ft. alternative with 2.7% grades due to a shorter critical length of grade.

The AASHTO 2001 Green Book (page 241) Exhibit 3-62 (or Exhibit 3-58, AASHTO 2004 Green Book, (page 238)) "Crash Involvement Rate of Trucks for Which Running Speeds Are Reduced below Average Running Speed of All Traffic," displays the Crash Involvement Rate (crashes per 100 million vehicle miles of travel) versus Speed Reduction (mph). Using the speed reduction data discussed above and as shown in Table 5-1, the accident rates between the Mid-Level (73'), In-Between (100'), In-Between (90') and High-Level (120') profile alternatives can be obtained within Figure 5-1.

Figure 5-1
 EXHIBIT 3-62, AASHTO 2001 GREEN BOOK or
 EXHIBIT 3-58, AASHTO 2004 GREEN BOOK



Legend:	(AASHTO)	(Vissim)
Mid-Level #2 EB (73')	.....	.....
Mid-Level #2 WB (73')	————	.....
In-Between #1 EB (100')	.....	.....
In-Between #1 WB (100')	.....	.....
In-Between #2 EB (100')	.....	.....
In-Between #2 WB (100')	(not on chart)	————
In-Between #3 EB (90')	.....	.....
In-Between #3 WB (90')	.....	.....
In-Between #4 EB (90')	.....	.....
In-Between #4 WB (90')	————	.....
High-Level #6 EB (125')	(not on chart)	————
High-Level #6 WB (125')	(not on chart)	.....

Table 5-2 summarizes in tabular form the Involvement Rate Results of Figure 5-1.

**Table 5-2 INVOLVEMENT RATE
(CRASHES PER 100 MILLION VEHICLE MILES OF TRAVEL)**

Alternative & Direction	Approximate Crash Involvement Rate Total Speed Reduction (AASHTO method) (crashes per 100 million vehicle miles of travel)	Approximate Crash Involvement Rate Total Speed Reduction (Vissim Model) (crashes per 100 million vehicle miles of travel)
Mid-Level #2 EB (73')	2200	650
Mid-Level #2 WB (73')	1900	800
In-Between #1 EB (100')	3200	1160
In-Between #1 WB (100')	3200	1300
In-Between #2 EB (98')	3200	1160
In-Between #2 WB (98')	(off the chart) \approx 4100	1900
In-Between #3 EB (90')	2200	900
In-Between #3 WB (90')	2200	1160
In-Between #4 EB (90')	2200	900
In-Between #4 WB (90')	1900	900
High-Level #6 EB (120')	(off the chart) \approx 4800	2000
High-Level #6 WB (120')	(off the chart) \approx 5100	2550

Calculation of 100 million vehicle mile of travel factor (100M VMT Factor)

- Distance vehicle traveled per Eastbound and Westbound approach = 0.5 miles
- Average Daily Traffic (ADT) = 71,500 vehicles per day
- Directional Factor = 0.5
- Average Daily Traffic for just EB and WB directions = $71,500 \times 0.5 = 35,750$ vehicles per day
- Percentage of Trucks = 12%
- Total truck vehicles per day = $35,750 \text{ veh} \times 12\% = 4290$ trucks per day
- Distance one vehicle/truck travels per day = 0.5 miles per day
- Distance all traffic traveled per day = $4290 \text{ trucks per day} \times .5 \text{ miles} = 2,145$ truck-miles per day
- Distance all traffic traveled per year = $2,145 \text{ truck miles per day} \times 365 \text{ days} = 782,925$ truck-miles per yr
- 100M VMT Factor (Annual) = $782,925 \text{ truck-miles per yr} \div 100,000,000 \text{ veh-miles} = .00783$ per yr

The resulting number of accidents involving trucks per year is shown in Table 5-3.

**Table 5-3 SPEED REDUCTION RESULTS
(NUMBER OF ACCIDENTS INVOLVING TRUCKS)**

Alternative & Direction	Based on AASHTO Speed Reduction			Based on Vissim Speed Reduction		
	Approximate Crash Involvement Rate (AASHTO method) (crashes per 100 million VMT)	100M VMT Factor (Annual)	Crashes per year	Approximate Crash Involvement Rate (Vissim Model)* (crashes per 100 million VMT)	100M VMT Factor (Annual)	Crashes per year
Mid-Level #2 EB (73') 3.0,0.7,2.7%	2200	0.00783	17	650	0.00783	5
Mid-Level #2 WB (73') 2.7%	1900	0.00783	15	800	0.00783	6
In-Between #1 EB (100') 3.0%	3200	0.00783	25	1160	0.00783	9
In-Between #1 WB (100') 3.5%	3200	0.00783	25	1300	0.00783	10
In-Between #2 EB (98') 3.0%	3200	0.00783	25	1160	0.00783	9
In-Between #2 WB (98') 3.0%	(off the chart) \approx 4100	0.00783	32	1900	0.00783	15
In-Between #3 EB (90') 2.7%	2200	0.00783	17	900	0.00783	7
In-Between #3 WB (90') 2.7%	2200	0.00783	17	1160	0.00783	9
In-Between #4 EB (90') 2.7%	2200	0.00783	17	900	0.00783	7
In-Between #4 WB (90') 3.0%	1900	0.00783	15	900	0.00783	7
High-Level #6 EB (120') 3.84%	(off the chart) \approx 4800	0.00783	38	2000	0.00783	16
High-Level #6 WB (120') 4.6%	(off the chart) \approx 5100	0.00783	40	2550	0.00783	20

5.1. Summary of Results

The purpose of this chapter is to compare I-10 Calcasieu Bridge profile alternatives with respect to each other. Crashes per year for each profile alternative can be found within Table 5-3 above and results relative to the Mid-Level (73') profile can be found within Table 5-4 below.

As expected, higher vertical clearances, steeper grades, and longer lengths yield higher accident numbers between passenger cars and heavy vehicles along the bridge. However, it should be noted that a combination of all three factors (approach length, grade, and vertical clearance heights) determine the accident rate. It is possible to have a steeper grade and have less anticipated accidents than that of one with less grades (as shown in with In-Between #4 WB with a 3.0% grade and 15/7 crashes verses In-Between #3 WB with a 2.7% grade and 17/9 crashes) as long as the other two factors are collectively less.

The AASHTO results show substantially more crashes than that of the Vissim results. This is due to the use of older truck statistics with lesser weight to power ratios to develop the ASSHTO speed reduction curve as noted earlier in the report. However when you compare results of the AASHTO method relative to each other, you find that the relative difference of the crash factors is comparable to Vissim's results as shown in Table 5-4. This validates the Vissim model and since we expect the crash rates to be more comparable to

the Vissim method than that of the AASHTO method, the Vissim results will be used further within this report.

Table 5-4 CRASH INVOLVEMENT RATE RELATIVE TO MID-LEVEL ALTERNATIVE

Alternative	Approach Grade (%) West /East	AASHTO		VISSIM	
		Factor of more crashes than Mid-Level	Estimated More Crashes than Mid-Level (AASHTO)	Factor of more crashes than Mid-Level	Estimate More Crashes than Mid-Level (VISSIM)
Mid-Level #2 (73')	3.0,0.7,2.7 / 2.7	1.0	0	1.0	0
In-Between #1 (100')	3.0 /3.5	1.6	18	1.7	8
In-Between #2 (98')	3.0 /3.0	1.8	25	2.2	13
In-Between #3 (90')	2.7 /2.7	1.1	2	1.5	5
In-Between #4 (90')	2.7 /3.0	1.0	0	1.3	3
High-Level #6 (120')	3.84 /4.6	2.5	46	3.3	25

This analysis of the results indicates the following observations:

- The Mid-Level (73') profile is the safest alternative with approximate speed reductions of 7-9 mph resulting in approximately 11 crashes per year.
- The In-Between (90') profile is the second best option with speed reductions of 10-11 mph, resulting in approximately 3-5 more crashes a year than that of the Mid-Level (73') profile alternative.
- The In-Between (100') profile is the third best option with speed reductions of 11-14 mph, resulting in approximately 8-13 more crashes a year than that of the Mid-Level (73') profile alternative.
- The High-Level (120') profile is the worst option with speed reductions of 14-16 mph resulting in approximately 25 more crashes a year than that of the Mid-Level (73') profile alternative.

6. CONCLUSIONS

A summary of the descriptions of the profile Alternatives compared in this study, the engineering factors, and the overall evaluation and ranking of the Alternatives is provided in Table 6-1 *Summary of Profile Comparison and Evaluation*. The factors shown in Table 6-1 are not weighted based on importance and therefore the rankings should not be summed to determine the most desirable profile. One should apply his/her own importance to each factor to reach an overall profile preference. The study findings are also summarized below.

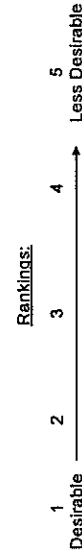
Construction Cost Comparison. Estimates of probable costs for the Mid-Level (73'), In-Between (90'), In-Between (100'), and High-Level (120') bridge profiles were made using 2nd Quarter 2007 LaDOTD Bid Item Weighted Unit Prices and other appropriate sources. As expected the higher the vertical clearance and/or the longer the approaches, the higher estimated construction cost. The Mid-Level (73') profile alternative resulted in the lowest estimated construction cost of \$132 million dollars. The two In-Between (90') profiles had the second least estimated costs ranging from \$12 million (3.0% max grade) to \$16 million (2.7% max grade) more than that of the Mid-Level (73') profile. The two In-Between (100') profiles had estimated costs of \$12 (3.5% max grade) to \$26 million (3.0% max grade) more than that of the Mid-Level (73') profile. The High-Level (120') profiles estimated costs ranged from \$13 million (4.6% max grade) to \$74 million (3.0% max grades) more than that of the Mid-Level (73') profile.

Road User Cost Comparison. The evaluation conducted under this study determined that the Mid-Level (73') and In-Between (90') profiles resulted in the same user cost. As discussed in Chapter 4, this is due to the precision of data available. A difference can not be computed, however, it is reasonable to conclude that a lower bridge profile with equal or less grades and equal or less approach lengths would perform operationally better than that of the higher profile and therefore would result in less user delays and costs. The In-Between (100') profile yielded a 51% increase in queue length and vehicle-hours of delay per week, a 61% increase in delay minutes per week, and an approximate 39% (\$115,535 per wk) increase in Road User Cost per week than that of the Mid-level (73') profile. The High-Level (120') profile indicates an approximate 165% increase in queue length, a 214% increase in vehicle-hours of delay per week, a 203% increase in delay minutes per week, and a 166% (\$492,419 per wk) increase in Road User Cost per week than that of the Mid-Level (73') profile alternative.

Accident Rate Comparison. The analysis of the approximate number of accidents involving trucks based on the total speed reduction of heavy vehicles anticipated due to the approach grades and lengths has been performed. As anticipated, the results show that the lower the profile the less effect the bridge will have on heavy vehicle speeds and therefore a lower number of accidents would be anticipated. Alternatively, the higher the profile the greater effect on heavy vehicle speeds, resulting in a higher number of accidents. The Mid-Level (73') and the In-Between (90') profiles are rated the one and two safest alternatives with a relatively slight accident rate difference between them. The In-Between (100') and High-Level (120') profiles were rated as the two worst alternatives with significantly more accidents than that anticipated for the two lower profiles.

Table 6-1
SUMMARY OF PROFILE COMPARISON AND EVALUATION¹

PROFILE ALTERNATIVES	DESCRIPTION					ENGINEERING FACTORS							OVERALL EVALUATION
	Vertical Clearance ² (ft.)	Length of Bridge (ft.)	Design Speed (mph)	East Approach Grade (%)	West Approach Grade (%)	Cost in Millions ³	Delay & Cost per wk			Safety (Vissim)			
							User Delay (veh/hr)	User Delay (min)	Delay Cost (Total \$)	Truck Speed Reduction	Crashes (per/yr) ⁴		
<i>Mid Level #2</i>	73	7,250 2	70 1	2.70 1	-2.70 1	132 1	11,664	9.16	\$295,770	7 (EB) 9 (W/B)	11	1	1
<i>High Level A</i>	120	9,600 5	70 1	3.00 2	-3.00 2	206 5	Expect Similar results to that of High Level # 6						5
<i>High Level #6</i>	118	6,960 1	60 3	3.84 3	-4.60 4	145 2	36,663	27.71	\$788,189	14 (EB) 16 (W/B)	36	4	4
<i>In Between #1</i>	100	7,250 2	60 3	3.00 3	-3.50 3	144 2	17,649	14.71	\$411,305	11 (EB) 14 (W/B)	19	3	3
<i>In Between #2</i>	98	7,790 4	70 1	3.00 1	-3.00 2	158 4	Expect Similar Results to that of In-Between #1						3
<i>In Between #3</i>	90	7,720 4	70 1	2.70 1	-2.70 1	148 3	Expect Similar Results to that of In-Between #4			10 (EB) 11 (W/B)	16	2	2
<i>In Between #4</i>	90	7,480 3	70 1	2.70 1	-3.00 2	144 2	11,664	9.16	\$295,770	10 (EB) 10 (W/B)	14	2	2



Note: 1 Table above is based on mainline bridge over Calcasieu River along Centerline 3 with Bridge Typical Section A as shown in the I-10 Calcasieu River Bridge and Approaches Comprehensive Preliminary Alternatives Report, 2002.
 2 Vertical Clearances as noted are based on average annual high water elevation of 4.3' and at the 200R Navigation Channel.
 3 The total bridge costs listed in this table refer to new construction of an I-10 Calcasieu River Bridge crossing only. These costs include the mainline lanes, but do not include cost for increased Substructure design (Ship Collision Protection System), ramps until connected to the mainline river bridge, improvements at Sampson Street interchange, improvements along I-10 west & east of river bridge, or removal of existing river bridge. Furthermore these estimated construction costs are based on 2007 prices and not the date of actual construction.
 4 Number of accidents involving trucks.

APPENDIX A

GEOMETRIC DESIGN FOR BRIDGE PROFILE ALTERNATIVES

**Table A-1
PROJECT DESIGN CRITERIA**

GEOMETRIC DESIGN STANDARDS (NEW CONSTRUCTION)

I-10 Calcasieu River Bridge and Approaches

EA & Engineering Studies

S.P. NO. 700-10-0115

F.A.P. NO. BR-10-1(212)29

Updated 1/12/04

ITEM	UNITS	I-10 MAINLINE	LINEAR RAMP	FRONTAGE ROAD	ARTERIAL AND INTERCHANGE CROSSING STREET	OTHER CROSSING STREET
Design Speed	mph	70 60	50 (70mph mainline) ¹ 45 (60mph mainline) ¹	40 (Typical)	40	Varies ²
Number of Continuous Travel Lanes		3 each direction	1 or 2	2	4	2
Width of Travel Lane	ft	12	15 or 12	12	12	12
Width of Shoulders						
Left	ft	12	4	Curb and Gutter	Curb and Gutter ³	Curb and Gutter ³
Right	ft	12	6	Curb and Gutter	Curb and Gutter ³	Curb and Gutter ³
Pavement Cross Slope	%	2.5	2.5	2.5	2.5	2.5
Minimum Median Width (With 12' shoulders)	ft	27'	--	--	--	--
Stopping Sight Distance (Level conditions)	ft	970 (70 mph) 780 (60 mph)	535 (50 mph) ³ 425-360 (45 mph) ⁴	305	305	Varies
Rate of Vertical Curvature						
Crest Curve	K	436 (70 mph) 282 (60 mph)	133 (50 mph) 84-61 (45 mph)	44	44	Varies
Sag Curve		220-206 (70 mph) 160-157 (60 mph)	115 (50 mph) 79 (45 mph)	64	64	
Maximum Superelevation	%	10	8	4	4	4
Minimum Horizontal Radius (Where sight distance is unrestricted (at entrances and exits refer to SC-01))	ft	1700 (70 mph) 1100 (60 mph)	800 (50 mph) 600 (45 mph) 500 (40 mph)	700 (normal crown) 550 (2.5% e) 500 (full e)	700 (normal crown) 550 (2.5% e) 500 (full e)	Varies
Horizontal Curve Length (I-10)⁵	ft	30 x Design Speed (des.) 15 x Design Speed (min.)	--	--	--	--
Horizontal Curve Length (Min.) (not I-10) Superelevated	ft	--	Superelevation Transition Length Within Curve Plus 1 sec at Design Speed for Superelevated Section			
Normal Cross Slope			1 sec at Design Speed			
Maximum Grade						
Downgrade	%	3 - 4	6 (5 for high truck volumes)	7	7	6-9
Upgrade	%	3 - 4	4 (5 with few trucks)	7	7	6-9
Minimum Vertical Clearance						
Roadways and Drives	ft	16.5	16.5	16.5	16.5	15.5
Railroad Tracks	ft	23.5	23.5	23.5	23.5	23.5
Minimum Horizontal Clearance (without protection)						
From Edge of Travel Lane (shoulder sections)	ft	34 (70 mph) 32 (60 mph)	Varies Based on Design Speed and traffic (15' min)	--	10	--
From Back of Curb	ft	--	--	6 (min.) 15 (des.)	6 (min.) 15 (des.)	1 (min.) 6 (typ.)
Width of Right of Way						
From Edge of Shoulder ⁶	ft	15 (min.)	15 (min.)	8 (min.) 17 (des.)	8 (min.) 17 (des.)	8 (min.) 11 (des.)
From Edge of Structure ⁷	ft	25	25	25	25	25
Minimum Weaving Lengths						
Between Entrance and Exit Ramps ⁸	ft	1600	--	Varies	--	--
Between Frontage Road Ramp Terminal and Cross Street	ft	--	--	Varies (350' min with no queue)	--	--

Table A-1
PROJECT DESIGN CRITERIA (Con't)

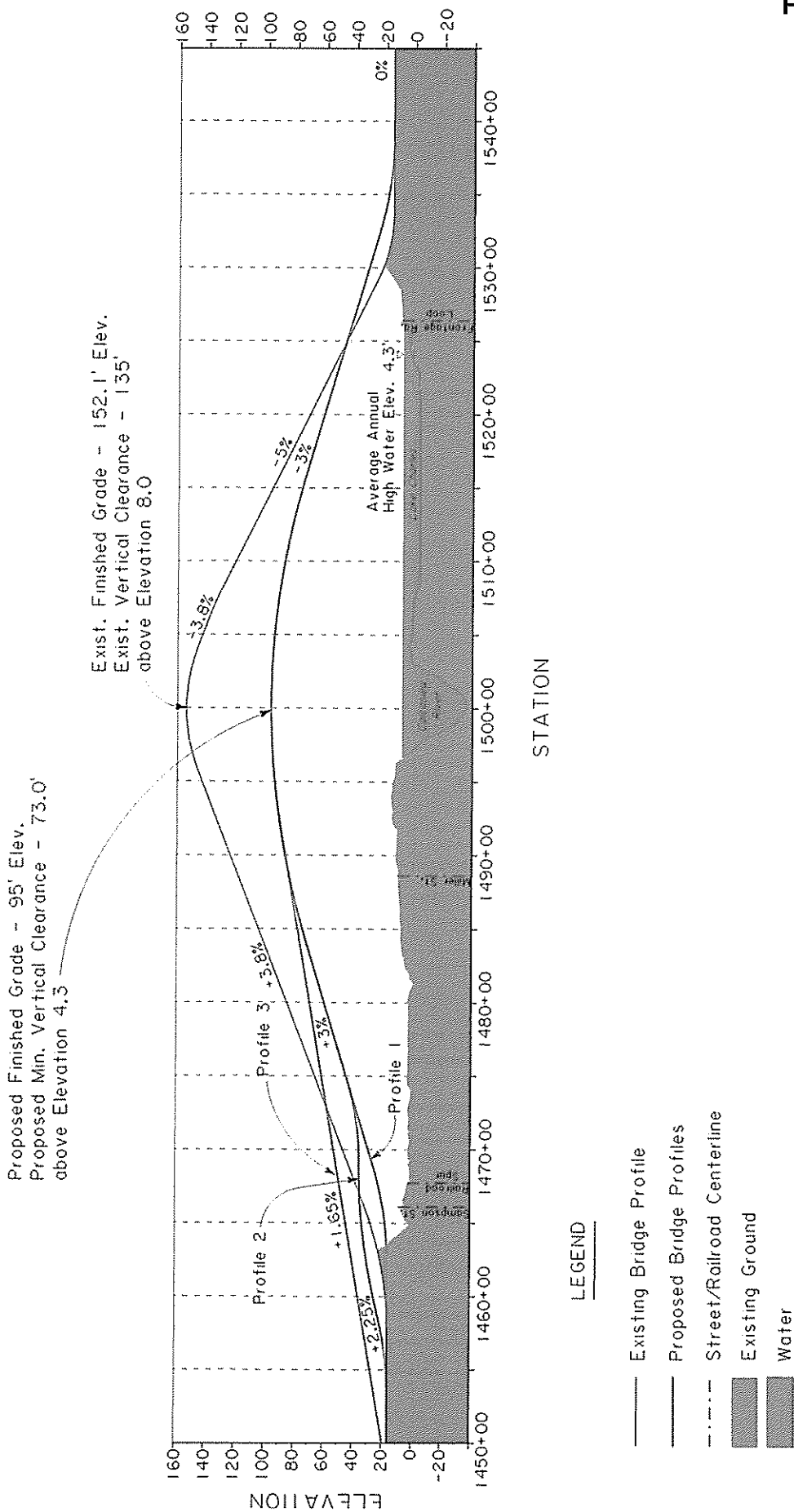
NOTES:

1. The design speed is only applicable at the I-10 ramp terminals.
2. See LaDOTD Standard Criteria.
3. Where conditions allow, shoulders will be provided on crossing streets within control of access lines.
4. Criteria applies for crest curves on ramps at the I-10 ramp terminals. At the striped nose, Case B decision sight distance (based on ramp exit speed) should be provided to the back of the anticipated design year ramp queue.
5. Reverse curves to enact an alignment shift can be considered a special case. Desirably the reverse curves should be flat enough not to require superelevation. For an $e_{max}=10\%$ and a -2.5% cross slope the following minimum horizontal curve radii should be used for the various design speeds:
 - 60mph – 22880'
 - 65 mph – 24730'
 - 70 mph – 26790'
6. Barriers may be required to satisfy minimum clear zone criteria.
7. Less may be provided with LaDOTD approval.
8. The minimum shall be the larger of that shown or that determined from traffic capacity analysis.

ADDITIONAL NOTES:

9. 200' platform area will be provided at exit and entrance ramps where tying into I-10 mainline.
10. Horizontal clearance to walls, if any, should be several feet more than to the barrier used to protect the wall, as individual site conditions warrant.

Figure A-1





8201 Goodwood Boulevard
 Suite J
 Baton Rouge,
 Louisiana 70806
 (225) 927-4392
 FAX (225) 927-8355
 www.hntb.com

January 30, 2003

Mr. Tony Ducote
 Louisiana Department of Transportation and Development
 1201 Capitol Access Road, Room 302
 Baton Rouge, LA 70802-4438

Re: State Project No. 700-10-0115
 Federal Aid Project No. BR-10-1(212)29
 Calcasieu River Bridge
 (Columbia Southern Road to Ryan Street)
 Route I-10
 Calcasieu Parish

Dear Mr. Ducote:

In follow-up to our January 28 meeting in Lake Charles with the Mayor's office, DOTD District, and Friend Ships, this letter report has been developed to provide information relative to the decision-making process for the studies currently being conducted for the subject project.

The lead-in to the discussion of the issues below is that the Department and FHWA have been progressing on feasibility studies and an Environmental Assessment based on replacing the existing Calcasieu River Bridge on I-10 with a new bridge that provides less vertical clearance for marine navigation. Another key component of the project is the construction of a new interchange at Sampson Street on the west side of the river. General consensus has been that the new Sampson Street interchange would be constructed in the near future, while the bridge may be constructed at a later date as funds become available. Advance planning requires that the bridge and the interchange fit together in a coordinated manner. A design solution has been identified that accomplishes this.

Recently, during the midst of the study process, it has become known that a company called Friend Ships would like to purchase land upriver from the I-10 Bridge and locate a port facility on this land. The types of ships to be operated would require approximately 120' of vertical navigation clearance rather than the 73' that has been advanced under the current study. It is understood that currently three ships each would operate in and out of the port approximately four times per year. Providing the 120' of vertical navigation clearance has several implications regarding the proposed bridge replacement and Sampson Street interchange project.

We have developed and are providing attached an elevation view of the existing, currently proposed, and potentially higher bridge as an aid in understanding the issues. This drawing takes that the Sampson Street interchange as proposed will remain in its current location, except that proposed I-10 mainline will pass over Sampson Street rather than under Sampson Street. The most significant issues regarding the higher bridge are discussed below.

The HNTB Companies

OFFICES: ALEXANDRIA, VA; ANCHORAGE, AK; STARKES, GA; KENNESAW, TN; BAYON, BOULE, LA; BOSTON, MA; CHARLOTTE, NC; CHARLESTON, WV; CHICAGO, IL; CINCINNATI, OH;
 COLUMBUS, OH; DALLAS, TX; DENVER, CO; DETROIT, MI; EL PASO, TX; FARGO, ND; FT. WORTH, TX; HARTFORD, CT; HOUSTON, TX; INDIANAPOLIS, IN; IRVING, TX; KANSAS CITY, MO;
 KNOXVILLE, TN; LAS VEGAS, NV; LOS ANGELES, CA; LOUISVILLE, KY; MADISON, WI; MIAMI, FL; MILWAUKEE, WI; MINNEAPOLIS, MN; NASHVILLE, TN; NEW YORK, NY; OAKLAND, CA;
 ORLANDO, FL; OVERLAND PARK, KS; PHOENIX, AZ; RICHMOND, VA; RICHMOND, VA; RICHMOND, VA; RICHMOND, VA; RICHMOND, VA; RICHMOND, VA; RICHMOND, VA; RICHMOND, VA; RICHMOND, VA;
 SACRAMENTO, CA; SAN ANTONIO, TX; ST. LOUIS, MO; TAMPA, FL; TORONTO, ON; WASHINGTON, DC.

Traffic Operations

The higher bridge would require that the length of the 3% bridge approach upgrades on mainline I-10 be increased from approximately 3500' to approximately 5200' or more. This will have a negative impact on mainline traffic operations, especially on heavy trucks. Critical length of grade is the determining factor regarding truck operations. According to the AASHTO Green Book, a 15 mph reduction in the speed of heavy trucks below the average running speed of all traffic is the acceptable current practice value to determine the critical length of grade. Taking an average running speed of 70 mph for all traffic, Exhibit 3-63 in the Green Book indicates that 3% upgrades of 3500' in length (currently proposed design) will cause a reduction in truck speeds of around 16 mph, which is about the maximum current practice value. If the 3% upgrades were increased in length to approximately 5200', the truck speed reduction would be in the range of 20 to 25 mph, or 5 to 10 mph higher than the 15 mph accepted maximum.

Additionally, the connecting ramps between Sampson Street and I-10 east of the interchange will be required to have steep grades (maybe 6% or 7%) as they attempt to "catch up" with mainline I-10 that is already above Sampson Street and is continuing to climb at 3%. These steep grades will have a deleterious effect in that ramp traffic (especially heavy truck traffic) will generally be entering mainline I-10 at reduced speeds. Observations of these conditions at other locations around the state indicate less than desirable performance. Even with the steeper ramp grades, the lengths of the ramps may be exceptionally long in order to make up the grade differentials. Upon further study, it is possible these conditions may require that a new interchange type be developed for the Sampson Street area.

Phased Construction

The current design concept for the I-10 corridor will allow for phased construction where Sampson Street would be built initially and the river bridge and the rest of I-10 mainline will be built at a later date. If a new interchange location and type are needed, the ability to provide phased construction will need to be carefully considered.

Costs

For mainline I-10 the length of the Calcasieu River bridge approaches on each side of the river would be increased by approximately 1700'. For a mainline of three lanes in each direction with shoulders (a width of 126'), this will add approximately \$28 million to the cost of the I-10 mainline bridge (assuming \$65 per square foot). An additional cost increase could be expected due to higher piers.

Other cost increases will be incurred because of the longer structural ramp connections to the mainline bridge on the east and west sides of the river. If the Sampson Street interchange location/type remains as currently conceived, these costs could be in the \$5 to \$15 million range. If a new interchange type and location is necessary, these costs will likely be even higher.

Given the above, it is concluded that the total cost of the project could be increased by \$30 million to \$60 million for the condition of a higher mainline bridge.

Community Impacts

The river bridge will extend approximately 1700' farther on each end of the bridge into the surrounding communities. In general, the project will be much more visually noticeable to the surrounding communities. On the east side of the river this is especially notable in that the new mainline I-10 bridge would be directly adjacent to the existing lake front park in the area. Some may consider this an adverse visual effect.

Potential Options

Given the situation, we have discussed that several options may exist regarding the planning for the new bridge and interchange. Some of these are summarized below:

1. Proceed with planning with a bridge clearance of 73' and build the currently designed Sampson Street interchange in the near future.
 - o At the time of construction of the bridge (say 10, 15, or even 20 years in the future) Friend Ships may not be in operation upriver of the bridge (either never established or established and vacated), in which case there would be no issues and the mainline would be constructed at the lower clearance and integrated into the Sampson Street interchange that was constructed earlier.
 - o If Friend Ships is actually in operation of its upriver facility at the time of construction of the new bridge, an acquisition and relocation payment could be made for the Friend Ships operation. The dollar value of this option would be expected to be much less than the dollar cost of building the bridge at the 120' clearance elevation (extra \$30 million to \$60 million). The new bridge would then be constructed at its lower clearance elevation and integrated into the Sampson Street interchange that was constructed earlier.
 - o If Friend Ships is actually in operation of its upriver facility at the time of construction of the new bridge, build the new bridge as a moveable bridge at 73' clearance elevation. The Friend Ships operation is expected to warrant few openings (current levels are three ships at approximately four port calls per year). These openings could be scheduled at night and I-10 traffic would be routed on the I-210 bypass.
 - o If Friend Ships is actually in operation of its upriver facility at the time of construction of the new bridge, build the new bridge at the high clearance elevation and integrate the Sampson Street interchange into an I-10 mainline that passes over Sampson Street rather than under Sampson Street. This would require steep ramp grades as discussed previously and possibly some reconstruction of parts of the Sampson Street interchange that would have already constructed.

As we have discussed, the issue before us has raised the awareness level that if we plan for a new lower bridge, it is possible that any business requiring high clearance (not just Friend Ships) could locate upriver between the planning studies and the time of construction of the new bridge.

Tony Ducote
January 30, 2003
Page 4 of 4

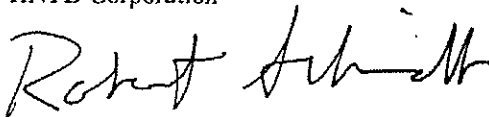
The options presented above are designed to show that contingencies exist for a condition where this might occur.

2. Proceed with planning with a bridge clearance of 120' and relocate/redesign the Sampson Street interchange for this new concept. New studies will need to be conducted to determine an approach that will satisfy the goal of phased construction (Sampson interchange first, bridge later) and will also promote good geometry and satisfactory traffic operations.

There may be other options for consideration that are not listed above. As you review this matter further, please let us know if we can assist.

Very truly yours,

HNTB Corporation



Robert W. Schmidt, P.E.
Asst. Project Manager

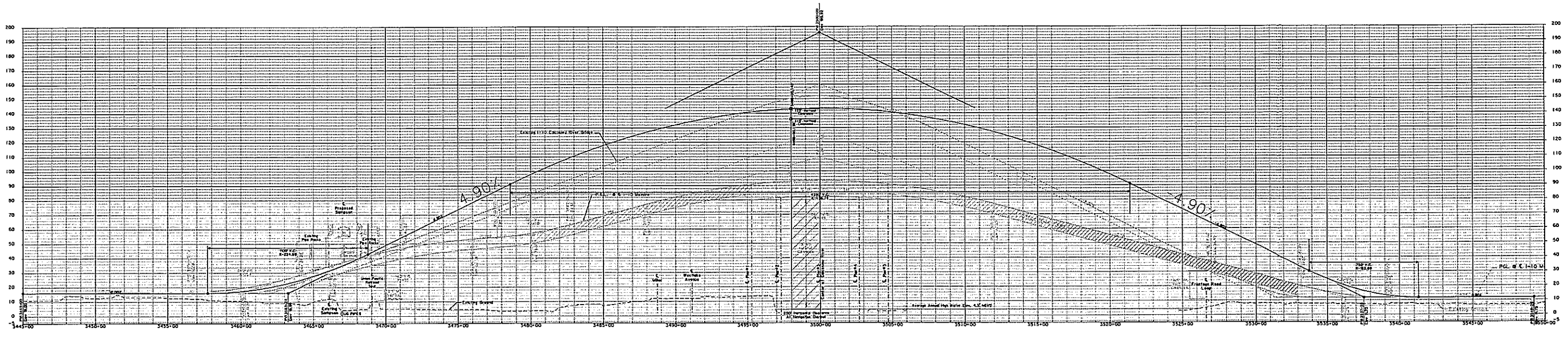
Attachment

Copy: Guy Leonard
Lei Jin

J:\OBS\31831_Calcasieu\TECHPROD\LETTERS\Ducote18.doc

Figure A-3

High Level Bridge Profile Option #1
DS=70/80 MPH, PVI 3500+00
Clearance=125'



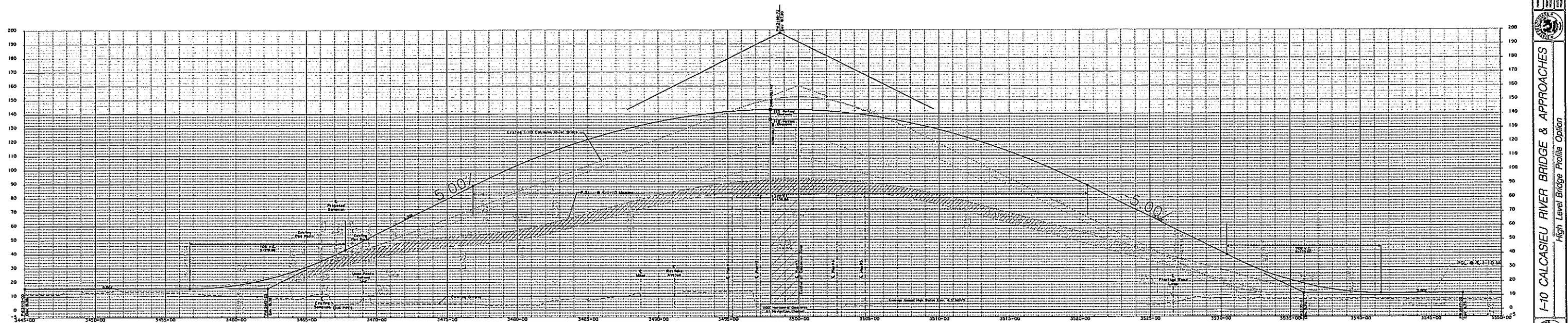
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Sheet: BR-10-12(2)29
Scale: 1"=40'
Date: 7-00-10-0115

I-10 CALCASIEU RIVER BRIDGE & APPROACHES
High Level Bridge Profile Option

ENTB

Figure A-4

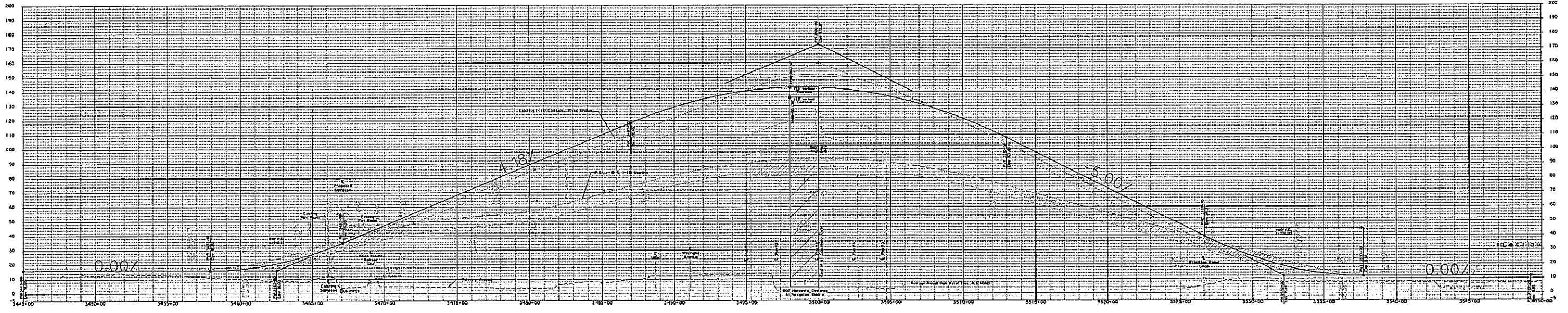
High Level Bridge Profile Option #2
DS=70/80 MPH, PVI 3498+70
Clearance=125'



11	2
CALCASIEU	
BR-10-1(2/2/2)	
700-10-015	
I-10 CALCASIEU RIVER BRIDGE & APPROACHES	
High Level Bridge Profile Option	

Figure A-5

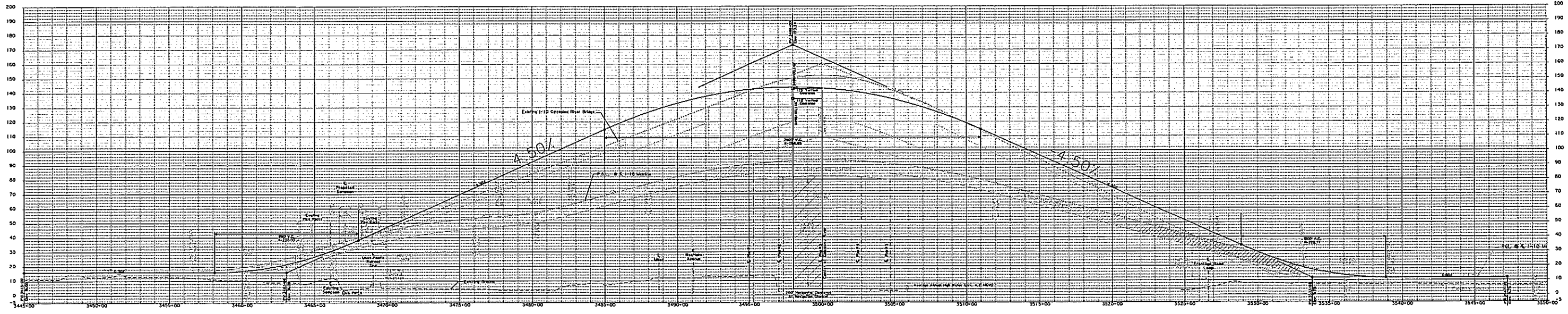
High Level Bridge Profile Option #3
DS=60/70 MPH, PVI 3500+00
Clearance=125'



3
CALCASIEU
BR-10-102028
700-10-015
I-10 CALCASIEU RIVER BRIDGE & APPROACHES
High Level Bridge Profile Option
HNTB

Figure A-6

High Level Bridge Profile Option #4
DS=60/70 MPH, PVI 3498+00
Clearance=125'



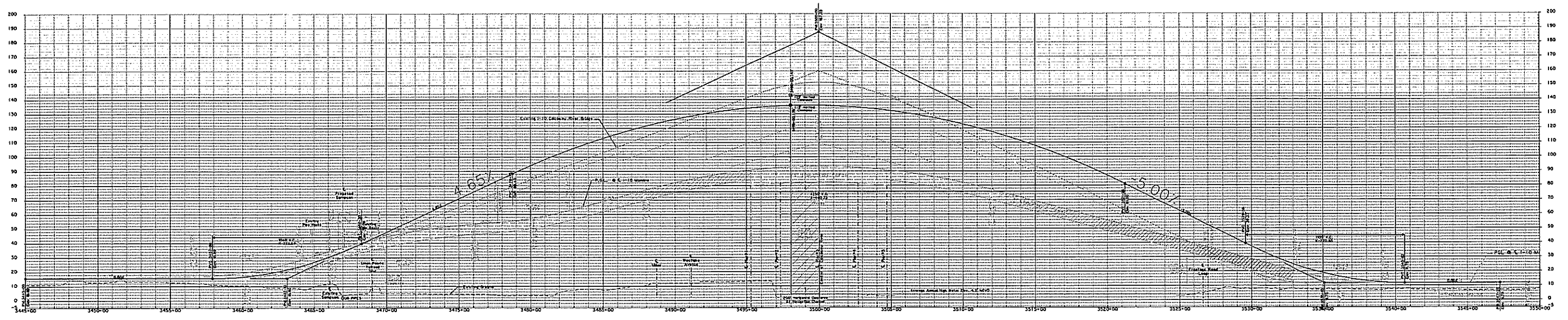
1-10 CALCASIEU RIVER BRIDGE & APPROACHES
High Level Bridge Profile Option

DATE: 7/01/15
PROJECT: BR-10-10(2)23
SCALE: 1"=10'-0"

HNTB
CALCASIEU RIVER BRIDGE AUTHORITY

Figure A-7

High Level Bridge Profile Option #5
DS=70/80 MPH, PVI 3500+00
Clearance=118'

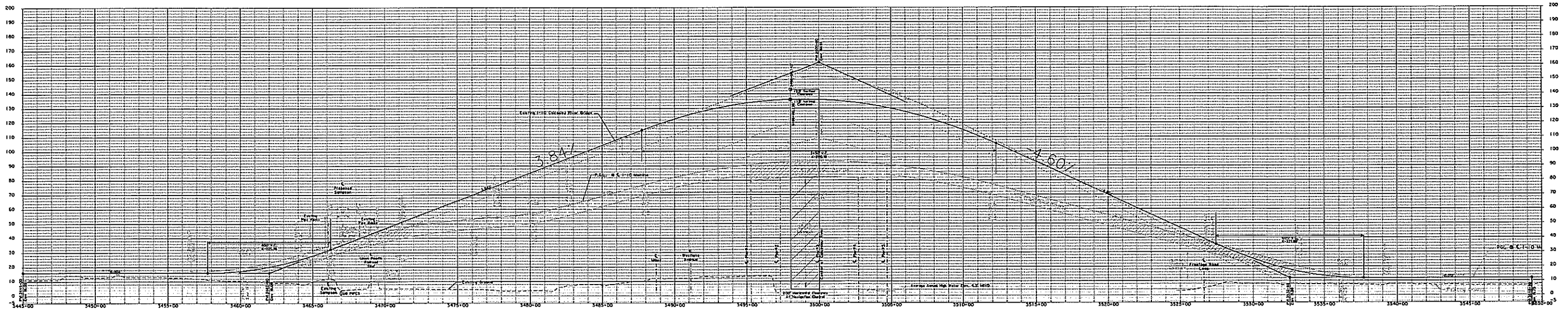


1-10 CALCASIEU RIVER BRIDGE & APPROACHES
High Level Bridge Profile Option

DATE: 12/23/23
PROJECT: BR-10-102123
DRAWN BY: J. [unreadable]
CHECKED BY: [unreadable]

Figure A-8

High Level Bridge Profile Option #6
DS=60/70 MPH, PVI 3500+00
Clearance=118'



118'

CALCASIEU
BR-10-12/29
700-10-015

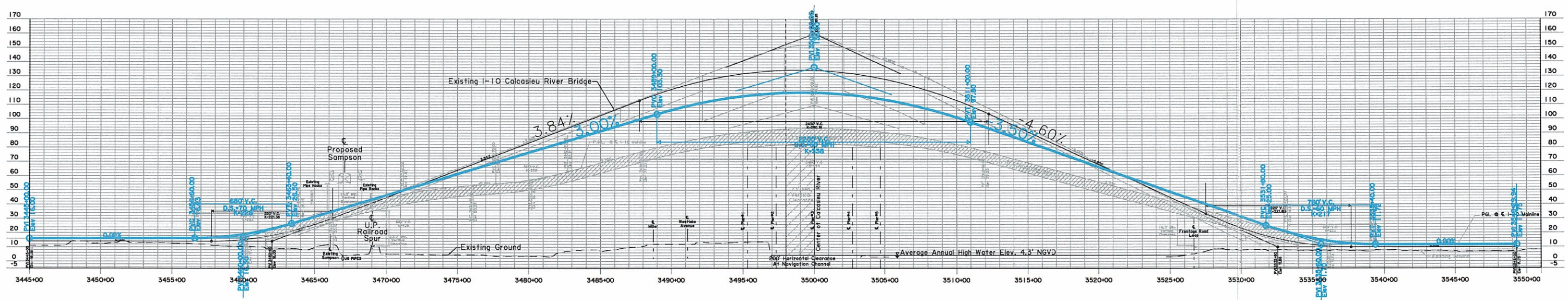
1-10 CALCASIEU RIVER BRIDGE & APPROACHES
High Level Bridge Profile Option

118'

118'

Figure A-9

In-Between Bridge Profile Option #1
 DS=60 MPH, PVI 3500+00
 Clearance=100'

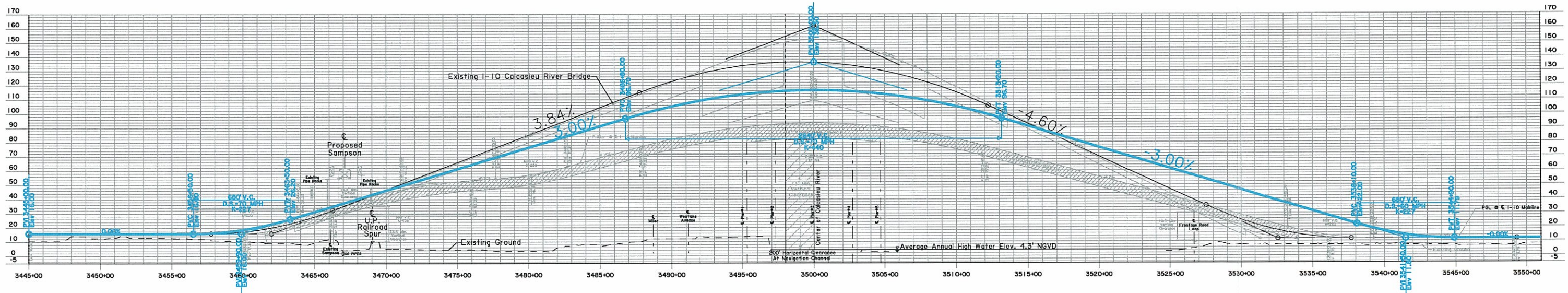


LEGEND:

- Existing Bridge
- ▨ Preferred Mid Level Bridge
- Preferred High Level Bridge
- In-Between #1 Bridge

	I-10 CALCASIEU RIVER BRIDGE & APPROACHES In Between Bridge Profile Option #1		FEDERAL PROJECT BR-10-1(212)29	SHEET NUMBER 700-10-0115
		PROJECT CALCASIEU	STATE LOUISIANA	PROJECT BR-10-1(212)29
		PROJECT 700-10-0115		

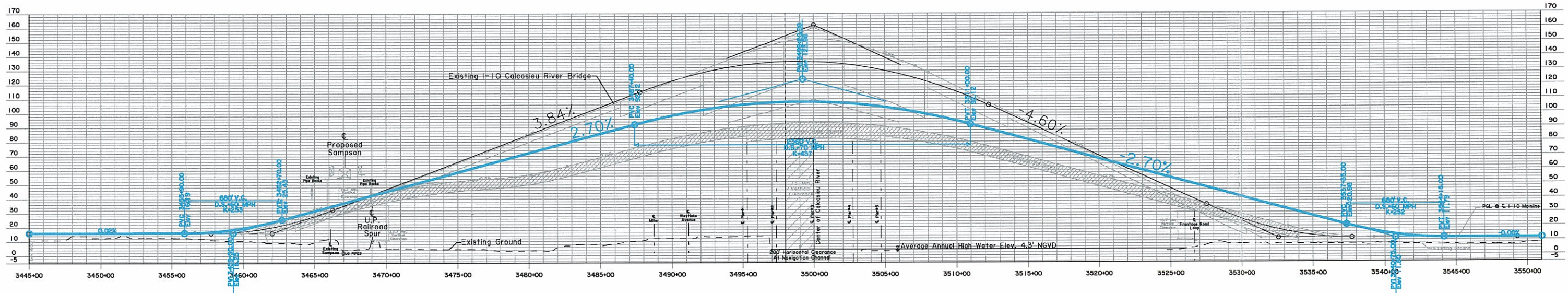
In-Between Bridge Profile Option #2
 DS=70 MPH, PVI 3500+00
 Clearance=98'



- LEGEND:
- Existing Bridge
 - ▨ Preferred Mid Level Bridge
 - ▩ Preferred High Level Bridge
 - In-Between #2 Bridge

SHEET NUMBER	
CALCASIEU	BF-10-1(212)29
FEDERAL PROJECT	700-10-0115
I-10 CALCASIEU RIVER BRIDGE & APPROACHES In Between Bridge Profile Option #2	

In-Between Bridge Profile Option #3
 DS=70 MPH, PVI 3499+20
 Clearance=90'



- LEGEND:
- Existing Bridge
 - ▨ Preferred Mid Level Bridge #2
 - Preferred High Level Bridge #6
 - In-Between #3 Bridge

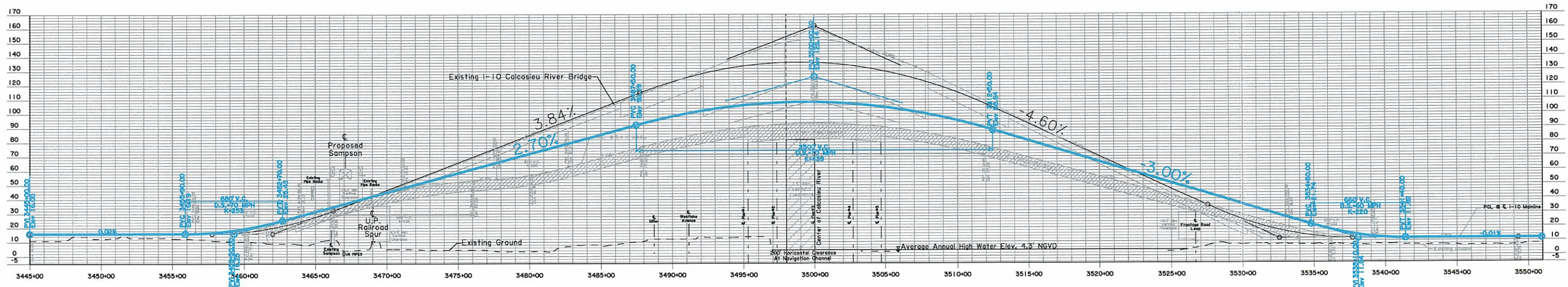
SHEET NUMBER			
CALCASIEU		BR-10-1(212)29	
FEDERAL PROJECT		STATE PROJECT	
700-10-0115		700-10-0115	

I-10 CALCASIEU RIVER BRIDGE & APPROACHES

In Between Bridge Profile Option #3

HNTB

In-Between Bridge Profile Option #4
 DS=70 MPH, PVI 3500+00
 Clearance=90'



- LEGEND:
- Existing Bridge
 - ▨ Preferred Mid Level Bridge #2
 - Preferred High Level Bridge #6
 - In-Between #4 Bridge

SHEET NUMBER	
CALCASIEU	BR-10-1(212)29
FEDERAL PROJECT	700-10-0115
STATE PROJECT	
I-10 CALCASIEU RIVER BRIDGE & APPROACHES In Between Bridge Profile Option #4	

APPENDIX B
MAINLINE BRIDGE UNIT COSTS

Table B-1

I-10 CALCASIEU PROFILE WITH 73 FT VERTICAL CHANNEL CLEARANCE ESTIMATE OF PROBABLE CONSTRUCTION SQUARE FOOT COST - SEPTEMBER 2007 MAIN SPAN 200-270-270-200 FT STEEL BOX TYPE STRUCTURE OPTION ONE 940 FT UNIT WITH A 148.5 FT WIDE DECK SUPPORTED BY 6-STEEL BOX GIRDERS AND 71 FT HIGH FOUR COLUMN PIERS WITH PILE FOOTINGS					
ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	COST
802-04	<i>Structural Excavation for Piers (Wet)</i>	6,370.0	CY	\$ 40.00	\$ 254,800
804-01-G	<i>Precast Concrete Piles (30")</i>	23,200	LF	\$ 130.00	\$ 3,016,000
805-01-D	<i>Class A Concrete (Footing)</i>	4,415.00	CY	\$ 450.00	\$ 1,986,750
805-01-E	<i>Class A Concrete (Piers)</i>	3,249.00	CY	\$ 600.00	\$ 1,949,400
805-01	<i>Class A Concrete (Seals)</i>	2,150.00	CY	\$ 400.00	\$ 860,000
805-03	<i>Class AA Concrete (Bridge Deck)</i>	4,439.00	CY	\$ 600.00	\$ 2,663,400
806-01	<i>Deformed Reinforcing Steel (Deck)</i>	1,174,600	LB	\$ 0.90	\$ 1,057,140
806-01	<i>Deformed Reinforcing Steel (Piers)</i>	1,222,300	LB	\$ 0.90	\$ 1,100,070
807-06	<i>Structural Metalwork (Steel Box Girders)</i>	6,400,000	LB	\$ 1.80	\$ 11,520,000
810-01	<i>Concrete Railing (Exterior Barrier)</i>	1,880.00	LF	\$ 50.00	\$ 94,000
810-01	<i>Concrete Railing (Median Barrier)</i>	940.00	LF	\$ 60.00	\$ 56,400
	<i>Expansion Joints</i>	144.00	LF	\$ 250.00	\$ 36,000
	<i>Bearings</i>	65.00	EA	\$ 2,000.00	\$ 130,000
	<i>Navigation Lighting</i>	1.00	EA	\$ 60,000.00	\$ 60,000
	<i>Barge Collision Protection</i>	1.00	EA	\$ 300,000.00	\$ 300,000
	<i>Cofferdams (Shallow Water Piers)</i>	2.00	EA	\$ 300,000.00	\$ 600,000
	<i>Mobilization and Miscellaneous</i>	20.00	%		\$ 5,136,792
Total Cost Without Mobilization					\$ 25,683,960
Total Cost With Mobilization					\$ 30,820,752
Total Square Foot (940 Ft x 148.5 Ft)					139,590
Total Square Foot Cost Without Mobilization					\$ 184
Total Square Foot Cost With Mobilization					\$ 221

Note: Item numbers and unit prices taken from LDOTD "Bid Item Weighted Unit Prices" 2nd Quarter 2007 unless noted.

Table B-2

I-10 CALCASIEU PROFILE WITH 90 FT VERTICAL CHANNEL CLEARANCE ESTIMATE OF PROBABLE CONSTRUCTION SQUARE FOOT COST - SEPTEMBER 2007 MAIN SPAN 200-270-270-200 FT STEEL BOX TYPE STRUCTURE OPTION ONE 940 FT UNIT WITH A 148.5 FT WIDE DECK SUPPORTED BY 6-STEEL BOX GIRDERS AND 87 FT HIGH FOUR COLUMN PIERS WITH PILE FOOTINGS					
ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	COST
802-04	<i>Structural Excavation for Piers (Wet)</i>	6,677.0	CY	\$ 40.00	\$ 267,080
804-01-G	<i>Precast Concrete Piles (30")</i>	25,000	LF	\$ 130.00	\$ 3,250,000
805-01-D	<i>Class A Concrete (Footing)</i>	4,604.00	CY	\$ 450.00	\$ 2,071,800
805-01-E	<i>Class A Concrete (Piers)</i>	4,300.00	CY	\$ 600.00	\$ 2,580,000
805-01	<i>Class A Concrete (Seals)</i>	2,150.00	CY	\$ 400.00	\$ 860,000
805-03	<i>Class AA Concrete (Bridge Deck)</i>	4,439.00	CY	\$ 600.00	\$ 2,663,400
806-01	<i>Deformed Reinforcing Steel (Deck)</i>	1,174,600	LB	\$ 0.90	\$ 1,057,140
806-01	<i>Deformed Reinforcing Steel (Piers)</i>	1,344,500	LB	\$ 0.90	\$ 1,210,050
807-06	<i>Structural Metalwork (Steel Box Girders)</i>	6,400,000	LB	\$ 1.80	\$ 11,520,000
810-01	<i>Concrete Railing (Exterior Barrier)</i>	1,880.00	LF	\$ 50.00	\$ 94,000
810-01	<i>Concrete Railing (Median Barrier)</i>	940.00	LF	\$ 60.00	\$ 56,400
	<i>Expansion Joints</i>	144.00	LF	\$ 250.00	\$ 36,000
	<i>Bearings</i>	65.00	EA	\$ 2,000.00	\$ 130,000
	<i>Navigation Lighting</i>	1.00	EA	\$ 60,000.00	\$ 60,000
	<i>Barge Collision Protection</i>	1.00	EA	\$ 300,000.00	\$ 300,000
	<i>Cofferdams (Shallow Water Piers)</i>	2.00	EA	\$ 300,000.00	\$ 600,000
	<i>Mobilization and Miscellaneous</i>	20.00	%		\$ 5,351,174
Total Cost Without Mobilization					\$ 26,755,870
Total Cost With Mobilization					\$ 32,107,044
Total Square Foot (940 Ft x 148.5 Ft)					139,590
Total Square Foot Cost Without Mobilization					\$ 192
Total Square Foot Cost With Mobilization					\$ 230

Note: Item numbers and unit prices taken from LDOTD "Bid Item Weighted Unit Prices" 2nd Quarter 2007 unless noted.

Table B-3

I-10 CALCASIEU PROFILE WITH 98 FT & 100 FT VERTICAL CHANNEL CLEARANCE ESTIMATE OF PROBABLE CONSTRUCTION SQUARE FOOT COST - SEPTEMBER 2007 MAIN SPAN 200-270-270-200 FT STEEL BOX TYPE STRUCTURE OPTION ONE 940 FT UNIT WITH A 148.5 FT WIDE DECK SUPPORTED BY 6-STEEL BOX GIRDERS AND 96 FT HIGH FOUR COLUMN PIERS WITH PILE FOOTINGS					
ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	COST
802-04	<i>Structural Excavation for Piers (Wet)</i>	6,850.0	CY	\$ 40.00	\$ 274,000
804-01-G	<i>Precast Concrete Piles (30")</i>	26,000	LF	\$ 130.00	\$ 3,380,000
805-01-D	<i>Class A Concrete (Footing)</i>	4,710.00	CY	\$ 450.00	\$ 2,119,500
805-01-E	<i>Class A Concrete (Piers)</i>	4,890.00	CY	\$ 600.00	\$ 2,934,000
805-01	<i>Class A Concrete (Seals)</i>	2,150.00	CY	\$ 400.00	\$ 860,000
805-03	<i>Class AA Concrete (Bridge Deck)</i>	4,439.00	CY	\$ 600.00	\$ 2,663,400
806-01	<i>Deformed Reinforcing Steel (Deck)</i>	1,174,600	LB	\$ 0.90	\$ 1,057,140
806-01	<i>Deformed Reinforcing Steel (Piers)</i>	1,413,200	LB	\$ 0.90	\$ 1,271,880
807-06	<i>Structural Metalwork (Steel Box Girders)</i>	6,400,000	LB	\$ 1.80	\$ 11,520,000
810-01	<i>Concrete Railing (Exterior Barrier)</i>	1,880.00	LF	\$ 50.00	\$ 94,000
810-01	<i>Concrete Railing (Median Barrier)</i>	940.00	LF	\$ 60.00	\$ 56,400
	<i>Expansion Joints</i>	144.00	LF	\$ 250.00	\$ 36,000
	<i>Bearings</i>	65.00	EA	\$ 2,000.00	\$ 130,000
	<i>Navigation Lighting</i>	1.00	EA	\$ 60,000.00	\$ 60,000
	<i>Barge Collision Protection</i>	1.00	EA	\$ 300,000.00	\$ 300,000
	<i>Cofferdams (Shallow Water Piers)</i>	2.00	EA	\$ 300,000.00	\$ 600,000
	<i>Mobilization and Miscellaneous</i>	20.00	%		\$ 5,471,264
Total Cost Without Mobilization					\$ 27,356,320
Total Cost With Mobilization					\$ 32,827,584
Total Square Foot (940 Ft x 148.5 Ft)					139,590
Total Square Foot Cost Without Mobilization					\$ 196
Total Square Foot Cost With Mobilization					\$ 235

Note: Item numbers and unit prices taken from LDOTD "Bid Item Weighted Unit Prices" 2nd Quarter 2007 unless noted.

Table B-4

I-10 CALCASIEU PROFILE WITH 120 FT VERTICAL CHANNEL CLEARANCE					
ESTIMATE OF PROBABLE CONSTRUCTION SQUARE FOOT COST - SEPTEMBER 2007					
MAIN SPAN 200-270-270-200 FT STEEL BOX TYPE STRUCTURE OPTION					
ONE 940 FT UNIT WITH A 148.5 FT WIDE DECK SUPPORTED BY 6-STEEL BOX GIRDERS AND 116 FT HIGH FOUR COLUMN PIERS WITH PILE FOOTINGS					
ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	COST
802-04	<i>Structural Excavation for Piers (Wet)</i>	7,120.0	CY	\$ 40.00	\$ 284,800
804-01-G	<i>Precast Concrete Piles (30")</i>	28,800	LF	\$ 130.00	\$ 3,744,000
805-01-D	<i>Class A Concrete (Footing)</i>	4,980.00	CY	\$ 450.00	\$ 2,241,000
805-01-E	<i>Class A Concrete (Piers)</i>	6,040.00	CY	\$ 600.00	\$ 3,624,000
805-01	<i>Class A Concrete (Seals)</i>	2,150.00	CY	\$ 400.00	\$ 860,000
805-03	<i>Class AA Concrete (Bridge Deck)</i>	4,439.00	CY	\$ 600.00	\$ 2,663,400
806-01	<i>Deformed Reinforcing Steel (Deck)</i>	1,174,600	LB	\$ 0.90	\$ 1,057,140
806-01	<i>Deformed Reinforcing Steel (Piers)</i>	1,634,000	LB	\$ 0.90	\$ 1,470,600
807-06	<i>Structural Metalwork (Steel Box Girders)</i>	6,400,000	LB	\$ 1.80	\$ 11,520,000
810-01	<i>Concrete Railing (Exterior Barrier)</i>	1,880.00	LF	\$ 50.00	\$ 94,000
810-01	<i>Concrete Railing (Median Barrier)</i>	940.00	LF	\$ 60.00	\$ 56,400
	<i>Expansion Joints</i>	144.00	LF	\$ 250.00	\$ 36,000
	<i>Bearings</i>	65.00	EA	\$ 2,000.00	\$ 130,000
	<i>Navigation Lighting</i>	1.00	EA	\$ 60,000.00	\$ 60,000
	<i>Barge Collision Protection</i>	1.00	EA	\$ 300,000.00	\$ 300,000
	<i>Cofferdams (Shallow Water Piers)</i>	2.00	EA	\$ 300,000.00	\$ 600,000
	<i>Mobilization and Miscellaneous</i>	20.00	%		\$ 5,748,268
Total Cost Without Mobilization					\$ 28,741,340
Total Cost With Mobilization					\$ 34,489,608
Total Square Foot (940 Ft x 148.5 Ft)					139,590
Total Square Foot Cost Without Mobilization					\$ 206
Total Square Foot Cost With Mobilization					\$ 247

Note: Item numbers and unit prices taken from LDOTD "Bid Item Weighted Unit Prices" 2nd Quarter 2007 unless noted.

Table B-5

I-10 CALCASIEU PROFILE WITH 73 FT VERTICAL CHANNEL CLEARANCE WITH MAX 3.0% GRADES ESTIMATE OF PROBABLE CONSTRUCTION SQUARE FOOT COST - SEPTEMBER 2007 APPROACH SPAN 135 FT BULB TEE 72" TYPE STRUCTURE OPTION ONE 135 FT SPAN WITH A 148.5 FT WIDE DECK SUPPORTED BY 18-BT 72" TYPE BEAMS AND 60 FT HIGH SIX COLUMN BENTS WITH PILE FOOTINGS					
ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	COST
802-02	<i>Structural Excavation for Intermediate Bents</i>	490.0	CY	\$ 30.00	\$ 14,700
804-01-D	<i>Precast Concrete Piles (18")</i>	5,760	LF	\$ 65.00	\$ 374,400
805-01-D	<i>Class A Concrete (Footing)</i>	356.00	CY	\$ 350.00	\$ 124,600
805-01-F	<i>Class A Concrete (Bents)</i>	557.00	CY	\$ 550.00	\$ 306,350
805-03	<i>Class AA Concrete (Bridge Deck)</i>	599.00	CY	\$ 600.00	\$ 359,400
806-01	<i>Deformed Reinforcing Steel</i>	328,849	LB	\$ 0.90	\$ 295,964
805-08-G	<i>PPC Girder (Type BT-72" F'c=6,500 psi)</i>	2,430	LF	\$ 210.00	\$ 510,300
810-01	<i>Concrete Railing (Exterior Barrier)</i>	270.00	LF	\$ 50.00	\$ 13,500
810-01	<i>Concrete Railing (Median Barrier)</i>	135.00	LF	\$ 60.00	\$ 8,100
	<i>Expansion Joints</i>	144.00	LF	\$ 150.00	\$ 21,600
	<i>Deck Drain System</i>	250.00	LF	\$ 40.00	\$ 10,000
	<i>Deck Drains</i>	12.00	EA	\$ 200.00	\$ 2,400
	<i>Mobilization and Miscellaneous</i>	20.00	%		\$ 408,263
Total Cost Without Mobilization					\$ 2,041,314
Total Cost With Mobilization					\$ 2,449,577
Total Square Foot (135 Ft x 148.5 Ft)					20,048
Total Square Foot Cost Without Mobilization					\$ 102
Total Square Foot Cost With Mobilization					\$ 122

Note: Item numbers and unit prices taken from LDOTD "Bid Item Weighted Unit Prices" 2nd Quarter 2007 unless noted.

Table B-6

I-10 CALCASIEU PROFILE WITH 73 FT VERTICAL CHANNEL CLEARANCE WITH MAX 3.0% GRADES ESTIMATE OF PROBABLE CONSTRUCTION SQUARE FOOT COST - SEPTEMBER 2007 APPROACH SPAN 125 FT BULB TEE 72" TYPE STRUCTURE OPTION ONE 125 FT SPAN WITH A 148.5 FT WIDE DECK SUPPORTED BY 18-BT 72" TYPE BEAMS AND 35 FT HIGH SIX COLUMN BENTS WITH PILE FOOTINGS					
ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	COST
802-02	<i>Structural Excavation for Intermediate Bents</i>	466.0	CY	\$ 30.00	\$ 13,980
804-01-D	<i>Precast Concrete Piles (18")</i>	5,333	LF	\$ 65.00	\$ 346,645
805-01-D	<i>Class A Concrete (Footing)</i>	333.00	CY	\$ 350.00	\$ 116,550
805-01-F	<i>Class A Concrete (Bents)</i>	352.00	CY	\$ 550.00	\$ 193,600
805-03	<i>Class AA Concrete (Bridge Deck)</i>	561.00	CY	\$ 600.00	\$ 336,600
806-01	<i>Deformed Reinforcing Steel</i>	253,760	LB	\$ 0.90	\$ 228,384
805-08-G	<i>PPC Girder (Type BT-72" F'c=6,500 psi)</i>	2,250	LF	\$ 190.00	\$ 427,500
810-01	<i>Concrete Railing (Exterior Barrier)</i>	250.00	LF	\$ 50.00	\$ 12,500
810-01	<i>Concrete Railing (Median Barrier)</i>	125.00	LF	\$ 60.00	\$ 7,500
	<i>Expansion Joints</i>	144.00	LF	\$ 150.00	\$ 21,600
	<i>Deck Drain System</i>	260.00	LF	\$ 40.00	\$ 10,400
	<i>Deck Drains</i>	10.00	EA	\$ 200.00	\$ 2,000
	<i>Mobilization and Miscellaneous</i>	20.00	%		\$ 343,452
Total Cost Without Mobilization					\$ 1,717,259
Total Cost With Mobilization					\$ 2,060,711
Total Square Foot (125 Ft x 148.5 Ft)					18,563
Total Square Foot Cost Without Mobilization					\$ 93
Total Square Foot Cost With Mobilization					\$ 111

Note: Item numbers and unit prices taken from LDOTD "Bid Item Weighted Unit Prices" 2nd Quarter 2007 unless noted.

Table B-7

I-10 CALCASIEU PROFILE WITH 90 FT VERTICAL CHANNEL CLEARANCE WITH MAX 3.5% GRADES ESTIMATE OF PROBABLE CONSTRUCTION SQUARE FOOT COST - SEPTEMBER 2007 APPROACH SPAN 135 FT BULB TEE 72" TYPE STRUCTURE OPTION ONE 135 FT SPAN WITH A 148.5 FT WIDE DECK SUPPORTED BY 18-BT 72" TYPE BEAMS AND 72 FT HIGH SIX COLUMN BENTS WITH PILE FOOTINGS					
ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	COST
802-02	<i>Structural Excavation for Intermediate Bents</i>	586.0	CY	\$ 30.00	\$ 17,580
804-01-D	<i>Precast Concrete Piles (18")</i>	6,336	LF	\$ 65.00	\$ 411,840
805-01-D	<i>Class A Concrete (Footing)</i>	472.00	CY	\$ 350.00	\$ 165,200
805-01-F	<i>Class A Concrete (Bents)</i>	672.00	CY	\$ 550.00	\$ 369,600
805-03	<i>Class AA Concrete (Bridge Deck)</i>	599.00	CY	\$ 600.00	\$ 359,400
806-01	<i>Deformed Reinforcing Steel</i>	384,000	LB	\$ 0.90	\$ 345,600
805-08-G	<i>PPC Girder (Type BT-72" F'c=6,500 psi)</i>	2,430	LF	\$ 210.00	\$ 510,300
810-01	<i>Concrete Railing (Exterior Barrier)</i>	270.00	LF	\$ 50.00	\$ 13,500
810-01	<i>Concrete Railing (Median Barrier)</i>	135.00	LF	\$ 60.00	\$ 8,100
	<i>Expansion Joints</i>	144.00	LF	\$ 150.00	\$ 21,600
	<i>Deck Drain System</i>	250.00	LF	\$ 40.00	\$ 10,000
	<i>Deck Drains</i>	12.00	EA	\$ 200.00	\$ 2,400
	<i>Mobilization and Miscellaneous</i>	20.00	%		\$ 447,024
Total Cost Without Mobilization					\$ 2,235,120
Total Cost With Mobilization					\$ 2,682,144
Total Square Foot (135 Ft x 148.5 Ft)					20,048
Total Square Foot Cost Without Mobilization					\$ 111
Total Square Foot Cost With Mobilization					\$ 134

Note: Item numbers and unit prices taken from LDOTD "Bid Item Weighted Unit Prices" 2nd Quarter 2007 unless noted.

Table B-8

I-10 CALCASIEU PROFILE WITH 90 FT VERTICAL CHANNEL CLEARANCE WITH MAX 3.5% GRADES ESTIMATE OF PROBABLE CONSTRUCTION SQUARE FOOT COST - SEPTEMBER 2007 APPROACH SPAN 125 FT BULB TEE 72" TYPE STRUCTURE OPTION ONE 125 FT SPAN WITH A 148.5 FT WIDE DECK SUPPORTED BY 18-BT 72" TYPE BEAMS AND 41 FT HIGH SIX COLUMN BENTS WITH PILE FOOTINGS					
ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	COST
802-02	<i>Structural Excavation for Intermediate Bents</i>	474.0	CY	\$ 30.00	\$ 14,220
804-01-D	<i>Precast Concrete Piles (18")</i>	5,463	LF	\$ 65.00	\$ 355,095
805-01-D	<i>Class A Concrete (Footing)</i>	337.00	CY	\$ 350.00	\$ 117,950
805-01-F	<i>Class A Concrete (Bents)</i>	392.00	CY	\$ 550.00	\$ 215,600
805-03	<i>Class AA Concrete (Bridge Deck)</i>	561.00	CY	\$ 600.00	\$ 336,600
806-01	<i>Deformed Reinforcing Steel</i>	269,500	LB	\$ 0.90	\$ 242,550
805-08-G	<i>PPC Girder (Type BT-72" F'c=6,500 psi)</i>	2,250	LF	\$ 190.00	\$ 427,500
810-01	<i>Concrete Railing (Exterior Barrier)</i>	250.00	LF	\$ 50.00	\$ 12,500
810-01	<i>Concrete Railing (Median Barrier)</i>	125.00	LF	\$ 60.00	\$ 7,500
	<i>Expansion Joints</i>	144.00	LF	\$ 150.00	\$ 21,600
	<i>Deck Drain System</i>	260.00	LF	\$ 40.00	\$ 10,400
	<i>Deck Drains</i>	10.00	EA	\$ 200.00	\$ 2,000
	<i>Mobilization and Miscellaneous</i>	20.00	%		\$ 352,703
Total Cost Without Mobilization					\$ 1,763,515
Total Cost With Mobilization					\$ 2,116,218
Total Square Foot (125 Ft x 148.5 Ft)					18,563
Total Square Foot Cost Without Mobilization					\$ 95
Total Square Foot Cost With Mobilization					\$ 114

Note: Item numbers and unit prices taken from LDOTD "Bid Item Weighted Unit Prices" 2nd Quarter 2007 unless noted.

Table B-9

I-10 CALCASIEU PROFILE WITH 100 FT CHANNEL CLEARANCE WITH MAX 3.5% GRADES ESTIMATE OF PROBABLE CONSTRUCTION SQUARE FOOT COST - SEPTEMBER 2007 APPROACH SPAN 135 FT BULB TEE 72" TYPE STRUCTURE OPTION ONE 135 FT SPAN WITH A 148.5 FT WIDE DECK SUPPORTED BY 18-BT 72" TYPE BEAMS AND 80 FT HIGH SIX COLUMN BENTS WITH PILE FOOTINGS					
ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	COST
802-02	<i>Structural Excavation for Intermediate Bents</i>	650.0	CY	\$ 30.00	\$ 19,500
804-01-D	<i>Precast Concrete Piles (18")</i>	6,720	LF	\$ 65.00	\$ 436,800
805-01-D	<i>Class A Concrete (Footing)</i>	550.00	CY	\$ 350.00	\$ 192,500
805-01-F	<i>Class A Concrete (Bents)</i>	748.00	CY	\$ 550.00	\$ 411,400
805-03	<i>Class AA Concrete (Bridge Deck)</i>	599.00	CY	\$ 600.00	\$ 359,400
806-01	<i>Deformed Reinforcing Steel</i>	420,700	LB	\$ 0.90	\$ 378,630
805-08-G	<i>PPC Girder (Type BT-72" F'c=6,500 psi)</i>	2,430	LF	\$ 210.00	\$ 510,300
810-01	<i>Concrete Railing (Exterior Barrier)</i>	270.00	LF	\$ 50.00	\$ 13,500
810-01	<i>Concrete Railing (Median Barrier)</i>	135.00	LF	\$ 60.00	\$ 8,100
	<i>Expansion Joints</i>	144.00	LF	\$ 150.00	\$ 21,600
	<i>Deck Drain System</i>	250.00	LF	\$ 40.00	\$ 10,000
	<i>Deck Drains</i>	12.00	EA	\$ 200.00	\$ 2,400
	<i>Mobilization and Miscellaneous</i>	20.00	%		\$ 472,826
Total Cost Without Mobilization					\$ 2,364,130
Total Cost With Mobilization					\$ 2,836,956
Total Square Foot (135 Ft x 148.5 Ft)					20,048
Total Square Foot Cost Without Mobilization					\$ 118
Total Square Foot Cost With Mobilization					\$ 142

Note: Item numbers and unit prices taken from LDOTD "Bid Item Weighted Unit Prices" 2nd Quarter 2007 unless noted.

Table B-10

<p align="center">I-10 CALCASIEU PROFILE WITH 100 FT VERTICAL CHANNEL CLEARANCE WITH MAX 3.5% GRADES ESTIMATE OF PROBABLE CONSTRUCTION SQUARE FOOT COST - SEPTEMBER 2007</p> <p align="center">APPROACH SPAN 125 FT BULB TEE 72" TYPE STRUCTURE OPTION</p> <p align="center">ONE 125 FT SPAN WITH A 148.5 FT WIDE DECK SUPPORTED BY 18-BT 72" TYPE BEAMS AND 45 FT HIGH SIX COLUMN BENTS WITH PILE FOOTINGS</p>					
ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	COST
802-02	<i>Structural Excavation for Intermediate Bents</i>	480.0	CY	\$ 30.00	\$ 14,400
804-01-D	<i>Precast Concrete Piles (18")</i>	5,550	LF	\$ 65.00	\$ 360,750
805-01-D	<i>Class A Concrete (Footing)</i>	340.00	CY	\$ 350.00	\$ 119,000
805-01-F	<i>Class A Concrete (Bents)</i>	418.00	CY	\$ 550.00	\$ 229,900
805-03	<i>Class AA Concrete (Bridge Deck)</i>	561.00	CY	\$ 600.00	\$ 336,600
806-01	<i>Deformed Reinforcing Steel</i>	280,000	LB	\$ 0.90	\$ 252,000
805-08-G	<i>PPC Girder (Type BT-72" F'c=6,500 psi)</i>	2,250	LF	\$ 190.00	\$ 427,500
810-01	<i>Concrete Railing (Exterior Barrier)</i>	250.00	LF	\$ 50.00	\$ 12,500
810-01	<i>Concrete Railing (Median Barrier)</i>	125.00	LF	\$ 60.00	\$ 7,500
	<i>Expansion Joints</i>	144.00	LF	\$ 150.00	\$ 21,600
	<i>Deck Drain System</i>	260.00	LF	\$ 40.00	\$ 10,400
	<i>Deck Drains</i>	10.00	EA	\$ 200.00	\$ 2,000
	<i>Mobilization and Miscellaneous</i>	20.00	%		\$ 358,830
Total Cost Without Mobilization					\$ 1,794,150
Total Cost With Mobilization					\$ 2,152,980
Total Square Foot (125 Ft x 148.5 Ft)					18,563
Total Square Foot Cost Without Mobilization					\$ 97
Total Square Foot Cost With Mobilization					\$ 116

Note: Item numbers and unit prices taken from LDOTD "Bid Item Weighted Unit Prices" 2nd Quarter 2007 unless noted.

Table B-11

I-10 CALCASIEU PROFILE WITH 98 FT & 100 FT VERTICAL CHANNEL CLEARANCE WITH MAX 3.0% ESTIMATE OF PROBABLE CONSTRUCTION SQUARE FOOT COST - SEPTEMBER 2007 APPROACH SPAN 135 FT BULB TEE 72" TYPE STRUCTURE OPTION ONE 135 FT SPAN WITH A 148.5 FT WIDE DECK SUPPORTED BY 18-BT 72" TYPE BEAMS AND 82 FT HIGH SIX COLUMN BENTS WITH PILE FOOTINGS					
ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	COST
802-02	<i>Structural Excavation for Intermediate Bents</i>	667.0	CY	\$ 30.00	\$ 20,010
804-01-D	<i>Precast Concrete Piles (18")</i>	6,888	LF	\$ 65.00	\$ 447,720
805-01-D	<i>Class A Concrete (Footing)</i>	564.00	CY	\$ 350.00	\$ 197,400
805-01-F	<i>Class A Concrete (Bents)</i>	767.00	CY	\$ 550.00	\$ 421,850
805-03	<i>Class AA Concrete (Bridge Deck)</i>	599.00	CY	\$ 600.00	\$ 359,400
806-01	<i>Deformed Reinforcing Steel</i>	431,000	LB	\$ 0.90	\$ 387,900
805-08-G	<i>PPC Girder (Type BT-72" F'c=6,500 psi)</i>	2,430	LF	\$ 210.00	\$ 510,300
810-01	<i>Concrete Railing (Exterior Barrier)</i>	270.00	LF	\$ 50.00	\$ 13,500
810-01	<i>Concrete Railing (Median Barrier)</i>	135.00	LF	\$ 60.00	\$ 8,100
	<i>Expansion Joints</i>	144.00	LF	\$ 150.00	\$ 21,600
	<i>Deck Drain System</i>	250.00	LF	\$ 40.00	\$ 10,000
	<i>Deck Drains</i>	12.00	EA	\$ 200.00	\$ 2,400
	<i>Mobilization and Miscellaneous</i>	20.00	%		\$ 480,036
Total Cost Without Mobilization					\$ 2,400,180
Total Cost With Mobilization					\$ 2,880,216
Total Square Foot (135 Ft x 148.5 Ft)					20,048
Total Square Foot Cost Without Mobilization					\$ 120
Total Square Foot Cost With Mobilization					\$ 144

Note: Item numbers and unit prices taken from LDOTD "Bid Item Weighted Unit Prices" 2nd Quarter 2007 unless noted.

Table B-12

I-10 CALCASIEU PROFILE WITH 98 FT & 100 FT VERTICAL CHANNEL CLEARANCE WITH MAX 3.0% ESTIMATE OF PROBABLE CONSTRUCTION SQUARE FOOT COST - SEPTEMBER 2007 APPROACH SPAN 125 FT BULB TEE 72" TYPE STRUCTURE OPTION ONE 125 FT SPAN WITH A 148.5 FT WIDE DECK SUPPORTED BY 18-BT 72" TYPE BEAMS AND 53 FT HIGH SIX COLUMN BENTS WITH PILE FOOTINGS					
ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	COST
802-02	<i>Structural Excavation for Intermediate Bents</i>	485.0	CY	\$ 30.00	\$ 14,550
804-01-D	<i>Precast Concrete Piles (18")</i>	5,655	LF	\$ 65.00	\$ 367,575
805-01-D	<i>Class A Concrete (Footing)</i>	348.00	CY	\$ 350.00	\$ 121,800
805-01-F	<i>Class A Concrete (Bents)</i>	488.00	CY	\$ 550.00	\$ 268,400
805-03	<i>Class AA Concrete (Bridge Deck)</i>	561.00	CY	\$ 600.00	\$ 336,600
806-01	<i>Deformed Reinforcing Steel</i>	305,000	LB	\$ 0.90	\$ 274,500
805-08-G	<i>PPC Girder (Type BT-72" F'c=6,500 psi)</i>	2,250	LF	\$ 190.00	\$ 427,500
810-01	<i>Concrete Railing (Exterior Barrier)</i>	250.00	LF	\$ 50.00	\$ 12,500
810-01	<i>Concrete Railing (Median Barrier)</i>	125.00	LF	\$ 60.00	\$ 7,500
	<i>Expansion Joints</i>	144.00	LF	\$ 150.00	\$ 21,600
	<i>Deck Drain System</i>	260.00	LF	\$ 40.00	\$ 10,400
	<i>Deck Drains</i>	10.00	EA	\$ 200.00	\$ 2,000
	<i>Mobilization and Miscellaneous</i>	20.00	%		\$ 372,985
Total Cost Without Mobilization					\$ 1,864,925
Total Cost With Mobilization					\$ 2,237,910
Total Square Foot (125 Ft x 148.5 Ft)					18,563
Total Square Foot Cost Without Mobilization					\$ 100
Total Square Foot Cost With Mobilization					\$ 121

Note: Item numbers and unit prices taken from LDOTD "Bid Item Weighted Unit Prices" 2nd Quarter 2007 unless noted.

Table B-13

I-10 CALCASIEU PROFILE WITH 120 FT VERTICAL CHANNEL CLEARANCE WITH MAX 4.6% GRADES ESTIMATE OF PROBABLE CONSTRUCTION SQUARE FOOT COST - SEPTEMBER 2007 APPROACH SPAN 135 FT BULB TEE 72" TYPE STRUCTURE OPTION ONE 135 FT SPAN WITH A 148.5 FT WIDE DECK SUPPORTED BY 18-BT 72" TYPE BEAMS AND 90 FT HIGH SIX COLUMN BENTS WITH PILE FOOTINGS					
ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	COST
802-02	<i>Structural Excavation for Intermediate Bents</i>	728.0	CY	\$ 30.00	\$ 21,840
804-01-D	<i>Precast Concrete Piles (18")</i>	7,526	LF	\$ 65.00	\$ 489,190
805-01-D	<i>Class A Concrete (Footing)</i>	616.00	CY	\$ 350.00	\$ 215,600
805-01-F	<i>Class A Concrete (Bents)</i>	838.00	CY	\$ 550.00	\$ 460,900
805-03	<i>Class AA Concrete (Bridge Deck)</i>	599.00	CY	\$ 600.00	\$ 359,400
806-01	<i>Deformed Reinforcing Steel</i>	470,000	LB	\$ 0.90	\$ 423,000
805-08-G	<i>PPC Girder (Type BT-72" F'c=6,500 psi)</i>	2,430	LF	\$ 210.00	\$ 510,300
810-01	<i>Concrete Railing (Exterior Barrier)</i>	270.00	LF	\$ 50.00	\$ 13,500
810-01	<i>Concrete Railing (Median Barrier)</i>	135.00	LF	\$ 60.00	\$ 8,100
	<i>Expansion Joints</i>	144.00	LF	\$ 150.00	\$ 21,600
	<i>Deck Drain System</i>	250.00	LF	\$ 40.00	\$ 10,000
	<i>Deck Drains</i>	12.00	EA	\$ 200.00	\$ 2,400
	<i>Mobilization and Miscellaneous</i>	20.00	%		\$ 507,166
Total Cost Without Mobilization					\$ 2,535,830
Total Cost With Mobilization					\$ 3,042,996
Total Square Foot (135 Ft x 148.5 Ft)					20,048
Total Square Foot Cost Without Mobilization					\$ 126
Total Square Foot Cost With Mobilization					\$ 152

Note: Item numbers and unit prices taken from LDOTD "Bid Item Weighted Unit Prices" 2nd Quarter 2007 unless noted.

Table B-14

<p align="center">I-10 CALCASIEU PROFILE WITH 120 FT VERTICAL CHANNEL CLEARANCE WITH MAX 4.6% GRADES ESTIMATE OF PROBABLE CONSTRUCTION SQUARE FOOT COST - SEPTEMBER 2007</p> <p align="center">APPROACH SPAN 125 FT BULB TEE 72" TYPE STRUCTURE OPTION</p> <p align="center">ONE 125 FT SPAN WITH A 148.5 FT WIDE DECK SUPPORTED BY 18-BT 72" TYPE BEAMS AND 45 FT HIGH SIX COLUMN BENTS WITH PILE FOOTINGS</p>					
ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	COST
802-02	<i>Structural Excavation for Intermediate Bents</i>	480.0	CY	\$ 30.00	\$ 14,400
804-01-D	<i>Precast Concrete Piles (18")</i>	5,550	LF	\$ 65.00	\$ 360,750
805-01-D	<i>Class A Concrete (Footing)</i>	340.00	CY	\$ 350.00	\$ 119,000
805-01-F	<i>Class A Concrete (Bents)</i>	418.00	CY	\$ 550.00	\$ 229,900
805-03	<i>Class AA Concrete (Bridge Deck)</i>	561.00	CY	\$ 600.00	\$ 336,600
806-01	<i>Deformed Reinforcing Steel</i>	280,000	LB	\$ 0.90	\$ 252,000
805-08-G	<i>PPC Girder (Type BT-72" F'c=6,500 psi)</i>	2,250	LF	\$ 190.00	\$ 427,500
810-01	<i>Concrete Railing (Exterior Barrier)</i>	250.00	LF	\$ 50.00	\$ 12,500
810-01	<i>Concrete Railing (Median Barrier)</i>	125.00	LF	\$ 60.00	\$ 7,500
	<i>Expansion Joints</i>	144.00	LF	\$ 150.00	\$ 21,600
	<i>Deck Drain System</i>	260.00	LF	\$ 40.00	\$ 10,400
	<i>Deck Drains</i>	10.00	EA	\$ 200.00	\$ 2,000
	<i>Mobilization and Miscellaneous</i>	20.00	%		\$ 358,830
Total Cost Without Mobilization					\$ 1,794,150
Total Cost With Mobilization					\$ 2,152,980
Total Square Foot (125 Ft x 148.5 Ft)					18,563
Total Square Foot Cost Without Mobilization					\$ 97
Total Square Foot Cost With Mobilization					\$ 116

Note: Item numbers and unit prices taken from LDOTD "Bid Item Weighted Unit Prices" 2nd Quarter 2007 unless noted.

Table B-15

I-10 CALCASIEU PROFILE WITH 120 FT VERTICAL CHANNEL CLEARANCE WITH MAX 3.0% GRADES ESTIMATE OF PROBABLE CONSTRUCTION SQUARE FOOT COST - SEPTEMBER 2007 APPROACH SPAN 135 FT BULB TEE 72" TYPE STRUCTURE OPTION ONE 135 FT SPAN WITH A 148.5 FT WIDE DECK SUPPORTED BY 18-BT 72" TYPE BEAMS AND 82 FT HIGH SIX COLUMN BENTS WITH PILE FOOTINGS					
ITEM NO.	ITEM	QUANTITY	UNIT	UNIT PRICE	COST
802-02	<i>Structural Excavation for Intermediate Bents</i>	667.0	CY	\$ 30.00	\$ 20,010
804-01-D	<i>Precast Concrete Piles (18")</i>	6,888	LF	\$ 65.00	\$ 447,720
805-01-D	<i>Class A Concrete (Footing)</i>	564.00	CY	\$ 350.00	\$ 197,400
805-01-F	<i>Class A Concrete (Bents)</i>	767.00	CY	\$ 550.00	\$ 421,850
805-03	<i>Class AA Concrete (Bridge Deck)</i>	599.00	CY	\$ 600.00	\$ 359,400
806-01	<i>Deformed Reinforcing Steel</i>	431,000	LB	\$ 0.90	\$ 387,900
805-08-G	<i>PPC Girder (Type BT-72" F'c=6,500 psi)</i>	2,430	LF	\$ 210.00	\$ 510,300
810-01	<i>Concrete Railing (Exterior Barrier)</i>	270.00	LF	\$ 50.00	\$ 13,500
810-01	<i>Concrete Railing (Median Barrier)</i>	135.00	LF	\$ 60.00	\$ 8,100
	<i>Expansion Joints</i>	144.00	LF	\$ 150.00	\$ 21,600
	<i>Deck Drain System</i>	250.00	LF	\$ 40.00	\$ 10,000
	<i>Deck Drains</i>	12.00	EA	\$ 200.00	\$ 2,400
	<i>Mobilization and Miscellaneous</i>	20.00	%		\$ 480,036
Total Cost Without Mobilization					\$ 2,400,180
Total Cost With Mobilization					\$ 2,880,216
Total Square Foot (135 Ft x 148.5 Ft)					20,048
Total Square Foot Cost Without Mobilization					\$ 120
Total Square Foot Cost With Mobilization					\$ 144

Note: Item numbers and unit prices taken from LDOTD "Bid Item Weighted Unit Prices" 2nd Quarter 2007 unless noted.