BOARD OF COUNTY COMMISSIONERS

DATE: May 22, 2012
AGENDA ITEM NO. 20a.

Consent Agenda ☐ Regular Agenda ☑ Public Hearing ☐

County Administrator's Signature:

Subject:

Demolition of Friendship Trail Bridge
County PID No. 000984A/2183

Department:

Department of Environment & Infrastructure

Staff Member Responsible:

Jorge M. Quintas, P.E., Director
Engineering & Technical Support

Recommended Action:

I RECOMMEND THE BOARD OF COUNTY COMMISSIONERS (BCC) APPROVE THE ADVANCEMENT OF $515,000 FROM FISCAL YEAR 2015 (FY15), AND THE SUBSEQUENT TRANSFER TO HILLSBOROUGH COUNTY IN FY13, FOR THE DEMOLITION OF THE FRIENDSHIP TRAIL BRIDGE.

Summary Explanation/Background:

The Friendship Trail Bridge has been in service for nearly 60 years and has exceeded its service design life of approximately 50 years. Located over the waters of Tampa Bay, it has been exposed to an extremely corrosive environment for many years, which has caused extensive chloride intrusion of the steel reinforced concrete members. The chloride intrusion has led to ongoing degradation of the concrete piles, caps, beams, deck, and other concrete elements. In 1995, the Florida Department of Transportation (FDOT) deemed the bridge to be structurally deficient to vehicular traffic, and subsequently planned at the time to demolish the middle section of the bridge, leaving the remaining portions as fishing pier segments.

Since 1999, the bridge was jointly operated, via an interlocal agreement between Pinellas and Hillsborough Counties, as a pedestrian use facility. In November 2008, the Friendship Trail was shut down indefinitely, although the ends remained open to pedestrian use, following a state inspection indicating significant structural issues with the bridge's pylons. In December 2008, a report by Kisinger Campo & Associates (KCA) and SDR Engineering Consultants warned of the potential for collapse due to the amount of structural degradation. Pinellas and Hillsborough County officials subsequently decided to close the entire bridge permanently.

In April 2010, a reassessment of the bridge by engineers determined that repairs to the facility would be cost prohibitive (estimated then at $48M). Subsequently, both Commissions voted to demolish the entire structure. As a result, both counties have programmed funds towards accomplishing the demolition.

In accordance with the interlocal agreement, Hillsborough County has coordinated efforts related to a 'Request for Proposal' (RFP) to secure bids for demolition of the bridge. Hillsborough County has received a bid from American Bridge Company for $4,195,000 to demolish approximately 11,000 linear feet of the bridge, along with a proposal for $1,020,060 to remove the remaining almost 3,000 linear feet of the bridge. Hillsborough County has already received $2 million from Pinellas County and is asking for an additional $515,000 to complete the 50% funding needed to demolish the entire bridge.

The recommendation for award of the demolition contract to American Bridge Company came before the Hillsborough County Commission on April 4, 2012. The item was deferred, following citizen input, until their June 6, 2012 Commission meeting to allow time for a special interest group to bring back a viable business plan to support an option to transform the facility into a linear park. On May 8, 2012, Hillsborough County received and forwarded a

draft business plan for staff review. Pinellas County staff has since provided technical review comments/concerns to Hillsborough County, which is summarized herein.

The draft business plan recommends replacing the 252 low level concrete deck spans with prefabricated aluminum or galvanized steel metal spans and maintaining the remainder of the bridge intact with minor repairs. The plan further indicates that it would cost $18.7M to re-open the bridge, and a total 30 year life cycle cost of $33.2M.

Staff's technical review has identified several concerns not readily addressed in the draft business plan:

1. To extend the service life of the piles, structural pile jackets with "cathodic" corrosion protection will be necessary. The draft plan indicates cathodic protection for only 20% of the piles. Staff anticipates the cost of the necessary structural pile jackets with cathodic protection of all piles to be approximately $12M and would extend the life of the piles by only approximately 15 years.

2. To extend the service life of the concrete pile caps, "cathodic" corrosion protection around all surfaces would also be necessary. It is anticipated that this would cost approximately $2M and would extend the life of the pile caps by only approximately 15 years.

3. The costs for these efforts total approximately $14M. The draft report received by Hillsborough County shows the cost for this work at $1M. Staff does not concur with the $1M estimate.

4. The internal corrosive forces to these structural members are significant due to the chloride intrusion. Even with the expenditures of millions of dollars, there is no guarantee that these corrosive forces can be controlled to the point of restoring and/or maintaining the desired structural integrity of the steel in the concrete members.

5. The present lack of structural integrity of this facility has the potential for unanticipated hazards to boat traffic traversing underneath the bridge.

The draft report assumes that over $20M will be received in donations and grants from 2012-2017 for repairs and construction purposes. Staff's technical review did not address the viability of a business plan based on these financial assumptions.

Notwithstanding the concerns associated with the proposed draft business plan, consideration of the engineering studies and reports to date strongly supports the recommendation to proceed with demolition at this time. Pinellas County staff considers the total bid by American Bridge Company of $5,215,060 to be a very competitive and responsive price for demolition of the entire facility. As such, we support Hillsborough County's plans for demolition of the bridge structure, and consider it to be the most fiscally responsible action plan from an engineering and liability perspective.

Fiscal Impact/Cost/Revenue Summary:

Funding for this project is budgeted in the County's Capital Improvement Program: Parks, Recreation and Culture, Countywide Park Infrastructure Replacements Allocation. The source of project funding is the Infrastructure Sales Tax (Penny for Pinellas).

Expenditure: $515,000.00 Penny for Pinellas funds.

Pinellas County has previously transferred $2.0M to Hillsborough County. The $515,000 will be added to the $2.0M and used as our 50% share of the demolition cost of the bridge.

This transfer of $515,000, in advance of the previously planned $4.5M allocation in FY15, results in a savings of $4.0M to Pinellas County.

Exhibits/Attachments Attached:

Interlocal Operation and Maintenance Agreement between Pinellas County and Hillsborough County, Nov. 1999
Slide from Pinellas County OM&B CIP presentation (Revised Capital Project Fund Forecast)
Letter to Hillsborough County from Jorge Quintas, P.E., Division Director, Engineering & Technical Support/DEI
Bid for demolition from American Bridge Company, received by Hillsborough County
"A Vision Beyond Demolition" Draft Business Plan report, dated May 7, 2012
"Probabilistic Assessment of the Friendship Trail Bridge", prepared by USF, August 2011
Project Financial Overview

14.40.01 cc: Jerry Cuneo, Jr.
12/16 S. Hanley

No. 34
BCC 11-23-99
9:35 A.M. Jones

File Gandy Bridge

Corr. Comp.

#34 INTERLOCAL AGREEMENT BETWEEN PINELLAS COUNTY AND HILLSBOROUGH COUNTY ON PARAMETERS FOR OPERATION AND MAINTENANCE OF OLD GANDY BRIDGE - APPROVED FOR EXECUTION

County Administrator Fred E. Marquis recommended approval of an Interlocal Agreement between Pinellas County and Hillsborough County on the parameters for operation and maintenance of the Old Gandy Bridge.

Commissioner Todd moved, seconded by Commissioner Stewart and carried, that the recommendation of the County Administrator be approved.

11-23-99 Copy of BO, 2 original partially executed interlocal agreement to David Sadowsky, County Atty.

11-24-99 Copy of BO to Bill Channer, Finance; Copy of BO, Bd memo, CRS, cc of partially executed interlocal to Michelle Farmin, Finance; Original BO, Bd memo, CRS, cc of partially executed interloca to file; Tickler.

TO: C. Richard Short, Chief Deputy Director, Finance Division
Domenick Murano, Director, Risk Management
Susan Churuti, County Attorney

RECEIVED BY
NOV 10 1999
RISK MANAGEMENT

FROM: Brian K. Smith, Director
Pinellas County Planning Department

SUBJECT: Review of Agreements Regarding Friendship Trail

DATE: November 9, 1999

This memo is to request your review and comment on the attached agreements regarding the Friendship Trail/Old Gandy Bridge. The agreements include the Interlocal Agreement and the License Agreement.

Your expedient review of these documents would be greatly appreciated.

Please call me or Ms. Gina Harvey at 464-4751 when complete and we will pick-up from your office. Again, thank you very much for your review and assistance.

RECEIVED
NOV 15 1999
COUNTY ATTORNEY

BKS/GH:ck
Attachments
MPO\Ginacor.ck.pg 33.

DEPARTMENT	SIGN-OFF	COMMENT
Planning Department		good G J IS
Risk Management	11/10/99	
Finance Division	11-12-99	
Legal Department	11-15-99	

NOV 1999
RECEIVED
FINANCE ADMIN.

COMMISSION AGENDA:
11/23/99
#34

TO: The Honorable Chairman and Members of the Board of County Commissioners

FROM: Fred E. Marquis, County Administrator

RE: Execution of an Interlocal Agreement Between Pinellas County and Hillsborough County on the Parameters for the Operation and Maintenance of the Old Gandy Bridge

DATE: November 23, 1999

RECOMMENDATION:
I RECOMMEND THAT THE BOARD OF COUNTY COMMISSIONERS AUTHORIZE ITS CHAIRMAN TO EXECUTE THE INTERLOCAL AGREEMENT BETWEEN PINELLAS COUNTY AND HILLSBOROUGH COUNTY ON THE PARAMETERS FOR THE OPERATION AND MAINTENANCE OF THE OLD GANDY BRIDGE.

DISCUSSION:
On October 15, 1997, the Department of Transportation, Pinellas County and Hillsborough County executed a Transfer Agreement pursuant to Section 335.0415, Florida Statutes, transferring the Old Gandy Bridge from the State Highway System to Pinellas County and Hillsborough County as joint owners. The Old Gandy Bridge is scheduled to be open to the general public as a County park on Saturday, December 11, 1999. This Interlocal Agreement will establish the parameters of the joint ownership of the Old Gandy Bridge by Pinellas and Hillsborough Counties from its effective date inclusive of conditions in which the Old Gandy Bridge is to open to the general public.

The Old Gandy Bridge Oversight Committee, which was formed by resolutions of the Pinellas and Hillsborough County Commissions and has members from each respective County, has reviewed the Interlocal Agreement and recommends its approval by the Board.

F:\USERS\ATTY\ATYKB09\BOARD\BRIDGE.MEM

Contracts/Leases/Agreements

14.40.01

99-399135 DEC-10-1999 3:42PM
PINELLAS CO BK 10750 PG 1790

INTERLOCAL AGREEMENT
OLD GANDY BRIDGE

THIS INTERLOCAL AGREEMENT, entered into on the 1st day of December, 1999, between PINELLAS COUNTY, FLORIDA (he einafter "PINELLAS"), a political subdivision of the state of Florida, and HILLSBOROUGH COUNTY, FLORIDA (hereinafter "HILLSBOROUGH"), a political subdivision of the state of Florida.

WHEREAS, on October 15, 1997, the Department of Transportation ("Department"), PINELLAS and HILLSBOROUGH executed a Transfer Agreement pursuant to Section 335.0415, Florida Statutes, transferring the Old Gandy Bridge ("Friendship Trail Bridge") from the State Highway System to PINELLAS and HILLSBOROUGH, and relieving the Department of all rights, obligations and liabilities for the Friendship Trail Bridge;

WHEREAS, the Friendship Trail Bridge is identified in the Roadway Transfer Agreement as Section 10130000, M.P. 0.172 to M.P. 2.785, of the State Highway System (Exhibit "A");

WHEREAS, PINELLAS and HILLSBOROUGH agreed, in Pinellas County Resolution No. 97-166 and Hillsborough County Resolution No. 97-157, respectively, to assume joint ownership of the Friendship Trail Bridge on a 50/50 cost-sharing basis;

WHEREAS, it is the intent of the parties to first utilize the $7.0 million available from the Department for expenditures on the Friendship Trail Bridge;

WHEREAS, on October 1, 1997, the parties executed a two (2) year Interlocal Agreement to establish the parameters for the joint ownership of the Friendship Trail Bridge during the period that the Friendship Trail Bridge was not to be open to the general public;

HOLDOVER FOR
OAKD RECORDS

WHEREAS, PINELLAS and HILLSBOROUGH, by resolution, have created an oversight committee with the responsibility of overseeing the planning, engineering, construction and operational activities for the Friendship Trail Bridge and making recommendations to their respective Board of County Commissioners;

WHEREAS, the Friendship Trail Bridge is scheduled to be open to the general public on Saturday, December 11, 1999; and

WHEREAS, this Interlocal Agreement will establish the parameters of the joint ownership of the Friendship Trail Bridge by the above parties from its effective date inclusive of conditions in which the Friendship Trail Bridge is to be open to the general public.

NOW, THEREFORE, PINELLAS and HILLSBOROUGH, in consideration of the mutual comments hereafter set forth, agree as follows:

SECTION 1. **AUTHORITY**. This Interlocal Agreement is entered into pursuant to the general authority of Section 163.01, F.S., known as the "Florida Interlocal Cooperation Act of 1969."

SECTION 2. **PURPOSE**. The purpose of this Interlocal Agreement is to establish the parameters for the joint ownership of the Friendship Trail Bridge by PINELLAS and HILLSBOROUGH, and to recognize the mutual benefits derived from such coordination of County resources.

SECTION 3. **LIABILITY**. PINELLAS and HILLSBOROUGH will have joint responsibility for the Friendship Trail Bridge.

SECTION 4. CLAIMS PROCEDURE. PINELLAS and HILLSBOROUGH will immediately notify the other County of any claim against the other party concerning the Friendship Trail Bridge.

SECTION 5. EXPENSES. PINELLAS and HILLSBOROUGH will share all costs, liabilities and expenses arising from the joint ownership of the Friendship Trail Bridge on a 50/50 cost-sharing basis. All expenditures on the Friendship Trail Bridge must be approved by the Pinellas and Hillsborough Board of County Commissioners.

SECTION 6. OVERSIGHT COMMITTEE. The Oversight Committee, as established by resolutions by PINELLAS and HILLSBOROUGH, has the responsibility of advising the Board of County Commissioners of Pinellas and Hillsborough Counties on the planning, engineering, construction, operational and other related matters for the Friendship Trail Bridge. Any substantive proposals concerning the Friendship Trail Bridge should be reviewed by the Oversight Committee prior to final action by Board of County Commissioners of Pinellas and Hillsborough Counties.

SECTION 7. OPERATION AND MAINTENANCE. PINELLAS and HILLSBOROUGH will be jointly responsible for the operation and maintenance of the Friendship Trail Bridge. However, each party, by mutual agreement, may solely perform the operation or maintenance functions, or any part thereof. The expense of performing such function shall still be borne by the parties on a 50/50 cost-sharing basis.

SECTION 8. LAW ENFORCEMENT, FIRE AND EMERGENCY MEDICAL SERVICES. PINELLAS and HILLSBOROUGH will be responsible only for law

enforcement, fire and emergency medical services on the portion of Friendship Trail Bridge located in their respective County.

SECTION 9. ACCESS. PINELLAS and HILLSBOROUGH will be responsible for securing the access to the Friendship Trail Bridge from the upland section in their respective County.

SECTION 10. TRUST AND AGENCY FUND. PINELLAS and HILLSBOROUGH agree to establish a Trust and Agency County Fund. All funds and revenue earmarked for expenditure on the Friendship Trail Bridge must be deposited in this Trust and Agency County Fund.

SECTION 11. FUNDING. PINELLAS's and HILLSBOROUGH's performance and obligation to pay under this Interlocal Agreement is contingent upon annual appropriations by the Pinellas and Hillsborough Board of County Commissioners. In the event that settlement funds are not available for a new fiscal period, PINELLAS or HILLSBOROUGH will notify the other County of such occurrence, and that party will have the right to terminate the Interlocal Agreement on the last day of the current fiscal period without penalty or expense.

SECTION 12. CONSTRUCTION. This Interlocal Agreement shall be construed as an expression of interagency cooperation enabling each party to make the most efficient use of its powers in furtherance of the joint ownership of Friendship Trail Bridge. This document, having been jointly drafted by the parties, shall not be construed in favor of either party. In addition, this Interlocal Agreement shall not be construed as delegating or

authorizing the delegation of the constitutional or statutory duties of either party to the other.

SECTION 13. TERMINATION. PINELLAS or HILLSBOROUGH reserve the right to terminate this Interlocal Agreement if it is in the public interest to do so, or if the other party fails to abide by any terms or conditions specified herein, by giving thirty (30) days prior notice to the other party's County Administrator in writing of the intention to terminate. Prior to the date of termination, the parties will meet to discuss the conditions and format of a successor Interlocal Agreement.

SECTION 14. DISPUTES. Any dispute of the terms of this Interlocal Agreement are governed by Chapter 164, Florida Statutes, the "Florida Governmental Cooperation Act."

SECTION 15. OFFICIAL NOTICE. All notices required by law and by this Interlocal Agreement to be given by one party to the other shall be in writing and shall be sent to the following respective addresses:

PINELLAS: County Administrator
Pinellas County Courthouse
315 Court Street
Clearwater, Florida 33756

HILLSBOROUGH: County Administrator
County Center
601 East Kennedy Boulevard
Tampa, Florida 33602

SECTION 16. ENTIRE AGREEMENT. This document embodies the whole Interlocal Agreement of the parties. There are no promises, terms, conditions or

allegations other than those contained herein and this document shall supersede all previous communications, representations or agreements, whether written or verbal, between the parties hereto. This Interlocal Agreement may be modified or amended only by an agreement in writing, signed by both parties to said Interlocal Agreement. Nothing in this Interlocal Agreement is intended to create a third party beneficiary in persons or entities not party to this Interlocal Agreement.

SECTION 17. FILING; EFFECTIVE DATE. As required by Section 163.01(11), Florida Statutes, this Interlocal Agreement shall be filed, after execution by the parties, with Clerks of the Circuit Court of Pinellas and Hillsborough Counties, and shall take effect upon the date of filing.

IN WITNESS WHEREOF, the undersigned have hereunto affixed their hands and seals the day and year first above written.

ATTEST:
KARLEEN F. DeBLAKER, CLERK

By: Deputy Clerk 11-23-99

[SEAL]

APPROVED AS TO FORM:

Office of the County Attorney

PINELLAS COUNTY, FLORIDA, by and through its Board of County Commissioners

By: Chairman

ATTEST:
RICHARD AKE, CLERK

By _____
Deputy Clerk

[SEAL]

HILLSBOROUGH COUNTY, FLORIDA,
by and through its Board of County Commissioners

By _____
Chairman

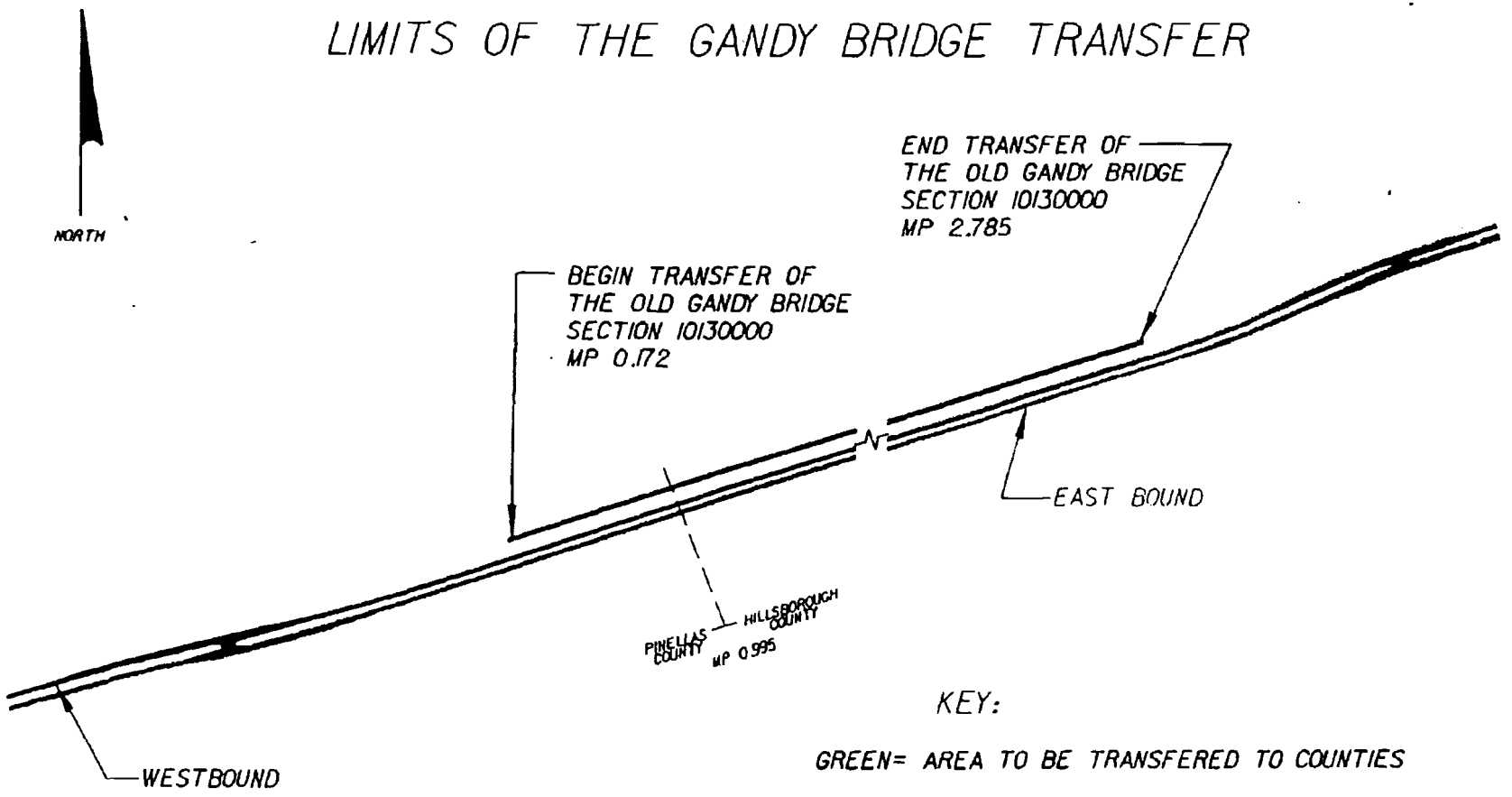
APPROVED AS TO FORM:

_____
Office of the County Attorney
F:\USERS\ATTY\ATYKB09\WPDOCS\PLANNING\AGMTS\GANDY.'99

BOARD OF COUNTY COMMISSIONERS
HILLSBOROUGH COUNTY FLORIDA
DOCUMENT No. 99-2219

HOLDOVER FOR

LIMITS OF THE GANDY BRIDGE TRANSFER



KEY:

GREEN= AREA TO BE TRANSFERED TO COUNTIES

BLUE= WEST BOUND GANDY BRIDGE

GOLD = EAST BOUND GANDY BRIDGE

TOTAL BRIDGE LENGTH 2.613 MILES INCLUDES APPROACH SLABS ON BOTH SIDES.

AS OF 04 SEP 97
NOT TO SCALE

Exhibit A

PINELLAS COUNTY FLA.
Or REC.BK 9915 PG 1656

\gandyp1.dgn Sep. 8, 1997 11:22:23

PINELLAS COUNTY FLA.
OFF.REC.BK 10750 PG 1797

Revised Capital Projects Fund Forecast

- Forecast has been updated since the February 7th version
- Fund shows a $6.6M surplus due to:
  - Friendship Trail Bridge Demolition project will cost $500K instead of $4.5M for a savings of $4.0M
    - Previously transferred amount of $2.0M will be used by Hillsborough County to cover the balance of Pinellas County's 50% share of demolition cost
  - Reimbursement of $3.2M from Florida Forever program for prior purchase of the Wilde property (Endangered Lands allocation)
    - Of the $3.2M, approximately $600K has been allocated for the Wilde property sport fields project, resulting in $2.6M of surplus funds
- The $6.6M surplus is available to be allocated to the 2010 to 2020 Penny Program

BOARD OF COUNTY COMMISSIONERS
Nancy Bostock
Neil Brickfield
Susan Latvala
John Morroni
Norm Roche
Karen Williams Seel
Kenneth T. Welch

Pinellas County
ENVIRONMENT AND INFRASTRUCTURE

March 21, 2012

Mr. John W. Lyons, P.E., Director
Hillsborough County Public Works
601 E. Kennedy Blvd., 22nd Floor
Tampa, FL 33602

Subject: Demolition of the Friendship TrailBridge

Dear Mr. Lyons:

As you are aware, after several years of operating our jointly owned facility, it was determined that the Friendship TrailBridge structure is not safe for public use. As the sole owners of the TrailBridge, Pinellas and Hillsborough Counties concurred that the structure be demolished.

To that end, each County programmed approximately $2.1 million towards the demolition of the TrailBridge. Originally, it was estimated that complete demolition could cost approximately $12 million. As a result, the recommendation at the time was to use available funding ($4.2 million) to demolish as much of the facility as possible.

Pinellas County now understands that Hillsborough County has a bid from American Bridge to remove nearly 11,000 linear feet of the Friendship TrailBridge for $4,195,000, and that Hillsborough County intends to proceed with this demolition utilizing funds previously provided by Pinellas County. Furthermore, we understand that Hillsborough County has also received a proposal from American Bridge to remove the remaining 3000 linear feet of bridge structure, for an additional $1,020,060.

Based upon the Interlocal Agreement between Pinellas County and Hillsborough County (attached), all maintenance related costs are shared on a 50-50 basis. Consequently, Pinellas County's share of the costs to remove the remaining 3000 linear feet of structure would be $510,310. We concur that this appears to be a feasible mechanism for reaching the goal of complete demolition.

As part of the County's budget process, staff will recommend to our Board of County Commissioners that a portion of the existing programmed CIP monies ($515,000) be advanced from FY 15 to FY13, to fund the removal of the remaining 3000 linear feet of structure. In order to provide adequate supporting documentation for our FY 13 budget process, please submit a formal request for advancement of these funds on behalf of Hillsborough County. (Attached please find an example of a similar such request by Hillsborough County, in 2007).

If you have additional questions, please contact me at (727) 464-8894.

Sincerely,

Jorge Quintas, P.E., Director

Cc: John Wesley White, Executive Director, Department of Environment and Infrastructure
John E. Woodruff, Budget Director, Pinellas County Office of Management and Budget
Stephen B. Carroll, Director, DEI Finance Division
Gina Harvey, Pinellas County Planning Department

PLEASE ADDRESS REPLY TO:
Engineering and Technical Support Division, 14 S. Ft. Harrison Avenue 6th Floor, Clearwater, FL 33756
Phone 727/464-3588 www.pinellascounty.org

Hillsborough County
Florida

BOARD OF COUNTY COMMISSIONERS
Brian Blair
Kathy Castor
Ken Hagan
Jim Norman
Thomas Scott
Mark Sharpe
Ronda Storms

Office of the County Administrator
Patricia G. Bean

Deputy County Administrator
Wally Hill

Assistant County Administrators
Kenneth C. Griffin
Carl S. Harness
Manus J. O'Donnell

November 1, 2007

Mr. Fred E. Marquis
Interim County Administrator
Pinellas County Government
315 Court Street
Clearwater, FL 33756

RE: FRIENDSHIP TRAIL BRIDGE REPAIRS

Dear Mr. Marquis:

On December 1, 1999 Hillsborough County and Pinellas County entered into an Interlocal agreement to assume joint ownership of the Friendship Trail Bridge on a 50/50 cost-sharing basis. Hillsborough County is prepared to invest $2,195,000 in FY08 to perform repairs to the bridge. Therefore, this is a formal request for Pinellas County to provide $2,195,000 to Hillsborough County so that we may advertise the repair work next month. We expect to begin construction in the spring of 2008. Thank you for your attention in this matter.

Please make the check payable to:

Hillsborough County Board of County Commissioners
c/o Public Works Department
P.O. Box 1110
Tampa, FL 33601-1110

Sincerely,

Robert R. Gordon, P.E. Director
Hillsborough County Public Works Department

RRG/CB/cmk
U:\Robert R Gordon\Correspondence\MEMOS\2007\Locally Funded Agreement-Pinellas.doc

cc: Leigh Ann Pyron, Director, Engineering Division
Chris Bridges, P.E., Project Manager, Design and Engineering Support Section

American Bridge

March 7, 2012

Hillsborough County, Florida

Att: Mr. Thomas Capell
601 E. Kennedy Blvd
18th Floor
Tampa, FL 33601

Re:Design-Build of Strategic Demolition of the Friendship Trailbridge
RFP no. C-0133-0-2011 (MK)

Subject:
Proposal for Removal of Remaining Portion of Friendship Trailbridge

Dear Mr. Capell,

American Bridge proposes the following for the removal of the remaining portion of the Friendship Trailbridge beyond the original bid scope:

Original Bid Breakdown:

Mobilization	=	$213,786
General Conditions (7 months)	=	$1,156,429
Demolition of 9,312 lf lower spans	=	$2,306,785
Demolition of 1,674.5 lf Navigation/72'Spans	=	$518,000
Original Bid Amount	=	**$4,195,000**

The remaining portion of bridge for demolition is consistant with the demolition of the lower spans. The footage is 2,784 lf.

The unit rate to perform the additional demolition = $2,306,785/9,312 lf = $247.72/lf

At a total length of 2,784 lf x $247.72 = $689,652

General Conditions will be extended by 2 months.

The monthly rate = $1,156,429 / 7 months for project duration = $165,204 / mo x 2 mo = $330,408

Total Additional Scope = $1,020,060

General Conditions consist of:

- Value related costs,such as insurances and bonds
- Management and Supervision.
- Site Office time related cost (rentals, consumables etc)
- Costs for property rentals, including disposal yard
- Support equipment and operators

PITTSBURGH
ORLANDO
TAMPA
WILLIAMSBURG
LOS ANGELES
SAN FRANCISCO
CHICAGO
NEW YORK
REEDSPORT

- Mechanics
- Utilities
- Other indirect costs, such as portable toilets, water and ice

Please contact me if you have any further questions at (813) 477-9487.

Thank You,

Robert Conroy
Project Manager

cc: File

A VISION BEYOND DEMOLITION:

A PLAN TO TRANSFORM THE FRIENDSHIP TRAIL BRIDGE INTO AN ICONIC LINEAR PARK FOR ALL OF TAMPA BAY TO ENJOY.

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Appendix A: Stantec/Wilson Miller Engineer letter, April 2012
Appendix B: KCA/SDR Report, December 2008
Appendix C: KCA/SDR Report, May 2009
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Appendix I: Pinellas County Operations Budget 2006
Appendix J: 2011 Walkway Over the Hudson Economic Impact Analysis
Appendix K: Structural Engineer Resume and Firm Profile
Appendix L: Proposal for Bridge Inspection

(Appendix available online at http://friendshiptrailbridge.com/storage/downloads/appendix.pdf)

Executive Summary

A VISION BEYOND DEMOLITION:

A PLAN TO TRANSFORM THE FRIENDSHIP TRAIL BRIDGE INTO AN ICONIC LINEAR PARK FOR ALL OF TAMPA BAY TO ENJOY.

The Friendship Trail Bridge can be saved. It can be made better and stronger. It can be transformed to a world-class linear park; a destination that opens up our bay to millions of visitors.

Between 1999, when the Friendship Trail Bridge (FTB) was opened for pedestrian use, and 2008, when the FTB was closed, more than 600,000 visitors per year visited the FTB. On April 4th, the County was on the verge of approving a contract to tear down the FTB. As a result of widespread community support and recognition from the County Commission that the FTB was a unique community resource, we were tasked with developing a business plan for the FTB in 30-days.

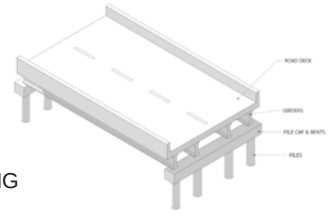
After a thorough analysis of the engineering reports, usage studies, analysis of nationwide comparable projects, and consulting with engineers, architects and lawyers who have donated their time to this project, we are certain that the Friendship Trail Bridge

can be transformed. For $13.7 million in additional funds we believe a new bridge can be built and it will last to 2047 and beyond.

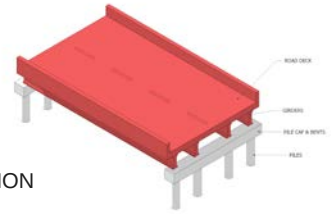
We have developed a comprehensive plan to save the bridge that addresses public safety, restoration, management, revenue generation, economic impact, and the fundraising required to accomplish these goals.

The FTB is a unique and irreplaceable community asset. Our solution includes partial demolition of damaged sections, light repair of sound portions of the bridge and replacement of the damaged decking sections of the bridge with new, more durable construction. We want to save what can be saved and replace what cannot.

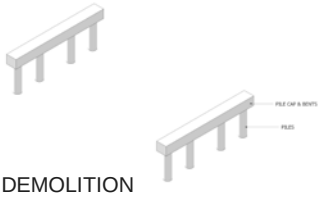
Using modern construction practices to replace the damaged decking sections, we can reopen a safer and more functional Friendship Trail Bridge.



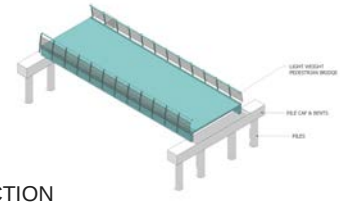
1-EXISTING



2-DAMAGED PORTION



3-LIMITED DEMOLITION



4-NEW CONSTRUCTION

The 2.6 mile long Friendship Trail Bridge is currently composed of three different bridge span types: the low span approaches, the high span approaches and the navigational channel spans. All of the post-closure reports and reviews focused on the bridge decking, the “superstructure”, of the low span approaches. These reports focused on the low-span approaches because they are closest to the water and, therefore, incur more of the effects from seawater and waves.

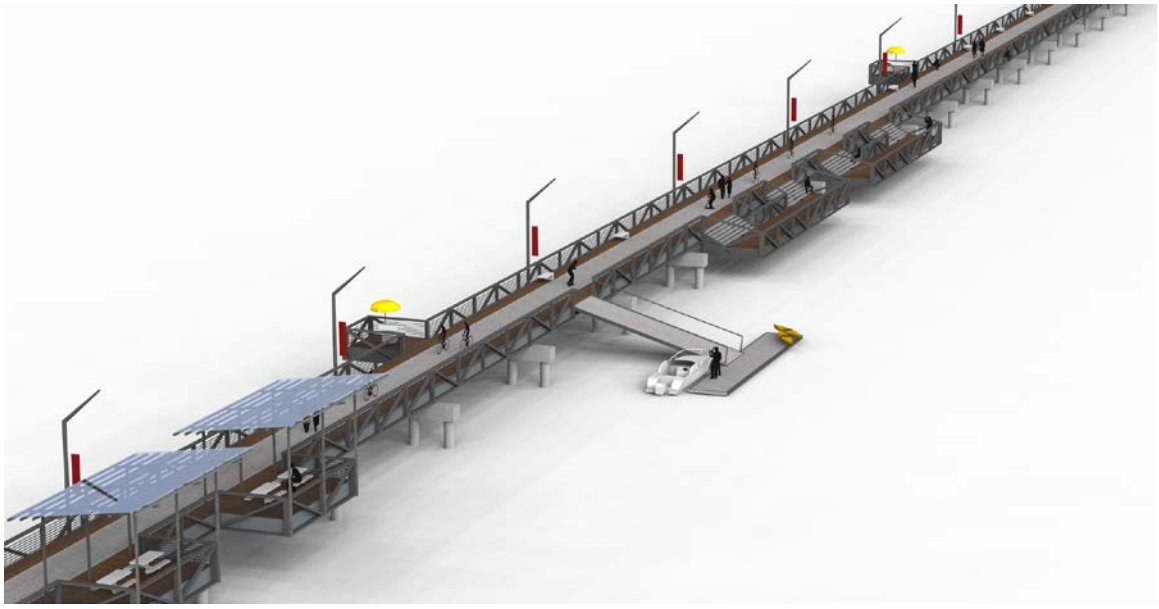
Our design solution removes all of low span approaches and keeps the remainder of the bridge intact with minor repairs.

The removed low span approaches can then be replaced with modern, prefabricated metal structures commonly used for pedestrian bridges and trails. By replacing the low span

approaches with new metal structures, the life expectancy is increased to over 30 years, while the overall weight and yearly maintenance costs are significantly decreased.

The FTB is a unique and irreplaceable community asset. The structural components that are safe and still functional have a replacement value of over $30 million.

The use of prefabricated metal bridge spans saves costs and allows for a greatly enhanced bridge that will provide new amenities along the trail. Using standard, prefabricated parts, the new bridge spans can accommodate **fishing platforms, vendor areas, picnic areas and boat slips**. By strategically scattering these amenity spans throughout the 2.6 mile trail bridge, the trail can become more active and inviting with several activity centers along the path.



We propose to form a public-private partnership with Pinellas and Hillsborough Counties to run the bridge for the benefit of everyone living in and visiting Tampa Bay.

Our long-term vision of the Friendship Trail Bridge includes the creation of a separate, not-for-profit corporation ("Non-Profit"), a legal entity that would work in partnership with local governmental bodies and be charged to:

- Manage the day to day operations and maintenance of the Bridge
- Raise private and public funds, through donations and grants, to assist the County in meeting the immediate and long-term operations and maintenance of the Bridge
- Guide the vision of the Bridge, including design, capital improvements, and services

The public-private partnership will take advantage of the county's existing experience and resources while leveraging the ability to raise private donations to contribute to the operation of the FTB.

Our proposal would have the Non-profit run by a board consisting of representatives of the County, as well as other participating local governments and stakeholders from the community.

The bridge itself would continue to be owned and governed by the Interlocal agreement between Hillsborough and Pinellas Counties. We would then request that a lease be signed between those governments and the new Non-Profit.

We have outlined a 5 phase schedule with benchmarks from proving feasibility to fully transforming the bridge into a linear park.

This schedule would begin after approval from both Hillsborough and Pinellas Counties and would lead to the bridge being open to the public in 5 years.

- Phase 1: June 16, 2012 to February 16, 2013: Prove the bridge is feasible and raise funds to do so
- Phase 2: 2013 to 2017: Raise the capital to transform the bridge
- Phase 3: 2016 to 2017: Repair and construction
- Phase 4: 2017: Opening of the bridge
- Phase 5: 2017 to 2047 and beyond: Operating and expansion of the bridge

We expect that the transformed bridge will be visited by over 680,000 people and will increase direct spending by $14 million per year or more in both counties.

Revenue to transform the FTB will come from three main sources; **donations, grants, and fees**. No one single source of revenue can be relied upon to fund the construction, operation or maintenance of the Friendship Trail Bridge.

After a 5 year fundraising program we anticipate this project will raise over $20 million from donations and grants to transform the bridge. During the complete 35 year life of the project; 55% of funds will come from donations and 45% will come from revenue after the bridge is opened including vendor rentals, parking fees and special events.

The transformation of the Friendship Trail Bridge into a lively linear park will give Tampa Bay's residents access to their bay in a unique setting that no other city or region could match. It will serve as an iconic destination, drawing visitors from all over the globe and encouraging them to spend more of their vacation time in Tampa Bay.

Over the lifetime of the bridge, we expect over 35 million visitors spending more than $786 million, while encouraging a healthier 21st century lifestyle for Tampa Bay citizens.

Description and Context

Given the history and infrastructure of the site, the Friendship Trail Bridge has the possibility to become a significant economic, cultural, and historical landmark that links and benefits both counties, Hillsborough and Pinellas. If we transform the bridge through a public-private partnership it would become a tourist destination, a celebration of our unique history, and once again become the longest pedestrian bridge in the world.

The bridge must be safe for all users and updated to allow for a wide variety of outdoor activities including but not limited to; running, walking, cycling, fishing, picnics, evening strolls, site seeing, special events and unique sports competitions. The Friendship Trail Bridge (FTB) will be a significant component of the Active Outdoor Recreation industry that generates more $780 billion dollars annually, supports 6.5 million jobs, and generates $88 billion in local, state, and national tax revenue[1]. While it will be more than a trail after transformation it is best to compare it to some of the best trails in the country like Pinellas Trail, North Tampa Bay Trail and the East Coast Greenway.

Surprisingly, the outdoor recreation business has increased during the current recession and it is expected to continue. For example in the last 7 years retailers have seen increases anywhere between 2 and 5 times overall retail sales[2]. We believe the FTB will help increase Hillsborough and Pinellas counties' share of that revenue, by increasing our tourism footprint and establishing a base for long term growth in the industry has continued outpace others.

This industry is divided on eight separate, but complimentary, categories; Wildlife observation, Cycling, Trails, Camping, Fishing, Hunting, Paddling, and Snow Sports[3]. It includes everything from manufacturing of equipment, to retail sales, to operation of recreational destinations. The Bridge clearly falls in the later category.

As a destination, the FTB provides a unique urban and natural environment where residents and tourists can experience 5 of the 8 previously mentioned activities. It is the only destination in the region that provides access to that many activities; especially within close proximity of both Tampa and St. Petersburg.

The trails and greenways system in the Tampa Bay area includes trails crisscrossing each of the counties. The goal of the Friendship Trail Bridge (FTB) is to provide a unique destination within that system and a vital connection between two most of the most populous cities in the region.

[1] The Active Outdoor Recreation Economy by the Outdoor Industry Foundation, 2006
[2] https://www.outdoorindustry.org/news.webnews.php?newsId=15810&newsletterId=256&action=display
[3] The Active Outdoor Recreation Economy by the Outdoor Industry Foundation, 2006

The FTB would even complement the upcoming Courtney Campbell Causeway trail to be completed in 4 to 5 years. Once completed, the FTB and the Courtney Campbell trail will provide links between the three major cities, and trails along two of the three major bridges crossing Tampa Bay.

The benefit we have in understanding the potential success of the FTB is that we have 9 years of previous use and data to base our conclusions. We know that after the car based bridge was reopened up for recreational use in 1999, the FTB saw more than 600,000 visitors a year[4]. It generated nearly as much use as the Pinellas Trail at the same time even though, the FTB is 1/5 the size.

Furthermore, studies of similar projects like Walkway over the Hudson and pedestrian trails in Orange County, FL show that anywhere between 20% and 48% visits will be from tourists residing outside either county. This is understandable when you note that Visit Florida's research indicates: "67% of Florida visitors include nature-based activities in their travel, and 80% of Florida residents suggest nearby natural, cultural and historical sites to out-of-state friends or family when they visit.[5]"

While the FTB will lure tourists to the area, the majority of users will be local. Habitual users of the bridge will contribute much of the daily, weekend, and off-season use of the trail. This includes everyone from residents that cycle on it every day for exercise, families looking for an afternoon stroll, and an inexpensive way to fish away from the shore without use of a boat.

The public outcry for support mirrors the data and shows that the Friendship Trail Bridge was a truly a unique asset. However, very little long term planning and revenue investigation was done until after the bridge was opened and this led to the decision that private funding could not be counted on to support the bridge despite it's popularity[6]. We believe this was a fatal mistake that had to do more with lack of public support for the bridge, lack of marketing, and lack of clear responsibilities for the non-profit rather than the popularity of the Friendship Trail Bridge itself.

That is why we will structure our non-profit corporation to enter into a public-private partnership with both Hillsborough and Pinellas counties and create a new agreement that would shield the local governments from future costs and force our non-profit to prove that it can raise money to rebuild and support the bridge. Instead of just taking responsibility for programming and private

[4] Reports from FTBOC meetings, 1999-2009
[5] Florida Department of Greenways and Trails, http://www.dep.state.fl.us/gwt/PDF/FAQ.pdf
[6] Report to Hillsborough BOCC,

support, we propose the non-profit be leased the bridge. The non-profit would pay to make improvements to the bridge and be responsible for its operation. The counties would offer their expertise, matching grant funding and serve as contractors.

The non-profit would be formed following a decision to delay demolition using the advice and guidance of Hillsborough County and Pinellas County Commissioners and legal departments. We will form a 501(c)3 corporation whose board will be determined with input from the counties and community leaders.

The non-profit will generate revenue from three main sources: corporate and individual donations, government and trust grants, and usage fees. The first phase of funding will rely mainly on donations and grants – while the later stages will begin to rely more heavily on usage fees. Here are a few examples of each:

Corporate and Individual Donation Examples:

- Naming rights (Large corporate and individual donations)
- In-Kind Contributions (pro-bono work from local firms)
- Membership Drive (micro funding from the community)

Government & Trust Grants Examples:

- Rails-to-Trails grants focused on innovative ways to reuse roads and out dated infrastructure.
- Historic preservation site grants dedicated to the site to the history of the Gandy Bridge and the entrepreneurs in the region. Currently, the Gandy Bridge is on Pinellas County's list of historic eligible properties.[7]

Usage Fee Examples:

- Voluntary donations from those who walk or cycle to the site
- Usage fees for each car parked.
- Rental fees for kayaks, bikes and other outdoor equipment.
- Lease of land near the bridge for development in conjunction with FDOT, the Counties, the cities, and other current lease holders.

[7] *http://www*.pinellascounty.org/Plan/comp_plan/8rec/ch13.pdf

As described above, the non-profit would take the lead in the public-private partnership so that it mitigates the cost of this project to taxpayers. This includes much of the capital costs as well as operations costs.

We believe all of these revenues can support the bridge for over 30 years because the bridge will be the only one of its kind in the world. It will not only represent that we are One Bay, but this time it will be one of the focal points of the region for people outside of it.

Of course, the most immediate question that must be answered, “Will it be safe?”

Yes. We will meet all FDOT, state and federal standards. Using reports generated by Hillsborough County consultants[8] and our own independent bridge engineer with experience renovating bridges[9], we have formed a unique solution for transformation of the Friendship Trail Bridge. Our solution includes partial demolition, light repair of sound portions of the bridge and complete replacement of entire sections of the bridge with new more durable construction. This new design, described in depth within this report, will allow the FTB to become even more of an icon than the previous version, provide an increased number of amenities, reduce routine maintenance costs and extend the life of the Friendship Trail Bridge to over 30 more years.

The vision for the Friendship Trail Bridge comes from a real understanding of the history of its history; trials and tribulations. In fact it is because of this information, we are confident of this community’s ability to take on this project. But it also shows us what we must do differently than what was done after 1997.

Figure 1: Multiple Uses for the Friendship Trail Bridge

[8] Appendix C, KCA/SDR Report, May 2009
[9] Appendix A, Stantec/Wilson Miller Engineer Letter, April 2012

Learn from the Past

The original Gandy Bridge was a unique entrepreneurial project by George S. Gandy and others to connect Tampa and St. Petersburg. It was taken over by the state by order of the President during World War II, but by the 1950s it was too popular and small to handle the traffic. The 1956 span was the second span built for the cost of $2,600,000[10], or over $20,000,000 in today's dollars. In 1975 the original Gandy Bridge was torn down and replaced with a third span. It handled road traffic from 1956 to 1996 when the fourth span was built.

When available, citizens have used bridges on the Gandy for walking and fishing purposes since 1924[11]. So it comes as no surprise that many have tried to save the various Gandy Bridges for recreational use. In 1975, citizens tried to save the original Gandy Bridge, but the effort was unsuccessful because some recreational use was built into the 1956 span[12].

Gandy Bridge span built in 1956[13] was previously slated for demolition. After two years of work with FDOT the bridge was saved and opened for recreational use for walking, biking, and fishing on December 11, 1999.

Figure 2: Opening Day, Dec. 11, 1999

[10] Sarasota Journal, 4/20/1956
[11] St. Petersburg Times, 4/16/1956
[12] St. Petersburg Times, 2/1/1975
[13] St. Petersburg Times, 2/8/1997

When the Friendship Trail Bridge was opened 13 years ago -- it was ahead of its time and tremendously successful. Some examples include:

- **One of the first road bridges to pedestrian bridge conversions in the country.** Shelby Street Bridge in Nashville opened 4 years after[14].
- **Bridge was in use more than any recreational bridge in US** – anywhere from 200,000 to 600,000 visits to the bridge a year[15].

The bridge was governed by the Friendship Trail Bridge Oversight Committee (FTBOC) and the budget was split between Pinellas and Hillsborough counties. The initial budget for the bridge was $7 million provided by FDOT, this money was exhausted by 2003 due to lack of private support. After 2003, all operations and maintenance costs came directly from the county.

The bridge was used by hundreds of thousands of people a year but it faced three main issues that we acknowledge and believe must not be repeated to have a bridge that will be open for an additional 30 years:

- **Structure was not fully converted:** The Gandy Bridge was initially slated for a 30 year life[16], but concerns about the superstructure made this impossible[17] and increased annual repair costs.
- **No real private donor support:** The non-profit was originally structured to fund operations, and was determined that "The Corporation should not be relied upon to provide … funding" within three years[18].
- **Lack of events and private enterprise to support the bridge:** No leases were signed with private businesses and special events were banned[19].

Each of these past issues are addressed in this plan, as well as other issues identified from hundreds of conversations with citizens, county commissioners, county staff, and experts in everything from engineering to legal issues.

During our research, we have also found that prior to the decision to demolish the bridge, the Friendship Trail Corporation did not file Federal 990 forms. Over time, public support waned and the lack of any endowment created serious issues. Our plan would not allow this to happen as it has built in benchmarks and responsibilities that the non-profit would have to meet in order to establish a lease agreement.

[14] The Tennessean, 8/4/2003
[15] Reports from FTBOC meetings, 1999-2009
[16] Report to BOCC, 6/1/01
[17] Appendix D, EC Driver Peer Review, March 2010
[18] Report to BOCC, 6/1/01
[19] Report of FTBOC Meeting, 7/18/02

Make it Safe: *Engineering Analysis*

Before we discuss our engineering and design strategy for the next phase of the Friendship Trail Bridge, there are several misunderstandings about the bridge's structural problems and repair costs. We would like to address a few:

- The bridge was not closed due to issues with the pylons, piers, or any parts of the substructure of the bridge.
- Repairs to the bridge don't need to cost $48 million. This figure came from one recommendation made in a peer review after a single site visit[20]. Other costs cited include: $7 million[21], $30 million[22], and $16.7 million[23].
- The $48 million repair cost is an outlier. Hillsborough County Public Works department has noted that $16.7 million to rehab was "on par" with many repair estimates with a 10 year life span[24].
- Over 75% of the investment made by the county on the bridge since 1997 was on the portions of the bridge that we wish to preserve[25].
- The majority of the money spent on the bridge by the counties will be on demolition no matter what is decided, not repairs or other operating costs.

By understanding that much of public discussion in the press has focused on many of these misconceptions, we believe it is best to first simply explain the existing construction of the bridge and then second, graphically illustrate our design intent for transformation. With the understanding of the history of the bridge and the true issues both counties have faced in maintaining its use by the public – we hope this plan will complete the over 40 year quest to have a true recreational bridge across the bay.

Existing Bridge Construction

The 2.6 mile long Friendship Trail Bridge is composed of three different bridge span types; the low span approaches, the high span approaches and the navigational channel spans.

[20] Appendix D, E.C. Driver Peer Review, March 2010
[21] Appendix C, KCA/SDR Report, May 2009
[22] Appendix B, KCA/SDR Report, December 2008
[23] Appendix A, Stantec/Wilson Miller Engineer Letter, May 2012
[24] Meeting with Public Works Department, 4/20/12
[25] Appendix F, Report to Hillsborough County BOCC, June 6, 2001

Low Span Approach – The level portions of the bridge extending out from land at each county to the center "hump." The superstructure in these spans is relatively close to the high water level; therefore experiences a high level of salt spray from the bay.[26] The 252 low level approaches span 48 feet between pile caps and each span contains 4 post tensioned concrete girders. The pile caps span over 4 piles (every third pile cap contains an additional 4 piles for additional lateral support)

Engineering Terms as related to the Friendship Trail Bridge:

Piles - *Concrete columns driven below the sea bed. According to design documents, each pile is designed to carry 57 tons.*

Pile Cap – *Concrete beam that connects the piles. The piles are poured directly into the pile cap and operate as one system.*

Substructure – *The piles and pile caps, also called Pile Bent.*

Girders – *Post tensioned concrete "beams" that span from pile cap to pile cap. Each span from pile cap to pile cap contains 4 girders supporting the deck*

Deck – *The useable surface of the bridge*

Superstructure – *The concrete girders and deck*

High Span Approach – The portions of the bridge that approaches the center "hump." These 20 spans are elevated above the high water level and experience little to no salt spray. They span 72 feet between pile caps and consist of 4 post tensioned concrete girders. These spans are supported by four independent pile caps with four piles each.

Navigational Channel – The highest portion of the bridge, AKA "the hump." This portion spans the navigation channel. These 3 spans are over 74 feet long and contain steel girders rather than concrete.

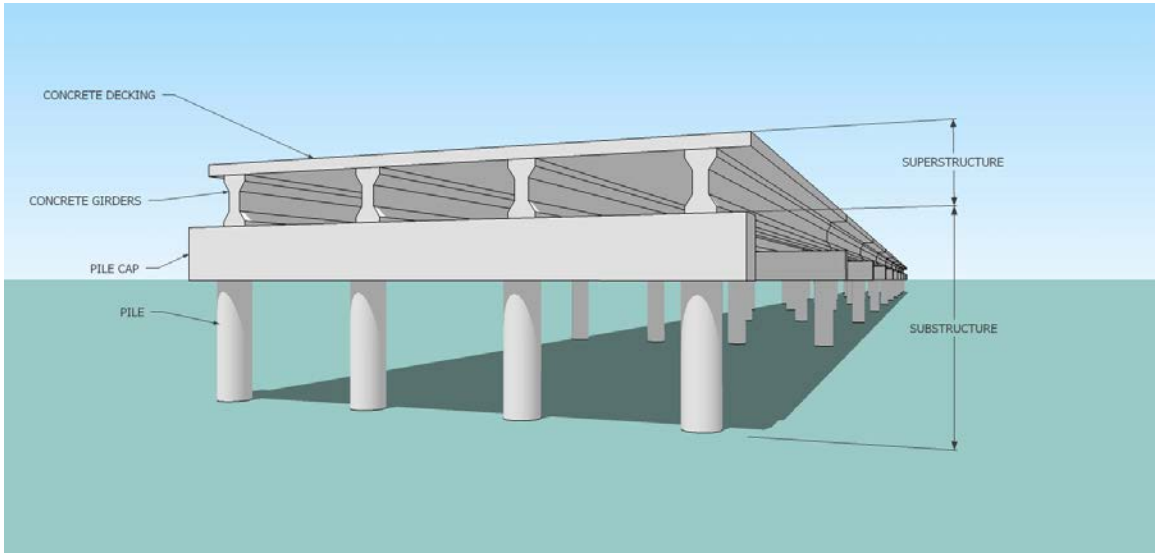


Figure 3: Structural Components of Typical Low Span Approach

**Structural design information obtained original FDOT construction documents and from KCA/SDR report May 2009*

[26] Appendix C, KCA/SDR Report, May 2009, page 2

Engineering Reports

While the Old Gandy Bridge operated as the Friendship Trail Bridge a series of reports were commissioned. Our design solution is generated from a thorough reading of these reports by our professional architectural and engineering team.[27]

May 2003
BRIDGE INSPECTION REPORT (including underwater inspection) AND LOAD RATING
Prepared by: Wade Trim

December 2008
LOAD CAPACITY ASSESSMENTS OF THE FRIENDSHIP TRAIL BRIDGE
Prepared by: Kissinger Campo and Associates with Structure Design and Rehabilitation Inc. (KCA/SDR)

May 2009
DETAILED INSPECTION AND EVALUATION OF THE FRIENDSHIP TRAIL BRIDGE
Prepared by: Kissinger Campo and Associates with Structure Design and Rehabilitation Inc. (KCA/SDR)

March 2010
FRIENDSHIP TRAIL BRIDGE PEER REVIEW – LETTER REPORT
Prepared by: E.C. Driver

August 2011
PROBABILISTIC ASSESSMENT OF THE FRIENDSHIP TRAIL BRIDGE
Prepared by: University of South Florida Civil and Environmental Engineering Faculty

[27] Appendix A, Stantec/Wilson Miller Engineer Letter, April 2012

A Review of the KCA/SDR Final Report

All of the post-closure reports and reviews focused on the superstructure of the low span approaches. This is due to the fact that their construction mirrored the Old Skyway construction; they were the first bridges in Florida to use post-tensioned concrete girders. The findings in the report noted that the superstructure; including the girders, within the low span approaches was crumbling, unstable and warranted closure of the bridge.

The May 2009 KCA/SDR report is the main report cited for closure of the bridge. On page 2 of the report, the reason for concrete deterioration is explained. The low span approach superstructure is: “most vulnerable to wave attacks and are located in extremely aggressive environment. The shallow reinforcement concrete cover does not provide the necessary protection against heavy concentration of chlorides with the resulting steel corrosion.”

On page 3 of the same report, the special inspection is detailed as consisting of invasive testing of a total of 7 spans of the low span approaches. It is important to note that there are 252 of these approaches. An investigation and testing of 7 spans constitutes less than 3% of this span type. At the bottom of the page “This inspection was limited to the low level approach spans.”

The only mention of the substructure is located on page 10 of the KCA/SDR May 2009 final report, “While repairs of such piles are desirable it is not immediately required since traffic on the bridge is limited. Deterioration in pile bents with only 4 piles will need to be repaired due to the lack of redundancy. Within the inspection results it was recommended that 23 pile caps (9% overall) and 47 piles (5% overall) should be repaired.

There is no mention of the High Span Approaches or the Channel Spans. Due to their elevation from the water level and different construction type it should not be assumed that these sections of the bridge suffer from the same deterioration as the Low Span Approaches.

On April 11, 2012, Ralph Verrasto P.E. and associate Rolando Corsa P.E., both from Stantec/ Wilson Miller a respected engineering firm with experience repairing bridges[28], visited the Friendship Trail Bridge to perform a visual inspection of the bridge’s structural system. Their findings are detailed in the attached report, addendum A. Their findings on the structural deterioration of the bridge’s superstructure are consistent with the previous reports. However, the recommendations for repair and transformation are unique providing economic engineering solutions.

[28] Appendix K: Structural Engineer Resume and Firm Profile

The Engineering Solution

All of the reports commissioned by Hillsborough County are conclusive that the superstructure within the Low Span Approaches are experiencing advanced deterioration and are not safe in their current state. Furthermore, the cost estimates within these reports conclude that these girders will have to undergo extended and costly repair during the lifespan of the bridge.

The reports did not study the High Span Approaches or the Channel Spans. However, it is stated within the reports that these sections are in considerably better condition than the Low Span Approaches due to their location above the corrosive salt spray and different construction type. Our design solution keeps these portions of the bridge intact with minor repairs.

In addition, the reports make little mention of the piles and pile caps. The only mention states that they are in sound structural condition due to redundancy and require repair of less than 10% overall. They do require regular maintenance, and were scheduled to be repaired prior to the closure of the bridge in 2008..

With all of this information in mind, our design approach is as follows:

1. Remove and demolish the superstructure (girders and decking) from the 252 Low Span approaches.
2. Keep and repair the piles and pile caps.
3. Replace the Low Span approaches with a prefabricated metal structure, 16 feet wide.

This new structure would be light weight, significantly reducing the dead weight of the overall span and structural load on the piles and pile caps, therefore, the life expectancy is increased and the yearly maintenance costs are significantly decreased.

Prefabricated metal structures are commonly used for pedestrian bridges and trails. The use of galvanized metal and/ or aluminum is also commonly used in saltwater environments, most often seen at boat launches, boat decks, and salt water vessels and equipment.

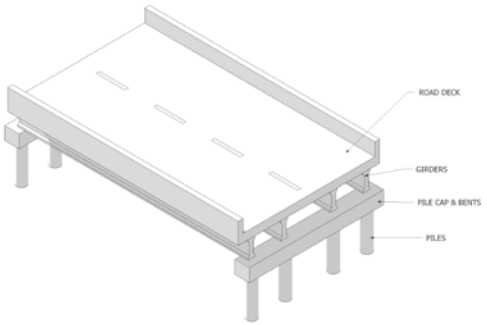


Figure 4 Diagram of Existing Low Span Approach

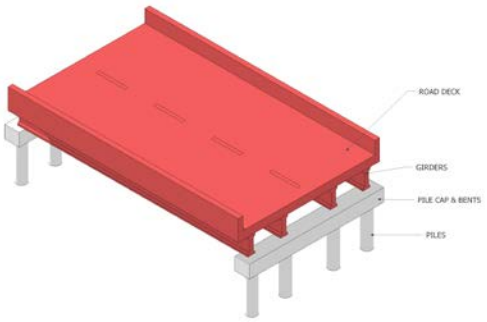


Figure 5 Diagram Demonstrating Existing Damage in Red (step 1)

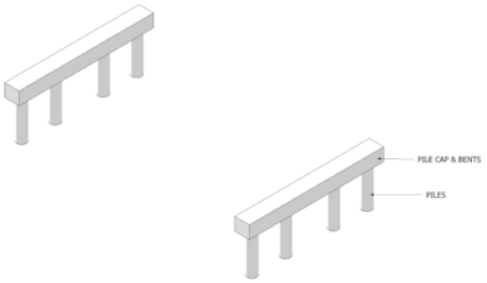


Figure 6 Diagram of Structure to Remain (step 2)

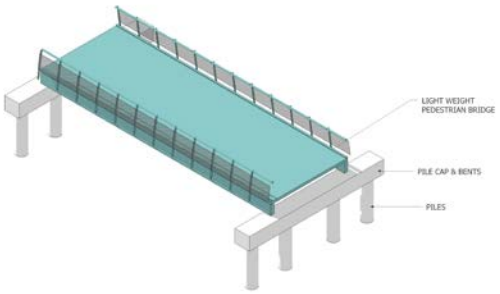


Figure 7 Diagram of Lightweight Metal Bridge (step 3)

Create a Linear Park: *Comprehensive Design Solution*

The new metal bridge spans would be prefabricated off site at a local steel fabrication facility. The size of the prefabricated spans measuring 48 feet long by 16 feet wide will allow them to be transported to the site where each would be lifted into place on top of the existing pile caps. The typical span would be constructed using a metal truss system that also functions as a guardrail to the trail. The walking surface of the span would be a combination of concrete and wood composite decking. Each typical span would contain a bench for sitting or resting and a light pole which allows for promotional or seasonal banners to be displayed.

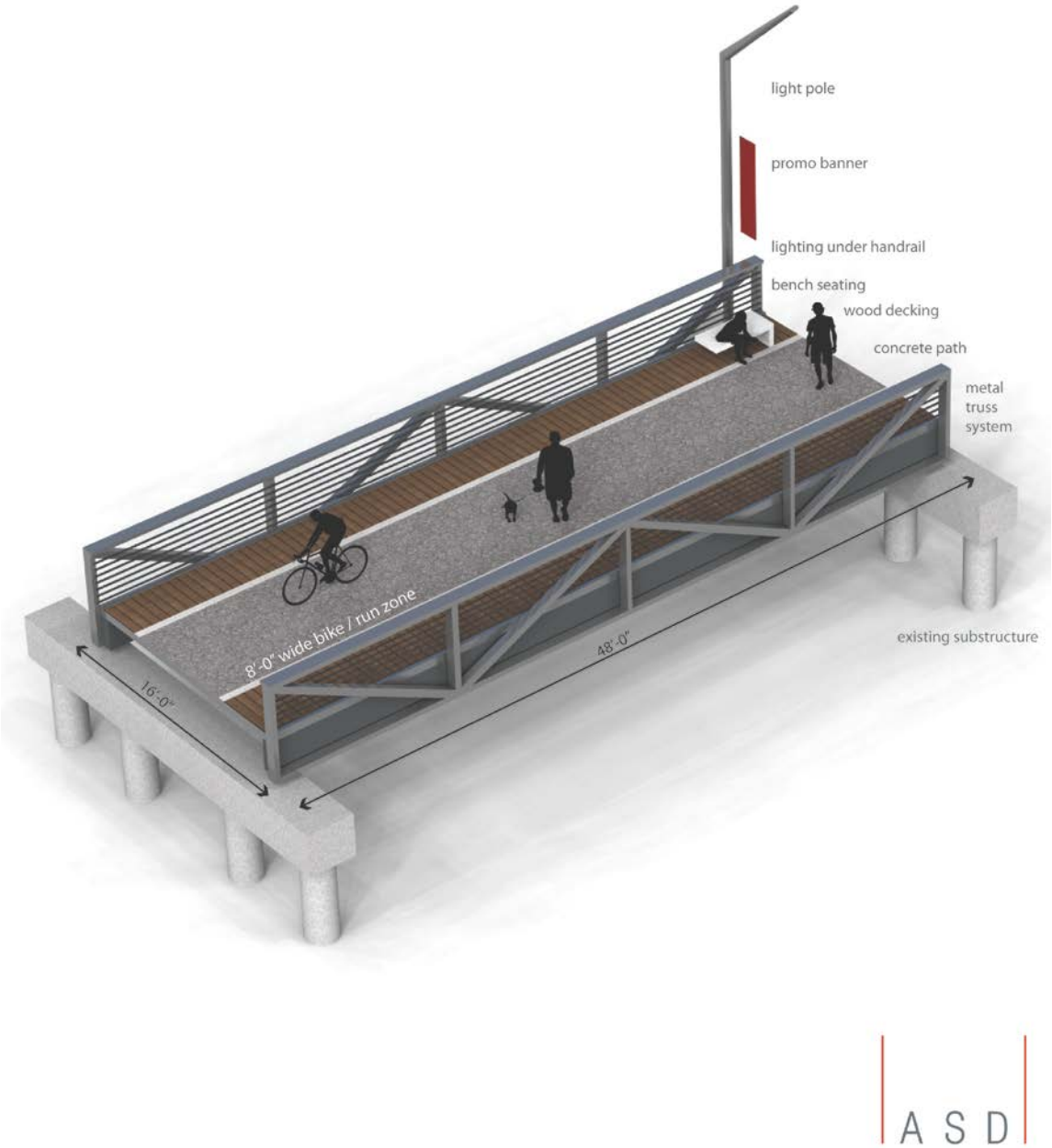


Figure 8 New metal bridge span (typical)

In total there will be 252 new metal bridge spans. In order to create amenities along the trail and points of interest for the users, approximately 50 of the 252 spans will be modified using a standard kit-of-parts. Examples of these spans include, fishing platforms, vendor areas, picnic areas and boat slips to name a few.

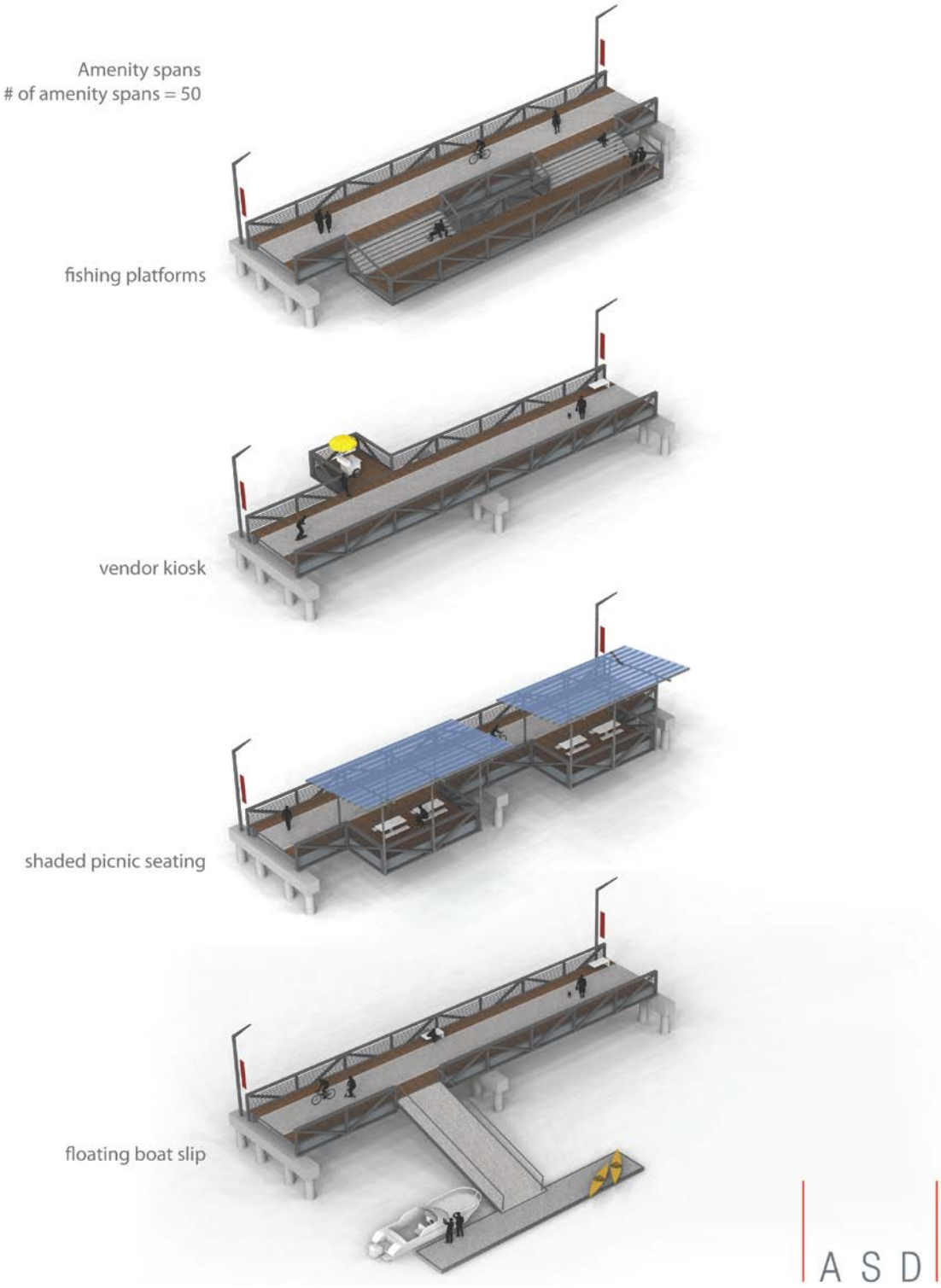


Figure 9 New metal bridge spans (amenities)

By strategically scattering these amenity spans throughout the 2.6 mile trail bridge, the trail can become more active and inviting with several activity centers along the path.

Figure 10 New metal bridge Eastside approach

Figure 11 Conceptual Rendering provided by ASD w/ Gordon Tarpley of studio AMD

Figure 12 Conceptual Rendering provided by ASD w/ Gordon Tarpley of studio AMD

Figure 13 Daytime conceptual rendering provided by ASD

Figure 14 Evening conceptual rendering provided by ASD

Form a Partnership: *Governing Structure and Liability*

Our long-term vision of the Friendship Trail Bridge includes the creation of a separate, not-for-profit, legal entity that would work in partnership with local governmental bodies and be charged with (a) managing the day to day operations and maintenance of the Bridge, (b) raising private and public funds, through donations grants and other sources, to assist the County in meeting the immediate and long-term operations and maintenance of the Bridge, and (c) guiding the overall vision of the Bridge, including design, capital improvements, and public services.

Under our plan, ownership of the Bridge and the underlying real estate on either side of the Bridge would remain unchanged. The separate legal entity, which would likely take the form of a non-profit or not-for-profit corporation (the "Non-Profit"), could lease the real estate and contract with private and/or government bodies to operate and maintain the Bridge. The Non-Profit's annual budget would consist of a combination of previously allocated public funds and private and public monies raised through the Non-Profit's efforts to solicit private donations and apply for state and Federal grants. Once the Bridge is operating, fundraising efforts could also include concessions; kayak rentals, bait sales, and parking charges.

Our plan advocates a model where the County retains significant control over the Bridge by playing a major role in the governing structure of the Non-Profit and maintaining its authority to have the final vote on "high-importance" issues as determined by the Non-Profits Articles of Incorporation and By-laws. For example, the Non-Profit's Officers and Board of Directors would likely include members of the County Commission and possibly other governmental bodies, including members of the Pinellas County Commission and Tampa City Council. In addition, the Non-Profit's bylaws could mandate that the Non-Profit's decisions are non-binding for issues designated to be of "high importance." Under this scenario, the Non-Profit would vote on a recommendation, which would thereafter be presented to the County Commission for a final vote.

Our plan also attempts to take advantage of the County's considerable experience in managing the bid and project management process for the engineering, architecture and construction of the Bridge. It is not desirable or practical for the Non-profit to "reinvent the wheel" when the County has existing expertise in a given area.

Other not-for-profit models have successfully operated in a similar fashion. Friends of the Riverwalk, Inc., for example, have a 16 member "Steering Committee" that directs the operation of the Board. Positions on the Steering Committee consist of "at large" seats appointed by the steering committee and dedicated seats for representatives from Hillsborough and Pinellas County. As a not-for-profit corporation, donations to support the transformation of the bridge would be tax deductible, given its status as a 501(c)(3).

The bridge itself would continue to be owned and governed by the current Interlocal agreement between Hillsborough and Pinellas Counties. We would then request that a lease be signed between those governments and a new non-profit.

The non-profit would be responsible for:

- Fundraising
- Design, rehabilitation and executing contracts
- Operations
- Maintenance
- Funding any eventual demolition

The partnership between the counties and the non-profit includes:

- Owner of the bridge and landlord
- Providing expertise and services
- Working on continuing to provide trail connections to the bridge.
- Matching grants from the money appropriated for demolition

Our proposal for a non-profit corporation would place bridge owner's representatives on the board as well as local government and non-profit stakeholders. The committee that is putting forth this proposal does not desire to have the bridge be controlled by anyone but the community itself.

While the county owns the bridge it would continue to be covered by the existing liability protection under the principle of sovereign immunity and Florida Statues. Currently each county is self insured for $100,000 of liability. This plan of partial demolition and transformation would also reduce the risk of this protection being necessary as the parts of the bridge that are of concern would be removed.

We plan to work with both counties and stakeholders to form the non-profit as soon as possible and recruit a board and advisors that have deep ties to the community.

Understand the Market: *Users and Usage of the Bridge*

Our initial focus of the bridge will be the outdoor recreation market as the original and most logical use of the bridge trail. Expanding on the initial focus our long term plan includes cultural opportunities (art and history), educational opportunities, and retail development. However, since these are dependent on the recreation market and require more investment we will focus on the recreation market for this study.

Outdoor Recreation Market in Hillsborough and Pinellas Counties

Outdoor recreation is a major activity in the region, much of this is due to draw of our waterways; the Hillsborough and Alafia River, Tampa and Hillsborough Bay and the Gulf of Mexico; as well as our year-round warm climate. As stated before outdoor recreation is increasing nationally and use of public lands for these purposes shows that same trend exists in Hillsborough and Pinellas counties. Both Pinellas and Hillsborough have seen increased use of parks between 4% and 7% over the past decade not-withstanding parks that have introduced fees.

The number of visitors to the Friendship Trail Bridge (FTB) increased steadily from 237,000 in its first year to over 550,000 in its final full year – an increase of 132%. During that same time regional parks and trails continue to increase as well but at a slower rate. From 2001 to 2009, Hillsborough county parks increased by 48% from 2.97 Million to 4.41 million[29]. Since the implementation of the fees there has been a drop in attendance to the regional parks to 2.5 million – bringing them back to 2003 levels, but the revenue generated by these parks exceeded $1.8 million during that time. During its operation, the FTB grew more than twice as fast as regional parks, continuing to increase in market share even as promotions decreased over time.

A prime example of the growing interest in thel park system is the Upper Tampa Bay Trail. Currently, the trail measures 7.25 miles[30] and had 319,598 visitors in 2011 and cost approximately $450,000 to operate[31]. Efforts are on the way to further enhance the Upper Tampa Bay Trail to connect it with the Pasco County Suncoast Trail.

Additionally, all outdoor recreational facilities within the Tampa Bay region are projected to increase in use according to budget documents from both counties despite the addition of fees imposed by both counties. Projections using the last ten years of data would put use of the FTB

[29] Hillsborough County, Schedules and Audits Reports, 2009
[30] http://www.dep.state.fl.us/gwt/guide/regions/westcentral/trails/pdfs/UTB_Trail_PDF.pdf
[31] Hillsborough County Recommended Budget, FY12-13

at between 625,000 to 830,000 or on par with the usage of the 38 mile Fred Marquis Pinellas Trail. [32]

We acknowledge that some people use the Fred Marquis Pinellas Trail and possibly the Upper Tampa Trail as a portion of their daily commute. The Friendship Trail Bridge's lack of connections to other trail systems at this time makes commuting less likely. However, given its geographic position as the shortest bike link between the population and employments centers of Tampa and St. Petersburg, it is estimated that up to 15% of users will be daily commuters. With this in mind as well as the scenic beauty of the FTB, our focus remains on the recreational features of the trail.

Most importantly, the transformation of the Friendship Trail Bridge and the establishment of connections with the Fred Marquis Pinellas Trail & Progress Energy Trial via both the Courtney Campbell Causeway Trail under construction and connections to the South Tampa Greenway would likely increase the use of across the entire trail network. Creating a complete network of trails should be the goal as we continue to establish our region as an outdoor paradise and destination.

Target Markets

The Friendship Trail Bridge's geographic location necessitates that our target markets are defined as local populations and tourists visiting the area. The bridge must be designed to facilitate a variety of uses that cater to a majority of the population and including special events while remaining focused on outdoor recreation. Subsequently, since 49% of people over the age of 6 in participated in Outdoor recreation activities in 2011[33], the target market is of considerable size.

Local Market

Local Community: 23,743 people live within 2 miles and 110,983 people live within 5 of the entrances to the Friendship Trail Bridge according to the 2010 census. We expect these communities to be regular users of the bridge.

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[32] Using average growth in park use of 4% a year for the last four years and the average increase of bridge use of 10% over 4 years.
[33] Outdoor Recreation Foundation, Topline Participation Report 2012

Target activities for the main activities the bridge will support:[34]

- Running: 1,367 users per month
- Cycling: 1,146 users per month
- Fishing: 1,433 users per month
- Walking: 1,091 users per month
- Other: 985 users per month

Local Market: 6,022 users per month

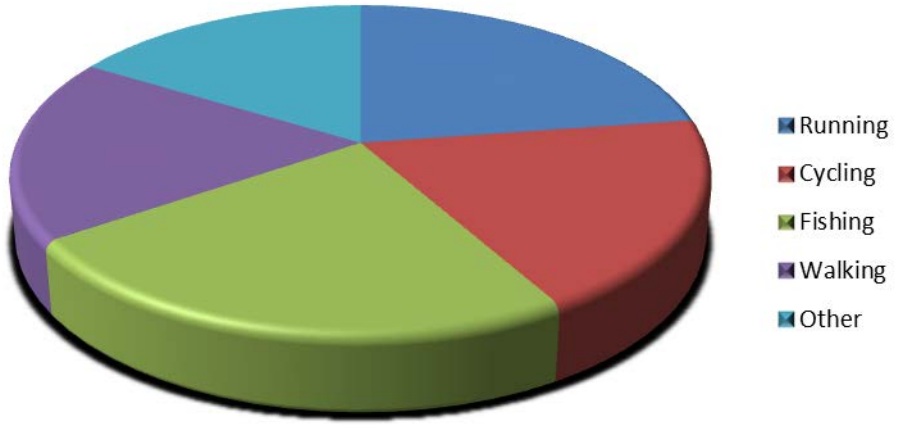


Figure 15 Breakdown of proposed uses

Aside from outdoor recreation the FTB, will also be a draw for local special events, historic value, public art and other park activities and we would expect that 10% or more of the people within five miles of the bridge would use the bridge once per year as has been seen at Walkway on the Hudson and Shelby Street bridge in Nashville.

Total Feasible Market: 79,490 users per year

Tampa & St. Petersburg: The Friendship Trail Bridge will connect the major population centers of the region: Tampa and St. Petersburg. The combined population of the two cities in 2010 was: 580,478 people. The number of people that live outside the previously defined local communities, but inside each city is 469,495 people. Additionally, Pinellas Park, Lealman, and Feather Sound are located less than 10 miles from the bridge and have an additional population of 72,288. According to the State of Florida, 10 miles is the median distance traveled for outdoor recreation[35]. This target market contains a total 541,783 people as of 2010.

Targets for the main activities the bridge will support:

[34] Outdoor Recreation Foundation, Topline Participation Report 2012
[35] Florida Department of Environmental Protection, Division of Recreation and Parks, 2011 Outdoor Recreation Survey, 2012

- Running: 5,790 users per month
- Cycling: 4,851 users per month
- Fishing: 6,064 users per month
- Walking: 4,616 users per month
- Other: 1,956 users per month

City market: 23,277 users per month

Its position as a local connection between these two cities and as a unique park, we expect to get around 5% of the people in each city to use the bridge for special events and other activities each year based on Walkway over the Hudson and Shelby Street Bridge's use data.

Total Feasible Market: 293,290 users per year

Hillsborough & Pinellas: The remaining population of the two counties was 1.49 Million in 2010. There are a number of parks in both counties that draw millions of locals as well of tourists.

Since we don't expect the bridge to be used monthly by a significant portion of this population, our feasible market outside the city limit and 10 mile radius is focused on only yearly visits. Because the latest survey states less than 40% of users travel more than 20 miles for outdoor recreation we will assume that our feasible market in the rest of the counties is no more than 40% of the overall recreation users.

Total feasible Market: 238,400 users per year

Tourism Market

Hillsborough and Pinellas counties draw over 17 million tourists each year, the FTB can be a destination for those tourists. Based on data from the Shelby Street Bridge, Walkway Over the Hudson, and Visit Florida as much as 40% of the users would be from outside Hillsborough and Pinellas counties.

Regional Tourism: The rest of the Tampa Bay region includes nearly 2 million people. Visitors to Hillsborough and Pinellas from the other counties in the region are over 1.2 million per year according to statistics from regional tourism agencies. According to a survey of people who travel, the vast majority plan on participating in outdoor recreation, generating a target market of over 800,000 local visitors from the rest of Tampa Bay.[36] Most of these visitors

[36] www.dep.state.fl.us/parks/files/scorp/scorp_summary.pdf

come for day trips and over 19%, or $183 million, of $966 million yearly expenditures are spent on admission fees.

Total Feasible Market: 800,000 visitors per year

Out of Region Tourism: The beauty of nature was one of the top reasons that tourists say that they came to the region in 2011 and almost every year before that[37]. The beaches in Pinellas County and the attractions in Hillsborough County have created a great combination and many tourists visit both counties during their stay. Like other tourists, nearly 50% will take part in the activities available on the Friendship Trail Bridge. This market is close to 8 million people per year between the counties[38] leaving a target market for the FTB of nearly 4 million visitors.

Additionally, we feel we can expand this market by incorporating the Gandy Historical Site and placing public art on the bridge – historic and cultural tourism include another 1 million tourists between the two counties[39].

Total Feasible Market: 5 million visitors per year

Estimated Users from Feasible Markets

We've identified feasible market of over 1.46 million local and 5 million tourism related visitors in our market that have spent more than $423 million dollars on admission fees in both counties. While little of the overall revenue from these markets will come to the Friendship Trail Bridge, a large market share is not required. We would only need to capture .01% of the money spent on admission fees by our target market to fund the bridge.

The feasible market we've outlined shows that a quality park and outdoor recreational area like the Friendship Trail Bridge has millions of possible users and plenty of spending to create destination for locals and tourists alike.

Looking at past use, regional trails have less than a million users now and over 1.6 million users when the Friendship Trail Bridge was opened. It is sensible to argue that the bridge itself is a draw and would increase the size of the trail and recreational market in the region because of its location and unique user experience.

[37] Visit Clearwater/St. Pete, 2010 Annual Visitor Profile Report
[38] Visit Clearwater/St. Pete, 2010 Annual Visitor Profile Report, Tampa Bay & Company, 2011 Research presentation
[39] Visit Clearwater/St. Pete, 2010 Annual Visitor Profile Report, Tampa Bay & Company, 2011 Research presentation

Attendance to the old version of the Friendship Trail Bridge has already been tracked for ten years – with attendance increasing from 237,000 to 600,000 visitors per year. Since the bridge will offer fishing, kayaking and other similar activities it's likely to get as much use as before. In addition, the marketing campaign surrounding fundraising efforts can be expected to raise overall interest in the bridge.

These numbers show us the possible number of users from the feasible market. In 1999 the number of users equaled 237,000 people or 6% of the total feasible market in 1999. In 2007 over 550,000 people used the bridge. While the feasible market had dropped considerably from its peak in 2005 and growth had slowed, the FTB still reached 12% of the overall feasible market.

We have set use projections for use that equals 7%, 12%, and 17% of the feasible market. These numbers assume a slight increase in interest in the bridge but are very close to the number of users from the feasible market for the FTB in 1999 and 2007 – 4.6 million and 5.2 million respectively.

Given the size of the feasible market and additional media exposure, we expect to be able to reach 680,000 users in the first full year and a target of over 1 million users in 10 years. This assumes an average of 4% to 7% growth in attendance each year which is on par with regional parks in both counties.

Below are estimates of users over a 33 year life span:

Year	Estimated Visitors (12%)	Low Expected (7%)	High Expected (17%)
1	800,000	500,000	1,100,000
2	680,000	425,000	935,000
3	727,600	454,750	1,000,450
4	771,256	482,035	1,060,477
5	809,819	506,137	1,113,501
6	842,212	526,382	1,158,041
7	892,744	557,965	1,227,523
8	982,019	613,762	1,350,276
9	1,040,940	650,587	1,431,292
10	1,082,577	676,611	1,488,544
11	1,169,184	730,740	1,607,627
12	1,134,108	708,818	1,559,399
13	1,156,790	722,994	1,590,587
14	1,179,926	737,454	1,622,398
19	1,268,420	792,763	1,744,078
24	1,331,842	832,401	1,831,282
29	1,398,434	874,021	1,922,846
34	1,328,512	786,619	1,730,562

Establish a Position: *Marketing Position*

The most significant change we anticipate making to the Friendship Trail Bridge beyond engineering and design is the overall marketing of the bridge. When the bridge was reopened in 1999 for pedestrian use it was a big event, but the conversion of the bridge left it mostly as a road designed for vehicles. As evidenced in our drawings and renderings, we plan to transform the bridge into more of a park through engineering and design, therefore the branding has to match this theme.

We believe the bridge must become a symbol for the entire bay. By connecting both counties, it's more than a "friendship bridge", but an extension of the focused work the business community has done to make the area, One Bay.

As an entrepreneur, George Gandy connected Hillsborough and Pinellas over the bay for the first time. We believe a new linear park over the bay that connects these two counties can do the same thing for the 21st century. It is a place that both communities can come together in special events and a symbol for the region.

Additionally, it will help the Tampa Bay area market to young professionals and creative professionals that scout out these types of amenities when deciding where to live or start a new business. The economic impact is a major component for how the Friendship Trail Bridge can also be successful beyond its physical limits.

Figure 16 Existing FTB with City of Tampa Park to the North

Other bridges and linear parks have become identifying icons for their communities. A few notable examples include:

Walkway Over the Hudson, Poughkeepsie, NY

Walkway over the Hudson is a $38.8 million project which transformed the abandoned Poughkeepsie-Highland Railroad Bridge into Walkway Over the Hudson State Historic Park. The bridge is controlled by a non-profit Walkway over the Hudson and operated with in a partnership with New York State Parks.

- Over 400,000 people visit it each year (twice as much as initial expectations)
- Over 48% of visitors are from outside the two connected counties and spend over $15,000,000 a year.

Shelby Street Bridge in Nashville, TN

The Shelby Street Bridge is located in downtown Nashville, TN. Originally a railroad bridge, it was converted to a pedestrian bridge in 2003. The State of Tennessee spent $15 million to repair and retrofit for pedestrian use. It is now part of the Metro Nashville Greenway.

- Closed the same year as the Friendship Trail Bridge and was reopened as a pedestrian bridge 5 years later.
- Shelby Street Bridge is used for everything from a bike path to special events like weddings and music video shoots.

The High Line, New York City, NY

The High Line is one of New York City's newest park. A volunteer group saved it from demolition and it took 5 years for them to get any funding help from the city. It now has millions of visitors each year and the city continues to expand it.

- It is estimated that the High Line has generated nearly $2 billion in economic activity, nearly 5 times it's cost
- Over $46 million in private funds to help build the elevated park from 1999 to 2007

Fred Marquis Pinellas Trail

Pinellas Trail is an example of success from one of the two counties we hope to work with. The Trail continues to be an ongoing project and has cost millions to build over time – but the impact on the region and the economy is clear.

- Mayor of Dunedin credits it for hundreds of thousands of dollars of economic impact in his downtown alone.
- Used by over 800,000 people a year

The Advantage of the Friendship Trail Bridge

There are a numbers of ways this project sets it apart from anything that has ever been done before and will bring attention and focus to it over the years.

The unique features include:

- **Longest pedestrian bridge in the world:** It will become the longest pedestrian bridge again by over 7,000 feet.[40]
- **Over a bay:** Almost every other similar project is done over a river or in a completely urban setting; this project is also over a bay and allows visitors to get closer to nature.
- **Wide variety of recreational activities:** Most similar linear parks are limited to walking and cycling (some even just walking). But the bridge can be the host to water based activities like fishing, kayaking, boating, and parasailing.
- **Previous use:** Unlike every project before it, the Friendship Trail Bridge has an existing user base of hundreds of thousands of people
- **Urban:** It would be the only recreational bridge of its kind in Florida by connecting two urban cities like St. Petersburg and Tampa.

Position Statement

The transformation we propose will become a completely different trail environment than has been previously considered. It will be a linear park allowing people from all over to experience the bay from a new perceptive. It will be designed enhance a 21st century lifestyle.

[40] http://blog.budgettravel.com/budgettravel/2009/10/this_weekend_stroll_the_worlds.html

Promotion Plan

The majority of promotion will occur in the community and during fundraising for the next five years. Since the bridge won't be opened during the first few years, we will be promoting its vision by involving the community in its design, and working to increase grassroots donations. For the first five years our promotion plan will focused on fundraising. However, we also intend to conduct marketing and promotions in the following ways:

- **Signage at site of future development:** Place signs at the current site so that people visiting the parks know what it will become and how to get involved
- **Special events and fundraisers:** Hosting events in the communities on both sides of the bay to show ideas and raise funds
- **VisitFlorida, Tampa Bay & Co, and Visit St. Pete/Clearwater:** Work with tourist agencies in the area to find ways to package the bridge in the future
- **Outreach to Running/Cycling/Fishing/Kayaking groups:** Reach out to these groups for input and support
- **Outreach to local businesses:** Partner with local businesses to make the project happen and promote the neighborhoods on both sides
- **Website:** Develop new website for the project to take donations and communicate with supporters

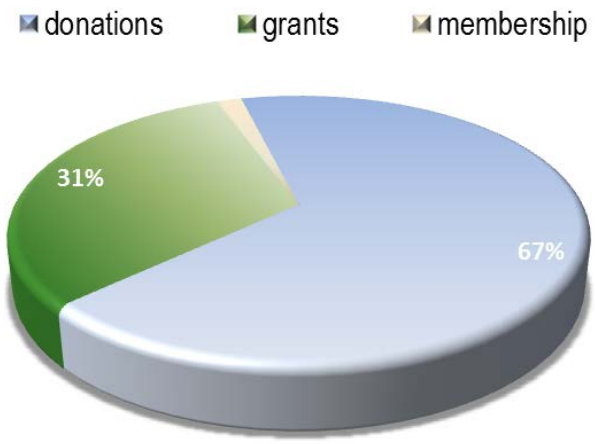
Realize the Potential: *Revenue Opportunities and Potential*

Revenue will come from three main sources; donations, grants, and fees. No one single source of revenue can be relied upon to fund the construction, operation or maintenance of the Friendship Trail Bridge.

Most of the money for construction and capital reserve will come from private donations – around $13 million or 67% of the overall cost. The second largest source would be $6.5 million from government and foundation grants, which includes $3 million we hope to raise from the county using savings from the demolition of the bridge. Smaller amounts will be raised from early sponsorships and membership support for a total of $330,000.

These totals include in-kind contributions, which we plan to make a critical part of the fundraising initiative.

Year	Donations	Grants	Sponsors	Membership	Total
2012	$220,000	0		$30,000	$250,000
2013	$1,100,000	$1,000,000	$10,000	$40,000	$2,150,000
2014	$2,000,000	$750,000	$10,000	$40,000	$2,800,000
2015	$3,150,000	$1,000,000	$25,000	$50,000	$4,200,000
2016	$3,425,000	$1,500,000	$25,000	$50,000	$5,000,000
2017	$3,450,000	$2,000,000	$50,000	0	$5,500,000
Total	**$13,345,000**	**$6,250,000**	**$120,000**	**$210,000**	**$19,900,000**



Donations

The Friendship Trail Bridge is a large capital project and will require significant large donations. Our focus will be on collecting those donations while establishing a solid small donor base to sustain the bridge over its 30 year life. The fundraising efforts for this project fall in between the fundraising work Friends of the Riverwalk and the stellar work to raise money for the Glazer Children's museum completely from private funds.

During the first five years, the primary capital fundraising drive will be the most donation heavy phase of the project. The fundraising techniques during this time will fall into four main categories: named donations, sponsorship of spans, sponsoring activities, and low dollar membership drives.

Named donations

There are at least four major naming opportunities for the bridge: the bridge itself, the approaches on both side, and the hump. Of the $20 million to be raised we hope to raise about 15% or $3 million from these donations. However, due to their size we do not expect these donations to come until later in the project and after receiving some matching grants from the county.

Sponsoring spans

252 spans of the bridge to be constructed at a cost of $41,000 to $76,000 per span. We hope to focus our fundraising efforts on having all of these spans sponsored with plaques on each span representing the sponsor to the spans. Using an innovative website we hope to entice corporate, foundation, and individual donations by allowing them to select the spans they wish to sponsor. Their name will appear on the website rendering of the bridge as soon as the donation is made – so their sponsorship is acknowledged while the capital fundraising campaign is going on.

For people who do not donate the cost of a span we will include multiple names on spans so that each donor – including "member spans" that will be paid for by the small dollar membership donations.

This will be the majority of the early fundraising and will include some friendly competition between Hillsborough and Pinellas counties (a race to the middle). Additionally, we plan on utilizing matching grants from the county in the early years to entice donations and show that their money is being matched by both counties' commitment to this project.

Sponsoring activities

In addition to the traditional fundraising we will host one or two activities each year and work with a sponsor to help raise money for the bridge. These activities would be related to the future use of the bridge like running, fishing, or kayaking and would also support the low dollar membership fundraising by promoting the opportunity as well.

Membership

Even prior to the creation of the bridge we want to focus smaller donations on a membership program. Eventually, this program would allow you to pay a yearly fee instead of paying each time you drive and park at the bridge. Before the Friendship Trail Bridge is constructed, we would like to create a membership card with the cooperation of local businesses that would allow members to receive a discount at local shops and restaurants. The High Line in New York has a similar program. This program is both successful in raising funds, but also marketing the FTB as an asset to the business community and promoting local business.

Additionally as part of the public/private partnership, the memberships could allow members access to regional parks in both counties as well. Once established, a portion of the fee would obviously be shared with both counties as well.

Breakdown of donations by type/year:

Year	Named Donations	Spans	Membership	Total
2012	$0	$220,000	$30,000	$250,000
2013	$0	$1,110,000	$40,000	$1,150,000
2014	$500,000	$510,000	$40,000	$1,050,000
2015	$2,000,000	$1,150,000	$50,000	$3,200,000
2016	$500,000	$2,950,000	$50,000	$3,500,000
2017	$0	$3,500,000	0	$3,500,000
Total	**$3,000,000**	**$9,440,000**	**$210,000**	**$12,650,000**

Grants

In addition to private donations we will pursue grants from multiple different types of foundations as well as federal, state, and city governments. We believe that this can make up as much as 30% of the funding and help the organization get off the ground.

Walkway over the Hudson for example received a $2 million donation from the Dyson foundation while other trails have received numerous smaller grants for foundations that support rails to trails initiatives. Additionally, the bridge will be such a unique asset and economic driver that we believe that other governments might join Hillsborough and Pinellas County in supporting the project.

We have already identified three main grant opportunities to pursue and will focus efforts on obtaining these grant monies:

Rails-to-Trails

The main focus of our efforts to obtain grants will be with foundations that have worked on and support rails-to-trails and roads-to-trails projects. Millions are given out each year to create new trails across the country. The long history and commitment from the county should make the Friendship Trail Bridge an attractive investment.

Historic preservation

The bridge is on an eligible historic site, where the first Gandy Bridge was built in the 1920's – the causeway for all three spans was built for the original bridge. Parts of the bridge's construction are still scattered over both sides of the bridges. In addition, one of the original toll towers was brought back to the bridge site. We will pursue designating the area as an historical site in honor of entrepreneurs like George S. Gandy – and will work to receive help from those foundations as well.

Public Art

We will work to beautify the area around the bridge and the bridge itself through public art grants. It is a unique place to showcase one of a kind installation artworks and it would draw additional users to the trail.

Operating Phase

Our focus will shift from large donations during the design and construction phase to events, fees, and membership during the operating phase. Fees and membership will make up most of the yearly revenue. There are other opportunities available, but at this time we do not know the future situation of leases and equipment rentals until we work with the existing FDOT lease. Therefore, those potential revenues are not included in this analysis. It should be noted however that Hillsborough county parks data shows they have the potential to increase revenue significantly.

Car Fees

Charging visitors coming to the bridge via car and parking is the number one revenue opportunity for the bridge. This fee will be structured similarly to the regional parks in Hillsborough and Pinellas – so that people using the bridge by walking or cycling will not be charged. Improvements will be made to both parking lots to increase their size and implement an electronic pay system. Our current estimate is $4 per car. This amount is higher than Hillsborough regional parks but lower than beaches like Fort DeSoto.

By analyzing the data from the past year in Hillsborough regional parks and the expected user numbers, we can project $250,000 or more generated from parking fees alone.

Membership

The second major revenue stream we will target is annual memberships. We will sell memberships to allow users to avoid paying for parking and to support the bridge in general. Similar to other Hillsborough parks, the bridge would have multiple types of memberships: for individuals, for families, and specific activities. We believe we can raise over $90,000 a year from these revenue streams as well.

Set Benchmarks: *Schedule for Design and Development*

Now that we have determined there is a market for the Friendship Trail Bridge, that it can attract enough users, generate revenue, and have a plan to fund its transformation; we propose a 5 year schedule for delivery with a goal to open the bridge by 2017 and operate until 2047.

We understand the county needs to mitigate risk to the taxpayer as much as possible and this schedule will allow us to raise money to transform the bridge while keeping the taxpayer risk low.

In addition, this process will allow the county time to evaluate the non-profit's progress based on a series of benchmarks. The county will have the ability to halt the project if benchmarks are not meet.

Bridge Development

- **Planning Phase:** April 4, 2012 to May 16, 2012

  Benchmarks

  - Create draft business plan

  Hillsborough County agrees to:

  - Delay demolition plans
  - Hillsborough County staff to study changes to the demolition scope as outlined in the plan and help with feasibility phase

- **Phase 1: Feasibility,** June 16, 2012 to Feb. 16, 2013

  During this phase we will provide additional proof that the project is feasible and will have a number of benefits to the community. We will raise money to conduct profession studies by outside consultants.

  Benchmarks:

  - Fundraising Benchmark: $150,000 raised
  - Engineering feasibility study: Inspection and engineering evaluation[41]
  - Economic Impact study: Completed and demonstrate value to taxpayers

  Next Steps for Hillsborough and Pinellas Counties:

  - Agreement reached with both county commission and approved by board
  - Final schedule for fundraising benchmarks reached
  - The county commissions match first $150,000 raised. Monies can be pulled from existing demolition fund

[41] Appendix L: Inspection Proposal of Services

- **Phase 2: Capital Costs Fundraising,** 2013 – 2017

  During this phase the focus will be raising the capital costs to transform the bridge to a linear park. Again, there will be yearly benchmarks for fundraising.

  Benchmarks:

  - Fundraising yearly benchmarks for 5 years:
    - 2013: $1 Million raised
      - County matches with a $1 Million grant *(All grants shared by both counties and are equal monies already set aside for demolition)*
    - 2014: $2.3 Million raised
      - County matches first $500,000 with a $500,000 grant
    - 2015: $4 Million raised
      - County matches first $500,000 with a $500,000 grant
    - 2016: $5.5 Million raised
      - County matches first $500,000 with a $500,000 grant
    - 2017: $4.5 Million raised
  - Lease agreements reached: Lease has 5 year sunset to complete raising capital costs
  - Grant requests: Work with both counties, cities and state on grant requests

- **Phase 3: Construction,** 2016-2017

  Once the capital fundraising on track and $15,000,000 is raised, we will begin repairs and construction to transform the bridge. These will occur in conjunction with the final fundraising push to pay for amenities and operations costs. We will work with Hillsborough County on establishing construction standards.

  - **Vendor Selection:** The non-profit will conduct a vendor selection process with the help of the county. This design-build vendor will be responsible for the design to the bridge under the lease.
  - **Demolition Bond:** Prior to construction, the non-profit will set up a demolition bond of $1.4 million or 20% of the expected demolition costs.
  - **Repairs:** Using inspection reports we will begin necessary repairs to prepare the bridge for its transformation.
  - **Construction:** Following the completion of the necessary fundraising we will begin manufacturing the spans and schedule construction with our vendors.

- **Phase 4: Opening & Operation,** 2017 to at least 2047

  The target date open date of the transformed Friendship Trail Bridge is November of 2017, in time for the 20th Anniversary of the transfer of ownership of the bridge and 100th

anniversary of when George S. Gandy filed his permits to construct the Gandy Bridge on this site.

- **Operations:** The non-profit will contract with Pinellas county to help operate the bridge as was done before, covering the expected $255,000 a year that will cost.
- **Operations Reserve:** The non-profit will keep enough in capital and operations reserve to operate, inspect and repair the bridge.
- **Opening Event:** We will work with both counties and private funders to hold an opening event that helps market the region as well as the bridge.

- **Phase 5: Expansion**

  After completion of the bridge we will focus on five main areas of expansion to further enhance the bridge.

  - **Special Events:** The Friendship Trail Bridge will be available for special events to raise money to offset operation costs. This will include athletic races, markets, and private events such as parties and weddings,
  - **Retail & Vendors:** We expect the bridge to open with some mobile vendors (kiosks, carts, etc.), but we will work with FDOT and the private sector to develop the causeway land near the bridge to vendors and even retail development.
  - **Historic Education:** By creating the Gandy Bridge historic site on both sides of the bridge we will create facilities and opportunities for education about the history of the bridge and entrepreneurship in the region.
  - **Environmental Education:** We will work with local schools, the Florida Aquarium and other environmental education facilities to use the bridge for marine and environmental education for children and adults across the bay.
  - **Public Art:** We hope to provide opportunities for local artists on both side of the bay to display their works on the bridge and at either approach.

- **Phase 6: Demolition or Version 3.0 (30 to 40 years)**

  After the useful life of the bridge is reached the non-profit will use the capital reserve of $5.6 million and the $1.4 million Demolition bond to pay for the demolition of the structure when it has reached it's useful life. Alternatively, if at this time there is new technology or other options to keep the bridge the capital reserves will be used to do so with the blessing of both counties.

Market Development

- **Phase 1: Awareness,** May 16, 2012 – February 16, 2013
  Following the completion of the Draft Plan we will move into a public support and awareness phase. The previous user base of the bridge will be the first target, we will reach out to new residents, new businesses and outdoor groups.

  - **Outreach:** We will work to reach out to all possible stakeholders in our target markets: Local, Cities, Counties, Region, and State.
  - **Press:** We will conduct press outreach and education to build public support for the project locally, and aggressively pursue national press.
  - **Website:** We will launch a new website which will host all information and the provide visitors the ability to donate to the effort immediately.
  - **Meetings:** We will hold bi-monthly public meetings for input in both counties. These meetings will be announced ahead of time using the same standard that public input meetings are announced in both counties.
  - **Events:** All events during this time will be focused on fundraising to fund the feasibility study.

- **Phase 2: Capital Costs Fundraising,** 2013 – 2017
  This entire phase will be dedicated to fundraising but this will require expanding the market of donors to raise the money necessary.
  - **Branding:** We will rename and rebrand the bridge and the non-profit so as to draw attention to the intended transformation.
  - **Local Business Partnership:** We will work to recruit local businesses to contribute and join the campaign, focusing on those that will benefit the most from the bridge's completion.
  - **Design Competition:** We will host a design competition for aspects of the bridge and draw national and international attention to the project.
  - **Yearly Events:** We can already make the bridge and this project part of the community by having the non-profit hold annual events and fundraisers over the five years. These events will also create a solid user base for the bridge.
  - **Small Dollar Fundraising:** We will to work to expand the membership component; an important community fundraising opportunity during the 5 years before it opens.

- **Phase 3: Construction,** 2017

  This phase will begin to move from awareness to marketing to users. We will continue to raise money, while ensuring that the visitor numbers reach the necessary operating costs.

  - **Connecting Trails:** One of the best ways to expand the market after completion of the bridge is connect the bridge to the Pinellas Trail loop and Downtown St. Petersburg, the Courtney Campbell Causeway Trail, Bayshore Blvd. and Tampa Riverwalk via the South Tampa Greenway.
  - **Tourism Marketing:** We will work with Visit Clearwater/St. Pete and Tampa Bay and Company to promote the bridge and begin to include it in their marketing efforts.
  - **Outdoor Recreation Industry:** We will reach out to the outdoor recreation industry to find cross-marketing opportunities to expand the awareness of the bridge outside the region focusing on companies like Ironman with a local component.

- **Phase 4: Opening,** 2017
  - **Opening Countdown:** Create countdown events in both counties leading up to the opening of the bridge.
  - **Opening Event:** We will raise money to host a major opening event via sponsors to gain local and national attention; including special acknowledgement for our sponsors with Hillsborough and Pinellas counties.

- **Phase 5: Expansion**

  Following the completion of the bridge we will conduct annual surveys of users and the community to find ways improve the bridge, as well as analyze revenues to find new ways to offer more services to the community.

- **Phase 6: Demolition or Version 3.0,** 2047 or later

  As the end of the expected life of the bridge approaches the non-profit will work to find ways to extend its life, but will also be prepared to finalize demolition of the structure that best reuses the area and useful components of the bridge.

Fuel the Economy: *Economic Impact Estimates*

The majority of this proposal has focused on feasibility and sustainability of transforming the Friendship Trail Bridge to be used as a linear park and trail. The benefit to quality of life is clear and was discussed many times during the use of the bridge from 1999 to 2008. However, there has been a shockingly little understanding of the economic benefits and long-term revenue benefits to taxpayers in both counties.

We have determined that the estimated increase in direct spending to start between $16 Million and $23 million per year and $718 Million to $1 Billion over the 30 year lifetime of the transformed bridge. We used out-of-county visitor projections and the results of economic studies for other bridges and trails across the country. Additional indirect spending is likely to increase these numbers anywhere from 25 to 40%.

Additionally, transforming the FTB would generate between $7 and $10 million in sales tax revenue for the counties over 30 years.

The plan to transform the Friendship Trail Bridge addresses the lost visitor spending since the bridge's closure in 2008. Overall trail use in both counties decreased when the bridge was closed. That means the loss of the Friendship Trail Bridge could translate to a loss of $22 million in spending from 2008 to 2010 alone.

The estimates also show a much improved return on investment by the county spending $5.3 million to build the bridge versus $5.3 million to demolish it. The only impact of the demolition is some temporary jobs. Investing the money in a public private partnership to transform the bridge would provide millions in impact on the economy.

Effect of spending of Bridge Users

We looked at a variety of trails and bridges with a wide variety of visitors and locations around the country to determine an estimated economic impact. The three studies listed below illustrate the two main categories of impact that have been calculated: spending by out of area visitors and spending by all visitors.

Walkway over the Hudson 2011 Study: This study shows the Bridge created $15.4 million in direct spending and $23.9 Million in 2011 its first year and created 383 jobs. Additionally, it created nearly $9.4 Million in additional wages. The study focused on out of area visitors which made up 48% of the visits. The spending per out-of-town visitor was $73.[42]

Orange County Trails Study: This study shows 1.7 million visitors spent $32.5 million, created $42.6 million in economic impact and 516 jobs. While the study used a different technique to determine impact, the average spending per visitor (both in and out of town) was $20.[43]

Minnesota Trails Study: This study shows that 46,460 visitors initiated $3.3 million in direct spending and created 108 jobs. It also shows a similar $70 per visitor spending as the Walkway study.[44]

We took each of these studies and created three models for the economic impact of the bridge. One based on "new spending" from out-of-county visitors, similar to the Walkway economic impact study. One representing the total spending of all users similar to the Orange County Trails, and one representing a combination of both – out of county visitors spending $73 and in county users spending $10 (reduction based on the exclusion of out-of-county visitors).

Figure 17 West Orange Trail

[42] Appendix J- 2011 Walkway Over the Hudson Economic Impace Analysis
[43] http://www.dep.state.fl.us/gwt/economic/PDF/Orange_County_Trail_Report_final_May2011.pdf
[44] http://atfiles.org/files/pdf/Trails-gateway-community-economy.pdf

These models all show similar results over 30 years based on our user estimates:

Year	Users	Walkway Model	Orange County	Combination
2017	800,000	$17,520,000	$16,000,000	$23,120,000
2018	680,000	$14,892,000	$13,600,000	$19,652,000
2019	727,600	$15,934,440	$14,552,000	$21,027,640
2020	771,256	$16,890,506	$15,425,120	$22,289,298
2021	809,819	$17,735,036	$16,196,380	$23,403,769
2022	842,212	$18,444,443	$16,844,240	$24,339,927
2023	892,744	$19,551,094	$17,854,880	$25,800,302
2024	982,019	$21,506,216	$19,640,380	$28,380,349
2025	1,040,940	$22,796,586	$20,818,800	$30,083,166
2026	1,082,577	$23,708,436	$21,651,540	$31,286,475
2027	1,169,184	$25,605,130	$23,383,680	$33,789,418
2028	1,134,108	$24,836,965	$22,682,160	$32,775,721
2029	1,156,790	$25,333,701	$23,135,800	$33,431,231
2030	1,179,926	$25,840,379	$23,598,520	$34,099,861
2031-35	6,342,100	$138,891,990	$126,842,000	$183,286,690
2036-40	6,659,210	$145,836,699	$133,184,200	$192,451,169
2041-45	6,992,170	$153,128,523	$139,843,400	$202,073,713
2046-47	2,657,024	$58,188,826	$53,140,480	$76,787,994
	Total	**$786,640,970**	**$718,393,580**	**$1,038,078,723**
	Increase in County Sales Tax Revenue	**$7,866,410**	**$7,183,936**	**$10,380,787**
	Increase in State Sales Tax Revenue	$47,198,458	$43,103,615	$62,284,723

These estimates demonstrate the significant impact on both of the two local counties and the return on investment for Hillsborough and Pinellas county taxpayers.

Of greater concern is the significant drop of trail users and spending across the system in Hillsborough and Pinellas County following the closure of the Friendship Trail Bridge:

	Pinellas Trail	Hillsborough Trails	FTB	Total
2006	701,675	372,708	540,000	1,614,383
2007	719,658	352,881	550,000	1,622,539
2008	872,424	335,179	450,000	1,657,603
2009	848,861	289,874	0	1,138,735
2010	678,735	318,027	0	996,762

Using the Orange County model ($20 of directspending per user of all types) the loss of spending after the closure of the Friendship Trail Bridge could be extensive. The table below shows estimates based on trail use in both counties:

	Total Visitors	Est. Spending	Est. Spending w/ FTB	Loss
2006	1,614,383	$32,287,660.00	$32,287,660.00	$-
2007	1,622,539	$32,450,780.00	$32,450,780.00	$-
2008	1,657,603	$33,152,060.00	$35,152,060.00	$2,000,000.00
2009	1,138,735	$22,774,700.00	$32,774,700.00	$10,000,000.00
2010	996,762	$19,935,240.00	$29,935,240.00	$10,000,000.00
			Total	**$22,000,000.00**

Other economic studies and user numbers of trails in the area indicate that loss of direct spending could be as great $22 Million from 2008 to 2010. While much of this money might have shifted to other activities in either county it is likely that it also shifted to other areas of the state. These estimates will need to be verified by future economic studies, but it must be understood that the closure of the bridge has economic impact as well.

Methodology

In addition to these 3 studies, we reviewed 20 studies of economic impact of trails and pedestrian bridge projects and recent studies by Tampa Bay & Company and Visit Clearwater/St. Pete. We focused mostly on direct spending because without further analysis it is impossible to look at the indirect impact. The Walkway, Orange County Trails and Minnesota Trail studies all estimated out-of-area visitors spend between $70 and $74. This is similar to the average $73 and $78 spent per person for day trip visitors in Tampa Bay & Company and Visit St. Pete/Pinellas studies from 2011.

The number of out-of-town visitors is determined to be 25% based on the use of other Florida trails including estimates for the Pinellas Trail, Orange County trails, and Walkway over the Hudson. Since Walkway and other bridges have seen as much as 48% to be outside their area 25% is a conservative estimate for FTB.

The estimates for the FTB are conservative as they do not include: any overnight guest spending, and any indirect wages and spending.

The additional spending by local users is difficult to calculate, but we have been able to give an estimate of the lost spending by local visitors since the bridge's closure. We used the estimated $20 per user spending that was identified in the Orange County trails study due to it's proximity and similarity.

Additional Benefits to the Economy

The direct spending by visitors is not the only economic impact that FTB will create in both counties it will also increase property values close to the bridge, decrease health care costs, and increase ability to recruit creative and technology oriented companies to the area.

Property Values: This analysis does not include any increase in property values close to the bridge that will result. The Proximity principle shows that land values will increase and more development will likely occur near the new bridge[45]. When the economic impact survey is performed during Phase 1 this will need to be studied in detail.

Additionally, according to the National Association of Homebuilders, trails are the top most

[45] http://sfnpc.org/files/DoParksMakeSense.pdf

requested community amenity wanted by perspective homeowners[46]. This bridge would provide that trail access for local development as well as a unique park.

Health Care Savings: Studies have shown that additional trails can create millions in savings for health care costs for counties of the size of Pinellas and Hillsborough County.

Studies also show that over 46% of American would likely bike to work if was possible[47]. This savings would be increased even further if the bridge is connected to trails on both sides of the bay and allows for a connection to the Courtney Campbell Causeway trail in development. Those connections would allow for additional cycling commuters in the region and significantly impact health care costs even from a small number of users.

Recruitment and Site Selection: It has been noted that trails and outdoor recreations like the Friendship Trail Bridge are a major part of recruiting people and companies in professional services and high tech industries[48]. This will have to be assessed as well in the Phase 1 economic impact study.

[46] National Association of Homebuilders Survey, 2008
[47] America Bikes; Trails and Greenways Clearing House; Bicycling/Moving America Forward, 2008
[48] The Rise of the Creative Class, Richard Florida, 2001
http://www.washingtonmonthly.com/features/2001/0205.florida.html

Manage Risk: *Risk Assessment*

There are three main categories of risk in this process which will need to be understood and mitigated; liability, risk to taxpayers, and fundraising.

Liability

The County has the option of delegating more or less authority to the Non-Profit at its discretion. However, our plan is based on analysis that attempts to minimize the exposure to liability for the County and Non-profit. The County enjoys significant protection from liability that would not exist if the Bridge was completely owned and operated by a private entity.

In Florida, under the principle of sovereign immunity and section 768.28, Florida Statutes, counties and municipalities are broadly immune from liability in excess of $200,000.00 per person and $300,000.00 per incident and punitive damages generally cannot be recovered. Further, a County is typically "immune from suit" for "judgmental" and "planning level" decisions. However, there are exceptions to the protection of sovereign immunity including, but not limited to, when a court finds bad faith or malicious conduct, and for certain willful and wanton acts. In addition, sovereign immunity only applies to government entities and "agents of the state." A court would look to the degree of control exercised by the County to determine whether a not-for-profit corporation is independent or acting at the direction of the County. An entity found to be acting outside of the control of the County will not be protected by sovereign immunity.

When the Non-Profit is created, its creation will have to be guided to ensure that both the Non-Profit and the County enjoy the maximum amount of protection from liability possible.

Due to the substantial liability protection enjoyed by the County pursuant to section 768.28, Fla. Stat., the County should retain ownership and significant control over the operations of the Bridge and any not-for-profit corporation formed to maintain and manage the operations of the Bridge. The formation of a not-for-profit corporation could alleviate some of the County's current burden regarding operating and funding the bridge while simultaneously drawing on the County's vast expertise regarding efficient allocation of resources and procurement of public funds.

References:

Section 768.29, Fla. Stat.
Agner v. APAC-Florida, Inc., 821 So. 2d 336, 339 (Fla. 1st DCA 2002)
Erickson v. Hunter, 932 F. Supp. 1380, 1386 (M.D. Fla. 1996)
Keck v. Eminisor, 46 So. 3d 1065, 1067 (Fla. 1st DCA 2010).

Perez v. Dep't of Transp., 435 So. 2d 830, 831 (Fla. 1983)

Pre-construction benchmarks

If the non-profit does not meet the pre-construction benchmarks in the first or second phases both counties will still need to demolish the bridge. However, this scenario creates very little risk at this time, since our plan calls for the demolition of the failing superstructure of the bridge. By doing this portion of demolition, we would have negated the major concerns about the existing structure and leave only the hump over the navigation channel and the piles. If the benchmarks are not met the counties could use the remaining appropriated funds to demolish more of the bridge (and possibly all of it if the bids are similar).

Post-construction fundraising

If at any point the non-profit cannot meet its obligations under the lease following the construction of the bridge then the county as owner of the bridge would be faced with the burden of operating the bridge. However, many different options will be available to the counties at that time including jointly operating the bridge themselves at a significantly reduced shared cost of $255,000 a year. For example, if attendance figures remain similar to the previous time the bridge was opened it would still only cost each county $81,000 per year over 30 years to operate after fees are taken into account

Identify Costs: *Development and Lifecycle Cost Analysis*

The organization will be responsible for fundraising and paying the capital and operations cost of the bridge in its entirety outside of the grants given by the counties and initial demolition of the superstructure of the bridge. Cost and revenue projections are outlined below.

Capital and Operations Requirements

The following table outlines the lifetime capital costs of this project:

LIFESPAN CAPITAL COSTS			
demolition of superstructure*	$	1,942,817.11	see following tables
repair of piles and caps	$	1,008,000.00	for breakdowns
repair to center hump	$	250,000.00	
repair high level spans	$	250,000.00	
reconstruct low spans	$	13,242,469.03	
base park facilities	$	500,000.00	
soft costs (eng, design, permit)	$	1,525,046.90	10% of hard cost
total cost reopen day one	**$**	**18,718,333.04**	
maintenance ops cost/ year	$	250,000.00	SDR May 2009 page 14 & 15 (avg)
number of years		30	
end of use demolition	$	7,000,000.00	
total lifecycle cost	**$**	**33,218,333.04**	

* Cost expended by the counties from existing appropriations

Demolition

Due to the change in demolition scheduling, our plan is to utilize the existing RFQ and proposals with a revision change order. The county's cost to demolish the bridge, is based below with estimated costs from on the RFP submitted by American Bridge Company.[49]

American Bridge RFP response	
246	total days
10,656	linear feet
$ 4,195,000.00	total fee
339	scope days (# of workers x # of days)
$ 12,374.63	**fee/scope day**
157	revised scope days (superstructure & mobilization)
$ 1,942,817.11	**revised demolition scope**

Repairs

The following table explains the estimated costs of repairs to the bridge prior to transforming the bridge and construction start in 2017:

REPAIR PILES AND CAPS	
252	pile caps
1,008	# piles
202	20% repair
5,000	$/ pile repair
$ 1,008,000.00	**total repair cost**

[49] Appendix E: Excerpts of American Bridge Bid for Demolition

Construction

The construction estimate is based on a construction estimate provided by local steel fabricator Florida Structural[50] and confirmed by a separate estimate from Sanford aluminum bridge manufacturer Gator Bridge.[51] The installation cost is based on a daily rate generated from American Bridge's RFP response.

RECONSTRUCTION OF LOW SPAN APPROACHES			
252.00	total spans		
48.00	length		
16.00	width	50	20 % amenity spans
768.00	total sqft per span	$ 35,000.00	amenity increase
$ 41,424.60	$/ span	$ 1,764,000.00	total increase
$ 10,439,000.00	from Florida Structural		
$ 1,764,000.00	amenity increase		
$ 1,039,469.00	installation (3/day, rate based on AB quote)		
$ 13,242,469.00	**total cost**		

Maintenance

Once opened, the bridge will require continual maintenance and inspection. We will follow FDOT's guidelines and allot an average of $250,000 per year, based on estimates provided in KCA/SDR report. These maintenance costs will eventually allow for the entire substructure to be repaired over the next 30 years.

[50] Appendix H: Florida Structural Estimate

[51] Appendix G: Gator Bridge Estimate

Operational Expenses

The previous operating costs were at most $255,000 a year for the bridge when it was open from 1999 to 2007[52]. We budget the same amount for the patrol and superficial maintenance of the bridge as was done at the time.

Previous expenses (Pinellas County):	
Personnel Expenses	**$126,820**
Salaries	$84,240
Overtime	$10,940
Benefits	$31,640
Operating Expenses	**$119,900**
Contracting Services	$100,000
Supplies	$7,100
Utilities	$10,300
Other Costs	$2,500
Total	**246,720**

We would contract with Pinellas County to use their expertise and services to operate the bridge. Therefore, we estimate the contract with Pinellas County will be the same amount to operate the bridge when previously opened. The leases and fees for additional amenities will cover all operating costs for those additions.

[52] Appendix I: Pinellas County Operations Budget 2006

Non-Profit Operating costs and Personnel

For the foreseeable future only one staff member would be required to oversee fundraising for the transformation of the Friendship Trail Bridge. During the fundraising phase, this staff member would be focused on fundraising. Following construction, this person would be an executive director in charge of all day-to-day aspects of the non-profit and bridge. This plan assumes that contractors will perform most of the remainder of the work and volunteer services.

Almost all the operational costs of the bridge will be associated with fundraising, administration, and the contracted services to Pinellas County.

- **Fundraising**

  We expect fundraising will cost $220,000 a year from staff, contractors, and materials during Phase 2 & 3. Afterward, this amount will be reduced by $180,000 to $40,000 per year in Phases 4 & 5.

Phase 2 & 3	Fundraising Operational Costs
Contracting	**$120,000**
Fundraising consultants	$60,000
Website & Consultant	$5,000
Printing & Design	$20,000
Events	$15,000
Grant Writers	$20,000
In House Expenses	**$100,000**
Salary	$70,000
Benefits	$20,000
Supplies & Travel	$10,000
Total	**$220,000**

Phase 4 & 5	Fundraising Operational Costs
Contracting	**$40,000**
Fundraising consultants	$18,000
Website & Consultant	$2,000
Printing & Design	$5,000
Events	$10,000
Grant Writer	$5,000
In House Expenses	**$0**
Salary	$0
Benefits	$0
Supplies	$0
Total	**$40,000**

- **Administrative**

During Phases 2 & 3 most administrative functions will be provided by volunteers and board members. The initial focus on fundraising will require this non-profit to stay very volunteer-centric, and will rely on the single fundraising staff member to do some administrative duties. Most expenses will be related to banking, legal, and public meeting expenses. This section also includes a yearly operating reserve of 5% of operating costs.

During Phases 4 &5 the budget of $30,000 in Phases 1 & 2 will increase to $310,000 to operate the bridge.

Phase 2 & 3	Admin Operating Costs
Contracting	**$13,000**
Banking	$2,000
Legal	$6,000
Printing	$5,000
In House Expenses	**$17,000**
Public Meetings	$6,000
Reserve	$11,000
Total	**$30,000**

Phase 4 & 5	Admin Operating Costs
Contracting	**$250,000**
Banking	$2,000
Legal	$8,000
Printing & Design	$15,000
Pinellas County	$225,000
In House Expenses	**$110,000**
Salary	$70,000
Benefits	$20,000
Public Meetings	$2,000
Supplies & Travel	$18,000
Reserve	$0
Total	**$360,000**

Operating Expenses

The table below shows the operating expenses of the bridge over a 30 year life-span. These expenses do not include any maintenance to the bridge which is included in capital costs. Operating costs are expected to be covered by revenue within 3 years of opening the bridge.

	Staff	Contractors	Variable Exp	Total
2012	$0	$225,000	$25,000	$250,000
2013	$70,000	$230,000	$50,000	$350,000
2014	$100,000	$120,000	$30,000	$250,000
2015	$100,000	$120,000	$30,000	$250,000
2016	$100,000	$120,000	$30,000	$250,000
2017	$100,000	$325,000	$55,000	$480,000
2018	$118,000	$280,000	$32,000	$430,000
2019	$118,000	$280,000	$32,000	$430,000
2020	$118,000	$280,000	$32,000	$430,000
2021	$118,000	$280,000	$32,000	$430,000
2022	$118,000	$280,000	$32,000	$430,000
2023	$118,000	$280,000	$32,000	$430,000
2024	$118,000	$280,000	$32,000	$430,000
2025	$118,000	$280,000	$32,000	$430,000
2026	$118,000	$280,000	$32,000	$430,000
2027	$118,000	$280,000	$32,000	$430,000
2028	$118,000	$280,000	$32,000	$430,000
2029	$118,000	$280,000	$32,000	$430,000
2030	$118,000	$280,000	$32,000	$430,000
2031-35	$590,000	$1,400,000	$285,000	$2,275,000
2036-40	$590,000	$1,400,000	$285,000	$2,275,000
2041-45	$590,000	$1,400,000	$285,000	$2,275,000
2046-47	$236,000	$560,000	$64,000	$860,000
	$4,010,000	**$9,540,000**	**$1,555,000**	**$15,105,000**

Capital Requirements

The table below demonstrates the complete table of Capital Requirements over a 30 year life-span of the bridge. The total comes to $31,025,000 over the entire life of the bridge including demolition. The capital costs will be supported mostly from fundraising.

	Construction	Repair & Maintenance	Demolition	Total
2012	$0	$0	$1,942,817*	$0
2013	$0	$0	$0	$0
2014	$0	$0	$0	$0
2015	$0	$0	$0	$0
2016	$0	$1,008,000	$1,400,000	$2,408,000
2017	$15,267,000	$250,000	$0	$15,517,000
2018	$0	$250,000	$0	$250,000
2019	$0	$250,000	$0	$250,000
2020	$0	$250,000	$0	$250,000
2021	$0	$250,000	$0	$250,000
2022	$0	$250,000	$0	$250,000
2023	$0	$250,000	$0	$250,000
2024	$0	$250,000	$0	$250,000
2025	$0	$250,000	$0	$250,000
2026	$0	$250,000	$0	$250,000
2027	$0	$250,000	$0	$250,000
2028	$0	$250,000	$0	$250,000
2029	$0	$250,000	$0	$250,000
2030	$0	$250,000	$0	$250,000
2031-35	$0	$1,250,000	$0	$1,250,000
2036-40	$0	$1,250,000	$0	$1,250,000
2041-45	$0	$1,250,000	$0	$1,250,000
2046-47	$0	$500,000	$0	$500,000
End of Life			$5,600,000	$5,600,000
	$15,267,000	**$8,758,000**	**$7,000,000**	**$31,025,000**

*Paid by existing appropriations from both counties

Fundraising & Revenue Projections

Fundraising can be divided into four categories:

1. Sponsors of the bridge including the named sponsors of the specific sections of bridge and the named sponsors of events.
2. Donations of all types
3. Grants
4. Pre-construction memberships.

While 77% of the fundraising will be done in the first 5 years, there is still a need for fundraising to cover the costs of the maintenance and any future shortfalls.

Year	Named Sponsors	Donations	Grants	Memberships	Total
2012	$0	$120,000	$150,000	$30,000	$300,000
2013	$10,000	$1,100,000	$1,000,000	$40,000	$2,150,000
2014	$510,000	$1,500,000	$750,000	$40,000	$2,800,000
2015	$2,025,000	$1,425,000	$1,000,000	$50,000	$4,500,000
2016	$525,000	$3,925,000	$1,500,000	$50,000	$6,000,000
2017	$50,000	$2,450,000	$2,000,000	$0	$4,500,000
2018	$50,000	$175,000	$25,000	$0	$250,000
2019	$50,000	$175,000	$25,000	$0	$250,000
2020	$50,000	$150,000	$25,000	$0	$225,000
2021	$50,000	$150,000	$25,000	$0	$225,000
2022	$50,000	$125,000	$25,000	$0	$200,000
2023	$50,000	$125,000	$25,000	$0	$200,000
2024	$50,000	$125,000	$25,000	$0	$200,000
2025	$50,000	$125,000	$25,000	$0	$200,000
2026	$50,000	$125,000	$25,000	$0	$200,000
2027	$50,000	$125,000	$25,000	$0	$200,000
2028	$50,000	$125,000	$25,000	$0	$200,000
2029	$50,000	$125,000	$25,000	$0	$200,000
2030	$50,000	$125,000	$25,000	$0	$200,000
2031-35	$250,000	$625,000	$125,000	$0	$1,000,000
2036-40	$250,000	$625,000	$125,000	$0	$1,000,000
2041-45	$250,000	$625,000	$125,000	$0	$1,000,000
2046-47	$100,000	$250,000	$50,000	$0	$400,000
Total	**$4,620,000**	**$14,420,000**	**$7,150,000**	**$210,000**	**$26,400,000**

Revenue

We expect the revenue once the bridge opened to continue to grow with use. While there are cyclical and demographic shifts that might change the users of the bridge, all indications suggest that the increases in attendance each year will be 4% to 7% and are well within the existing patterns of local parks and trails. This allowed us to project revenue over the life of the bridge from fees and memberships.

Year	Users	Parking Fees	Memberships	Total
2012	0	$0	$0	$0
2013	0	$0	$0	$0
2014	0	$0	$0	$0
2015	0	$0	$0	$0
2016	0	$0	$0	$0
2017	800,000	$280,000	$100,000	$380,000
2018	680,000	$251,600	$91,800	$343,400
2019	727,600	$291,040	$109,140	$400,180
2020	771,256	$331,640	$115,688	$447,328
2021	809,819	$364,418	$133,620	$498,039
2022	842,212	$378,995	$147,387	$526,382
2023	892,744	$401,735	$156,230	$557,965
2024	982,019	$441,908	$171,853	$613,762
2025	1,040,940	$468,423	$182,164	$650,587
2026	1,082,577	$487,160	$189,451	$676,611
2027	1,169,184	$526,133	$204,607	$730,740
2028	1,134,108	$510,349	$198,469	$708,818
2029	1,156,790	$520,556	$202,438	$722,994
2030	1,179,926	$530,967	$206,487	$737,454
2031-35	6,342,102	$2,853,946	$951,315	$3,805,261
2036-40	6,659,208	$2,996,643	$998,881	$3,995,525
2041-45	6,992,168	$3,146,476	$1,048,825	$4,195,301
2046-47	2,657,024	$1,195,661	$398,554	$1,594,214
	35,919,676	**$15,977,649**	**$5,606,911**	**$21,584,560**

Income

Over a 5 year fundraising program and a 30 year life span, we project the Friendship Trail Bridge will raise $47.9 million from donations and revenue to build and operate the bridge. During a 35 year life of the project 45% will come from revenue and 55% will come from donations. Over a 30 year lifetime of operating the bridge 79% of the income needed will come from revenue.

Year	Fundraising	Revenue	Income
2012	$300,000	$0	$300,000
2013	$2,150,000	$0	$2,150,000
2014	$2,800,000	$0	$2,800,000
2015	$4,500,000	$0	$4,500,000
2016	$6,000,000	$0	$6,000,000
2017	$4,500,000	$380,000	$4,880,000
2018	$250,000	$343,400	$568,400
2019	$250,000	$400,180	$625,180
2020	$225,000	$447,328	$672,328
2021	$225,000	$498,039	$698,039
2022	$200,000	$526,382	$726,382
2023	$200,000	$557,965	$757,965
2024	$200,000	$613,762	$813,762
2025	$200,000	$650,587	$850,587
2026	$200,000	$676,611	$876,611
2027	$200,000	$730,740	$930,740
2028	$200,000	$708,818	$908,818
2029	$200,000	$722,994	$922,994
2030	$200,000	$737,454	$937,454
2031-35	$1,000,000	$3,805,261	$4,805,261
2036-40	$1,000,000	$3,995,525	$4,995,525
2041-45	$1,000,000	$4,195,301	$5,195,301
2046-47	$400,000	$1,594,214	$1,994,214
Total	**$26,400,000**	**$21,584,560**	**$47,984,560**

The Balance Sheet

The projections for revenue in costs leave a balance of $1.4 million over a 30 year life. The balance is necessary for any legacy projects after demolition or to help fund any future use of the bridge to extend its life to beyond 30 years. Each year leaves a reserve that will cover the minimum operating and capital costs for the next year to keep the bridge open.

(In Thousands of Dollars)

Year	Fundraising	Revenue	Total Income	Operating Expense	Capital Expense	Total Costs	Balance
2012	$300	$0	$300	$250	$0	$250	$50
2013	$2,150	$0	$2,150	$350	$0	$350	$1,850
2014	$2,800	$0	$2,800	$250	$0	$250	$4,400
2015	$4,500	$0	$4,500	$250	$0	$250	$8,650
2016	$6,000	$0	$6,000	$250	$2,408	$3,358	$11,292
2017	$5,000	$380	$5,380	$480	$15,517	$15,997	$875
2018	$250	$343	$593	$430	$250	$680	$788
2019	$250	$400	$650	$430	$250	$680	$758
2020	$225	$447	$672	$430	$250	$680	$750
2021	$225	$498	$723	$430	$250	$680	$793
2022	$200	$526	$726	$430	$250	$680	$839
2023	$200	$558	$758	$430	$250	$680	$917
2024	$200	$614	$814	$430	$250	$680	$1,051
2025	$200	$651	$851	$430	$250	$680	$1,222
2026	$200	$677	$877	$430	$250	$680	$1,419
2027	$200	$731	$931	$430	$250	$680	$1,670
2028	$200	$709	$909	$430	$250	$680	$1,899
2029	$200	$723	$923	$430	$250	$680	$2,142
2030	$200	$737	$937	$430	$250	$680	$2,399
2031-35	$1,000	$3,805	$4,805	$2,275	$1,250	$3,525	$3,679
2036-40	$1,000	$3,996	$4,996	$2,275	$1,250	$3,525	$5,150
2041-45	$1,000	$4,195	$5,195	$2,275	$1,250	$3,525	$6,820
2046-47	$400	$1,594	$1,994	$860	$500	$1,360	$7,454
End of Life	$0	$0	$0	$0	$5,600	$5,600	$1,854
Total	**$26,400**	**$21,584**	**$47,984**	**$15,105**	**$31,025**	**$46,130**	**$1,854**

A VISION BEYOND DEMOLITION:

A PLAN TO TRANSFORM THE FRIENDSHIP TRAIL BRIDGE INTO AN ICONIC LINEAR PARK FOR ALL OF TAMPA BAY TO ENJOY.

Prepared by:

Kenneth Cowart AIA
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Julia Freeman
Brian Willis

Special thanks to:

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Shanna Gillette
Alan Snell
Ralph Verrastro P.E.
ASD, Inc.
Stantec/ Wilson Miller
Creative Tampa Bay
Walkway Over the Hudson
Hillsborough County BOCC
Hillsborough County Public Works Department
Pinellas County Parks
T. Hampton Dohrman
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Appendix A

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Tampa, FL 33605
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Stantec

April 16, 2012

Kenneth Cowart, AIA, LEED, AP
1240 E. 5th Avenue
Tampa, FL 33605

Re: Friendship Trail Bridge Rehabilitation

Dear Mr. Cowart:

This letter provides our professional opinion related to the condition of the Friendship Trail Bridge and recommendations related to the proposed bridge rehabilitation to allow reopening of the bridge for pedestrians and bicycles. It also provides a conceptual cost estimate for the rehabilitation. If a preliminary design cost estimate for the rehabilitation alternatives is desired we can provide a cost proposal that includes the following scope of services:

1. In-depth inspection of the bridge elements to remain including an underwater inspection
2. Repair recommendations for bridge rehabilitation based on a 30 year life
3. Preliminary design for at least 3 superstructure alternatives
4. Prepare a preliminary construction cost estimate for each alternative
5. Prepare a report summarizing the findings that provides a project approach for construction

Our opinions are based on a cursory inspection performed on April 11, 2012 and a review of the following:

1. "Load Capacity Assessments of the Friendship Trail Bridge (Old Gandy Bridge)" by Kisinger Campo & Associates in association with SDR Engineering Consultants, Inc. dated November 2008
2. "Detailed Inspection and Evaluation of the Friendship Trail Bridge (Old Gandy Bridge)" by Kisinger Campo & Associates in association with SDR Engineering Consultants, Inc. dated May 2009
3. "Friendship Trail Bridge Peer Review – Letter Report" by E. C. Driver & Associates, Inc. dated March 8, 2010
4. "Probabilistic Assessment of the Friendship Trail Bridge" by a USF research team dated August 2011
5. A Bridge Inspection Report prepared by Wade Trim in association with Bolt Underwater Services, Inc. dated March 2003
6. Copies of construction plans used for the original construction and past rehabilitation projects

The bridge is 13,770'-6" (2.608 miles) long and has a width of 30'-7". The bridge superstructure is comprised of three different span arrangements including:

1. 252 low-level approach spans that are spaced at 48'-0" that consist of four post-tensioned concrete beams and a composite concrete deck. These spans are founded on pile bents. Every third bent is supported on 6 – 20 inch square prestressed piles and the two bents in between are supported on 4 – 20 inch square prestressed concrete piles.
2. 20 high-level approach spans that are 72'-0" long that consist of six post-tensioned concrete beams and a composite concrete deck.
3. The main channel span configuration consists of four three-span continuous steel girders of 74'-0" - 86'-6" - 74'-0" and a composite concrete deck.

Our inspection findings and recommendations include:

1. The superstructure elements (4 post-tensioned concrete beams and concrete deck) for the 252 low-level approach spans are in poor condition and demolition of these spans is recommended.
2. The superstructure elements for the 20 high level approach spans and the 3 main channel spans (the "hump") are in relatively good condition and the continued use of these spans is feasible as part of the proposed rehabilitation project.
3. The concrete pier caps show signs of cracking due to corrosion of the embedded reinforcing steel. The bottom corners of the caps are where this problem is most prevalent. Many of the caps have been repaired in the past. This deficiency does not reduce the safe load capacity of the bridge; however, some repairs should be performed as part of the proposed bridge rehabilitation and future patching repairs will be required as part of on-going maintenance.
4. The condition of the prestressed concrete piles on the intermediate bents ranges from poor to good as a result of past pile jackets that have been installed. Some of the pile jackets have failed and some are in good condition. This deficiency has not reduced the safe load capacity of the bridge up to this point in time; however, some repairs should be performed as part of the proposed bridge rehabilitation and future repairs will be required as part of on-going maintenance. Integral, structural jackets using a galvanic cathodic protection system should be used for all future pile repairs. The pile bents supported on 4 piles are more of a concern than the pile bents supported on 6 piles due the additional redundancy.
5. We agree with E.C. Driver & Associates' opinion that using carbon fiber reinforced sheets is not an appropriate repair method for repairing the deteriorated post-tensioned beams. If an alternative is desired that includes opening the bridge at a minimum cost for a limited time period, we recommend considering:
    a. Adding "sister" beams immediately adjacent to the deficient beam using conventional reinforcement that works compositely with the deficient beam.
    b. Strengthening the deficient post-tensioned beams by adding high strength all thread bars on each side of the deficient beam to restore the original post-tension forces to the beams.

Feasible Rehabilitation Alternatives

The proposed feasible rehabilitation alternatives that could be considered for this bridge include:

Rehabilitation Alternative #1

1. Demolition of the superstructures of the 252 low level spans.
2. Salvage the pile bents for the 252 low level spans.
3. Salvage the superstructure and substructures for the 20 high level approach spans and the 3 main channel spans.
4. Perform patching repairs on the salvaged superstructure elements for the 20 high level spans.
5. Perform patching repairs on the pile caps and install structural cathodic protection pile jackets as required on all of the salvaged pile bents.
6. Construct new 48 foot span superstructures for the 252 low level spans. The proposed width of the bridge should be at least 12 feet wide clear between railings. The typical design live loading is 85 PSF and the design should also be checked for an occasional emergency vehicle. Some superstructure types that could be considered include:
    a. Precast, prestressed concrete double tee sections using concrete closure pours at the joints
    b. Precast, prestressed concrete adjacent slab units
    c. Prefabricated galvanized steel or aluminum through trusses with precast concrete deck panels

Rehabilitation Alternative #2

1. Demolition of the superstructures of the 252 low level spans.
2. Demolition of the pile bents that are supported by only 4 piles (estimate 166) and salvage the remaining pile bents that are supported by 6 piles (estimate 84)
3. Salvage the superstructure and substructures for the 20 high level approach spans and the 3 main channel spans.
4. Perform patching repairs on the salvaged superstructure elements for the 20 high level spans.
5. Perform patching repairs on the 84 salvaged pile caps and install structural cathodic protection pile jackets as required on all of the salvaged pile bents.
6. Construct new 144 foot span superstructures for the remaining 84 salvaged low level spans. The proposed width of the bridge should be at least 12 feet wide clear between railings. The typical design live loading is 85 PSF and the design should also be checked for an occasional emergency vehicle. Some superstructure types that could be considered include:
    a. Prefabricated galvanized steel through truss with precast concrete deck panels
    b. A galvanized, welded, steel through girder with precast concrete deck panels.

We anticipate that Alternative #2 would have a slightly higher initial cost, but the life cycle cost over an estimated 30 year life span would be lower due to the elimination of the 166 pile bents and the associated on-going maintenance costs for these bents.

Conceptual Cost Estimate

Partial Demolition	Based on negotiating a change order with American Bridge = $3,000,000
New Superstructure	252 spans x 48 feet x 14' wide x $75/SF = $12,700,000
Pile Bent Repairs	Based on recommendations in May 2009 report = $1,000,000

Total Construction Cost = $16.7mil

Thanks for the opportunity to assist your committee exploring options to save the Friendship Trail Bridge. Please contact me at 239-216-1370 by phone or ralph.verrastro@stantec.com by e-mail with questions.

Respectfully,

Ralph Verrastro, PE
Senior Project Manager, Bridges

Appendix B

KISINGER CAMPO & ASSOCIATES CORP.
engineering • inspection • planning
Allen Kisinger 1904-1981

December 16, 2008

Mr. Chris Bridges, P.E.
Hillsborough County
601 E. Kennedy Blvd., 23rd floor
Tampa, FL 33601

Re: Friendship Trail Bridge

Dear Mr. Bridges:

Kisinger Campo & Associates Corp. (KCA) has received the completed assessment report (attached) from Dr. Mohsen Shahawy, P.E., of SDR Engineering Consultants, Inc. (SDR), regarding the existing condition of the Friendship Trail Bridge. As we have discussed, SDR was part of the team that investigated the Skyway Fishing Piers during a long term evaluation through the Florida Department of Transportation (FDOT) District 1 & 7 Structures Maintenance Office. SDR's primary recommendation for the Friendship Trail Bridge is that it should be closed due to the condition of the existing post-tensioned beams, with a qualification that some spans may be suitable for conditional use pending further investigation. KCA concurs with this assessment.

As the County is aware, the FDOT had recently contacted KCA to share the results of the Skyway Fishing Pier study as the configuration of post-tensioned concrete beams are similar to that of the Friendship Trail Bridge (for which KCA had developed pending repair plans). Past load ratings of the Friendship Trail Bridge by others determined that the bridge had sufficient capacity for ongoing use considering an assumed reduction in beam capacity due to corrosion. However, information obtained from the fishing pier study regarding the behavior of the post-tensioned beams after the onset of corrosion, combined with observations during our recent site visit of substantial deterioration since KCA's previous inspection, indicated that the Friendship Trail Bridge beams may not provide the necessary level of reliability for the continued safe use of the structure. Even though KCA had incorporated a tendon splice repair detail in the proposed repair plans that had been used by the FDOT previously, Dr. Shahawy's analysis shows the beams still have corrosion-related strength limitations that affect the structure's integrity.

At your request, KCA has also attached budgetary estimates for the County's use in determining alternatives to full closure of the bridge. As a baseline, construction costs are provided for complete demolition and replacement of the bridge. Also included are costs for replacement of an individual superstructure span, a partial superstructure span (at half the current width), and repair of a typical span. The currently open portion of the bridge, in the region of the catwalk, comprises approximately 84 spans. As we have discussed, a planned detailed investigation, including invasive testing, will enable assignment of these cost alternatives per span depending on the respective suitability of the

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spans being investigated. Ultimately, this will allow for a better estimate of the total construction cost for the County's preferred option.

Please let me know of any comments or questions you may have after reviewing the report and estimates. KCA and SDR will be available to discuss these findings at the County's convenience.

Sincerely,

David B. Thompson, P.E.
Project Manager

cc: file 1200613.00

Structure Design and Rehabilitation, Inc.

LOAD CAPACITY ASSESSMENTS OF THE FRIENDSHIP TRAIL BRIDGE (OLD GANDY BRIDGE)

FINAL REPORT

Prepared for:

Kisinger Campo & Associates
Tampa, Florida

by

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November 2008

LOAD CAPACITY ASSESSMENTS OF THE FRIENDSHIP TRAILBRIDGE (OLD GANDY BRIDGE),

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PROJECT SUMMARY

The old Gandy Bridge was constructed in 1956. The Florida Department of Transportation (FDOT) transferred ownership of the bridge to both Hillsborough and Pinellas Counties in 1997 instead of the previously planned demolition. The counties assumed joint ownership and changed the name to the Friendship Trail Bridge. The primary objective of this report is to accurately evaluate the existing conditions and structural capacity of the Friendship Trail Bridge and recommend future action based on the results of this investigation.

A special visual inspection of the Friendship Trail Bridge was conducted on November 4, 2008 by SDR Engineering, Inc. This inspection was for the purpose of verifying the actual existing conditions and to evaluate the effectiveness of previous repairs. The results of this inspection indicate that the girders exhibit severe signs of deterioration and corrosion of the prestressing steel bars. Significant concrete spalling, broken prestressing steel bars, corrosion and longitudinal and inclined cracking following the trajectories of the steel bars can be observed routinely on the majority of the low spans. These observations are consistent with the presence of high concentration of chlorides in the concrete surrounding the steel bars which results in excessive internal corrosion and the corresponding swelling of the steel bars resulting in the observed cracking.

Exposed and corroded steel bars are observed at multiple locations in the same span. In many cases the corroded steel bars are very close to the end support which is a serious concern due to the sensitive nature of the anchorage areas and the potential for sudden failure if one or more anchorages are lost. This recent inspection suggests that the entire loss of the steel bars and corresponding failure is a serious possibility due to the continuing corrosion and the severity of the environment where the bridge is located.

Examination of previously repaired areas shows excessive concrete spalling and corrosion within the repaired areas which indicate the ineffectiveness of these

repairs. All signs point to excessive chlorides in the concrete and internal steel corrosion which could not be repaired by patching the concrete.

This bridge is one of the first prestressed structures built in the US and this early design does not conform to current AASHTO design specifications and lacks durability and safety features that are elements of modern design. Computer modeling and analysis of the bridge considered the cases of partial loss of 25% of the steel area, the loss of one of the bottom steel bars, total and partial loss of the bottom two steel bars and the loss of one of the bottom steel bars and a draped bar.

The analysis results indicate that the Friendship Trail Bridge is unsafe for operation and should be closed immediately. While some portions of the bridge might appear to be in good condition, the high concentration of chlorides and the shallow concrete cover will likely results in bar breakage within a short period of time. Unfortunately, breakage of the steel bars due to pitting and stress corrosion is currently present and has been observed in the past and since this is an unpredictable condition, continuing deterioration will result in unavoidable deterioration of the remaining girders.

Keeping the bridge in operation requires access to emergency vehicles to address the need for any immediate medical attention or other accidents. The analysis results clearly show that portions of the bridge could collapse under its own dead weight and the only safety margin is the factored dead load. This represents a serious problem with regard to the presence of emergency vehicles on the structure.

In summary, the Friendship Trail Bridge is located in extremely aggressive environment, vulnerable to wave attack, classified as structurally deficient and its design and service life are exceeded. The reinforcement concrete cover is shallow and the observed cracking is the result of internal steel corrosion due to heavy concentration of chlorides. The wide spread and significant corrosion, concrete section loss and broken prestressing steel bars near the ends of the girders cannot be remedied with current repair methods and will be extremely cost prohibitive to

repair. Previous repairs are showing significant degree of deterioration and any future repairs will be an expensive short fix and ineffective. It is therefore concluded that the closure of bridge and possible demolition is in the best interest to the two counties and the Public.

LOAD CAPACITY ASSESSMENTS OF THE FRIENDSHIP TRAILBRIDGE (OLD GANDY BRIDGE),

1. INTRODUCTION AND SCOPE OF WORK

1.1 Introduction

Constructed in 1956, the old Gandy Bridge carried westbound traffic across Old Tampa Bay until 1995 when a new westbound bridge was opened. The Florida Department of Transportation (FDOT) had plans to demolish the bridge when citizens from both Hillsborough and Pinellas Counties urged their local governments to save the bridge from demolition. In 1997, the counties assumed joint ownership and in December of 1999, the old bridge began its new life as the Friendship Trail Bridge (Figure 1.1), becoming one of the longest pedestrian structures over water in the world.

Figure 1.1 The Friendship Trail Bridge

This bridge is among a number of bridges designed and constructed in the state of Florida during the early to late 1950's that included the first wide use of prestressed concrete in the United States. The girders as will be described later in the report are post-tensioned and contain nominal shear reinforcement only in the end blocks.

1.2 Scope of the Work

The Friendship Trail Bridge is scheduled for rehabilitation; however, recent study of the Skyway Fishing Piers which is similar in details resulted in the closure of the piers. It is necessary to closely examine the current conditions of the Friendship Trail post-tensioned beams through field and structural evaluation before proceeding with the planed rehabilitation. This study will provide information on whether the planed rehabilitation is effective or for closure of the bridge, if and when that should become necessary.

The primary objective of this report is to accurately evaluate the current conditions and structural capacity of the bridge and recommend future actions based on the results of this investigation. Following are the tasks as specified in the scope of services:

1. Review of bridge inspection reports, load ratings, and as-built repair and modification plans for the post tensioned beams. The main purpose of these reviews would be to obtain a better understanding of past beam damage assessments.

2. Conduct water-side field review of the bridge to obtain an accurate assessment of current conditions. The primary focus will be on a pre-arranged selection of critical spans with cursory review of the remainder of the structure. A secondary purpose will be to collect direct and/or circumstantial data supporting causes of PT bar deterioration and potential fracture.

3. Perform analysis of current structural condition using data collected from tasks 1 and 2 above. Emphasis shall be placed on verifying accuracy of load carrying capacity for the critical spans identified in tasks 1 and 2. Examine

reasons for PT bar fracture and bridge safety with regard to brittle failure potential and update load rating as necessary.

4. Prepare a detailed report discussing the findings of all the above tasks for distribution to the counties. This report should include justification for action to further restrict access or close the structure, if necessary to maintain public safety.

2. SITE INSPECTION AND EVALUATION OF CURRENT CONDITIONS

2.1 Structure Description

The bridge is 13,770’-6” (2.608 miles) long and has a width of 30’-7”. On the approach spans, the top of the roadway centerline is at elevation 11.5’. The bridge is comprised of three different span arrangements. There are 252 low-level approach spans that are 48’-0” long, each consisting of four post-tensioned concrete beams. There are 20 high-level approach spans that are 72’-0” long that consist of six post-tensioned concrete beams each. The channel span configuration consists of four three-span continuous steel girders of 74’-0” - 86’-6” - 74’-0”. The minimum vertical clearance at the main channel is 43’-6” at mean high water.

The lower concrete approach spans are the most vulnerable to wave attacks and are located in extremely aggressive environment. The shallow reinforcement concrete cover does not provide the necessary protection against heavy concentration of chlorides with the resulting steel corrosion. Each simply supported span consists of 7.0” thick reinforced concrete deck supported by four prestressed concrete girders with a center to center spacing of 8’-6”.The overall length of the span from center to center of piers is 48'-0" while the center to center of bearings is 46'-4". The precast concrete intermediate diaphragms are transversely connected to the girders through a single lightly tensioned steel bar at the center of each diaphragm. The transverse tensioning bars are anchored to the exterior girders. Figure 2.1 shows the span details.

The precast I shape girders are 3’-4”. Each girder is precast with tapered block at each end. Each rectangular end block is 16 inches wide and extends for 3’-0” long distance before tapering to the thickness of the web over 1’-6” distance. Each girder is post-tensioned with (2) straight and (2) draped 1 1/8” diameter high strength steel bars. Each steel bar has an ultimate tensile strength of 150 ksi and is tensioned to 100 ksi. The post-tensioning bars are anchored at each end with wedge assemblies and 6”x 10”x 1 ¾” bearing plates recessed into the end blocks. The steel bars are

grouted into the 1 ½" aluminum ducts. The minimum specified compressive concrete strength of the girders and deck are 5,000 psi and 3,600 psi, respectively. Figure 2.2 shows girder details.

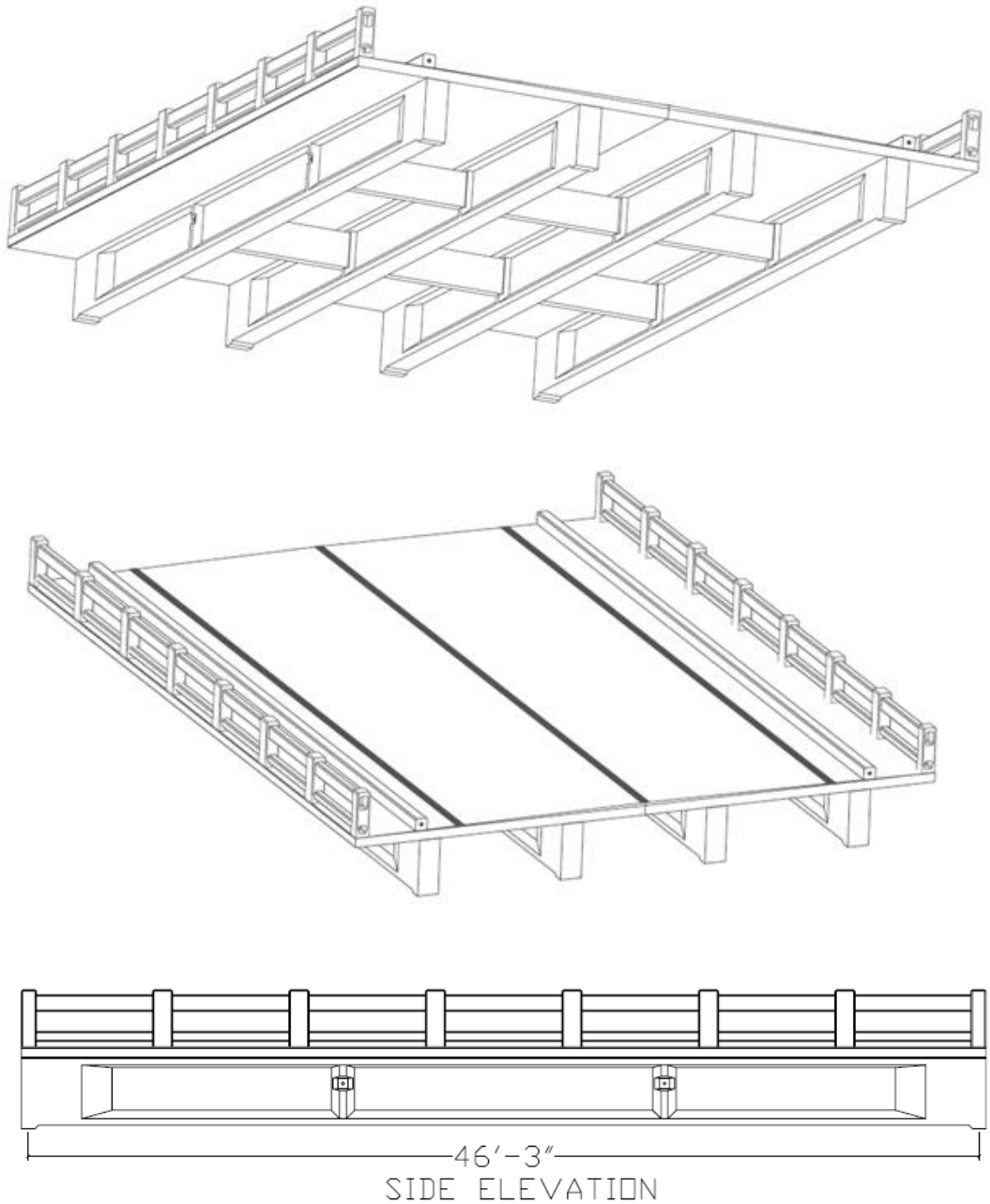

Figure 2.1 Span Details

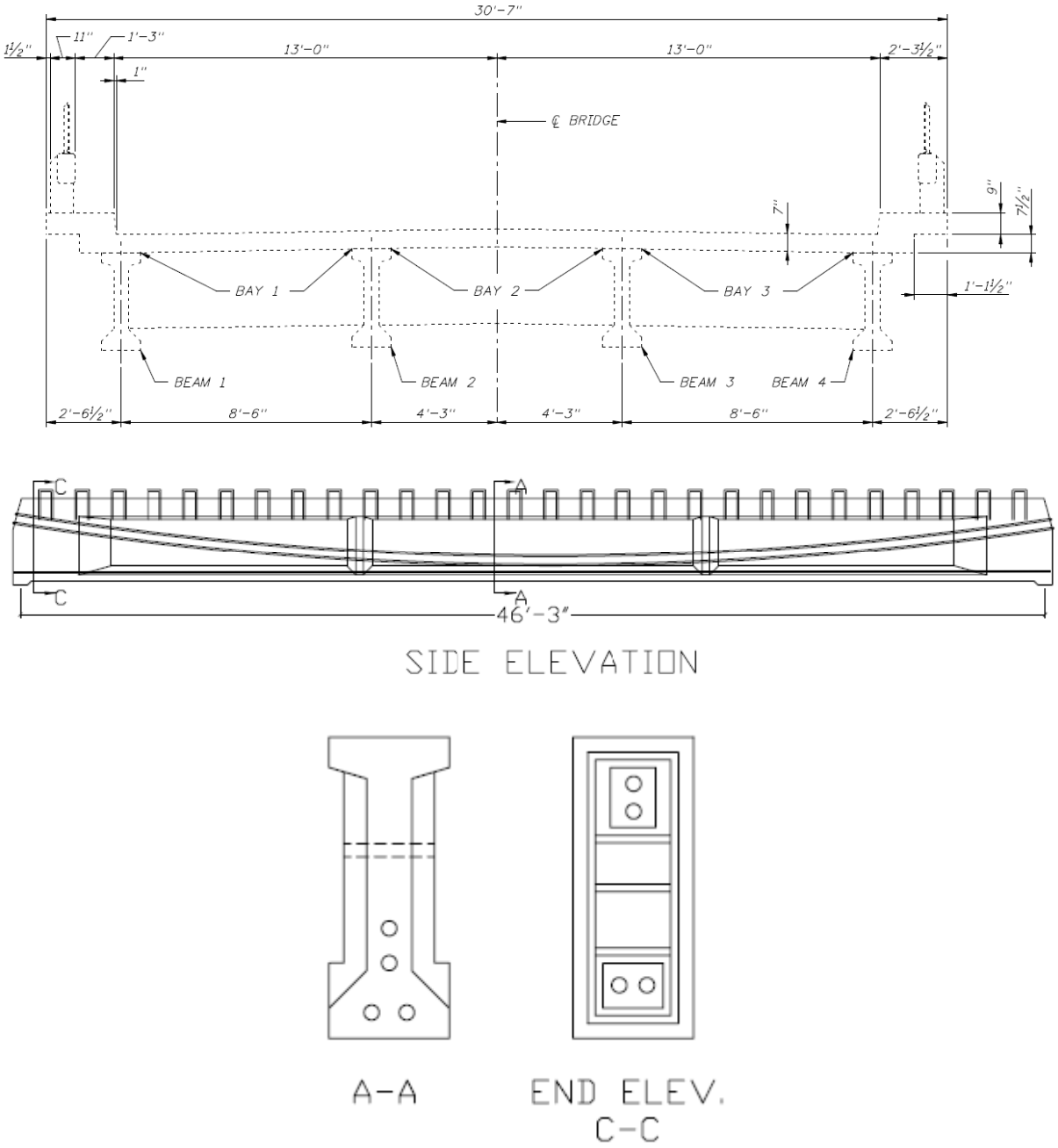

Figure 2.2 lower concrete approach spans - Cross-section and Girder Details

Shear reinforcement is provided only at the end blocks by 8 # 4 enclosed rectangular steel stirrups. In addition, four (4) No. 6 U-shaped horizontal steel bars, equally spaced over the depth of the beam extend beyond the end of the beam and are anchored into the end diaphragm. Interlaminate shear between the girder and the deck slab is resisted by U-shaped No. 6 bars spaced at 1-8 along the length of the beam. Figure 2.3 shows end block shear reinforcement details.

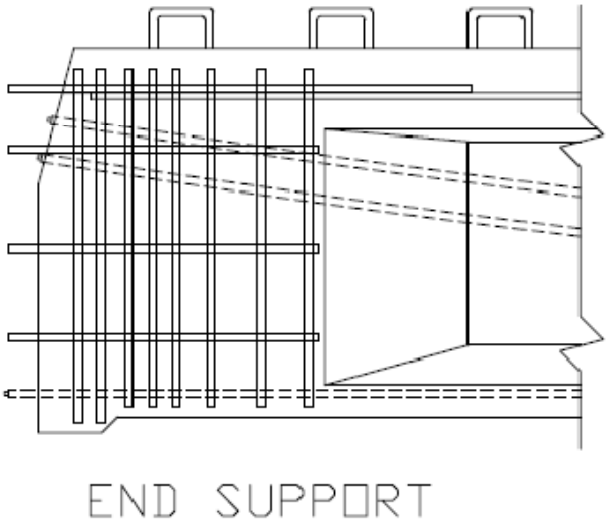

Figure 2.3 End Block Shear Reinforcement Details

2.3 November 2008 Site Inspection

A special inspection of the Friendship Trail Bridge was conducted on November 4, 2008 by SDR Engineering, Inc. This inspection was for the purpose of verifying the actual existing conditions and to evaluate the effectiveness of previous repairs. This inspection was limited to the low level approach spans. Figure 2.4 shows the observed typical deficiencies.

- Generally the girders show severe signs of deterioration and corrosion of the prestressing steel bars. Significant longitudinal and inclined cracking following the trajectories of the steel bars can be observed routinely on the majority of the low level approach spans. The general nature of the cracking observed on

the external girders is consistent with the presence of high concentration of chlorides in the concrete surrounding the steel bars which results in excessive internal corrosion and the corresponding swelling of the steel bars resulting in the observed cracking. These cracks are consistent in shape and frequency. In many cases multiple cracks are present.

- Broken and exposed corroded bars are observed at multiple locations. In many cases the corroded steel bars are very close to the end support which represents a safety issue with regard to shear resistance and anchorage failure. Exposed and heavily corroded bars with extensive surface pitting can be seen on the majority of the spans. It should be noted that according to FDOT sources with knowledge of the history of the bridge, significant number of PT splices have been installed in past projects to repair broken steel bars.

- Sounding of the concrete at various locations indicates significant internal voids. Light hammering of these areas resulted in significant concrete spalling and exposure of heavily corroded prestressing bars. Spot measurements of the corroded bars showed an average diameter of approximately ¾ inch which is only 66% of the original diameter of the steel bar. The corresponding loss in steel bar cross sectional area is approximately 56%.

- These heavily corroded steel bars are not limited to a single bar or a single girder. In many cases, 2 or 3 of the four steel bars in a girder are corroded and multiple girders in the same span show heavy corrosion and section loss.

This recent inspection indicates that there is a strong potential for sudden collapse of many of these spans due to the continuing corrosion and the loss of the steel area bars.

Figure 2.4 Observed Deficiencies in the Girders

Figure 2.4 Observed Deficiencies in the Girders (Cont.)

Figure 2.4 Observed Deficiencies in the Girders (Cont.)

Figure 2.4 Observed Deficiencies in the Girders (Cont.)

Figure 2.4 Observed Deficiencies in the Girders (Cont.)

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Figure 2.4 Observed Deficiencies in the Girders (Cont.)

Figure 2.4 Observed Deficiencies in the Girders (Cont.)

Figure 2.4 Observed Deficiencies in the Girders (Cont.)

Figure 2.4 Observed Deficiencies in the Girders (Cont.)

3. STRUCTURAL ANALYSIS AND EVALUATION

3.1 Effect of Corrosion on Steel Bar Stress

In the case of the Friendship Bridge girders, the steel bars are cast in the concrete and then tensioned to approximately 70% of their ultimate strength to provide the required prestressing of the concrete. For a steel bar with a specified ultimate strength of 145 ksi, as in this case, the initial prestressing steel stress is approximately 100 ksi. This initial stress experienced a loss of approximately between 25% to 30% loss due to various effects that are well explained in text books and in the AASHTO design specifications. Therefore, the effective steel stress due to prestressing alone assuming a 30% prestressing loss is approximately 70 ksi. In the Friendship Bridge girders this effective stress translates to an effective force, $P_{effective}$ (steel bar area x effective stress) of 70.0 kips. At the initial prestressing the steel bars are tensioned to the desired level and anchored effectively locking the prestressing force into the girder providing the required prestressing effect. The effects due to the dead loads, live loads and any other loading requirements produce corresponding steel stresses that are super positioned to the effective steel stress due to prestressing. The general design philosophy is to factor these effects up to account for any unforeseen circumstances and provide a reasonable operational safety level. For the Friendship Bridge girders, the specified yield stress of the bars is specified as 0.85 of the ultimate strength, f_{pu} which = 0.85 x 145 = 123.25 ksi. The general design criterion for the steel stress in the bars under all load effects is as follows:

Effective Prestressing stress + factored DL and LL stresses ≤ the specified yield stress of the steel bar

Table 3.1 shows the effect of the loss of steel bar area due to corrosion on the steel stress component provided by the post tensioning. It can be seen from the table that a loss of 50% of the steel bar area corresponds to approximately the ultimate strength of the bar. In this case breakage of the bar will occur without any consideration of the applied loads. Since stresses due to applied loads are present in the girders it is logical to expect steel bar breakage at even lower loss of area than the 50% shown.

Table 3.1 The Effect Of The Loss Of Steel Bar Area On The Steel Stress Component Provided By The Post Tensioning.

	Original Steel bar area, in^2	Percentage loss of steel bar area				
		10	20	30	40	50
Steel area, in^2	1.0	0.9	0.8	0.7	0.6	0.5
Effective steel stress, psi	70,000	77,777	87,500	100,000	116,666	140,000

The above discussion explains the experienced bar breakage as shown in Figure 3.1 that has been observed over the years and as early as 1973 according to FDOT. This observation alone represents a serious safety issue since detection or locating bar breakage are extremely difficult and cannot be predicted. The presence of one or more broken steel bars at any girder is highly probable.

Generally, the corrosion of these bars initiate due to the high chloride content and is undetectable from looking at the girders. Continued corrosion results in swelling of the steel bars which in turn results in the longitudinal cracking and spalling of the concrete as can be seen in Figure 3.1. In these cases the corrosion is not localized and extends the entire length of the steel bars. Once the corrosion reaches a critical level (approximately 30% section loss) breakage of the bars occur and the entire prestressing effect provided by the broken bar is lost. Once a steel bar breaks (snaps) the force resisted by this bar is redistributed to the other three remaining bars resulting in a jump in the steel stress in these bars. This jump in steel stress could lead to breakage of these remaining bars at lower section loss level and progressive failure. This mechanism is alarming since sudden collapse without warning signs under only dead loads becomes a possibility with multiple broken bars in the same span.

Longitudinal cracking, concrete spalling and extensive corrosion of multiple bars in the same girder and multiple deficient girders in the same span have been observed as can be seen from the results of the visual inspection presented in the previous section.

Figure 3.1 Steel Bar Rupture Due To Corrosion

CONSTRUCTION COST ESTIMATE

for

FRIENDSHIP TRAIL (OLD GANDY) BRIDGE REPAIRS

HILLSBOROUGH COUNTY, FLORIDA

THE FOLLOWING PRELIMINARY BUDGET FIGURES DESCRIBE THE POTENTIAL CONSTRUCTION COSTS FOR THE OPTIONS NOTED. THESE FIGURES ARE BASED UPON RECENT FINDINGS INVOLVING DETERIORATION OF THE POST TENSIONING TENDONS. A FOLLOW-UP INVESTIGATION USING INVASIVE TESTING WILL ENABLE REFINEMENT OF ASSUMED SPAN DESIGNATIONS AND COULD SINGIFICANTLY IMPACT THE TOTAL REPAIR ESTIMATE. AS SUCH, THESE VALUES ARE CURRENTLY FOR DISCUSSION ONLY UNTIL THE ASSESSMENT IS COMPLETED.

					OPTION TOTAL
1)	**DEMOLITION AND BRIDGE REPLACEMENT**				**$81.8 MILLION**
2)	**DEMOLITION ONLY**				**$12.4 MILLION**
3)	**REPAIR OF TOTAL BRIDGE**	SPAN	UNIT COST		
	84 CATWALK SPANS (39 WEST END, 45 EAST END)	84	40,700	$3,418,800	
	ASSUME 5 REQUIRE SUPERSTRUCTURE REPLACEMENTS*	5	135,000	$675,000	
				$4,093,800	
	HIGH LEVEL SPANS (23 ON PIERS, 8 ON ELEVATED BENTS)			NOMINAL COST	
	LOW LEVEL SPANS BEYOND CATWALKS (160)	160	40,700	$6,512,000	
	ASSUME 90% REQUIRE SUPERSTRUCTURE REPLACEMENT*	144	135,000	$19,440,000	
				$25,952,000	
	SUBTOTAL			**$30,045,800**	**$30.0 MILLION**
	*1/2 DECK CONFIG WOULD PROVIDE DISCOUNT				
4)	**REPAIR OF SPANS CURRENTLY OPEN (ADJACENT TO CATWALKS)**				
	84 CATWALK SPANS (39 WEST END, 45 EAST END)	84	40,700	$3,418,800	
	ASSUME 5 REQUIRE SUPERSTRUCTURE REPLACEMENTS*	5	135,000	$675,000	
				$4,093,800	**$4.1 MILLION**
	*1/2 DECK CONFIG WOULD PROVIDE DISCOUNT				

FOR BREAKDOWN OF ABOVE COSTS, REFER TO INDIVIDUAL SHEETS
REMOVAL OF CLOSED SPANS IS NOT INCLUDED IN OPTION 4

CONSTRUCTION COST ESTIMATE

for

FRIENDSHIP TRAIL (OLD GANDY) BRIDGE REPAIRS

HILLSBOROUGH COUNTY, FLORIDA

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount Per Item
BRIDGE REPLACEMENT				
DEMOLITION	413,130	SF	$30	$12,393,900
REPLACEMENT STRUCTURE (AREA IN KIND)	413,130	SF	$150	$61,969,500
CONTINGENCIES				$7,500,000
TOTAL				**$81,863,400**

CONSTRUCTION COST ESTIMATE

for

FRIENDSHIP TRAIL (OLD GANDY) BRIDGE REPAIRS

HILLSBOROUGH COUNTY, FLORIDA

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount Per Item
SUPERSTRUCTURE SPAN REPLACEMENT				
DEMOLITION	1440	SF	$15	$21,600
AASHTO GIRDER- TYPE 2	192	LF	$210	$40,343
DECK CONCRETE	38	CY	$1,051	$39,923
REINFORCING STEEL	7790	LB	$1.25	$9,738
TRAFFIC BARRIER	96	LF	$115	$11,040
CONTINGENCIES				$12,264
TOTAL				**$134,908**

CONSTRUCTION COST ESTIMATE

for

FRIENDSHIP TRAIL (OLD GANDY) BRIDGE REPAIRS

HILLSBOROUGH COUNTY, FLORIDA

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount Per Item
SUPERSTRUCTURE 1/2 SPAN REPLACEMENT				
DEMOLITION	1440	SF	$15	$21,600
AASHTO GIRDER- TYPE 2	96	LF	$210	$20,172
DECK CONCRETE	19	CY	$1,051	$19,961
REINFORCING STEEL	3895	LB	$1.25	$4,869
TRAFFIC BARRIER	96	LF	$115	$11,040
CONTINGENCIES				$7,764
TOTAL				**$85,406**

CONSTRUCTION COST ESTIMATE

for

FRIENDSHIP TRAIL (OLD GANDY) BRIDGE REPAIRS

HILLSBOROUGH COUNTY, FLORIDA

Item Description	Estimated Quantity	Unit	Unit Price	Total Amount Per Item
OTHER MISC. REPAIRS PER EXISTING SPAN				
MOBILIZATION	1	LS	$2,000	$2,000
MAINTENANCE OF TRAFFIC	1	LS	$1,000	$1,000
FLOATING TURBIDITY BARRIER	200	LF	$20	$4,000
CLEANING AND RESEALING JOINTS - CONCRETE PAVEMENT	30	LF	$40	$1,200
EPOXY MATERIAL-STRUCTURES REHAB	2	GA	$200.00	$400
CRACKS INJECT & SEAL-STRUCTURES REHAB	20	LF	$100.00	$2,000
RESTORE SPALLED AREAS	20.0	CF	$500	$10,000
REINFORCING STEEL-SUBSTRUCTURE	200	LB	$2.00	$400
ZINC MESH INTEGRAL PILE JACKET, STRUCTURAL	10	LF	$1,600.00	$16,000
CONTINGENCIES				$3,700
TOTAL				**$40,700**

Appendix C

Structure Design and Rehabilitation, Inc.

DETAILED INSPECTION AND EVALUATION OF THE FRIENDSHIP TRAIL BRIDGE (OLD GANDY BRIDGE)

FINAL REPORT

Prepared for:

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Tampa, Florida

by

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May 2009

DETAILED INSPECTION AND EVALUATION OF THE FRIENDSHIP TRAIL BRIDGE (OLD GANDY BRIDGE)

1. INTRODUCTION:

The November 2008 report titled "Load Capacity Assessments of the Friendship Trail Bridge (Old Gandy Bridge)" included detailed analysis of the bridge girders and recommended closure of the bridge due to the level of deficiencies found. The county requested additional work to assist their decision making with regard to the future of the structure.

The scope of the work under this phase is as follows:

1. Conduct detailed inspection and invasive testing of the Tampa side spans to determine the condition of these girders and the actual level of deficiencies.

2. Analyze found deficiencies and recommend possible repair methods.

3. Develop approximate repair cost estimates using these repair methods to address found deficiencies.

2. STRUCTURE DESCRIPTION

The bridge is 13,770'-6" (2.608 miles) long and has a width of 30'-7". On the approach spans, the top of the roadway centerline is at elevation 11.5'. The bridge is comprised of three different span arrangements. There are 252 low-level approach spans that are 48'-0" long, each consisting of four post-tensioned concrete beams. There are 20 high-level approach spans that are 72'-0" long that consist of six post-tensioned concrete beams each. The channel span configuration consists of four three-span continuous steel girders of 74'-0" - 86'-6" - 74'-0". The minimum vertical clearance at the main channel is 43'-6" at mean high water.

The lower concrete approach spans are the most vulnerable to wave attacks and are located in extremely aggressive environment. The shallow reinforcement concrete cover does not provide the necessary protection against heavy concentration of chlorides with the resulting steel corrosion. Each simply supported span consists of 7.0” thick reinforced concrete deck supported by four prestressed concrete girders with a center to center spacing of 8’-6”.The overall length of the span from center to center of piers is 48'-0" while the center to center of bearings is 46'-4". The precast concrete intermediate diaphragms are transversely connected to the girders through a single lightly tensioned steel bar at the center of each diaphragm. The transverse tensioning bars are anchored to the exterior girders. Figure 2.1 shows the span details.

The precast I shape girders are 3’-4”. Each girder is precast with tapered block at each end. Each rectangular end block is 16 inches wide and extends for 3’-0” long distance before tapering to the thickness of the web over 1’-6” distance. Each girder is post-tensioned with (2) straight and (2) draped 1 1/8” diameter high strength steel bars. Each steel bar has an ultimate tensile strength of 150 ksi and is tensioned to 100 ksi. The post-tensioning bars are anchored at each end with wedge assemblies and 6”x 10”x 1 ¾” bearing plates recessed into the end blocks. The minimum specified compressive concrete strength of the girders and deck are 5,000 psi and 3,600 psi, respectively. Figure 2.2 shows girder details.

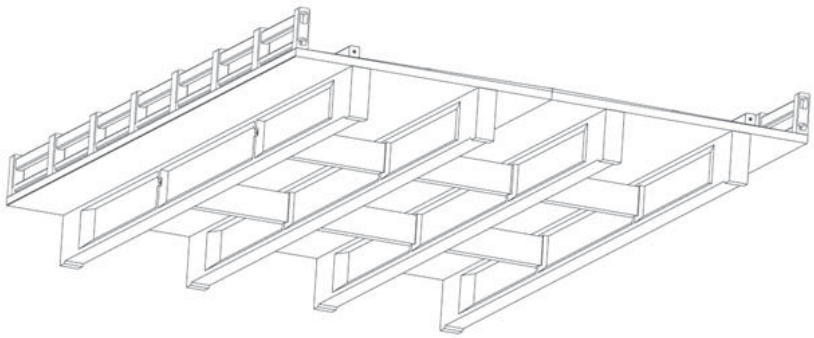


Figure 2.1 Lower Concrete Approach Spans

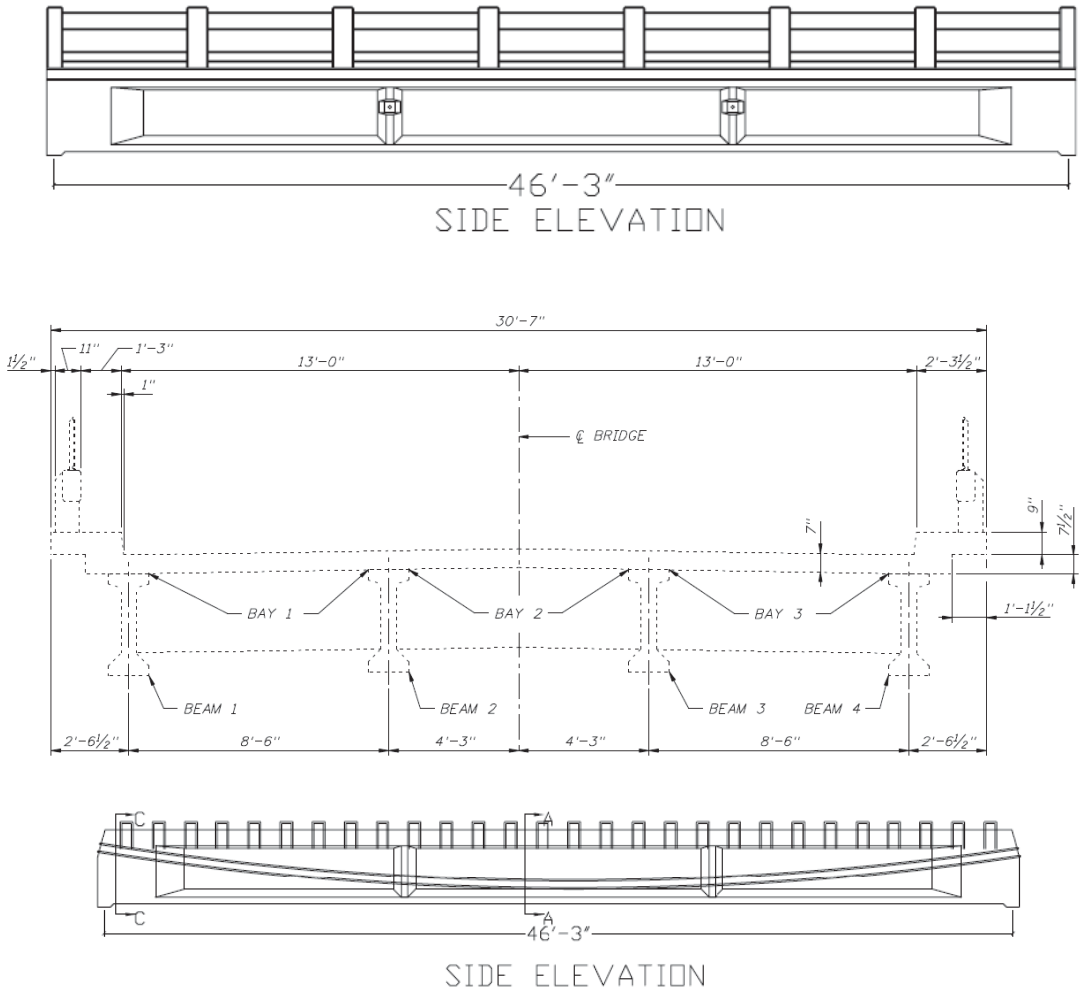


Figure 2.2 Lower concrete approach spans

3. Inspection and Invasive Testing

A special inspection of the Friendship Trail Bridge and invasive testing of the first five (5) spans on the east side and the first two (2) spans on the west side were conducted on March 10 and 11, 2009 by SDR Engineering, Inc. This inspection was for the purpose of verifying the actual existing conditions and determines the basis for the repair cost estimates. This inspection was limited to the low level approach spans. Figure 3.1 shows the observed typical deficiencies.

Invasive testing to remove cracked concrete and expose the PT bars was utilized to access the conditions of the PT bars. In two locations, removing the concrete revealed extensive corrosion and broken PT bars. Generally, girders with significant longitudinal and inclined cracking following the trajectories of the steel bars show severe signs of deterioration and corrosion of the prestressing steel bars. Broken and exposed corroded bars are observed at multiple locations.

4. Structural Inspection and Repair Criteria

Compete inspection of all East side spans up to the high spans was conducted to determine the number of deteriorated bridge elements requiring repair. Similar inspection was also conducted for the bride West side. The repair cost estimates are calculated based on various assumptions as will be presented later in this report and include only the repair of the bridge lower spans.

4.1 Criteria for Quantities Calculation

In order to accurately determine approximate repair quantities and associated repair costs criteria are established to determine the quantity of the deficient elements and the level of deterioration for the girders, piles and pile caps.

4.1.1 Girders

G : Good: no cracking or spalling and appears to be structurally sound

P : Partial Damage: Cracking, spalling and steel corrosion in limited areas of the beam not exceeding 1/3 of the beam length and limited to one location

F : Full damage: Cracking, spalling and steel corrosion along the entire beam or multiple locations.

4.1.2 Pile Bents

The majority of the pile bents contain more than four (4) piles and partial deterioration of up to 2 piles do not represent a structural problem. While repairs of such piles are desirable it is not immediately required since traffic on the bridge is limited. Deterioration in pile bents with only 4 piles will need to be repaired due to the lack of redundancy. In the following cost estimates only deficient piles in 4-pile bents are considered.

4.1.3 Pile Caps

Only caps with extensive cracking and corroded reinforcement are considered.

4.1.4 Miscellaneous Repairs

These repairs include concrete patching and sealing of spalled areas along the entire bridge.

4.2 Inspection Results

The inspection results for both sides of the bridge based on the criteria presented above are shown on the following tables. The results don't include the high spans, since these areas are not part of the scope of the work.

TAMPA END (EAST)

Component	Repair Type	Quantity
GIRDERS	PARTIAL	9
	FULL	2
PILE CAP	CONCRETE REPAIR	8
PILES		24

ST. PETERSBURG END (WEST)

Component	Repair Type	Quantity
From Beginning to End of Catwalk		
GIRDERS	PARTIAL	6
	FULL	0
PILE CAP	CONCRETE REPAIR	3
PILES		1
From End of Catwalk to High spans		
GIRDERS	PARTIAL	202
	FULL	93
PILE CAP	CONCRETE REPAIR	12
PILES		22

5. Repair Options

5.1 Estimated Repair Costs Utilizing Carbon Fiber Strengthening

From studying the girders deficiencies and extensive experience in bridge repairs, utilizing Carbon Fiber Reinforced Polymer (CFRP) offers an efficient repair method and cost benefits over traditional repair methods. In addition, life cycle maintenance costs are very low compared to traditional repair methods. Therefore, CFRP repair of the girders is recommended for this project.

The repair cost estimates are based on the following repair methods:

Girders:	Repair with Carbon Fiber Polymer, Structural
Piles:	Zinc Mesh Integral Pile Jacket, Structural
Bent Cap:	Concrete Spall Repair
Miscellaneous Repairs:	RESTORE SPALLED AREAS
	CLEANING AND SEALING

The recommended Carbon Fiber Repair configuration is shown in Figure 5.1.

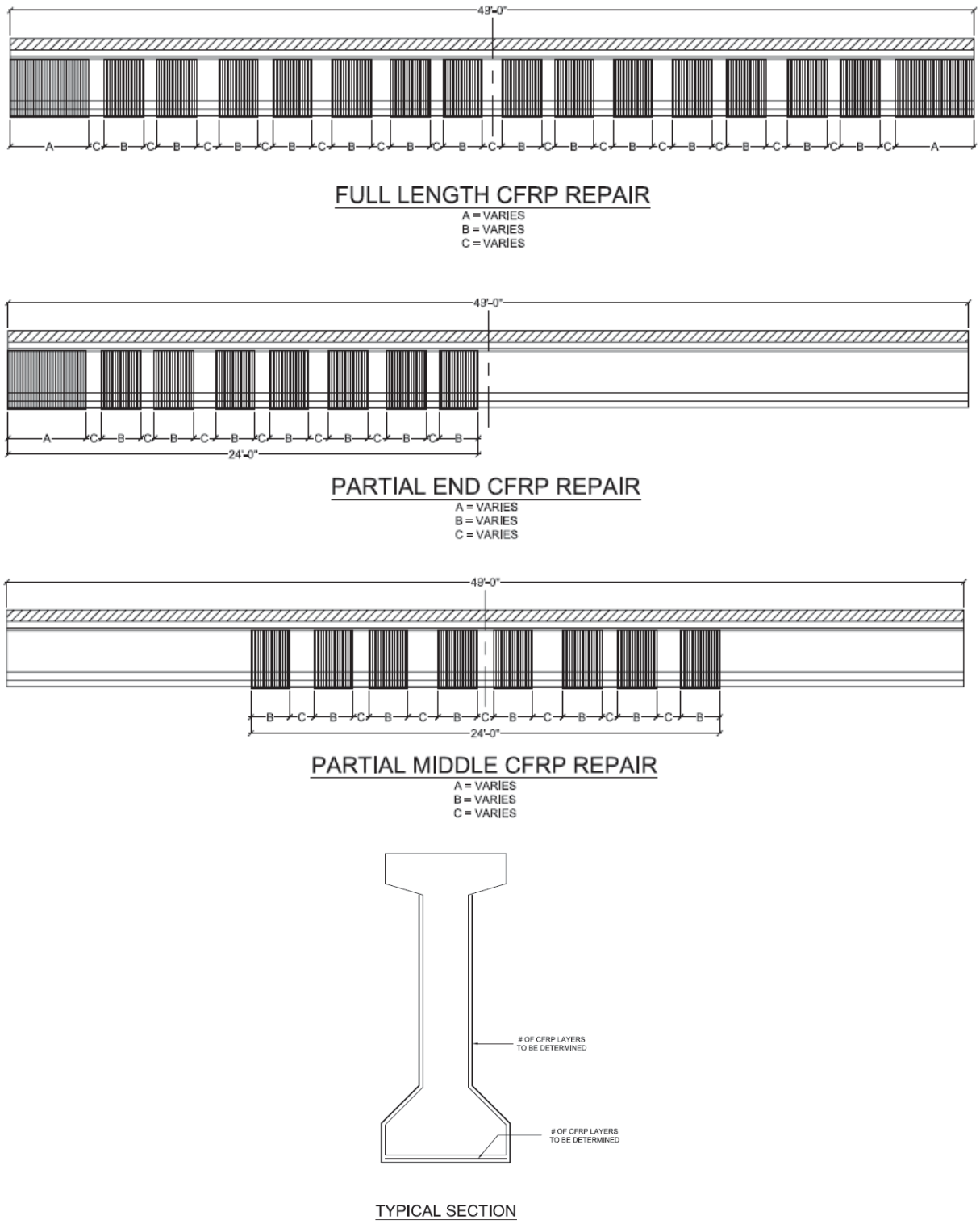


Figure 5.1 Carbon Fiber Repair Configurations.

Structural Components Repairs

TAMPA END (East Side)					
Component	**Repair Type**	**Quantity**	**Unit**	**Estimated Cost (Each) $**	**Total Cost**
GIRDERS	PARTIAL	9	EA.	10,000.00	90,000.00
	FULL	2	EA.	20,000.00	40,000.00
PILE CAP	Concrete Repair	8	EA.	4,000.00	32,000.00
PILES	CP Jackets	24	10' EA.	16,000.00	384,000.00
MISCELLANEOUS	Spall Repair	20	CF	500.00	10,000.00
				Cost	**556,000.00**
ST. PETERSBURG END					
From Beginning to End of Catwalk					
GIRDERS	PARTIAL	6	EA.	10,000.00	60,000.00
	FULL	0	EA.	20,000.00	0.00
PILE CAP	Concrete Repair	3	EA.	4,000.00	12,000.00
PILES	CP Jackets	5	10' EA.	16,000.00	80,000.00
MISCELLANEOUS	Spall Repair	40	CF	500.00	20,000.00
From End of Catwalk to High spans					
GIRDERS	PARTIAL	202	EA	10,000.00	2,020,000.00
	FULL	93	EA	20,000.00	1,860,000.00
PILE CAP	CONCRETE REPAIR	12	EA	4,000.00	48,000.00
PILES	CP Jackets	22	10' EA	16,000.00	352,000.00
MISCELLANEOUS		40	CF	500.00	20,000.00
				Cost	**4,472,000.00**

Total Repair Costs of structural Components = $ 5,028,000.00

The above repair costs are approximate and considered to be a lower bound needed to extend the bridge lower spans life by up to 10 years. Additional funds will be needed to address the bridge high spans. Continued deterioration of other elements of the bridge will continue and additional funds will be needed within the projected 10 years to address new deficiencies.

5.2 Repair Options

Based on the evaluation of the bridge current conditions and the knowledge of its current use, the following options should be examined to determine the best future course of action.

Option I: Repair the entire bridge

This option will extend the projected remaining life of the bridge by 10 years and will allow opening the entire bridge for recreational use.

Estimated Repair Costs: **$7 M**

Continued deterioration will continue and additional funds will be required to address other deficiencies.

Estimated Repair Costs over next 10 years: **$4 M**

Contingencies: **$4 M**

Total Budget*: $15 M

Option II: Repair spans starting from the beginning of bridge at either end up to the Catwalk

This option will extend the projected remaining life of the selected spans bridge by 10 years and will allow opening these spans for recreational use.

Estimated Repair Costs: $2 M

Continued deterioration will continue and additional funds will be required to address other deficiencies.

Estimated Repair Costs over next 10 years: $1 M

Contingencies: $1 M

Demolition from end of catwalk to High Level: $6 M

Total Budget*: $10 M

* Does not include future demolition Costs of remaining spans.

Option III: Demolition of the entire bridge and building two new fishing piers at either end of the bridge at the current location.

This option will provide two new fishing piers at either end for recreational use.

New Piers: dependent upon size

$150/SF x (2) 30'x500' structures : $4.5M

Demolition of entire structure now $13M

Total Budget $17.5M

Notes:

- Relocating the new piers might be necessary to avoid future conflict if a new bridge is to be constructed.
- The current cost of the bridge demolition will be considerably less than what is projected after 10 years due to the current cost of money and the downturn in the economy.

Option IV: Demolition of the entire bridge and building two new fishing piers at either end of the bridge to be supported by the new Gandy Bridge.

This option will provide two new fishing piers at either end of the new Gandy Bridge for recreational use.

New Piers: dependent upon size

$150/SF x (2) 30'x500' structures	**$4.5M**
Land use:	**$2 M**
Demolition of entire structure now	**$13M**
Total Budget	**$19.5M**

Notes:

- Relocating the new piers to the new Gandy Bridge will eliminate the possibility of conflict if a new bridge is to be build at the current location.
- Parking requirements at the new location should be evaluated.
- Recreational facilities can be Incorporated into this plan for the purpose of generating revenue fund for the future maintenance of the fishing piers.
- The current cost of the bridge demolition will be considerably less than what is projected after 10 years due to the current cost of money and the downturn in the economy.
- FDOT should be contacted with the plan details for approval since the proposed piers will be supported by the existing bridge.
- ADA requirements should be evaluated to determine if this plan meet these requirements.

6. Summary and Recommendations

The invasive inspection of the first 5 spans on the East side and the first 2 West side spans revealed conditions consistent with previously reported findings. The number and magnitude of structural deficiency found in the East Side spans are limited compared to the deficiencies found in the West side spans.

Recommended repair methods have been identified and repair costs based on utilizing these methods are estimated. These repair methods are intended to raise the load capacity of the bridge to handle occasional emergency situations and limited recreational vehicular traffic.

The calculated cost estimates are only for the lower spans. The higher spans were not inspected but they appear to be in good shape and might require limited upgrades. The conditions of the high spans should be verified if the repair option is selected. If the repair option is selected, the closure of the bridge should be maintained until repair work is completed.

It should be pointed out that these repairs are limited to existing deficiencies and deterioration of other structural elements of the bridge will continue considering the bridge advanced age and the extreme environmental conditions. The availability of funding to address future deficiencies is an important element in the decision making.

Various options are presented for the repair or complete demolitions of the bridge and building two new fishing piers. These options should be evaluated to arrive on the most economical and functioning option to meet the objectives of both counties.

Appendix D

Consulting Engineers
Boca Raton
Tallahassee
Tampa

March 8, 2010

Chris Bridges, P.E.
Hillsborough County Public Works
Design and Engineering Support Section (DESS)
601 E. Kennedy Blvd., 23rd Floor
Tampa, FL 33602

Re: Friendship Trail Bridge Peer Review - Letter Report
POPW10516001

Dear Mr. Bridges:

At the request of Hillsborough County, E.C. Driver & Associates, Inc. (EC Driver), has performed an independent peer review of the evaluation of the Friendship Trail Bridge prepared by Structure Design and Rehabilitation, Inc., (SDR). This letter report summarizes our findings and recommendations. Attachment A to this letter includes a more detailed set of peer review comments on the evaluation.

In general, we find that the evaluation was prepared consistent with standard engineering practice and established State and Federal codes. EC Driver agrees with the assessment stated in the first of the two Final Reports, *Load Capacity Assessments of the Friendship Trail Bridge, dated November 2008*, which concludes its summary with the following:

> *"The widespread and significant corrosion, concrete section loss and broken prestressing steel bars near the ends of the girders cannot be remedied with current repair methods and will be extremely cost prohibitive to repair. Previous repairs are showing significant degree of deterioration and any future repairs will be an expensive short fix and ineffective. It is therefore concluded that the closure of the bridge and possible demolition is in the best interest to the two counties and the Public."*

EC Driver does not support the recommendation of the second Final Report, *Detailed Inspection and Evaluation of the Friendship Trail Bridge, dated May 2009*, to repair the bridge using Carbon Fiber Reinforced Polymer (CFRP). It is our professional opinion that such repairs would be cost prohibitive, would not significantly reduce the risk of structural failure of the bridge and would not be sufficient to extend the service life of the bridge with a high degree of certainty. This opinion is based on fundamental engineering principles and a practical understanding of concrete repair and restoration techniques.

For structural repairs that are bonded to the existing beams to be effective they must arrest the ongoing corrosion of the steel within the concrete beams. Otherwise, the corrosion will continue at an accelerated rate and the concrete will continue to crack and spall. Cracking and spalling of the concrete will compromise the structural integrity of the concrete and therefore render the

CFRP repairs, which are reliant upon the bond of the CFRP to the concrete, ineffective. The most practical and reliable method to arrest corrosion is through the use of cathodic protection. Cathodic protection is widely used to protect concrete bridge substructures from the adverse impacts of corrosion and is currently employed on many Florida bridges, including the adjacent Gandy Bridge constructed in 1975. Cathodic protection is less frequently used to protect precast/prestressed (or post-tensioned) beams although it is technically feasible. The reason for this is that the typical methods of achieving electrical continuity (e.g. drilling and tapping into reinforcing steel or exposing reinforcing steel) are difficult to apply to prestressed or post-tensioned elements using conventional methods.

Our independent cost estimates indicate repair costs with CFRP and cathodic protection to be two to three times the previous estimates for repair with CFRP alone. Even if the repairs were economical, there are unique technical issues that will make the application of effective cathodic protection difficult. Furthermore, these unique issues, combined with the highly corrosive and humid salt water environment, add great uncertainty to the reliability and effectiveness of both cathodic protection and CFRP repairs for this particular structure with its unique precast, post-tensioned beams. Also significant is the fact that cathodic protection requires periodic maintenance that must also be programmed.

The scope of the peer review included review of the evaluation reports, collection and review of pertinent studies of similar bridges and research papers related to current and proposed rehabilitation methods and materials. A field visit and general review of the bridge was conducted on February 16, 2010 by Jim Phillips with the assistance of Hillsborough County staff and the use of a County inspection boat. This review was to observe the reported conditions first hand and obtain a general sense of the nature and extent of the deterioration. No detailed inspection was performed at this time. In addition, the peer review included a review of engineering and analysis assumptions, cost estimates and proposed CFRP repairs.

EC Driver's recommendation is to keep the Friendship Trail Bridge closed and remove it at such time as the demolition project can be programmed. Repair of the bridge is not recommended as the costs would far outweigh the benefits.

Respectfully Submitted

EC Driver & Associates, Inc.

3/8/10

James M. Phillips III, PE
Vice President
FL PE No. 36865
Certificate of Authorization No. EB3828

JAMES M. PHILLIPS III
LICENSE
No. 36865
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

Attachments

Attachment A - Friendship Trail Peer Review –Letter Report ECDriver

A. The following documents were reviewed by EC Driver as part of this peer review:

a) Final Report, *Detailed Inspection and Evaluation of the Friendship Trail Bridge (Old Gandy Bridge)*, May 2009, Prepared by SDR for Kisinger Campo & Associates, Tampa, Florida.

b) Final Report, *Load Capacity Assessments of the Friendship Trail Bridge (Old Gandy Bridge)*, dated November 2008, Prepared by SDR for Kisinger Campo & Associates, Tampa, Florida.

c) Sunshine Skyway Trestle Span Rehabilitation, FPID 41664125201, Hillsborough & Pinellas Counties, Florida Dept. of Transportation plans and bid results (CFRP repair of prestressed concrete girders), bid August 2, 2006.

d) Bridge Inspection Report (including underwater inspection) and Load Rating, Bridge Number 100068, Wade-Trim, May 25, 2003.

e) *Thermo-mechanical Durability of Carbon Fiber Reinforced Polymer Strengthened Reinforced Concrete Beams* dated July 20, 2009 by the University of Central Florida for the Florida Department of Transportation

f) *Shear Performance of Existing Concrete Bridge Girders* dated May 2009 by University of Florida for the Florida Department of Transportation

B. Comments on Bridge Condition:

a) The bridge currently exhibits severe widespread corrosive deterioration of the reinforcing in the beams, deck, diaphragms, bent caps and piles. This severe widespread corrosive deterioration includes the main post tensioning bars of the beams with visual evidence that a number of the bars have already fractured. Loss of a sufficient number of the post tensioning bars in the beams within a span could lead to the sudden and catastrophic collapse of a span. Similarly, the severe widespread corrosive deterioration of the pile reinforcing in a sufficient number of piles could lead to the sudden and catastrophic collapse of a pile bent.
b) The bridge exhibits severe widespread corrosive deterioration of the concrete surrounding the reinforcing steel including cracking and spalling that permits the highly corrosive saltwater direct access to the steel, which further promotes and accelerates corrosion.
c) The severe widespread cracking, spalling, and delaminating of the concrete reduces the bond between the concrete and reinforcing steel, which further reduces the component load carrying capacity, ductility and internal redundancy (i.e. the ability of the component to fail with advance warning and to redistribute loads during failure.) This is of most concern with the beams and piles, for which there is little redundancy.
d) Without implementation of corrosive inhibiting repairs (e.g. cathodic protection systems), the corrosive deterioration of the beam post tensioning bars is expected to continue at an accelerated rate. With continued loss in cross-sectional area of the post tensioning bars and corrosive pitting that creates stress risers that increase the potential for fracture at a

lower stress level, the post tensioning bars will continue to fracture under the current pre-stressing forces in the bars (i.e. the bars will continue to fail with no additional external loading) at an accelerated rate. The continued fracture of the post tensioning bars will eventually lead to the failure of a beam and potentially an entire span under the self-weight of the superstructure. Because of the complexity of the structural system and the potential modes of failure, it is not known whether this failure will be catastrophic. However, as the structural system provides only limited redundancy, there exists a potential for a catastrophic failure with no advance warning.

e) The summary of inspection results does not specifically identify whether there are spans with multiple adjacent beams with multiple post tensioning bar failures or imminent post tensioning bar failures. Spans with these conditions could be close to a condition where catastrophic collapse could occur. Note that EC Driver's field observations revealed that there are several spans with visible signs of multiple beams with advanced post tensioning bar corrosion, evidenced by horizontal cracks in the beam sides and/or bottom.

C. Comments on Structural Analysis & Load Rating:

a) In general, EC Driver concurs with the methodology applied in the analysis. Alternative methods, such as a non-linear finite element analysis, could be used to more accurately calculate the shear capacity of the existing beams. However, given the severe corrosion that is present and the uncertainties of the actual corrosion of existing post tensioning bars, the approach taken is prudent.

b) Load rating of the existing bridge using AASHTO HL93 and SU4 Florida Legal Load is prudent in terms of standard practice. However, given that the Friendship Trail Bridge is only to support pedestrian loading and a possible emergency vehicle, evaluation could have included loadings for the intended use. It should be noted however that emergency vehicles, unless limited to specific types, can be significant (fire trucks for example) and forces due to pedestrian loading can also approach those caused by the lighter legal truck loads. Also, it should also be noted that the analysis indicates the bridge could fail under its own dead load. Therefore, the choice of load rating vehicle is only of consequence if the bridge is to be strengthened such that failed post tensioning bars are not relied upon for capacity.

c) The magnitude of the deterioration of the post tensioning bars (i.e. loss in cross-sectional area of the post tensioning bars throughout the bridge, number and location of already fractured bars, rate of corrosive deterioration, etc.) and magnitude of the delamination and debonding have not been determined and summarized with statistical certainty. These unknown conditions greatly increase the complexity of analysis and greatly limit the ability to accurately estimate and reliably predict the load carrying capacity. The report addresses only four separate deterioration scenarios. It is not clear whether the analysis includes the affect of the intermediate diaphragms to redistribute the loading between the beams and if it did, whether the deterioration of the diaphragm's single post tensioning bar was addressed in the analysis. It is not clear whether these scenarios accurately and conservatively assess the current worse case scenarios. As such, the report conveys a false sense of accuracy with the computed load capacity. The actual capacity could be significantly different from that computed and perhaps lower resistance

factors (below the 0.85 applied in the analysis) used to reflect the greater degree of uncertainty regarding the current conditions.

d) The evaluation does not discuss in detail the risks associated with the corrosive deterioration of the pile reinforcing steel and the associated loss in structural load carrying capacity. As the piles are columns, they require ties to provide containment of the primary longitudinal reinforcing steel and central concrete column. Loss of more than two consecutive ties will result in a sufficient lack of confinement to permit a non-ductile failure of the piles. Corrosive deterioration of the piles typically includes complete loss of multiple ties and partial or complete loss of some of the primary longitudinal reinforcing steel, which significantly reduces the axial and flexural load carrying capacity of the piles. Without ties and with significant loss in load in section to the primary longitudinal reinforcing, the piles could fail in a catastrophic manner (i.e. suddenly with little or no advance warning.) The report does not identify whether there are currently multiple piles within an individual pile bent with severe deterioration (as was observed in the field). The specific location of the deteriorated piles may also be of concern. If the two adjacent interior piles or an exterior and adjacent interior piles were to fail, a deteriorated bent cap may not have adequate capacity to support the superstructure. Although the report does recommend the construction of structural pile jackets on the piles that currently exhibit poor condition, it is possible that many other piles previously jacketed without structural pile jackets exhibit similar deterioration or other piles could exhibit similar conditions in a short period of time. As such, the number of piles requiring structural pile jackets is likely underestimated.

D. Comments on Suggested Repairs & Carbon Fiber Reinforced Polymer (CFRP) Repairs:

a) Unless the corrosion of the reinforcing steel can be arrested, the expected service life of any repairs is expected to be short. High forces from the corrosive expansion of the reinforcing steel will likely cause concrete repairs including carbon fiber strengthening repairs to fail in a short period of time. Deterioration is expected to continue unless the corrosion can be slowed with the introduction of cathodic protection systems (e.g. metalizing, induced current systems, etc.) but these systems have high costs and have limited service life requiring periodic replacement, reapplication and/or ongoing maintenance (Note: The repair strategies identified in the report for the beams, deck, diaphragms, and bent caps do not include cathodic protection systems and thus accelerated deterioration would be expected despite the repairs. Only the piles are specified to include cathodic protection. Inclusion of the cathodic protection systems will significantly increase the cost of the repairs and should be included in the rehabilitation alternatives even if only a ten-year service life is used. The repair alternatives should fully evaluate the maintenance costs of cathodic protection systems including the periodic reapplication or replacement of the systems.)

b) EC Driver disagrees that carbon fiber strengthening repairs are a cost effective repair strategy for this bridge. Carbon fiber repairs are currently not considered a long-term or permanent repair strategy and there is not sufficient research or trial installations of sufficient duration in similar environments to support use on such a widespread use as required on this bridge. (Note: Refer to *Thermo-mechanical Durability of Carbon Fiber Reinforced Polymer Strengthened Reinforced Concrete Beams* dated July 20, 2009 by the

University of Central Florida for the Florida Department of Transportation.) Furthermore, unless the corrosion of the post tensioning steel of the beams can be arrested, the expected service life of the carbon fiber strengthening would be expected to be short. High forces from the corrosive expansion of the post tensioning steel will likely cause the carbon fiber strengthening repairs to fail in a short period of time. The beam location that becomes in need of the CFRP strengthening due to the local failure of a post tensioning bar would also be the location most likely to have localized concrete failure due to corrosion of the steel bar. Therefore, the events that would reduce the capacity of the existing beam are likely coincident with the events that could reduce the effectiveness of the CFRP strengthening.

c) The report states that life cycle maintenance costs for CFRP repairs will be low compared to traditional repairs. While the CFRP material itself may not require significant maintenance, the material has not been time tested in a similar environment and the repairs are dependent upon the integrity of the structure the CFRP is bonded to and therefore subject to the maintenance requirements for the concrete and/or cathodic protection.

E. Comments on Cost Estimates:

a) It is not clear whether the cost estimates include the cost of mobilization, demolition, design, permitting, construction engineering and inspection (CEI). However, it appears as though 40 percent was added to the construction estimate to obtain the total cost which would be adequate to cover some if not all of these costs.
b) The report states that "the current cost of bridge demolition will be considerably less than what is projected after 10 years due to the current cost of money and the downturn in the economy." This statement is only valid if the current market continues until such time as the demolition project is bid.
c) In general the costs for the work shown are consistent with recent bid prices with the exception of the CFRP work. Based on bids for the strengthening of the beams on the Sunshine Skyway approach girders the cost of CFRP wrapping of a beam is estimated in the $900 per lineal foot of beam range. Adjusting for this unit cost, the estimate for the repair project of the entire bridge (Option I in the report) would increase from $7 million to $14 million.
d) The costs shown do not include cathodic protection of the beams. Adding cathodic protection to the beams scheduled for repair would increase the project cost from $7 million to $18 million.
e) EC Driver's recommendation would be to install cathodic protection on all beams of the lower spans. This would increase the project cost from $7 million to $36 million.
f) The construction cost to replace the bridge with fishing piers, based on a unit price of $150 per square foot is on the high side, unless this includes mobilization, design, permitting, and construction engineering and inspection (CEI), which is not clear.

F. Other comments and factors:

a) Recent construction and load testing of beams similar to those on the Friendship Trail Bridge demonstrate that the beams have substantially more capacity to resist shear than

predicted by current AASHTO LRFD Bridge Design Specification provisions. Load testing demonstrated that the beams generally do not fail in shear and that failure of the beams is a result of yielding of the post tensioning bars following development of principle tension cracks in the concrete. Non-linear finite element analysis performed for the Sunshine Skyway Fishing Piers and Anna Maria Island Bridge, which have similar beams, further supports that this type of beam has significantly more shear capacity than predicted by the AASHTO Bridge Specifications. The above load testing study concluded that a strut-and-tie approach to computing the shear capacity more accurately predicts the shear capacity than the AASHTO Bridge Specifications. (See *Shear Performance of Existing Concrete Bridge Girders* dated May 2009 by University of Florida for the Florida Department of Transportation.)

b) Load testing of beams from the Sunshine Skyway Fishing Piers, performed during the late1970's on beams which exhibited similar corrosive deterioration as those of the Friendship Trail Bridge, demonstrated that the beams had reasonable reserve capacity even after a single post tensioning bar fractured. However, there was a significant drop-off in capacity after a second post-tensioning bar fractured. This load testing demonstrated that post tensioning bars with corrosive pitting failed by fracturing and bars without corrosive pitting failed by yielding. Failure by fracture occurs with little or no advance warning, while failure by yielding usually provides advance warning with evidence of imminent failure (i.e. extensive deflection and failure cracking patterns.)

c) The bridge exhibits widespread cracking of the concrete as a result of corrosive expansion of the post tensioning and reinforcing steel. This cracking is not necessarily a sign of imminent collapse. Cracking associated with structural failure from overload exhibits a different pattern. The distinction between these different cracking patterns is only discernible to the trained observer.

Appendix E

Section 2 - Staffing Plan - Man-Loading Requirements

Description /Responsible Party	2012									2013	
	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb
Design Phase											
Submit Permit Application											
Ayres Associates	1	1									
Design & Bathymetric Survey											
Ayres Associates	1	1									
Hyatt Survey Services, Inc.	1	1						1	1		
Design 90% Submittal											
Ayres Associates	2	2									
American Bridge Company	1	1									
Design Final Submittal											
Ayres Associates			1								
American Bridge Company			1								
Construction Phase											
Mobilization/Preconstruction Planning											
American Bridge Company	1	2	2								
Design/Engineering Support											
Ayres Associates		1	1	1	1	1	1	1	1		
Management and Supervision											
American Bridge Company		1	4	4	4	4	4	3	2		
Span Demolition Work and Disposal											
American Bridge Company			3	3	3	3	3	3			
Demobilization											
American Bridge Company										2	
TOTAL MAN-LOADING STAFF	**7**	**10**	**12**	**8**	**8**	**8**	**8**	**8**	**4**	**2**	**0**

EXHIBIT 4

HILLSBOROUGH COUNTY
DESIGN-BUILD OF
STRATEGIC DEMOLITION OF THE FRIENDSHIP TRAIL BRIDGE
GUARANTEED MAXIMUM PRICE PROPOSAL

RFP NO: C-0133-0-2011(MK)

PROJECT LOCATION/DESCRIPTION: PARTIAL STRATEGIC DEMOLITION OF THE FRIENDSHIP TRAIL BRIDGE OVER TAMPA BAY, HILLSBOROUGH AND PINELLAS COUNTIES.

The Design-Builder is required to state the proposed contract time and length in linear feet (LF) of bridge to be removed for the **Guaranteed Maximum Price (GMP) of $4,195,000 including allowances.** The length of bridge to be removed excludes the 234'-6" steel plate girder superstructure span over the navigational channel and the first and last 48' span at each end. An equal length of bridge from each end shall be removed.

PROPOSED CONTRACT TIME: 246 Days

PROPOSED LENGTH OF BRIDGE TO BE REMOVED (LF): 10,656.00 LF

ITEM DESCRIPTION	UNIT	QUANTITY	PRICE
DESIGN-BUILD FEE	LS	1	$ 3,995,000
DESIGN-CONSTRUCTION ALLOWANCE	LS	1	$ 200,000
GUARANTEED MAXIMUM PRICE			$ 4,195,000

TOTAL CONTRACT AMOUNT WRITTEN OUT:
Four Million, One Hundred and Ninety-Five Thousand Dollars

DESIGN-BUILD FIRM NAME: American Bridge Company

DESIGN-BUILD FIRM VENDOR NO: 251607500-01

DESIGN-BUILD FIRM ADDRESS: 5430 West Tyson Avenue
Tampa, Florida 33611

DESIGN-BUILD FIRM

SIGNATURE

PRINTED NAME Mark Bell

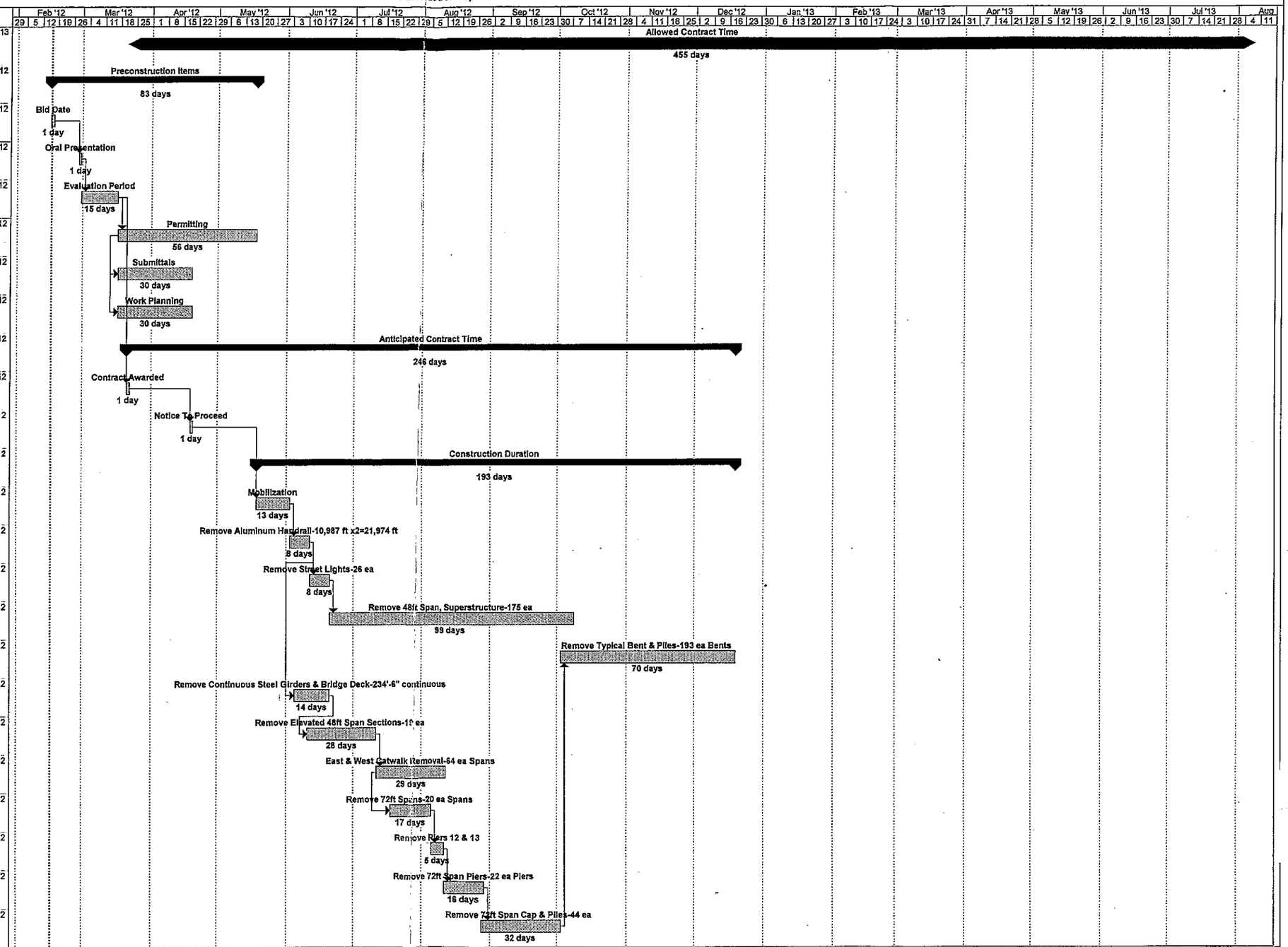
TITLE Vice President

American Bridge

STRATEGIC DEMOLITION OF THE FRIENDSHIP TRAILBRIDGE
DESIGN/BUILD PROJECT
RFP NO.: C-0133-0-2011 (MK)
TECHNICAL PROPOSAL
FEBRUARY 16, 2012

AYRES ASSOCIATES

ID	Task Name	Duration	Start	Finish
1	Allowed Contract Time	455 days	Wed 3/21/12	Thu 8/6/13
2	Preconstruction Items	83 days	Thu 2/16/12	Fri 5/18/12
3	Bid Date	1 day	Thu 2/16/12	Fri 2/17/12
4	Oral Presentation	1 day	Tue 2/28/12	Wed 2/29/12
5	Evaluation Period	15 days	Wed 2/29/12	Fri 3/16/12
6	Permitting	56 days	Sat 3/17/12	Fri 5/18/12
7	Submittals	30 days	Sat 3/17/12	Thu 4/19/12
8	Work Planning	30 days	Sat 3/17/12	Thu 4/19/12
9	Anticipated Contract Time	246 days	Wed 3/21/12	Wed 12/19/12
10	Contract Awarded	1 day	Wed 3/21/12	Thu 3/22/12
11	Notice To Proceed	1 day	Wed 4/18/12	Thu 4/19/12
12	Construction Duration	193 days	Fri 5/18/12	Wed 12/19/12
13	Mobilization	13 days	Fri 5/18/12	Sat 6/2/12
14	Remove Aluminum Handrail-10,987 ft x2=21,974 ft	8 days	Sat 6/2/12	Mon 6/11/12
15	Remove Street Lights-26 ea	8 days	Mon 6/11/12	Wed 6/20/12
16	Remove 48ft Span, Superstructure-175 ea	99 days	Wed 6/20/12	Mon 10/8/12
17	Remove Typical Bent & Piles-193 ea Bents	70 days	Tue 10/2/12	Wed 12/19/12
18	Remove Continuous Steel Girders & Bridge Deck-234'-6" continuous	14 days	Mon 6/4/12	Wed 6/20/12
19	Remove Elevated 48ft Span Sections-19 ea	28 days	Sun 6/10/12	Wed 7/11/12
20	East & West Catwalk Removal-64 ea Spans	29 days	Wed 7/11/12	Sun 8/12/12
21	Remove 72ft Spans-20 ea Spans	17 days	Tue 7/17/12	Sun 8/5/12
22	Remove Piers 12 & 13	5 days	Sun 8/5/12	Sat 8/11/12
23	Remove 72ft Span Piers-22 ea Piers	16 days	Sat 8/11/12	Wed 8/29/12
24	Remove 72ft Span Cap & Piles-44 ea	32 days	Tue 8/28/12	Tue 10/2/12



Project: FriendshipDemoCalDays2-3-1
Date: Thu 2/16/12

Task | Split | Milestone | Project Summary | External Milestone
Project Guide: Critical Task | Progress | Summary | External Tasks | Deadline

Appendix F

HILLSBOROUGH COUNTY, FLORIDA

REPORT TO THE

BOARD OF COUNTY COMMISSIONERS

June 6, 2001

FRIENDSHIP TRAIL

PARKS AND RECREATION DEPARTMENT
COMMUNITY SERVICES TEAM

SIGN-OFF APPROVALS	DATE
DIRECTOR	7-19-01
MGMT&BUDGET	7/26/01
CONTRACTS N/A	7-19-01
LEGAL	7-19-01
ACA	7/26/01

[ ] Consent (Informational Item)
[ ] Regular (Requires staff/Board discussion and/or public input)

FRIENDSHIP TRAIL

STAFF REPORT

History

- The Friendship Trail Bridge is operated and maintained through a joint agreement between Pinellas and Hillsborough Counties. The agreement was enacted in 1997.

- The Counties established a Friendship Trail Bridge Oversight Committee to address issues related to the facility. The Bridge Oversight Committee members are: Pinellas County Commissioners John Morroni, and Ken Welch; Hillsborough County Commissioners Jan Platt, and Stacey Easterling; State Senator Jim Sebesta; State Representative Kim Berfield; Renee A. Williams, City of Tampa; Friendship Trail Corporation members Frank Miller and Tom Bryan.

- The Friendship Trail Bridge has approximately 20,000 users each month with an annual attendance of 250,000. 31,177 citizens visited the Trail Bridge during the month of May 2001.

- The present operational budget is $300,000 and each county provides 50% of the funding. During the first several years of operation, this cost was absorbed by dollars left over from the retrofit of the bridge.

At the Board of County Commissioners Regular Meeting on April 4, 2001, the Board requested Parks and Recreation Department to explore the following:

Potential Funding Sources

- Parks and Recreation staff met with City officials concerning potential sharing of funding. City officials informed that they would discuss this matter with Mayor Greco. No information has been forthcoming from the City on this issue at the writing of this report.

- Pinellas County Parks staff has indicated that their Board of County Commissioners plans to fund their share of the operational costs of the Friendship Trail.

- The County's share of the operating expenses of the Trail has been included in the FY 2003 County Administrator's recommended budget.

Potential Funding Sources (cont'd)

- Parks and Recreation staff contacted Hillsborough County Metropolitan Planning Organization (MPO) concerning the available funding for operation of the Friendship Trail. The MPO advised that transportation enhancement funds are available only for capital improvement projects within the County. Federal guidelines governing the administration of these funds prohibit the utilization of it for annual operational costs. The County, however, will apply for maintenance money to repair the bridge as indicated in Public Works' attachment.

- At the Friendship Oversight Committee meeting of Tuesday, July 17, 2001, the committee voted to approach state legislators with a request to establish a policy that would allow Hillsborough County and Pinellas County to apply for transportation monies that are allocated for bridge structure maintenance.

Research of a State Operated Trail Bridge in Nassau County

- Through telephone conversations with Talbot Island State Park's personnel, Hillsborough County Parks & Recreation staff found that the Old Nassau Sound Bridge in Nassau County has some similarities with the Old Gandy Bridge. Florida Department of Transportation (FDOT) had constructed a new bridge connecting Amelia Island to Nassau Sound and had planned to demolish the old one. Special interest groups fought to save the old bridge and FDOT agreed to leave the old bridge standing.

  There are, however, a number of differences between the two bridges. The Old Nassau Sound Bridge is approximately 1/2 mile long and is primarily used for fishing. The land on each end of the bridge is State Park land. The State Park System assumed responsibility for the day-to-day operation and minor maintenance of the bridge. Yet, the bridge is still owned and maintained to some degree by FDOT.

  The bridge will someday be a segment of a proposed trail system, currently in the planning stage. The Department of Environmental Protection (DEP) has a budget request of $204,000 for operation of the Nassau Sound Bridge and a capital request of $436,000 for capital improvements. Also, an agreement is being contemplated between Nassau and Duval Counties to set up an escrow account for major maintenance repairs.

Discussion with Legislators

- Commissioner Norman and Deputy County Administrator Pat Bean visited the Trail Bridge in Nassau County.

- On Wednesday, July 18, 2001, Ed Radice and Frank Miller met with State Senator Jim Sebesta and State Representative Chris Hart and provided information to both gentlemen regarding the Friendship Trail Bridge. The information presented emphasized that both Pinellas and Hillsborough Counties would be appreciative if the State Legislators could assist both counties with funding sources for the long-time liability issues related to the bridge. They will review the information and advise the Oversight Committee of their recommendation.

Clerk of the Circuit Court's Financial Review

- The Clerk of the Circuit Court found that to continue to operate the Bridge as a recreational facility will cost a minimum of $300,000 annually plus the cost of major repairs which are estimated to average an equal amount on a net present value basis over the 30 year estimated useful life. The Friendship Trail Corporation should not be relied upon to provide a significant portion of the funding. (See Attachment A)

Liability Insurance

- The Board of County Commissioners' question concerning liability insurance was directed to Insurance and Claims Division. They have stated that there are two insurance issues associated with the trail and the bridge - liability claims cost and damage to the structure. Hillsborough County is self-insured for liability claims associated with injury or death and, by agreement, is to share the costs with Pinellas County. We have a potential exposure of $100,000 ($200,000 divided) on serious claims of body injury or death.

  The possibility of insuring the bridge for damage is rather remote. Waterfront structures are the least attractive risk to property insurers, and the property insurance market this year is turning costly. Even in a better underwriting climate, it would probably cost more than one would want to pay.

Cost Estimate for Repairs and Maintenance of the Trail Bridge

- Funds in the amount of $6,635,946 ($7m less FDOT requirements) allocated for the demolition of the bridge were also reallocated on a cost-reimbursable basis to the Counties to repair and transform the bridge into a non-vehicular, recreational facility and trail link between the two Counties. (See Attachment B)

- The completion of the contracts for Superstructure and Substructure Rehab. & Repairs have placed the bridge in structurally sound condition.

- Both Counties assumed the responsibilities for the structure and agreed to share the costs on a 50/50 basis for all future repairs and maintenance of the bridge.

- To estimate the future costs and repairs required for this structure, a service life must first be assumed. If the desired life is set at a 30-year span, the consulting engineers have concluded that the bridge would remain structurally sound at an estimated cost of $7,953,500 for repairs, inspections and maintenance programs over the 30-year period as shown on Attachment C.

- The cost identified in Attachment C for completing the substructure rehab and repairs are eligible for federal funding through Hillsborough County and Pinellas County MPO. Grant request will be submitted by each agency to offset repair and maintenance costs.

Awards Received for Friendship Trail Bridge

- See Attachment D

Richard Ake
Clerk of the Circuit Court
Hillsborough County, Florida

P.O. Box 1110
Tampa, Florida 33601
Telephone (813) 276-8100

Memorandum

Date; July 3, 2001

To. County Commissioners

From: Richard Ake

Subject: Friendship TrailBridge

In its meeting of April 4, 2001, during a discussion about the fur ding options for the future operating costs of the Friendship TrailBridge (Bridge), the Board of County Commissioners requested this Office to look into the financial activities related Bridge and the not for profit corporation, the Gandy Bridge and Friendship Trail Corporation (Corporation).

My staff reviewed the County's official records related to the Bridge, including resolutions and interlocal agreements, obtained financial information from Pinellas County, read the summary minutes of the Oversight Committee established by interlocal agreement between Pinellas and Hillsborough counties, and reviewed information provided by the Corporation. The work performed was not an audit and no opinions are expressed on the financial affairs of the Corporation.

When Pinellas and Hillsborough counties entered into Transfer, agreement with the Florida Department of Transportation (FDOT) in October 1997, the FDOT agreed to make available up to $7 million to satisfy permit and environmental requirements for the new Gandy Bridge which arose as a result of the transfer with any balance remaining being available for Bridge improvements and maintenance as approved by the District VII Secretary. The FDOT provided the following information regarding the uses of the funds:

Amount available under the Bridge Transfer Agreement		$7,000,000
Expenditures through April 27, 2001:		
Mitigation activities for new Gandy Bridge	$ 2 46,498	
Repairs to the Bridge fender system	117,556	
Engineering services	495,371	
Bridge repairs and electrical system	2,859,110	
Substructure Bridge repairs	1,909,496	
Miscellaneous	1,437	**5,629,468.**
Unexpended balance		$ 1,370,532

ATTACHMENT A

The Hillsborough County Public Works Department staff indicated that allocations of the above balance is planned for additional repairs, improvements, and bridge operating costs for the 1999-2000 and 2000-2001 fiscal years as follows:

Unexpended balance		$1,370,532
Engineering services	$ 51,710	
Bridge repairs and electrical system	55,482	
Substructure Bridge repairs	123,987	
Facility enhancement	80,000	
Operating reserve	600,000	911,179
Unexpended and unallocated balance		**$ 459,353**

The Hillsborough County Public Works Department filed an application in April 2001 for federal funds to complete the restoration work that was deferred due to the limited funding noted above. The application is for the 2006-07 fiscal year in the amount of $4.8 million. We were advised that the amount was based on the projected requirements to repair the expected deficiencies to accumulate by 2005.

An engineering firm retained by the Hillsborough County Public Works Department recently compiled information on the life cycle cost to own and operate the Bridge as a recreational facility over the next 30 years. It estimated that the average cost per year would be approximately $600,000 on a net present value basis, exclusive of $8 million to demolish the structure at the end of its useful life.

The Gandy Bridge and Friendship Trail Corporation was formed by a group of citizens that advocated the Bridge be taken over and operated as a recreational facility by Pinellas and Hillsborough counties. It initially pledged to raise private contributions to cover the annual operating cost of the Bridge. The Corporation has been unable to raise sufficient funds and an alternative needs to be identified.

The Corporation represents that it is recognized as a tax exempt charitable organization by the Internal Revenue Service under Section 501(c)(3). Its stated mission is to support the operation and maintenance of the Friendship TrailBridge to remain safe, clean, and free of charge and to advocate for the construction of the planned 15 mile Friendship Trail. Since 1997 there have been a number of fund raising events sponsored by the Corporation. Most of the events were planned to raise operating funds for the Corporation itself. Pinellas County records indicate that $15,150 has been received from the Corporation through May 1, 2001, for deposit into the account administered by Pinellas County for the operating costs of the Bridge. Many of the Corporation's proposals which could generate funding to help pay the recurring operating costs of the Bridge have not been approved by the Oversight Committee.

In conclusion, the decision to continue to operate the Bridge as a recreational facility will cost a minimum of $300,000 annually plus the cost of major repairs which are estimated to average an equal amount on a net present value basis over the 30 year estimated useful life. The Corporation should not be relied upon to provide a significant portion of the funding.

Friendship Trailbridge Budget Summary

Prepared by Hillsborough County Public Works Department
May 24, 2001

Summary of Expenditures and Commitments

Initial Demolition Fund Balance	**$7,000,000**
FDOT Picnic Island Reef Mitigation	**-246,498**
FDOT Fender Repairs	**-117,556**
Engineering & Constr. Insp. Costs	**-547,081**
Superstructure Rehab. & Repair Contract	**-2,914,592**
Operating Reserve (June 3, 1999 motion)	**-600,000**
Substructure Rehab. & Repair Contract [1]	**-2,033,483**
Two Temporary Restroom Facilities	**-80,000**
Signage for Dec. 1999 Grand Opening	**-600**
Adv. & Notification of Constr. Contracts	**-837**
Unallocated Fund Balance [2]	**$459,353**

1 Pending approval of final deductive change order of $2,158.
2 Construction reserve unused; $100,000 added to unallocated fund balance.

Friendship Trailbridge Rehabilitation

Repair the most critical deficiencies as noted in Wade-Trim's bridge inspection report Dated March 1999.

Phase II repairs were performed in 2000/2001 for a cost of $ 2,033,483 Repairs included beams, pile jackets and bent caps.

How much money will be required to be spent over the next 10, 20 and 30 years assuming only critical repairs were completed in the year 2000?

Year	Bi-Annual Inspection/ Operation	Superstructure				Substructure		Mobilization Cost	Sub Total Repair Cost	Total Cost	Cumulative Cost
		Deck Spalling	Rail Replacement	Beam Repairs	Paint Steel Beams Pads and Bents	Pile Jackets	Bent Cap Repairs				
2001	$308,000								$0	$308,000	$308,000
2002	$358,000								$0	$358,000	$666,000
2003	$308,000								$0	$308,000	$974,000
2004	$363,000								$0	$363,000	$1,337,000
2005	$308,000			$450,000	$250,000	$1,850,000	$2,000,000	$250,000	$4,800,000	$5,108,000	$6,445,000
2006	$368,500								$0	$368,500	$6,813,500
2007	$308,000								$0	$308,000	$7,121,500
2008	$374,550								$0	$374,550	$7,496,050
2009	$308,000								$0	$308,000	$7,804,050
2010	$381,205	$60,000	$70,000	$210,000			$250,000	$83,000	$673,000	$1,054,205	$8,858,255
2011	$308,000								$0	$308,000	$9,166,255
2012	$388,526								$0	$388,526	$9,554,781
2013	$308,000								$0	$308,000	$9,862,781
2014	$396,578								$0	$396,578	$10,259,359
2015	$308,000								$0	$308,000	$10,567,359
2016	$405,436								$0	$405,436	$10,972,794
2017	$308,000								$0	$308,000	$11,280,794
2018	$415,179								$0	$415,179	$11,695,974
2019	$308,000								$0	$308,000	$12,003,974
2020	$425,897	$100,000	$105,000	$300,000		$400,000	$1,350,000	$225,500	$2,480,500	$2,906,397	$14,910,371
2021	$308,000								$0	$308,000	$15,218,371
2022	$437,687								$0	$437,687	$15,656,058
2023	$308,000								$0	$308,000	$15,964,058
2024	$450,656								$0	$450,656	$16,414,714
2025	$308,000								$0	$308,000	$16,722,714
2026	$464,921								$0	$464,921	$17,187,636
2027	$308,000								$0	$308,000	$17,495,636
2028	$480,614								$0	$480,614	$17,976,249
2029	$308,000								$0	$308,000	$18,284,249
2030	$497,875								$0	$497,875	$18,782,124
	$10,828,624	$160,000	$175,000	$960,000	$250,000	$2,250,000	$3,600,000	$558,500	$7,953,500	$18,782,124	$18,782,124

Bridge Replacement Cost (including fishing catwalk)
13,770 ft x 32 ft x $115/sq. ft. = $ 50,673,600.00

AWARDS RECEIVED FOR FRIENDSHIP TRAILBRIDGE

July 20, 2001

PROJECT AWARDS AND NOMINATIONS

American Public Works Association (APWA) State
2000 Environmental Project of the Year

American Public Works Association (APWA) National
2000 Historical Restoration/Preservation - $2 to $10 Million

Hillsborough County Metropolitan Planning Organization (MPO)
Award of Merit

American City and County – (Nominated)
Crown Cities Award

Florida Gulf Coast Chapter of Paralyzed Veterans of America
Accessibility Award

Innovations in American Government
Finished in top 25% of applicant pool for 2001 awards program

Tampa Bay Regional Planning Council
FY 99 1st Place – Future of the Region Award – Infrastructure Category

GRAND OPENING CEREMONY AWARDS

National Association of County Information Officers 2000 Awards
Excellence Competition Best in Class, Special Events

National Association of Counties
2000 Achievement Award

Florida Public Relations Association, Tampa Bay Chapter
Image Award

Florida Public Relations Association State Contest
Golden Image Award

3CMA (City-County Communications and Marketing Association) Savvy Awards
Savvy for Best Marketing Campaign

IABC (International Association of Business Communicators) District 2
Silver Quill 2000, Award of Excellence

Florida Government Communicators Association, 2000 Crystal Award
Special Events

Tampa Bay Regional Planning Council
FY 2000 1st Place – Future of the Region Award – Cultural/Sports/Recreation Category

Prepared By: Hillsborough County Public Works Department
(Friendship TrailBridge Awards.doc)

Appendix G

GATORBRIDGE™

Durable Pedestrian Bridges

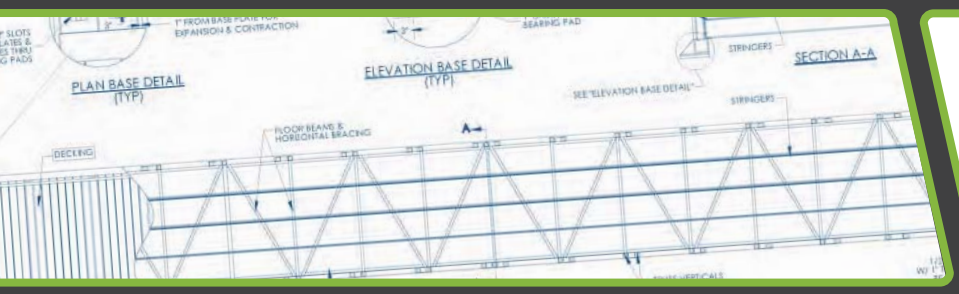
Project Proposal

Project | Friendship Trail Bridge

Prepared exclusively for | Advanced System Designs

Prepared by | Paul Schmitz

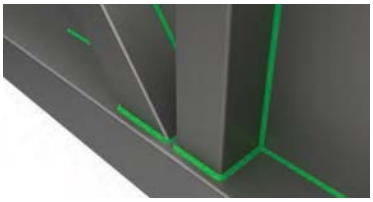
Presented | 4/16/12



Anatomy of a GatorBridge

Standard Features

Each of our GatorBridge products are expertly crafted with attention to detail. We take pride in making sure that we deliver a premium quality product for every customer. Here are some of the features that come standard in every one of our bridges.

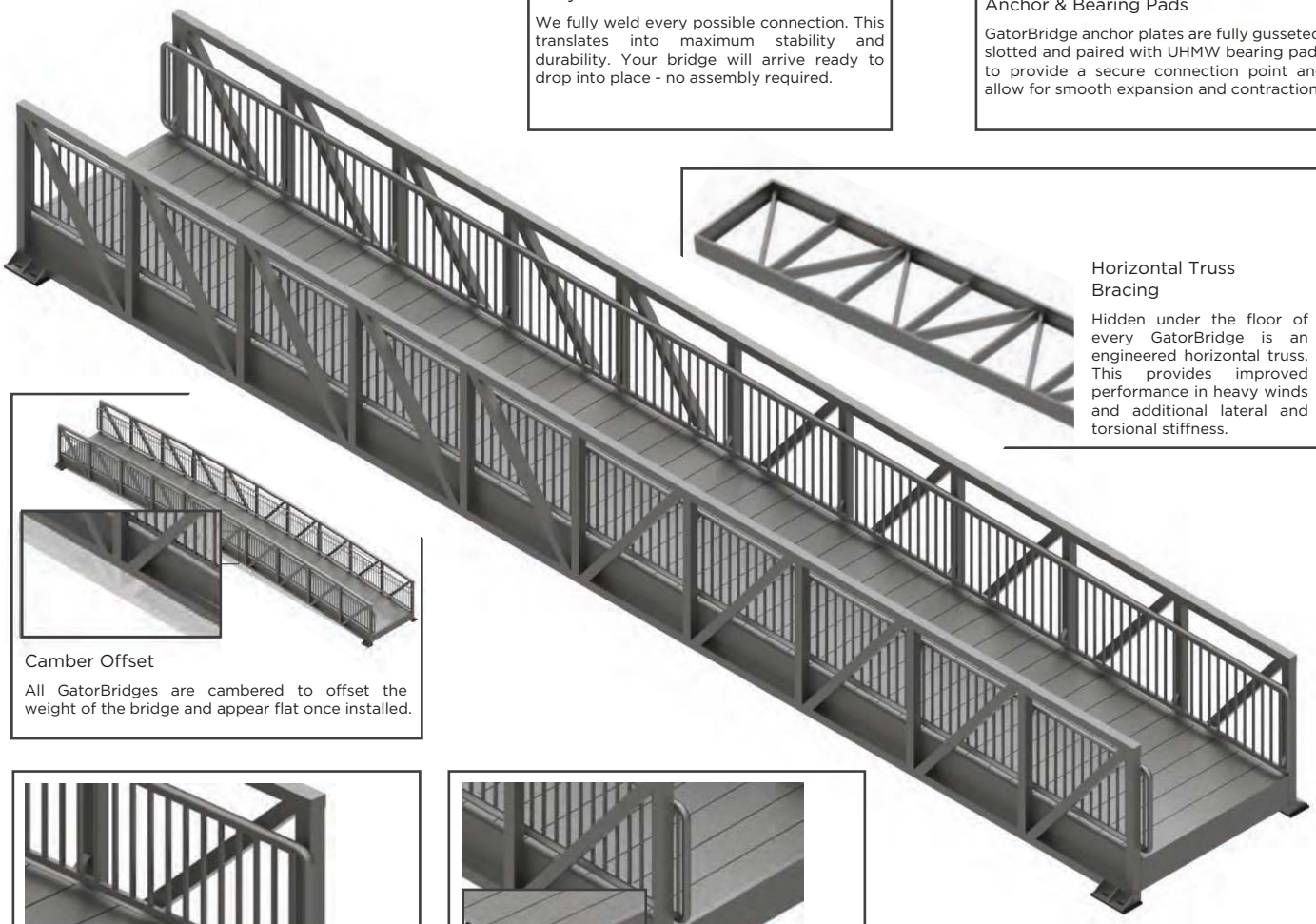


Fully Welded

We fully weld every possible connection. This translates into maximum stability and durability. Your bridge will arrive ready to drop into place - no assembly required.

Anchor & Bearing Pads

GatorBridge anchor plates are fully gusseted, slotted and paired with UHMW bearing pads to provide a secure connection point and allow for smooth expansion and contraction.



Horizontal Truss Bracing

Hidden under the floor of every GatorBridge is an engineered horizontal truss. This provides improved performance in heavy winds and additional lateral and torsional stiffness.

Camber Offset

All GatorBridges are cambered to offset the weight of the bridge and appear flat once installed.

Combination Rail

The Gator Combination Rail is our most effective rail design. It utilizes patented technology to combine ergonomic handrail, toe rail and guard rail together into one elegant package.

Aluminum Deck Enclosed Floor System

By constructing the horizontal truss, floor beams, stringers and deck within an enclosed frame, stability is dramatically improved. The standard aluminum deck option is designed to seamlessly integrate into the GatorBridge Floor System. It is durable, slip resistant and remains cool to the touch.

GATORBRIDGE™
Durable Pedestrian Bridges

GATORBRIDGE™
Durable Pedestrian Bridges

We are providing this budgetary estimate because we are either missing some important information necessary to develop a final quotation and/or you have not made a decision on the final product you want. If you would like a final quotation, please contact your CMI representative listed below to complete your project information.

Budgetary Estimate*

Bridge Details

Inside Clear Width	16'
Bridge Length	45' (253 pcs)
Elevation Change	N/A

Standard Attributes

Truss Style | Cascade
Deck Style | Aluminum Decking
Rail Style | 42 inch Combination Rail
Color | Standard Aluminum

Standard Total N/A

Upgrade and Add-On Options Choosen

Truss Style |	N/A
Deck Style |	N/A
Rail Style |	N/A
Color |	N/A
Other |	

Upgrade Total See Comments

Bridge Weight Estimate	TBD
Delivery Cost Estimate	TBD

Total Projected Cost $80-$100 /square foot

Project Details

Estimate Date	4/16/12
CMI Representative	Paul Schmitz
	pschmitz@cmilc.com
Project Name	Friendship Trail Bridge
Project City	Tampa
Project State	FL
Project Contact	Advanced System Designs

Comments

Pricing reflects favorable loading, design, and configuration conditions and is extremely preliminary.

Standard truss styles and other attributes may not be available.

Framing for a light-weight concrete deck, light and occasional maintenance vehicle loading, Combination rail (FDOT index 860 equal) and sufficient backwall height (bottom of bearing to top of deck) are assumed.

www.gatorbridge.com phone. 866.709.0034 fax. 770.933.8363

*This budgetary estimate is not an official quotation and cannot be used to place an order. All information presented is based on customer provided information. CMI cannot and does not make any claims or recommendations related to fitness for any particular use or application.

CMI LIMITED COMPANY is a Crane Building Products® company. ShoreGuard®, The ShoreGuard Seawall SystemTM, C-Loc®, TimberGuard®, GeoGuard®, Dura Dock®, Shore-All®, GatorGates®, GatorDock EliteTM, ArmorWareTM, ArmorRodTM, Box ProfileTM, UltraCompositeTM, Elite WallTM, Elite PanelTM, Elite Fascia PanelTM, Flat PanelTM, XCRTM, XCR TechnologyTM, XCR VinylTM, GatorBridgeTM, Gator AluminumTM, Gator Sheet PilingTM, GatorDockTM, I-Beam LockTM, Textured SlateTM, Crane Materials InternationalTM logo, CMI Sheet Piling SolutionsTM, Aqua Terra SystemTM, EnduranceTM, Endurance CSPTM, PolarisTM, EclipseTM, GridSpineTM, 21 PolyTM, PileClawTM and CMI Waterfront SolutionsTM are trademarks, service marks or trade names of CMI LIMITED COMPANY and may not be used without prior written permission. CMI LIMITED COMPANY products are covered by one or more of the following U.S. Patents and International Patents: 4,674,921; 4,690,588; 5,292,208; 5,145,287; 6,000,883; 6,033,155; 6,053,666; D420,154; 6,575,667; 7,059,807; 7,056,066; 7,025,539; 7,393,482; 5,503,503; 5,803,672; 6,231,271; 1,245,061CA and other patents pending.

CRANE MATERIALS INTERNATIONAL

TAMPA BAY
RAYS

FLORIDA STRUCTURAL STEEL

an affiliate of TAMPA TANK INC.
Steel Fabrication & Erection

TO: ASD

Via e-mail: kcowart@asdnet.com

ATTN: Kenneth Cowart
Ph: 813-223-2293
Fx: 813-223-2433

QUOTE# 12-098
DATE: April 24, 2012
PROJECT: Friendship trail, Gandy Bridge – **Budgetary Pricing**
LOCATION: Tampa/St Pete
A/E: ASD
PLANS: Sketches
SPECS: None

SUBJECT TO THE PRINTED TERMS AND CONDITIONS, which are hereby referred to and made a part of this proposal, Florida Structural Steel (www.tti-fss.com), an AISC certified fabricator, quotes you as follows:

We propose to furnish, F.O.B. jobsite, unloading not included, the following:

01. Galvanized steel beam longitudinal framing (252 sections 16' x 48') including neoprene pads and anchor bolts
02. Galvanized steel angle cross connections
03. Galvanized steel handrail with Pipe cap and 2 runs of ½" cable
04. Galvanized steel framing for canopies, every 3rd span one side only

EXCLUSIONS:

1. **DESIGN**
2. **BOND**
3. **Any and all framing at the start of the hump and ending at the end of the hump.**
4. Erection
5. Field measurements
6. All taxes: ie Florida sales/use tax, gross receipts tax, Excise tax, Duties, Port fees
7. All anchors, bolts, screws, brackets, hangers, wheels, etc., for other trades.
8. All other items not listed above.

NOTES:

1. Preparation of shop and erection drawings, material quality, fabrication, delivery, and erection shall be executed in accordance with "Code of Standard Practice for Steel Building and Bridges" as defined in AISC Manual of Steel Construction ASD, Ninth Edition, unless specifically noted otherwise in this document.

2710 5th Avenue • Tampa, Florida 33605 • Ph (813) 241-4261 • Fax (813) 247-3864

2. This quotation is based on size and type of materials designed by the architect/engineer for this project. Florida Structural Steel is not responsible for redesign or interpretation of these designs in order to meet federal, state or local building codes.
3. Payments will be made for materials delivered to the jobsite or stored in our warehouse or other approved locations upon presentation of our invoices.
4. Contractor or Owner shall carry All Risk Insurance to cover our materials stored or installed at the jobsite including our necessary labor to correct damages by others, including vandalism, fires, etc.
5. Payments due us are not contingent upon payments by others nor shall we waive our lien rights prior to receiving payments then due us.
6. We shall not be bound by any hold harmless agreement. We shall be liable for our own negligence only and that of our employees or the acts of our subcontractors.
7. Backcharges are not acceptable without our prior written approval.
8. Acceptance of all orders and shipments are subject to the approval of our credit department.
9. **Standard truck rate is $125.00 per hour for standby waiting after 2 hours up to 4 hours and then an increased rate may apply or no further standby time may be available. Special tractors, trailers and/or permitted loads will require extra charges. Holding time may affect future scheduled loads due to turn around times being affected. Standby time may not be allowed due to schedules, permits etc.**
10. **ALL deliveries are daytime.**
11. Should delivery and/or installation of material be substantially delayed as a result of actions by the Owner, the Contractor or their representatives, Florida Structural Steel shall be compensated to cover actual costs plus overhead and profit as a result of such delays.
12. See final page of our quotation for further notes.
13. In the absence of a delivery schedule prior to bid date, any subsequent schedule will be on a mutually agreed upon basis.
14. Price is subject to review pending terms and conditions of contract that differ and/or conflict with this quotation.
15. Florida Structural Steel reserves the right to substitute any fasteners with ones of equal structural value, due to availability and/or minimum order requirements of those specified.

16. Steel is not limited to domestic origin.
17. Testing and cost of testing by others.
18. Above prices are based on truckload shipments. Additional costs for lesser quantities to be added to the above price.
19. Upon acceptance of this proposal, the scope of work, exclusions, notes, terms and conditions noted herein shall be incorporated into and become a part of the sub-contract agreement.

LUMP SUM BUDGETARY PRICE $10,439,465.00

This proposal is valid for 30 days. However, steel prices are fluctuating daily. At the time the owner/contractor is ready to place an order with FSS. FSS will then verify cost and availability of raw steel and confirm to the owner/contractor if pricing of this proposal is still valid, or advise the owner/contractor of any adjustments that may be necessary prior to placement of the order.

ACCEPTED BY BUYER FLORIDA STRUCTURAL STEEL

Stephen J Firman

PH 813-241-4261 x 203

FLORIDA STRUCTURAL STEEL TERMS AND CONDITIONS

Unless altered in the typewritten portions of this proposal, the following shall prevail:

1. This proposal is for material and services as defined by the applicable code: Structural steel in accordance with the AISC Code of Standard Practice; Steel joist and accessories in accordance with the Code of Standard Practice of the Steel Joist Institute; Miscellaneous and architectural metals in accordance with the Code of Standard Practice of the National Association of Architectural Metal Manufacturers, all revised to this date thereof.
2. There are no other understandings between parties other than as set forth herein.
3. In the event of a conflict between terms and conditions of this proposal and the terms and conditions stated in the drawings and/or specifications, the terms of this proposal shall govern.
4. The Seller shall not be responsible for the accuracy, adequacy, or consistency of any information given by others.
5. Terms, unless noted otherwise are **NET 30 DAYS** from date of invoice, NO discount. The sums due shall bear interest after 30 days at the rate of 18% per annum or the legal minimum. Buyer agrees to pay all of the Sellers cost and expenses including reasonable attorney's fees and legal expenses, such as attorney's fees to include but not limited to, fees and cost incurred in all matters of collection and enforcement, construction and interpretation, before, during, and after trial proceedings and appeals, as well as appearances in and connected with any bankruptcy proceedings, creditors reorganization and arrangement proceedings or probate proceedings, arising out of, pertaining to or relating to this quotation as well as any and all contracts or agreements arising therefrom and in enforcing or defending the terms and provisions contained in any and all documents evidencing Buyer's liabilities to Sellers.
6. Acceptance, shipments and performance of this contract shall at all times be subject to the approval of the Sellers Credit Department.
7. When prices quoted are for delivery by Seller's truck, then delivery shall be f.o.b. trucks, jobsite, curbline, at the nearest accessible road or street in such a state of condition of repair as not to injure or cause undo hardship to Seller's personnel, trucks, or equipment. Unloading is not included. Buyer is to arrange for prompt unloading in order to avoid trucks delay.
8. The Seller shall not be responsible for delays in the performance in whole or in part of any contract made on the basis of this proposal resulting in whole or in part from cause out of control of Seller, including but not limited to fire; earthquake; flood; rainstorm; strikes; lockouts or other differences with workmen or employees; accidents; war; riots; embargoes; delays; losses or damages in transportation shortages in cars, fuel, labor, or material; delays of other companies or contractors, or any other contingencies beyond the reasonable control of the Seller whether occurring at the producing mills, the Seller's works, in route to the plant/jobsite, or at the jobsite. In the event of such delay, the time of completion shall be extended, as the circumstances require.
9. The Seller will replace any defective material under terms of this contract, within one year after deliver, upon presentation of evidence of such defects satisfactory to the Seller, but no claims for direct or consequential damage shall be allowed. The Buyer shall not fill any shortages nor return to the Seller any defective material or do any work for the Seller's account without specific written authorization from Seller. No payment shall be withheld by the Buyer pending adjustment of liability or the amount of the claim.

10. When the Seller has delivered the material covered by this proposal to the jobsite or designated storage site, the Buyer shall assume full responsibility for the theft of and any damages to such material caused by but not limited to fire, accident, earthquake, flood, exposure, windstorm, war, riot, strikes, embargoes, or any other damage from whatever source not under control of the Seller.
11. The Seller shall not be responsible for any liquidated damages or penalties.
12. It is agreed that all payments hereunder are due and payable at Seller's place of business in Tampa, Hillsborough County, Florida. Acceptance by Seller at other places, including invoicing payable at lock box (es), shall not be deemed to constitute a waiver of foregoing agreement and, unless expressly prohibited by applicable state statute, it is agreed that suit hereunder may be brought in a court of competent jurisdiction in Hillsborough County, Florida, with any privilege of Buyer to be sued in county of residence or place of business to be waived.
13. EXCEPT AS OTHERWISE SET FORTH HEREIN, THERE ARE NO WARRANTIES EXPRESSED OR IMPLIED BY THE SELLER.

Appendix I

FRIENDSHIP TRAIL (3334000)

GENERAL FUND (0101)

In 1997 the Florida Department of Transportation transferred ownership of the "Old Gandy Bridge" to Hillsborough and Pinellas Counties jointly. The Friendship Trail is a 2.6 mile bicycle and pedestrian trail spanning Tampa Bay via the Old Gandy Bridge. Facilities include 91 parking spaces and restrooms. This cost center accounts for the operation and maintenance of park facilities along Gandy Boulevard approaching the bridge and the bridge itself.

As part of the departmental reorganization in FY06, the budget for this cost center is consolidated to the Parks-North District (3300001) cost center.

Expenditure Summary	FY04 Actual	FY05 Budget	FY06 Request
0101 5120000 REGULAR SALARIES & WAGES	78,581	84,240	0
0101 5140000 OVERTIME	2,838	10,490	0
0101 5200000 EMPLOYEE BENEFITS	31,643	37,900	0
PERSONAL SERVICES	113,062	132,630	0
0101 5310000 PROFESSIONAL SERVICES	150	170	0
0101 5340000 OTHER CONTRACTUAL SERVICES	80,620	100,000	0
0101 5365000 INTRGOV SVCS-RISK FINANCING	16,560	0	0
0101 5400000 TRAVEL AND PER DIEM	324	500	0
0101 5410000 COMMUNICATION SERVICES	8	2,000	0
0101 5430000 UTILITY SERVICES	2,559	3,500	0
0101 5440000 RENTALS AND LEASES	5,976	4,800	0
0101 5460000 REPAIR & MAINTENANCE SVCS	0	2,000	0
0101 5470000 PRINTING AND BINDING	0	50	0
0101 5510000 OFFICE SUPPLIES	1,629	50	0
0101 5520000 OPERATING SUPPLIES	2,304	7,000	0
OPERATING EXPENSES	110,130	120,070	0
Total	223,192	252,700	0

Appendix J

Walkway Over the Hudson

Economic Impact Update

Final Report

February 2012

Prepared By:

camoin associates
ECONOMIC DEVELOPMENT

P.O. Box 3367
Saratoga Springs, NY 12866
518.899.2608

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EXECUTIVE SUMMARY

In 2008, the Dyson Foundation commissioned Camoin Associates to conduct an economic impact analysis of the then-proposed Walkway Over the Hudson (WOTH) project. Because no visitation data was available in 2008, Camoin Associates used comparative data from other destination tourism sites to project visitation counts. Since the dedication of the WOTH in 2009, New York's Office of Parks, Recreation and Historic Preservation (OPRHP) has kept detailed records of visitation to the bridge and Camoin Associates has overseen a random-sample survey of visitors to the WOTH. Using this newly available data, Camoin Associates is modifying its 2008 projections and recalculating economic and fiscal impacts.

The OPRHP usage data shows that the WOTH is attracting approximately 500,000 visitors annually since it first opened. Our survey, conducted by WOTH volunteers in the Fall of 2010 and the Spring and Summer of 2011 collected visitor origin and spending patterns from over 1,000 respondents. We used both of these sources to determine the number of out-of-county and out-of-state visitors to the WOTH and the amounts and types of spending that they bring to the area.

In addition to the economic impact of the pedestrian bridge, Camoin Associates also considered the fiscal impacts on government revenues. The new business activity and wages resulting from visitor spending generates additional revenue for local and state government in the form of sales, hotel and income tax. The following is a summary of the major findings of the report.

Dutchess and Ulster County

The survey data analysis found that, of the 500,000 annual visitors to the Walkway Over the Hudson, 48% are from places other than Dutchess and Ulster Counties. These 48% are considered "net new" to the area and, therefore, their spending has an impact on the local economy. We aggregated this new spending into major categories and ran them through an economic impact modeling system. The following table shows the direct and indirect economic and fiscal impacts of the WOTH on Dutchess and Ulster Counties.

Summary of Impacts on Dutchess and Ulster Counties		
Annual Sales	**$**	**23,942,410**
Direct Sales	$	15,446,716
Annual Jobs		**383**
Direct Jobs		290
Annual Wages	**$**	**9,435,000**
Direct Wages	$	5,788,344
Annual County Revenue	**$**	**779,181**

The $15.4 million in direct spending by non-local users results in nearly $8.5 million in indirect "spillover effects" for a total of almost $24 million in new sales throughout the Counties, 383 new jobs and $9.4 million in new wages. In addition, Dutchess and Ulster Counties receive $779,181 in sales and hotel tax revenue generated by this new economic activity.

New York State

A review of the zip codes provided by the survey respondents showed that 28% of the visitors to the WOTH are from outside of New York State. Based on the same methodology used to determine the economic impacts on Dutchess and Ulster Counties, Camoin Associates determined that spending by

non-state residents resulted in over $10.5 million in direct annual sales. The following table shows the economic and fiscal impacts of the WOTH on New York State.

Summary of Impacts on New York State		
Annual Sales	**$**	**21,990,514**
Direct Sales	$	10,521,777
Annual Jobs		**208**
Direct Jobs		130
Annual Wages	**$**	**8,519,000**
Direct Wages	$	3,980,841
Annual State Revenue	**$**	**575,479**

The $10.5 million in direct sales results in almost $22 million in total sales, 208 total jobs and $8.5 million in new wages. In addition, the State receives $575,479 in sales tax revenue.

INTRODUCTION

In anticipation of the construction and completion of the Walkway Over the Hudson pedestrian bridge, Camoin Associates was hired in 2008 by the Dyson Foundation to complete an economic impact study on the proposed Walkway Over the Hudson pedestrian bridge ("WOTH" or "pedestrian bridge"). At that time, construction of the pedestrian bridge had not yet been completed and the visitation and spending data were based on the best available research including interviews with regional visitor attractions, review of other studies on the impact of trails and estimates based on local visitation. The Camoin Associates study in 2008 used figures to estimate the number of visitors to the pedestrian bridge and therefore the economic impact of the project. In 2008, Camoin Associates estimated that annual visitation by both local and non-local users would be approximately 267,799.

Since the WOTH opened in 2009, the response has been overwhelming and visitation has been higher than originally estimated by Camoin Associates. In 2010, the Dyson Foundation engaged Camoin Associates to conduct an updated economic impact analysis based on two sources: (1) visitation counts completed by the New York State Office of Parks, Recreation and Historic Preservation ("OPRHP") and (2) face-to-face surveys conducted throughout the year with visitors to the WOTH.

Camoin Associates worked with the Walkway Over the Hudson organization and OPRHP to develop a survey instrument to gather information from visitors that could not only be used in this economic impact analysis, but would also provide helpful information regarding marketing/promotion, suggestions from visitors and other information that the Walkway Over the Hudson organization and OPRHP can use to improve the WOTH. The survey was administered by volunteers during the Fall of 2010 and Spring and Summer of 2011.

The following report prepared by Camoin Associates quantifies the value of the WOTH on the State of New York and Dutchess and Ulster Counties. Specifically the report determines the impact in sales, jobs and wages. As with the study conducted in 2008, this report focuses on the impact of the WOTH on two specific geographies: (1) the State of New York and (2) Dutchess and Ulster Counties, the counties that act as the entry points for the bridge.

Project Background

The Walkway Over the Hudson pedestrian bridge is the world's longest elevated pedestrian bridge and it links the City of Poughkeepsie on the east banks of the Hudson River to the Town of Highland on the west banks of the Hudson River. The pedestrian bridge is over 1.25 miles long and is used by pedestrians and bicyclists throughout the year. The nonprofit organization Walkway Over the Hudson took ownership of the bridge in 1998 as part of their efforts to link rail trails that exist on both sides of the Hudson. In 2008, Walkway Over the Hudson organization partnered with the Dyson Foundation to secure funding, public and private, to begin construction that would allow the bridge to open for pedestrian use. Construction finally began in 2008 after funding was accessed and the bridge opened as a State Historic Park in October 2009.

METHODOLOGY

Camoin Associates used the following methodology in conducting this study:

1. Survey bridge users throughout the year to determine actual spending by visitors to the Walkway Over the Hudson pedestrian bridge.
2. Analyze data to determine what percentages of visitors are residents of Dutchess/Ulster County and what percentage are residents of New York State.
3. Collect data from OPRHP on total visitor counts to WOTH.
4. Determine the total number of new annual visitors by multiplying the survey's new visitation percentages and the OPRHP total visitor counts.
5. Based on survey findings, determine average visitation spending of a typical non-local Walkway Over the Hudson user, including those attendees that are day trippers and those that would stay overnight.
6. Aggregate "new" spending by multiplying the average spending (Step 5) by the "new annual visitor" estimates (Step 4).
7. Calculate direct jobs/economic activity resulting from the "new" spending.
8. Model indirect impacts on jobs/economic activity using the EMSI software package.
9. Arrive at total economic impacts as the sum of all direct and indirect impacts.

We performed these calculations first on the "new" visitors to Dutchess/Ulster Counties and a second time on "new" visitors to New York State.

Modeling Software

Economic Modeling Specialists, Inc. (EMSI) designed the input-output model used in this analysis. The EMSI model allows the analyst to input the amount of new direct economic activity (spending or jobs) occurring within the study area and uses the direct inputs to estimate the spillover effects that the net new spending or jobs have as these new dollars circulate through the study area's economy. This is captured in the indirect impacts and is commonly referred to as the "multiplier effect." See Attachment A for more information on economic impact analysis.

Visitor Counts

The NYS Office of Parks, Recreation and Historic Preservation conducts daily visitor counts on the bridge and these numbers were provided to Camoin Associates for this study. The table below shows the visitor counts as provided by the Office of Parks, Recreation and Historic preservation. Note that counts for September through December were not available at the time this report was written.

OPRHP Visitor Counts		
	2010	2011
Jan	13,855	8,318
Feb	9,641	9,718
March	3,863	17,352
April	48,571	45,212
May	45,263	61,659
June	28,954	66,936
July	37,432	42,491
August	44,755	30,665
Sept	43,940	Not Available
Oct	75,912	Not Available
Nov	21,795	Not Available
Dec	1,592	Not Available

Source: OPRHP

Based on data provided by the Walkway Over the Hudson organization and the NYS Office of Parks, Recreation and Historic Preservation Camoin Associates uses an estimate of 500,000 visitors annually to the park for this report. The Walkway Over the Hudson organization reports that average visitation per month over the last 24 months (since the park was opened) has been 47,270 which equals over 560,000 visitors per year but the annual visitation number has been reduced to account for the very high number of visitors during the first two months of the bridge's operation[1].

Visitor Surveys

As described in the introduction, Camoin Associates was commissioned to assess and report on the economic impacts of the Walkway Over the Hudson pedestrian bridge on Dutchess and Ulster Counties and New York State based on primary data gathered through an on-site survey. The survey tool was developed to collect data on socioeconomic characteristics including visitor origins and per party spending data. Surveys were distributed through the entire day on the following days:

[1] Note that during the period that the survey was conducted (September 2010 through August 2011) there were 425,590 visitors to the WOTH. However, WOTH and the State Office of Parks, Recreation and Historic Preservation believe that 500,000 is a better estimate for annual visitation.

- October 17, 2010
- October 22, 2010
- October 23, 2010
- October 24, 2010
- May 13, 2011
- May 28, 2011
- July 29, 2011
- August 5, 2011
- August 6, 2011
- August 13, 2011
- August 20, 2011

The survey was administered by volunteers recruited and trained by the Walkway Over the Hudson organization. Surveys were distributed randomly to pedestrian bridge users by Walkway Over the Hudson organization volunteers. Volunteers did their best to make the survey as random as possible by approaching every 5th user of the bridge, but Camoin Associates acknowledges that not all users approached were willing to complete the survey and therefore the results of the study are not to be considered completely random or scientific. The volunteers collected over 1,000 surveys and Camoin Associates entered the data into a spreadsheet for analysis.

ECONOMIC IMPACTS ON DUTCHESS AND ULSTER COUNTIES

New Visitation Estimates

As summarized in the following table, net new visitation is considered the percentage of visitors to the WOTH who are from outside of Dutchess County and Ulster County. Based on the survey findings, on average 48% of parties that returned surveys are visiting the WOTH from outside of Dutchess and Ulster Counties. Note that the "net new" percentages were relatively consistent across time periods.

Net New Visitors			
	Parties From Dutchess/Ulster County	Parties Not From Dutchess/Ulster County	Net New %
Fall	208	224	52%
Spring	160	115	42%
Summer	133	122	48%
Average	**167**	**154**	**48%**

Note: Not all survey respondents completed this field

Based on the annual visitation numbers shown in the Methodology section of this report, the table below shows that over 240,000 visitors to the WOTH bridge are net new to Dutchess and Ulster Counties, and therefore their spending has an economic impact on the local economy.

Net New Annual Visitors - Dutchess and Ulster Counties	
Total Annual Visitors	500,000
Net New Percentage	48%
Net New Visitors	240,000

Source: OPRHP, Camoin Associates

New Visitation Spending Estimates

Visitor Spending by Category

The next step in the analysis is to calculate the types and amounts of non-county resident visitor spending. In general, the types of purchases that are expected to occur as a direct result of the project include spending on lodging, transportation, recreation, food, and retail. The survey asked for an estimate of the amount of money spent by the respondent's whole party during their stay in Dutchess and Ulster Counties. The table below shows the non-county resident spending reported in the survey responses.

Spending Reported by Non-County Residents in Survey								
	Transport	Restaurant	Grocery	Lodging	Retail	Recreation	Other	Total
Total Spending Reported	$ 8,604	$ 31,158	$ 4,700	$ 35,433	$ 5,769	$ 4,314	$ 5,856	$ 95,834

Source: Camoin Associates

Using the information provided by the survey respondents regarding the number of people (adults and children) in their party, the following table establishes average spending per person figures. As seen

below, the average spending per non-county resident WOTH users is $64.36 (this includes those from out of NYS and those that live in NYS but not within the two counties). [2]

Average Spending Per Person - Non-County Residents								
	Transport	Restaurant	Grocery	Lodging	Retail	Recreation	Other	Total
Total Spending Reported	$ 8,604	$ 31,158	$ 4,700	$ 35,433	$ 5,769	$ 4,314	$ 5,856	$ 95,834
Average Per Person (1,489 visitors reported on survey)	**$ 5.78**	**$ 20.93**	**$ 3.16**	**$ 23.80**	**$ 3.87**	**$ 2.90**	**$ 3.93**	**$ 64.36**

Source: Camoin Associates

Total Net New Spending by Category

Using the average per person spending calculated in the section above, Camoin Associates multiplied that figure by the number of annual non-county resident visitors to the WOTH ("net new" visitors). The tables below show the direct net new spending occurring in Dutchess and Ulster Counties that is attributable to the WOTH.

Net New Annual Spending - Non-County Residents								
	Transport	Restaurant	Grocery	Lodging	Retail	Recreation	Other	Total
Average Spending Per Person (1,489 visitors reported on survey)	$ 5.78	$ 20.93	$ 3.16	$ 23.80	$ 3.87	$ 2.90	$ 3.93	$ 64.36
Non-County Resident Annual Spending (240,000 visitors)	**$1,386,810**	**$5,022,109**	**$ 757,555**	**$5,711,162**	**$ 929,859**	**$ 695,339**	**$ 943,882**	**$15,446,716**

Source: OPRHP, Camoin Associates

Direct spending that is occurring in Dutchess and Ulster County as a result of the pedestrian bridge is equal to $15,446,716.

Total Impacts on Dutchess and Ulster Counties

$15,446,716 in direct net new spending by non-county residents was used as the input for the EMSI economic impact model. The EMSI model allows the analyst to break down the total spending by NAICS code to get an accurate read for how one dollar spent in a specific sector multiplies throughout the local economy. To analyze the impact of the pedestrian bridge on Dutchess and Ulster Counties, the total spending is broken down into a variety of NAICS codes which capture the spending habits of a WOTH user.

The table below outlines the direct and indirect economic impact of the WOTH on Dutchess and Ulster Counties. The indirect impacts are those that occur as the dollars from direct impacts cycle through the economy. For example, the new employees receive wages and in turn spend a portion of those dollars in the local economy for daily needs, housing and other expenses, and a proportion of those dollars are again re-spent in the local economy. As those dollars continue to circulate, additional jobs and business activity are created. This effect is captured in the indirect impacts. Taking into account the indirect economic impacts, the WOTH is estimated to create a total of $23.9 million in new sales, 383 new jobs, and $9.4 million in new earnings.

[2] It is important to note that the average spending per person for the lodging category includes both day visitors and overnight visitors as reported on in the survey. A higher percentage of bridge users reported being in the area just for the day and therefore did not include any costs associated with lodging, effectively lowering the average lodging expenditures per visitor figure. Camoin Associates is aware that additional lodging spending research is being conducted on the City of Poughkeepsie, but this analysis was conducted on the information reported by visitors in the survey.

Economic Impact on Dutchess and Ulster Counties			
	Direct	Indirect	Total
Sales	$ 15,446,716	$ 8,495,694	$ 23,942,410
Jobs	290	93	383
Wages	$ 5,788,344	$ 3,646,656	$ 9,435,000

Source: EMSI, Camoin Associates

ECONOMIC IMPACTS ON NEW YORK STATE

Camoin Associates followed the same process as above to determine the economic impact of Walkway Over the Hudson on New York State. In order to do this, the survey responses were separated into non-NYS residents and NYS residents. The data on spending and number of visitors is based on the responses from the non-NYS residents and the impact is calculated in the following section.

New Visitation Estimates

Camoin Associates used the reported zip codes to identify the percentage of parties that are coming to WOTH from outside of New York State. Based on the survey findings, on average 28% of parties that returned surveys are visiting the WOTH from outside of New York State. A small percentage even report originating from outside of the United States of America.

Net New Visitors			
	Parties From New York State	Parties Not From New York State	Net New %
Fall	337	117	26%
Spring	208	92	31%
Summer	183	75	29%
Average	**243**	**95**	**28%**

Note: Based on the zip code reported per survey returned

Based on the annual visitation numbers reported by OPRHP and listed in the Methodology section of this report, the table below shows that just under 140,316 visitors to the WOTH bridge are net new to New York State, and therefore their spending has an economic impact on the state economy.

Net New Annual Visitors - New York State	
Total Annual Visitors	500,000
Net New Percentage	28%
Net New Visitors	140,316

Source: OPRHP, Camoin Associates

New Visitation Spending Estimates

Visitor Spending by Category

Just as was done for Dutchess and Ulster Counties, the following table breaks down the non-NYS resident survey responses into total spending by category.

Spending Reported by Non-State Residents in Survey								
	Transport	Restaurant	Grocery	Lodging	Retail	Recreation	Other	Total
Total Spending Reported	$ 6,232	$ 20,912	$ 3,339	$ 25,474	$ 3,490	$ 3,190	$ 7,925	$ 95,834

Source: Camoin Associates

Based on the survey respondents' report of the number of people in their party, the following table establishes average spending per person figures. As seen below, the average spending per non-State resident WOTH users is $74.99.

Average Spending Per Person - Non-State Residents								
	Transport	Restaurant	Grocery	Lodging	Retail	Recreation	Other	Total
Total Spending Reported	$ 6,232	$ 20,912	$3,339	$25,474	$3,490	$ 3,190	$7,925	$95,834
Average Per Person (941 visitors reported on survey)	**$ 6.62**	**$ 22.22**	**$ 3.55**	**$ 27.07**	**$ 3.71**	**$ 3.39**	**$ 8.42**	**$ 74.99**

Source: Camoin Associates

Total Net New Spending by Category

Using the average per person spending calculated in the section above and the number of non-NYS resident annual visitors, the tables below show the direct net new spending that is attributable to the WOTH.

Net New Annual Spending - New York State								
	Transport	Restaurant	Grocery	Lodging	Souvenir	Recreation	Other	Total
Blended Average Per Person	$ 6.62	$ 22.22	$ 3.55	$ 27.07	$ 3.71	$ 3.39	$ 8.42	$ 74.99
Non-NYS Resident Annual Spending (140,316 visitors)	**$ 929,278**	**$3,118,270**	**$ 497,891**	**$3,798,528**	**$ 520,408**	**$ 475,673**	**$1,181,728**	**$10,521,777**

Source: OPRHP, Camoin Associates

Spending occurring in New York State as a result of the pedestrian bridge totals $10,521,777. The impact of the bridge on NYS is less than that on the Counties because some of the new visitors to Dutchess and Ulster will be residents of New York State and are therefore not bringing "new dollars" into the state.

Total Impacts on New York State

The direct net new spending by non-NYS residents was used as the input for the EMSI economic impact model. The EMSI model allows the analyst to break down the total spending by NAICS code to get an accurate read for how one dollar spent in a specific sector multiplies throughout the local economy.

The table below outlines the direct and indirect economic impact of the WOTH on New York State. The indirect impacts are those that occur as the dollars from direct impacts cycle through the economy. For example, the new employees receive wages and in turn spend a portion of those dollars in the local economy for daily needs, housing and other expenses, and a proportion of those dollars are again re-spent in the local economy. As those dollars continue to circulate, additional jobs and business activity are created. This effect is captured in the indirect impacts. Taking into account the indirect economic impacts, the WOTH is estimated to create an additional $21.9 million in sales, 208 jobs and $8.5 million in new wages in New York State each year.

Economic Impact on New York State			
	Direct	Indirect	Total
Sales	$ 10,521,777	$ 11,468,737	$ 21,990,514
Jobs	130	78	208
Wages	$ 3,980,841	$ 4,538,159	$ 8,519,000

Source: EMSI, Camoin Associates

LIMITED FISCAL IMPACT STUDY

Fiscal impacts of the WOTH on Dutchess and Ulster Counties include sales tax revenue from direct sales and earnings and hotel tax revenue. New York State will also enjoy additional sales tax revenue related to the project. The section below outlines the additional municipal revenue associated with WOTH.

Dutchess County and Ulster County Fiscal Impacts

Sales Tax Revenue

County sales tax is generated in two ways 1) total direct sales related to the WOTH, 2) spending related to job creation and new earnings.

First, of the $23,942,410 in new sales generated as a result of the WOTH, the majority would be taxable and, therefore, result in sales tax revenue for the Counties. Based on the analysis, direct sales would result in an additional $556,661 combined local tax revenue for Dutchess and Ulster Counties

Dutchess and Ulster Counties Sales Tax Revenue - Direct Sales		
Direct Sales	$	23,942,410
Percent Taxable*		60%
Taxable Sales	$	14,365,446
County Sales Tax Rate **		3.88%
New Local Tax Revenue	**$**	**556,661**

* Not all sales will be subject to sales tax
**Ulster County sales tax rate reported as 4% by County Finance Department, Dutchess County sales tax rate reported as 3.75% by website.

Source: Camoin Associates, Ulster County, Dutchess County

Secondly, the additional earnings described by the total economic impact of the ongoing use of WOTH (see the previous section) would lead to additional sales tax revenue for the Counties. It is assumed that 70% of the earnings are spent within Dutchess County or Ulster County and that 20% of those purchases are taxable.

Dutchess and Ulster County Sales Tax Revenue - Earnings		
Total New Earings	$	9,435,000
Amount Spent in County (70%)	$	6,604,500
Amount Taxable (20%)	$	1,320,900
County Sales Tax Rate*		3.88%
New Local Tax Revenue	**$**	**51,185**

*Ulster County sales tax rate reported as 4% by County Finance Department, Dutchess County sales tax rate reported as 3.75% by website.

Source: Camoin Associates, Ulster County, Dutchess County

Under these assumptions, the Counties receive approximately $51,185 annually from the economic impacts of the Project.

Hotel Tax Revenue

In addition to the sales tax revenue, Ulster County and Dutchess Counties would also receive additional Hotel Tax revenue from the new visitation lodging spending. With an average of 3% hotel tax, Dutchess County and Ulster County receive a combined $171,335 in additional revenue annually.

Dutchess and Ulster County Hotel Tax	
New Visitation Lodging Spending	$ 5,711,162
Hotel Tax*	3%
New County Hotel Tax Revenue	**$ 171,335**

* Ulster County hotel tax rate reported as 2% by County Finance Department, Dutchess County hotel tax rate reported as 4% by website.

Source: Camoin Associates, Ulster County, Dutchess County

Summary of Dutchess County and Ulster County Revenue

Based on the figures calculated in the above sections, WOTH generates $779,181 in revenue for Dutchess and Ulster Counties.

Combined New County Revenue	
Sales Tax - Direct Sales	$ 556,661
Sales Tax - Earnings	$ 51,185
Hotel Tax	$ 171,335
Combined County Revenue	**$ 779,181**

Source: Camoin Associates

New York State Fiscal Impacts

Sales Tax Revenue

Sales and earnings associated with the Walkway Over the Hudson pedestrian bridge will generate 4% sales tax on most goods purchased in New York State. The following tables calculate the State sales tax revenue.

Sales tax generated from the new spending in NYS associated with the WOTH pedestrian bridge will generate $527,772 in sales tax receipts for NYS. This assumes that approximately 60% of the goods purchased by non-NYS resident bridge users are taxable.

New York State Sales Tax Revenue - Direct Sales	
Direct Sales	$ 21,990,514
Percent Taxable*	60%
Taxable Sales	$ 13,194,308
State Sales Tax Rate	4.00%
New State Tax Revenue	**$ 527,772**

* Not all sales will be subject to sales tax

Source: Camoin Associates

In addition, the new earning in NYS associated with WOTH will also lead to additional sales tax for NYS. It is assumed that 70% of the earnings are spent within New York State and that 25% of those purchases are taxable.

New York State Sales Tax Revenue - Earnings	
Total New Earings	$ 8,519,000
Amount Spent in County (70%)	$ 5,963,300
Amount Taxable (20%)	$ 1,192,660
State Sales Tax Rate	4.00%
New State Tax Revenue	**$ 47,706**

Source: Camoin Associates

Combined, New York State will receive $575,479 annually in sales tax associated with the use of the WOTH pedestrian bridge.

Combined New State Revenue	
Sales Tax - Direct Sales	$ 527,772
Sales Tax - Earnings	$ 47,706
Hotel Tax	N/A
Combined County Revenue	**$ 575,479**

Source: Camoin Associates

Attachment A: What is an Economic Impact Analysis?

The purpose of conducting an economic impact study is to ascertain the total cumulative changes in employment, earnings and output in a given economy due to some initial "change in final demand". To understand the meaning of "change in final demand", consider the installation of a new widget manufacturer in Anytown, USA. The widget manufacturer sells $1 million worth of its widgets per year exclusively to consumers in Canada. Therefore, the annual change in final demand in the United States is $1 million because dollars are flowing in from outside the United States and are therefore "new" dollars in the economy.

This change in final demand translates into the first round of buying and selling that occurs in an economy. For example, the widget manufacturer must buy its inputs of production (electricity, steel, etc.), must lease or purchase property and pay its workers. This first round is commonly referred to as the "Direct Effects" of the change in final demand and is the basis of additional rounds of buying and selling described below.

To continue this example, the widget manufacturer's vendors (the supplier of electricity and the supplier of steel) will enjoy additional output (i.e. sales) that will sustain their businesses and cause them to make additional purchases in the economy. The steel producer will need more pig iron and the electric company will purchase additional power from generation entities. In this second round, some of those additional purchases will be made in the US economy and some will "leak out". What remains will cause a third round (with leakage) and a fourth (and so on) in ever-diminishing rounds of spending. These sets of industry-to-industry purchases are referred to as the "Indirect Effects" of the change in final demand.

Finally, the widget manufacturer has employees who will naturally spend their wages. As with the Indirect Effects, the wages spent will either be for local goods and services or will "leak" out of the economy. The purchases of local goods and services will then stimulate other local economic activity; such effects are referred to as the "Induced Effects" of the change in final demand.

Therefore, the total economic impact resulting from the new widget manufacturer is the initial $1 million of new money (i.e. Direct Effects) flowing in the US economy, plus the Indirect Effects and the Induced Effects. The ratio between Direct Effects and Total Effects (the sum of Indirect and Induced Effects) is called the "multiplier effect" and is often reported as a dollar-of-impact per dollar-of-change. Therefore, a multiplier of 2.4 means that for every dollar ($1) of change in final demand, an additional $1.40 of indirect and induced economic activity occurs for a total of $2.40.

Key information for the reader to retain is that this type of analysis requires rigorous and careful consideration of the geography selected (i.e. how the "local economy" is defined) and the implications of the geography on the computation of the change in final demand. If this analysis wanted to consider the impact of the widget manufacturer on the entire North American continent, it would have to conclude that the change in final demand is zero and therefore the economic impact is zero. This is because the $1 million of widgets being purchased by Canadians is not causing total North American demand to increase by $1 million. Presumably, those Canadian purchasers will have $1 million less to spend on other items and the effects of additional widget production will be cancelled out by a commensurate reduction in the purchases of other goods and services.

Changes in final demand, and therefore Direct Effects, can occur in a number of circumstances. The above example is easiest to understand: the effect of a manufacturer producing locally but selling globally. If, however, 100% of domestic demand for a good is being met by foreign suppliers (say, DVD

players being imported into the US from Korea and Japan), locating a manufacturer of DVD players in the US will cause a change in final demand because all of those dollars currently leaving the US economy will instead remain. A situation can be envisioned whereby a producer is serving both local and foreign demand, and an impact analysis would have to be careful in calculating how many "new" dollars the producer would be causing to occur domestically.

Attachment B: Definition and Abbreviations

- **Counties:** Dutchess County and Ulster County
- **Direct Effects**: The difference in visitation spending between Case One and Case Two, namely the amount of visitation spending that will only occur in the County if the Project occurs.
- **EMSI**: Economic Modeling Specialists' proprietary data source and economic modeling services at www.economicmodeling.com.
- **Indirect Effects**: Direct Effects circulate through the economy causing additional follow-on impacts including (a) spending by businesses impacted by the Direct Effects and (b) spending of employees of those same businesses on local goods and services.
- **WOTH:** Walkway Over the Hudson pedestrian bridge

Appendix K

Ralph Verrastro PE

Senior Project Manager, Bridges

Mr. Verrastro specializes in the design, inspection, technical supervision, and quality assurance/quality control for new and rehabilitation bridge projects. He offers vast technical experience related to bridge superstructure and substructure design. Mr. Verrastro has worked on Florida highway and bridge projects since 1978 and is responsible for overseeing the structural engineering services for the Florida operations. Mr. Verrastro is a technical expert in the use of fast track repair/replacement methods using prefabricated bridge components also known as Accelerated Bridge Construction. He has presented technical presentations on this topic at numerous industry conferences. He has served as the Specialty Structural Engineer for over 500 bridge projects throughout the USA working as a consultant to precast concrete manufacturers.

EDUCATION

Associate of Science, Engineering Science, Broome Community College, Binghamton, New York, 1974

Bachelor of Science, Civil Engineering, Cornell University, Ithaca, New York, 1976

REGISTRATIONS

Professional Structural Engineer #59235, State of New York

Professional Engineer #39784, State of Florida

PROJECT EXPERIENCE

Matanzas Pass Bridge Rehabilitation, Fort Myers Beach, Florida (Project Manager)

Stantec provided roadway and bridge engineering services for Wright Construction Group on this FDOT design/build project that included the rehabilitation of this bridge in Fort Myers Beach, Florida. The project included concrete patching repairs, deck expansion joint replacement, installation of a bicycle bullet rail, rehabilitation of the navigational lights, painting of the bridge fascia, and the installation of ADA sidewalk ramps. The engineering services included in-depth bridge inspection, survey/mapping, documentation, evaluation, repair recommendations, permitting, utility coordination, structural design, final bridge plans, maintenance of traffic plans, specifications and coordination with the CEI firm and FDOT during construction.

Anna Maria Bridges Rehabilitation, Manatee County, Florida (Project Manager)

Responsible for client and project coordination including in-depth inspection, evaluation of existing conditions, repair recommendations, documentation of project issues, technical supervision of staff, plan reviews, quality assurance, project cost control, and communication and coordination with Wright Construction and FDOT. Stantec served as the Structural Engineer-of-Record on this FDOT design/build project that included the rehabilitation of two bridges in the City of Anna Maria, Manatee County, FL. Both bridges are single span bridges carrying two lanes and traffic over navigable canals providing access to the Gulf of Mexico. One bridge carries Crescent Drive over Crescent Drive Canal and the other carries North Bay Boulevard over North Canal. The bridges consist of prestressed concrete double tee beams supported on prestressed concrete pile bents and wingwalls.

Mooringline Drive Bridge Rehabilitation, Naples, Florida (Project Manager)

Responsible for the overall project structural engineering design. Stantec is serving as the Structural Engineer-of-Record for Wright Construction Group on this FDOT design/build project that includes the rehabilitation of this bridge in Naples, Florida. The bridge carries two (2) lanes of traffic over Dr. Pass Inlet and consists of adjacent, prestressed concrete voided slab units supported on abutments founded on prestressed concrete soldier piles and prestressed sheet piling. The engineering services have included performing an in-depth inspection, load rating calculations, specifications, and preparing preliminary plans for repairs.

** denotes projects completed with other firms*

Ralph Verrastro PE

Senior Project Manager, Bridges

Belleair Country Club Entrance Bridges, Pinellas County, Florida (Project Manager)

Performed in-depth inspections, load rating calculations, and prepared recommendations for repairs for two bridges. One bridge is a three-span, filled, concrete arch structure that was built in 1925. The other bridge is a four-span, adjacent, prestressed concrete slab structure. Performed conceptual bridge plans for a new third bridge crossing at this site.

Palmer Road Bridge Scour Repairs, Sarasota, Florida (Project Manager)

Responsible for the preparation of repair plans and specifications that include installing a steel sheet piling toe wall and rip rap fabric bags to stabilize and support the undermined footing. The Palmer Road Bridge has a dam structure attached to the north fascia that utilizes removable aluminum stop logs to retain the water head. The foundation for the dam structure and a portion of the bridge footing was undermined as a result of some construction activities in the area that caused a higher than planned water level differential.

Bridge Program Study Report, City of Pompano Beach, Florida (Project Manager)

Served as the lead structural engineer for this project that included performing a bridge program study of four (4) bridges owned by the City of Pompano Beach. The bridges carry local City streets over navigable canals that provide access to the Atlantic Ocean. The results of this study will be used by the City Engineer as a tool in developing a multi-year bridge infrastructure improvement plan.

Quality Assurance/Peer Review for Bridge Construction Projects, City of Pompano Beach, Florida (Project Manager)

Served as the lead structural engineer for this project that included performing an independent peer review of the construction plans that were prepared by another consulting engineer for the replacement of the SE 8th Court Bridge in the City of Pompano Beach. This project has been awarded to a contractor and the construction project will be completed in 2010. The new bridge is a 3-sided precast concrete rigid frame founded on pile bents. This bridge is the only access for a community of homes on a small island that required the bridge design criteria to include an accelerated construction approach. Precast concrete components were specified to minimize the duration of construction and the construction will be completed in stages to allow for maintenance of traffic.

Bridge Program Study Report, Collier County, Florida (Project Manager)

Responsible for the preparation of a Bridge Program Study Report bridge program study report for 24 bridges owned by the County. The results of this study will to be used by the County as a tool in developing a multi-year bridge infrastructure improvement plan.

Melbourne Street Bridge Replacement, Charlotte County, Florida (Project Manager)

Responsible for the replacement of this 54 foot span prestressed concrete beam bridge supported on concrete pile bents. Stantec worked for Wright Construction Group on the design/build project that included survey, mapping, permitting, environmental, roadway and bridge design services. The improved roadway section provides two lanes and sidewalks.

Replacement of 17th Street Bridge, Winter Haven, Florida (Project Manager)

Stantec was responsible for the design of the replacement of this local bridge that is owned and maintained by the City of Winter Haven, Florida. Bridge closure and the use of an off-site detour was preferred by the City which led to the decision to utilize an Accelerated Bridge Construction (ABC) approach to minimize the duration of construction. The new bridge was designed using all precast concrete components including a 4 sided-rigid frame and cantilever wingwalls. The bridge design included aesthetic elements that were requested by the City including a Texas Barrier system, aesthetic lighting fixtures, and a textured finish on the wingwalls. We provided services that included survey, mapping, ROW mapping, roadway and bridge design, environmental permitting, contract plans, specifications and construction phase services.

** denotes projects completed with other firms*

BRIDGES

Global Expertise. Local Strength.

Stantec

NEW BRIDGE DESIGN

Whether the need is for a replacement bridge on an existing alignment or a new bridge on a new alignment, our proven track record in the management and coordination of large and small scale projects, along with the experience that our staff has developed on federal, state, provincial, and locally funded projects, will help the successful completion of any type of bridge project.

TOP LEFT TO RIGHT:
Glenmore Trail Elbow Drive Interchange | Calgary, Alberta | *New Bridge Design*

Brooklyn Queens Expressway—61st to Broadway | New York, New York | *Bridge Replacement Design*

BOTTOM:
I-86/US Route 15 Interchange | Painted Post, New York | *New Bridge Design*

Across North America, we have designed numerous bridges of various materials, span lengths and configurations, from single span rural crossings to complex multi-span expressway and urban arterial crossings.

Stantec delivers innovative and cost-effective design solutions tailored to suit any transportation network. Maintenance and inspectability are carefully considered in our design process, as are material details and durability. Our designs provide safe bridge crossings that accent the character of the surrounding environment.

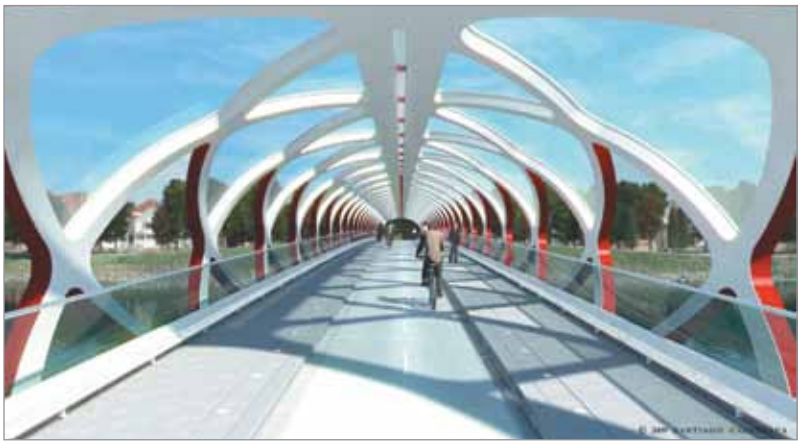
ROADWAY BRIDGES

Stantec's roadway bridge design experience ranges from structures on major highways to river crossings and small rural connectors. Our experience allows us to recommend the appropriate structure type and materials that make the most sense for our clients. We follow a streamlined detailed design phase, creating preliminary plans, followed by detailed plans and final contract documents. Working with federal, state, provincial, or local agencies, we design roadway bridges with the local setting and community preferences in mind, and communicate regularly with the community and other involved stakeholders.

TOP LEFT TO RIGHT:
Poags Hole Road Bridge over Canaseraga Creek | North Dansville, New York | *Bridge Replacement Design*

Douglas Boulevard/Interstate 80 Interchange | Roseville, California | *New Bridge Design*

BOTTOM:
Pokiok Stream Bridges No.2 | Pokiok, New Brunswick | *New Bridge Design*



PEDESTRIAN BRIDGES

Pedestrian bridges provide aesthetically pleasing community connections, while increasing safety and promoting health and wellness. Stantec has designed all types of pedestrian bridges in varying terrains—over bodies of water, across major highways, and as extensions of trails. We work closely with our landscape architects and environmental scientists to design pedestrian bridges and approaches that both preserve and enhance the surrounding environment. We also take into account the various aspects of safety and accessibility for the physically challenged, including bridge grades and width, landing areas, railings, protective fencing, lighting, and slip-resistant surface treatments.

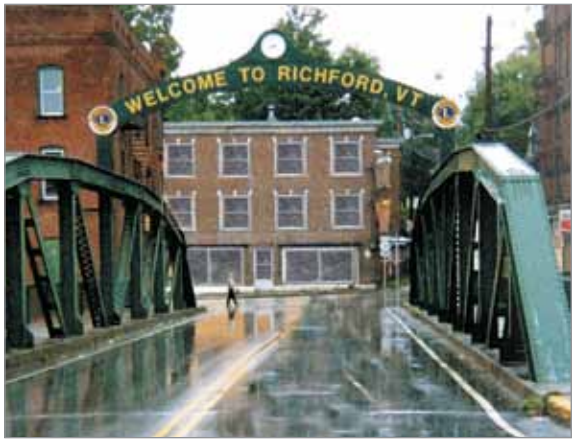
TOP LEFT TO RIGHT:
Peace Bridge | Calgary, Alberta | Stantec: Engineer of Record, Designer: Santiago Calatravas:

Circle Drive Suspended Pedestrian Bridge | Saskatoon, Saskatchewan | *New Bridge Design*

RIGHT:
Children's Bridge | St. Albert, Alberta | *Design, Inspection, Rehabilitation, Recoating*

BOTTOM LEFT TO RIGHT:
Fort York Pedestrian Bridge | Toronto, Ontario | *Preliminary Design, Environmental Assessment* | Architect: Montgomery Sisam

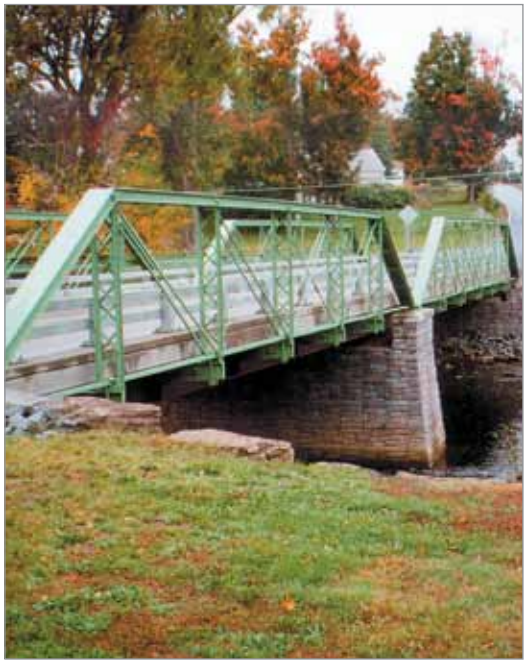
Rotary Centennial Pedestrian Bridge | Whitehorse, Yukon | *Bridge Truss Erected By Launching Method*



HISTORIC BRIDGES

Projects involving historic bridges require careful evaluation of a structure's importance to the community it serves as well as how it represents a period in time or a historic event. The benefits of historic preservation must be weighed against municipal goals and objectives and the ability of a structure to carry modern loads and serve the needs of the traveling public.

Stantec is well versed in progressing projects of this type and has the knowledge and experience to complete the studies and coordination required for successful project delivery. Our experience includes inspecting and evaluating historic structures to determine preservation and/or mitigation requirements, coordinating with governing agencies, generating cultural resource documents, conducting public involvement programs, and generating appropriate construction plans and specifications.



TOP LEFT TO RIGHT:
County Road 44 Over Grasse River | Madrid and Waddington, New York | *Bridge Rehabilitation Design, Construction Support Services*

Richford Bridge #41 Rehabilitation | Richford, Vermont | *Bridge Rehabilitation Design, Inspection, Load Rating*

BOTTOM:
County Road 57 Over St. Regis River | Hamlet of West Stockholm, New York | *Bridge Replacement Design, Rehabilitation of Historic Bridge Elements, Construction Observation and Support Services*

BRIDGE INSPECTION

Stantec's teams have inspected bridges throughout North America and internationally for national, state, provincial, municipal, and county agencies, turnpike authorities, port authorities, as well as railway and transit operators. Stantec has a large team of qualified professional bridge inspectors available to tackle any inspection project regardless of the number, size, or type of structure. This has included major long span structures such as the George Washington, Williamsburg, Queensboro, Manhattan, and Brooklyn bridges in New York, and complete state and provincial highway system inventories for major US and Canadian agencies.

Our inspection team leaders and inspectors have extensive experience in the inspection and evaluation of concrete, steel, masonry, and timber bridge structures using all possible access methods including climbing inspections. In addition to in-depth, routine, and detailed visual inspections, our bridge testing services include ultrasonic thickness measurements of steel members, gusset plates, non-destructive testing examination for fatigue, concrete coring and testing, half-cell corrosion potential surveys, coatings assessments, as well as scour and channel bed monitoring and surveys. We regularly provide load rating using a variety of tools, fracture critical inspections, and other specialized investigations.

Our specialists bring significant experience in working with National Bridge Inspection Standards, CoRe Element, NYSDOT, OSIM, and many other inspection standards as well as in using a variety of bridge inventory and inspection systems including Pontis, BIPPI, and other bridge management services. Our Bridge Management System (BMS) also include maintenance recommendations and project prioritization, risk analysis, and budget planning.

OPPOSITE CLOCKWISE FROM TOP LEFT:
Abutment Seat and Bearing Inspection | Manitoba | *Infrastructure and Transportation*

Stantec Bridge Inspection Training Course | Prince Edward Island | *Inspection Of A 10-Span Timber Bridge Crossing A Tidal Estuary*

Detailed Bridge Coatings Inspection and Testing | Red Deer, Alberta | *Coating Testing*

Biennial Detailed Visual Bridge Inspections | Manitoba | *Infrastructure and Transportation*

Biennial Inspection of George Washington Bridge | New York, New York | *Bridge Inspection*

TOP:
Biennial Brooklyn Bridge Inspection | New York, New York | *Bridge Inspection*

UNDERWATER BRIDGE INSPECTION

Stantec provides underwater bridge inspection services according to National Bridge Inspection Standards (NBIS) requirements with a focus on safety assurance of in-service bridges and cost efficiency. Stantec has been performing underwater bridge inspections and scour evaluations since 1987.

Our inspection and reporting services are conducted to not only help ensure the safety of in-service bridges, but also to increase reliability; lengthen service life; and reduce monitoring, maintenance, and reconstruction costs. Stantec's staff includes NBIS-qualified program managers, team leaders, inspectors, and support personnel with combined professional experience, comprehensive bridge inspection training, and commercial dive training to form efficient underwater inspection teams.

Stantec's underwater bridge inspection teams provide the necessary equipment and experience to efficiently and safely inspect bridges with difficult access conditions and in varying environments. Channel bed monitoring and surveys are often performed using GPS-enabled hydrographic surveying equipment to quickly, accurately, and efficiently assess localized and general scour conditions. Upon completion of the inspections, Stantec is available to provide thorough, clear, concise reports documenting the conditions found and to provide condition ratings and recommendations formatted to meet our clients' individual needs.

LEFT:
Tennessee Department of Transportation Underwater Bridge Substructure Inspections | Multiple Sites, Tennessee | *Underwater Bridge Inspection*

RIGHT:
Ohio Department of Transportation Underwater Bridge Substructure Inspections | Multiple Sites, Ohio | *Underwater Bridge Inspection*

BRIDGE ASSESSMENT AND LOAD RATING

For many transportation agencies in North America faced with an aging inventory of bridges, deferred bridge maintenance due to funding limitations is an unfortunate reality. In combination with continually increasing truck configurations and weights, there is a growing need for bridge inspection in combination with load rating to evaluate the safe load-carrying capacity of bridges or to determine the magnitude of strengthening required to bring capacity to a specified limit. This is often supplemented by a complete assessment to determine the remaining service life and overall functional and structural adequacy of the structure.

The proper assessment, inspection, and load rating of an existing structure requires experienced bridge engineers with technical know-how along with knowledge and experience using the right tools, equipment, and software. Stantec's inspection teams have all the necessary tools and test equipment for assessing the condition of an existing structure, and our load rating engineers are experienced with software such as Virtis, BAR7, BRASS, and in-house solutions using advanced non-linear structural analysis packages. Stantec has completed in-depth bridge inspections, testing, functional assessments, and load ratings as part of state/provincial highway and municipal roadway programs, and to support strengthening rehabilitation or strengthening design projects. This can also include instrumentation and load testing of components or spans.

TOP LEFT:
Woodland Viaduct Rehabilitation | Westchester County, New York | *Bridge Assessment, Rehabilitation Design*

BOTTOM LEFT:
O'Byrnes Ferry Bridge Over the Stanislaus River | Calaveras County, California | *Feasibility Study, Bridge Design*

BOTTOM RIGHT:
Brooklyn-Queens Expressway and Van Wyck Expressway Viaduct Rehabilitation | Queens, New York | *Bridge Inspection, Rehabilitation Design*

BRIDGE REHABILITATION AND REPAIR

Bridges are exposed to many types of environmental and traffic loading conditions and naturally deteriorate over time. In order to maximize the service life of bridges, repairs or rehabilitation are required at various times during the life of the structure. These actions can prolong service life or increase structural or functional capacity. Sometimes modifications are made to provide continuity for existing, simply-supported multi-span bridges, or to eliminate deck joints by incorporating integral or semi-integral abutment designs. For seismic retrofits, it is important to first assess the vulnerability for collapse or major seismic damage and then implement appropriate measures to improve performance and mitigate risk; structures are strengthened, ductility is enhanced, bearings are modified, or restraints are provided to meet the latest seismic standards and current practices.

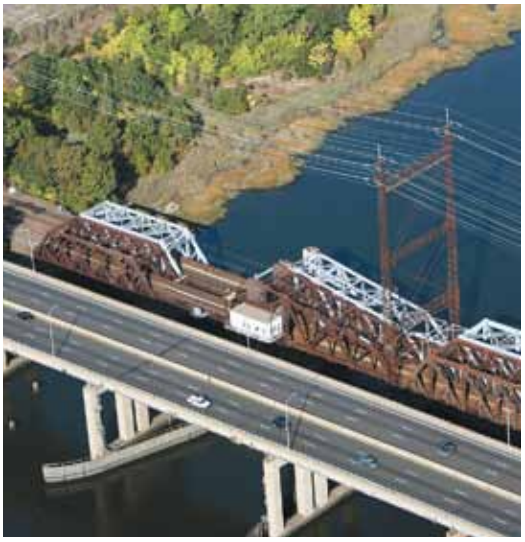
Following detailed inspection, testing, and evaluation, our bridge engineers determine appropriate interventions consisting of repair, minor rehabilitation, or major rehabilitation. This includes development of specifications and tender documents and review during construction. At other times, our engineers are called to investigate and recommend repairs as a result of accidents such as vehicle impact, high load damage, or fire. These types of repairs, rehabilitations, and strengthenings require a unique mix of experience, technical insight, and creativity.

In all cases, Stantec's bridge engineers provide advanced techniques for repair, rehabilitation, and strengthening including external post-tensioning for concrete, steel, and other structure types, and the use of materials including advanced composites (FRP, GFRP, etc.). In some cases, structural monitoring alone or in combination with rehabilitation is employed as the most cost-effective solution.

Whether designing repairs or rehabilitation for a single bridge, or determining repair and rehabilitation needs for a group of bridges and prioritizing the work program, Stantec's specialists are there to help.

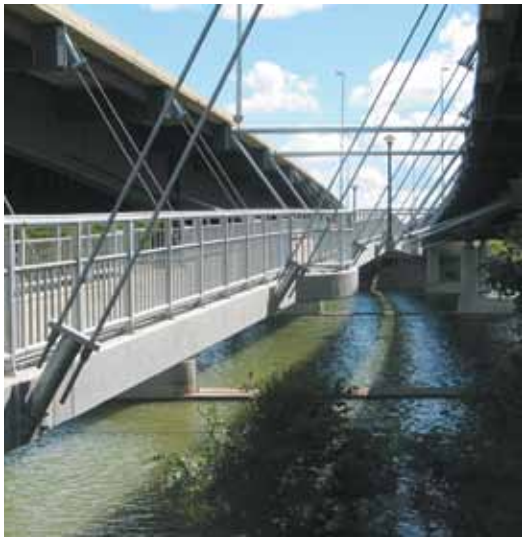
LEFT:
Boudreau Bridge | St. Albert, Alberta | *Rehabilitation and Conversion to Semi-Integral Abutments*

RIGHT:
Devon Bridge | Milford, Connecticut | *Bridge Inspection, Assessment, Alternatives Analysis*



INNOVATIVE SOLUTIONS AND SUSTAINABILITY

Innovation in the design of new structures and rehabilitation of existing structures is encouraged through our association with various research institutes and universities. These associations have kept Stantec at the forefront of developments in the use of advanced materials, such as carbon and aramid fiber sheets, steel-free bridge decks, and remote bridge monitoring.



The recommendations we make regarding materials and bridge preservation strategies have a major impact on sustainability outcomes. At Stantec we are acutely aware of the importance of sustainability.

Stantec routinely assists clients in their desire to integrate alternate transportation modes into their projects, from pedestrian pathways and bikeways to mass transit and light rail systems. We have experience in applying transit-oriented development around mass transit facilities, as well as assisting clients with making their communities more pedestrian-friendly. In order to produce a more sustainable transportation network, we design our bridges and related roadways with the surrounding environment in mind, avoiding impacts to historical and ecologically-sensitive areas, optimizing the traffic flow, and using long-life pavement options. Whenever possible, we source recycled pavement content in our road surfaces or use "cool" pavement materials to help reduce the urban heat island effect.

TOP:
Garven Road Timber Bridge
| Winnipeg, Manitoba
| *Bridge Design Involving Strengthening With GFRP Composites*

LEFT:
Circle Drive Suspended Pedestrian Bridge
| Saskatoon, Saskatchewan
| *New Bridge Design*

BOTTOM:
Fish Creek Bridges
| Calgary, Alberta
| *New Bridge Design*

Appendix L

WilsonMiller
2205 North 20th Street
Tampa, FL 33605
Tel: (813) 223-9500

Stantec

PROFESSIONAL SERVICES PROPOSAL

To: Mr. Kenneth Cowart, AIA
Friendship Trail Bridge Team
C/O ASD
1240 East 5th Avenue
Tampa, Florida 33605

From: _____
Ralph Verrastro, PE
Senior Project Manager, Bridges

Date: April 30, 2012

Subject: **Professional Services Proposal**
Bridge Assessment and Recommendation Report
Friendship Trail Bridge (Old Gandy Bridge)

1. OVERVIEW

1.1. The Friendship Trail Bridge Team (FTBT) is requesting the Hillsborough County Commission to halt the planned demolition of the Friendship Trail Bridge.

1.2. WilsonMiller Stantec assisted the FTBT by performing a recent cursory inspection and prepared a letter proposing an approach to rehabilitate the bridge.

1.3. This Professional Services Proposal provides a recommend scope of engineering services and associated compensation to allow the preparation of a detailed engineering inspection and study for rehabilitation of the bridge.

2. ASSUMPTIONS

2.1. The professional services to be provided by the CONSULTANT are limited to those described in the Scope of Services.

2.2. Design Specification: AASHTO LRFD Bridge Design Specifications, 6th Edition, 2012.

2.3. The inspection will be limited to:

2.3.1. The end and intermediate bents on the 252 low level spans.

2.3.2. The intermediate bents on the 20 high level approach spans and the 3 channel spans.

2.3.3. The underside of the superstructure elements on the 20 high level approach spans and the 3 channel spans.

2.4. The inspection of the bridge underside will be performed using a rented boat. A complete underwater inspection is included in the scope of services.

2.5. A detailed scour analysis of this bridge is not included in the scope of services.

2.6. The scope of the bridge inspection will be limited to a visual inspection. If further investigation and testing is recommended, the scope and fee for those additional services will be included in the report.

3. SCOPE OF SERVICES

3.1. **Review of Record Documents** – Obtain and review copies of all available record documents for the bridge which may include construction drawings, as-built plans, specifications, design computations, shop drawings, field reports, previous inspection reports, photographs, load rating computations, scour documentation, traffic counts, maintenance records, etc.

3.2. **Meetings/Coordination –** Conduct a kickoff meeting with the FTBT and county design and maintenance officials to discuss the past maintenance and future needs at this bridge site. Also conduct a review meeting after the submittal of the draft report to discuss our findings.

3.3. **In-Depth Inspection** – Perform a detailed "hands-on" inspection of all visible bridge elements in accordance with the assumptions noted above. Obtain measurements and document the dimensions of each bridge superstructure element for comparison to any record documents. Prepare field sketches to document the bridge geometry and member sizes including connections. Document the condition of each bridge element in a field report for comparison to the condition documented in past inspection reports. Determine the soundness of the exposed concrete surfaces of the substructure units using sounding techniques. Document the inspection findings including all significant defects including cracks, spalls, corrosion, impact damage, etc. using field notes and digital photographs.

3.4. **Evaluation of Alternatives –** Perform the following tasks as part of the evaluation of the of the existing bridge:

3.4.1. Establish recommendations for additional testing, detailed structural analyses, etc.

3.4.2. Determine the feasible alternatives for bridge rehabilitation and replacement.

3.4.3. Estimate the remaining service life before major repairs are necessary to maintain its serviceability and prevent a reduction in load carrying capacity.

3.4.4. Perform an estimate of costs for construction, engineering and construction engineering inspection for each of the feasible alternatives. The estimated construction costs will be based on FDOT average bid prices and input from a local contractor.

3.5. **Report Preparation –** Prepare a report that summarizes the findings for the above described tasks that includes specific recommendations for each of the feasible rehabilitation and replacement alternatives. The report will be supplemented using design sketches, summary tables and photographs.

3.6. **Quality Assurance –** The report will be peer reviewed by an independent engineer to confirm agreement on the content of the report.

4. DELIVERABLES

The deliverable for this project will be Bridge Assessment and Recommendation Report with attachments.

5. SCHEDULE

Complete services within 180 Calendar Days from Notice-to-Proceed.

6. COMPENSATION

The fee for providing the SCOPE OF SERVICES shall be a lump sum of **$190,284.**

Underwater Services, Inc
7930 62ND STREET NORTH • PINELLAS PARK, FL 33781 • (727)546-4198 • FAX (727)549-8131
www.boltunderwater.com

April 30, 2012

Mr. Ralph Verrastro, P.E.
Stantec
3200 Bailey Lane, Suite 200
Naples, FL 34105

RE: Underwater Inspection of the Friendship Trail Bridge No. 100068

SCOPE FOR UNDERWATER SERVICES

All bridge substructure elements will be inspected from the high watermark and/or the top of the marine growth down to the mudline.

Prior to getting in the water, degradation/aggradation measurements will be taken to determine water depth, channel alignment, velocity of current, and to identify any suspect areas for scour which need further attention during the underwater inspection. In addition, the team will also perform all pre-dive procedures, including performing operational checks on necessary inspection equipment, safety equipment, and underwater photography equipment. Unusual on-site safety hazards will be identified and safety/emergency procedures verified.

A Level I Inspection will be conducted on 100% of the sub-structure elements. A Level II Inspection shall be conducted on 10% of the sub-structure elements. The Level II inspection will be random based on findings from the Level I and will consist of the removal of marine growth from three locations: the mudline, the low waterline, and mid-way between the mudline and low waterline. In water less than 6ft. deep, only one or two locations will be cleaned. At the different elevations, marine growth will be removed from either 1ft. high bands or 1ft. by 1ft. patches to view the underlying element material (cleanings will follow FDOT Level II inspection guidelines). Suspicious areas on the elements will be scraped of marine growth to allow better inspection of the potential deficiency.

The channel bottom will be probed around each substructure unit and the material type and condition will be noted. Any observed scour conditions around the bridge elements and debris buildup will be noted.

Significant underwater findings will be photographed or detailed in a sketch, as appropriate. A final report for each structure will be submitted signed by the Lead Certified Bridge Inspector in PONTIS format, unless otherwise specified by Client.

To abide by OSHA and ADC regulations a three (3) Person Crew is required for SCUBA diving or surface supplied diving projects.

COMPENSATION

The Total Cost Not to Exceed includes travel portal to portal, equipment, insurances, labor/dive team, camera, final report, consumables.

Bridge No.	U/W Insp. Cost	Expenses	Total Cost
100068	$ 12,391.92	Boat 6 days x 260.00 (1,560.00)	$ 13,951.92
		TOTAL COST NOT TO EXCEED	***$ 13,951.92***

If you have any questions or require additional information, please feel free to contact me.

Sincerely,

Mollie Griswold, C.B.I.,
President

WilsonMiller
2011 Proposal Back-up Form

Bridge Assessment Reports for 4 Bridges
Proposal Name

Opportunity Number

Department	
Roadway	
Bridge	X
Survey	
Environmental	
Geotech	
Hydraulics	
Precast	

Phase	
Schematic	X
Preliminary	
Design	
Construction	

Prepared by: RV
Date:
Checked by: RC
Date:

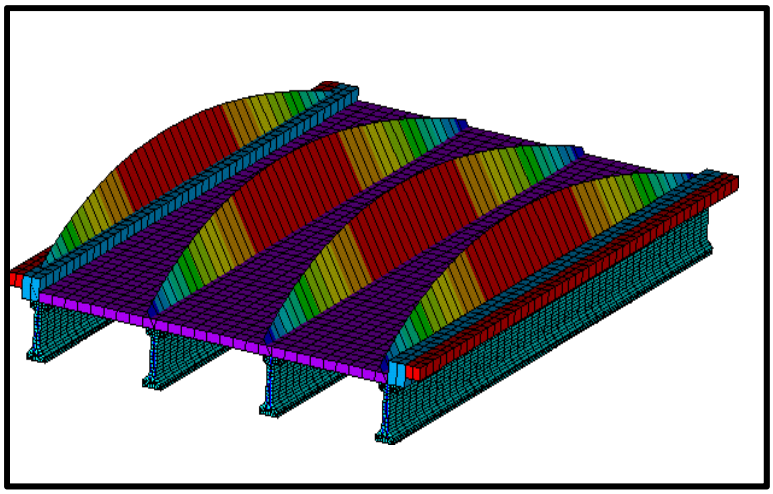
Proposal Sheet No. 1 of 1
Department Sheet No. of

Task Description or Drawing Title	Principal $195.00	Sr. Proj. Mgr. $165.00	Sr. Engineer $155.00	Engineer $119.00	Sr. Designer $115.00	Designer $100.00	Sr. Inspector $85.00	Inspector $65.00	CADD Tech. $85.00	Labor Subtotal	Direct Expenses	Reimbursable Expenses	Total Task Fee
Document Review		8		16	16					$ 5,064			$ 5,064
										$ -			$ -
Bridge Inspection		60		400	400					$ 103,500			$ 103,500
										$ -			$ -
Evaluate Alternatives		40		80	40					$ 20,720			$ 20,720
										$ -			$ -
Report Preparation		16		40	40					$ 12,000			$ 12,000
										$ -			$ -
Coordination/meetings		16								$ 2,640			$ 2,640
										$ -			$ -
										$ -			$ -
Quality Assurance	24									$ 4,680			$ 4,680
										$ -			$ -
Boat Rental (50 days x $260 plus 10%)		4								$ 660	$ 14,300		$ 14,960
Access to high spans		4								$ 660	$ 10,000		$ 10,660
Diving Inspection Subcontractor		4								$ 660	$ 15,400		$ 16,060
										$ -			$ -
										$ -			$ -
										$ -			$ -
										$ -			$ -
										$ -			$ -
										$ -			$ -
SHEET TOTALS	24.0	152.0	0.0	536.0	496.0	0.0	0.0	0.0	0.0	$ 150,584	$ 39,700	$ -	$ 190,284

PROBABILISTIC ASSESSMENT OF THE FRIENDSHIP TRAIL BRIDGE

Prepared for:

Hillsborough County



Prepared by:

Department of Civil and Environmental Engineering

Rajan Sen, Ph.D., P.E. and Gray Mullins, Ph.D., P.E.

Niranjan Pai, Ph.D., P.E.

Department of Civil and Environmental Engineering

University of South Florida

Tampa, FL 33620-5350

August, 2011

Executive Summary

Description

The Friendship Trail Bridge is the current name of the old Gandy Bridge which carried westbound traffic across Old Tampa Bay until 1995. It was designed to H20 truck loading and was constructed in 1956. The 2.6-mile long bridge has 274 spans, of which 252 are low-level 48ft spans. The typical 48ft span consists of a 30ft 7in wide low-level bridge deck supported by four 3ft 4in deep post-tensioned concrete girders that act compositely with the 7in thick deck slab and are spaced 8ft 6in apart. The four girders are each post-tensioned with four 1 1/8in diameter, Grade 160 post-tensioning (PT) bars. Two of these bars are straight and located in the bottom flange, while the other two have a parabolic profile. Partial-depth post-tensioned diaphragms tie the girders together at third points (16ft on center). The girders resist shear load through the parabolic tendons and do not have additional shear reinforcement.

The bridge was to be demolished when the new Gandy Bridge was opened, however actions from citizens of Hillsborough and Pinellas counties resulted in the two counties assuming joint ownership of the bridge in 1997 and making the bridge available for recreational use.

Condition of Bridge

A bridge inspection by KCA documented severe corrosion induced deterioration to the bridge. These include significant longitudinal cracking on the girder web and soffit along the path of the post-tensioning bars. In addition, post-tensioning bar breakages and multiple concrete spalls were also observed.

The main cause of the observed deterioration in the bridge is corrosion of the post-tensioning bars. Corrosion occurs in such concrete structures once the chloride from salt water diffuses through the concrete cover and reaches the steel.

Objective of the Study

The objective of the study was to determine the probability of collapse of the superstructure of a typical 48 ft span over the next 20 years under its own self-weight and pedestrian loading during which period no repairs are undertaken. *The study did not involve any actual inspection of the bridge. Therefore, parameters used in making the probabilistic assessment were taken from the published literature.*

Corrosion Assumptions

Corrosion is characterized by two types of deterioration, uniform corrosion and pitting corrosion. Uniform corrosion refers to situations where there is uniform loss of steel section. In this study, the rate of loss of steel diameter is assumed to be 6 mils/year based on data found in the literature. Pitting corrosion refers to localized corrosion where a part of the bar has significant section loss that can lead to bar breakage. This type of corrosion was considered in the study by modeling breakage in post-tensioning bars. The study does not account for any potential benefits of repairs on the behavior of the structure.

Technical Challenges

Accurate prediction of the failure load of the bridge requires the analysis to account for redundancy of the structure arising from the inter-connection of the four girders through the diaphragms and the deck. Furthermore, the analytical approach must accurately account for staged construction, long term creep/shrinkage, non-linear behavior due to concrete cracking and yielding of post-tensioning steel, post-tensioning losses and load redistribution due to post-tensioning bar breakage and creep/shrinkage. Unfortunately, most available prestressed concrete analysis software are intended to be

used for design. They use design code-based simplifications and are therefore not capable of accurate analysis that accounts for the factors required for this analysis.

Structural Analysis Approach

Due to lack of design software capable of meeting the technical requirements noted above, a general purpose finite element code, ANSYS, was used for the study. A three-dimensional model of a typical span was generated using beam elements to model the girder/diaphragm and shell elements to model the deck. Special routines had to be written to accurately model girder post-tensioning using non-linear beam elements. Since the available beam elements could not simultaneously model creep and concrete material non-linearity due to cracking, special multi-step techniques were developed to generate accurate analytical models accounting for long term creep and concrete cracking.

Model Validation

As part of model validation, analytical results from the structural model were calibrated against available test results. The analytical results were shown to agree well with test data from full scale testing of post-tensioned girders from the old Sunshine Skyway Bridge conducted in 1973. The structural model results were further validated by ensuring the model predictions match the design-code based ultimate load predictions for the Friendship Trail Bridge.

Finite Element Simulation

Finite element analysis was performed for the different construction stages considered during design, including post-tensioning of girders, application of non-composite dead load and formation of the composite section. In addition, nine cases were analyzed to assess the impact of partial or complete failure in the girder post-tensioning bars on the structure's ultimate capacity. In these analyses, the projected steel section loss values after 5, 10, 15 and 20 years were used. These cases were:

Case 1 - All post-tensioning bar areas reduced by 45% (to simulate 2009 level of average post-tensioning bar area loss due to corrosion)

Case 2 – Case 1 and two straight bars broken in all four girders

Case 3 – Case 1 and bottom three bars broken in an interior girder

Case 4 – Case 1 and all bars broken in an interior girder

Case 5 – All post-tensioning bar areas reduced by 59% (to simulate 2029 level of average post-tensioning bar area loss due to corrosion)

Case 6 – Case 5, with PT area reduction applied locally only to 1ft zone at the mid-span (to simulate impact of local area loss and simulate any stress concentration due to sudden section change)

Case 7 – All post-tensioning bar areas reduced by 48% (to simulate 2014 level of average post-tensioning bar area loss due to corrosion)

Case 8 – All post-tensioning bar areas reduced by 52% (to simulate 2019 level of average post-tensioning bar area loss due to corrosion)

Case 9 – All post-tensioning bar areas reduced by 55% (to simulate 2024 level of average post-tensioning bar area loss due to corrosion)

Finite Element Simulation Results

Analysis results from all the above cases indicated that due to the redundancy in the structure because of the interaction of multiple girders connected through the diaphragms and the deck, there is sufficient capacity in all the above cases to resist self-weight + pedestrian loading (85 psf). The analysis also indicated that the structural failure mode may be sudden brittle collapse due to girder cracking at the mid-span through the entire girder section. The predicted deflection at the failure load was minimal (0.4in). The lack of ductility occurs because the analysis predicts that the PT bar does not yield at failure. It was found that this was because the change in load on the post-tensioning bar is governed by the axial strain in the composite section and is therefore limited since the change in the composite section axial strain is relatively small when it is due to the lost PT force.

The nine three-dimensional, non-linear finite element analyses did not account for variation in corrosion rate, material properties, geometry and loading. Thus these results are indicative of the response of an average span, not of a span that may be more severely distressed. Probabilistic analysis methods were used to predict the response of such severely distressed spans.

Probabilistic Analysis Method

The Monte Carlo method was used to compute the probability of failure of a bridge span for the period from 2009-2029. This method requires an understanding of the variation of all the factors that cause failures, such as loads, material properties and section geometry. These are typically expressed using statistical distributions, such as normal and log-normal distributions.

Statistical parameters defining these distributions for live load, dead load and flexural resistance for prestressed concrete bridge were obtained from the literature. The Monte Carlo method involves generating a large number of samples consistent with the statistical distribution of the variable, such as loads and resistance, and using these to perform the analysis. The results from the large number of analysis provide a good indication of the expected behavior of the system due to variation of the various factors considered. For this study, the likelihood of the load exceeding the flexural resistance was determined using 100,000 statistical samples.

Probabilistic Analysis Studies

Monte Carlo analysis of the as-designed case was performed to validate the method by comparison of the results with those found in the literature for prestressed concrete girder bridges. The probability of failure and reliability index obtained from the analysis was found to agree well with published literature.

Monte Carlo method was also used to determine the distribution of post-tensioning bar area loss using equations for corrosion initiation and rate of corrosion found in the literature. A statistical distribution of the likelihood of post-tensioning bar breakage was developed using the information that only 1 in 252 typical spans had a bar breakage. These two statistical distributions were combined with the distribution found in the literature for flexural resistance to obtain a new distribution for flexural resistance of distressed spans for periods from 2009 to 2029 in 5 year increments. These distributions were used to compute the likelihood of failure of the bridge under self-weight plus pedestrian loading and under just self-weight alone.

Probabilistic Analysis Findings

Results from the above analysis indicate that the probability of failure of the bridge under pedestrian load increases from 128 in 100,000 to 1569 in 100,000 during the period from 2009 to 2029. Given that analysis with the original design code would have resulted in a probability of failure of 43 in 100,000, the state of the bridge in 2029 represents a significantly higher risk of failure than is currently found acceptable by design codes. The analysis suggests that of the 252 spans, 1 may fail under full pedestrian loading around 2014, 3 spans around 2024 and 4 spans around 2029. The analysis also shows that the bridge has a very low probability of failure (19 in 100,000) under self-weight alone between 2009 and 2029.

Recommendations

The analysis performed in this study is theoretical and uses data found in the open literature rather than actual data for the bridge. The results presented indicate that the bridge is unlikely to meet a service life of an additional 20 years at reliability levels required by prevailing design codes while foregoing routine maintenance. In the light of the lower than typical reliability predicted by the analysis, more frequent bridge inspections will be needed to maintain safety in the event the bridge is repaired.

The predictions are critically dependent on assumptions relating to the corrosion rate and statistical distributions of the load and the resistance. The validity of these assumptions needs to be verified from appropriate field inspection of the bridge. Without such verification, it will be unwise to base decisions exclusively on the reported theoretical analysis.

Acknowledgements

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1. INTRODUCTION

1.1 INTRODUCTION

A $4.76 million contract, April 15, 2008 pending award to repair the Friendship Trail Bridge was terminated on November 7, 2008. This bridge is one of the longest pedestrian bridges in the country and is a major recreational facility for the Tampa Bay community with over 600,000 citizens using it on an annual basis.

The recommendations for the repair are included in a report [1] prepared by consultants commissioned by the owners (Hillsborough County and Pinellas County). They are based on a thorough inspection of the bridge and its substructure, and are intended to ensure the bridge can be in service for the anticipated remaining service life of 15 to 20 years. This report describes a theoretical probabilistic structural analysis to provide independent data to the owners on the condition of the girders supporting the deck slab in spans located closest to the water-line. The objective of this study is to determine the probability of collapse of the Friendship Trial Bridge under self-weight and pedestrian load in the next 20 years.

1.2 BRIDGE OVERVIEW

The Friendship Trail Bridge is the old Gandy Bridge, which was constructed in 1956 and carried westbound traffic across Old Tampa Bay until 1995. The bridge was to be demolished when the new westbound bridge was opened, however actions from citizens of Hillsborough and Pinellas counties resulted in the two counties assuming joint ownership of the bridge in 1997 and making the bridge available for recreational use.

The 2.6-mile long bridge has 274 spans of which 252 are low-level 48ft spans. The current report focuses on the behavior of a typical 48ft span. The elevation of the top of the roadway above the waterline is 11ft 6in for these spans.

The 30ft 7in wide low-level bridge deck is supported by four 3ft 4in deep post-tensioned beams spaced 8ft 6in apart. These act compositely with a 7in thick deck slab. Partial-depth post-tensioned diaphragms tie the beams together at the third points (16ft on center).

The 48ft girders are pre-stressed (post-tensioned) by four, 1.125in diameter, Grade 160, post-tensioning (PT) bars, two straight and two parabolic. With the exception of two 3ft long end zones, no shear steel is provided in the 6in thick webs, over its remaining 42ft length.

The dimensions and details of the bridge deck, from the original plans, are illegible in places and some key information is not clear, e.g., cover at mid-span for the tendons. Additionally, as-built section dimensions, diaphragm, location of the post-tensioned tendons, material strengths of the concrete in the deck slab, and the pre-stressed beams are unknown.

1.3 Consultant's repair recommendations

As noted earlier, consultants selected by the owners inspected the entire bridge and recommended repairs valued at $4.76 million. Of this, $962k was set aside for repairing cracks (1924 linear ft. @$500/ft.) and $15k for repairing a broken pre-stressed bar in span 92. Other recommendations were for painting the structural steel ($500k), repairing pile jackets ($1.96 million) and repairing cracks in the piles and pile caps ($892k).

1.4 Scope of USF Study

This study is limited to the analysis of the superstructure of the 252 low-level 48ft spans. The objective of the study is to determine the probability of superstructure collapse under self-weight and pedestrian loading in the next 20 years. The study considers collapse due to flexural failure.

The accurate prediction of the flexural resistance of a bridge requires analysis of the total structure, rather than analysis of individual girders using simplified AASHTO design guidelines (as is typically done during design). This is because the span consists of four girders interconnected with diaphragms and the deck slab, which allows for significant redistribution of loads amongst the girders.

Variables that impact flexural and shear capacity include:

a. *Geometric Dimensions* – Variability in dimensions results from construction tolerances. Critical variables include the concrete cover and the location of the post-tensioning ducts.
b. *Initial Post-Tensioning (PT) Force* – This is expected to vary due to construction process variation.
c. *Material Properties*– These include strength, modulus of elasticity and density of materials used for the bridge.
d. *Post-tensioning (PT) Losses* – Creep and shrinkage cause significant reduction in the effective post-tensioning force and redistribute loads from the girder to the composite structure.
e. *Loading* –Pedestrian loads, other live load (ex. Ambulance) and other concurrent loads (such as dead load).
f. *Current Level of PT Corrosion* – Loss of post-tensioning steel section changes the service and ultimate capacity of the girders.

g. *Future Corrosion Rate* – This is dependent on the exposure of the structure to chlorides, effectiveness of performed repairs, future exposures in unrepaired area etc.

h. *Effectiveness of Grouting* – PT duct grouting is essential to maintain effective pre-stressing force in the event of corrosion section loss of the steel.

i. *Location of Girder* – Exposure to chlorides (see corrosion)

j. *Current level of Rebar Corrosion* – Rebar corrosion can lead to significant reduction in the capacity of reinforced concrete section (deck and girder end blocks).

k. *Fatigue Damage* – In the event of severe corrosion, fatigue failure of PT or rebar may become critical.

l. *Loss of Concrete Section Due to Spalling* – Corrosion causes loss of concrete section due to spalling.

Items a through e are considered in typical design codes and addressed through appropriate load and resistance factors. These are not considered separately in this study. This study focuses on the impact of PT bar section area loss due to corrosion on the capacity of the bridge while accounting for load redistribution between the four girders of a span through the deck and diaphragm. This situation is not addressed by AASHTO code equations and therefore assessed in this work through fundamental structural analysis.

1.5 OUTLINE

This section outlines the contents of the rest of the report. Chapter 2 discusses finite element model development in ANSYS [2]. Since the use of ANSYS for prestressed beam analysis is not very widespread, the modeling approaches was verified by comparing the predicted results against AASHTO equations and also test data from a 1973 report [3] on static load tests performed on similar girders of the old Sunshine Skyway Bridge.

Results of the as-designed condition of the bridge are presented in Chapter 3. The objective of these studies is to compare the current pedestrian loading to the original H20-44 truck loading and estimate the available margin in the ideal case without any consideration for loss of capacity due to corrosion induced deterioration. Chapter 3 also covers some of the fundamental design and behavior of the bridge, such as load balancing approach for post-tensioning design, and the impact of long term creep on load redistribution from the girders in the composite structure.

Chapter 4 focuses on failure analysis of the bridge. The primary objective of these studies is to understand the scenarios under which the bridge might collapse. The studies performed include cases with uniform loss of PT bar area and cases where PT bars are assumed to have broken in some girders.

Probabilistic assessment of the bridge is considered in Chapter 5. The approach used here was to assume statistical distribution for the rate of corrosion from the literature [4-6] and estimate the likelihood of collapse under self-weight and pedestrian loading after a 5-20 years period using Monte Carlo analysis.

Chapter 6 summarizes the findings from the studies and presents conclusions and recommendations.

2. FINITE ELEMENT MODEL

2.1 INTRODUCTION

The objective of this study is to determine the probability of collapse of the Friendship Trail Bridge under self-weight and pedestrian loading in the next 20 years. One approach to determine the likelihood of collapse is to estimate the loss of post tensioning (PT) bar cross-section area due to corrosion and use equations from AASHTO codes to determine the ultimate capacity of the girders [4-6]. This approach is likely to be very conservative since it does not take credit for redistribution of loads between girders occurring through the deck and diaphragms in the presence of distress to some girders. A more realistic estimate of the capacity of the bridge can be obtained by using a structural model capable of accounting for load redistribution.

This chapter presents details of a three dimensional model developed using ANSYS Version 11 [2] to model a typical 48 feet span of the Friendship Trail Bridge. Section 2.2 presents details of the typical bridge span. Section 2.3 describes the ANSYS model in detail. Material properties and boundary conditions are discussed in Sections 2.4 and 2.5 respectively. For verification purposes, ANSYS model results are compared to test data from a 1973 report [3] on the old Sunshine Skyway Bridge girder testing. These comparisons are discussed in Section 2.6.

2.2 TYPICAL SPAN CONFIGURATION

As noted in Section 1.2, the current report focuses on a typical 48ft span of the Friendship Trail Bridge. The typical span is 30ft 7in wide with 7in thick deck and supported by four 3ft 4in deep post-tensioned concrete girders spaced at 8ft 6in. The girders have end diaphragms and post-tensioned partial depth diaphragms at 16ft

spacing. A typical cross-section and side elevation of the bridge from available drawings is shown in Figure 2-1. Since many dimensions are illegible, their values had to be determined by scaling the drawing.

Figure 2-2 shows profile and details of post-tensioning bars used in the concrete girders. There are a total of four 1.125in diameter Grade 160 bars in each girder. Two of the four bars are straight and located at the bottom of the girder, while the other two have a parabolic profile and are located above the two straight bars.

Due to the illegible dimensions, it was initially thought that the post-tensioning bars were of 1.25in diameter, however, subsequently based on subsequent discussions with other engineers inspecting the bridge, it was discovered that the diameter was actually 1.125in. This correction required updating of the analysis presented in the report.

In addition to unknown dimensions, another important cause of uncertainty is the state of grouting of the post-tensioning bars. The post-tensioning bars were assumed to be grouted during an initial assessment of the bridge performed as part of this study. However, further field analysis of the bridge suggested that the grouting may have been ineffective in some locations. This finding is reflected in Chapter 4.

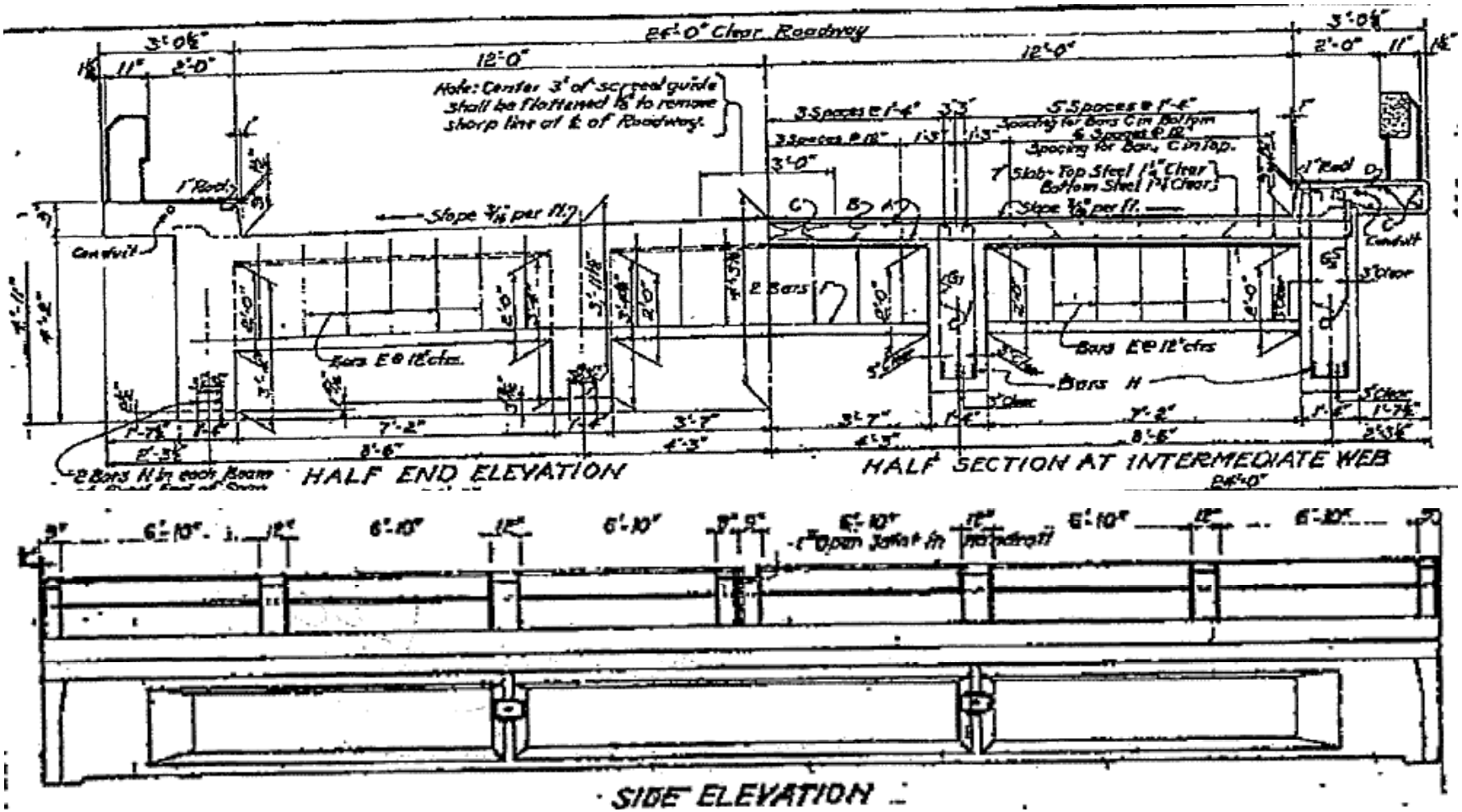


Figure 2-1 Cross section and side elevation of typical 48ft span.

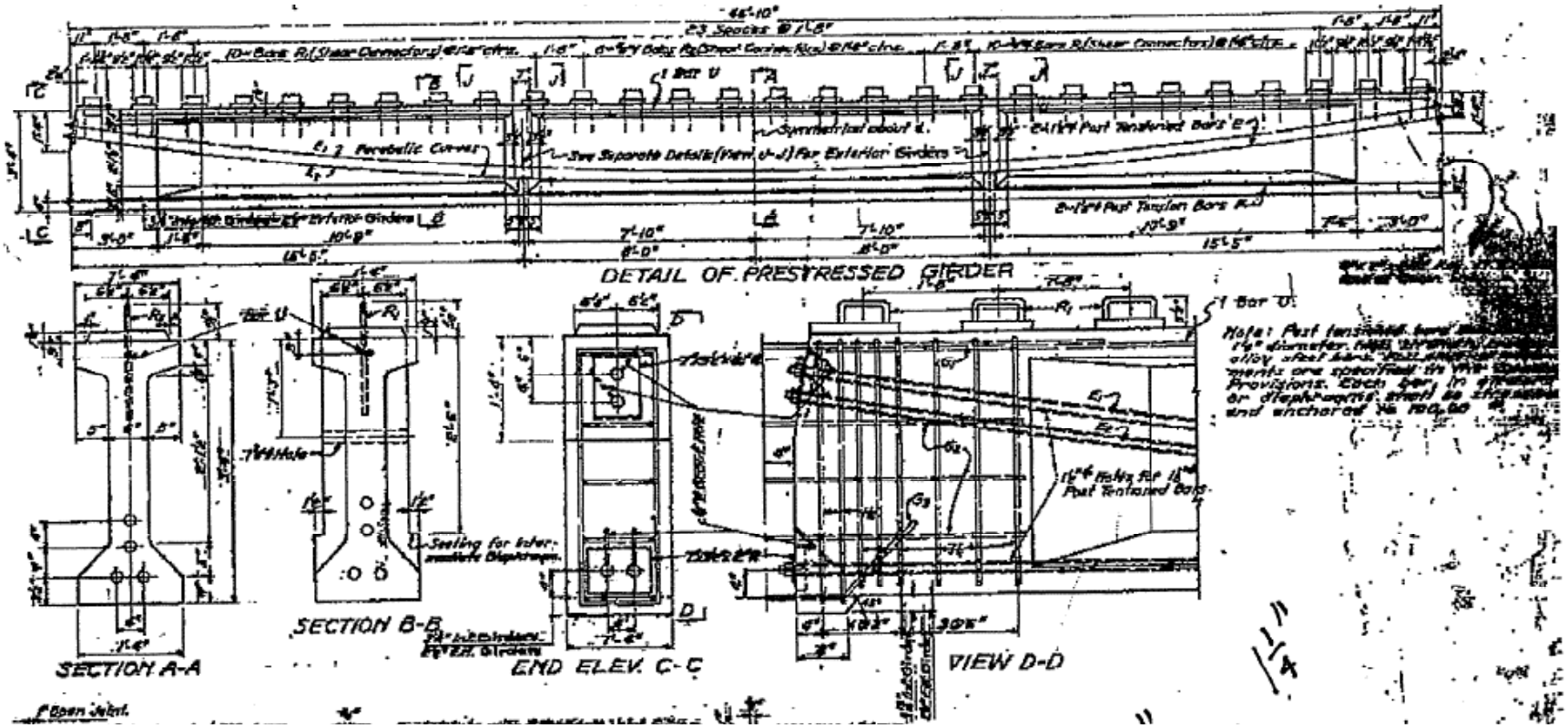


Figure 2-2 Girder Post Tensioning details.

2.3 Typical Span Finite Element Model

Figure 2-3 shows the finite element mesh of a typical 48ft simple span (46ft 10in between centerline bearings) found in the Friendship Trial Bridge. This was developed using ANSYS Version 11 [2]. The mesh uses a grid size of approximately 1ft. The model consists of girders and diaphragm modeled with 2 node beam elements (BEAM188). The deck was modeled with 4 node shell elements (SHELL181) with nodes located coincidently with the girder. Both the beam and shell elements have the feature to locate the cross-section offset from the node. This helps in easily modeling composite action without the need for rigid links between the girder and the deck. The model consists of 8914 nodes and 7250 elements.

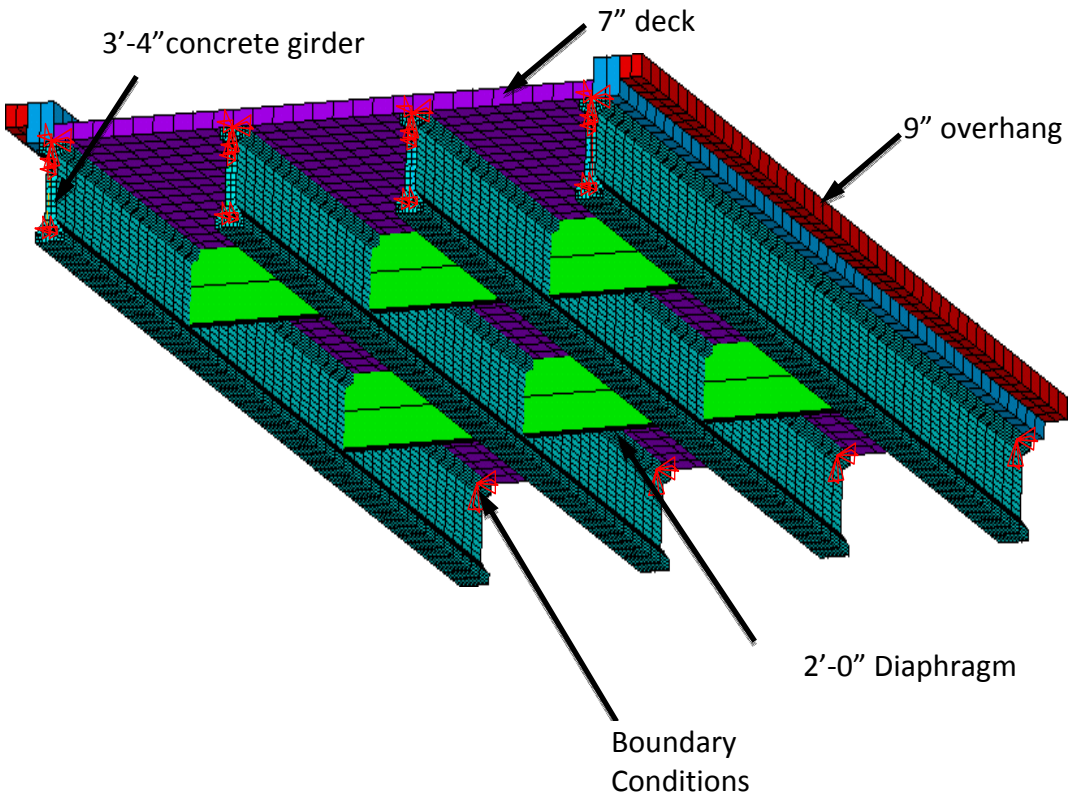


Figure 2-3 Three dimensional finite element mesh.

For typical design analysis, post-tensioning may be modeled with spar elements (LINK8) or by applying equivalent forces and moments at the nodes of the girder. However, in this model, post-tensioning bars were modeled with BEAM188 elements (see Figure 2-4). The choice of BEAM188 element for post-tensioning was based on the ability of this element to capture non-linear yielding of steel, which is important for determining the ultimate capacity of the bridge. In addition, this approach helps capture losses due to creep and shrinkage more accurately.

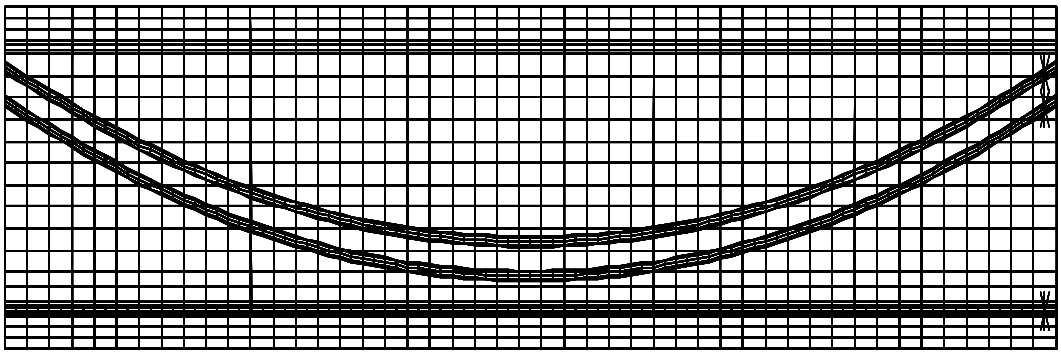


Figure 2-4 Side elevation of typical girder mesh showing post-tensioning elements (Note: Not to scale).

Due to lack of information on continuity of the barrier over a span, the model conservatively ignores the contribution of the barrier to the stiffness of the composite system.

2.4 MATERIALS

Concrete was modeled using a plasticity model (UNIAXIAL) [2] that allows differing failure stresses for compression and tension. The material has zero stiffness once the stress exceeds the specified failure stresses. Compression failure was set to the

compressive strength of the concrete (parabolic response was not modeled), and tension failure was set to 7.5 √f'c [7]. The compressive strength of the girder was assumed to be 6 ksi, while that of the deck was taken as 4 ksi. This is based on strengths documented in the report regarding testing of similar girders on the old Sunshine skyway bridge [3]. Post-tensioning steel was modeled as an elastic-perfectly plastic model with yield stress of 160 ksi. Although 160 ksi is actually the ultimate strength of the PT bar, the simplified material model still provides a good estimate of the ultimate strength of the structure.

2.5 Boundary Conditions

The typical span was modeled as being simply supported by constraining vertical displacement at both ends of the girder and deck and the longitudinal displacement at one end of the deck (see Figure 2-1). In addition, lateral displacement of all girder ends was restrained to model the effect of end diaphragms.

2.6 Validation Against Sunshine Skyway Girder Test Results

Since the use of ANSYS to model staged construction of post-tensioned concrete structures is not very widespread, the modeling approach was validated against test results. A 1973 report [3] documents the findings of static load tests conducted on girders of the old Sunshine Skyway Bridge. The old Sunshine Skyway Bridge was completed in 1954, two years prior to the Friendship Trial Bridge and used very similar post-tensioned concrete girders. The dimensions of the tested section are shown in Figure 2-5.

The sequence of loading used to simulate the test conditions is as follows:

1. Beams are post-tensioned to 0.81 F_u
2. Post-tensioning is grouted

3. Self weight of the beam is applied
4. Non-composite dead load (deck load) is applied to the girder
5. Composite section is formed
6. Test load is applied

The report [3] presents results from five girder tests. For validation purposes, results from the test of an undamaged girder (171-S2) were used first. The density of concrete in the finite element model was reduced to 130 pcf to match the dead load measured during the test. The load was applied at a distance for 14ft from the support and the failure load from the test was 112 kip. The finite element model failure load was estimated to be 102 kip based on the load at which the non-linear solution stopped converging due to excessive distortion. The finite element result is within 10% of the measured value and can be considered to be an acceptable comparison.

The difference in computed versus measured result could be due to many factors, including the non-inclusion of creep/shrinkage. Creep/shrinkage strain tends to reduce the compressive stress in the concrete girder and transfer the non-composite load to the composite section, which lowers the stress in the post-tensioning bar and can sometimes increase the ultimate section capacity. Other possible factors contributing to the mismatch include uncertainty associated with material properties and typical construction tolerances (with both the post-tensioning bar location and force).

To ensure the ability of the model to accurately capture the impact of corrosion, a second finite element model was run assuming a loss of 0.125in surface of all the three post-tensioning bars. This resulted in a reduction of the failure load from 102 kip to 61 kip, or a 40 % reduction in capacity. This compares to a 37% reduction reported from the tests (Girder 171-S3 in [3]). These comparisons suggest that the finite element model captures the structural behavior of the undamaged and damaged girders quite well.

Based on the findings of this preliminary validation study, models presented in Chapter 3 include creep and shrinkage effects to improve the accuracy of the predictions.

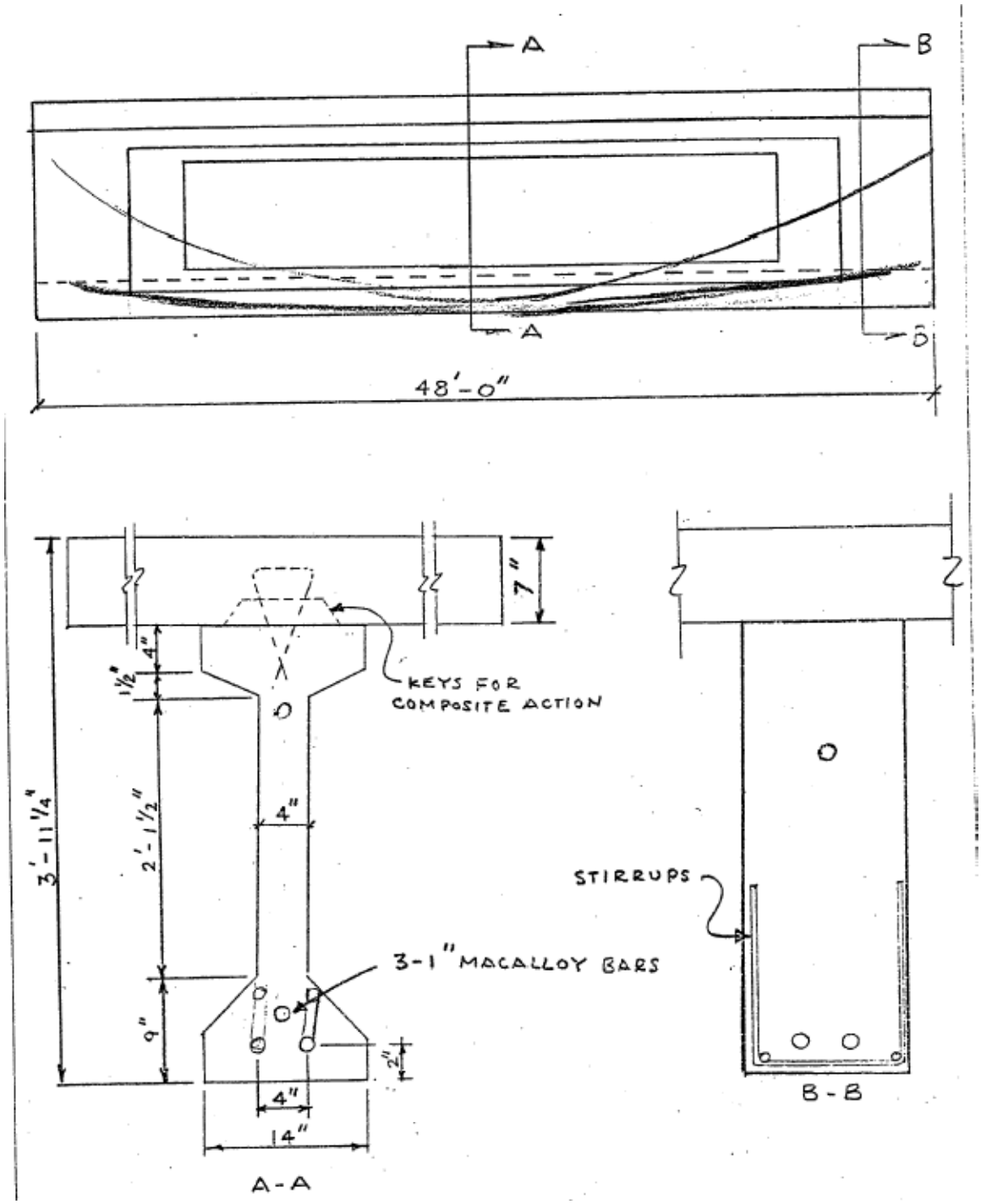


Figure 2-5 Dimension of test girders from the old Sunshine Skyway bridge [3].

3. RESULTS: DESIGN CONDITION

3.1 INTRODUCTION

Chapter 2 presented details of the finite element model used to analyze the typical span of the Friendship Trail Bridge. It also presented results of the validation study performed using test results of girders taken from the old Sunshine Skyway Bridge. This chapter presents results from enhanced finite element models which include the impact of creep and shrinkage determined using the European CEB FIP 1990 code [8].

The objective of this chapter is to present some results using the undamaged bridge model to use as a benchmark to compare against the damaged bridge model results presented in Chapter 4. Some simple design equation based calculations are also presented to compare the original design loading (H20-44) versus the proposed loading (85 psf pedestrian loading).

3.2 DESIGN EQUATION BASED COMPARISON

Appendix A contains design calculations to understand the relative order of magnitude of various loads acting on the as-designed bridge. These calculations suggest that the amount of post-tensioning was selected based on meeting service criteria for maintaining compression at the bottom fiber. As a result, the original design has a factored ultimate moment capacity which is 37% higher than the factored load.

These design calculations also show that the moment due to pedestrian loading is roughly half the moment due to the original design live load of the H20-44 truck. Incidentally, this is practically the load capacity required to accommodate an H10-44

truck, which is representative of an ambulance loading that a pedestrian bridge is required to handle in case of emergencies.

Service assessment design calculations also show that only 25% of the original PT section area is sufficient to carry DL+ pedestrian loading of the bridge.

3.3 Finite Element Model Loading Sequence

The following load steps were applied to the finite element model to determine the state of the structure in the designed condition:

1. Beams are post-tensioned to 0.81 F_u.
2. Post-tensioning is grouted
3. Self-weight of the beam is applied
4. Creep and shrinkage effects are computed for period between post-tensioning and deck pour (estimated to be 10 days)
5. Non-composite dead load (deck + diaphragm load) is applied to the girder (note composite dead load from barriers is ignored since exterior girders do not govern due to smaller tributary loads from the deck)
6. Composite section is formed
7. Creep and shrinkage effects are computed for 1 year
8. Creep and shrinkage effects are computed for 5 years
9. Creep and shrinkage effects are computed for 10 years
10. Creep and shrinkage effects are computed for 20 years
11. Creep and shrinkage effects are computed for 50 years
12. Pedestrian load x 10 (850 psf) is applied to the deck and run until failure occurs

ANSYS 11 does not permit combination of UNIAXIAL plasticity model (used to model concrete cracking) with creep. To accurately account for creep behavior, Steps 1-11 are run without plasticity since the stresses are expected to be in the linear range. The

creep induced strains at the end of step 11 are applied as initial strains to a new model that uses the UNIAXIAL plasticity model for concrete. The new model also uses the PT forces obtained from step 11.

3.4 Results

Bending moment diagrams, shear force diagrams and the axial force distributions of an interior girder for load cases 1 through 12 are shown in Appendix B. The results agree well with code-based hand calculations (see Table 4-1). Accurate prediction of failure load requires the analytical model to account for load redistribution of the non-composite load from the girder to the composite section due to creep/shrinkage. Figure 3-1 shows the interior girder concrete stress at the neutral axis and the bottom straight PT bar stress for the different load steps. It can be seen that both the concrete and PT bar start with a high stresses (concrete is compressive while PT bar is tensile) right after post-tensioning. However, at load steps modeling creep and shrinkage (4 and 6 thru 11), both concrete stress and PT bar stress reduce due to creep. Creep/shrinkage strain reduces the compressive stress in the post-tensioned concrete and this results in the non-composite load being shed from the girder to the composite section. The reduction of compressive concrete stress in the girder is undesirable since concrete is poor in tension and will crack due to lack of longitudinal reinforcement in the girder.

Figure 3-2 shows the girder axial force right after composite action is formed (Load Step 6) and after 50 years of creep and shrinkage (Load Step 11). It may be seen that the compressive axial force from the post-tensioning at mid-span reduces from about 410 kip to about 290 kip, a 30% reduction.

Girder shear force results for load steps 6 and 11 (see Figure 3-3) show a small shear load when the composite section is formed (load step 6). This means that the post-tensioning force carries the dead load of the structure, which is consistent with the load

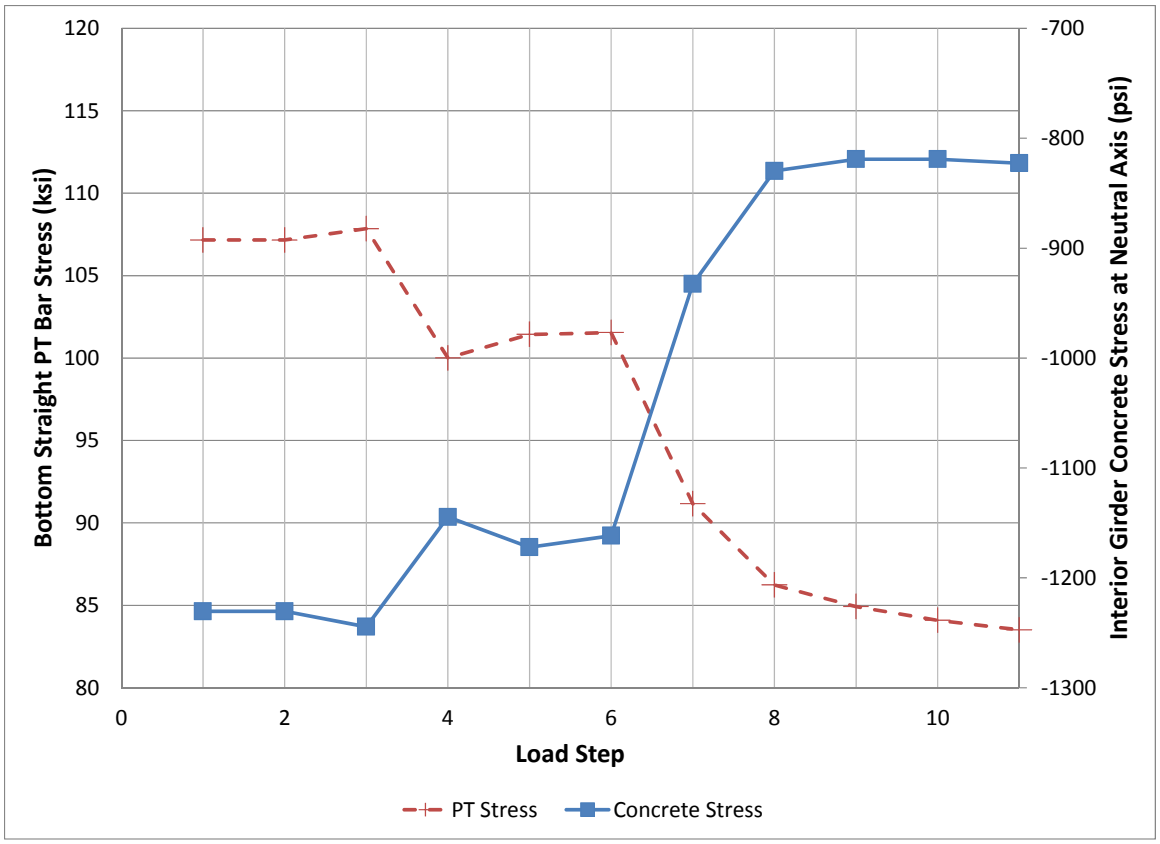


Figure 3-1 Interior Girder Concrete Stress at neutral axis and bottom straight PT bar stress at mid-span over load steps.

balancing approach to post-tensioned concrete design. However, due to creep and shrinkage, a significant part of the dead load is carried by the girders after 50 years (load step 11).

Figure 3-4 shows the interior girder bending moment diagram, shear force diagram and axial force at ultimate load. The failure load for this load step results in a moment of 2018 ft-kip, which compares well with design equation based prediction of 1982 ft-kip. The slight difference in prediction is most likely due to difference in estimated creep and shrinkage loss used for design equation versus that computed based on CEB FIP 1990 [8] in the finite element model.

The next chapter presents results on studies where the area of the post-tensioning bar is reduced after load step 11 and the distressed structure is subsequently subjected to load to determine its ultimate capacity.

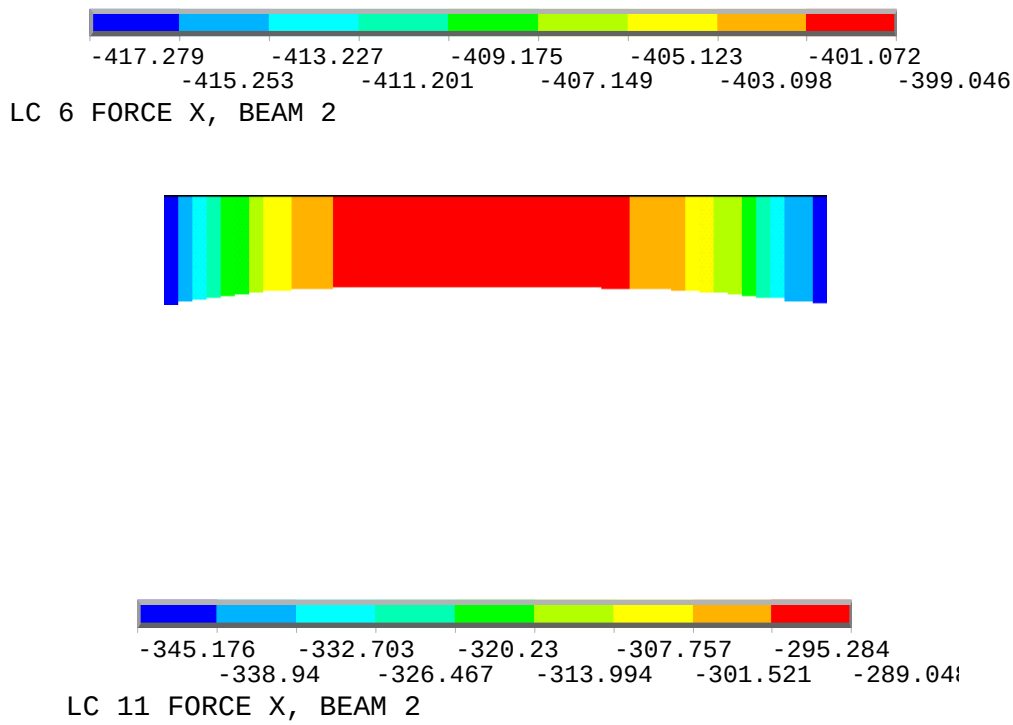
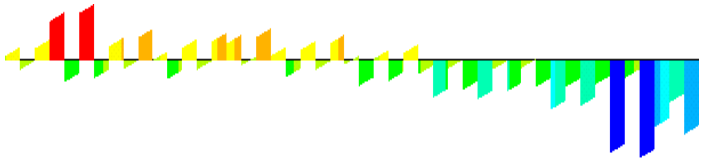
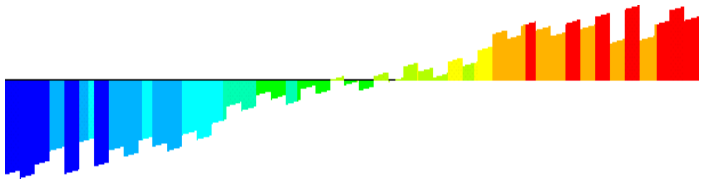


Figure 3-2 Effect of creep on girder axial post-tensioning forces (kip).



LC 6 SHEAR FORCE, BEAM 2



LC 11 SHEAR FORCE, BEAM 2

Figure 3-3 Effect of creep on girder shear forces (kip).

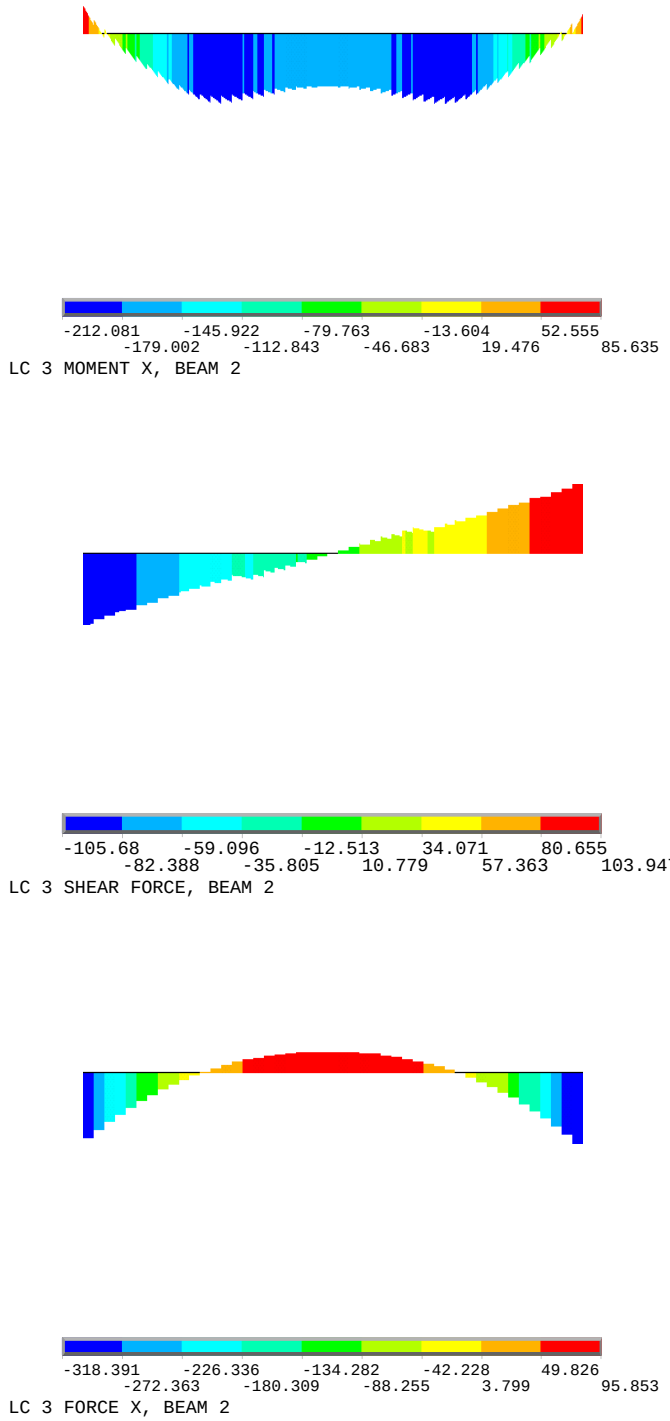


Figure 3-4 Load Case #12 - Interior Beam Bending Moment Diagram, Shear Force Diagram and Axial Force (units – kip-ft, kip).

4. RESULTS: DISTRESSED CONDITION

4.1 INTRODUCTION

Chapter 3 presented results of the as-designed condition of the bridge after 50 years of creep and shrinkage. It was found that the ultimate capacity of the bridge predicted in this state was fairly close to the capacity computed in Appendix A using design code based equations. In this chapter, results of models that incorporate loss of post-tensioning bar area due to corrosion are shown. The results presented here form the basis for the next chapter, where the probability of collapse of any typical span of the Friendship Trail Bridge is computed.

4.2 CORROSION BEHAVIOR

The main cause of deterioration observed in the bridge is corrosion of the post-tensioning (PT) bars. The corrosion of a PT bar in a bridge does not start immediately after construction. It takes several years for the chloride from sea water to diffuse through the concrete cover and reach the post-tensioning bar. Based on average rates found in the literature [6], the initial diffusion period is estimated to be about 5 years based on a cover of 2.25in (1.5in diameter duct in a 6in web).

Once the chlorine reaches the steel surface, corrosion is known to cause two primary types of deterioration to the steel bars. Firstly, there is a uniform loss of steel section. Based on an average rate of corrosion of 0.006 in/year [6], the average loss of area of PT bars is estimated to be 45% (as of 2009). It must be pointed out that the rate of loss is based purely on data found in the literature and can be refined if further data is carefully collected from the field.

The second type of deterioration occurs due to pitting corrosion, where a part of the bar has significant loss of section locally. Pitting corrosion can lead to breakage of the PT bar. It is difficult to predict the average number of locations where pitting corrosions can occur, therefore the capability of the structure to carry girder with multiple broken PT bars must be determined to assess safety of the span.

4.3 Modeling Area Loss

The following load steps were used with the finite element model to analyze the structure in the distressed condition

1. Beams are post-tensioned to 0.81 F_u
2. Post-tensioning is grouted
3. Self-weight of the beam is applied
4. Creep and Shrinkage effects are computed for period between post-tensioning and deck pour (estimated to be 10 days)
5. Non-composite dead load (deck + diaphragm load) is applied to the girder (note composite dead load from barriers is ignored since exterior girders do not govern due to smaller tributary loads from the deck)
6. Composite section is formed
7. Creep and shrinkage effects are computed for 1 year
8. Creep and shrinkage effects are computed for 5 years
9. Creep and shrinkage effects are computed for 10 years
10. Creep and shrinkage effects are computed for 20 years
11. Creep and shrinkage effects are computed for 50 years
12. Reduce the cross-section area of affected PT bars
13. Apply Pedestrian Load $\times$ 10 and run until failure occurs

As shown in Step 12 above, uniform loss of area due to corrosion was modeled by reducing the cross-section area of the post-tensioning bars in the bridge. Bar breakage

due to pitting corrosion is modeled by changing the post-tensioning bar cross section to a very small value (0.1% of original area). Based on observations about the grouting quality on the bridge during inspections, it was decided that the broken tendons will be conservatively assumed to be ungrouted. Therefore, a local breakage is modeled by changing the PT bar section area to along the entire span.

Service design equation based analysis in Appendix A show that the PT bar cross-section area needed to prevent collapse is approximately that corresponding to one PT bar. The following nine scenarios were investigated using the finite element model to understand the impact of post-tensioning bar breakage on the ultimate capacity of the bridge. Five of the nine scenarios (1,5,7-9) consider different levels of average PT area loss occurring from 2009 to 2029 in 5 year increments. Three of the cases (2-4) consider scenarios where there is severe level of distress resulting in broken PT bars in addition to uniform area loss. Finally, case 6 looks at the impact of local PT area loss.

Case 1 - All post-tensioning bar areas reduced by 45% (to simulate 2009 level of average post-tensioning bar area loss due to corrosion)

Case 2 – Case 1 and two straight bars broken in all four girders

Case 3 – Case 1 and bottom three bars broken in an interior girder

Case 4 – Case 1 and all bars broken in an interior girder

Case 5 – All post-tensioning bar areas reduced by 59% (to simulate 2029 level of average post-tensioning bar area loss due to corrosion)

Case 6 – Case 5, with PT area reduction applied locally only to 1ft zone at the mid-span (to simulate impact of local area loss and simulate any stress concentration due to sudden section change)

Case 7 – All post-tensioning bar areas reduced by 48% (to simulate 2014 level of average post-tensioning bar area loss due to corrosion)

Case 8 – All post-tensioning bar areas reduced by 52% (to simulate 2019 level of average post-tensioning bar area loss due to corrosion)

Case 9 – All post-tensioning bar areas reduced by 55% (to simulate 2024 level of average post-tensioning bar area loss due to corrosion)

Per computations shown in Appendix A, the target ratio of pedestrian loading needed to meet AASHTO LFD code requirement is 2.7, i.e., if the structure can resist a load of 2.7 x 85 psf on the deck, it meets AASHTO code requirements for strength (moment capacity of 865 ft-kip).

4.4 Results

Figure 4-1 shows the bending moment diagram, the shear force diagram and the axial force distribution for an interior girder at failure load of 5.2 x pedestrian loading (ultimate moment capacity of 1364 ft-kip) for Case 1. It is evident that there is significant loss of moment and shear capacity when compared to Figure 3-4, which shows the ultimate state for PT bar without area loss Despite the significant loss of area, the structure still exceeds the target ultimate moment of 865 ft-kip, indicating significant margin to carry pedestrian load.

Deflected shapes of the bridge at the failure load are shown in Figure 4-2. The low value of peak deflection of 0.4 inch at mid span indicates that the failure is likely to be a sudden brittle failure, which is suggests behavior similar to unreinforced concrete under force loading. Figure 4-3 shows the stress in an interior girder at failure. It may be seen that a significant portion of the girder in the mid-span has tensile stresses (red contour) indicative of a severely cracked girder. It is interesting to note that the model did not predict failure of the PT bars despite significant loss of area due to corrosion.

To understand why the PT bar does not fail, additional models (Case 5 and 6) were run with more severe PT area loss. Case 5 has uniform area loss of 59%, while Case 6 has this area loss occurring only over 1 ft zone at the mid-span. Figure 4-4 shows interior

girder concrete stress at the neutral axis and bottom straight PT bar stress for different levels of uniform pedestrian loading for these cases. It was shown in Chapter 3 (see Figure 3-1) that creep causes significant reduction in both the compressive stress in concrete and tensile stress in the PT bar. Data at X axis value of -1 shown in Figure 4-4 corresponds to Load Step 11 in Figure 3-1. The change in PT bar stresses and concrete stress from X axis value of -1 to 0 occurs due to reduction in area of the PT bar in the model (Load Step 12). The change in PT bar stress is not very significant since the composite system behavior is essentially strain controlled. This means that the loss of PT bar force results in the non-composite load being shed to the composite sections (which cause a reduction in concrete compressive stress) and the overall strain of the PT bar is not significantly affected. Since stress is proportional to strain prior to yielding, the overall change in PT bar stress is not very significant in both Case 5 and Case 6. In both cases, there is an increase in the concrete tensile stress and PT bar stress for higher levels of applied uniform pedestrian load. At some point, the tensile cracking in concrete causes a significant loss of stiffness and the PT bar sees higher rate of increase in stress. The analysis suggests that the entire girder section cracks prior to the PT bar reaching its yield stress, thus resulting in a brittle failure with minimal deflection. The analysis shows that the case with only local loss of PT bar area has significantly higher capacity due to limited shedding of non-composite load to the composite section over the length of the span.

Results from Case 2, which assumes a 45% section loss in parabolic tendons and 100% loss of straight tendons are shown in Figure 4-5. The results indicate significant reductions in flexural and shear capacity and significant tension is indicated by the axial force. Despite the severe loss of post-tensioning, the structure failed at 2.93 x pedestrian load (M=915 ft-kip), which is above the 865 ft-kip target needed to meet code requirements.

Figure 4-6 shows results from Case 3, where all PT bars are assumed to have 45% section loss and an interior girder (second girder from bottom in the figure), is modeled with complete loss of bottom three PT bars. Despite the extremely severe condition, the failure load was 4.0 x pedestrian loading (M=1127 ft-kip), indicating that the structure meets the code based target of 865 ft-kip. It is clear from the results that the adjacent girders take on the excess load as seen by the difference in the moment and shear of the exterior girder adjacent to the one with PT loss compared to the one at extreme top in the figure. This clearly shows that the structure has a significant level of redundancy due load redistribution occurring through the deck and the diaphragms.

Finally, results from Case 4, which assumes a 45% section loss in all tendons plus complete loss of post tensioning in an interior girder (second girder from bottom in the figure), are shown in Figure 4-7. As with the previous case, the results indicate significant reduction in flexural and shear capacity and significant tension is indicated by the axial force. Despite the severe loss of post-tensioning, the structure failed at 2.78 x pedestrian load (M=885 ft-kip), which is just above the 865 ft-kip target needed to meet code requirements.

Failure loads obtained from all the analyses are summarized in Table 4-1. All the above results indicate that there is significant redundancy in the structure and a collapse is highly unlikely for an average span in the short term. The next chapter looks at computing the probability of failure after additional 5-20 years while accounting for spans that may have more than average level of distress due to corrosion.

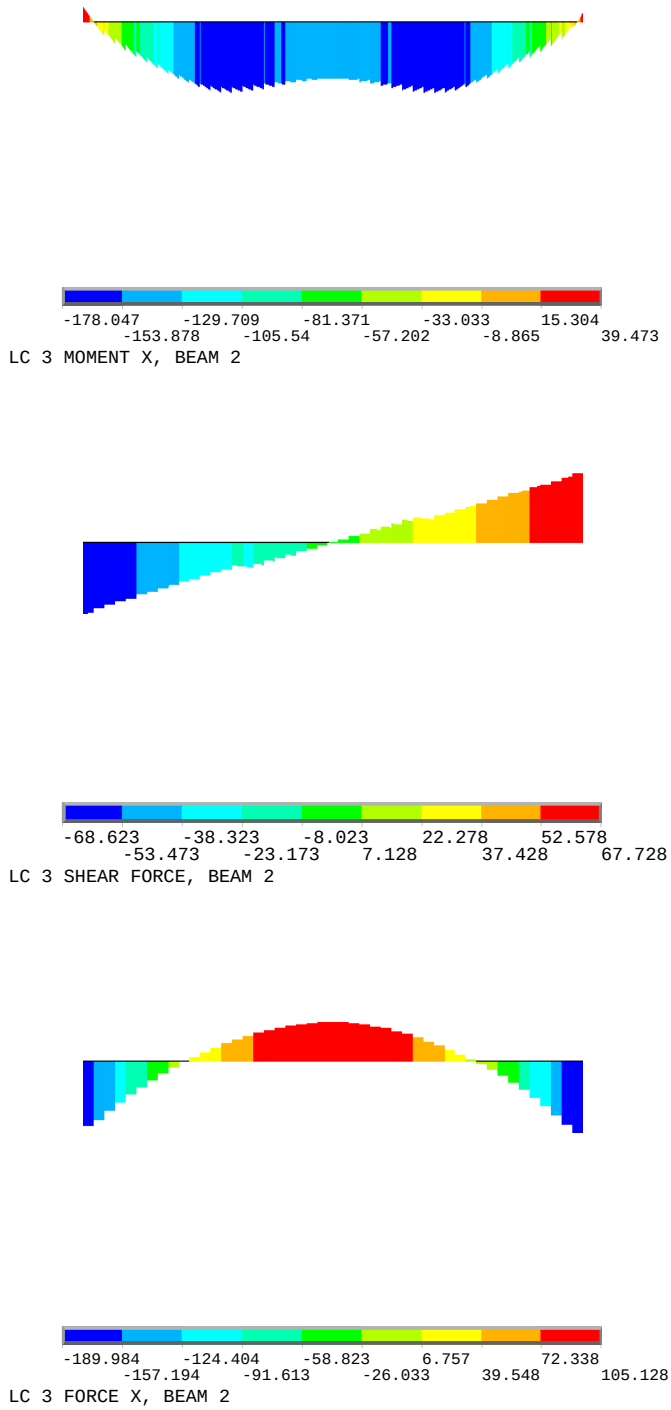


Figure 4-1 Interior Beam Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip) – Case 1, Failure Load.

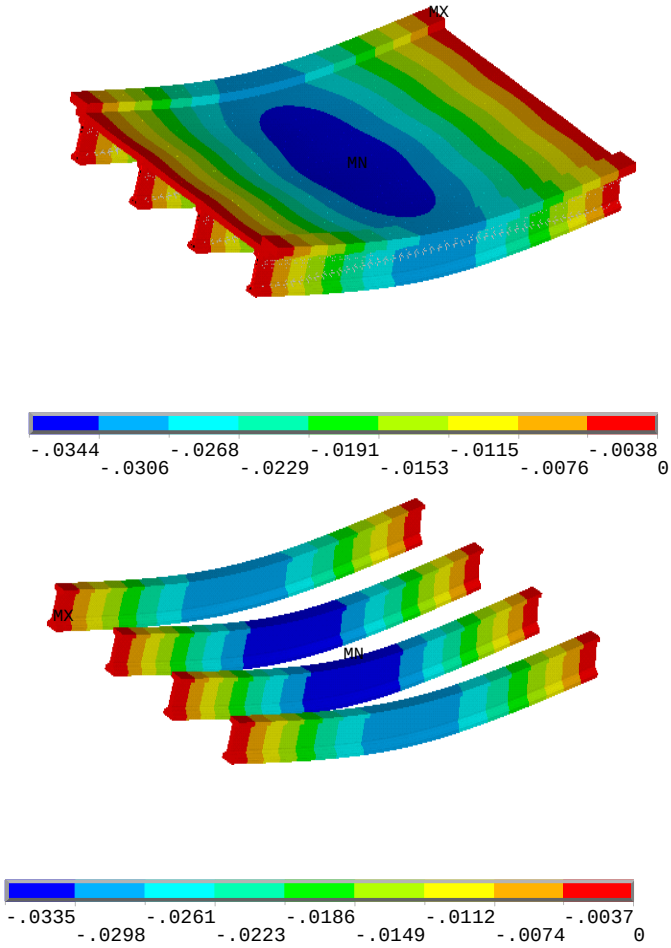


Figure 4-2 Deflections (ft) – Case 1, Failure Load.

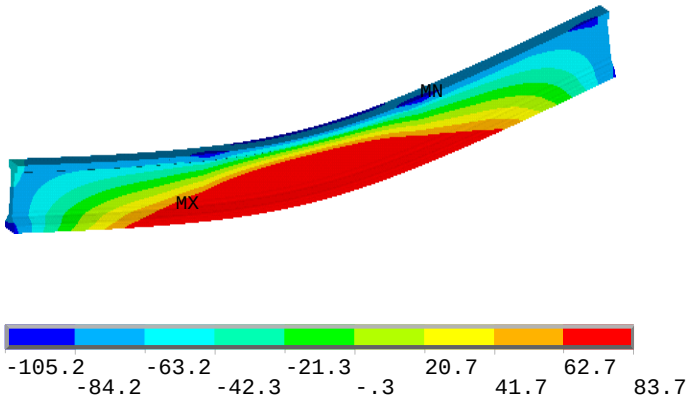


Figure 4-3 Interior Beam Concrete Stress (ksf)- Case 1, Failure Load.

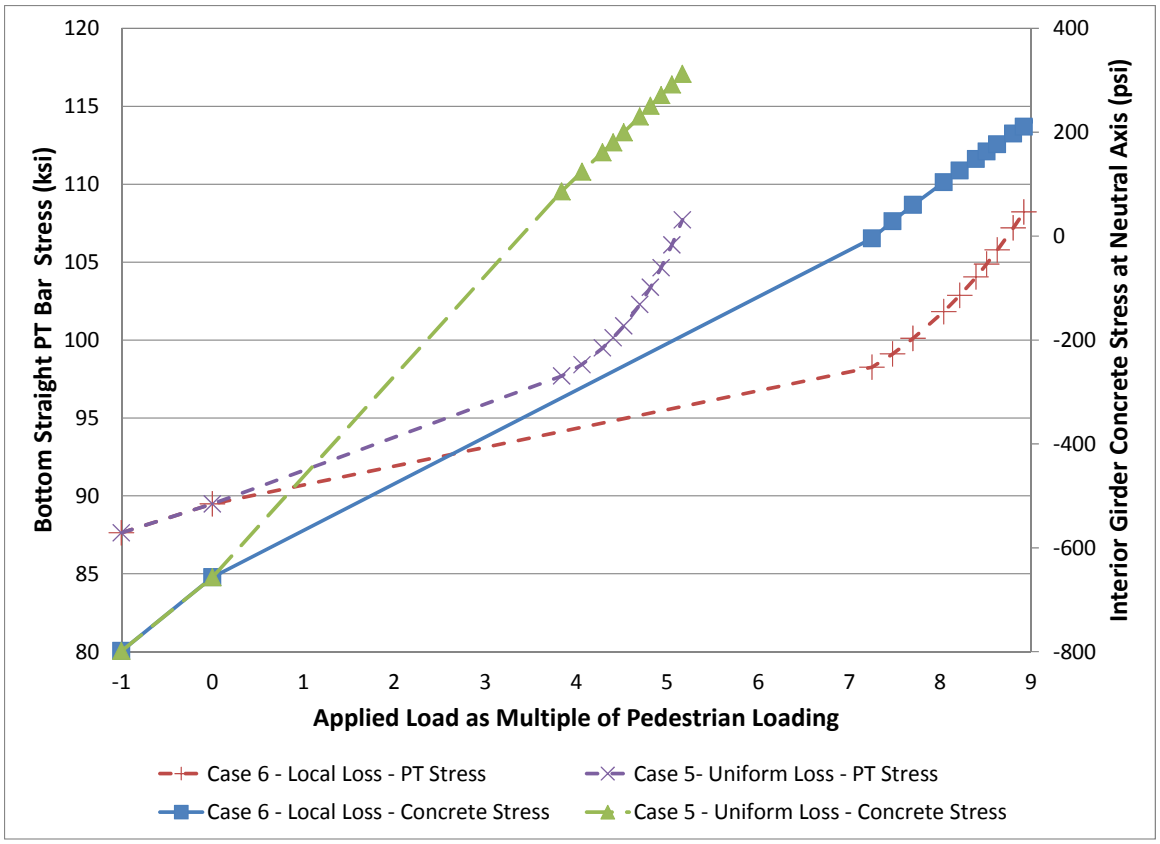


Figure 4-4 Interior Girder Concrete Stress at neutral axis and bottom straight PT bar stress at mid-span under uniform pedestrian loading.

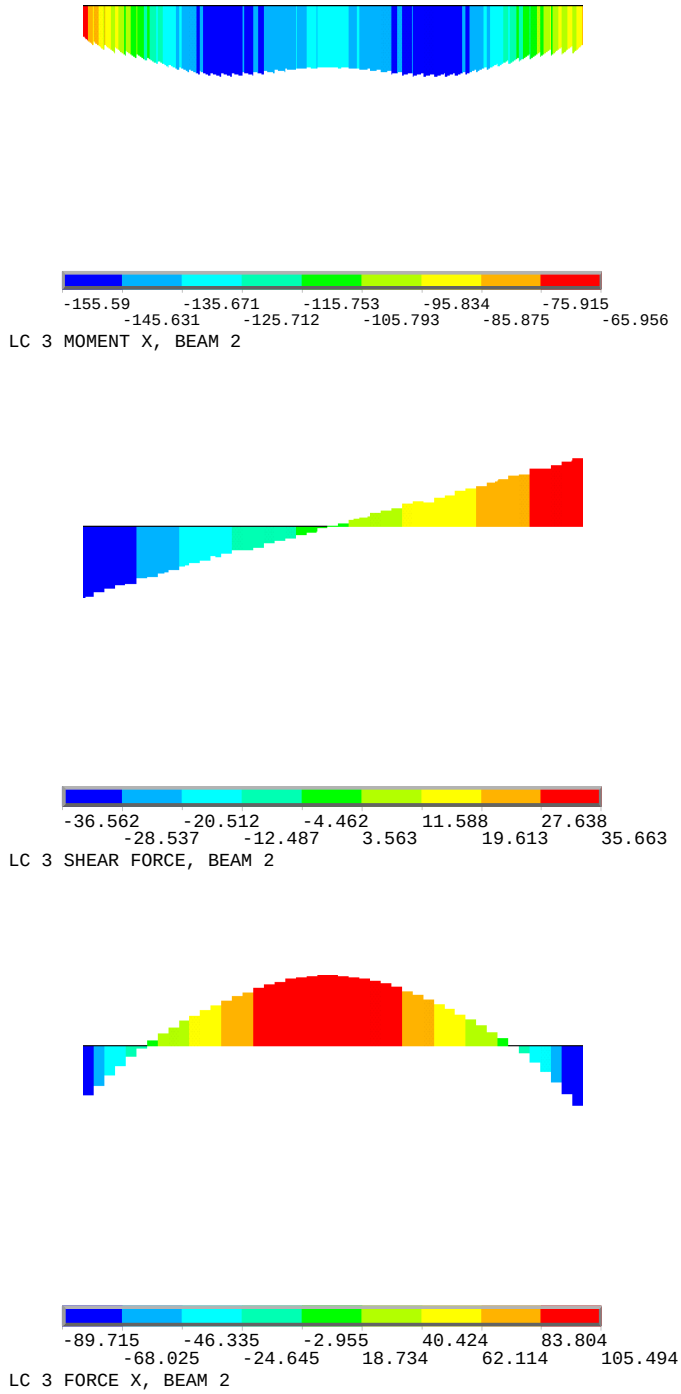
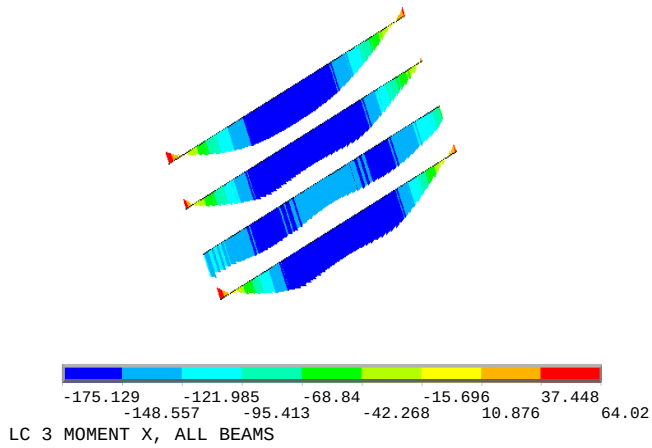
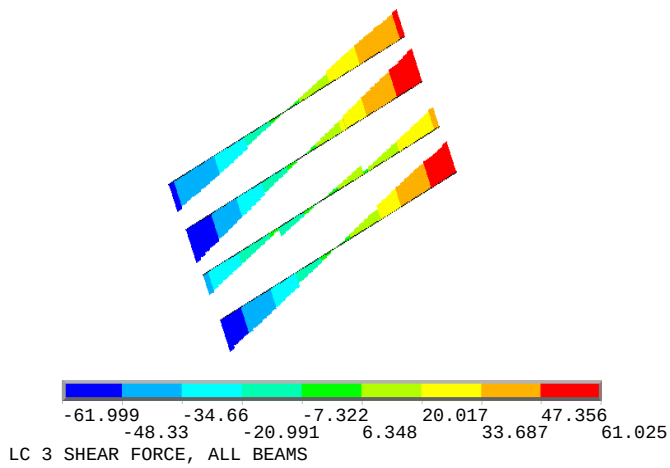


Figure 4-5 Interior Beam Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip) – Case 2, Failure Load.





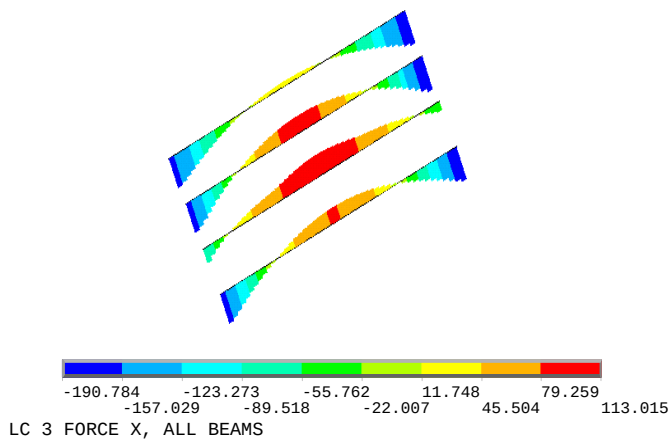


Figure 4-6 All Beams Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip) – Case 3, Failure Load.

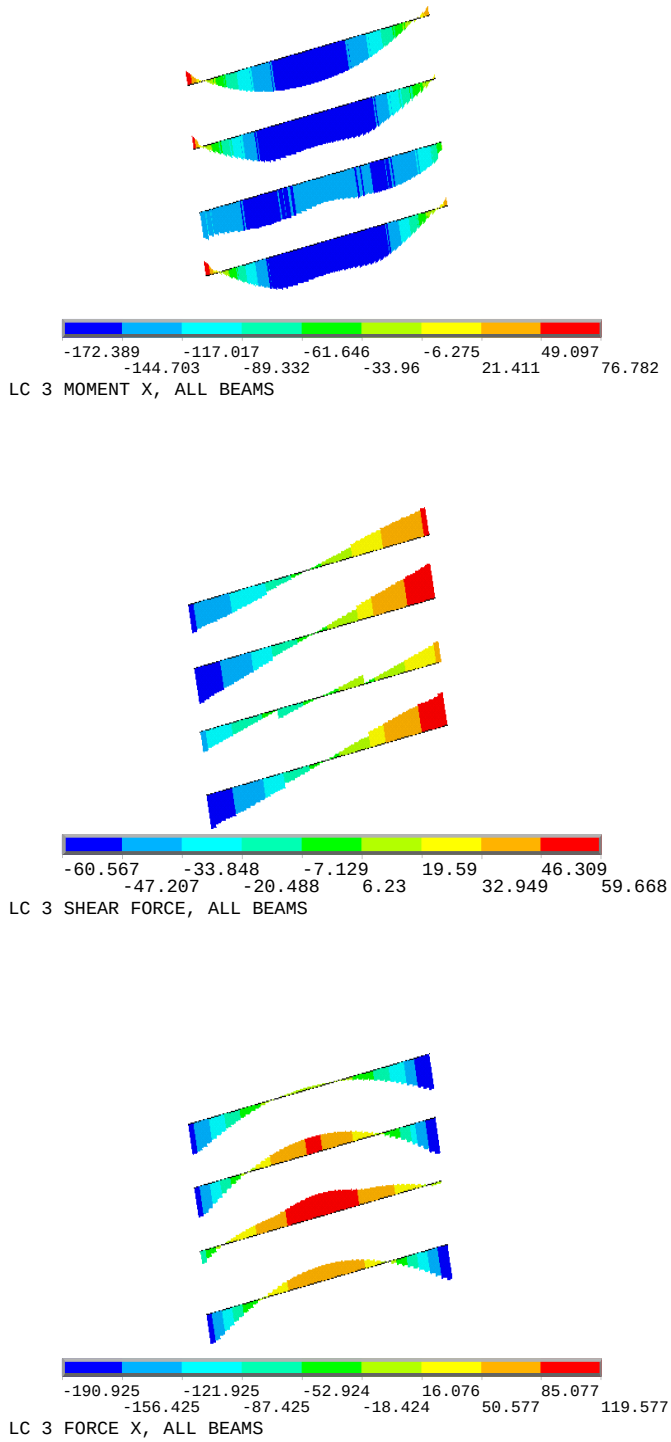


Figure 4-7 All Beams Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip) – Case 4, Failure Load.

Table 4-1 Summary of analysis results.

Case Num	Description	Ultimate Moment Capacity (ft-kip)
Design	Code based ultimate moment (see Appendix A)	1982
Design	Finite element based ultimate moment	2018
1	All post-tensioning bar areas reduced by 45% (to simulate 2009 level of post-tensioning bar area loss due to corrosion)	1364
2	Case 1 and two straight bars broken in all four girders	915
3	Case 1 and bottom three bars broken in an interior girder	1127
4	Case 1 and all bars broken in an interior girder	885
5	All post-tensioning bar areas reduced by 59% (to simulate 2029 level of post-tensioning bar area loss due to corrosion)	1159
6	All post-tensioning bar areas reduced by 59% only for 1ft zone at the mid-span. (to simulate 2029 level of post-tensioning bar area loss due to corrosion in local area)	2018
7	All post-tensioning bar areas reduced by 48% (to simulate 2014 level of post-tensioning bar area loss due to corrosion)	1287
8	All post-tensioning bar areas reduced by 52% (to simulate 2019 level of post-tensioning bar area loss due to corrosion)	1240
9	All post-tensioning bar areas reduced by 55% (to simulate 2024 level of post-tensioning bar area loss due to corrosion)	1192

5. PROBABILISTIC ASSESSMENT

5.1 INTRODUCTION

The main deliverable from the project is the probability of collapse of the bridge under its own self-weight and pedestrian loading. Deterministic results presented in Chapter 4 provide some insight into the expected structural behavior under severe distress. This chapter uses knowledge of statistical distribution of variables that impact corrosion to compute the probability of collapse within the next 20 years. The probabilistic analysis shown here uses the Monte Carlo method. The values of variables and their distributions are based on available literature on similar analysis performed by other researchers.

5.2 MONTE CARLO ANALYSIS

The likelihood of collapse of a bridge span depends on several variables, such as material strength, geometric dimensions and loads. These are random variables, i.e., their values vary from point to point on the bridge and may vary over time. Such variables can be characterized using statistical distributions, such as normal distribution or log-normal distributions. They are defined using their mean value and coefficient of variation or standard deviation (σ).

A practical method to understand the implication of these variations on probability of failure is to use the Monte Carlo analysis. This method involves generating a very large number of samples (10,000-100,000+) for the variables using the statistical distribution of the variable and evaluating the design at these sampled points. The probability of failure obtained from the large number of samples provides a good indication of expected likelihood of failure.

5.3 VARIABLE DISTRIBUTIONS

As discussed in Chapter 1, the key variable and the focus for this study is the loss of post-tensioning (PT) bar section area due to corrosion. Uncertainty of other variables, such as geometry and material properties are addressed by codes and were incorporated using data from [9].

Table 5-1 shows the variables that impact corrosion initiation and rate of corrosion from [6]. Corrosion initiation time, T_I, in years is given by the following expression [6]

$$T_I = \frac{X^2}{4D_c}\left[erf^{-1}\left(\frac{C_0 - C_{cr}}{C_0}\right)\right]^{-2}$$

In this expression, D_c is the chloride diffusion coefficient (in^2/year), X is the concrete cover (in), and C_o and C_{cr} the chloride concentration at the surface and the critical chloride concentration. The effective diameter of PT bar is computed by reducing the original diameter by R_{corr} x ($T-T_I$), where T is the time from end of construction at which the structure is being assessed.

Table 5-1 Variable distributions used for Monte Carlo Analysis

Variable	Distribution	Mean	Coefficient of variance (% of mean)
Diffusion Coefficent, D (in^2/yr)	Lognormal	0.2	0.10
Surface chloride concentration, C_o (wt % conc.)	Lognormal	0.20	0.10
Critical chloride concentration, C_{cr} (wt % conc.)	Lognormal	0.025	0.10
Corrosion Rate, R_{corr} (in/yr)	Lognormal	0.006	0.30
Cover (in)	Lognormal	2.25	0.05

5.4 Results

A Monte Carlo Analysis was performed using Microsoft Excel and the variable distributions in Table 5-1 to combine the different possible T_I and R_{corr} and obtain a distribution of the area of any post-tensioning bar using 10,000 sampling points. Figure 5-1 shows the results of the distribution of PT bar diameter obtained from the Monte Carlo analysis for the year 2029. The results suggest that the average diameter of the PT bar will be around 0.73in, which corresponds to an average loss of 59% of section area. In addition, the results show the worst case diameter to be 0.21in, which corresponds to a loss of 97% of the section area.

Table 5-2 shows results from additional Monte Carlo analysis showing the average and standard deviation of the PT area over 5 year increments from 2009 to 2029.

Table 5-2 PT Area Variation and Flexural Resistance Coefficient of Variation - 2009 to 2029.

Year	Avg. PT Area (in^2)	Ultimate Moment Capacity (ft-kip)	Std Dev (in^2)	-2 σ Reduced Area (in^2)	-2 σ Ultimate Moment Capacity (ft-kip)	Coefficient of Variation due to PT Area	Delta from cut strands (ft-kip)	Coefficient of Variation due to broken PT Bar	Coefficient of Variation due to dimensions, materials etc.	Combined Coefficient of Variation for
2009	0.566	1377	0.113	0.341	1089	0.105	475	0.112	0.075	0.175
2014	0.527	1300	0.120	0.288	1026	0.105	475	0.118	0.075	0.184
2019	0.494	1250	0.127	0.239	950	0.120	475	0.123	0.075	0.192
2024	0.458	1205	0.131	0.196	859	0.144	475	0.127	0.075	0.198
2029	0.426	1171	0.137	0.152	738	0.185	475	0.131	0.075	0.204

Table 5-2 also contains predictions on the ultimate moment capacity corresponding to the different PT area. These were estimated by fitting a third order polynomial that relates loss of PT area to the failure load using results obtained from ANSYS for Cases 1, 5 and 7 through 9 shown in Table 4-1.

5.5 Probability of Failure

Probability of failure of a typical span can be computed if the distribution of applied loads (dead load and live load) and resistance (flexural resistance) is known. These were obtained from [9] and are summarized in Table 5-3.

To obtain a baseline probability of failure, Monte Carlo analysis was performed using 100,000 sample using these distributions with original design loads for the typical 48ft span from Friendship Trial Bridge (see Appendix A) and using the nominal resistance specified by the AASHTO Standard Specification. The probability of failure obtained from the analysis was 43 per 100,000. This corresponds to a reliability index of 3.3 and agrees well with the published reliability index for prestressed concrete girder bridges in [9].

The probability of failure in the distressed condition was computed by using the nominal resistance obtained using ANSYS and adjusting the coefficient of variation of resistance to include the expected variation in PT area and likelihood of having broken tendons (see Table 5-2). The inspection report [1] indicated that only 1 of the girders in the 252 spans had a broken PT bar. This corresponds to a probability of 1/252 of having a broken bar. Using results from Chapter 4 which show a reduction of 475 ft-kip ultimate capacity for the case with all straight bars broken, a coefficient of variation was computed to reflect the 1/252 likelihood of having this condition at different time periods (see Table 5-2 for computed Coefficient of Variation due to broken PT Bar). This assumption is conservative since it assumes all straight PT bars are broken in the span.

This conservatism is required since it is very likely that the pitting corrosion deterioration will accelerate over time.

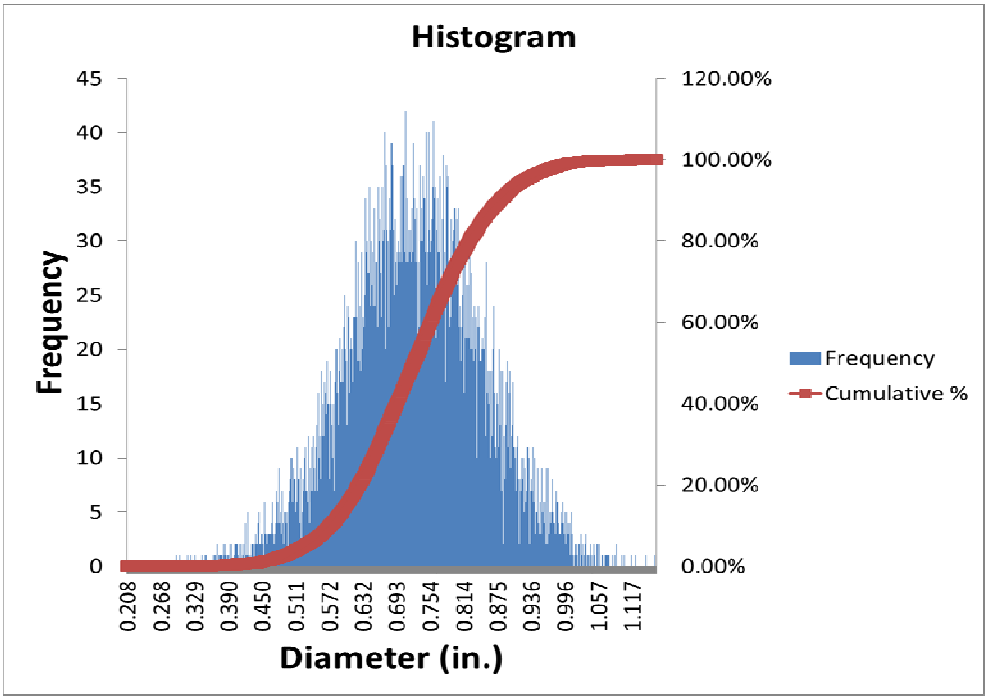


Figure 5-1 Monte Carlo Results of distribution of Friendship Trail Bridge PT Bar diameter in year 2029.

Table 5-3 Distribution of load and resistance [9].

Load	Distribution	Bias (ratio of mean to nominal)	Coefficient of variance (% of mean)
Dead Load (factory produced girders)	Normal	1.03	0.08
Dead Load (cast-in-place)	Normal	1.05	0.10
Live Load	Normal	1.75	0.18
Moment Resistance	Normal	1.05	0.075

Table 5-4 Probability of Failure from 2009 to 2029.

Year	SELF WT. + PEDESTRIAN LOAD		SELF WT. ONLY		Number of Span Likely to Fail under full Pedestrian Load
	Probability of Failure	Reliability Index	Probability of Failure	Reliability Index	
2009	0.00128	3.0	0	>4.3	0.32
2014	0.00373	2.7	0.00001	4.3	0.94
2019	0.00624	2.5	0.00003	4.0	1.57
2024	0.01075	2.3	0.00006	3.8	2.71
2029	0.01569	2.2	0.00019	3.6	3.95

Table 5-4 shows the probability of failure computed using Monte Carlo analysis using the coefficient of variation for loads shown in Table 5-3 and the coefficient of variation for resistance shown in Table 5-2. Results from the above analysis indicate the probability of failure of the bridge under pedestrian load increases from 128 in 100,000 to 1569 in 100,000 during the period from 2009 to 2029. Given that the original design code would have resulted in a probability of failure is 43 in 100,000, the state of the bridge in 2029 represents a significantly higher risk of failure than is currently found acceptable by design codes. The analysis suggests that of the 252 spans, 1 may fail under full pedestrian loading around 2014, 3 spans around 2024 and 4 spans around 2029. The analysis also shows that the bridge has a very low probability of failure (19 in 100,000) under self-weight alone between 2009 and 2029.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The goal of this study was to predict the likelihood collapse of a typical 48ft span of the Friendship Trial Bridge under pedestrian loading and self-weight A three dimensional non-linear, finite element model was used to capture redistribution of loads and obtain a more realistic prediction of ultimate capacity of the span than typical single girder analysis would provide. The validity of the model was confirmed by comparison with test results from a 1973 report [3] on load test of old Sunshine Skyway Bridge and also by comparison to results obtained using design equations.

Analysis results from the three dimensional finite element model of the bridge for different corrosion scenarios (for years 2009-2029) indicate that due to redundancy in the structure from multiple girders connected through diaphragms and the deck, there is sufficient capacity in the average span to resist self-weight + pedestrian loading. However, the above analysis did not account for variation in the corrosion rate, material properties, geometry and loading. Thus these results are indicative of an average span and not the span that may be more severely distressed. The analysis also indicates the structure failure mode may be sudden brittle collapse due to girder cracking at the mid-span. This is because, the strain controlled behavior of the composite section limits the amount of stress developed in the PT bar even when there is significant reduction in bar area and results in the concrete section developing significant tensile stresses that lead to failure with minimal deflection (0.4in).

The Monte Carlo method was used to compute the probability of failure of a bridge span for the period from 2009-2029 while accounting for the possibility of more distressed spans than those considered in the finite element analysis. The likelihood of the load exceeding the flexural resistance was determined using 100,000 statistical samples. The source of variation considered in the study included loss of post-tensioning bar section area due to corrosion, load and resistance.

Results from the above analysis indicate the probability of failure of the bridge under self-weight + pedestrian load increases from 128 in 100,000 to 1569 in 100,000 during the period from 2009 to 2029. Given that the original design code would have resulted in a probability of failure is 43 in 100,000, the state of the bridge in 2029 represents a significantly higher risk of failure than is currently found acceptable by design codes. The analysis suggests that of the 252 spans, 1 may fail under full pedestrian loading around 2014, 3 spans around 2024 and 4 spans around 2029. The analysis also show that the bridge has a very low probability of failure under self-weight alone between 2009 and 2029.

6.2 Study Limitations

The analysis presented here had to use conservative assumptions where possible to compensate for the high level uncertainty in the state of the bridge. Some of these assumptions were:

1. The PT bars were modeled as ungrouted based on field inspection data.
2. Impact of pitting corrosion was modeled by assuming all straight bars were broken in the span being considered.
3. When computing PT area loss due to corrosion, no credit was taken for corrosion of the zinc PT duct.
4. The PT area loss was assumed to be uniform over the entire length of the bar.

The study presented here focused on PT bar section area loss due to uniform corrosion and only estimated the impact of pitting corrosion by incorporating its impact on the variation of resistance of the span. Pitting corrosion is likely to be a more serious problem since it can cause breakage of PT bars. If the frequency of pitting corrosion is established by performing a bridge survey, the combined result of uniform area loss corrosion and pitting corrosion may be assessed in a more rigorous manner.

The analysis presented here did not address shear strength of the girders. Testing performed on the old Sunshine Skyway Bridge shows that the composite girder plus deck section has significant shear capacity. There would be some impact to shear capacity due to damage to the parabolic tendons, however, in these scenarios the flexural capacity would most likely be the limiting factor.

The study did not assess the impact of loss of concrete section due to spalling. This refinement is not expected to change the conclusions significantly since the ultimate capacity analysis assumed cracked concrete on the tension face, where most of the spalling occurs.

The structural model did not consider deterioration of the diaphragm, anchorages for the PT bars and the deck due to corrosion. Although, the inspection report [1] mentions some form of distress in some diaphragms, they are assumed to have sufficient capacity to help the girder redistribute the load to adjacent girders. This was considered to be a reasonable simplification since the deck also helps load redistribution.

The distributions used for the corrosion rates, load and resistance are based on those found in the literature [6, 9]. Results can be more accurate if they are compared to field data from inspection and updated periodically based on observations.

6.3 RECOMMENDATIONS

The analyses performed in this study show that the bridge is unlikely to meet a service life of additional 20 years at reliability levels required by design codes. In the light of the lower than typical reliability predicted by the analysis, more frequent bridge inspections will be needed to maintain safety in the event the bridge is repaired.

In case the bridge is demolished, it is recommended that a sample of the dimension of PT bars and state of the grouting be studied and documented for potential use in other similar bridges in Florida or elsewhere.

The analysis performed in this study is theoretical and uses data found in the open literature rather than actual measurements from the bridge. As noted in the previous section, many assumptions had to be made, such as the corrosion rate and statistical distributions of load and resistance, which have a critical impact on the failure load predictions. It is therefore recommended that no decision be made solely based on these findings. These results must be used in conjunction with other information based on more detailed inspection of the bridge that document bridge deterioration over time.

REFERENCES

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2. ANSYS Inc, ANSYS User Manual Version 11, 2007.

3. Self, Morris and Bollman, Henry, “Results of the Static Load Tests Conducted on the Sunshine Skyway Bridge Girders at the University of Florida”, District 7 Structures Design Office, 1973.

4. Li, Chun Qing, “Reliability based Service Life Prediction of Corrosion Affected Concrete Structures”, Journal of Structural Engineering, pp.1570-1577, October 2004.

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APPENDIX A: DESIGN/CODE EQUATION BASED CALCULATIONS

Inputs

$L_{span} := 46.833\,ft$ Span

$D_{girders} := 8.5 \cdot ft$ Spacing between girders

$T_{deck} := 7 \cdot in$ Deck thickness

$\rho_c := 0.150 \frac{kip}{ft^3}$ Density

Calculate Non Composite DL

a. Girder

$A_{girder} := 2.4458\,ft^2$

$w_{girder} := A_{girder} \cdot \rho_c$

$w_{girder} = 0.367 \cdot \frac{kip}{ft}$

$M_{DL_girder} := \frac{w_{girder} \cdot L_{span}^2}{8}$

$\boxed{M_{DL_girder} = 100.583\,kip \cdot ft}$

$V_{DL_girder} := w_{girder} \cdot \frac{L_{span}}{2}$

$\boxed{V_{DL_girder} = 8.591 \cdot kip}$

b. Slab

$A_{slab} := T_{deck} \cdot D_{girders}$

$A_{slab} = 4.958\,ft^2$

$w_{slab} := A_{slab} \cdot \rho_c$

$w_{slab} = 0.744 \frac{kip}{ft}$

$M_{DL_slab} := \frac{w_{slab} \cdot L_{span}^2}{8}$

$\boxed{M_{DL_slab} = 203.911\,kip \cdot ft}$

$V_{DL_slab} := w_{slab} \cdot \frac{L_{span}}{2}$

$\boxed{V_{DL_slab} = 17.416\,kip}$

Calculate Composite DL & Live Load

$W_b := (8.5)\cdot ft$

$W_b = 8.5\cdot ft$

$L_b := 46.8\cdot ft$

$p := 85\cdot psf$

$w := W_b\cdot p$

$w = 0.723\,\frac{kip}{ft}$

$R_a := w\cdot\frac{L_b}{8}$

$M_{pedestrian} := \frac{\left(w\cdot L_b^{\,2}\right)}{8}$

$R_a = 4.227\cdot kip$

$M_{pedestrian} = 197.806\,kip\cdot ft$

$w_b := \frac{225}{2}\cdot\frac{lbf}{ft}$ Per girder

$M_{barrier} := w_b\cdot\frac{L_b^{\,2}}{8}$

$M_{barrier} = 30.8\cdot kip\cdot ft$

$V_{barrier} := w_b\cdot\frac{L_b}{2}$

$V_{barrier} = 2.632\cdot kip$

$V_{Pedestrian} := w\cdot\frac{L_b}{2}$

$V_{Pedestrian} = 16.907\cdot kip$

$V_{Total} := V_{DL_girder} + V_{DL_slab} + V_{Pedestrian}$

$V_{Total} = 42.913\,kip$

$I := \frac{50\cdot ft}{L_b + 125\cdot ft}$

$I = 0.291$

$M_{H20} := 425.6\,ft\cdot kip$ From AASHTO Tables

$M_{fraction} := \frac{8.5\cdot 0.5}{5.5}$

$M_{H20}\cdot M_{fraction}\cdot(1 + I) = 424.587\,ft\cdot kip$ Unfactored LL + Impact

$M_{ult} := \left[(1 + I)\cdot 1.3\cdot 1.67\cdot M_{H20}\right]\cdot M_{fraction} + 1.3\cdot\left(M_{DL_slab} + M_{DL_girder} + M_{barrier}\right)$

$M_{LL} := M_{fraction}\cdot(1 + I)\cdot M_{H20}$

$M_{LL} = 424.587\,ft\cdot kip$

$M_{ult} = 1.358\times 10^{3}\cdot ft\cdot kip$

$$Ratio := \frac{M_{ult}}{\left(M_{DL_slab} + M_{DL_girder} + M_{barrier} + M_{pedestrian}\right)}$$

$$Ratio = 2.547$$

$$M_{ult_ped} := \left(1.3 \cdot 1.67 \cdot M_{pedestrian}\right) + 1.3 \cdot \left(M_{DL_slab} + M_{DL_girder} + M_{barrier}\right)$$

$$M_{ult_ped} = 865.32\,ft \cdot kip$$

Needed capacity to meet code with pedestrian loading only

Original Factored Moment Capacity

$b := 8.5 \cdot ft$

$f_u := 160 \cdot ksi$

$a_{ps} := 4 \cdot in^2$ Note 1 bar = 1 sq. in (uncorroded)

$\beta_1 := 0.85$

$f'_c := 5000 \cdot psi$

$$c := \frac{a_{ps} \cdot f_u}{b \cdot f'_c}$$

$c = 1.255 \cdot in$

$$a := \frac{c}{\beta_1}$$

$a = 1.476 \cdot in$

$d := 31.148 \cdot in + 7 \cdot in - 0.25 \cdot in$ Extra 1/4" assuming bar rides top of duct

$d = 37.898 \cdot in$

$\Phi := 0.90$

$$M_{capacity} := a_{ps} \cdot f_u \cdot \left(d - \frac{a}{2}\right)$$

$M_{capacity} = 1.982 \times 10^3 \cdot ft \cdot kip$

$d_{orig} := 3 \cdot ft + 4 \cdot in + 7 \cdot in - 7.5 \cdot in$

$$M_{ultimate} := \Phi \cdot a_{ps} \cdot f_u \cdot \left(d_{orig} - \frac{a}{2}\right)$$

$M_{ultimate} = 1.861 \times 10^3 \cdot ft \cdot kip$

$$R_{reserve} := \frac{M_{ultimate}}{M_{ult}}$$

$R_{reserve} = 1.37$ Significant excess capacity - design was likely governed by service

Estimate Min PS Area Required for resisting unfactored DL+LL

$b := 8.5 \cdot ft$

$f_u := 160 \cdot ksi$

$a_{ps} := 1.03 \cdot \pi \cdot \frac{(1.125)^2}{4} \cdot in^2$

Note 1 bar = 1 sq. in (uncorroded)

$a_{ps} = 1.024 in^2$

$\beta_1 := 0.85$

$f'_c := 5000 \cdot psi$

$c := \frac{a_{ps} \cdot f_u}{b \cdot f'_c}$

$c = 0.321 \cdot in$

$a := \frac{c}{\beta_1}$

$a = 0.378 \cdot in$

$d := 31.148 in + 7 \cdot in - 0.25 \cdot in$

Extra 1/4" assuming bar rides top of duct

$d = 37.898 in$

$M_{capacity} := a_{ps} \cdot f_u \cdot \left(d - \frac{a}{2}\right)$

$M_{capacity} = 514.774 ft \cdot kip$

$d_{orig} := 3 \cdot ft + 4 \cdot in + 7 \cdot in - 7.5 \cdot in$

$M_{ultimate} := a_{ps} \cdot f_u \cdot \left(d_{orig} - \frac{a}{2}\right)$

$M_{ultimate} = 536.643 ft \cdot kip$

$$R_{ped_reserve} := \frac{M_{ultimate} - \left(M_{DL_slab} + M_{DL_girder} + M_{barrier}\right)}{M_{pedestrian}}$$

$R_{ped_reserve} = 1.018$

Ratio of pedestrian LL to remaining capacity assuming no uncertainty in DL

Estimate Ultimate Load as Multiple of Pedestrian Load

$b := 8.5 \cdot ft$

$f_u := 160 \cdot ksi$

$a_{ps} := 4 \cdot \pi \cdot \frac{(1.125)^2}{4} \cdot in^2$

$a_{ps} = 3.976\, in^2$

$\beta_1 := 0.85$

$f'_c := 5000 \cdot psi$

$c := \frac{a_{ps} \cdot f_u}{b \cdot f'_c}$

$c = 1.247 \cdot in$

$a := \frac{c}{\beta_1}$

$a = 1.468 \cdot in$

$d := 31.148 \cdot in + 7 \cdot in - 0.25 \cdot in$

Extra 1/4" assuming bar rides top of duct

$d = 37.898 \cdot in$

$M_{capacity} := a_{ps} \cdot f_u \cdot \left(d - \frac{a}{2}\right)$

$M_{capacity} = 1.97 \times 10^3 \cdot ft \cdot kip$

$d_{orig} := 3 \cdot ft + 4 \cdot in + 7 \cdot in - 7.5 \cdot in$

$M_{ultimate} := a_{ps} \cdot f_u \cdot \left(d_{orig} - \frac{a}{2}\right)$

$M_{ultimate} = 2.055 \times 10^3 \cdot ft \cdot kip$

$$R_{ped_reserve} := \frac{M_{ultimate} - \left(M_{DL_slab} + M_{DL_girder} + M_{barrier}\right)}{M_{pedestrian}}$$

$R_{ped_reserve} = 8.695$ Ratio of pedestrian LL to remaining capacity assuming no uncertainty in DL - used to compare to ANSYS

Service Design Check

$I_g := 3.1228\,ft^4$

$A_g := 2.4458\,ft^2$

$r := \sqrt{\frac{I_g}{A_g}}$

$M_D := M_{DL_girder}$

$M_{SD} := M_{DL_slab}$

$y_t := 1.723\,ft$

$h := 3 \cdot ft + 4 \cdot in$

$y_b := h - y_t$ $\qquad y_b = 19.324\,in$

$S_b := \frac{I_g}{y_b}$

$M_{CSD} := M_{barrier}$

$M_L := M_{H20} \cdot (1 + I) \cdot M_{fraction}$

$y_{bar1} := y_b - 4.5 \cdot in$

$y_{bar2} := y_b - 4.5 \cdot in$

$y_{bar3} := y_{bar1} - 4 \cdot in$

$y_{bar4} := y_{bar3} - 4 \cdot in$

$N_{bars} := 4$

$e := \frac{(y_{bar1} + y_{bar2} + y_{bar3} + y_{bar4})}{N_{bars}}$

$e = 11.824\,in$

$c_b := y_b$

$A_{bar} := \pi \cdot \frac{(1.125\,in)^2}{4}$

$A_{bar} = 0.994\,in^2$

$P_{bar} := 0.8 \cdot 0.8 \cdot 0.80 \cdot 160\,ksi \cdot A_{bar}$

$P_{bar} = 81.43\,kip$

$P_e := N_{bars} \cdot P_{bar}$

$P_e = 325.72\,kip$

$M_D = 100.583\,ft \cdot kip$

$M_{SD} = 203.911\,ft \cdot kip$

$M_{CSD} = 30.8\,ft \cdot kip$

$M_L = 424.587\,ft \cdot kip$

$I_{comp} := 187702.845\,in^4$

$y_{bcom} := 33.485\,in$

$S_{cb} := \frac{I_{comp}}{y_{bcom}}$

$$f_b := \frac{-P_e}{A_g} \cdot \left(1 + \frac{e \cdot c_b}{r^2}\right) + \frac{M_D + M_{SD}}{S_b} + \frac{M_{CSD} + M_L}{S_{cb}}$$

$f_b = -8.875\,psi$

Okay, bottom fiber in compression

$f'_c = 5 \times 10^3 \cdot psi$

$f_r := 7.5 \cdot \sqrt{\frac{f'_c}{psi}} \cdot psi$

$f_r = 530.33\,psi$

Modulus of Rupture

Needed Ultimate Load as Multiple of Pedestrian Load

$M_{ult_ped} = 865.32 ft \cdot kip$

$M_{totl_DL} := M_{DL_slab} + M_{DL_girder} + M_{barrier}$

$M_{totl_DL} = 335.295 ft \cdot kip$

$M_{req} := M_{ult_ped} - M_{totl_DL}$

$M_{req} = 530.025 ft \cdot kip$

$$R_{reqd} := \frac{M_{req}}{M_{pedestrian}}$$

$R_{reqd} = 2.68$

This is the target ratio of pedestrian loading needed from ANSYS for the structure to be consider safe.

APPENDIX B: FINITE ELEMENT ANALYSIS RESULTS –DESIGN CONDITIONS

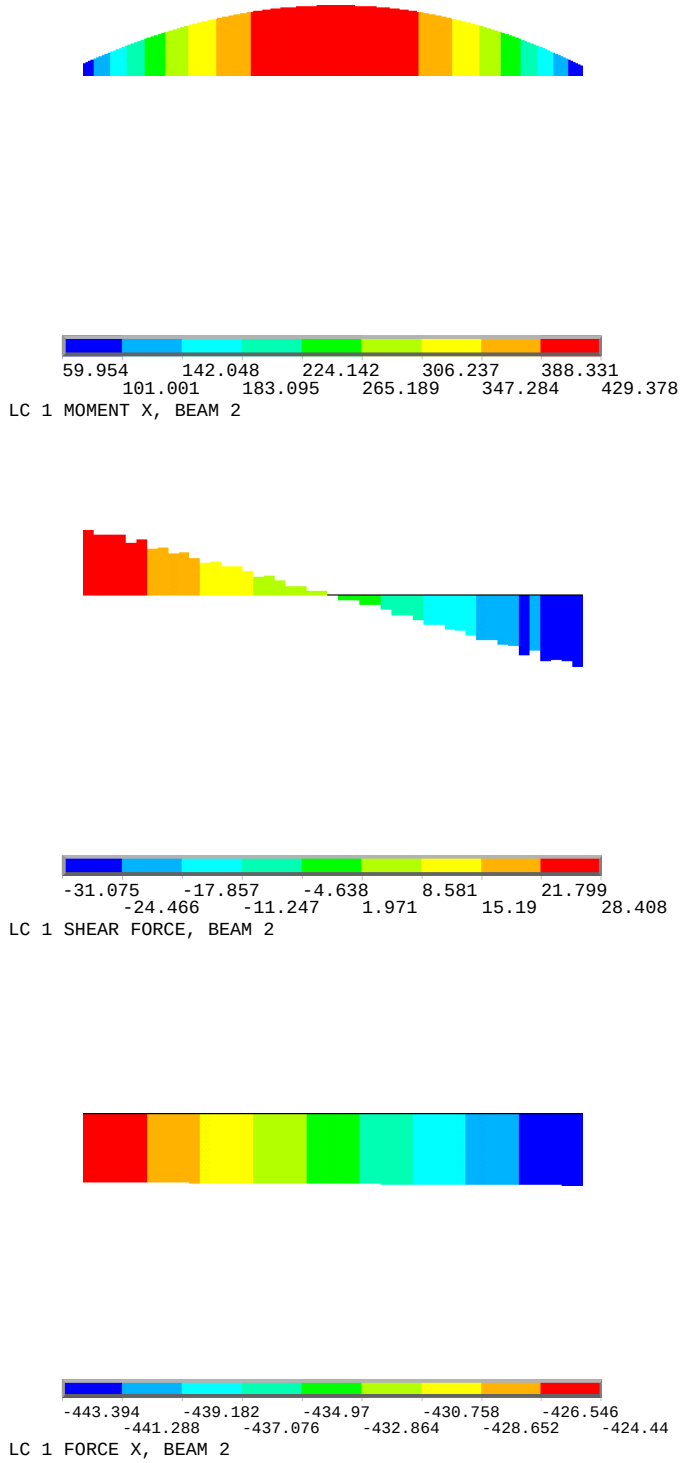


Figure B-1 Load Case #1 - Interior Beam Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip).

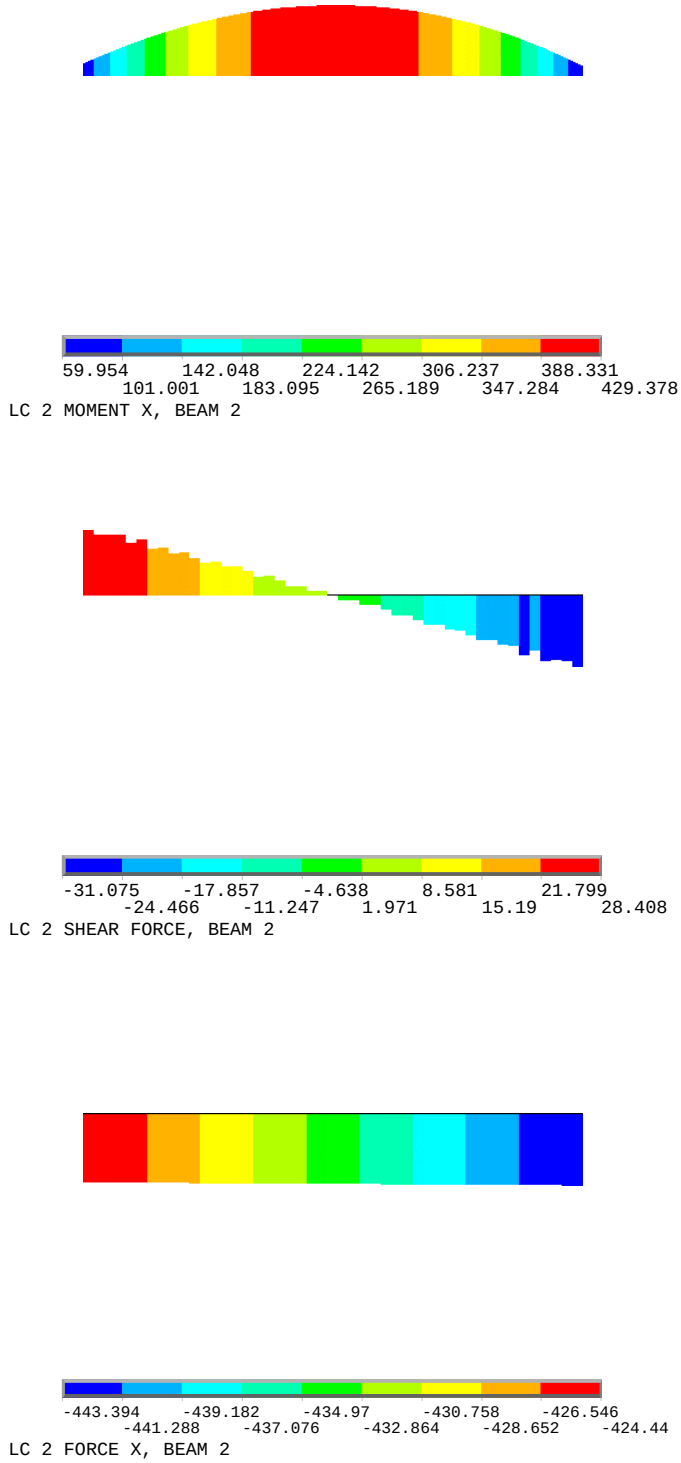


Figure B-2 Load Case #2 - Interior Beam Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip).

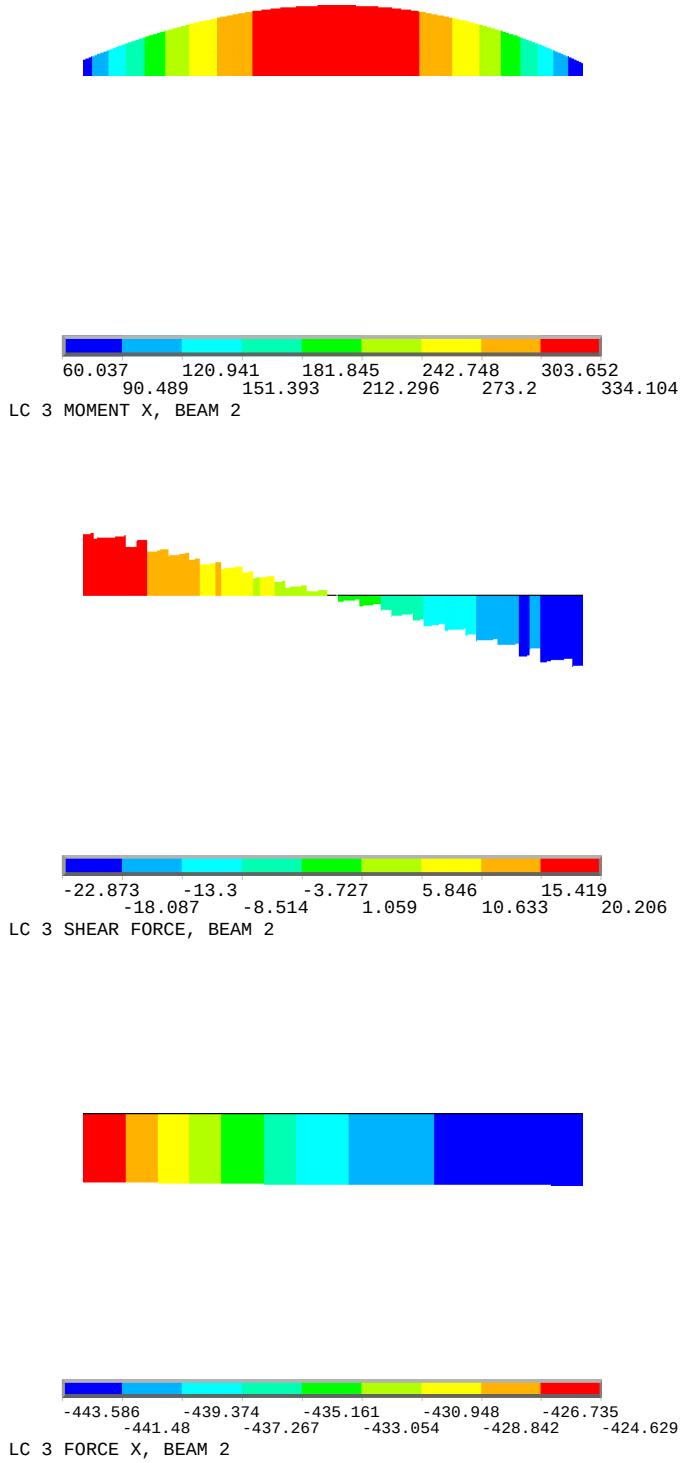


Figure B-3 Load Case #3 - Interior Beam Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip).

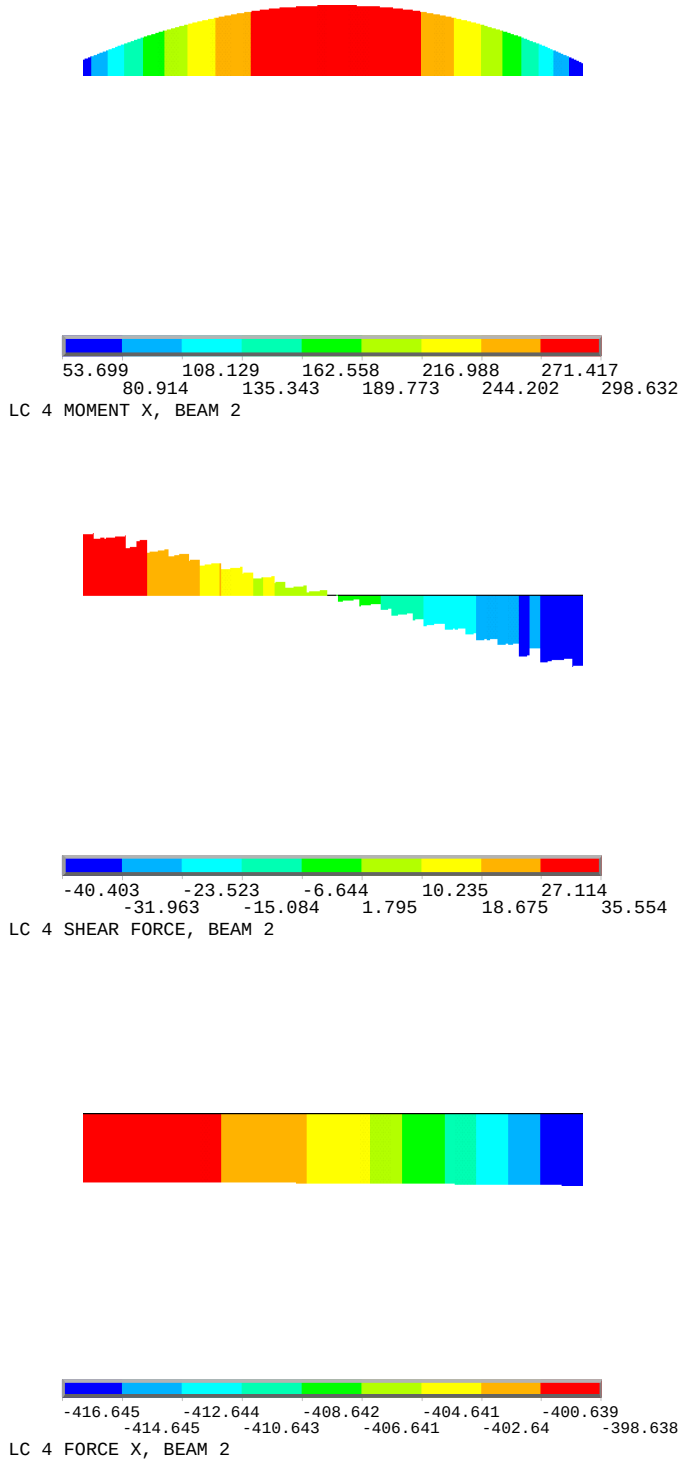


Figure B-4 Load Case #4 - Interior Beam Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip).

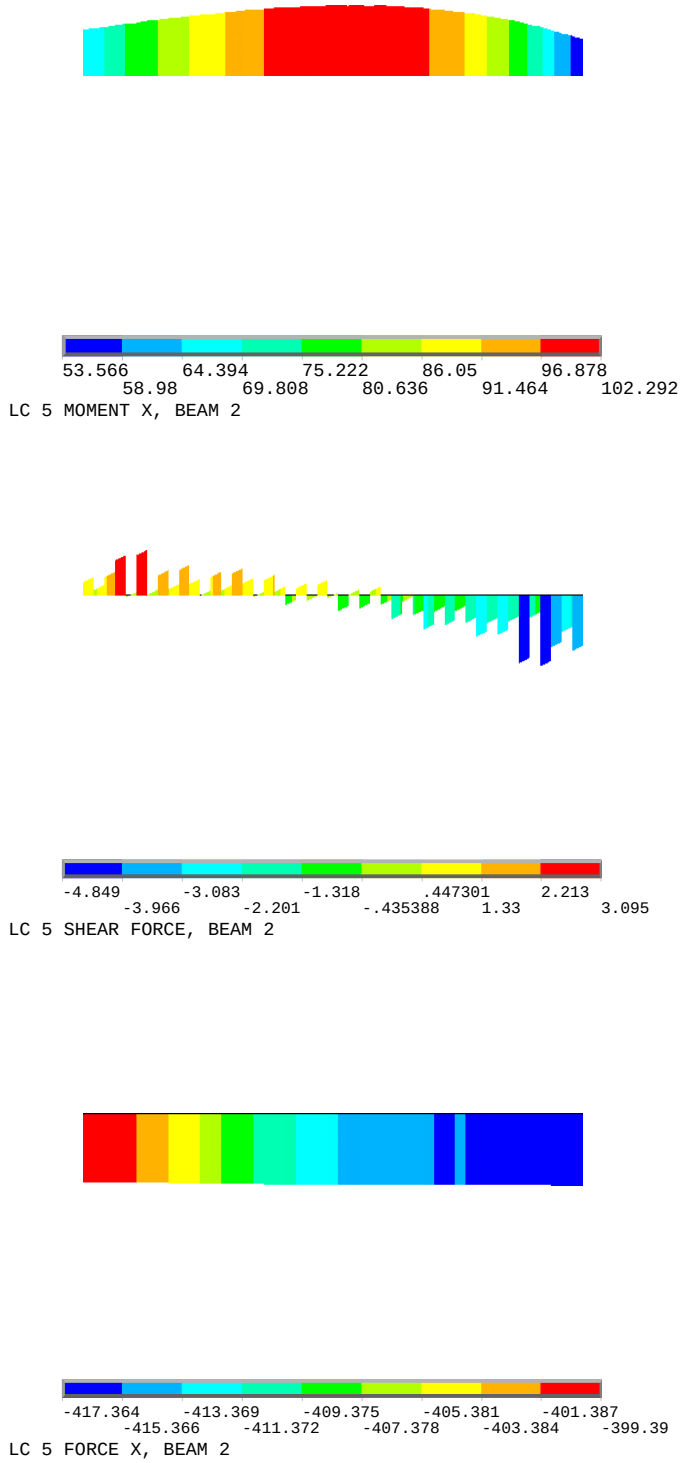


Figure B-5 Load Case #5 - Interior Beam Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip).

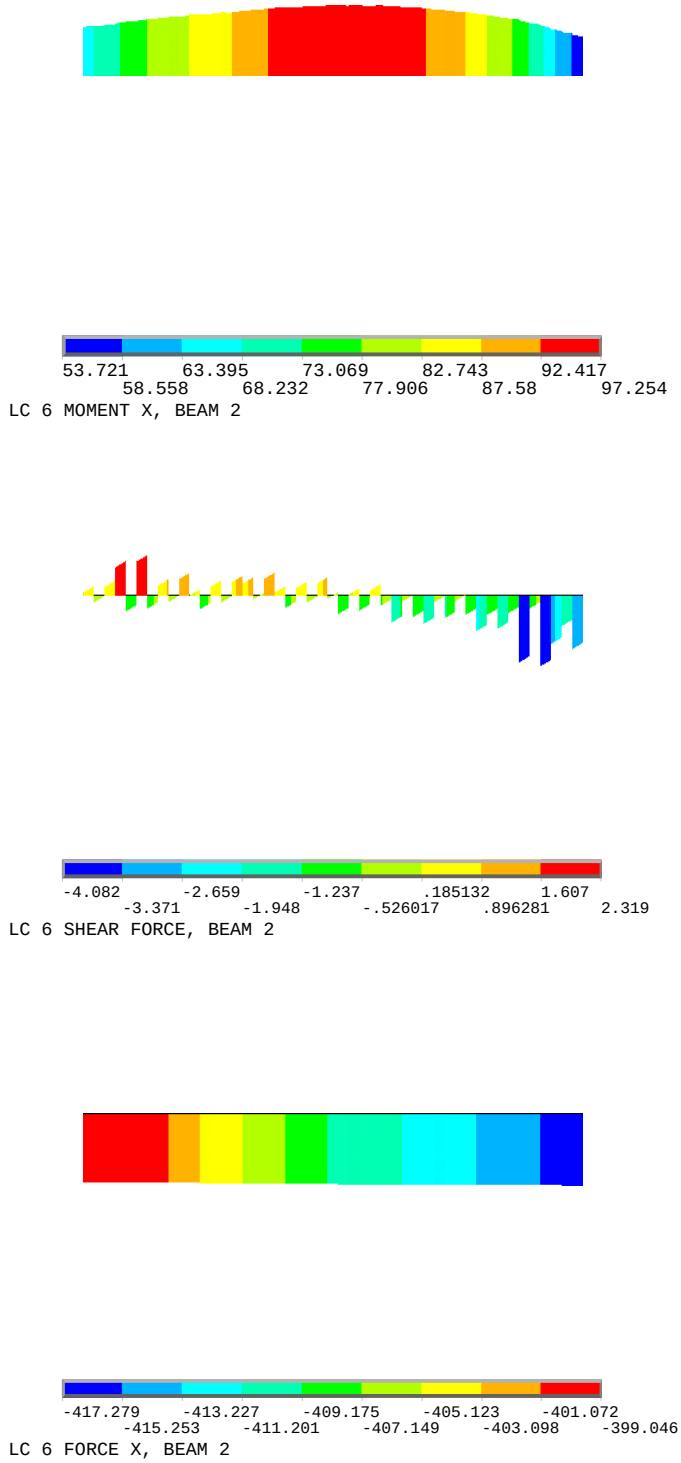


Figure B-6 Load Case #6 - Interior Beam Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip).

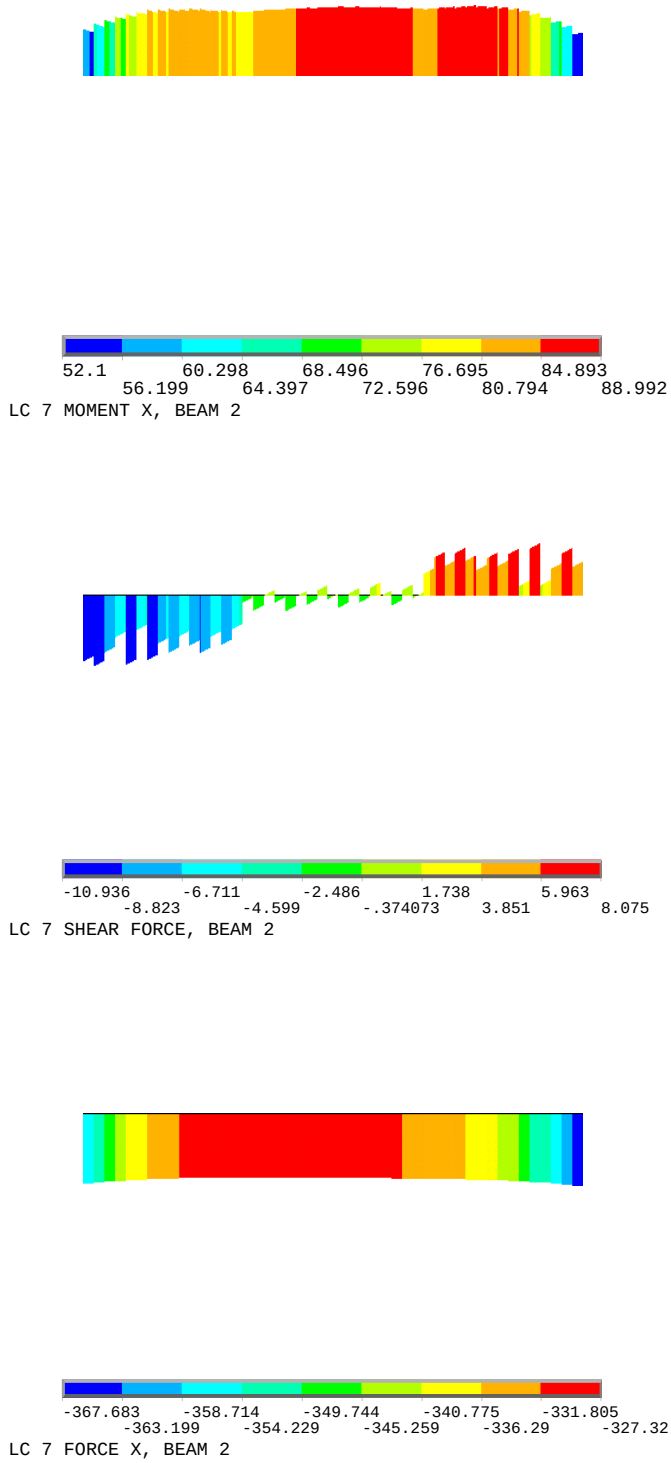


Figure B-7 Load Case #7 - Interior Beam Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip).

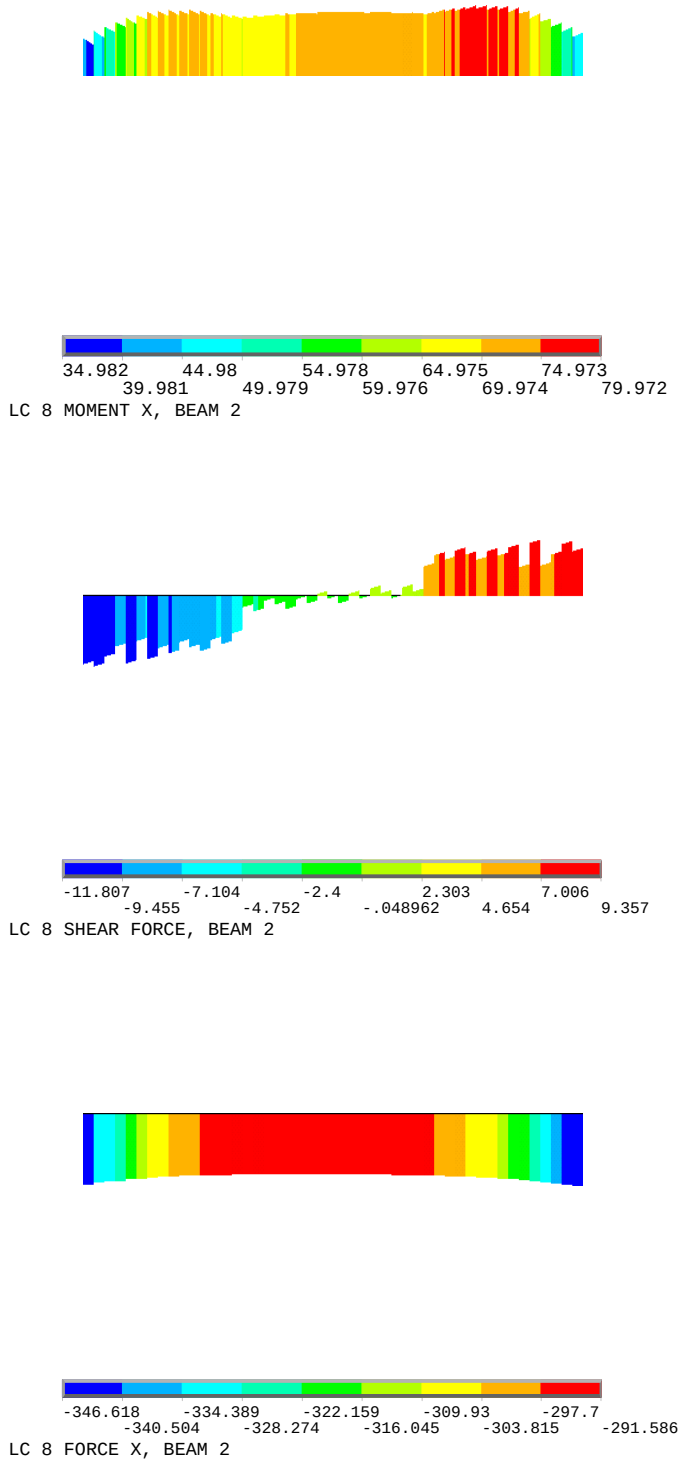


Figure B-8 Load Case #8 - Interior Beam Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip).

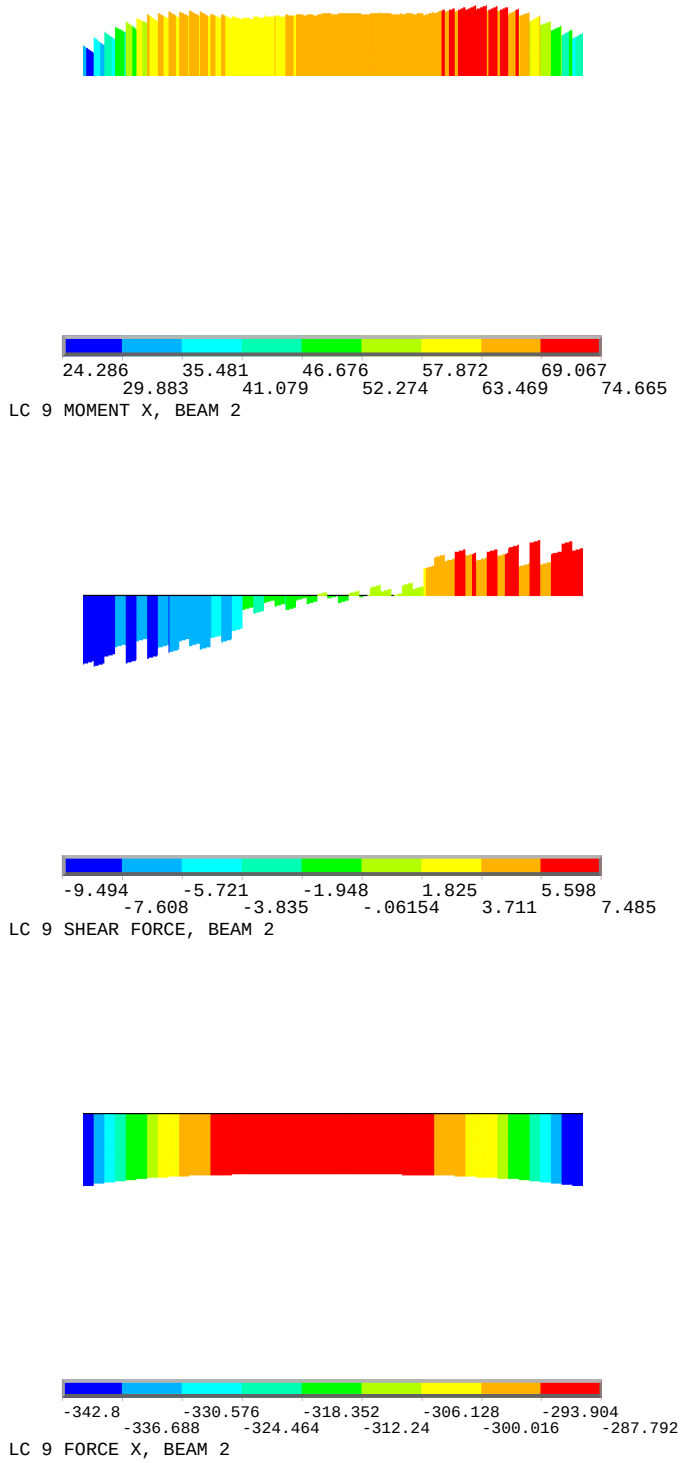


Figure B-9 Load Case #9 - Interior Beam Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip).

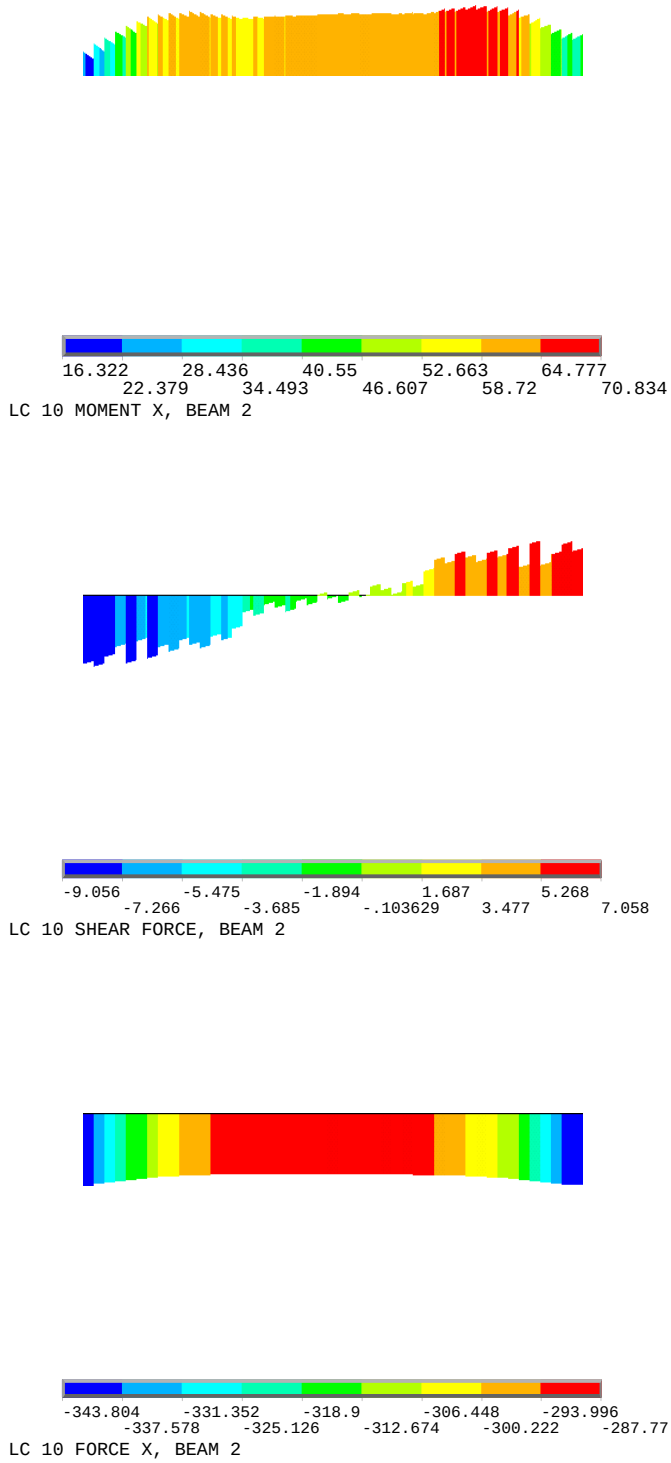
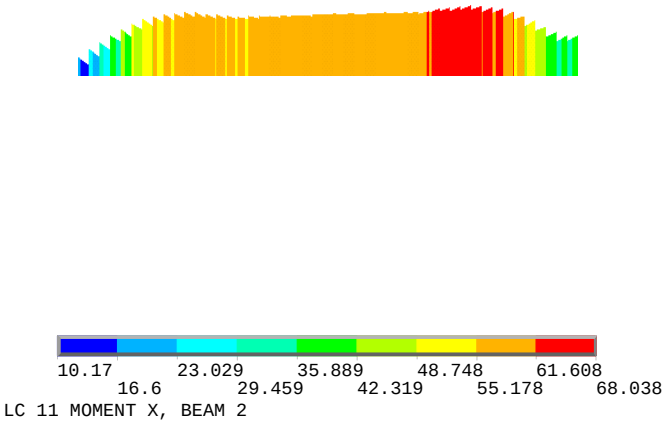
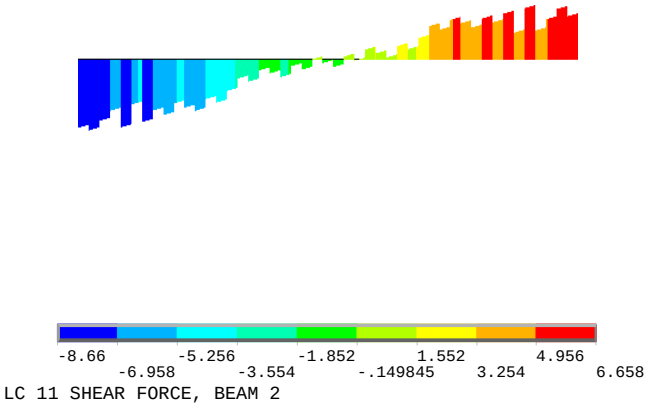


Figure B-10 Load Case #10 - Interior Beam Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip).





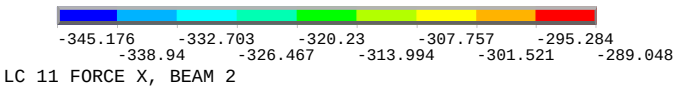


Figure B-11 Load Case #11 - Interior Beam Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip).

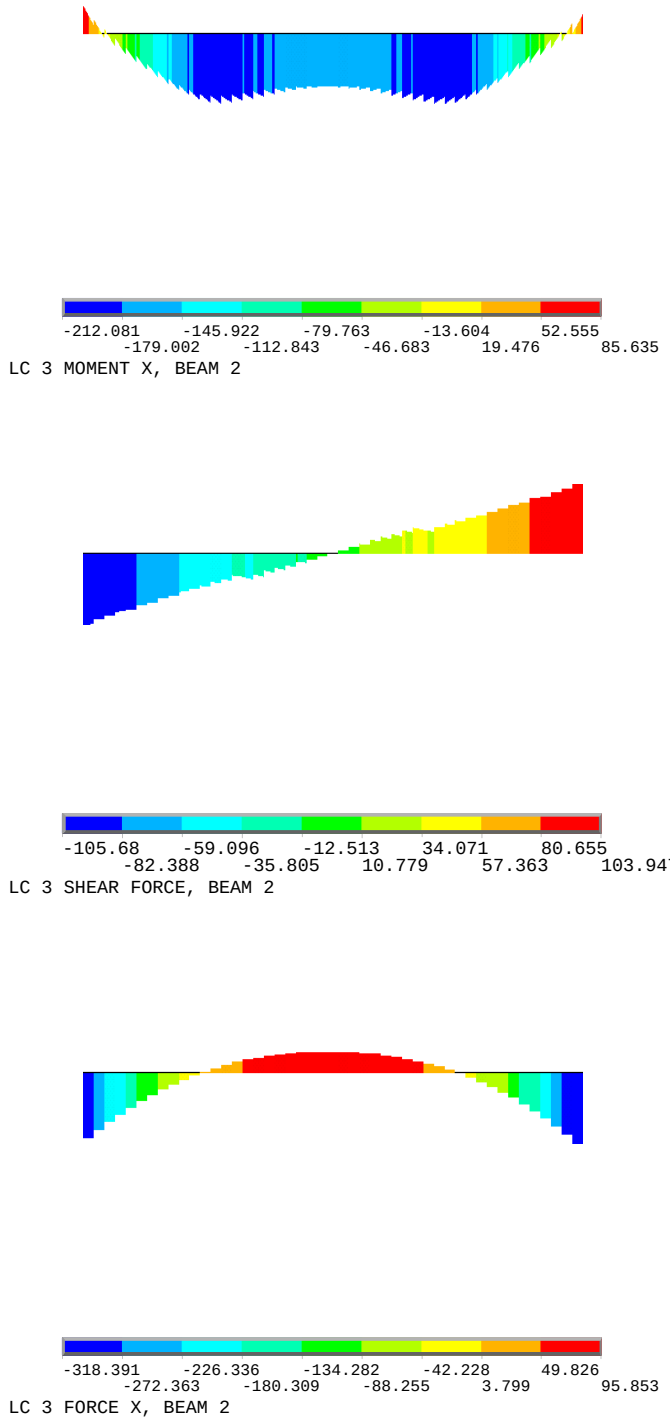


Figure B-12 Load Case #12 - Interior Beam Bending Moment Diagram, Shear Force Diagram and Axial Force (units kip-ft, kip).

PINELLAS COUNTY CAPITAL IMPROVEMENT PROJECT (CIP)
PROJECT FINANCIAL OVERVIEW

1. Construction Phase: [x] **2. Date:** May 22, 2012
3. Hillsborough County Funding: [x]

4. Title: Friendship Trail Bridge Demolition (PID # 000984; Old PID # 2183)	
5. Anticipated Scope and Description: Pinellas County contributory funds to demolish the Friendship Trail Bridge.	
6. YEAR OF CONSTRUCTION START: FY13	
7. PROJECT BUDGET:	**Requested FY 13 Appropriation** / **Multi-Year Plan**
Professional Services (Architectural/Engineering/Consulting)	
Land/Right of Way/Building Acquisitions	
Construction:	$ 515,000 / $ 515,000
Testing	
Inter-local	
TOTAL PROJECT BUDGET	$ (1) 515,000 / $ (2) 515,000
8. FINANCIAL RESOURCES:	
Penny for Pinellas Sales Tax:	$ 515,000
Local Option Gas Tax:	
Transportation Impact Fees:	
Grant(s): FDOT	
Reimbursements:	
Enterprise Revenue (Water, Sewer, Solid Waste, Airport):	
Other:	
TOTAL FINANCIAL RESOURCES	$ (2) 515,000
9. Project's First Full Year Estimated Operating Budget Fiscal Impact: (3)	
Fiscal Year:	FY xx
New Positions:	NONE
Number:	N.A.
Type:	N.A.
Total Est. Fiscal Impact (Personal Services, Operating Expenses)	$ 0

(1) Amount represents requested FY 13 appropriation.
(2) Amount represents current Multi - Year Plan's project estimate and anticipated resources.
(3) Does not apply to current phase.

Prepared By Public Works Financial Services, May 16, 2012. *Revised Form 11 03*