Table of Contents

Table of Contents ................................................................................................................................. 2

I. Site Information ................................................................................................................................. 3
   Need........................................................................................................................................................ 3
   Traffic ...................................................................................................................................................... 3
   Design Criteria ...................................................................................................................................... 4
   Inspection Report Summary .................................................................................................................. 4
   Hydraulics............................................................................................................................................... 5
   Utilities ................................................................................................................................................... 5
   Right Of Way ......................................................................................................................................... 5
   Resources ................................................................................................................................................ 5
      Wetlands/Watercourses: .......................................................................................................................... 5
      Hazardous Materials: ........................................................................................................................... 6
      Historic: .............................................................................................................................................. 6
      Archeological: ..................................................................................................................................... 6
      Stormwater: ......................................................................................................................................... 6

II. Maintenance of Traffic .................................................................................................................. 6
   Option 1: Temporary Bridge ................................................................................................................... 7
   Option 2: Phased Construction ............................................................................................................... 7
   Option 3: Off-Site Detour ....................................................................................................................... 8

III. Alternatives Discussion .................................................................................................................. 8
   Alternative 1: No Action ......................................................................................................................... 8
   Alternative 2: Minor Rehabilitation ....................................................................................................... 8
   Alternative 3: Full Bridge Replacement ................................................................................................. 9

IV. Alternatives Summary .................................................................................................................. 10

V. Cost Matrix ....................................................................................................................................... 11

VI. Conclusion ...................................................................................................................................... 12

VII. Appendices .................................................................................................................................. 13
I. Site Information

Bridge 98 is located on VT Route 100 in a rural area approximately 1.1 miles south of the intersection with VT 155. It is adjacent to the intersection of VT 100 and TH-15, Felton Road and is located on a tangent. Sight distance is good in the vicinity of the bridge. The existing conditions were gathered from a combination of a Site Visit, the Inspection Report, the Route Log and the existing Survey. See correspondence and mapping in the Appendix for more detailed information.

Roadway Classification Rural Minor Arterial (State Highway)
Bridge Type Single span, cast-in-place concrete deck on rolled beams.
Bridge Length 34 feet
Year Built 1959
Ownership State of Vermont

Need

Bridge 98 carries VT Route 100 across the West River. The following is a list of deficiencies of Bridge 98:

1. The bridge is structurally deficient with a substructure rating of 4 (Poor).
2. Bridge lane and shoulder widths are substandard.
3. The bridge does not meet hydraulic standards.
4. The existing bridge railing is substandard.

Traffic

A traffic study of this site was performed by the Vermont Agency of Transportation. The traffic volumes are projected for the years 2016 and 2036.

<table>
<thead>
<tr>
<th>TRAFFIC DATA</th>
<th>2016</th>
<th>2036</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADT</td>
<td>1900</td>
<td>2000</td>
</tr>
<tr>
<td>DHV</td>
<td>330</td>
<td>350</td>
</tr>
<tr>
<td>ADTT</td>
<td>150</td>
<td>250</td>
</tr>
<tr>
<td>%T</td>
<td>8.9</td>
<td>14.2</td>
</tr>
<tr>
<td>%D</td>
<td>57</td>
<td>57</td>
</tr>
</tbody>
</table>

The project location is not at a high crash location.
**Design Criteria**

The design standards for this bridge project are the Vermont State Standards, dated October 22, 1997. Minimum standards are based on ADT of 2,000 and a design speed of 50 mph for a Rural Minor Arterial.

<table>
<thead>
<tr>
<th>Design Criteria</th>
<th>Source</th>
<th>Existing Condition</th>
<th>Minimum Standard</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach Lane and Shoulder Widths</td>
<td>VSS Table 4.3</td>
<td>12′/4.5′ (33′)</td>
<td>11′/5′ (32′)</td>
<td></td>
</tr>
<tr>
<td>Bridge Lane and Shoulder Widths</td>
<td>VSS Section 4.7</td>
<td>12′/3.25′ (30.5′)</td>
<td>11′/5′ (32′)</td>
<td>Substandard</td>
</tr>
<tr>
<td>Clear Zone Distance</td>
<td>VSS Table 4.4</td>
<td>Some items in the approach areas may be substandard, such as utility poles, side slopes, and ditches</td>
<td>20′ fill / 12′ (1:3) cut 14′ (1:4) cut</td>
<td>Substandard, but beyond project scope</td>
</tr>
<tr>
<td>Banking</td>
<td>VSS Section 4.13</td>
<td>Varies</td>
<td>8% (max) 6% max. at side road</td>
<td></td>
</tr>
<tr>
<td>Speed</td>
<td>VSS Section 4.13</td>
<td>Varies</td>
<td>50 mph</td>
<td>50 mph (Design)</td>
</tr>
<tr>
<td>Horizontal Alignment</td>
<td>AASHTO Green Book Table 3-10b</td>
<td>Roadway alignment is straight in the project area</td>
<td>R_{min} = 758' @ e=8%</td>
<td></td>
</tr>
<tr>
<td>Vertical Grade</td>
<td>VSS Table 4.5</td>
<td>-0.59% (south) 0.85% (north)</td>
<td>4% (max) for level terrain</td>
<td></td>
</tr>
<tr>
<td>K Values for Vertical Curves</td>
<td>VSS Table 4.1</td>
<td>Bridge is on vertical curve (sag) K=174</td>
<td>110 crest / 90 sag</td>
<td></td>
</tr>
<tr>
<td>Vertical Clearance Issues</td>
<td>VSS Section 4.8</td>
<td>None noted</td>
<td>14′-3” (min)</td>
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</tr>
<tr>
<td>Stopping Sight Distance</td>
<td>VSS Table 4.1</td>
<td>709′</td>
<td>400’</td>
<td></td>
</tr>
<tr>
<td>Bicycle/Pedestrian Criteria</td>
<td>VSS Table 4.7</td>
<td>Approx. 3′ shoulder</td>
<td>5′ Shoulder</td>
<td>Substandard</td>
</tr>
<tr>
<td>Bridge Railing</td>
<td>Structures Design Manual Section 13</td>
<td>Inspector’s rating is “0”, indicating not meeting current standards.</td>
<td>TL-3</td>
<td>Substandard</td>
</tr>
<tr>
<td>Hydraulics</td>
<td>VTrans Hydraulics Section</td>
<td>Does not meet std for Q_{10}</td>
<td>Q_{30} with one ft freeboard</td>
<td>Substandard</td>
</tr>
<tr>
<td>Structural Capacity</td>
<td>SM, CH 3.4.1</td>
<td>Structurally Deficient</td>
<td>Design Live Load: HL-93</td>
<td>Substandard</td>
</tr>
</tbody>
</table>

**Inspection Report Summary**

Deck Rating 5 Fair  
Superstructure Rating 7 Good  
Substructure Rating 4 Poor  
Channel Rating 5 Fair  
Deficiency Status of Structure SD Structurally Deficient

From latest inspection report:

“09/10/2011 – Irene note: Small erosion hole formed along the outer edge of the approach roadway at the southeast corner adjacent to the curb and pylon. Filled in with stone and gravel. Pylon tipped out but was impacted hard recently and not storm related. – MJ/DK”
“4/18/2011 The spalling in the bridge seats on the ends at Abutment 1 should be repaired. The spalling is starting to undermine the upstream fascia beam abutment 1 and threaten the downstream bearing at abutment 1. The deck continues to deteriorate along with the abutments. There is deep scour hole at abutment 1 which is over the chest waders which should be filled in with some means of scour protection. DCP & FRE”

**Hydraulics**

A Preliminary Hydraulics Report was done for this project and can be seen in the Appendix. The existing bridge is not capable of meeting the hydraulic standard for State-owned bridges, which requires passing the 50 year storm event ($Q_{50}$) with one foot of freeboard below the low beam elevation. In fact, the $Q_{10}$ flow cannot pass through the structure. The hydraulics staff recommends a clearspan perpendicular to the river of 50 ft. minimum to provide the appropriate Bank Full Width, and raising the bottom of beams to elevation 1430.4 to provide an adequate waterway for $Q_{50}$.

A small amount of material removed from the river bank near the NW wingwall would provide minor improvements to the flow characteristics, such as reduced turbulence and reduced scour tendencies.

**Utilities**

There are aerial utilities running along the west (downstream) side of VT Route 100 through the project area and along TH-15, Felton Road. Near the project location, the utilities cross VT 100 in two places. Relocation of aerial utilities will be required. The existing utilities are shown on the Layout Sheet. There are believed to be no buried utilities in the project area.

**Right Of Way**

The existing 4-rod State Right-of-Way is plotted on the Layout Sheet. Also shown is the 3-rod Right-of-Way claimed by the Town of Weston on TH-15, Felton Road. Negotiations with the Town are anticipated to address work done in the Town Right of Way for work at the intersection of TH-15 and VT 100.

**Resources**

The environmental resources present at this project are shown on the Existing Conditions Layout Sheet, and are as follows:

**Wetlands/Watercourses:**

See the Resource Identification Memo in the Appendix. Summarizing, there are high function, high value Class II wetlands within the immediate area of the project. Locations are shown in the Appendix. It should be possible to accomplish the work without disturbing these wetlands.

The West River is regulated by the US Army Corps of Engineers (COE), thus any impacts below Ordinary High Water require permitting. The river is classified as an Essential Fish Habitat and therefore there are no non-reporting activities.
Wildlife Habitat

Based on a VT Fish and Wildlife linkage rating of “4”, good wildlife habitat exists on both sides of VT 100 within this corridor. Connectivity is expected to be adequate.

Rare, Threatened and Endangered Species

According to the VT Fish and Wildlife Natural Heritage Database, there are no federal or state listed mapped threatened or endangered plants or animals within the project corridor and no impacts are anticipated.

Agricultural

No impacts to any prime agricultural soils are anticipated.

Hazardous Materials:

According to the Vermont Agency of Natural Resources (VANR) Vermont Hazardous Sites List, there are a number of hazardous waste sites in the community. Most are closed and none are near the project. None are expected to be impacted by the project.

Historic:

There are no historic or section 4(f) properties in the project area.

Archeological:

There are no known areas of archeological sensitivity in the vicinity of the project.

Stormwater:

The stormwater conditions on this project are unknown. There are no known concerns.

II. Maintenance of Traffic

The Vermont Agency of Transportation has developed an Accelerated Bridge Program, which focuses on faster delivery of construction plans, permitting, and Right of Way, as well as faster construction in the field. One practice that will help in this endeavor is closing bridges for portions of the construction period, rather than providing temporary bridges. In addition to saving money, the intention is to minimize the closure period with faster construction techniques and incentives to contractors to complete projects sooner. The Agency will consider the closure option on most projects where rapid reconstruction or rehabilitation is feasible. The use of prefabricated elements in new bridges will also expedite construction schedules. This can apply to decks, superstructures, and substructures. Accelerated Construction should provide enhanced safety for the workers and the travelling public while maintaining project quality.

Since the current alignment and sight distance are adequate, and there would be adverse impacts, building a new bridge off-alignment was ruled out. The following options have been considered:
**Option 1: Temporary Bridge**

A temporary bridge could potentially be placed on either side of the existing bridge from a constructability standpoint. If this method of traffic maintenance is chosen, a one lane bridge with alternating two-way traffic would be appropriate, with a temporary traffic signal on each end. Temporary Right-of-Way would be necessary.

There are factors however on both sides that would require resolution. See the plans in the appendix. On the west side of the bridge, the southern approach for a temporary bridge would have a potential minor impact on a wetland area. It is probable that a temporary approach on the northwest quadrant of the bridge could be built to avoid the wetlands there. On the east side of the bridge, wetlands could probably be avoided, but a temporary bridge approach on the east side would impact TH-15, Felton Road. Because of the skew of the river and the rising elevation of the adjacent terrain, a temporary bridge on the east side would be difficult to construct and would require a lot of space. There would be potential impacts to the first property on Felton Road.

*Advantages:* Traffic flow can be maintained through the project corridor during construction.

*Disadvantages:* Regardless of which side a temporary bridge is built on, this option would require temporary Right-of-Way acquisition. There would be temporary impacts to adjacent properties, including Class II wetlands. This traffic control option would be costly, and time consuming, as construction activities would require a portion of a second construction season, due to the temporary bridge.

**Option 2: Phased Construction**

Phased construction is the maintenance of one way alternating traffic on the existing bridge while building one lane at a time of the proposed structure. This allows keeping the road open during construction, while minimizing impacts to adjacent property owners and environmental resources. Based on the traffic volumes, it is reasonable to close one lane of traffic, and maintain one lane of traffic, alternating direction, with a traffic signal at each end. Difficulties present on this project include the close proximity of TH-15 and a residential driveway at the northwest quadrant of the bridge. These features would be within the traffic signal stop bars, which is not ideal since traffic turning onto or off of them will be interrupting the traffic flow through the zone.

*Advantages:*

Traffic flow would be maintained through the project corridor during construction. Also, this option would have minimal impacts outside the existing Right of Way.

*Disadvantages:*

- Phasing typically exposes the traveling public and the work crews to additional safety risks, as they co-exist in close proximity. There are minor delays occasionally with phased construction.
- Phased construction typically takes much longer. The contractor will be forced to work in tight quarters, which slows the work. Mobilization for certain tasks must be repeated for phased construction whereas it is done once normally. The longer the contractor is on site, the more his costs rise due to on-site general conditions costs.
Phased construction costs more, as many tasks must be done two or even three times as work moves through the phases. Also, temporary traffic signals would likely be used, which add cost.

Option 3: Off-Site Detour

This option would close the bridge and reroute traffic onto VT 103 in Ludlow, then south on VT 103 to Chester. From there, the detour would go west on VT 11 back to VT 100 in the Town of Londonderry. The end to end distance of this route is 43 miles. This detour adds 12 miles to the route through the area between Londonderry and Ludlow.

There are a couple of local bypass routes that may see an increase in traffic from local passenger cars. Local bypass routes are not signed detours, but may experience higher traffic volumes if VT 100 is closed during construction. The two most likely local bypass routes are Andover Road to the east into Andover (approximately 18.2 miles end to end) or Old County Road (approximately 3.5 miles end to end) to the west.

Advantages: This option would eliminate the need for a temporary bridge, which would significantly decrease cost and time of construction, cost of Right of Way acquisition, and resource impacts. It allows a safer and much faster construction project than phasing.

Disadvantages: Traffic flow would not be maintained through the project corridor during construction.

III. Alternatives Discussion

Alternative 1: No Action

This alternative leaves the bridge in its current condition. Generally, a No Action choice suggests that nothing will be done for at least the next ten years. Given the rating of 4 (Poor) for the substructures, however, it is not advisable for the No Action alternative to be chosen. The bridge seats need attention soon, and there are significant cracks in some areas of the abutments. The bridge is rated as structurally deficient. The No Action Alternative is not recommended.

Alternative 2: Minor Rehabilitation

Bridge repair was considered, which would include minor repairs to the deck and repairs to surface deficiencies on the abutments, replacement of the bridge railings, and new membrane and pavement. However, there has been deterioration of the substructures and deck such that major repair or replacement work is required. There is significant deterioration of the bridge seats, and the cracking in some areas of the substructures is also significant. The scour concerns and hydraulic condition would not be addressed with Minor Rehabilitation. No further consideration will be given to Minor Rehabilitation.
**Alternative 3: Full Bridge Replacement**

This alternative describes the replacement of all bridge components; substructure, superstructure, deck, and railing. All structural conditions, scour, and hydraulic issues would be resolved. The full 80 year service life estimated for new bridge construction is provided.

Several full replacement alternatives were considered:

- 3a - full replacement, off-site detour;
- 3b - full replacement, temporary bridge;
- 3c - full replacement, phased construction.

For comparison, a fourth alternative was briefly considered in which the new bridge is not raised, but matches the existing low beam elevation. The hydraulic standard is not met when matching the existing low beam elevation and it was determined that building a new bridge to meet hydraulic standards is approximately 10% more expensive. The fourth alternative was not developed further.

**a. Alignment**

The existing horizontal alignment is straight and ideal on the bridge and for over one hundred feet in either direction. A full replacement alternative that maintains traffic on the existing bridge while a new bridge is constructed off alignment was briefly considered, but this idea was discarded for two reasons; impacts on abutting properties, resources, and Right of Way needs; and the fact that new horizontal curves would be introduced into a currently very satisfactory condition.

The vertical alignment of the existing bridge and roadway is geometrically favorable. However, in the full replacement alternatives, vertical alignment is influenced by the hydraulic conditions at the site. The recommendation of the preliminary hydraulics report is to provide a 50 ft. clearspan and a low beam elevation of 1430.4 to meet the hydraulic standard. Using this low beam elevation and a shallower superstructure depth raises the bridge grade by approximately 1.7 ft. This will require an extension of the project to blend new grades back into existing, and a wider impact area, including toes of slopes, than the current footprint. A 20 degree skew would be proposed to accommodate simpler design of integral abutments and precast superstructure if applicable.

The proposal is to maintain the existing horizontal alignment and raise the bottom of beam elevation to 1430.4.

**b. Bridge**

The proposed bridge characteristics are as follows:

- Bridge length would be 59 ft. River clearspan would be 50 ft.
- Horizontal alignment would be unchanged.
- Low beam elevation 1430.4 (raised approximately 2 ft.).
- Vertical alignment would be raised 1.7 ft.
- Skew would be 20 degrees.
- Lane and shoulder widths should be 5-11-11-5.
• No raised sidewalk on the bridge, but lane and shoulder widths to accommodate shared vehicular, bicycle, and pedestrian use.
• New bridge rail required to be TL-3, min. Consideration should be given to Galvanized Three Rail Box Beam Bridge Rail (TL-4), with Galvanized Three Rail Box Beam Approach section.
• There is uncertainty regarding the geotechnical characteristics of the site. A preliminary study conducted by VTrans indicates that several nearby residential wells encountered bedrock at fairly shallow depths, in a range of 2 ft. to 30 ft. There are no other known borings in the vicinity. Typically, integral abutments would be the first choice on a full replacement project where bedrock is deep enough for piles. If bedrock is very shallow, reinforced concrete abutments on spread footings could be placed directly on the bedrock. For intermediate depths of bedrock, the spread footings could be supported by micropiles.
• Traffic could be maintained by any of the three methods described above; off-site detour, temporary bridge, or phased construction.

IV. Alternatives Summary

Based on the existing site conditions, bridge condition, and recommendations from hydraulics, the alternatives developed are:

Alternative 3a: Full Replacement with Off-site detour.

Alternative 3b: Full Replacement with Temporary Bridge.

Alternative 3c: Full Replacement with Phased Construction.
## V. Cost Matrix

<table>
<thead>
<tr>
<th>Weston BF 013-2(13)</th>
<th>Do Nothing</th>
<th>Alt 3a</th>
<th>Alt 3b</th>
<th>Alt 3c</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Full Replacement</td>
<td>Full Replacement</td>
<td>Full Replacement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off-Site Detour</td>
<td>Temporary Bridge</td>
<td>Phased Construction</td>
</tr>
<tr>
<td><strong>COST</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridge Cost</td>
<td>$0</td>
<td>$605,600</td>
<td>$605,600</td>
<td>$667,000</td>
</tr>
<tr>
<td>Removal of Structure</td>
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<td>$40,000</td>
<td>$60,000</td>
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<tr>
<td>Roadway</td>
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<td>$305,000</td>
<td>$335,500</td>
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<td>Maintenance of Traffic</td>
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<td>$150,000</td>
<td>$15,000</td>
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<tr>
<td>Construction Costs</td>
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<td>$1,100,600</td>
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<tr>
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<td><strong>Right of Way</strong></td>
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<td>$0</td>
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<td><strong>Total Project Costs</strong></td>
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<td>Project Development Duration</td>
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<td>Construction Duration</td>
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<tr>
<td>Closure Duration (If Applicable)</td>
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<td>4 weeks</td>
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<td>none</td>
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<tr>
<td><strong>ENGINEERING</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical Section - Roadway (feet)</td>
<td>33''</td>
<td>33''</td>
<td>33''</td>
<td>33''</td>
</tr>
<tr>
<td>Typical Section - Bridge (feet)</td>
<td>3-12-12-3</td>
<td>5-11-11-5</td>
<td>5-11-11-5</td>
<td>5-11-11-5</td>
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<tr>
<td>Traffic Safety</td>
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<td>Improved</td>
<td>Improved</td>
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<tr>
<td>Alignment Change</td>
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<td>Vertical Only</td>
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<td>Vertical Only</td>
</tr>
<tr>
<td>Bicycle Access</td>
<td>No Change</td>
<td>Improved</td>
<td>Improved</td>
<td>Improved</td>
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<tr>
<td>Hydraulic Performance</td>
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<td>Meets Std</td>
<td>Meets Std</td>
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<tr>
<td>ROW Acquisition</td>
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<td>Road Closure</td>
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<tr>
<td>Design Life</td>
<td>&lt;10 years</td>
<td>80 years</td>
<td>80 Years</td>
<td>80 Years</td>
</tr>
</tbody>
</table>

---

1 Costs are estimates only, used for comparison purposes.

2 Preliminary Engineering costs are estimated starting from the end of the Project Definition Phase.

3 Project Development Durations are starting from the end of the Project Definition Phase.
VI. Conclusion

Alternative 3a is recommended to replace the bridge while maintaining traffic on an offsite detour, increasing the span, and raising the roadway to meet the hydraulic standard. This solution provides a completely new bridge, meeting the applicable standards, with a length of 59 ft. and a curb to curb width of 32 ft. This alternative will be the least expensive one, and provides a safe work zone. The closure would be expected to be 4 weeks. It is desirable over a phased method, which takes much longer and provides a less safe work zone for workers and travelers through the zone. A temporary bridge option is the most expensive and takes the longest, usually extending into the following construction season to finish up the removal of the temporary bridge and restoration of the temporary bridge site and the approaches.
VII. Appendices

- Site Pictures
- Town Map
- Bridge Inspection Report
- Hydraulics Memo
- Preliminary Geotechnical Information
- Natural Resources Memo
- Archeology Memo
- Historic Memo
- Detour and Local Bypass Maps
- Community Input
- Plans
  - Existing Conditions
  - Proposed Typical Sections
  - Proposed Layout
  - Proposed Profile
  - Phasing Typical Sections
  - Phasing Layouts
  - Temporary Bridge
Deterioration of Abutment 1

Concrete erosion at Girder Bearing
**STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET**

Vermont Agency of Transportation ~ Structures Section ~ Bridge Management and Inspection Unit

**Inspection Report for**  
**WESTON**  
**bridge no.:** 00098  
**District:** 2  
**Located on:**  
**VT 00100 ML over WEST RIVER**  
**approximately 1.1 MI S JCT. VT.155**  
**Owner:** 01 STATE-OWNED

---

**CONDITION**

- **Deck Rating:** 5 FAIR  
- **Superstructure Rating:** 7 GOOD  
- **Substructure Rating:** 4 POOR  
- **Channel Rating:** 5 FAIR  
- **Culvert Rating:** N NOT APPLICABLE  
- **Federal Str. Number:** 200013009814212  
- **Federal Sufficiency Rating:** 053.8  
- **Deficiency Status of Structure:** SD

---

**STRUCTURE TYPE and MATERIALS**

- **Bridge Type:** ROLLED BEAM  
- **Number of Approach Spans:** 0000  
- **Number of Main Spans:** 001  
- **Kind of Material and/or Design:** 3 STEEL  
- **Deck Structure Type:** 1 CONCRETE CIP  
- **Type of Wearing Surface:** 6 BITUMINOUS  
- **Type of Membrane:** 2 PREFORMED FABRIC  
- **Deck Protection:** 0 NONE

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**APPRAISAL *AS COMPARED TO FEDERAL STANDARDS**

- **Bridge Railings:** 0 DOES NOT MEET CURRENT STANDARD  
- **Transitions:** 0 DOES NOT MEET CURRENT STANDARD  
- **Approach Guardrail:** 1 MEETS CURRENT STANDARD  
- **Approach Guardrail Ends:** 1 MEETS CURRENT STANDARD  
- **Structural Evaluation:** 4 MEETS MINIMUM TOLERABLE CRITERIA  
- **Deck Geometry:** 5 BETTER THAN MINIMUM TOLERABLE CRITERIA  
- **Underclearances Vertical and Horizontal:** N NOT APPLICABLE  
- **Waterway Adequacy:** 4 OCCASIONAL OVERTOPPING OF BRIDGE & ROADWAY WITH SIGNIFICANT TRAFFIC DELAYS  
- **Approach Roadway Alignment:** 8 EQUAL TO DESIRABLE CRITERIA  
- **Scour Critical Bridges:** 8 STABLE FOR SCOUR

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**DESIGN VEHICLE, RATING, and POSTING**

- **Load Rating Method (Inv):** 1 LOAD FACTOR (LF)  
- **Posting Status:** A OPEN, NO RESTRICTION  
- **Bridge Posting:** 5 NO LOAD POSTING REQUIRED  
- **Load Posting:** 10 NO LOAD POSTING SIGNS ARE NEEDED  
- **Posted Vehicle:** POSTING NOT REQUIRED  
- **Posted Weight (tons):**  
- **Design Load:** 2 H 15

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**INSPECTION and CROSS REFERENCE**

- **Insp. Date:** 052013  
- **Insp. Freq. (months):** 12  
- **X-Ref. Route:**  
- **X-Ref. BrNum:**

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**INSPECTION SUMMARY and NEEDS**

5/6/2013 Spalling on the fascias should be cleaned and patched. South east cheekwall has not changed from last inspection. More riprap should be installed along abutment #1 to help stop any further scour there is no undermining at this time. ~FRE/DAK

09/10/2011 - Irene note: Small erosion hole formed along the outer edge of the approach roadway at the southeast corner adjacent to the curb and pylon. Filled in with stone and gravel. Pylon tipped out but was impacted hard recently and not storm related. ~MJ/DK

04/18/2011 The spalling in the bridge seat on the ends at abutment 1 should be repaired. The spalling is starting to undermine the upstream fascia beam and threaten the downstream bearing at abutment1 the deck continues to deteriorate along with the abutments. There is deep scour hole at abutment1 which is over the chest waders which should be filled in with some means of scour protection. DCP & FRE

04/21/2009 The overall condition of this bridge is fair, due to slow deterioration of the deck soffit area, slow breakdown of the abutment No.1 stemwall, and deep local scour running along the stemwall of abutment No.1. PLB

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**Monday, August 12, 2013**
We have completed our preliminary hydraulic study for the above referenced site, and offer the following information for your use:

**Existing Bridge Information**

The original bridge was constructed in 1923 based on the bridge inspection reports and record information. The bridge is owned by the State, based on the bridge inspection reports, located on VT 100 approximately 1.1 miles south of the intersection with VT 155. The bridge is a 2-lane single span rolled beam and concrete deck bridge. The bridge also has an asphalt pavement surface. The bridge is significantly askew (i.e. 26°±) to the river and located at the downstream end of a river bend. The abutments appear to be normal to the stream. The total width of bridge is approximately 34.67 feet normal to the roadway (29.67’ curb to curb), but approximately 39.4 feet along the stream. The total clear span along the roadway is approximately 28 feet (abutment face to abutment face), but the clear span normal to the stream is approximately 24.5 feet. The superstructure depth for the span is approximately 3.25 feet (11” deck and 28” beam). The approximate height to the bottom of the superstructure to the streambed varies since the bridge is located at the downstream of a curve, but the maximum height is approximately 9 feet.

The existing bridge does not meet the hydraulic standard for the Q_{50} design storm event. In fact, the Q_{10} storm event doesn’t pass through the structure. The bridge is located on the West River. The structure is located on a section of the river having a well-defined channel having a sandy-gravelly streambed with some stones. We did not evaluate the scour for the existing conditions or any proposed bridge configurations as part of the preliminary design. Scour calculations will be performed during final hydraulics since the foundations have not been fully evaluated or selected at this time.

**Recommendations**

The bridge option selection criteria should be to provide a bridge opening that does not restrict the bank full width, nor provide an unrealistic widening of the existing channel, or create any worse backwater flooding conditions than the existing conditions. The VANR Bank Full Width (BFW) Equation estimates the width to be approximately 35 feet, but the actual field conditions have varying natural bank full stream widths within the study reach between 25 to 30 feet upstream of the bridge and between 30 to 35 feet downstream of the bridge from site observation and survey.

It has been assumed a replacement structure will be located in the existing horizontal roadway alignment. Given the site constraints relative to TH 15, it was anticipated that the South (Left) abutment will only be able to be adjusted slightly towards the South which will make the span increase in a northerly direction for the North abutment. For a replacement structure, we have
anticipated that the proposed abutments will be vertical face concrete abutments placed normal to the
river with 3H:2V sloped stone fill placed to provide scour protection in front of the abutments.

Based on our analysis, we have reviewed a couple of viable replacement bridges. A 50-foot clear
span (normal to the stream channel between the abutment faces) with low beam elevation of 1430.4
feet and a 60-foot clear span with low beam elevation of 1430.7 feet are the viable options which
pass the $Q_{50}$ design storm event through the structure and meet the VTrans hydraulic standards.
However, each of the potential options will also require a significant low beam elevation adjustment
(i.e. 2 feet and greater which also increases the roadway elevations) and possible reconfiguration of
the TH 15 intersection since the existing structure is significantly undersized. Conversely creating
too long a replacement span to limit roadway elevation adjustments will not be desirable given the
bridges location and its existing river characteristics (i.e. being located just downstream of a large
bend).

As anticipated and based on the modeling, the longer 60-foot span option will have lower velocities
in the area of the bridge than the existing conditions. However, the magnitudes of the velocities for
the 50-foot structure increase in the vicinity of the bridge for the $Q_{50}$ design flow event due to the
flow being passed through a constricted area, rather than having a relief over the roadway in a
submerged condition in the existing condition. Both options noted above are also recommended to
have approximately 4’ to 4.5’ height of 3H:2V sloped stone fill for scour protection in front of both
abutments. It is anticipated that this stone fill will be blended back to the existing banks along wing
walls. If additional stone fill height is determined to be necessary during further bridge design, the
low beam elevation will need to be evaluated further and possibly raised slightly. Refer to the
attached sketches showing the limits of the stone fill slopes and bridge opening cross section
configuration.

It is noted with the stone fill scour protection for the 50-foot option provides width through the
structure of approximately 30 feet of channel width at the toe, which is relatively close to the
existing conditions just upstream of the bridge site and also close to the estimated VANR BFW.
This 50-foot option also appears to be able to blend into the site better given some of the site
constraints, but it is noted there will be slightly increased velocities from the existing conditions for
the $Q_{50}$ design event which will most likely require some stream armoring. The proposed opening
width at the toe of the 60-foot option is approximately 40 feet. Therefore, the 50-foot clear span
structure is the preferred option since it appears to fit the bridge site better, but the 60-foot clear span
structure is also considered to be viable option. For this particular bridge site, it may not be practical
to meet the above recommendations and meet the VTrans Hydraulic Standards. If a different bridge
alternative is desired which will not meet the VTrans Hydraulic Standards, the VTrans Hydraulic
section should be contacted in order for other options to be considered.

Temporary Bridge/Phasing
Based on pre-scoping information from the Structures Group, it has not been determined whether a
detour or a temporary bridge will be used for this location.

Please contact us if you have any questions or if we may be of further assistance.

MAH/BMB
cc:  Hydraulics Project File via NJW  
    Hydraulics Chrono File
In an effort to assist the Structures Section with their bridge type study, the Soils and Foundations Unit within the Materials and Research Section has completed a review of available geological data for Bridge 98 on Vermont 100 in Weston, which flows over the West River. This review included our in-house bridge boring files, record plans, USDA Natural Resources Conservation soil survey records, surficial geology and bedrock maps of the State and the Agency of Natural Resources Well logs.

**Previous Projects**
Record plans were found for the project, which show the bridge supported on spread footings placed 6 feet below the bottom of streambed. No soil information was available. The Soils and Foundations Unit maintains a GIS based historical record of subsurface investigations, which contains electronic records for the majority of borings completed in the past 10 years. An exploration of this map revealed no previous borings in the town of Weston.

**Water Well Logs**
The Agency of Natural Resources (ANR) documents and publishes all water wells that are drilled for residential or commercial purposes. Published online, the logs can be used to determine general characteristics of soil strata in the area. The soil description given on the logs is done in the field, by unknown personnel, and as such, should only be used as an approximation. Five surrounding well logs were examined for depths to bedrock and soil strata.

Figure 1 contains the project and surrounding well locations. The specific wells used to gain information on the subsurface conditions are highlighted by red boxes.
Table 1 lists the well sites used in gathering the surrounding information. Wells are listed with the distance from the bridge project, depth to bedrock, and type of soils encountered.

Table 1. Depths to bedrock and subsurface strata of surrounding sites

<table>
<thead>
<tr>
<th>Well Number</th>
<th>Distance From Project (feet)</th>
<th>Depth To Bedrock (feet)</th>
<th>Overburden Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>“A”</td>
<td>225</td>
<td>30</td>
<td>Gravel</td>
</tr>
<tr>
<td>“B”</td>
<td>500</td>
<td>12</td>
<td>N/A</td>
</tr>
<tr>
<td>30366</td>
<td>275</td>
<td>20</td>
<td>Till &amp; boulders</td>
</tr>
<tr>
<td>5696</td>
<td>500</td>
<td>2</td>
<td>N/A</td>
</tr>
<tr>
<td>112</td>
<td>1000’</td>
<td>47</td>
<td>Clay</td>
</tr>
</tbody>
</table>
USDA Soil Survey
The United States Department of Agriculture Natural Resources Conservation Service maintains a surficial geology map of the United States, which is available online. According to the Web Soil Survey, the strata directly underlying the project site consists of Podunk fine sandy loam, which is well draining and has a seasonally high water table, which can lead to flooding.

A site visit was conducted to determine potential issues with boring operations, and to make any other pertinent observations about the project. Figure 2 was taken on June 16, 2013.

![Figure 2. View of bridge, looking North](image)

Overhead power exists on the NW and SE corner of the bridge, which may conflict with boring operations. With the available sight distance, the borings could also easily be located in the roadway.

With a relatively short span, it is anticipated the structure may be replaced with a precast arch or stub abutment, which would both be founded on spread footings. If this is the case, two borings could be completed in the roadway, to relatively shallow depths, in a short timeframe. If integral abutments are the preferred alternative, borings should be advanced to bedrock, in which case we recommend two borings on opposite corners. The shallow depths to bedrock seen in private wells could make integral abutments unfeasible.

Figure 3 shows the West River flowing downstream. The minimal presence cobbles and boulders should not interfere with boring and pile driving operations.
Based on this information, possible foundation options for a bridge replacement include the following:

- A precast arch supported on spread footings
- Reinforced concrete abutments on spread footings
- Pile caps on a single row of H-Piles
- Spread footings supported on micropiles

If spread footings are the favored alternative, two borings in the roadway to a depth of 35 feet should be completed. If piles are the chosen foundation preference, we recommend a minimum of two borings be taken at opposite corners of the proposed bridge, in order to more fully assess the subsurface conditions at the site including, but not limited to, the soil properties, ground water conditions and depth to bedrock.

If you have any questions or would like to discuss this report, please contact us by phone at (802) 828-6910, or via email at chris.benda@state.vt.us.

cc: Project File/CCB
    NSM
To: James Brady, VTrans Environmental Specialist

From: Glenn Gingras, VTrans Environmental Biologist

Date: 5/15/2013

Subject: Weston BF 013-2(13) - Natural Resource ID

I have completed my natural resource ID for the above referenced project. My evaluation has included the following resources: wetlands, wildlife habitat, agricultural soils, and rare, threatened and endangered species. I have reviewed all existing mapped information and completed a field visit. I have evaluated 100 feet of the approaches and 50 feet upstream and downstream.

**Wetlands/Watercourses**

There are wetlands within the immediate area of the project. The wetlands are all scrub shrub/forested wetlands which are all Class II wetlands. Wetlands at this site all exhibited signs of hydric soils, wetland vegetation and hydrology indicators at the time of the visit. Functions and values of the wetlands at this project site have high functions and values with the primary functions being flood storage, wildlife habitat and erosion control. Location information was collected and is available and it is in the geo-database ready for “dgn” creation.

The West River flows through the project area. Any impacts below ordinary high water to this watercourse will need to be avoided and minimized and reported to the ANR and US Corps of Engineers (COE) for permitting purposes. Additional field work will be required if wetland areas cannot be avoided. As this waterway is classified as having Essential Fish Habitat “EFH” under the COE GP there are no non-reporting activities.

**Wildlife Habitat**

According to VT Fish and Wildlife linkage rating “4”, good wildlife habitat exists on both sides of VT Route100 within this corridor. As this is a bridge project opportunities to cross will exist.

The West River supports a variety of aquatic organisms. Timing restrictions for in-stream work will be likely.

**Rare, Threatened and Endangered Species (R/T/E)**

According to the VT Fish and Wildlife Natural Heritage Database there are no federal or state listed mapped threatened or endangered plants or animals within the project corridor, therefore, no impacts are anticipated.

**Agricultural Soils**

No impacts to any prime agricultural soils are anticipated.
Map created by Glenn Gingras, PDD Environmental Section on 5/13/13.

Deer Wintering Areas
Endangered Species - In House Backup
Vermont Wetlands (VSWI)
WetlandResourceID
1 (less important)
2
3
4
5 (more important)
WetlandResourceID
EcologicOther_RTNATCOM_internal
<Cat all other values>
CATEGORY
Invertebrate Animal
Vertebrate Animal
Vascular Plant
Nonvascular Plant
Palustrine Natural Community
Terrestrial Natural Community

72°46'59.002"W, 43°19'21"N
To:       James Brady, Environmental Specialist
From:    Jeannine Russell, VTrans Archaeology Officer
Date:    June 24, 2013
Subject: Weston BF 013-2(13) – Archaeological Resource ID

This is a scoping study for Bridge 98 on VT 100. The project area is defined by a 200 foot radius adjacent to the bridge. A field visit was conducted on 5-24-13 for the above bridge project. No areas of archaeological sensitivity were encountered during the site visit and there are no known sites in the vicinity of the project.

Please contact me if you have any questions.

Thank you,
Jen Russell
VTrans Archaeology Officer
Hi James,

There are no Historic or Section 4(f) properties in the project area for the above-subject project.

Thanks,
Scott
Off Site Detour Option

Mileage Summary
A-B Thru = 15.5 miles
A-B Detour = 27.5 miles
Added Miles = 12 miles
End – End Distance = 43 miles

Major Factors
Traffic Volume = 1,900
Added Miles = 12 miles
Duration = 4 weeks
Will have significant affect on the intersections of VT 11 & VT 103, VT 11 & VT 100, and VT 100 & VT 103 as well as other intersections
**Community Considerations**

1. **Are there any scheduled public events in the community that will generate increased traffic (e.g. vehicular, bicycles and/or pedestrians), or may be difficult to stage if the bridge is closed during construction?** Examples include: a bike race, festivals, cultural events, farmers market, concerts, etc. that could be impacted? If yes, please provide date, location and event organizers’ contact info.  
   - No

2. **Is there a “slow season” or period of time from May through October where traffic is less?**  
   - No

3. **Please describe the location of emergency responders (fire, police, ambulance) and emergency response routes.**  
   - Rt 100

4. **Where are the schools in your community and what are their schedules?**  
   - [Flood Brook Union School](Rt 11 Londonderry, Vt.)

5. **Is the proposed project on an established or planned school bus or public transit route(s)?**  
   - Yes

6. **Are there any businesses (including agricultural operations) that would be adversely impacted either by a detour or due to work zone proximity?**  
   - No

7. **Are there any important public buildings (town hall or community center) or community facilities (recreational fields or library) in close proximity to the proposed project?**  
   - Yes

8. **Are there any town highways that might be adversely impacted by traffic bypassing the construction on another local road?**  
   - Yes

9. **Are there any other municipal operations that could be adversely impacted if the bridge is closed during construction?** If yes, please explain.  
   - No

10. **Please identify any local communication channels that are available—e.g. weekly or daily newspapers, blogs, radio, public access TV, Front Porch Forum, etc. Also include any unconventional means such as local low-power FM.**  
    - [GNAT-TV](Vermont Journal, The Message)

11. **Is there a local business association, chamber of commerce or other downtown group that we should be working with?**  
    - No

**Design Considerations**

1. **Are there any concerns with the alignment of the existing bridge?** For example, if the bridge is located on a curve, has this created any problems that we should be aware of?  
   - No

2. **Are there any concerns with the width of the existing bridge?**  
   - No

3. **What is the current level of bicycle and pedestrian use on the bridge?**  
   - Low
4. If a sidewalk or wide shoulder is present on the existing bridge, should the new structure have one? **No**

5. Is there a need for a sidewalk or widened shoulder if one does not currently exist? Please explain. **No**

6. Does the bridge provide an important link in the town or statewide bicycle or pedestrian network such that bicycle and pedestrian traffic should be accommodated during construction? **No**

7. Are there any special aesthetic considerations we should be aware of? **No**

8. Are there any traffic, pedestrian or bicycle safety concerns associated with the current bridge? If yes, please explain. **No**

9. Does the location have a history of flooding? If yes, please explain. **No**

10. Are you aware of any nearby Hazardous Material Sites? **No**

11. Are you aware of any historic, archeological and/or other environmental resource issues? **No**

12. Are there any other comments you feel are important for us to consider that we have not mentioned yet? **No**

**Land Use & Public Transit Considerations** – to be filled out by the municipality or RPC.

1. Does your municipal land use plan reference the bridge in question? If so please provide a copy of the applicable section or sections of the plan. **No**

2. Please provide a copy of your existing and future land use map, if applicable. **None**

3. Are there any existing, pending or planned development proposal that would impact future transportation patterns near the bridge? **No** If so please explain.

4. Is there any planned expansion of public transit service in the project area? If not known please contact your Regional Public Transit Provider. **No**
PROPOSED VT 100 TYPICAL SECTION

PROPOSED BRIDGE TYPICAL SECTION

MATERIAL TOLERANCES

<table>
<thead>
<tr>
<th>Material</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>+/- 1/8&quot;</td>
</tr>
<tr>
<td>Aggregate</td>
<td>+/- 1/2&quot;</td>
</tr>
<tr>
<td>Subbase</td>
<td>+/- 1&quot;</td>
</tr>
<tr>
<td>Sand Borrow</td>
<td>+/- 1&quot;</td>
</tr>
</tbody>
</table>
PHASE 1 TYPICAL SECTION
SCALE 1/8" = 1'-0"

PHASE 2 TYPICAL SECTION
SCALE 1/8" = 1'-0"

NOTE: PAVEMENT TO BE APPLIED AFTER PHASE 2