Pedestrian Bridge Task Force
Report to the Selectboard
January 21, 2021

The current pedestrian bridge has been in use for over 100 years by the Hardwick community. Even before that bridge, other bridges have provided Hardwick with a convenient crossing between the center of Hardwick's downtown and the north side of the Lamoille River. Unfortunately, on August 14, 2020, the pedestrian bridge had a critical failure, resulting in the closing of the bridge to pedestrian traffic.

On August 25. 2020, DeWolfe Engineering Associates conducted a general conditions assessment of the bridge, which confirmed it to be unsafe for use. This initial assessment was then provided to Engineering Ventures, PC, which conducted a preliminary assessment on October 15, 2020. A $500 grant from the Preservation Trust of Vermont provided some support for this assessment work. According to Engineering Venture's assessment, a repair of the existing bridge would cost between $40,000 and $60,000. However, this repair would not bring the bridge to code and would limit the number of people on the bridge at any one time. Further, they estimated that a repair would likely only extend the life of the bridge for another five to ten years. With that understanding, Engineering Ventures' preferred alternative is a replacement bridge. They provided an estimate for a replacement bridge at between $200,000 and $300,000, plus abutment work. To develop a more detailed cost estimate, the Task Force reached out to several contractors who do work in the region. Contech Engineered Solutions was able to provide an estimate for a galvanized steel truss bridge at $190,000, and noted a wooden covered bridge would cost slightly more, but did not provide a specific figure. Blow & Cote were able to provide two additional estimates critical to understanding the full breadth of the overall project budget. First, they estimated the bridge's removal at around $25,000. Second, they estimated the abutment work at around $100,000. This brings the replacement bridge project cost to around $315,000 to $425,000 plus other project related costs like design.

Since the bridge's closure, informal conversations have revealed a growing financial and social impact on businesses and residents in and around the downtown. To more accurately account for these challenges, the Town, under the guidance of the Task Force, has created and begun circulating a survey to more formally assess the impact of the bridge's closure on the community. Feedback from this survey will assist the Town in its search for grant funding from Federal, State and philanthropic organizations. In that vein, on December 11, 2020, the Town of Hardwick submitted a Letter of Intent (LOI) for the USDA Rural Development Rural Business Development Grant (RBDG) Program. While this particular grant is highly competitive, due to Hardwick being located within the Northeast Kingdom, it is eligible for significantly more grant funding (up to $250,000) than is typical of other Vermont communities outside of the NEK (up to $30,000). The Town of Hardwick's LOI for the current RBDG Program round is for $250,000. To make this grant competitive, letters of support are necessary, and affirmation of the bridge's economic impact on jobs is critical. We believe that the Town has an objectively competitive project given the bridge's current and historic significance to the economy and community. However, grants are not guaranteed, and so the work creating a competitive RBDG application (e.g. letters of support, survey) will be useful to other grants, such as the Bicycle and Pedestrian Program from the Vermont Agency of Transportation.

With this information and history, the Task Force would like to present the Selectboard with several alternatives in regards to the pedestrian bridge. Please note the numbers provided below are rough estimates. The alternatives identified are as follows:

1) Replacement, $315,000 to $425,000, including abutment work and removal of existing bridge. Does not include other of related project work such as design.
2) Repair, $40,000 to $60,000. Lifespan of five to ten years.
3) Removal, $25,000.

The Task Force's preferred alternative, in line with the assessment by Engineering Ventures, is a replacement bridge. A replacement bridge would provide the longest lasting bridge alternative (repairs would have a lifespan of approximately

five to ten years). Further, a replacement bridge would improve accessibility and bring the structure up to code. While the current bridge does have historical and cultural value, after discussions with the Vermont Division of Historic Preservation and the Preservation Trust of Vermont, it is the historic use by pedestrians to traverse the Lamoille River for well over 100 years that is perhaps the most valuable asset to retain when considering history. A new bridge may become historic in its own right, one hundred years from now. But, beyond the historical value of the bridge's use, it is the current economic and community value that rests on the restoration if this route that encourages the Task Force to recommend a replacement to the existing bridge.

Should the selectboard choose to replace the bridge, there are several options forward.

A) The Town could apply for grant funding and utilize municipal funds to close the gap, thereby replacing the bridge as soon as is possible. There are several benefits to replacing the bridge quickly, one, restoration of the pathway and restoring the economic and community value to the businesses and residents who utilize the bridge for everyday use. Second, the replacement would be more accessible, safe and up to code, Project cost is estimated around $315,000 to $425,000.
B) The Town could repair the existing bridge, with limits applied as directed by engineers and state regulators. This repair would provide an additional five to ten years of life to the existing bridge, and give the community time to identify the preferred bridge type and allow for a public engagement, such as a design charrette. This path would provide a temporary solution to the bridge, but add additional costs onto the project. It is possible additional grants may be available in the future and the project may be more competitive, but does not guarantee an award. Project cost is estimated around $355,000 to $485,000 plus an average annual inflation rate 4%.
C) The Town could conduct a public engagement process, again, like a design charrette, which would give the community an opportunity to identify the preferred bridge type. Again, it is possible additional grants may be available in the future and the project may be more competitive, but it does not guarantee an award. This option would not provide a quick solution to reactivating the pedestrian pathway across the Lamoille River and would likely result in permanent and long term negative economic and social impacts.

Respectfully Submitted,

Pedestrian Bridge Task Force
Elizabeth Dow, Selectboard Vice Chair
Shari Cornish, Selectboard Member
Tracy Martin, Resident

Task Force Staff
Shaun Fielder, Town Manager
Geoffrey Sewake, Community Development Coordinator

CONTECH®
ENGINEERED SOLUTIONS

Nathan Cote
Blow & Cote
(802) 888-2067
nathan@blowandcote.com

Project: **Hardwick Pedestrian Bridge**
Location: **Hardwick, VT**
Contech #:
Date: **January 12, 2021**

The following is a Continental Pedestrian Bridge System ENGINEER'S COST ESTIMATE for the subject project. This ESTIMATE is intended for preliminary estimating purposes only and should **not** be interpreted as a final QUOTATION. The information presented is based on the most current data made available to Contech Engineered Solutions, LLC (CES).

CES will fabricate and deliver the following described Continental Pedestrian Bridge components and appurtenances:

- Bridge Model: Continental Connector Pedestrian Steel Truss
- Length: 102 ft (out to out dimension)
- Width: 6 ft (clear between structural elements)
- Finish: Galvanized and painted
- Decking: Pressure treated wood
- Railing Type: Horizontal safety rails with 4" maximum openings
- Railing Height: 48" above deck
- Included safety features: Steel toe plate, wood rub rail
- Design Code: AASHTO LRFD Guide Specification for Design of Pedestrian Bridges
- Design Vehicle: 4,000 lbs
- Live Load: 90 psf
- Wind Load: 35 psf
- Bearing pads and plates: Included
- Preliminary Assembled Weight: 30,000 lbs (to be verified upon final design)
- Number of sections: 3 (field bolting by others)

ESTIMATE: $190,000 Delivered (F.O.B.)

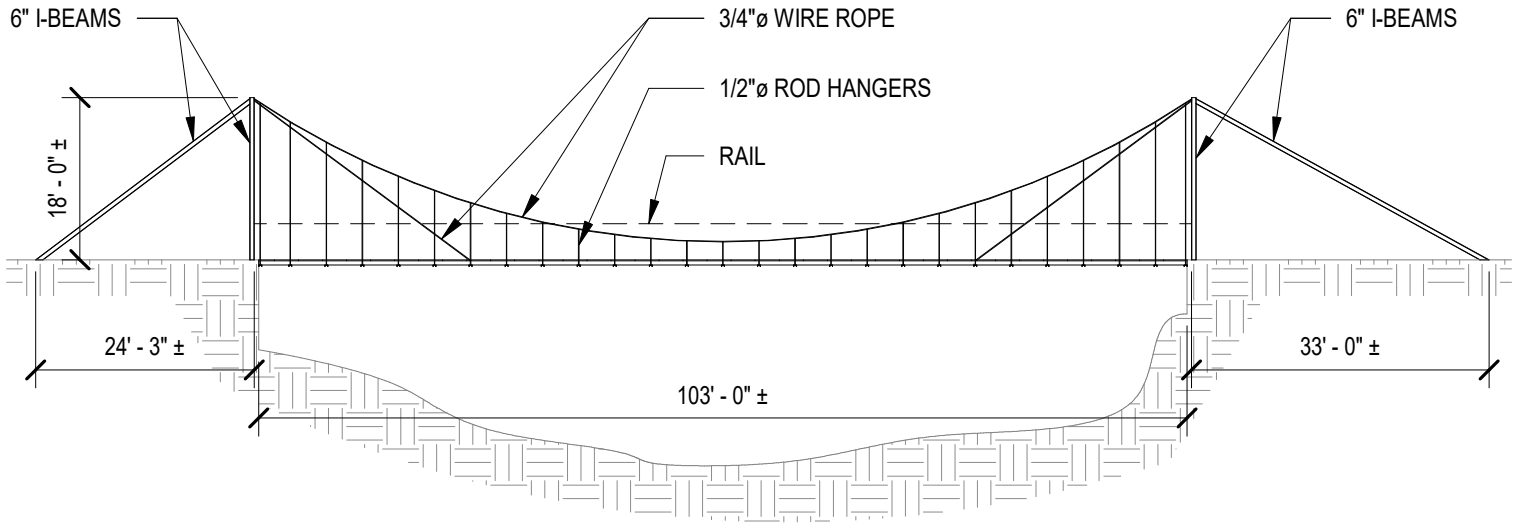
Excluded Items:
CES will not or does not include the cost for:

1. Applicable Sales and/or Use Tax
2. All construction surveying, including field measurement and verification of abutments and anchor bolt placement.
3. Design, excavation and construction of bridge foundations and/or piers.
4. Unloading all trucks delivering CES materials.
5. Erection and Installation of the bridge.
6. Providing and installing all anchor bolts. Provide and install any wing wall or approach railings.
7. Materials and work for reinforced concrete deck slab (if applicable).
8. Any costs associated with testing by an independent agency.
9. Costs associated with any special inspection. CES will provide access to facilities and assist with coordination to accommodate special inspection.

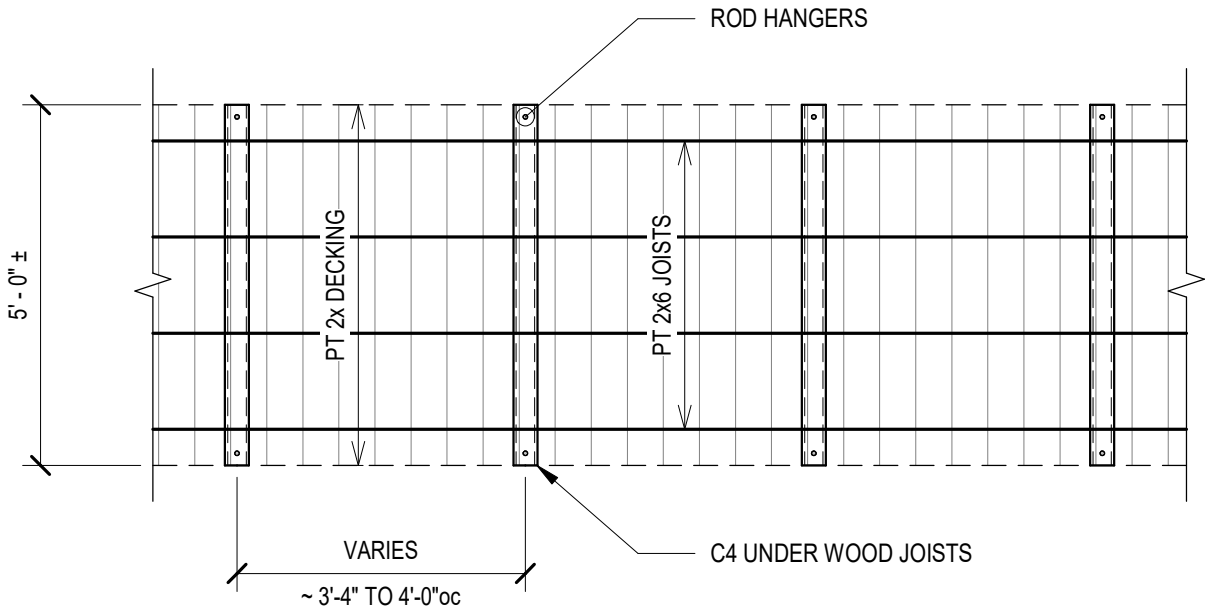
We look forward to working with you on this project. If you have any questions, please contact us.

Sincerely,

Justin Reardon, P.E.
Truss Consultant
Contech Engineered Solutions
(207) 885-6125
jreardon@conteches.com



1 ELEVATION
3/64" = 1'-0"



2 PARTIAL DECK FRAMING PLAN
3/8" = 1'-0"

SUSPENSION BRIDGE EVALUATION	ENGINEERING VENTURES PC 208 Flynn Avenue, Suite 2A Burlington, VT 05401 tel. 802-863-6225 www.engineeringventures.com	Checked By: RAN	Scale: As indicated
		Drawn By: KLG	EV Project No.: 20470
HARDWICK, VT		Date: 11/05/20	**SKS-01**

ENGINEERING VENTURES PC

208 Flynn Avenue, Suite 2A, Burlington, VT 05401 · Tel: 802-863-6225
85 Mechanic Street, Suite E2-3, Lebanon, NH 03766 · Tel: 603-442-9333
414 Union Street, Schenectady, NY 12305 · Tel: 518-630-9614

November 6, 2020

Shaun Fielder, Town Manager
Town of Hardwick
PO Box 523
Hardwick, VT 05843
shaun.fielder@hardwickvt.org

Re: Preliminary Engineering assessment
Pedestrian Suspension Bridge- Hardwick, VT EV # 20470

Dear Shaun:

At your request, a site visit was made by Bob Neeld, PE on October 15, 2020 to review the structural condition of the existing suspension bridge. I met with you and Lisa Ryan from the Preservation Trust of Vermont. A copy of the 9/3/2020 report by DeWolfe Engineering was provided for review prior to our visit. I thank all of you for your time and input on the issues.

This assessment report has been partially funded by the Preservation Trust of Vermont.

Introduction:

The bridge is on the order of 100 years old and spans about 100 feet across the Lamoille River and provides pedestrian connection of several neighborhoods and the school district office with the commercial downtown center. It was reported that several repairs and improvements were made in the 19990's, although there does not appear to be any documentation of the original bridge or the modifications. The Town has closed the bridge. Preliminary calculations have been made to develop an order of magnitude structural capacity. More detailed review is required to finalize any rehabilitation design.

For orientation purposes, the bridge is assumed to span north-south with the Lamoille River running east to west.

The following is a report of our observations and recommendations and discussions.

Observations & Discussion:

The geometry of the bridge is roughly outlined in the attached sketch.

Generally, the bridge components have deteriorated and several elements were not well constructed. The following was noted:

Cables: There are two wire rope cables each side of the bridge. One supports bridge hangers directly and the other runs under the bridge near the center. Deficiencies noted include:

- The wire rope is spliced at several locations and connected with insufficient clamps
- Some of the clamps have been installed upside down
- The rope has deteriorated near the supports
- One of the upstream cables is broken
- The wire rope is rusted throughout

It appears the cables themselves had reasonable capacity when new. However, deterioration and poor construction limit the capacity substantially.

Hangers: There are ½" rods that hang the bridge deck from the cables. These appear in fair to good condition with adequate capacity. However, the threaded sections and nuts are deteriorated and may make them difficult to reuse. Several hangers have slipped at the connection to the support cable causing the channels at the bridge deck to drop.

Channel Stringers: The C4x5.4 channels span between hangers and support the wood joists. Without deterioration, these have 40-50 psf capacity. However, they are severely rusted and, in some cases, do not appear to have any residual capacity. Several have deflected or slipped enough that they no longer support the deck floor joists.

2x6 Deck Framing & Decking: Assuming support at each channel, these members are adequate and appear in good condition. Where channels no longer support them, the joist span increases to a level where capacity is limited to less than 60 psf.

Tower Columns: The tower columns appear to be S6x12.5. These limit the bridge capacity substantially and are generally in fair to good condition with moderate deterioration. A brace at the north abutment has come loose due to a failed weld.

Abutments: The concrete abutment at the south is in fair condition There is visible cracking and spalling that will affect the longevity unless repairs are made. The north abutment is mostly buried and does not exhibit signs of deterioration. Each abutment appears to be performing adequately without substantial leaning or settling observed.

Cable Anchorage: A critical element of suspension bridge capacity is the anchorage of the cables at each terminus. There is likely buried concrete resisting this force. The condition of the buried attachments was not observable.

Recommendations:

Due to the condition of the bridge elements and the limited capacity of some of the elements even when new, a replacement bridge is inevitable and should be considered the preferred option.

Replacement options include:

- A new suspension bridge similar to the existing and built to current standards.
- A steel truss bridge- either locally fabricated or pre-engineered (See Contech Bridges)
- Laminated wood bridge
- Reinforcing of the existing bridge with new steel beams

A replacement bridge is likely to be on the order of $200,000 to $300,000 plus any rework of the abutments.

Since the operation of the bridge is important to the commercial center, a set of repairs and load limitation may allow for a temporary extension of the life of the bridge. The repairs would include:

- Replacement of the broken cable.
- Repair/reinstallation of the cable splices to increase their capacity
- Replacement or reinforcing of the steel channels along with either re-setting of the hangers that have slipped or shimming to ensure contact between wood framing and the channels.
- Repair of loose and missing brace elements at the support towers.
- Limiting the load on the bridge. This might mean no more than, say, two pedestrians at once and keeping the bridge closed after a snowfall until the snow can be cleared.

Order of magnitude cost $40,000 to $60,000.

Some cautions on a temporary fix:

- The guard rails are not included and would be difficult to bring up to current code standards.

- The bridge would not meet current standards for loading and monitoring for load limitation would be needed. This would include limiting the number of people on the bridge and quickly removing snow and ice or closing the bridge under these conditions.
- A temporary fix might last 5-10 years.
- Due to the level of deterioration and the amount of further investigative work required, the level of certainty of this cost opinion could vary widely.

Limitations:

This report is a conditions assessment to address the areas identified and to assist in making steps toward financial planning, restoration and re-use; it is not intended to be used as a construction document for implementation of specific work. Additional design, drawings, specifications and integration of project steps may be required to finalize recommendations and provide direction to contractors.

Opinions of Construction Cost provided herein are to be considered preliminary for planning purposes only. Since a final design has not been developed and we have no control over the costs or price of labor, equipment or materials, or over the selected contractor's method of pricing, it is understood that the opinions of cost provided are made based on experience and may differ from bid or actual costs. The cost for engineering, permitting, and other soft costs are not included.

Please let me know if you have questions.

Respectfully Submitted,

ENGINEERING VENTURES

Bob Needd, PE
President

cc: Lisa Ryan, Elise Seraus PTV

Civil & Structural Engineers
DeWolfe
ENGINEERING ASSOCIATES
PROFESSIONAL CORPORATION

September 3, 2020

Shaun Fielder
Town Manager
Town of Hardwick
20 Church Street, PO Box 523
Hardwick, VT 05843

Reference: Hardwick Suspension Bridge General Conditions Assessment
46 Vermont Route 15, Hardwick Vermont

Dear Shaun,

As requested, on August 25, 2020, I visited the above referenced site to complete a general conditions assessment of the above referenced pedestrian bridge. It is my understanding that recently pedestrians reported that one of the main cables of the bridge had been severed and therefore the safety of the bridge was in question. I further understand that the bridge has been temporarily closed to traffic until a professional opinion of the bridge condition is completed. Based upon the results of my general inspection it is my opinion that the bridge requires repairs prior to reopening for use and therefore I recommend that the bridge remain closed until repairs can be designed and completed.

In my initial general review of the bridge, I completed a visual inspection of the readily observable components. These components were viewed from the bridge deck and from the river bed. At this time, a full-service close-up inspection of the bridge components has not been completed and as such it is likely that additional flaws in the bridge components will be discovered if further inspection of the bridge is authorized. In addition to the visual inspection a cursory analysis was completed using measurements of critical components that were taken during the site visit.

The bridge span is approximately 102'-0", the bridge deck is approximately 5'-0" wide, and the tower height is approximately 18'-0". Overall the decking appears in good condition but the connections, steel channels supporting the decking, and the main cables appear to be near the end of their life. The bridge also utilizes angles that run parallel to the deck joists that are severely rusted.

Based upon initial calculations assuming the bridge components (excluding the end columns) were in good to excellent condition, the bridge capacity would be limited to 75 pounds per square foot(psf) while the code requires 90 psf. The end columns are undersized significantly and reduce the capacity of the bridge even further. In addition to the capacity issues the following items are of significant concern and are already considered to be in a failed state by engineering standards:

317 River Street
P.O. Box 1576
Montpelier, VT
05601-1576
phone: 802.223.4727
fax: 802.223.4740
www.dirtsteel.com

- Bridge main cable anchorage is inadequate
  - The 1" main bridge cable is anchored with 2 Crosby clamps at each end and the clamps are installed backwards (See photograph #1). The required number of clamps for a 1" cable is 5 per end.
  - Several of the wire rope clamps that anchor the bridge are severely decayed (See photograph #2).
  - The original wire rope is brittle.
  - The end connection plates are severely rusted.
  - The additional wire ropes that have been installed are not effectively reinforcing the main cable.
- Some drop cables have slipped on the main cable and no longer support the deck beams resulting in significantly increased floor deck joist spans (see photograph #3).
- The main beams that support the deck are showing significant signs of rust (see photograph #4).
- The rail system does not meet the code guard rail requirements.

Based upon my visual inspection and subsequent calculations, it is my opinion that the bridge should be closed to public access until repairs can be made. Furthermore, initial evaluation indicates that repairs are likely to be extensive given the decay discovered throughout the bridge structure. In fact, it is likely that replacement of the bridge will be less expensive than repair of the extensive decay, however, given the historic nature of the bridge restoration may be the preferred solution.

If you have any questions concerning this report, please call or write.

Sincerely,

Christopher J. Temple, P.E.

Cc: Casey Rowell via email

Photograph #1 – Cable clamp on backwards and less Than recommended quantity

Photograph #2 – Cable clamp decay

Photograph #3 – Drop cable slip

Photograph #4 – Deck Beam decay