

VALUE ENGINEERING CHANGE PROPOSAL
MISSOURI DEPARTMENT OF TRANSPORTATION

Conceptual Proposal Final Proposal Date 4/19/10
Contract ID 091208-601 Job No. J6I0984
County St. Louis Original Bid Cost \$229,450,505.00
Contractor Massman, Traylor, Alberici By Thomas G. Tavernaro
Designed By HNTB Phone (314) 881-6704
VECP# 10-57 (to be completed by C.O.) VECP or PDVECP

1. **Description of existing requirements and proposed change(s). Advantages/Disadvantages**
Section Q-3.0, Stay Cable Testing of the Job Special Provisions (Bridge) requires testing to be performed in accordance with PTI. Section 4.3 of the 5th Ed. PTI allows for substitution of of stay cable tests performed on prior projects at the Engineer's discretion, which was obtained in the response to RFI-020 dated 3/29/10. The advantage to elimination of the testing is that the shop drawings and plans for the stay system can be finalized earlier in the project which enables better coordination of details between the stay system and structural steel elements. There are no apparent disadvantages.

2. **Estimate of reduction in construction costs.** \$255,706.00

3. **Prediction of any effects the proposed change(s) will have on other department costs, such as maintenance and operations.**

A preliminary assesment of the effects this Change Order may have on other Department costs indicate no, or negligible cost.

4. **Anticipated date for submittal of detailed change(s) of items required by Section 104.6 of the Specifications.**

4/22/10
(date)

5. **Deadline for issuing a change order to obtain maximum cost reduction, noting the effect of contract completion time or delivery schedule.**

6/01/10
(date)

Potential delay in scheduling test laboratory to perform tests.
(effect)

6. **Dates of any previous or concurrent submission of the same proposal.**

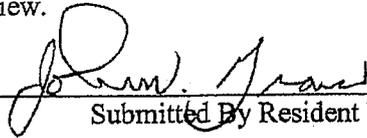
None
(date and/or dates)

Additional Comments:

**** Portion Below This Line To Be Filled Out by MoDOT ****

Comments:

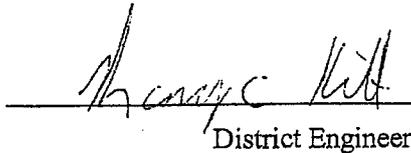
This concept proposal provides for a partial elimination of the stay cable system testing. Based on discussions with MoDOT's design consultant (HNTB) and acceptance of the Fatigue/Static Strength Test Reports and Leak Tightness Test Reports, approval is recommended for this concept proposal. Final cost savings are currently under review.


Submitted By Resident Engineer

6/2/10
Date

Comments:

- Approval Recommended
- Rejection Recommended


District Engineer

6/2/10
Date

Comments:

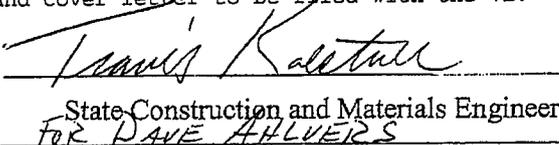
- Approval Recommended
- Rejection Recommended


Federal Highway Administration
Required for FHWA Full Oversight Projects

6/3/10
Date

Comments: Concept is approved based upon the documentation from MTA and analysis from HNTB regarding accepted tests from previous projects and tests still required for this project according to PTI. HNTB has provided a draft testing list and will provide a final list and cover letter to be filed with the VE.

- Approval
- Rejection


State Construction and Materials Engineer
FOR DAVE AHLVERS

6/18/10
Date

Distribution: Resident Engineer, Project Manager, District Construction & Materials Engineer, State Construction & Materials Engineer, FHWA Value Engineering Administrator - MoDOT, P. O. Box 270, Jefferson City, MO 65102



MASSMAN - TRAYLOR - ALBERICI

April 19, 2010
MTA-MODOT-008

Missouri Department of Transportation
707 North Second Street, Suite 300
St. Louis, MO 63102

Attention: Mr. John V. Grana, Resident Engineer

Subject: I-70 Mississippi River Bridge, St. Louis City
MoDOT Job No. J610984
Value Engineering Cost Proposal-Partial Elimination of Stay Cable System Testing

Gentlemen:

Please review and approve our Value Engineering Cost Proposal for the partial elimination of the stay cable system testing, per the response to our RFI-MTA-MoDOT-020.

Attached is a completed form C104 with backup of pricing from VSL, along with a copy of the aforementioned RFI.

Sincerely,

MASSMAN, TRAYLOR, ALBERICI
A Joint Venture

A handwritten signature in black ink that reads "Thomas G. Tavernaro". The signature is written in a cursive style with a large, sweeping initial "T".

Thomas G. Tavernaro
Project Engineer

Enclosure

Table 1 – Fee Structure for HDPE-Sheathed Performance Tests

Test Items	Number of Tests	Subtotal for both series
Chemical Resistance	1	\$2,350
Chloride Permeability	1	\$2,350
Impact Test	1	\$1,500
Abrasion Resistance	1	\$1,500
Salt Fog Test	1	\$19,000
Test Report and Management	1	\$2,000
Grand Total		\$28,700

Table 2 presents the numbers of test samples required for one (1) series of tests:

Table 2 – Estimated Sample Length Requirements

Test Items	Sample Requirement
Chemical Resistance	30 strands @ 155 mm (6 inch) each
Chloride Permeability	Film with two 3x3 square, or one 5x5 square
Abrasion Resistance	2 strands @ 155 mm (6 inch) each
Impact Test	7 strands @ 410 mm (16 inch) each
Salt Fog Test	2 strands @ 1800 mm (70 inch) each
Total Length	~15 meters (50 ft)

TERMS AND CONDITIONS

This proposal is subject to our Standard Terms and Conditions (attached) and the following additional terms and conditions are part of this proposal.

1. VSL will be responsible for the cost related to custom clearance and shipping to and from CTL.
2. This proposal is based on the entire scope of work being awarded. If the scope is changed, pricing is subject to change.
3. This quotation is valid for 30 days. Schedule is based on availability at time of contract execution and confirmed by prepayment.



Table 1 – Fee structure for Testing of Stay Cable System

Test Description	Test Fee
Fatigue and Leak Test – 6-31 Cable (Does not include socket head cutting costs ¹)	\$55,000
Fatigue and Static Test – 6-55 Cable (Does not include socket head cutting costs ¹)	\$83,000
Fatigue and Static Test – 6-73 Cable (Does not include socket head cutting costs ¹)	\$67,000

NOTE: 1) Slicing cuts of socket head not included above can be performed if requested at an additional fee of \$2,500 per cut.

PAYMENT SCHEDULE

The payment for acceptance testing of strands will be billed when the tests are completed. The payment schedule for acceptance testing of stay cables will be billed based on Table 2.

Table 2 – Payment Schedule for Acceptance Testing of Cable systems

Test Description	Mobilization	Test Completion	Report Submission
Fatigue and Leak Test – 6-31	\$25,000	\$25,000	\$5,000
Fatigue and Static Test – 6-55	\$25,000	\$33,000	\$5,000
Fatigue and Static Test – 6-73	\$30,000	\$32,000	\$5,000

TEST SCHEDULE

The small large cable test rig will be available after February 1, 2010. The large cable rig will be available after March 1, 2010. Currently, CTL has made commitments with several clients for stay cable testing. Based on these commitments, further scheduling will be based on order of signed agreement and prepayment (mobilization) to reserve a test fixture.

TERMS AND CONDITIONS

This proposal is subject to our Standard Terms and Conditions (attached) and the following terms and conditions are part of this proposal.

1. The CTL axial fatigue test fixture will not require modification for the proposed test other than what has been listed in this proposal and therefore no additional fees would be



Massman, Traylor, Alberici, A Joint Venture
Mississippi River Bridge, Project J610984, Route I-70, St. Louis MO.

8901 State Line • P.O. Box 8458 • Kansas City, MO 64114 • 816-523-1000 • (Fax) 816-333-2109

REQUEST FOR INFORMATION

TO: Missouri Department of Transportation, District 6
707 North 2nd Street, Suite 300
St. Louis, MO 63102

RFI Number: 020
Document Date: 03/06/10

ATTN: John V. Grana, P.E., Resident Engineer

FROM: Thomas G. Tavernaro

SUBJECT: Acceptance Testing of Stay Cables
REFERENCE: JSP (Bridge) Q.3, 5th Ed. PTI-Section 4.3

REQUEST RESPONSE BY: 03/12/10

Request:	
Please confirm that the Engineer would approve stay cable tests that have been conducted for prior projects (similar in design and details to those proposed for this project) as the basis for stay cable approval on this project, subject to the qualifications contained in the 5th Ed. PTI Section 4.3.	
Originated By: MTA	Reviewed By: TGT
Response:	
HNTB is willing to consider the results of previous tests as the basis for approval of the stay cable system qualification and testing as outlined in Section 4.0 of the PTI Recommendations for Stay Cable Design, Testing and Installation, 5 th edition, provided:	
<ol style="list-style-type: none"> 1. The requirements specified in Job Special Provision Q, "Stay Cables" are met 2. New tests are performed, and results submitted for approval, as outlined in Section 3.0 of the PTI Recommendations. 	
Responder: HNTB	Date: 3/25/10
Response:	
<p>MODOT CONCURS WITH HNTB RESPONSE ABOVE.</p> <p>MODOT WOULD CONSIDER THIS A 75/25 VALUE ENGINEERING CONCEPT PROPOSAL.</p>	
Responder: MODOT	Date: 3/29/10



Kent Nelson, PE, SSPC #29496

Fabrication Operations Engineer
MoDOT Bridge Division
(573) 751-3693

Gregory G Sunde Kent, is this RFI something that you 03/17/2010 09:59:00 AM



**VSL STAY CABLE SYSTEM
FATIGUE/STATIC STRENGTH
TESTS**

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FATIGUE/STATIC STRENGTH TEST REPORTS

VSL STAY CABLE SYSTEM SSI 2000

PROJECT : I-70 MISSISSIPPI RIVER BRIDGE (ST. LOUIS)
 CONTRACTOR : MASSMAN
 OWNER : MoDOT

Reviewed for general conformity to plans and specifications. Detail dimensions and quantities not completely checked.

Review is not intended to coordinate any party or miscellaneous item.

Contractor is solely responsible for verifying field measurements when so stated in plans and/or specifications.

Contractors responsibility is in no way relieved by this review.

DATE MAY 25 2010

- APPROVED DESIGN FEATURES ONLY
- NO CORRECTIONS NOTED
- CORRECTIONS NOTED
- FOR FILES AND DISTRIBUTION
MoDOT DIVISION OF BRIDGES

April 2010
Fatigue/Static Strength Test Reports

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1. Introduction
2. Fatigue/Static Strength Tests
3. Appendix

<h1>REVIEW</h1>	NO EXCEPTIONS TAKEN MAKE CORRECTIONS NOTED AMEND AND RE-DESIGN REJECTED-SEE REVISIONS
<p>This review is only for general conformance with the intent of Contract Documents. Contractor is responsible for verifying dimensions, for establishing processes, means, techniques, sequencing of construction and for coordination. Review action taken and noted. Review does not authorize deviations from contract documents so stated in separate letter or otherwise.</p>	
<h2>HNTB</h2> 10 SOUTH BROADWAY ST LOUIS, MO 63102	BY: <u>SBS</u> DATE: <u>5/21/10</u>



**VSL STAY CABLE SYSTEM
FATIGUE/STATIC STRENGTH
TESTS**

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1. INTRODUCTION

1.1 General

VSL will be furnishing the SSI 2000 stay cable system for the St. Louis Mississippi River Bridge project. This system has been used successfully on dozens of projects since its introduction in the year 2000.

The job special provisions state that stay cable testing shall be performed in accordance with PTI (see "Stay Cable Testing" on page 68). Per Section 4.3 of the PTI Stay Cable Guide Specifications (see reference below), "When the stay cable tests have been conducted for previous projects on specimens similar in design and details to those proposed for a new project, the previous tests may, at the Engineer's discretion, be used as the basis for stay cable approval on the new project." The intent of this report is to provide a basis for the Engineer to accept previous test results for the fatigue and static strength testing specified in PTI Section 4.2.

1.2 Reference Documents

The following documents will be referenced in this report:

- Job Special Provisions (Bridge) for MoDOT Job No. J610984. Item Q.3.0 (Stay Cable Testing) contains the testing provisions for the new stay cables.
- PTI Guide Specifications: Recommendations for Stay Cable Design, Testing and Installation, 5th Edition (2007), 3rd Edition (1993)
- *fib* Bulletin 30: Acceptance of Stay Cable Systems Using Prestressing Steels (2005)
- CTL Full-Scale Fatigue/Static Strength Test Report for 6-31 Anchorage per PTI 5th Edition (Test Report No. 251058, dated August 2009)
 - EMPA Full-Scale Fatigue/Static Strength Test Report for 6-31 Anchorage per *fib* Bulletin 30 (Test Report No. 453'275, dated September 2009)
 - EMPA Full-Scale Fatigue/Static Strength Test Report for 6-37 Anchorage per *fib* Bulletin 30 (Test Report No. 453'002, dated August 2009)
- EMPA Full-Scale Fatigue/Static Strength Test Report for 6-43 Anchorage per *fib* Bulletin 30 (Test Report No. 447'425, dated May 2008)
- TUM Full-Scale Fatigue/Static Strength Test Report for 6-55 Anchorage per *fib* Bulletin 30 (Test Report No. we-2209363, dated November 2009)
 - LCPC Full-Scale Fatigue/Static Strength Test Report for 6-55 Anchorage per PTI 3rd Edition (Test Report No. BP/BP 2005-182, dated August 2005)
 - CTL Full-Scale Fatigue/Static Strength Test Report for 6-73 Anchorage per PTI 5th Edition (Test Report No. 251058, dated August 2009)
 - LCPC Full-Scale Fatigue/Static Strength Test Report for 6-73 Anchorage per PTI 3rd Edition (Test Report No. BP/BP 2005-181, dated July 2005)

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2. FATIGUE/STATIC STRENGTH TESTS

2.1 Overview

PTI Section 4.2 ("Acceptance Testing of Stay Cables") states: "Tests of at least 3 representative stay cable specimens shall be carried out. Stay cables are to be tested with all load bearing appurtenances." The commentary on the same section provides further clarification: "The 3 stay cable test specimens should represent the largest, the smallest, and the average sizes (areas of MTE) of all bridge cables."

PTI Section 4.1.6.1 specifies that the smallest stay cable specimen should be subjected to fatigue and leak tests, while Section 4.2 calls for fatigue and static strength tests to be conducted on the average and largest specimens. VSL is proposing to submit a series of prior test results for the tests identified in PTI Section 4.2 in order to satisfy the project requirements. This document will focus on the fatigue and static strength tests. A separate report will propose the acceptance of prior leak test results. The cable sizes and testing parameters vary from test to test; the following sections will describe the applicability of the previous test reports to the St. Louis project.

2.2 Relevance of Previous Test Results to St. Louis Project (Smallest Cable Size)

As described above, the smallest stay cable specimen is typically subjected to fatigue and leak tests, which will be discussed in a separate document. However, in order to demonstrate the capabilities of the SSI 2000 system across a range of sizes, we will include here test results from fatigue and static strength tests conducted on small cable specimens. Using VSL's SSI 2000 system, the smallest size stay cable on the St. Louis project is a 6-31. VSL is submitting the following reports with either equivalent or similar sizing:

- CTL Full-Scale Fatigue/Static Strength Test Report for 6-31 Anchorage per PTI 5th Edition (Test Report No. 251058, dated August 2009)
- EMPA Full-Scale Fatigue/Static Strength Test Report for 6-31 Anchorage per *fib* Bulletin 30 (Test Report No. 453'275, dated September 2009)
- EMPA Full-Scale Fatigue/Static Strength Test Report for 6-37 Anchorage per *fib* Bulletin 30 (Test Report No. 453'002, dated August 2009)

Table 2 in the Appendix compares the specific data from each test to the requirements for the St. Louis project. The following paragraphs will elaborate on the data contained in the table.

The previous test on VSL's 6-31 conducted at CTL utilized the same size anchorages as the smallest ones specified for St. Louis. The test stay cable consisted of larger strands than what will be used on the St. Louis project (0.62" diameter versus 0.6"). Since VSL's SSI 2000 stay cable system is designed to be compatible with either 0.6" or 0.62" diameter strands, a difference in strand diameter will not be identified in the remaining test descriptions below (see Table 2 for the specific parameters of each test included in this report). All other test parameters were identical to those of the current project, as the test in question was conducted in accordance with the 5th Edition of PTI.

The other 6-31 test and the 6-37 test included with this report were conducted at EMPA in accordance with *fib* Bulletin 30. The testing requirements of *fib* Bulletin 30 are similar to those



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FATIGUE/STATIC STRENGTH
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of the PTI 5th Edition, with two exceptions. The *fib* document requires a higher stress range in the fatigue portion of the test than PTI (200 vs. 159 MPa), and it also specifies a minimum cable elongation of 1.5% at the maximum force. The *fib* Bulletin 30 fatigue/static strength test is thus more rigorous than the one detailed in PTI, since it subjects the test specimen to a greater range of stresses. The test in question successfully met the requirements of *fib* Bulletin 30.

2.3 Relevance of Previous Test Results to St. Louis Project (Average Cable Size)

Using VSL's SSI 2000 system, the average size stay cable on the St. Louis project is a 6-55. In order to fulfill the requirement to test this size cable, VSL is submitting the following reports:

- EMPA Full-Scale Fatigue/Static Strength Test Report for 6-43 Anchorage per *fib* Bulletin 30 (Test Report No. 447'425, dated May 2008)
- TUM Full-Scale Fatigue/Static Strength Test Report for 6-55 Anchorage per *fib* Bulletin 30 (Test Report No. we-2209363, dated November 2009)
- LCPC Full-Scale Fatigue/Static Strength Test Report for 6-55 Anchorage per PTI 3rd Edition (Test Report No. BP/BP 2005-182, dated August 2005)

Table 2 in the Appendix compares the specific data from each test to the requirements for the St. Louis project. The following paragraphs will elaborate on the data contained in the table.

The 6-43 test performed at EMPA and the 6-55 test performed at TUM were conducted in accordance with *fib* Bulletin 30. As described above, the testing requirements of *fib* Bulletin 30 are equivalent to or more stringent than those of the PTI 5th Edition. Both of these tests successfully met the requirements of *fib* Bulletin 30.

The 6-55 test performed at LCPC was conducted in accordance with a modified version of test criteria from 3rd Edition of PTI. For this particular test, the stress range for the fatigue test was increased (from 159 MPa to 200 MPa), and an angular deviation of 0.007 radians was introduced at the anchorages (not required by PTI 3rd Edition). As shown in Table 2, this angular deviation is slightly lower than what is required for the St. Louis project; however, the stress range exceeds the St. Louis requirements.

2.4 Relevance of Previous Test Results to St. Louis Project (Largest Cable Size)

Using VSL's SSI 2000 system, the largest size stay cable on the St. Louis project is a 6-73. In order to fulfill the requirement to test this size cable, VSL is submitting the following reports:

- CTL Full-Scale Fatigue/Static Strength Test Report for 6-73 Anchorage per PTI 5th Edition (Test Report No. 251058, dated August 2009)
- LCPC Full-Scale Fatigue/Static Strength Test Report for 6-73 Anchorage per PTI 3rd Edition (Test Report No. BP/BP 2005-181, dated July 2005)

Table 2 in the Appendix compares the specific data from each test to the requirements for the St. Louis project. The following paragraphs will elaborate on the data contained in the table.



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FATIGUE/STATIC STRENGTH
TESTS**

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The previous test on VSL's 6-73 conducted at CTL utilized the same size anchorages as the largest ones specified for St. Louis. The test was conducted in accordance with the 5th Edition of PTI.

The 6-73 test performed at LCPC was conducted in accordance with a modified version of test criteria from 3rd Edition of PTI. For this particular test, the stress range for the fatigue test was increased (from 159 MPa to 200 MPa), and an angular deviation of 0.007 radians was introduced at the anchorages (not required by PTI 3rd Edition). As shown in Table 2, this angular deviation is slightly lower than what is required for the St. Louis project; however, the stress range exceeds the St. Louis requirements.

2.5 Similarity of Anchorage Details

As noted above, PTI Section 4.3 states: "When the stay cable tests have been conducted for previous projects on specimens similar in design and details to those proposed for a new project, the previous tests may, at the Engineer's discretion, be used as the basis for stay cable approval on the new project."

VSL may not utilize the same suppliers for all stay cable anchorage or strand components. However, VSL utilizes the same SSI 2000 stay cable system around the world; the "design and details" of this system are similar on each project.

All VSL SSI 2000 stay cable components are required to conform to a set of internal specifications and fabrication drawings, which are proprietary. Particular material specifications for the various components may be adapted to meet various national and regional standards that may be required on particular projects. For instance, ASTM standards are often substituted for similar EN codes. However, the actual material properties of each component must conform to VSL's internal standards, ensuring system similarity regardless of the geographical context.

Other details of the SSI 2000 stay cable system are not affected by the diversity of international material standards. Thus, these details remain unchanged regardless of the geographic context of a particular project.

The anchorages used in the prior fatigue and static strength tests referenced in this report and the ones to be utilized on the St. Louis project all conform to VSL's SSI 2000 specifications.

2.6 Proven Strength of VSL Stay Cables

VSL has successfully performed dozens of full-scale stay cable fatigue and static strength tests over the last three decades. Since its introduction in 2000, VSL's current stay cable system, SSI 2000, has consistently demonstrated its strength by passing numerous tests performed in accordance with a variety of specifications. In order to keep this report concise, the number of proposed prior test results has been limited to eight. However, VSL could supply many more successful test reports in order to verify the fatigue and static strength of the SSI 2000 system.



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2.7 Approval of Prior Tests on Previous Projects

Prior fatigue/static strength test results have been accepted previously on the Main Street Bridge project in Columbus, Ohio; the John James Audubon Bridge project in St. Francisville, Louisiana; the Autoroute 25 project in Montreal, Quebec, Canada; and the kcICON project in Kansas City, Missouri (see Table 1 in the Appendix for project information).

3. APPENDIX

As described above, the following information is included as an appendix to this report:

- CTL Full-Scale Fatigue/Static Strength Test Report for 6-31 and 6-73 Anchorages per PTI 5th Edition (Test Report No. 251058, dated August 2009)
- EMPA Full-Scale Fatigue/Static Strength Test Report for 6-31 Anchorage per *fib* Bulletin 30 (Test Report No. 453'275, dated September 2009)
- EMPA Full-Scale Fatigue/Static Strength Test Report for 6-37 Anchorage per *fib* Bulletin 30 (Test Report No. 453'002, dated August 2009)
- EMPA Full-Scale Fatigue/Static Strength Test Report for 6-43 Anchorage per *fib* Bulletin 30 (Test Report No. 447'425, dated May 2008)
- TUM Full-Scale Fatigue/Static Strength Test Report for 6-55 Anchorage per *fib* Bulletin 30 (Test Report No. we-2209363, dated November 2009)
- LCPC Full-Scale Fatigue/Static Strength Test Report for 6-55 Anchorage per PTI 3rd Edition (Test Report No. BP/BP 2005-182, dated August 2005)
- LCPC Full-Scale Fatigue/Static Strength Test Report for 6-73 Anchorage per PTI 3rd Edition (Test Report No. BP/BP 2005-181, dated July 2005)
- Table 1 – Acceptance of Prior Full-Scale Fatigue/Static Strength Tests on Recent VSL Stay Cable Projects
- Table 2 – Summary of Fatigue and Static Strength Tests



**VSL STAY CABLE SYSTEM
LEAK TEST**

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LEAK TIGHTNESS TEST REPORTS

VSL STAY CABLE SYSTEM SSI 2000

PROJECT : I-70 MISSISSIPPI RIVER BRIDGE (ST. LOUIS)
 CONTRACTOR : MASSMAN
 OWNER : MODOT

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Reviewed for general conformity to plans and specifications. Detail dimensions and quantities not completely checked.

Review is not intended to coordinate any party or miscellaneous item.

Contractor is solely responsible for verifying field measurements when as stated in plans and/or specifications.

Contractors responsibility is in no way relieved by this review.

DATE MAY 25 2010

- APPROVED DESIGN FEATURES ONLY
 - NO CORRECTIONS NOTED
 - CORRECTIONS NOTED
 - FOR FILE AND DISTRIBUTION
- MODOT DIVISION OF BRIDGES

April 2010
Leak Tightness Test

1. Introduction
2. Leak Tightness Test
3. Appendix

REVIEW	NO EXCEPTIONS TAKEN <input checked="" type="checkbox"/>
	MAKE CORRECTIONS NOTED <input type="checkbox"/>
	AMEND AND RESUBMIT <input type="checkbox"/>
REJECTED-SEE REVISED <input type="checkbox"/>	
<p>is only for general conformance with design and intent of Contract Documents. Contractor is responsible for verifying dimensions; for establishing processes, means, techniques, sequences of construction and for coordination of work.</p> <p>Review action taken and noted to instruct contractor does not authorize deviations from contract documents unless so stated in separate letter or Change Order.</p>	
HNTB	BY: <u>JSB</u>
10 SOUTH BROADWAY ST LOUIS, MO 63102	DATE: <u>5/27/10</u>



VSL STAY CABLE SYSTEM LEAK TEST

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INTRODUCTION

1.1 General

VSL will be furnishing the SSI 2000 stay cable system for the Mississippi River Bridge project. This system has been used successfully on dozens of projects since its introduction in the year 2000.

The job special provisions state that stay cable testing shall be performed in accordance with PTI (see "Stay Cable Testing" on page 68). Per Section 4.3 of the PTI Stay Cable Guide Specifications (see reference below), "When the stay cable tests have been conducted for previous projects on specimens similar in design and details to those proposed for a new project, the previous tests may, at the Engineer's discretion, be used as the basis for stay cable approval on the new project." The intent of this report is to provide a basis for the Engineer to accept a previous test report for the "Leak Test" as specified in Section 4.1.6 of PTI.

1.2 Reference Documents

The following documents will be referenced in this report:

- Job Special Provisions (Bridge) for MoDOT Job No. J610984, Item Q.3.0 (Stay Cable Testing) contains the testing provisions for the new stay cables.
- PTI Guide Specifications: Recommendations for Stay Cable Design, Testing and Installation, 5th Edition (2007), 4th Edition (2001)
- *fib* Bulletin 30: Acceptance of Stay Cable Systems Using Prestressing Steels (2005)
- EMPA Leak Tightness Test Report for 6-37 Anchorage per PTI 4th Edition (Test Report No. 445'447, dated April 2007)
- TUM Leak Tightness Test Report for 6-31 Anchorage per *fib* Bulletin 30 (Test Report No. di-2209354, dated September 2009)
- VSL Leak Tightness Test Report for 6-31 Anchorage per *fib* Bulletin 30 (Test Report No. 523, dated April 2007)

2. LEAK TIGHTNESS TEST

2.1 Overview

PTI Section 4.2 ("Acceptance Testing of Stay Cables") states: "Tests of at least 3 representative stay cable specimens shall be carried out. Stay cables are to be tested with all load bearing appurtenances." The commentary on the same section provides further clarification: "The 3 stay cable test specimens should represent the largest, the smallest, and the average sizes (areas of MTE) of all bridge cables."

PTI Section 4.1.6.1 specifies that the smallest stay cable specimen should be subjected to fatigue and leak tests, while Section 4.2 calls for fatigue and static strength tests to be conducted on the average and largest specimens. VSL is proposing to submit a series of prior test results for the tests identified in PTI Section 4.1.6 in order to satisfy the project requirements. This document will focus on the leak tests; a separate report will propose the



VSL STAY CABLE SYSTEM LEAK TEST

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acceptance of prior fatigue and static strength test results. The cable sizes and testing parameters vary from test to test; the following sections will describe the applicability of the previous test reports to the St. Louis project.

2.2 Relevance of Previous PTI Leak Test Results to St. Louis Project

Using VSL's SSI 2000 system, the smallest size stay cable on the St. Louis project is a 6-31. In order to fulfill the requirement to test this size cable, VSL is submitting the following report:

- EMPA Leak Tightness Test Report for 6-37 Anchorage per PTI 4th Edition (Test Report No. 445'447, dated April 2007)

The previous test on VSL's 6-37 conducted at EMPA utilized a slightly larger anchorage than the smallest one specified for St. Louis (6-37 vs. 6-31). The test stay cable also consisted of larger strands than what will be used on the St. Louis project (0.62" diameter versus 0.6"). Since VSL's SSI 2000 stay cable system is designed to be compatible with either 0.6" or 0.62" diameter strands, a difference in strand diameter will not be identified in the remaining test descriptions below (see Table 2 for the specific parameters of each test included in this report). The remaining test parameters were identical to those of the current project, with two exceptions: the 6-37 test had a higher upper stress limit for the fatigue portion of the test than what is specified in PTI (58% vs. 45% of MUTS), and the stress range was slightly lower than the standard from PTI (140 vs. 159 MPa).

2.3 Relevance of Previous *fib* Leak Test Results to St. Louis Project

In order to demonstrate the leak tightness capabilities of the SSI 2000 system, VSL is also submitting the following *fib* leak tightness test reports:

- TUM Leak Tightness Test Report for 6-31 Anchorage per *fib* Bulletin 30 (Test Report No. di-2209354, dated September 2009)
- VSL Leak Tightness Test Report for 6-31 Anchorage per *fib* Bulletin 30 (Test Report No. 523, dated April 2007)

The PTI and *fib* leak tests measure different aspects of a stay cable system's ability to resist water intrusion. The *fib* leak tightness test includes provisions for cable rotation and water temperature fluctuations, which are not part of the PTI requirements (see Table 2 for specific test parameters). However, the anchorage tested per PTI was subjected to a two million cycle fatigue test prior to being immersed in dyed water; the *fib* Bulletin 30 test is performed on an anchorage that has not been subjected to prior loading (the anchorage is subjected to ten load cycles after it has been immersed). VSL's SSI 2000 system has conclusively demonstrated its overall leak tightness by passing both tests.

2.4 Similarity of Anchorage Details

As noted above, PTI Section 4.3 states: "When the stay cable tests have been conducted for previous projects on specimens similar in design and details to those proposed for a new project, the previous tests may, at the Engineer's discretion, be used as the basis for stay cable approval on the new project."



**VSL STAY CABLE SYSTEM
LEAK TEST**

DOC: Leak Test	Page	4 of 4
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REVISION		DATE

VSL may not utilize the same suppliers for all stay cable anchorage or strand components. However, VSL utilizes the same SSI 2000 stay cable system around the world; the "design and details" of this system are similar on each project.

All VSL SSI 2000 stay cable components are required to conform to a set of internal specifications and fabrication drawings, which are proprietary. Particular material specifications for the various components may be adapted to meet various national and regional standards that may be required on particular projects. For instance, ASTM standards are often substituted for similar EN codes. However, the actual material properties of each component must conform to VSL's internal standards, ensuring system similarity regardless of the geographical context.

The structural and leak tightness details of the SSI 2000 stay cable system are not affected by the diversity of international material standards. Thus, these details remain unchanged regardless of the geographic context of a particular project.

The anchorages used in the prior leak tightness tests referenced in this report and the ones to be utilized on the St. Louis project all conform to VSL's SSI 2000 specifications.

2.5 Approval of Prior Tests on Previous Projects

Prior PTI leak tightness test results have been accepted previously on the Autoroute 25 project in Montreal, Quebec, Canada, and the kcalCON project in Kansas City, Missouri (see Table 1 in the Appendix for project information).

3. APPENDIX

As described above, the following information is included as an appendix to this report:

- EMPA Leak Tightness Test Report for 6-37 Anchorage per PTI 4th Edition (Test Report No. 445'447, dated April 2007)
- TUM Leak Tightness Test Report for 6-31 Anchorage per *fib* Bulletin 30 (Test Report No. di-2209354, dated September 2009)
- VSL Leak Tightness Test Report for 6-31 Anchorage per *fib* Bulletin 30 (Test Report No. 523, dated April 2007)
- Table 1 – Acceptance of Prior Full-Scale Leak Tests on Recent VSL Stay Cable Projects
- Table 2 – Summary of Leak Tests

John V
Grana/D6/MODOT
06/16/2010 01:53 PM

To Travis D Koestner/SC/MODOT@MODOT
cc Randy C Hitt/D6/MODOT@MODOT, Christopher A
Kelly/D6/MODOT@MODOT, Christopher K
Morgan/D6/MODOT@MODOT
bcc
Subject Contract 091208-601, J6I0984, Rte 70, St. Louis City, VE #2
Stay Cable Acceptance Testing Requirements

History: This message has been forwarded.

Travis,

Attached is a draft version of the stay cable acceptance testing requirements. The final version is forthcoming and will be part of the VE documents. Let me know if you need anything else for VE approval. Thanks.

Jeff Smith John,

06/16/2010 01:44:42 PM



Jeff Smith
<JESmith@HNTB.com
>
06/16/2010 01:44 PM

To "John.Grana@modot.mo.gov"
<John.Grana@modot.mo.gov>
cc
Subject Stay-Cable Testing Submittals

John,

Here's the DRAFT version I forwarded to Hans.

Jeff Smith, P.E.
Bridge Department Manager
■ **HNTB Corporation**
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211 N. Broadway, Suite 950
St. Louis, Missouri 63102

Direct (314) 242-2264
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Required Tests

<u>PTI Sec.</u>	<u>Test</u>
3.2.2.1	a. yield strength, ultimate strength, elastic modulus, ductility (one test per 22,000 lb material)
STRAND MATERIAL	b. fatigue and static strength (one test per 44,000 lb material)
	c. corrosion (one test per 22,000 lb material)
3.3.6/3.3.7	a. ASTM D4976 or D4101 material requirements
SHEATHING MATERIAL	b. UV stabilization
	c. non-reactive with stay cable system materials
	d. chemical stability (non-embrittlement or softening)
3.3.9	a. chemical resistance
SHEATHED STRAND	b. chloride permeability
	c. impact
	d. abrasion resistance
	e. salt spray (fog)
	f. water-tightness
3.5.3.2	a. density, melt index, flexural modulus, yield strength, crack resistance, hydrostatic design (one 6 foot specimen per 3300 foot of pipe (per each size)
PIPE	b. non-reactive with stay cable system materials

Acceptable Tests from Prior Projects

<u>PTI Sec.</u>	<u>Test</u>
4.1.4	a. salt spray (fog) for internal barriers
BARRIERS	b. salt spray (fog) for external barriers
4.1.5	a. weatherometer
TEMPORARY CORROSION PROTECTION	
4.1.6	a. leak test
ANCHORAGE ASSEMBLY	
4.2	a. anchorage fatigue test
STAY CABLES	

VALUE ENGINEERING CHECK SHEET

TYPE OF WORK

(Check one that applies)

- Bridge/Structure/Footings
- Drainage Structures (RCP, RCB, CMP's, ect.)
- TCP/MOT
- Paving (PCCP, ect.)
- Grading/MSE Walls
- Signal/Lighting/ITS
- Misc. _____

SUMMARY OF PROPOSAL

(If needed, condense summary to a couple of lines)

_____ Modifies the Stay Cable System testing in accordance with PTI

SCANNING OF DOCUMENT

If the proposal is large, please mark or make note, which pages need to be scanned into the database. If there are special instructions, make note of them here.
