

July 17, 2012

**Revised July 26, 2012**

1270007

To: Halifax, VT – Board of Selectmen  
From: Holden Engineering & Surveying, Inc.

**RE: Halifax, VT  
Old County Farm Road (Highway C3022) over Bridge #0037 (Green River)  
Bridge Deck Replacement**

***Historical***

This bridge was built in 1939, and reconstructed in 1974.

***Materials***

The superstructure consists of four steel beams (24 inches tall by 9 inches wide by approximately 66 feet long) at 45-1/2 inch spacing with one set of diaphragms (bracing) at the midpoint. It includes a timber deck, timber curbs, and timber guardrails. The existing curb-to-curb width is 12'-9". The superstructure sits on steel masonry plates that rest on poured concrete abutments. There are no concrete wing walls.

***Paint***

There may be lead paint on the steel beams. Current environmental law dictates strict encapsulation methods when removing such hazardous materials to prevent contaminating the environment, particularly the river below.

***Condition***

The timber deck is deteriorating. There is heavy rot in the wood curbs and bridge guardrails. The steel beams are in very good condition with only minor surface rust.

***Access***

There are 2-3 houses beyond the bridge and the road dead ends. Minimizing construction duration is critical because there is no other way to reach these residents.

***Design Goals***

Try to achieve a structure that will carry all legal loads (HS-20). Key vehicles would include a Town Fire Truck, a fuel oil truck, and a Town snowplow truck. All design work to conform with current VTrans Standards.

### ***Exploring Different Deck Replacement Options***

In all cases, the existing timber deck, curbs, and guardrails must be removed. The top surface of the steel beams should be ground down to provide a clean working surface. The existing beams should be jacked up to remove the existing steel masonry plates. The seat area should be completely cleaned. Deteriorated concrete should be removed (if any) and the seat areas repaired. Neoprene bearing pads should be installed, and then the beams lowered back into place.

#### General

We have analyzed the existing bridge beams. They are significantly undersized for a bridge of this span length (66 feet).

#### Concrete Deck Option

Simply adding a precast concrete deck to rest on top of the beams will abolish any reasonable live load carrying capacity, in accordance with current Bridge Design Codes. Making the concrete deck panels act compositely with the steel beams (binding them together to act as a unit) brings much more rigidity and subsequently more load carrying capability to the bridge. This is accomplished by welding metal shear studs to the top flanges of the steel beams. Concrete is then poured around the studs and between the precast panels to make the superstructure act as a unit. This would produce a bridge that should handle an HS-20 Load (all legal loads).

#### Timber Deck Option

We have evaluated the bridge if we were to reinstall a timber deck with timber curb and guardrails. A glulam timber deck system would be placed transversely over the steel stringers. Included is a crash-tested timber guide rail system that satisfies AASHTO PL1 requirements.

In this option, the bridge would have to be posted as follows:

Posting for 8 Tons. (HS 4.9) - no modifications made to the steel

Posting for 22 Tons. (HS 12.6) - add additional lateral bracing to the steel

#### ***Construction Costs***

Concrete Deck Option - (Overall length = 66', Width = 17' overall, Clear roadway = 14')

Included in this estimate are:

Precast Concrete deck panels with concrete curbs, placed transverse to the steel stringers, and tensioned together. Shear studs would be welded to the top flanges of the steel for composite action. The new bridge rail would conform to VTrans Standard SB-R7-90. New bearing plates would be installed.

#### Cost Breakdown

Remove and Dispose of Existing Timber Deck, Rail, Curb = \$5,000

Grind Top of Steel to Clean Surface = \$1,200

Added Cross Bracing = \$13,000

Jacking, Remove Masonry Plates, install Neoprene Pads = \$10,000

Precast Concrete Deck Panels = \$83,000

Bridge Guard Rail = \$15,000  
Shear Studs = \$3000  
Backwall Construction/Modifications = \$3,600  
Waterproof Membrane = \$3,600  
Bridge Approach Rail (80 L.F.) = \$6,000  
Roadway Approach Grading = \$2,000  
Beam Guardrail (Roadway) = \$1,500  
Stabilize Four Abutment Corners (Stone Fill) = \$4,000  
Subtotal = \$141,900  
(Optional but recommended - paving the bridge to 20 feet off each end) = \$5,700

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Timber Deck Option – (Overall length = 66', Width = 16' overall, Clear roadway = 14')

Included in this estimate are:

Glulam timber deck panels, longitudinal stiffeners and guide rail components  
All hardware needed for assembly of these components and connection to steel stringers  
Glulam preservative treatment, Penta in Type A oil  
All glulam is precut and predrilled, except deck at guard rail location  
Shop drawings  
Truck delivery to jobsite - unloading, assembly and installation by others.

Cost breakdown

Remove and Dispose of Existing timber Deck, Rail, Curb = \$5,000  
Grind Top of Steel to Clean Surface = \$1,200  
Added Cross Bracing = \$13,000  
Jacking, Remove Masonry Plates, install Neoprene Pads = \$10,000  
Deck panels, stiffeners, associated hardware = \$31,100  
On-bridge guide rail components, associated hardware = \$17,500  
Install Timber bridge components = \$12,000  
Backwall Construction/Modifications = \$3,600  
Waterproof Membrane = \$3,600  
Bridge Approach Rail (80 L.F.) = \$6,000  
Roadway Approach Grading = \$2,000  
Beam Guardrail (Roadway) = \$1,500  
Stabilize Four Abutment Corners (Stone Fill) = \$4,000  
Subtotal = \$110,500  
(Optional but strongly recommended - paving the bridge to 20 feet off each end) = \$5,700

Lead Paint

To provide full containment with a suspended platform, abrasive blast to a SSPC SP-10 with 3 coats of paint would be approximately \$42,000.00

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**Concrete Deck with New Steel Beams Option**

This option removes the existing steel beams to eliminate the possible lead paint issue, and purchase new, painted steel beams. The deck would be made composite with the steel beams using welded shear studs.

**Cost Breakdown**

Remove and Dispose of Existing Timber Deck, Rail, Curb = \$5,000

Four new steel beams – 4 x 66LF x 76 lbs./LF x \$2.50 = \$50,160

Steel Painting – Shop Applied = \$12,000

Surface Preparation – Shop = \$7,000

Added Cross Bracing = \$13,000

Remove Masonry Plates, install Neoprene Pads = \$4,000

Partial Removal of Structure = \$10,000

Precast Concrete Deck Panels = \$83,000

Bridge Guard Rail = \$15,000

Backwall Construction/Modifications = \$6,000

Waterproof Membrane = \$3,600

Bridge Approach Rail (80 L.F.) = \$6,000

Roadway Approach Grading = \$2,000

Beam Guardrail (Roadway) = \$1,500

Stabilize Four Abutment Corners (Stone Fill) = \$4,000

Contingencies = \$27,740

Subtotal = \$250,000

(Optional but recommended - paving the bridge to 20 feet off each end) = \$5,700

**Additional Engineering for Complete New Superstructure = \$6,000**

**Construction Supervision = \$10,000**

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