STATE OF VERMONT
AGENCY OF TRANSPORTATION

Scoping Report

FOR

Braintree BF 0241(51)

VT Route 12, BRIDGE 47 OVER AYERS BROOK

April 12, 2019

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I. Site Information

Bridge 47 is a State-owned bridge located on VT Route 12 approximately 5.0 miles north of the junction with VT Route 12A North. The bridge is located on a straight tangent in the middle of a sharp S-curve. The existing bridge conditions were gathered from a combination of a Site Visit, the Inspection Report, the Route Log and the existing Survey. See correspondence in the Appendix for more detailed information.

Roadway Classification	Major Collector
Bridge Type	T-Beam Bridge/Multi-Plate Arch
Bridge Length	33 feet
Year Built	1928, Reconstructed in 1969
Ownership	State of Vermont

Need

Bridge 47 carries VT Route 12 across Ayers Brook. The following is a list of deficiencies of Bridge 47 and VT Route 12 in this location:

1. The bridge deck on the T-Beam portion of the bridge is in poor condition and has widespread deterioration and saturation on the soffit. The T-Beams have scattered longitudinal cracking with large delaminations. Additionally, there is saturation and scattered small areas of rust staining throughout. There is minor spalling at the center of beam 1 with exposed reinforcing. Some of the spalling has reached the pavement, and full depth holes may occur at any time.

2. The abutments and wingwalls have fine map cracking throughout with light staining. The downstream, wall of abutment 1 has extensive spalling with loose granular concrete.

3. There are substandard horizontal curves at both approaches and a substandard vertical sag curve at the approach on the North end of the bridge.

Traffic

A traffic study of this site was performed by the Vermont Agency of Transportation. The traffic volumes are projected for the years 2023 and 2043.

Traffic Data	2023	2043
AADT	400	440
DHV	60	70
ADTT	25	40
%T	4.8	7.2
%D	51	51

Design Criteria

The design standards for this bridge project are the Vermont State Standards, dated October 22, 1997. Minimum standards are based on an ADT of 440, a DHV of 70, and a design speed of 30 mph for a Collector Road.

Design Criteria	Source	Existing Condition	Minimum Standard	Comment
Approach Lane and Shoulder Widths	VSS Table 5.3	(30')	11'/3' (28')[1]	
Bridge Lane and Shoulder Widths	VSS Table 5.3	11'/4' (30')	11'/3' (28')[1]	
Clear Zone Distance	VSS Table 5.5	No Issues Noted	7' fill / 7' cut	
Banking	VSS Section 5.13	7% (North Approach) 6% (South Approach)	8% (max)	
Speed	VSS Section 5.3	30 mph (Posted) 20 mph (cautionary sign)		
Horizontal Alignment	AASHTO Green Book, Table 3.10b	R = 225' (North Approach) R = 150' (South Approach)	R = 157' @ e=6.6% R = 214' @ e=8% (30 mph)	Substandard
Vertical Grade	VSS Table 5.6	2.6%	7% (max) for level terrain	
K Values for Vertical Curves	VSS Table 5.1	18 sag / 26 sag	30 crest / 40 sag	Substandard
Vertical Clearance	VSS Section 5.8	No Issues Noted	14' 3" (min)	
Stopping Sight Distance	VSS Table 5.1	325'	200'	
Bicycle/Pedestrian Criteria	VSS Table 5.8	4' Shoulder	3' Shoulder	
Bridge Railing	Structures Design Manual Section 13	Fascia Mounted W-Beam Rail	TL-2	
Hydraulics	VTrans Hydraulics Manual, Table 6.1	• Passes 100-year storm with 1.1' of freeboard • Passes 50-year storm event with 2.4' of freeboard • 25.5' Clear span	• Passing 50-year storm event with 1' of freeboard • 46'(min) Bank full width	Substandard Clear Span
Structural Capacity	Structures Design Manual, Ch. 3.4.1	Structurally Deficient	Design Live Load: HL-93	Substandard

Inspection Report Summary

Deck Rating	4 Poor
Superstructure Rating	6 Satisfactory
Substructure Rating	6 Satisfactory
Channel Rating	8 Very Good

[1] The Vermont State Standards specifies a minimum lane and shoulder width of 9'/2' for safety and service. However, as per HSDEI 11-004, a 14' minimum paved width shall be provided for State plow trucks.

From the Bridge Inspection Summaries:

4/9/2018 – T-Beam section will need rehab in the near future due to the heavy spalling in the soffit area. Asphaltic plug joints have been added and are in good condition. ~FRE/SMP

4/25/2017 – Due to wide spread deterioration and saturation, a new deck should be considered or have an extensive rehabilitation project. The spalling in the downstream bay near abutment 1 has now reached the asphalt layer, penetrating 14"+/- beyond the soffit. A full depth hole could occur at any time and preventive measures need to be taken. ~JW/AC

4/14/2016 – Structure is in fair condition. Should consider repairing the soffit area and the wing on the downstream side of abutment#1. ~FRE/TJB/JAS

6/4/2015 – Extensive saturation continues to deteriorate the deck on the downstream side. Heavy spalling in the soffit has penetrated beyond the second layer of rebar. A deck rehabilitation project should be considered or possibly tying in a multi plate arch to the downstream end and removing the T-Beams and deck. ~JWW/JDM

Hydraulics

The existing structure meets the current standards of the VTrans Hydraulic Manual. Additionally, all flows up to and including Q_{100} flow through this bridge. The arch has a 25.5-foot clear span, which does not meet the required bankfull width per ANR of 46'. The VTrans Hydraulics Section advises that either a rehabilitation or replacement option would be acceptable. See the preliminary hydraulics report in Appendix D for additional information.

Utilities

The existing utilities are shown on the Existing Conditions Layout Sheet, and are as follows:

Municipal Utilities

- There are no municipal water or sewer facilities in the project area.

Public Utilities

Underground:

- There are a few buried service lines within the project area. Additionally, there are Fiber Optic Network cables buried in the project area.

Aerial:

- There are aerial utilities which cross directly over the bridge as well as cross VT Route 12 at both the northern and southern approaches. These aerial utilities include a 3-phase electric line and communication cables.

The relocation utilities will be necessary for construction.

Right of Way

The existing Right-of-Way (ROW) is plotted on the Existing Conditions Layout sheet. Additional ROW may be required depending on the alternative chosen.

Resources

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

Biological:

Wetlands/Watercourses

There are no wetlands in the project area.

The project spans Ayers Brook. Aquatic organism passage is currently in place at the structure, a new structure should maintain this passage. This passage can be improved by spanning the stream fully to allow for more unobstructed flows through under VT Route 12.

Wildlife Habitat

The riparian area of Ayers Brook acts as a wildlife corridor to some extent. There are large habitat blocks up and downstream of the structure. If the bridge were to be lengthened to include grubbed riparian areas on both sides of the stream under the bridge, this riparian corridor would be reestablished. Planting should occur along the riparian area to the best extent practicable.

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

The only listed species in the project area is the federally threatened northern long-eared bat. No habitat species are present at the bridge itself and tree clearing will likely be under the threshold to require time-of-year restrictions.

Agricultural

The project area is mapped as Buckland loam, a prime agricultural soil.

Hazardous Materials:

According to the Vermont Agency of Natural Resources (VANR) Vermont Hazardous Sites List, there are no hazardous waste sites located in the project area.

Historic:

Bridge 47 is not historic, and there are no historic properties in the project area.

Archaeological:

There is one area of archaeological sensitivity within the project area in the southwest quadrant. See the Archaeological Resource ID in Appendix H for additional information.

Stormwater:

There are no stormwater concerns for this project.

II. Safety

There have been four crashes along VT Route 12 in Braintree in the last 5-year reporting period. None of these crashes were on the bridge. There are no High Crash Location segments within the project area.

III. Maintenance of Traffic

The Vermont Agency of Transportation developed an Accelerated Bridge Program in 2012, which focuses on expedited delivery of construction plans, permitting, and Right-of-Way, as well as accelerated construction of projects 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 accelerated construction techniques and incentives to encourage contractors to complete projects early. The Agency will consider the closure option on projects where rapid reconstruction or rehabilitation is feasible. The use of prefabricated elements and systems for new bridges will also expedite construction schedules. This can apply to decks, superstructures, and substructures. Accelerated Bridge Construction should provide enhanced safety for the workers and the travelling public while maintaining project quality. The following options have been considered:

Option 1: Off-Site Detour

This option would close the bridge and reroute traffic onto an offsite detour during construction. There are two regional detours that could be signed for this location:

Regional Detour 1: Vermont Route 12, to Vermont Route 12A, back to VT Route 12. This detour has an end-to-end distance of 39.4 miles and adds approximately 7.7 miles to travel distance.

Regional Detour Route 2: Vermont Route 12, to Vermont Route 64, Interstate 89, and VT Route 66 back to VT Route 12. This detour has an end-to-end distance of 32.4 miles and adds approximately 2.8 miles to travel distance.

There is a local bypass route that may see an increase in traffic from local passenger cars if VT Route 12 is closed during construction. Local bypass routes are not signed detours but may experience higher traffic volumes if VT Route 12 during a road closure. The most likely local bypass route is as follows:

Local Bypass 1. VT Route 12, to Farnsworth Brook Road, Brainstorm Road, and Peth Road, back to VT Route 12 (6.7 mi end-to-end)

A map of the detour routes and possible local bypass route, which could see an increase in traffic, can be found in Appendix O.

Advantages: This option would eliminate the need for a temporary bridge or phased construction, which would significantly decrease cost and time of construction. This option would not require rights from adjacent property owners for a temporary bridge. Additionally, this option would have the least impacts to adjacent properties and environmental resources. This option reduces the time and cost of the project both at the development stage and construction.

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

Option 2: Phased Construction

Phased bridge construction involves building one-side of the structure at a time, while maintaining traffic on the opposite side of the structure. This allows the road to stay open during construction, while having minimal impacts on neighboring property owners and environmental resources.

While the time required to develop a phased construction project would remain the same, the time required to complete the project would increase because some construction tasks would have to be performed multiple times. In addition to increased design and construction costs, the costs also increase for phased construction due to the difficulty of working around traffic and coordinating the joints between the phases. Another negative aspect of phased construction is decreased worker and vehicular traffic safety, which is caused by the increased proximity and duration that workers and vehicles are operating in the same confined space. Phased construction is usually considered when the benefits include reduced impacts to resources and decreased costs and development time by not requiring the purchase of additional ROW for a temporary bridge.

Based on the current traffic volumes, it would be acceptable to close one lane of traffic and maintain one lane of signalized two-way traffic. 12 feet of the existing bridge width should be kept open for one lane of traffic for each phase. The total traveled width of the bridge is 30-feet, with 9 feet of traveled way over the culvert section. If a new bridge is constructed using phased construction then traffic would be maintained on the T-beam section during the first phase, while the culvert section is replaced. For a rehabilitation option, the traveled way over the culvert section would be widened by 5-feet in order to maintain traffic while the T-Beam sections are replaced.

This option would decrease safety, as vehicular traffic would be in close proximity with the construction site and construction vehicles entering and exiting the site. The impact on property owners and environmental resources, however, would decrease.

Advantages: Traffic flow would be maintained through the project corridor during construction. Also, this option would have minimal impacts to adjacent properties and environmental resources. Right-of-Way would not be required for this maintenance of traffic option.

Disadvantages: Phased construction generally involves higher costs and complexity of construction. Costs are usually higher and construction duration is longer, since many construction activities have to be performed two times. Additionally, since cars are traveling near construction activity, there is decreased safety. There would be some delays and disruption to traffic, since the road would be reduced to one-way traffic.

Option 3: Temporary Bridge

Any temporary bridge could be placed on either the upstream or downstream side of the bridge. A downstream temporary bridge would have impacts to archaeologically sensitive resources. On the upstream side the existing structure extends approximately 22 feet outside of the edge of pavement, so the location of a temporary bridge on the upstream side would need to take that into consideration. There are houses and driveways in 3 of the quadrants at the project site. In the northwest quadrant of the project area is a large gravel parking lot/driveway. Both an upstream and downstream temporary bridge alignment would require acquiring temporary rights from adjacent property owners.

A one-way temporary bridge would be sufficient based on the daily traffic volumes. Due to steep slopes and the tight horizontal curve before and after the bridge, there is poor sight distance. Therefore, a one-lane temporary bridge should be signalized. A layout of the temporary bridge can be seen in the scoping plan set in Appendix P.

Advantages: A temporary bridge will maintain traffic flow through the project corridor during construction.

Disadvantages: The costs to construct and signalize a temporary bridge would be high, as well as time consuming. Additional Right-of-Way acquisition would be required. A downstream temporary bridge would have impacts to archaeological resources.

IV. Alternatives Discussion

No Action

The existing bridge is structurally deficient due to the deteriorating T-Beams and soffit. The T-Beam soffit in poor condition and has widespread deterioration and saturation. The T-Beams have some Large cracks and deterioration with reinforcement exposed. For the safety of the traveling public, the No Action alternative is not recommended.

Minor Rehabilitation

Due to the extent of deterioration of the existing T-Beams and rust staining and exposed rebar throughout the T-Beam sections, concrete patching of the beams and soffit is not recommended. Due to the saturation and amount of deterioration, concrete patching would be expected to last less than 10 years.

Partial Superstructure replacement

A partial superstructure replacement would include replacement of the T-Beams with a new superstructure on the existing abutments. Replacement of the deck portion only would not be considered as the T-Beams were cast integrally with the deck and removing the deck from the beams would be cost prohibitive. For this option, the concrete footing for the multi-plate arch should be extended up along the face of the metal arch to above the ordinary highway water mark.

The existing lane widths and shoulders on the bridge are 11 feet and 4 feet wide respectively. This meets the minimum standard as set forth in the Vermont State Standards and it meets the minimum width required for maintenance activities. As such, this option would maintain the 30-foot paved width over the bridge.

Advantages: This alternative would address the immediate concerns of poor deck condition and would eliminate maintenance concerns for the beams with the minimum upfront cost. The effects on the adjacent properties, archaeological resources, and wildlife would be minimal.

Disadvantages: This alternative would not address the substandard hydraulics of the structure. The anticipated design life of the remaining substructures and the metal culvert section would be 30 years.

Full Bridge Replacement ON-Alignment with A New Bridge

A full bridge replacement would include a new deck, superstructure, and substructure at the existing location. Both the T-Beam portion of the bridge and the metal culvert would be removed and replaced with a new bridge. The various considerations for this option include the bridge width and length, skew, superstructure type and substructure type.

a. Bridge Width

The minimum standard roadway width is 28 feet. However, the current bridge provides a rail-to-rail width of 30 feet. It is recommended that the new bridge width matches the existing 30-foot approaches and bridge width. This would include two 11-foot travel lanes with 4-foot shoulders.

b. Bridge Length and Skew

The existing bridge is 34 feet in length with no skew. The structure provides a clearspan normal to the channel of approximately 25.5 feet. This clearspan does not meet the minimum recommended bankfull width. If a new structure is constructed it is recommended that it meet the minimum clearspan requirement of 46 feet. Borings have not been drilled at this site, however, based on nearby well information and site observations, the project site may be conducive to integral abutments.

The layout procedures for integral abutment results in a span length of 75 feet. If a new shallow foundation structure is constructed, a span length of approximately 55 feet would be expected. It is anticipated that both options would have no skew.

Approximate span and skew geometry for various new bridge alternatives:

- Integral Abutment Bridge On alignment: Span 75’ Skew 0 degrees
- Shallow Abutment Bridge On alignment: Span 55’ Skew 0 degrees

c. Superstructure Type

If traffic is to remain open during construction, a cast in place deck on steel beams is the most cost-effective superstructure type. If an offsite detour is the chosen traffic control, then a prefabricated structure would be recommended to reduce the closure duration. The possible 55-foot to 75-foot length

prefabricated bridge types that are most commonly used in Vermont are a steel and composite concrete deck (also known as PBU's), or NEXT beams. The superstructure depth is not critical for meeting hydraulic standards, so the superstructure type shall be determined during the design phase.

d. Substructure Type

The existing abutments are founded on spread footings that are likely bearing on soil. Borings have not been drilled at the site, however, based on nearby well information and site observations, the project area is expected to have ledge approximately 30 to 60 feet below finish grade. Borings should be taken early on the design phase to confirm depth to bedrock. If bedrock is found to be at a depth conducive to integral abutments, then that would be the preferred structure type.

e. Maintenance of Traffic

The possible options for this alternative are an offsite detour, phased construction, or a temporary bridge.

Full Bridge Replacement ON-Alignment with A New Buried Structure

A full bridge replacement with a new buried structure, would include removal of the existing metal arch and footings, T-Beams, and abutments, and replacement with a new prefabricated buried structure on concrete pedestal walls. The new structure would be an open-bottom structure based on the required span length for hydraulics. Since the existing roadway alignment over the crossing is located on a reverse curve, this option would reduce bridge construction and design difficulties. The various considerations for this option include the culvert length, span, skew, structure, and substructure type.

a. Culvert Length

The minimum standard roadway width is 28 feet. However, the current bridge provides a rail-to-rail width of 30 feet. It is recommended that any new structure provide a rail to rail distance of 30-feet to match the existing bridge and approaches. This would include two 11-foot travel lanes with 4-foot shoulders. In order to accommodate a 30-foot traveled way, and new culvert would need to be approximately 60-feet long. This length could be reduced if headwalls are constructed at the inlet and outlet.

b. Culvert Span and Skew

The existing bridge is 34 feet in length with no skew. This provides a clearspan normal to the channel of approximately 25.5 feet. This clearspan does not meet the minimum recommended bankfull width. If a new buried structure is constructed it is recommended that it meet the minimum clearspan requirement of 46 feet. The new culvert span would be approximately 50-feet and would be aligned with the stream channel.

c. Structure Type

It is recommended that any new buried structure is founded on concrete pedestals that extend above ordinary high water. There are many buried structure options that could be suited for this site such as

corrugated galvanized structural steel plate arch on concrete pedestals or a composite arch bridge system on concrete pedestals.

d. Substructure Type

The existing abutments are founded on spread footings that are likely bearing on soil. Borings have not been drilled at the site, however, based on nearby well information and site observations, the project area is expected to have ledge approximately 30 to 60 feet below finish grade. Borings should be taken early on the design phase to confirm depth to bedrock. The new culvert would be founded on spread footings with a pedestal wall extending above the ordinary high water mark in order to extend the design life of the structure.

e. Maintenance of Traffic

The possible options for this alternative are an offsite detour, phased construction, or a temporary bridge.

V. Alternatives Summary

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

Alternative 1a: Partial Superstructure Replacement with Traffic Maintained on an Offsite Detour
Alternative 1b: Partial Superstructure Replacement with Traffic Maintained on a Temporary Bridge
Alternative 1c: Partial Superstructure Replacement with Traffic Maintained via Phasing
Alternative 2a: Full Bridge Replacement with a New Integral Abutment Bridge On Alignment with Traffic Maintained on an Offsite Detour
Alternative 2b: Full Bridge Replacement with a New Integral Abutment Bridge On Alignment with Traffic Maintained on a Temporary Bridge
Alternative 2c: Full Bridge Replacement with a New Integral Abutment Bridge On Alignment with Traffic Maintained via Phasing
Alternative 3a: Full Bridge Replacement with a New Shallow Foundation Bridge On Alignment with Traffic Maintained on an Offsite Detour
Alternative 3b: Full Bridge Replacement with a New Shallow Foundation Bridge On Alignment with Traffic Maintained on a Temporary Bridge
Alternative 3c: Full Bridge Replacement with a New Shallow Foundation Bridge On Alignment with Traffic Maintained via Phasing
Alternative 4a: Full Bridge Replacement with a New Buried Structure On Alignment with Traffic Maintained on an Offsite Detour
Alternative 4b: Full Bridge Replacement with a New Buried Structure On Alignment with Traffic Maintained on a Temporary Bridge
Alternative 4c: Full Bridge Replacement with a New Buried Structure On Alignment with Traffic Maintained via Phasing

VI. Cost Matrix[2]

Braintree BF 0241(51)		Do Nothing	Alternative 1			Alternative 2			Alternative 3			Alternative 4		
			Partial Superstructure Replacement			Full Bridge Replacement: Integral Abutment			Full Bridge Replacement: Spread Footings			Full Bridge Replacement: Buried Structure		
			a. Offsite Detour	b. Temporary Bridge	c. Phasing	a. Offsite Detour	b. Temporary Bridge	c. Phasing	a. Offsite Detour	b. Temporary Bridge	c. Phasing	a. Offsite Detour	b. Temporary Bridge	c. Phasing
COST	Bridge Cost	0	260,600	142,900	164,300	894,200	588,600	676,900	1,014,500	749,300	861,700	884,575	884,575	1,017,261
	Removal of Structure	0	29,040	29,040	33,396	137,700	137,700	158,355	137,700	137,700	158,355	137,700	137,700	158,355
	Roadway	0	112,000	145,000	209,000	202,000	168,000	241,000	161,000	197,000	283,000	192,379	192,379	276,544
	Maintenance of Traffic	0	98,300	274,040	159,100	98,700	274,040	384,100	98,300	274,040	159,100	98,300	274,040	166,600
	Construction Costs	0	499,940	590,980	565,796	1,332,600	1,168,340	1,460,355	1,411,500	1,358,040	1,462,155	1,358,854	1,534,594	1,671,546
	Construction Engineering & Contingencies	0	99,988	118,196	113,159	306,498	292,085	438,107	324,645	339,510	438,647	339,713	383,648	417,886
	Total Construction Costs w CEC	0	599,928	709,176	678,955	1,639,098	1,460,425	1,898,462	1,736,145	1,697,550	1,900,802	1,698,567	1,918,242	2,089,432
	Preliminary Engineering[3]	0	174,979	206,843	198,029	199,890	233,668	292,071	211,725	271,608	292,431	190,240	214,843	234,016
	Right of Way	0	10,000	50,000	10,000	20,000	60,000	20,000	20,000	60,000	20,000	20,000	60,000	20,000
	Total Project Costs	**0**	**784,907**	**966,019**	**886,984**	**1,858,988**	**1,754,093**	**2,210,533**	**1,967,870**	**2,029,158**	**2,213,233**	**1,908,807**	**2,193,085**	**2,343,448**
	Annualized Costs	0	19,623	24,150	22,175	24,787	23,388	29,474	26,238	27,055	29,510	25,451	29,241	31,246
TOWN SHARE		0	0	0	0	0	0	0	0	0	0	0	0	0
TOWN %		0	0	0	0	0	0	0	0	0	0	0	0	0
SCHEDULEING	Project Development Duration[4]	N/A	2 Years	4 years	2 Years	2 Years	4 years	2 Years	2 Years	4 years	2 Years	4 years	4 years	4 years
	Construction Duration	N/A	2 months	9 months	4 months	4 months	18 months	9 months	4 months	18 months	9 months	4 months	18 months	9 months
	Closure Duration (If Applicable)	N/A	21 days	N/A	N/A	45 days	N/A	N/A	60 days	N/A	N/A	60 days	N/A	N/A
ENGINEERING	Typical Section - Roadway (feet)	30	30			30			30			30		
	Typical Section - Bridge (feet)	30	4-11-11-4			4-11-11-4			4-11-11-4			4-11-11-4		
	Geometric Design Criteria	Substandard Horiz./Vert. Curves	Substandard Horizontal/Vertical Curves			Substandard Horizontal/Vertical Curves			Substandard Horizontal/Vertical Curves			Substandard Horizontal/Vertical Curves		
	Traffic Safety	No Change	Improved			Improved			Improved			Improved		
	Alignment Change	No Change	No			No			No			No		
	Bicycle Access	No Change	Meets Standard			Meets Standard			Meets Standard			Meets Standard		
	Pedestrian Access	No Change	No Change			No Change			No Change			No Change		
	Hydraulics	Substandard BFW	Substandard BFW			Meets Hydraulic Standard			Meets Hydraulic Standard			Meets Hydraulic Standard		
	Utilities	No Change	Relocation	Relocation	Relocation	Relocation	Relocation	Relocation	Relocation	Relocation	Relocation	Relocation	Relocation	Relocation
OTHER	ROW Acquisition	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Road Closure	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes	No	No
	Design Life (years)	<10	40	40	40	75	75	75	75	75	75	75	75	75

[2] Costs are estimates only, used for comparison purposes.
[3] Preliminary Engineering costs are estimated starting from the end of the Project Definition Phase.
[4] Project Development Durations are starting from the end of the Project Definition Phase.

VII. Conclusion

We recommend **Alternative 1a**; to replace the existing concrete T-Beams while maintaining traffic on an offsite detour.

Structure:
The rehabilitation option has both the lowest upfront cost and lowest annualized cost. A rehabilitation will address the poor deck rating and eliminate maintenance concerns with a minimal upfront cost. The new superstructure would provide a structure with a 40-year design life. The concrete footing for the multi-plate arch should be extended up along the face of the metal arch to above the ordinary highway water mark to extend the life of the existing structure.

The proposed structure would have two 11-foot travel lanes with 4-foot shoulders, which meets the minimum standard for width as set forth in the Vermont State Standards.

Traffic Control:
The recommended method of traffic control is to close the bridge for 21 days and maintain traffic on an offsite detour. This option will not require additional Right-of-Way acquisition for placement of a temporary bridge. The AADT on VT Route 12 is 400 vehicles per day, which is considered relatively low. By not providing a temporary bridge, both the project development time and the project cost are significantly reduced.

VIII. Appendices

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C: Bridge Inspection Report
D: Preliminary Hydraulics
E: Preliminary Geotechnical Information
F: Natural Resources Memo
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H: Archeology Memo
I: Historic Memo
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Appendix A: Site Pictures

Picture 1: Looking South over Bridge

Picture 2: Looking North over Bridge

Picture 3: Looking Downstream from Bridge 47

Picture 4: Looking Upstream from Bridge 47

Picture 5: Upstream Fascia

Picture 6: Rust Staining on metal pipe along water line

Picture 7: Rust Staining on underside of T-Beam deck

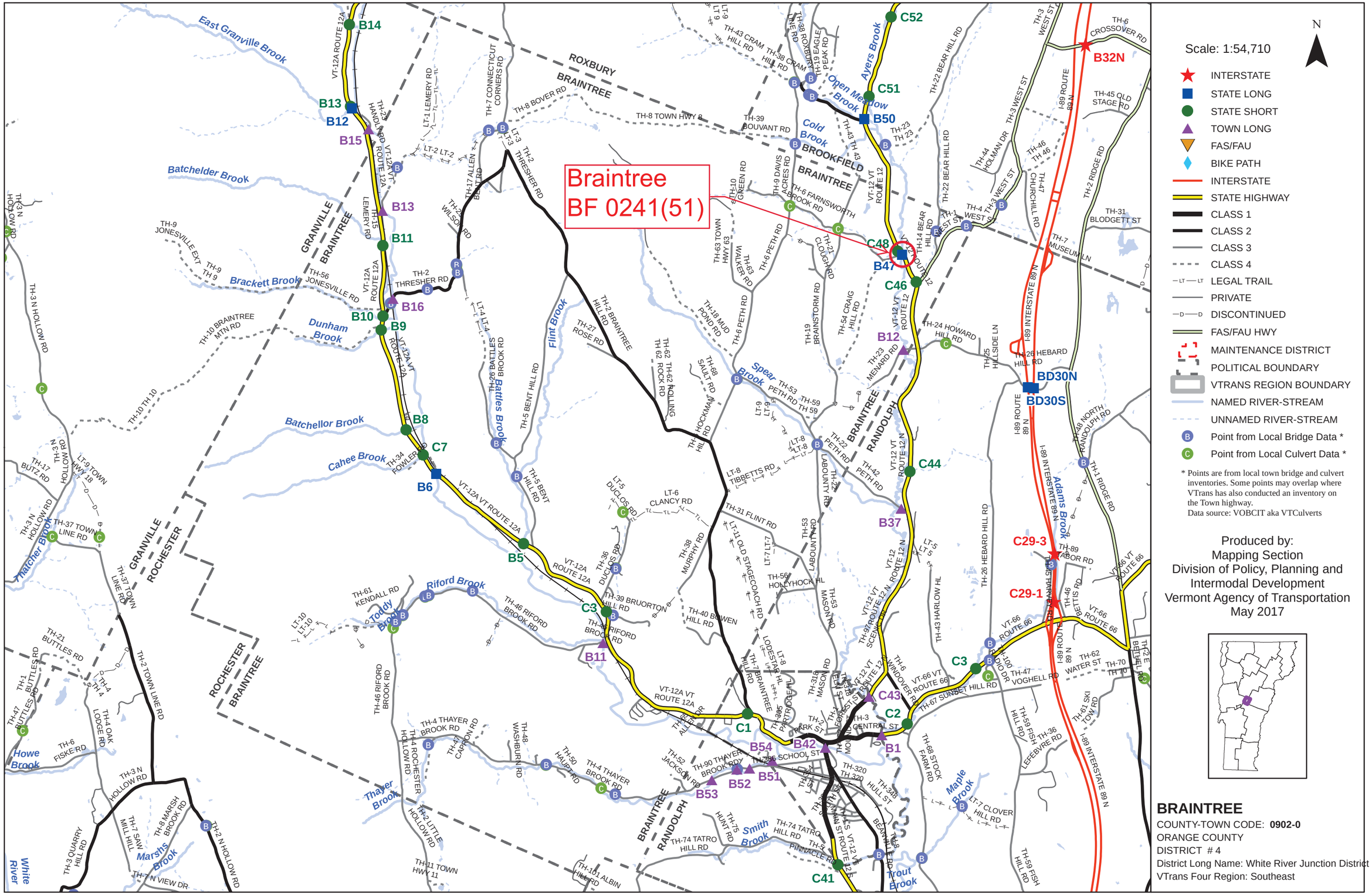
Picture 8: Southern Abutment

Picture 9: Northern Abutment

Picture 10: Downstream Fascia

Picture 11: Deck Deterioration

Appendix B: Town Map



This map was funded in part through grants from the Federal Highway Administration, U.S. Department of Transportation. The representation of the authors expressed herein do not necessarily state or reflect those of the U. S. Department of Transportation.

Appendix C: Bridge Inspection Report

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

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

Inspection Report for BRAINTREE **bridge no.:** 00047 **District:** 4

Located on: VT 00012 ML **over** AYERS BROOK **approximately** 5.0 MI N JCT. VT.12A N **Owner:** 01 STATE-OWNED

CONDITION

Deck Rating: 4 POOR

Superstructure Rating: 6 SATISFACTORY

Substructure Rating: 6 SATISFACTORY

Channel Rating: 8 VERY GOOD

Culvert Rating: N NOT APPLICABLE

Federal Str. Number: 200241004709022

Federal Sufficiency Rating: 090.8

Deficiency Status of Structure: SD

AGE and SERVICE

Year Built: 1928 **Year Reconstructed:** 1969

Service On: 1 HIGHWAY

Service Under: 5 WATERWAY

Lanes On the Structure: 02

Lanes Under the Structure: 00

Bypass, Detour Length (miles): 04

ADT: 000570 **% Truck ADT:** 06

Year of ADT: 1998

GEOMETRIC DATA

Length of Maximum Span (ft): 0032

Structure Length (ft): 000033

Lt Curb/Sidewalk Width (ft): 0

Rt Curb/Sidewalk Width (ft): 0

Bridge Rdwy Width Curb-to-Curb (ft): 31.1

Deck Width Out-to-Out (ft): 54

Appr. Roadway Width (ft): 031

Skew: 00

Bridge Median: 0 NO MEDIAN

Min Vertical Clr Over (ft): 99 FT 99 IN

Feature Under: FEATURE NOT A HIGHWAY OR RAILROAD

Min Vertical Underclr (ft): 00 FT 00 IN

STRUCTURE TYPE and MATERIALS

Bridge Type: T-BM/MULTI PLT ARCH

Number of Approach Spans: 0000 **Number of Main Spans:** 001

Kind of Material and/or Design: 1 CONCRETE

Deck Structure Type: 1 CONCRETE CIP

Type of Wearing Surface: 6 BITUMINOUS

Type of Membrane: 0 NONE

Deck Protection: 0 NONE

APPRAISAL *AS COMPARED TO FEDERAL STANDARDS

Bridge Railings: 1 MEETS CURRENT STANDARD

Transitions: 1 MEETS CURRENT STANDARD

Approach Guardrail: 1 MEETS CURRENT STANDARD

Approach Guardrail Ends: 1 MEETS CURRENT STANDARD

Structural Evaluation: 6 EQUAL TO MINIMUM CRITERIA

Deck Geometry: 6 EQUAL TO MINIMUM CRITERIA

Underclearances Vertical and Horizontal: N NOT APPLICABLE

Waterway Adequacy: 6 OCCASIONAL OVERTOPPING OF ROADWAY WITH INSIGNIFICANT TRAFFIC DELAYS

Approach Roadway Alignment: 3 INTOLERABLE, CORRECTIVE ACTION NEEDED

Scour Critical Bridges: 8 STABLE FOR SCOUR

DESIGN VEHICLE, RATING, and POSTING

Load Rating Method (Inv): 1 LOAD FACTOR (LF)

Posting Status: A OPEN, NO RESTRICTION

Bridge Posting: 5 NO POSTING REQUIRED

Load Posting: 10 NO LOAD POSTING SIGNS ARE NEEDED

Posted Vehicle: POSTING NOT REQUIRED

Posted Weight (tons):

Design Load: 2 H 15

INSPECTION and CROSS REFERENCE

X-Ref. Route:

Insp. Date: 042018 **Insp. Freq. (months)** 12 **X-Ref. BrNum:**

INSPECTION SUMMARY and NEEDS

4/9/2018 T-Beam section will need rehab in the near future due to the heavy spalling in the soffit area . Asphaltic plug joints have been added and are in good condition. ~FRE/SMP

4/25/2017 Due to wide spread deterioration and saturation, a new deck should be considered or have an extensive rehabilitation project. The spalling in the downstream bay near abutment 1 has now reached the asphalt layer, penetrating 14"+/- beyond the soffit. A full depth hole could occur at any time and preventive measures need to be taken. JW/AC

4/14/2016 Structure is in fair condition. Should consider repairing the soffit area and the wing on the downstream side of abutment#1. ~FRE/TJB/JAS

6/4/2015 Extensive saturation continues to deteriorate the deck on the downstream side. Heavy spalling in the soffit has penetrated beyond the second layer of rebar. A deck rehabilitation project should be considered or possibly tying in a multi plate arch to the downstream end and removing the tee beams and deck. JWW/JDM

Appendix D: Preliminary Hydraulics

Date January 28 , 2019
Project BF 024-1(51), 12c578
Structure Braintree VT-12, Bridge 47

Preliminary Hydraulics

Braintree VT-12, MM 0.8773
Bridge 47 over Ayers Brook, tributary to Third Branch White River

The existing inlet section is a Multi-Plate Open Bottom Arch (CGMPA) transitioning to a T-beam bridge, built in 1928 and reconstructed in 1969. The arch has 25.5-foot clear span and provides a waterway opening of approximately 200 square feet. The outlet section, comprised of concrete T-beams founded on concrete abutments, has a 28.9-foot clear span between abutments and provides a waterway opening of approximately 370 square feet. Our model indicates the existing structure does meet current standards of the VTrans Hydraulic Manual:

- Low beam: 737.2 (outlet)
- 2% WSE: 734.8 feet
    - Freeboard: 2.4 feet
- 1% WSE: 736.1 feet
    - Freeboard: 1.1 feet

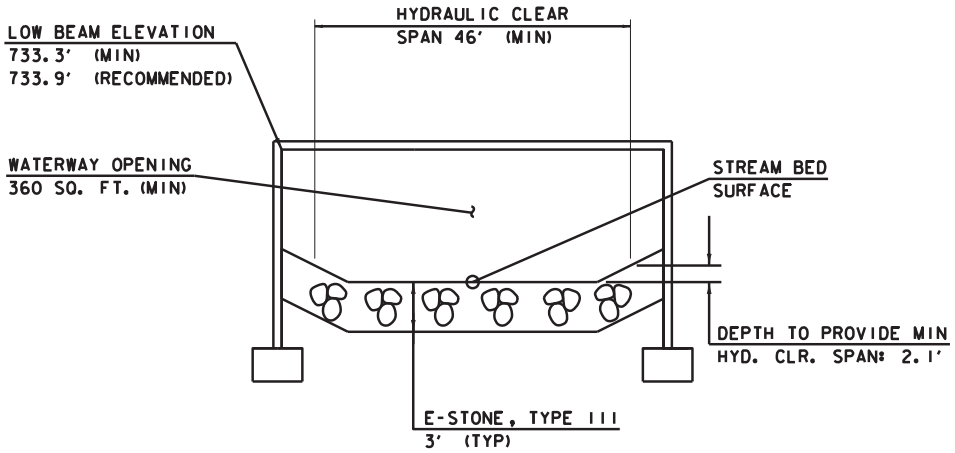
The stream bankfull width, as determined from field measurements, indicates that the structure does not meet state stream equilibrium standards. Jaron Borg, ANR River Management Engineer, has been consulted and agrees that a replacement structure should provide a hydraulic clear span of no less than 46 feet, measured perpendicular to flow at a depth of 2.1 feet. Based on the above considerations and the results of the preliminary analysis, we recommend the following as a replacement for this structure:

A bridge with a hydraulic clear span of 46 feet and a minimum of 360 square feet of waterway area. E-stone, Type III should to be used to build the channel through this structure. This structure results in the following:

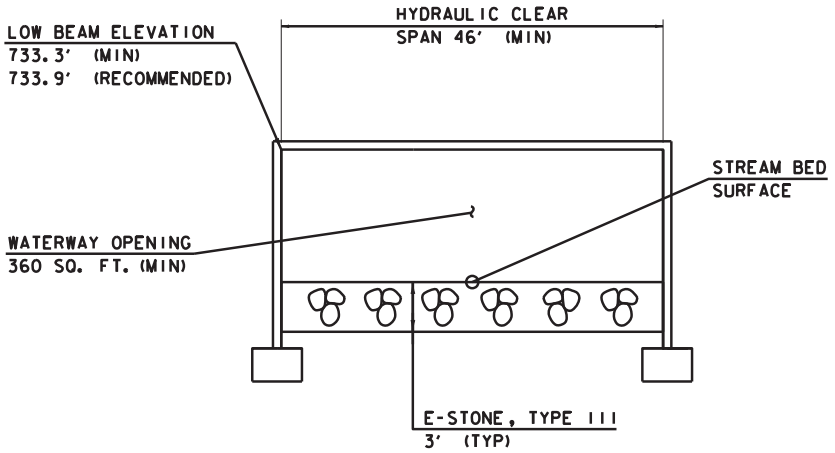
- 2% WSE: 732.21 feet
    - Minimum Low beam: 733.3 feet
- 1% WSE: 732.84 feet
    - Recommended Low Beam: 733.9 feet

The minimum low beam configuration has been developed per the Vtrans Hydraulics Manual. As this structure resides within a National Flood Insurance Program floodplain, permit conditions require that there be no impacts to base flood elevations (1% AEP). If the replacement structure employs the minimum low beam, the layout will need to be analyzed in detail to determine if this criterion is satisfied. In the event that it is desirable to steer clear of potential base flood impacts, we suggest use of the recommended low beam given above.

Note: Any similar structure that fits the site conditions could be considered. Please contact the VTrans Hydraulics Section with alternatives that have significantly different inlet geometry, so headwater depths may be calculated. Please reach out if you have any questions or if we may be of further assistance.



TYPICAL SECTION
TRAPEZOIDAL OPENING



TYPICAL SECTION
RECTANGULAR OPENING

PROJECT NAME:	BRAINTREE
PROJECT NUMBER:	BF 024I(51)
FILE NAME: I2c578/sI2c578border.dgn	PLOT DATE: 1/17/2019
PROJECT LEADER: N.WARK	DRAWN BY: C.B.COTE
DESIGNED BY: C.B.COTE	CHECKED BY: J.D.MORRISON
PRELIMINARY HYDRAULICS SECTION LAYOUT	SHEET 1 OF 1

Appendix E: Preliminary Geotechnical Information

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

To: Nick Wark, P.E., P.I.I.T Program Manager

From: Kara Yelinek, Geotechnical Engineer, via Ian Donovan, Senior Geotechnical Engineer

Date: October 5, 2018

Subject: Braintree BF 0241(51) Preliminary Geotechnical Information

1.0 INTRODUCTION

We have completed our preliminary geotechnical investigation for the replacement of Bridge No. 47 on VT Route 12 in Braintree, VT, which crosses over the Ayers Brook. The existing bridge is a single span structure that is comprised of concrete T-beam construction and a corrugated metal pipe arch. The T-beam portion of the structure rests on concrete abutments on spread footings. The pipe arch's foundation is also founded on spread footings. The project is currently in the scoping phase. This review included the examination of as-built record plans, historical in-house bridge boring files, water well logs and hazardous site information on-file at the Agency of Natural Resources, published surficial and bedrock geologic maps, and observations made during a site visit.

2.0 SUBSURFACE INFORMATION

2.1 Previous Projects

Record plans were available for both the original bridge construction in 1928 and the bridge widening that was completed in 1969. The 1969 plan set included boring locations and soil data, plan and elevation sheets, and arch details. Boring logs showed blows per foot and soil types encountered but were missing information regarding groundwater depths encountered, soil laboratory classification data, and rock core drilling information and classification data.

Boring 1 was advanced adjacent to Abutment 1 and encountered granular material described as sand, silt, and gravel. Based on the blows/foot data of the sampler the material was very loose to medium dense in the upper layers underlain by very dense material. Bedrock was encountered at a depth of 41 feet (ft) below ground surface (bgs), corresponding to an elevation (El.) of 52.9 ft. Boring 2 was advanced adjacent to Abutment 2 and encountered medium dense to dense gravel, silt, and sand. The boring was terminated within the granular material at a depth of 20.7 ft bgs, corresponding to El. 65.4 ft.

According to the Arch Details Sheet the bridge has concrete abutments founded on spread footings likely bearing on soil. The bottom of footing elevation at the inlet is given as 79.97 ft and the bottom of footing elevation at the outlet is given as 78.88 ft. Record plans indicate the stream immediately downstream of Bridge 47 was excavated to alter the stream alignment during original construction in 1928.

2.2 Hazardous Materials and Underground Storage Tanks

The ANR Natural Resource Atlas also maps the location and information of known hazardous waste sites and underground storage tanks. There are no hazardous waste sites or underground storage tanks within a half mile radius of the project area.

2.3 Published Geologic Data

Mapping conducted in 1970 for the Surficial Geologic map of Vermont shows that the project area consists of glacial till (Doll, 1970) underlain with slate, phyllite, and schist of the Waits River Formation (Ratliffe, et. al, 2011).

The Agency of Natural Resources (ANR) documents and publishes all water wells that are drilled for residential or commercial purposes. Published online, these logs can be used to assess general characteristics of soil strata in the area. Four water wells located in a 425-foot radius of the project area and are highlighted below in Figure 2.1.

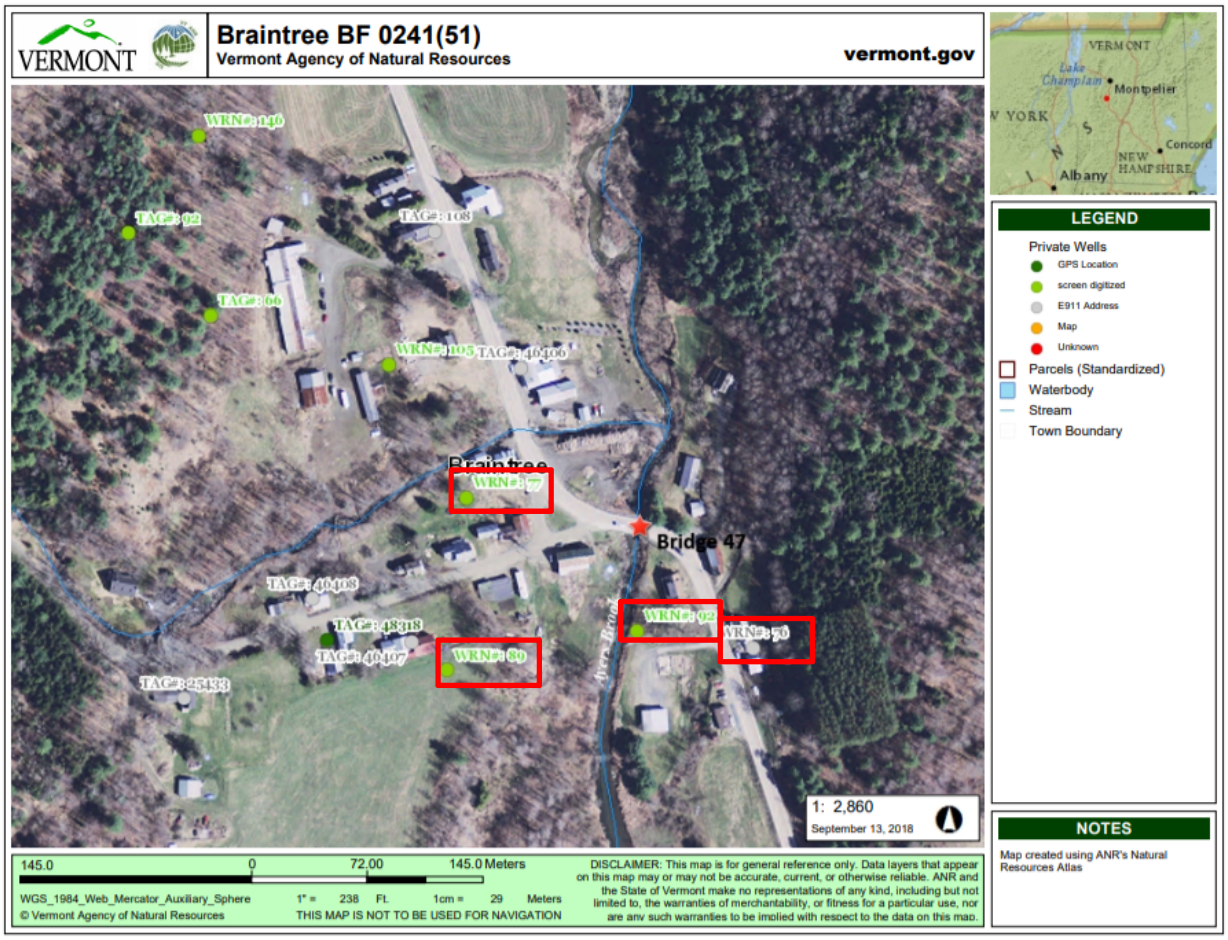


Figure 2.1: Well ID numbers and their location relative to Bridge 47.

Table 2.1 lists the well sites used in gathering the surrounding information. Wells are listed with the distance from the bridge project and depth to bedrock at their respective locations.

Table 2.1. Depths to Bedrock of Surrounding Wells

Well ID	Distance From Project (feet)	Depth To Bedrock (feet)
76	260	25
92	185	28
77	250	90
89	425	30

3.0 FIELD OBSERVATIONS

A preliminary site visit was conducted on September 24, 2018 to assess possible obstructions inhibiting boring operations and to make any other pertinent observations about the project. The structure consists of two bridge types, a concrete T-beam span and a corrugated metal pipe arch. All sections of the abutments appear to be founded on spread footings. The streambed material appears to contain a significant amount of cobbles with some sediment deposits along the abutment foundations shown in Figure 3.1. There are occasional boulders and no bedrock visible in the streambed or in the vicinity of the bridge. There are overhead utilities that cross over the road at the project site, shown in Figure 3.2, however these are not anticipated to impact boring operations.

Figure 3.1: Cobbles within streambed and sediment deposition at abutment foundation of the pipe arch.

Figure 3.2. Overhead utility lines cross over the road at Bridge 47.

4.0 PRELIMIARY FOUNDATION ALTERNATIVES

Based on this information, possible foundation options for a bridge replacement include the following:

- Reinforced concrete abutments on spread footings
- Integral and/or semi-integral abutments founded on piles and/or spread footings

5.0 PROPOSED SUBSURFACE INVESTIGATION

We recommend a minimum of one boring be advanced at each abutment in order to more fully assess the subsurface conditions at the site including, but not limited to, bedrock conditions, the soil properties, and groundwater conditions. If the depth to bedrock varies across either abutment, additional borings may be required to better profile the bedrock surface.

6.0 CLOSING

When a design alternative and a preliminary alignment has been chosen, the Geotechnical Engineering Section should be contacted to help design an appropriate subsurface investigation for the alternative chosen.

If you have any questions or would like to discuss this report, please contact us by phone at (802) 828-2561.

7.0 REFERENCES

Doll, C. G., 1970, Surficial Geologic Map of Vermont, Vermont Geological Survey, Montpelier, VT.

Ratcliffe, N. M., Stanley, R. S., Gale, M. H., Thompson, P. J., Walsh, G. J., 2011, Bedrock Geologic Map of Vermont, Vermont Geological Survey, Montpelier, VT.

Vermont Agency of Natural Resources Department of Environmental Conservation, Natural Resources Atlas, www.anr.vermont.gov/maps/nr-atlas%20, accessed 9/14/2017.

cc: Electronic Read File/MG
Project File/CEE
KBY

Appendix F: Natural Resources Memo

OFFICE MEMORANDUM

AOT - PDB - ENVIRONMENTAL SECTION

RESOURCE IDENTIFICATION COMPLETION MEMO

To:	Nicholas Wark , Project Manager
From:	Lee Goldstein, Environmental Specialist
Date:	12/04/2018
Project:	**Braintree BF 0241(51)**

Environmental Resources:

	Yes	No	
Archaeological Site:	X		See Archaeological Resource ID Memo: 11/09/2018 .dgn
Historic/Historic District:		X	See Historic Resource ID Memo: 09/20/2018 No concerns for historic properties per Memo
4(f) Property:		X	See HP ID Memo dated 09/20/2018
Wetlands:		X	See Natural Resource ID Memo: 10/31/2018 not present in approximate project area
Agricultural Land:	X		Buckland Loam
Fish & Wildlife Habitat:	X		see Natural Resource Memo dated 10/31/2018 for guidance on revegetation to
Wildlife Habitat Connectivity:	X		mid-range connectivity exists; opportunity to promote and re-establish this at the site.
Endangered Species:	X		NLEB; requires Contract language; most likely no time-of-year restrictions
			N/A
Stormwater:		X	
Landscaping:		X	
6(f) Property:		X	
Hazardous Waste:		X	no HazMat sites or Urban Soils Background areas identified via ANR mapping
Contaminated Soils:		X	not identified
USDA-Forest Service Lands:		X	

	Yes	No	
Scenic Highway/Byway:		X	
Act 250 Permits:		X	
FEMA Floodplains:		X	will require FHARC review
Flood Hazard Area/River Corridor:	X		River Corridor only
US Coast Guard:		X	
Lakes and Ponds:		X	
Environmental Justice:		X	
303D List/ Class A Water/ Outstanding Resource Water:		X	
Source Protection Area:		X	
Public Water Sources/ Private Wells:		X	
Other:		X	

CC: Project File

Appendix G: Natural Resources ID

State of Vermont
Program Development Division
One National Life Drive
Montpelier, VT 05633-5001
vtrans.vermont.gov

[phone] 802-279-2562
[fax] 802-828-2334
[ttd] 800-253-0191

Agency of Transportation

To: Lee Goldstein, VTrans Environmental Specialist

From: James Brady, VTrans Environmental Biologist

Date: October 31, 2018

Subject: Braintree BF 0241(51) - Natural Resource ID

I have completed my natural resource report for the above referenced project. My evaluation has included wetlands, wildlife habitat, agricultural soils and rare, threatened and endangered species.

Project Braintree BF 0241(51) is located at bridge 47 on VT Route 12 in the town of Braintree.

Wetlands/Watercourses
There are no wetlands in the project area.

The project spans Ayers Brook. Aquatic organism passage is currently in place at the structure, a new structure should maintain this passage. This passage can be improved by spanning the stream fully to allow for more unobstructed flows through under VT Route 12.

Wildlife Habitat
The riparian area of Ayers Brook acts as a wildlife corridor to some extent. There are large habitat blocks up and downstream of the structure. If the bridge were to be lengthened to include grubbed riparian areas on both sides of the stream under the bridge, this riparian corridor would be reestablished. Planting should occur along the riparian area to the best extent practicable.

Rare, Threatened and Endangered Species
The only listed species in the project area is the federally threatened northern long-eared bat. No habitat species are present at the bridge itself and tree clearing will likely be under the threshold to require time-of-year restrictions.

Agricultural Soils:
The project area is mapped as Buckland loam, a prime agricultural soil.

Appendix H: Archeology Memo

VERMONT

Brennan Gauthier
VTrans Archaeologist
Vermont Agency of Transportation
Project Delivery Bureau
Environmental Section
1 National Life Drive
Montpelier, VT 05633
tel. 802-279-1460
Brennan.Gauthier@Vermont.gov

To: Lee Goldstein, VTrans Environmental Specialist
From: Brennan Gauthier, VTrans Senior Archaeologist
Date: 11/8/2018
Subject: Braintree BF 0241(51) Archaeological Resource ID

Dear Lee,

I have completed my background research and field inspection of the unscoped bridge project located along Vermont Route 12 in the village of Snowsville in the town of Braintree, Orange County, Vermont. The current structure, Bridge 47, was constructed in 1963 and replaced an earlier concrete bridge that was at the end of its functional lifespan.

A field inspection was conducted on August 22, 2018 and was adequate to identify one area of archaeological sensitivity within the project area based on field observations. This area, the southwest quadrant, contains foundation remains from a structure that is present on 1870s maps, but does not appear in 1963 construction images. The foundation appears to be in stable condition but is difficult to photograph due to Japanese knotweed growth next to the river.

Imagery from the 1960s (***Figure 9***) shows heavy disturbance in the three additional quadrants. Soil auger tests confirmed this supposition. There are no concerns for precontact archaeology in the immediate area near Bridge 47. I've mapped the quadrant that contains the foundation into the archaeology geodatabase for inclusion in future plans. As always, please feel free to reach out with any questions or concerns that may arise as part of this project. I can provide additional images, maps and as-built plans if needed.

Sincerely,

Brennan

Brennan

VTrans Working to Get You There
Vermont Agency of Transportation

Images and Illustrations

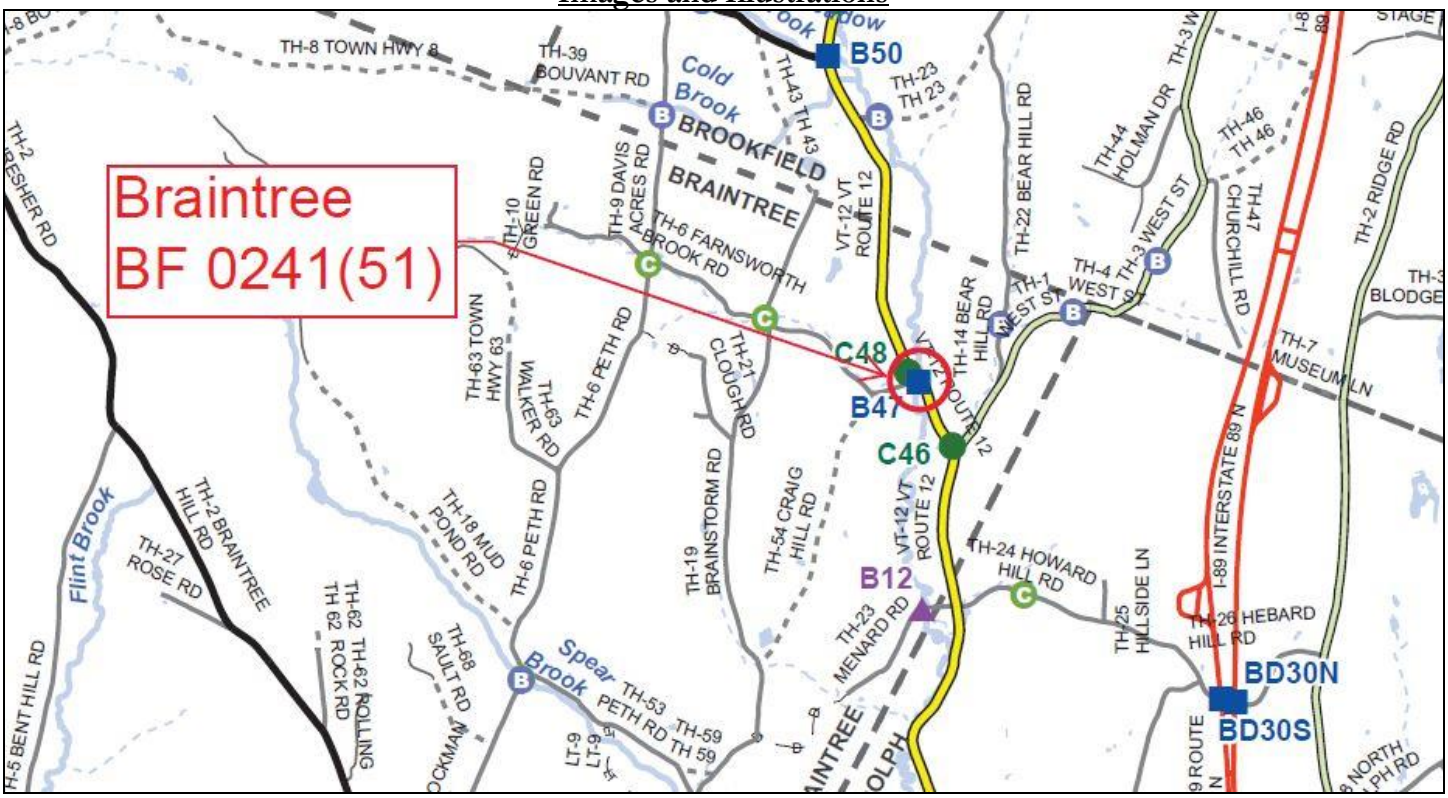


Figure 1: Project Location Map.

Figure 2: Location Ortho Photo.

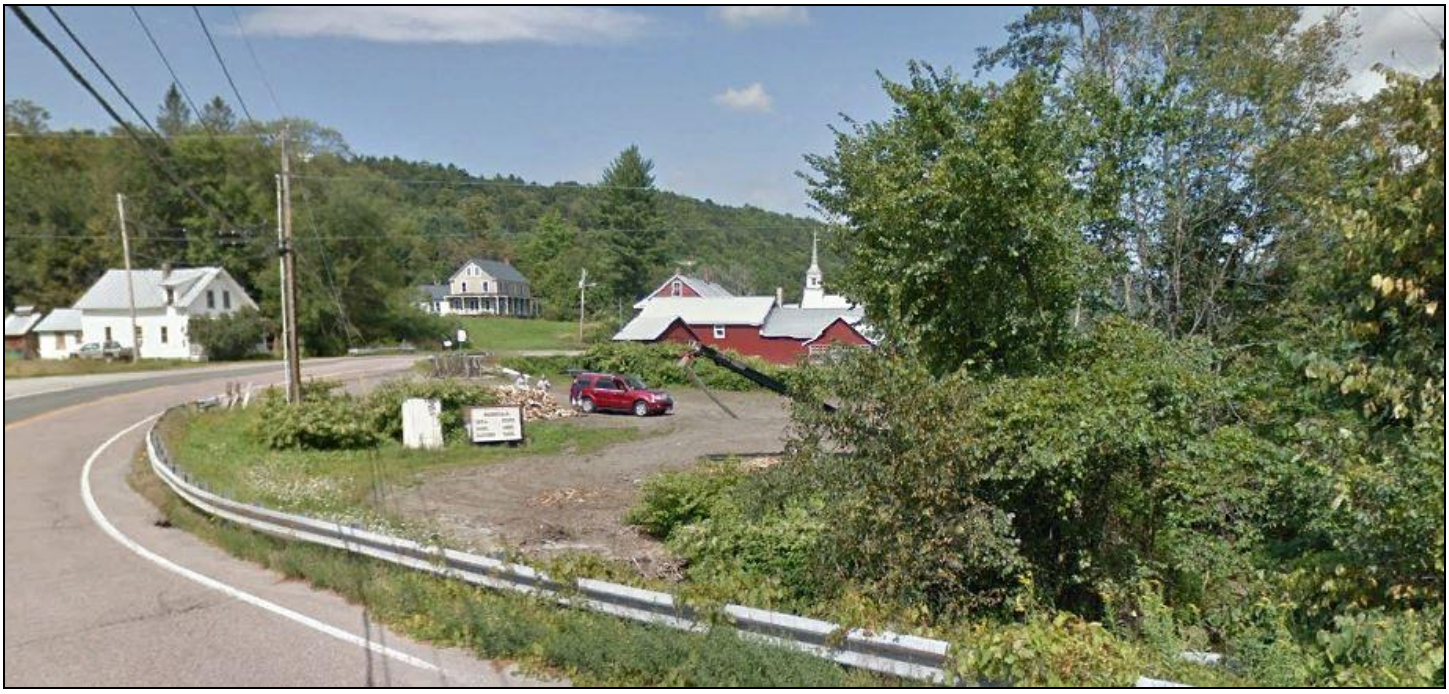


Figure 3: Google Earth Image of NW Quadrant.

Figure 4: SW Quadrant.

Figure 5: SE and NE Quadrants.

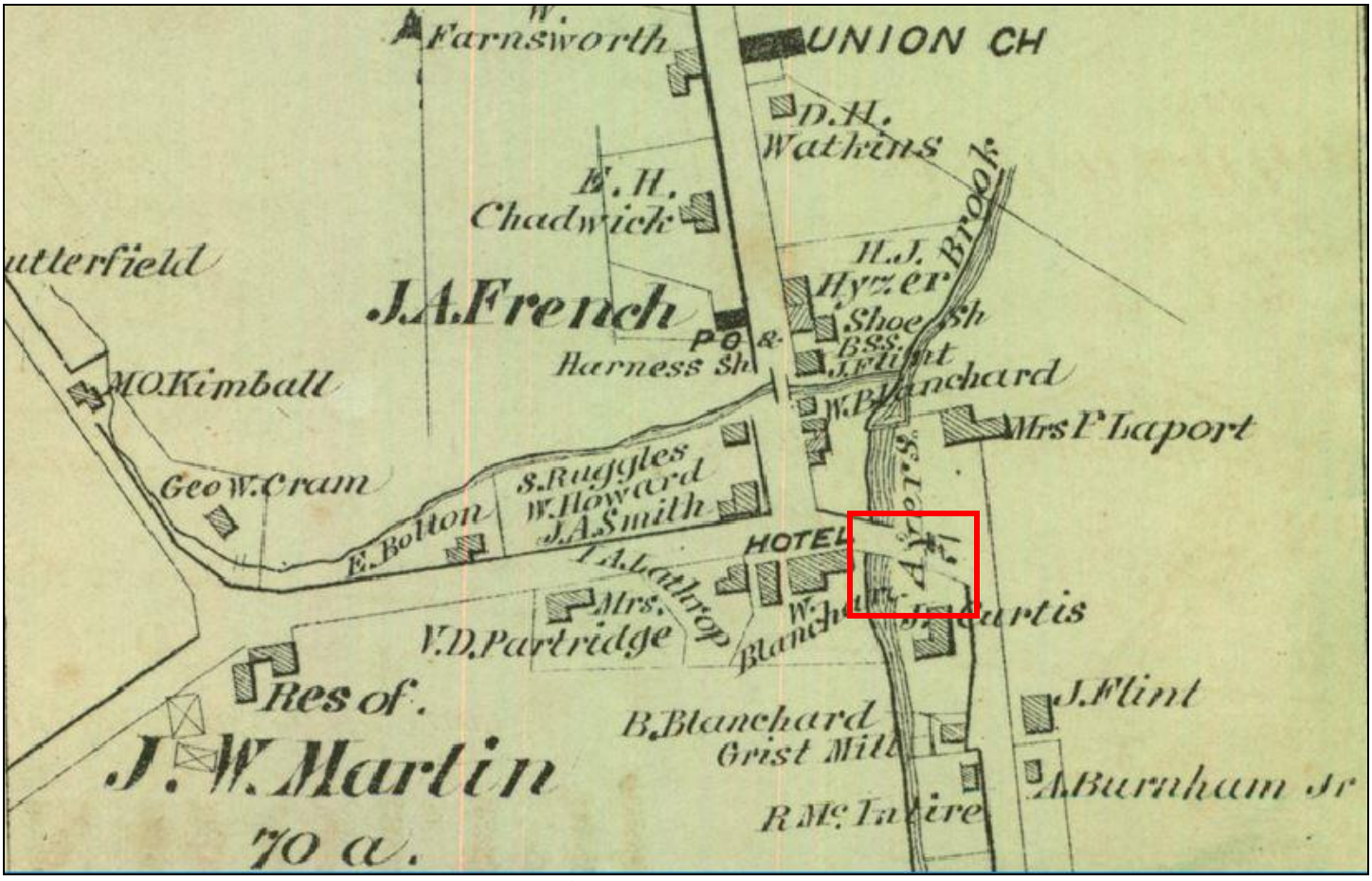


Figure 6: Ca. 1870 Map.

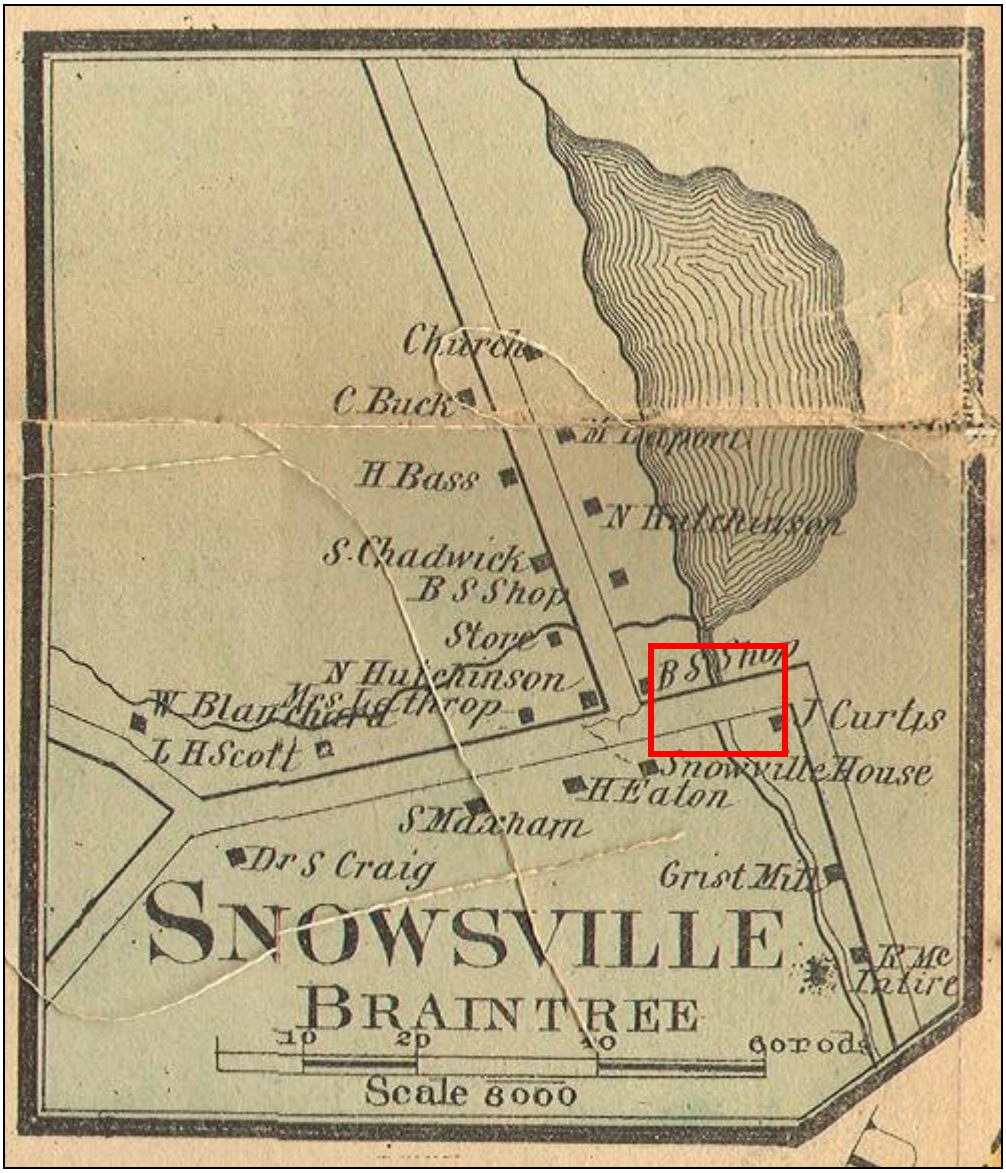


Figure 7: Ca. 1860 Map.

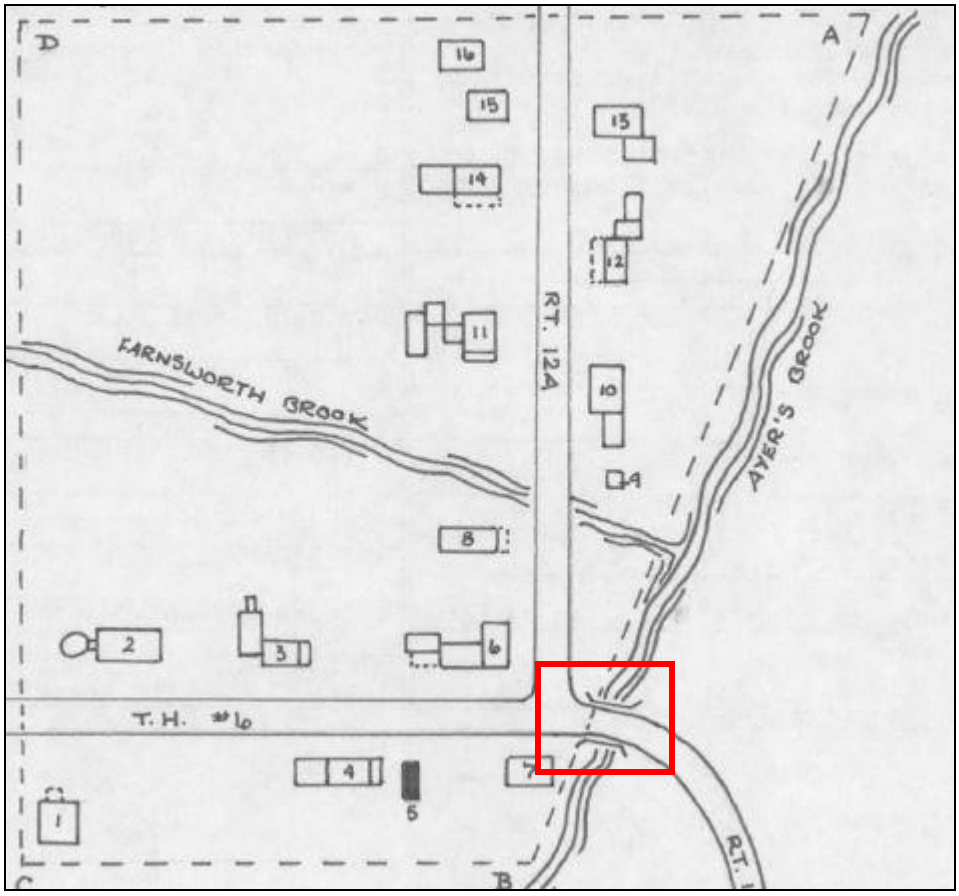


Figure 8: Historic District Boundary.

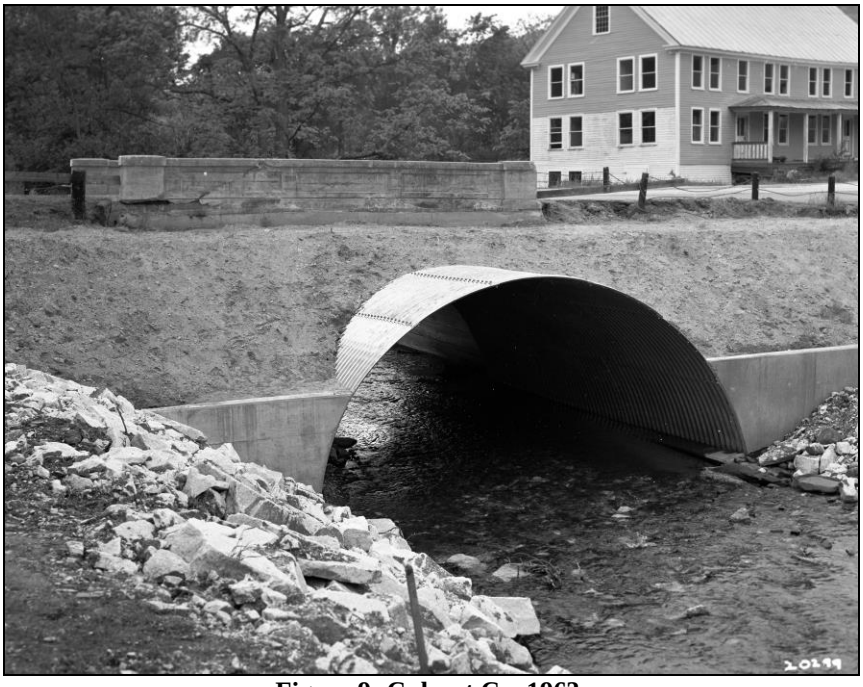


Figure 9: Culvert Ca. 1963.

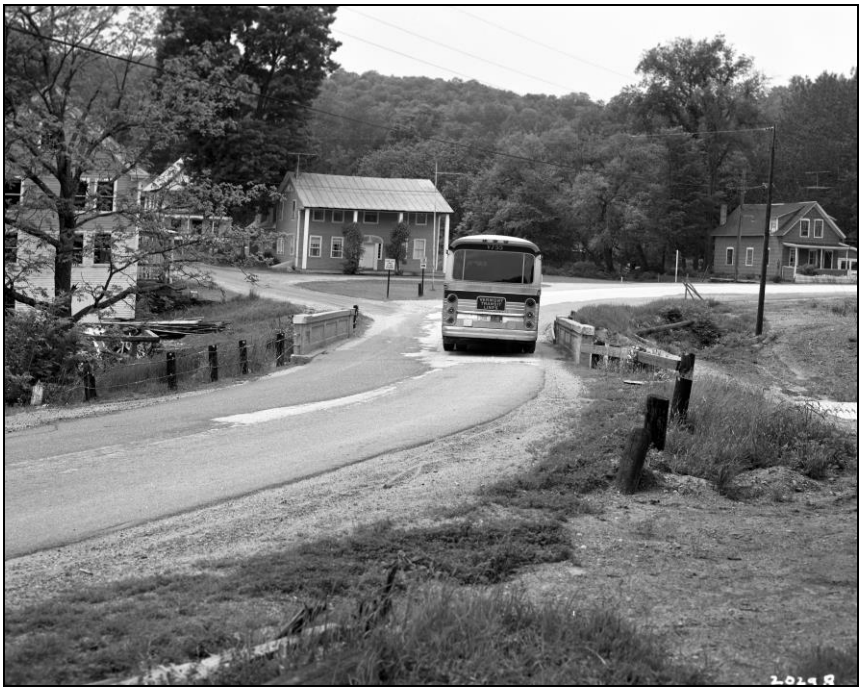


Figure 10: Post-Construction Photo.

Figure 11: SW Quadrant w/ Foundation.

Figure 12: Sensitive SW Quadrant.

Appendix I: Historic Memo

Kyle Obenauer
Historic Preservation Specialist

Vermont Agency of Transportation

Project Delivery Bureau - Environmental Section
One National Life Drive
Montpelier, VT 05633-5001

kyle.obenauer@vermont.gov
(802) 279-7040
www.vtrans.vermont.gov

Historic Preservation Resource Identification Memo

To: Lee Goldstein, VTrans Environmental Specialist

Cc: Brennan Gauthier, VTrans Archaeologist

Date: September 20, 2018

Subject: Braintree BF 0241(51)

Lee,

This Resource Identification effort is being undertaken to identify cultural resources within a broad preliminary survey area that could possibly be impacted by a future project at Bridge No. 47 on Vermont Route 12 in Braintree, Orange County, Vermont *(Figures 1-2)*. Once a project has been defined at the conceptual design phase, VTrans Cultural Resources staff will be able to determine a formal APE for purposes of Section 106 and 22 VSA § 14.

In 1979, a preliminary survey identified the potential for an East Braintree Historic District located directly west of Bridge No. 47; however, the passage of time has resulted in the deterioration, removal, significant alteration, and a general loss of historic integrity for many buildings initially considered to be contributing resources, including the former Snowsville Hotel standing southwest of Bridge No. 47 *(Figures 3-4)*.

Consequently, no historically-significant or Section 4(f) resources were identified within the broad survey area delineated below at Figure No. 2 – a bridge rehabilitation and/or replacement project at this location would likely have no effect on historic resources.

Please, let me know if there are any questions.

Sincerely,

Kyle Obenauer

Images and Illustrations

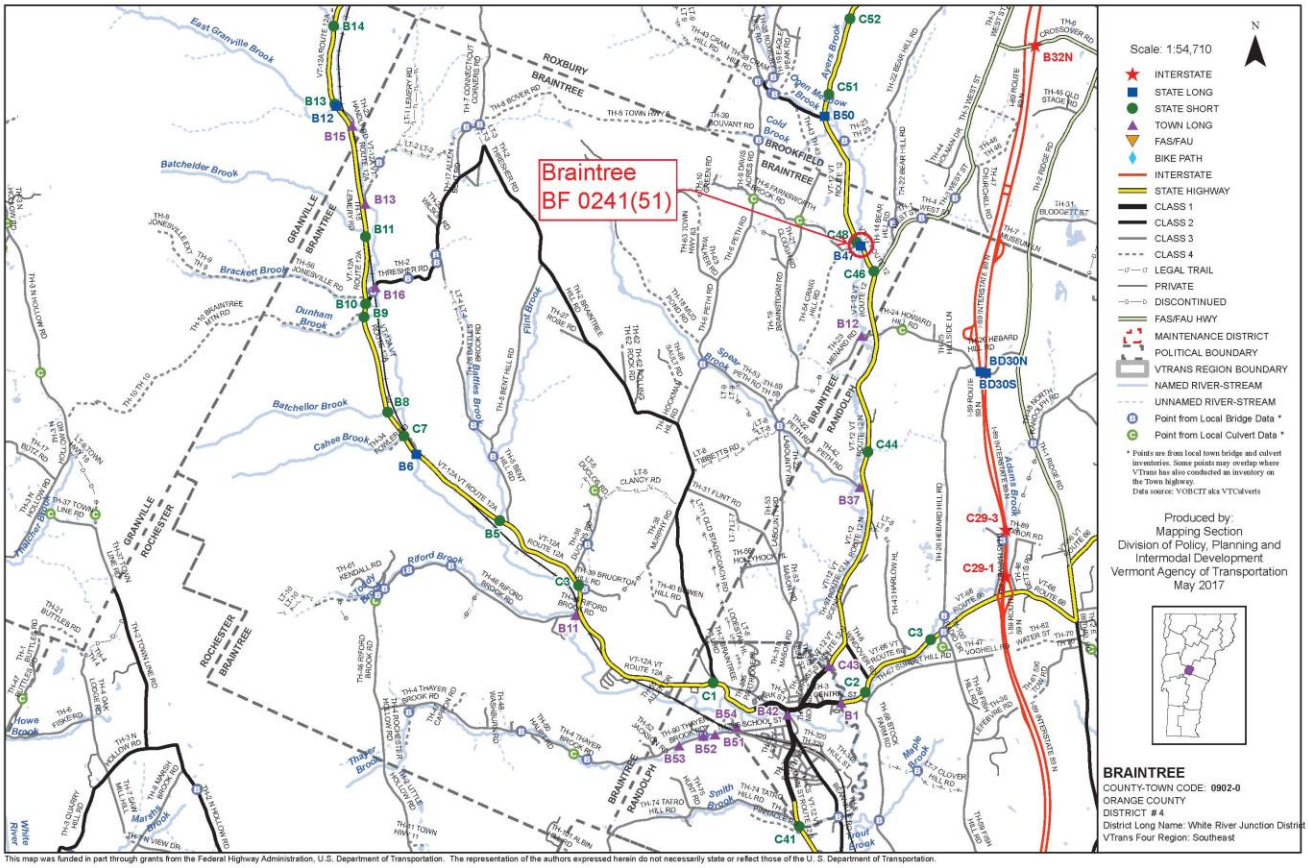


Figure 1. Location of Bridge No. 47 on Vermont Route 12 in Braintree.

Figure 2. Preliminary Survey Area

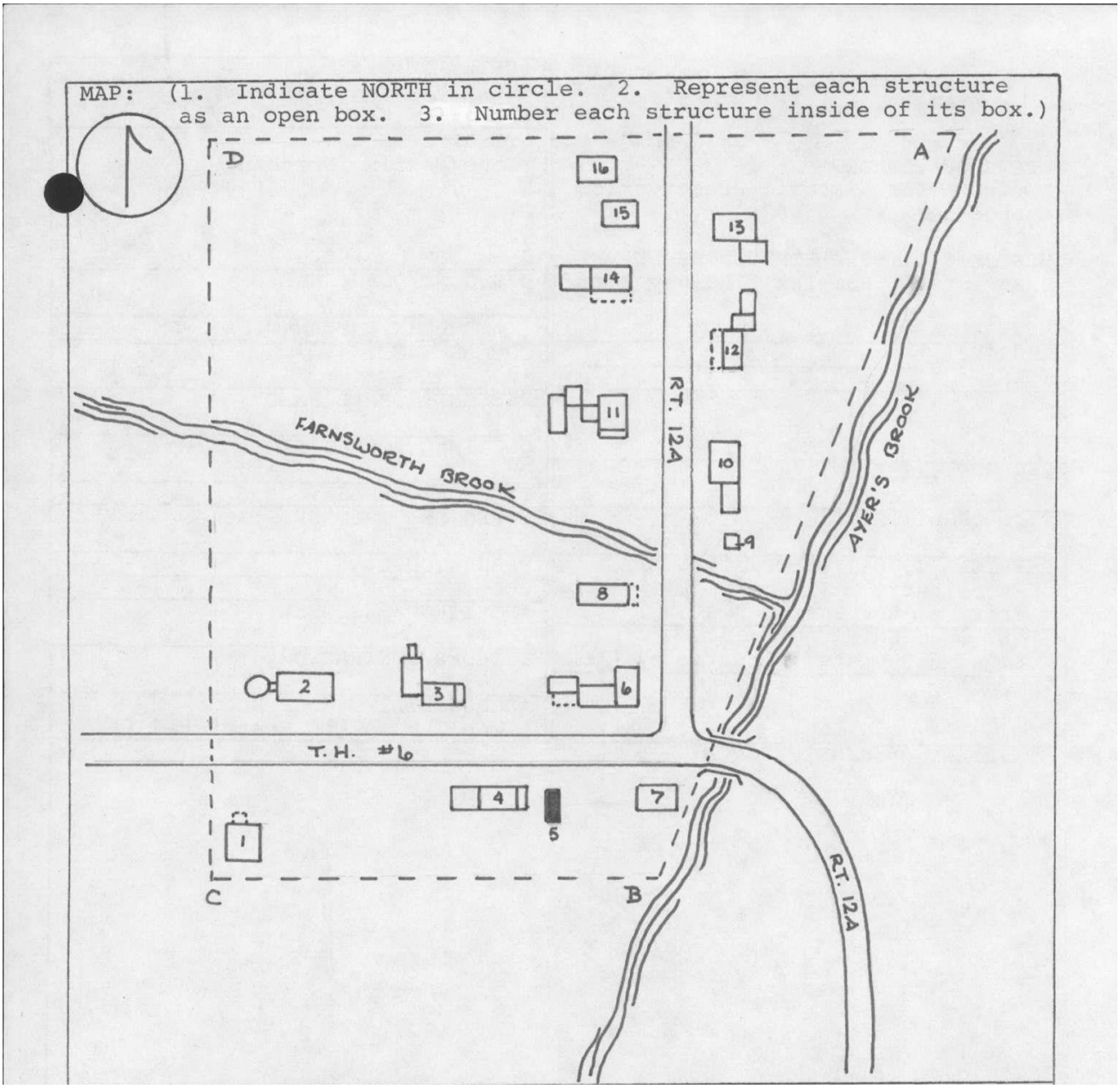


Figure 3. Preliminary boundaries and contributing resources of a potential East Braintree Historic District, surveyed in 1979.

Figure 4. Former Snowsville Hotel located southwest of Bridge No. 47. No longer NRHP-eligible due to a loss of historic integrity.

Appendix J: Stormwater ID

VERMONT

State of Vermont
Environmental Section
One National Life Drive
Montpelier, VT 05633-5001
www.aot.state.vt.us

Agency of Transportation

[phone] 802-279-0583
[fax] 802-828-2334
[ttd] 800-253-0191

To: Lee Goldstein, VTrans Environmental Specialist
From: Emily Peck, VTrans Assistant Stormwater Management Engineer
Date: October 10th, 2018
Subject: Braintree BF 0241(51) - Stormwater Resource ID Review

Project Description: I have reviewed the project area for Braintree BF 0241(51) for stormwater related regulatory and water quality concerns. The project will involve bridge 47 and associated work on VT 12 in Braintree, VT. My evaluation has included the review of existing imagery and mapping (ANR Natural Resource Atlas, VTrans Operational Stormwater Permits & VTrans Corridor Needs) to capture existing stormwater features and existing drainage. I have completed a field visit on 10/8/18 for reconnaissance.

Regulatory Considerations

There are no noteworthy stormwater regulatory concerns at this time.

The project site area does not have any existing stormwater permits.
This project site is not within an MS4 area.
This project site is not within a designated public water supply source protection area.
The project site does not include an impaired (303(d) list) or stressed waters.

Existing Drainage

There are no noteworthy drainage concerns at this time.

The project site is in a rural setting where much of the runoff sheet flows off the road and naturally infiltrates or outfalls into Ayers Brook.

VERMONT

VERMONT

Natural Resources Atlas

Vermont Agency of Natural Resources

vermont.gov

LEGEND

Existing stormwater point

- <all other values>
- Pipe Cross (not connected)
- Catchbasin
- Dry Well
- Drop Inlet
- Grate/Curb Inlet
- Yard drain
- Junction Box
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Treatment feature (see notes)
- Retrofit
- Unknown Point
- Information Point

Existing stormwater line

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

Existing stormwater area

Sanitary Points

Sanitary Lines

Combined Sewer Points

- CB tied to sanitary sewer
- Combined sewer MH
- Known CSO outfalls (location approximate)

Combined Sewer Lines

Roads

1: 1,954

1in = 163 ft.
1cm = 20 meters

99.0 0 50.00 99.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere

NOTES

SW Infrastructure

Appendix K: Crash Data

General Yearly Summaries - Crash Listing: State Highways and All Federal Aid Highway Systems

WHERE Year of Crash >= 2012 AND Year of Crash <= 2016

*	Reporting Agency/ Incident No.	City/Town	Mile Marker	Crash Date	Time	Weather	Contributing Circumstances	Direction of Collision	Number Of Injuries	Number Of Fatalities	Number Of Untimely Deaths	Direction	Road Group
							erratic, reckless, careless, negligent, or aggressive manner, Wrong side or wrong way						
	VT0090100/13RD00842	Randolph	2.37	08/19/2013	18:16	Clear	Failed to yield right of way, Inattention	Left Turn and Thru, Same Direction Sideswipe/Angle Crash vv--	0	0	0	W, N	SH
	VT0090100/13RD01248	Randolph	2.37	12/19/2013	17:14	Cloudy	Made an improper turn	Head On	0	0	0	N, S	SH
	VT0090100/12RD00252	Randolph	2.43	03/27/2012	07:45	Clear		Same Direction Sideswipe	0	0	0	S	SH
	VT0090100/12RD00928	Randolph	2.45	09/17/2012	19:18	Clear	Failed to yield right of way, No improper driving	Right Turn and Thru, Broadside ^<--	0	0	0	E, W	SH
	VT0090100/13RD00146	Randolph	2.46	02/19/2013	12:45	Clear	No improper driving	Head On	0	0	1	W	SH
	VT0090100/16RD00633	Randolph	2.47	07/26/2016	07:08	Rain	Inattention, No improper driving	Head On	0	0	0	E, N	SH Class 1 TH
	VT0090100/15RD01054	Randolph	2.51	12/04/2015	10:40	Clear	Inattention, No improper driving	Rear End	0	0	0	N	SH
	VT0090100/14RD00587	Randolph	2.55	07/21/2014	10:48	Clear	Followed too closely, No improper driving	Rear End	0	0	0	E	SH
	VT0090100/16RD01162	Randolph	2.55	12/06/2016	10:40	Clear	Failed to yield right of way	Single Vehicle Crash	1	0	0	S	SH Class 1 TH
	VT0090100/12RD00496	Randolph	2.77	06/01/2012	14:30	Clear	Inattention	Single Vehicle Crash	1	0	0	N	SH
	VT0090000/14ORC0335	Randolph	3.39	04/04/2014	07:45	Clear	Failure to keep in proper lane	Head On	0	0	0	N	SH
	VT0090100/12RD00039	Randolph	3.40	01/12/2012	19:20	Snow	Driving too fast for conditions	Head On	0	0	0	N	SH
	VTVSP1100/16D305128	Randolph	3.75	12/22/2016	17:02	Cloudy	Failure to keep in proper lane	Single Vehicle Crash	0	0	0	S	SH State Owned
	VTVSP1100/12D300569	Randolph	4.95	01/11/2012	02:55	Cloudy	No improper driving	Single Vehicle Crash	0	0	0	N	SH
	VT0090100/14RD00175	Randolph	UNK	03/11/2014	10:20	[No Weather]		[No Direction of Collision]	0	0	0	S	SH
	VTVSP1100/13D303041	Braintree	0.20	07/14/2013	09:00	Clear		Single Vehicle Crash	1	0	0	S	SH
	VTVSP1100/14D302889	Braintree	0.20	07/22/2014	09:13	[No Weather]		[No Direction of Collision]	0	0	0		SH
	VTVSP1100/13D302248	Braintree	0.55	06/01/2013	13:37	Clear	No improper driving, Driving too fast for conditions	Head On	1	0	0	N, S	SH
	VTVSP1100/13D301175	Braintree	1.20	03/24/2013	18:59	[No Weather]		[No Direction of Collision]	0	0	0		SH
	VTVSP1100/14D302403	Brookfield	0.15	06/21/2014	13:00	Clear	Exceeded authorized speed limit, Failure to keep in proper lane, No improper driving	Opp Direction Sideswipe	1	0	0	S, N	SH
	VTVSP1100/14D302948	Brookfield	0.72	07/25/2014	16:24	[No Weather]		[No Direction of Collision]	0	0	0		SH
	VTVSP1100/13D302637	Brookfield	1.54	06/21/2013	08:35	Clear	Driving too fast for conditions	Single Vehicle Crash	0	0	0	S	SH
	VTVSP1100/12D300497	Brookfield	2.70	01/31/2012	12:49	Snow	Failure to keep in proper lane	Single Vehicle Crash	1	0	0	N	SH
	VTVSP1100/15D304682	Brookfield	4.04	12/01/2015	13:36	Sleet, Hail (Freezing Rain	Driving too fast for conditions, No improper driving	Rear End	0	0	0	N	SH

**Crash occurred prior to the last Highway Improvement Project. This data should not be used in a crash analysis. UNK indicates Mile Marker is Unknown.*

Appendix L: Utility ID

Braintree BF 0241(51)

Existing Utilities within Project Limits Report 11-28-2018

Bridge 47 on VT Route 12 in Braintree, Vt.

AERIAL

-Green Mountain Power Company (Electric)

-Consolidated Communications

-E C Fiber, LLC D/B/A Valley Net

-Comcast

UNDERGROUND

-E C Fiber, LLC D/B/A Valley Net dose have a few underground services.

MUNICIPAL

There is No known Water and Sewer in vicinity of the bridge.

Appendix M: Local Input

Local & Regional Input Questionnaire

Project Summary

This project, BF 0241(51), focuses on bridge 47 on VT Route 12 in Braintree, Vermont. The bridge is deteriorating and is in need of either a major maintenance action or replacement. Potential options being considered for this project include a deck replacement, deck and superstructure (concrete T-beam) replacement. It is possible that VTrans will recommend a road closure and detour traffic away from the project site for the duration of the work. Efforts will be made to limit the detour to State roads.

Community Considerations

1. Are there regularly 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 annual bike races, festivals, parades, cultural events, weekly farmers market, concerts, etc. that could be impacted? If yes, please provide approximate date, location and event organizers' contact info.

   A: Gifford's Last Mile Ride in mid-August. (https://giffordhealthcare.org/donate/last-mile-ride/)

   Braintree 357 Gravel Enduro (bike race/ride) near the beginning of Oct. We expect some other Saturday events throughout the summer at the Braintree Meeting House at 2756 Braintree Hill Road. None of these should be directly impacted. There could be an increase in traffic around the bridge. (Contact information: Zac Freeman, zac@jsfreeman.com, 728-9946)

2. Is there a "slow season" or period of time from May through October where traffic is less or no events are scheduled?

   A: Before July the events may be a bit slower, but I don't think the events will really be a problem.

3. Please describe the location of the Town garage, emergency responders (fire, police, ambulance) and emergency response routes that might be affected by the closure of the bridge, one-way traffic, or lane closures and provide contact information (names, address, email addresses, and phone numbers.

   A: As with any bridge closures it would slow response to incidences in the area.

   Braintree contracts with Randolph for its fire service (contact information: Jay Collette, Jay.Collette@gwplastics.com, home number -728-9220). Brookfield has its own fire department. So a bridge closure in that area will not hamper access for them.

   Braintree is a member town with White River Valley Ambulance, located at 3190 Pleasant Street, Bethel, VT 05032. Brookfield is also a member town but I believe they also work with Northfield Ambulance. (Contact information: fulltime@wrva.net, phone - 234-6800).

Both Braintree and Brookfield do not have police, we both rely on the State Police, out of the Royalton Barracks.

The Town Garage is on Route 12A, and would not be greatly impacted (contact information: Jeff Masterson, braintreehighway@gmail.com, 728-9787 ext. 4)

4. Are there businesses (including agricultural operations and industrial parks) or delivery services (fuel or goods) that would be adversely impacted either by a detour or due to work zone proximity?

   A: There is a farm at 4877 VT Route 12, owned by Lynn & Alice Wakefield.

   The Snowsville Store is closed.

5. Are there important public buildings (town hall, community center, senior center, library) or community facilities (recreational fields, town green, etc.) close to the project?

   A: Nothing heavily used.

6. What other municipal operations could be adversely affected by a road/bridge closure or detour?

7. Are there any town highways that might be adversely impacted by traffic bypassing the construction on other local roads? Please indicate which roads may be affected and their condition (paved/unpaved, narrow, weight-limited bridges, etc), including those that may be or go into other towns.

   A: Peth Road – unpaved
   Brainstorm Road – unpaved
   Farnsworth Brook Road – unpaved, narrow
   West Street – unpaved
   Bear Hill Road - unpaved, narrow
   Maloney Road (in Brookfield)

8. Is there a local business association, chamber of commerce, regional development corporation, or other group that we should be working with? If known, please provide name, organization, email, and phone number.

9. Are there any public transit services or stops that use the bridge or transit routes in the vicinity that may be affected if they become the detour route?

   A: I don't think so, but if any do, it would be Stagecoach Transportation - (802) 728-3773

Schools

1. Where are the schools in your community and what are their schedules?

A. The elementary school is on Route 12A, the High school is in Randolph.

2. Is this project on specific routes that school buses or students use to walk to and from school?

   A. There may be a bus route over the Bridge. (Contact information: Danny Bellavance, dbellavance@orangesouthwest.org, work number 802-779-1251)

3. Are there recreational facilities associated with the schools nearby (other than at the school)?

   A. No.

Pedestrians and Bicyclists

1. What is the current level of bicycle and pedestrian use on the bridge?

   A: Low to moderate bicycle use, very limited pedestrian use.

2. Are the current lane and shoulder widths adequate for pedestrian and bicycle use?

   A. Yes.

3. Does the community feel there is a need for a sidewalk or bike lane on the bridge?

   A. No.

4. Is pedestrian and bicycle traffic heavy enough that it should be accommodated during construction?

   A. Not really.

5. Does the Town have plans to construct either pedestrian or bicycle facilities leading up to the bridge? Please provide any planning documents demonstrating this (scoping study, master plan, corridor study, town or regional plan).

   A. No.

6. In the vicinity of the bridge, is there a land use pattern, existing generators of pedestrian and/or bicycle traffic, or zoning that will support development that is likely to lead to significant levels of walking and bicycling?

   A. It is in the village district. One of the old buildings in the area may become a community center of sorts. There is nothing official about it yet.

Communications

1. Please identify any local communication channels that are available for us to use in communicating with the local population. Include weekly or daily newspapers, blogs, radio,

public access TV, Front Porch Forum, etc. Also include any unconventional means such as local low-power FM.

A: Front Porch Forum & Herald of Randolph (weekly paper)

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?

   A. No.

2. Are there any concerns with the width of the existing bridge?

   A. No.

3. Are there any special aesthetic considerations we should be aware of?
   A. No.

4. Does the location have a history of flooding? If yes, please explain.

   A: It is in a flood plan, but I'm not aware much flooding in the area.

5. Are there any known Hazardous Material Sites near the project site?

   A: No.

6. Are there any known historic, archeological and/or other environmental resource issues near the project site?

   A: There are old buildings with lots of history, but nothing official. So, no.

7. Are there any utilities (water, sewer, communications, power) attached to the existing bridge? Please provide any available documentation.

   A: Not that I know of, maybe communication or power.

8. Are there any existing, pending, or planned municipal utility projects (communications, lighting, drainage, water, wastewater, etc.) near the project that should be considered?

   A: ECFiber will be running lines in the area, but I believe they will be on the poles.

9. Are there any other issues that are important for us to understand and consider?

Land Use & Zoning

1. Please provide a copy of your existing and future land use map or zoning map, if applicable.
   A. See map.

2. Are there any existing, pending or planned development proposal that would impact future transportation patterns near the bridge? If so, please explain.

   A: One of the old buildings in the area may become a community center of sorts. There is nothing official about it yet.

3. Is there any planned expansion of public transit or intercity transit service in the project area? Please provide the name and contact information for the relevant public transit provider.

   A: Not at this time.

Communications

1. Please identify any local communication outlets that are available for us to use in communicating with the local population. Include weekly or daily newspapers, blogs, radio, public access TV, Facebook, Front Page Forum, etc. Also include any unconventional means such as local low-power FM.
   A: Front Porch Forum
   Herald of Randolph (weekly paper)

2. Other than people/organizations already referenced in this questionnaire, are there any others who should be kept in the loop as the project moves forward?
   A: No.

Appendix N: Operations and Maintenance Input

Bridge Scoping Project BF 0241(51)
Operations Input Questionnaire

The Structures Section has begun the scoping process for BF 0241(51), VT Route 12, Bridge 47, over the Ayers Brook in Braintree. This is a combination T-beam/Multi plate arch bridge constructed in 1928 and reconstructed in 1969. The Structure Inspection, Inventory, and Appraisal Sheet (attached) rates the deck as 4 (poor), the superstructure as 6 (satisfactory), and the substructures as 6 (satisfactory). We are interested in hearing your thoughts regarding the items listed below. Leave it blank if you don't wish to comment on a particular item.

1. What are your thoughts on the general condition of this bridge and the general maintenance effort required to keep it in service?

   Overall, this bridge is in pretty good condition…other than the spall underneath, which now has a 10' x 12' steel plate over the through hole, under the new pavement placed in 2017.

   Interesting method used for making a two lane bridge out of a one lane bridge.

2. What are your comments on the current geometry and alignment of the bridge (curve, sag, banking, sight distance)?

   Sharp corners before and after this bridge

3. Do you feel that the posted speed limit is appropriate?

   possibly – village area with sharp corners before and after this bridge

4. Is the current bridge and approach roadway width adequate for winter maintenance including snow plowing?

   Yes

5. Are the joints salvageable or would you recommend replacement?

   No Joints

6. Are the railings constantly in need of repair or replacement? What type of railing works best for your district? (We are recommending more and more box beam guardrail on our bridges because of crash-worthiness and compatibility with accelerated projects).

If ne rail installed – Rail should be 39" or taller to meet Vosha standards especially since a general store is within walking distance of local residents. – Wide shoulder should be considered for pedestrian traffic (easy to plow with truck)

7. Are you aware of any unpermitted driveways within close proximity to the bridge? We frequently encounter driveways that prevent us from meeting railing and safety standards.

Driveway – Yes, Unpermitted = I don't know.

8. Are you aware of abutting property owners that are likely to need special attention during the planning and construction phases? These could be people with disabilities, elderly, or simply folks who feel they have been unfairly treated in the past.
   Village area so – likely yes

9. Do you find that extra effort is required to keep the slopes and river banks around the bridge in a stable condition? Is there frequent flood damage that requires repair?
   No

10. Does this bridge seem to catch an unusual amount of debris from the waterway?
    Not that I'm aware of

11. Are you familiar with traffic volumes in the area of this project?
    No

12. Do you think a closure with off-site detour and accelerated construction would be appropriate? Do you have any opinion about a possible detour route, assuming that we use State route for State projects and any route for Town projects? Are there locations on a potential detour that are already congested that we should consider avoiding?
    Yes, This road does see high traffic. VT 12A and I89 can be utilized as detour routes

13. Please describe any larger projects that you have completed that may not be reflected on the attached Appraisal sheet, such as deck patches, paving patches, railing replacement with new type, steel coating, etc.
    10' x 12' steel plate over the through hole, under the new pavement placed in 2017.

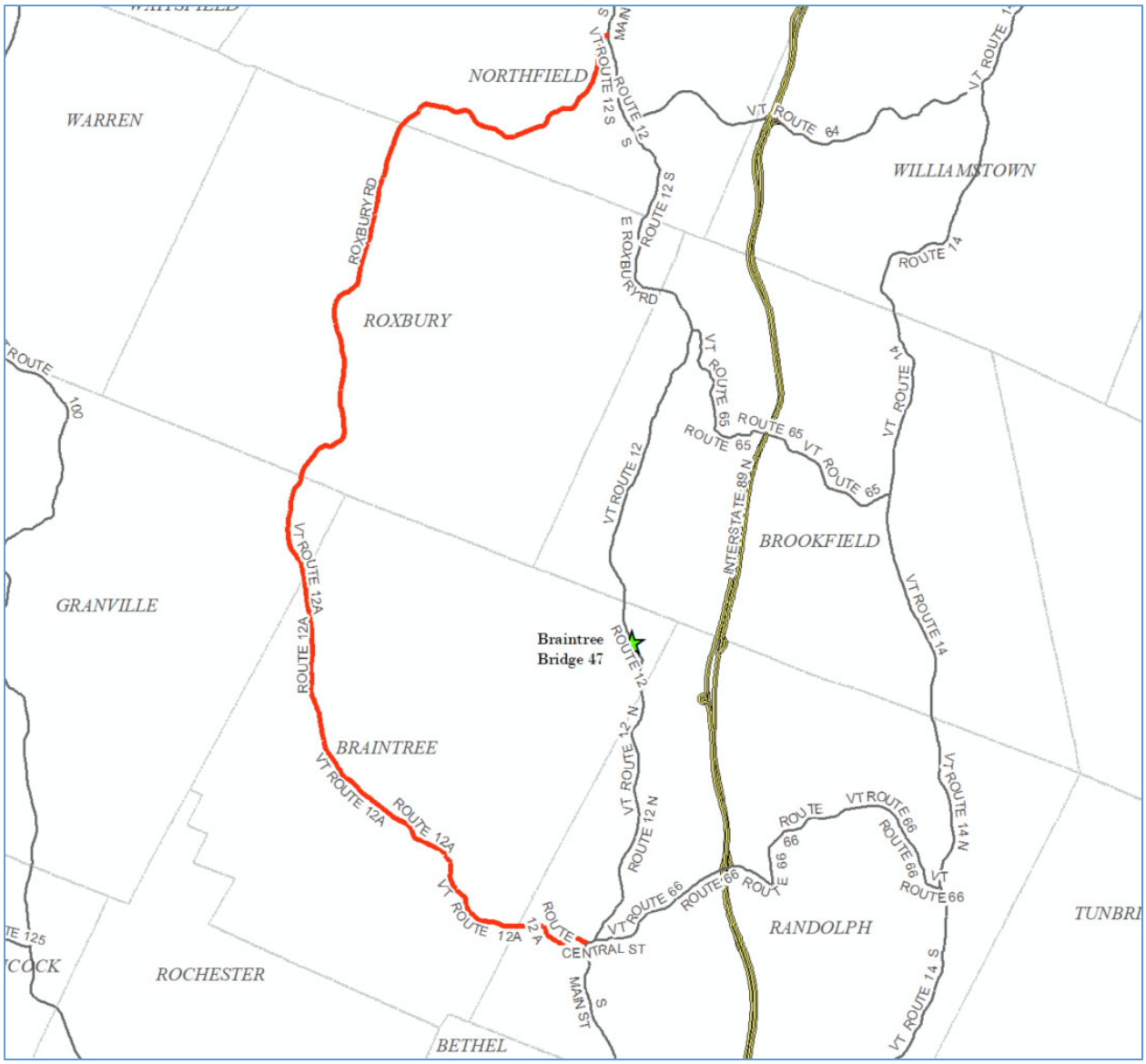
14. If there is a sidewalk on this bridge, how effective are the Town's efforts to keep it free of snow and ice?
    No sidewalk – Wide shoulder should be considered for pedestrian traffic

15. Are there any drainage issues that we should address on this project?
    No

16. Are you aware of any complaints that the public has about issues that we can address on this project?
    No

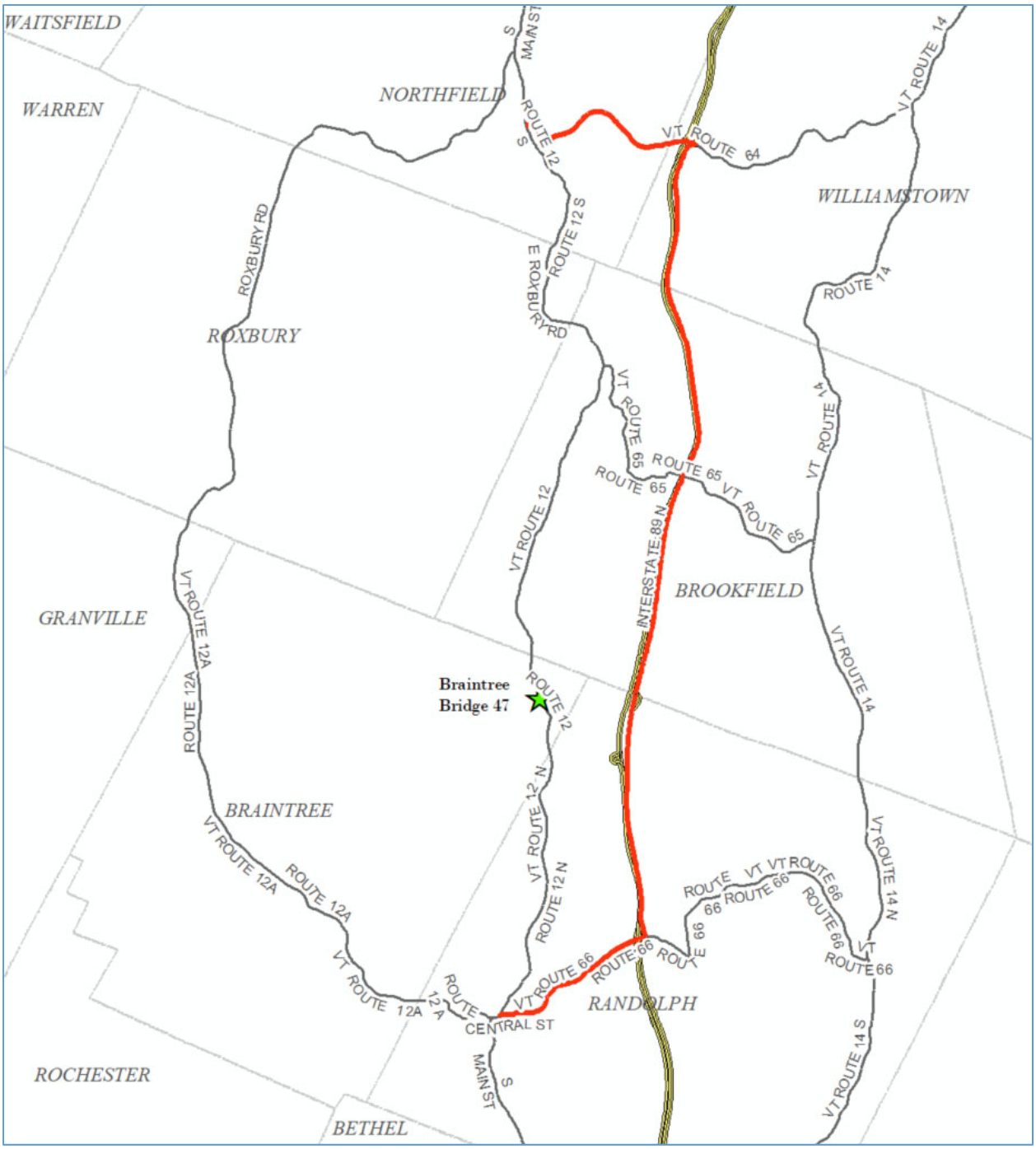
17. Is there anything else we should be aware of?
    No

Appendix O: Detour Maps



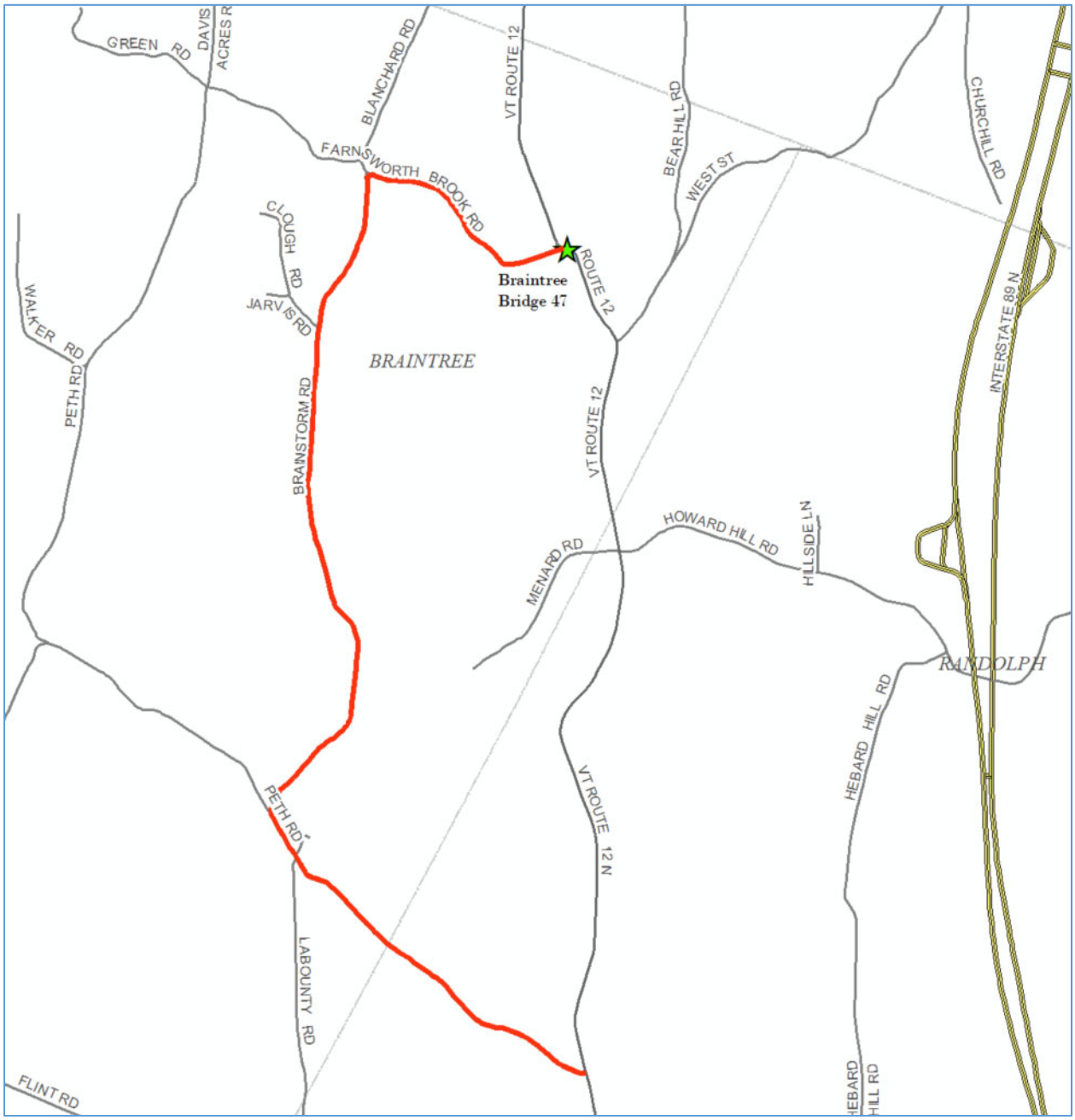
Regional Detour Route 1: Vermont Route 12, to Vermont Route 12A, back to VT Route 12

39.4 Miles end-to-end
15.9 Miles Through-Route
23.6 Miles Detour Route
7.7 Miles Added



Regional Detour Route 2: Vermont Route 12, to Vermont Route 64, Interstate 89, and VT Route 66 back to VT Route 12

32.4 Miles end-to-end
14.8 Miles Through-Route
17.6 Miles Detour Route
2.8 Miles Added



Local Bypass 1: VT Route 12, to Farnsworth Brook Road, Brainstorm Road, and Peth Road, back to VT Route 12 (6.7 mi end-to-end)

6.7 Miles end-to-end
2.6 Miles Through-Route
4.1 Miles Detour Route
1.5 Miles Added

Appendix P: Plans

INDEX OF SHEETS

SHEET NO.	SHEET DESCRIPTION
1	Existing Conditions Layout Sheets
2	Existing Conditions Profile
3	Alternative 1 Typical Sections
4	Alternative 1 Layout
5	Alternatives 2 and 3 Typical Sections
6	Alternative 2 Layout
7	Alternative 3 Layout
8-9	Alternative 4 Typical Sections
10	Alternative 4 Layout
11-12	Phasing Plans
13-14	Temporary Bridge Layouts

VT ROUTE 12 CURVE 2
DELTA = 57°12'03"
D = 25°27'53"
R = 225.00'
T = 122.68'
L = 224.63'
E = 31.27'

VT ROUTE 12 CURVE 1
DELTA = 61°22'14"
D = 38°11'50"
R = 150.00'
T = 89.01'
L = 160.67'
E = 24.42'

EXISTING BRIDGE INFORMATION
T-BEAM BRIDGE BUILT 1928
MULTI PLATE ARCH ADDED 1969
SPAN LENGTH 33'-0"

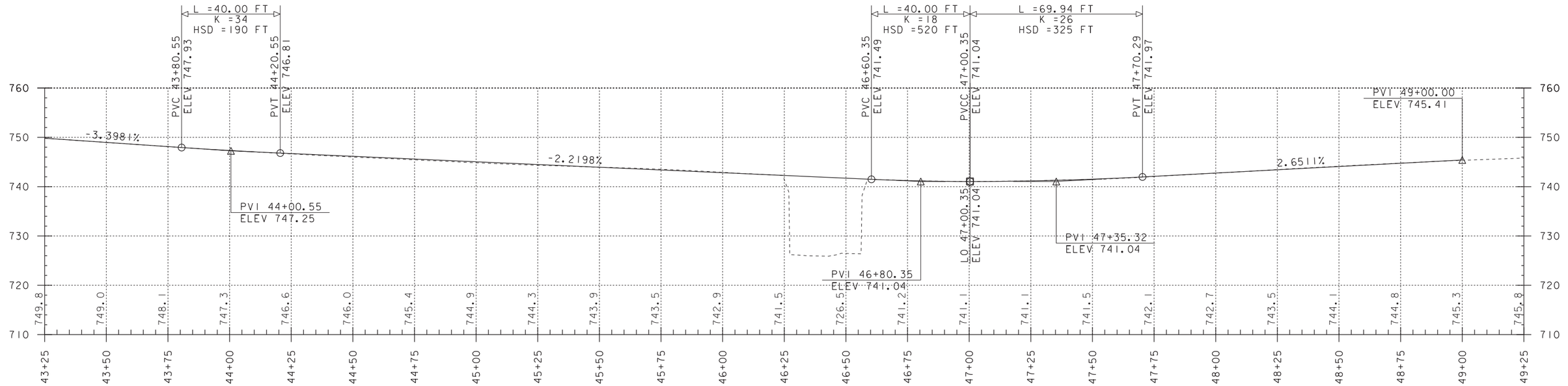
BENCHMARK
CHISELED SQUARE
ON HEADWALL
ELEV=744.97

BENCHMARK
RAIL ROAD SPIKE
IN TREE
ELEV=746.00

EXISTING CONDITIONS

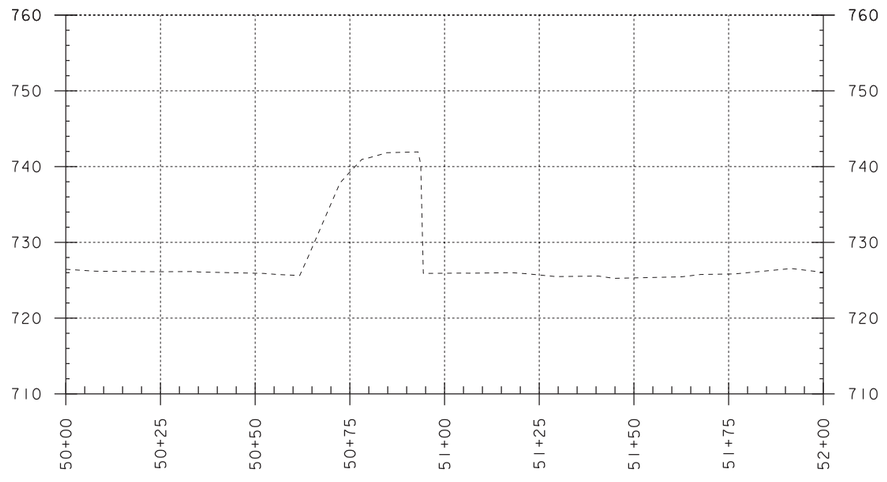
SCALE 1" = 20'-0"
20 0 20

PROJECT NAME:	BRAINTREE
PROJECT NUMBER:	BF 0241(51)
FILE NAME:	I2c578/sI2c578border.dgn
PROJECT LEADER:	N.WARK
DESIGNED BY:	L.J.STONE
EXISTING CONDITIONS LAYOUT SHEET	
PLOT DATE:	05-FEB-2019
DRAWN BY:	D.D.BEARD
CHECKED BY:	L.J.STONE
SHEET	1 OF 14



VT ROUTE 12 PROFILE

SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"

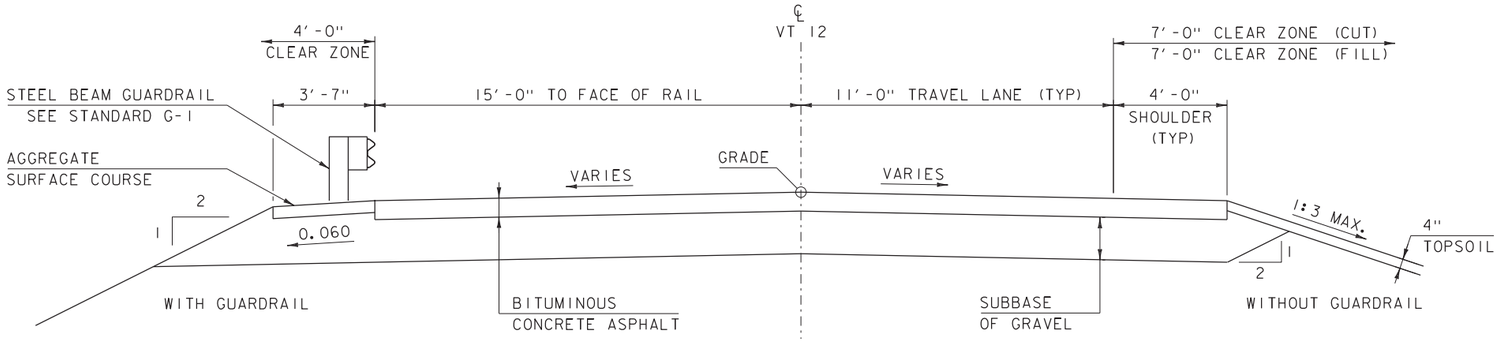


AYERS BROOK PROFILE

SCALE: HORIZONTAL 1"=20'-0"
VERTICAL 1"=10'-0"

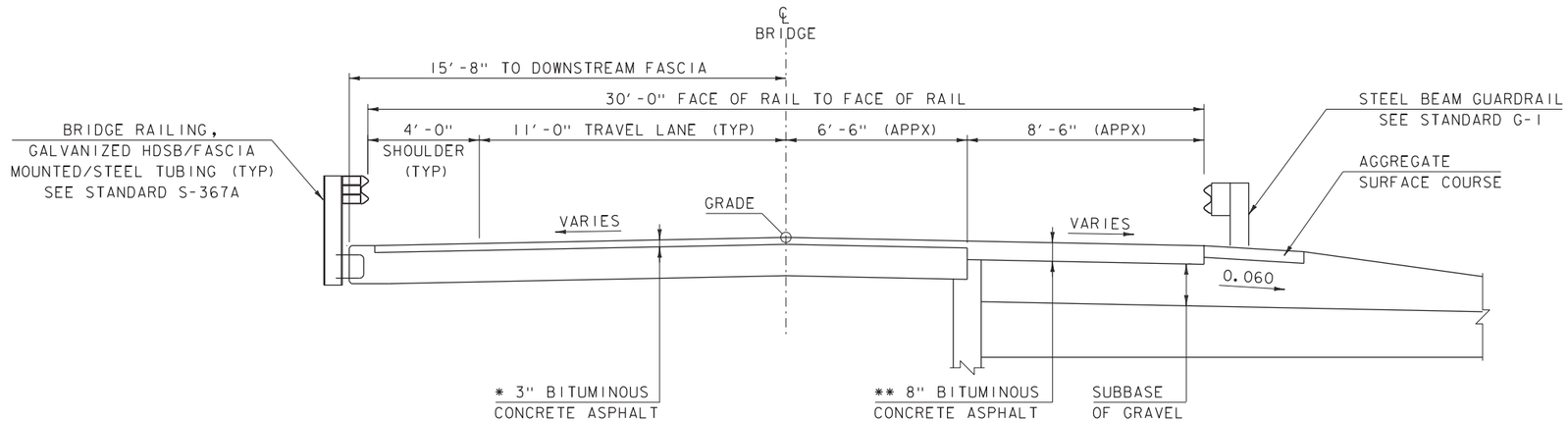
NOTE:
GRADES SHOWN TO THE NEAREST TENTH ARE EXISTING GROUND ALONG ℄
GRADES SHOWN TO THE NEAREST HUNDREDTH ARE FINISH GRADE ALONG ℄

PROJECT NAME:	BRAINTREE
PROJECT NUMBER:	BF 0241(51)
FILE NAME:	12c578/sl2c578profile.dgn
PROJECT LEADER:	N.WARK
DESIGNED BY:	L.J.STONE
PROFILE SHEET	
PLOT DATE:	05-FEB-2019
DRAWN BY:	D.D.BEARD
CHECKED BY:	L.J.STONE
SHEET	2 OF 14



PROPOSED VT 12 TYPICAL SECTION

SCALE 3/8" = 1'-0"

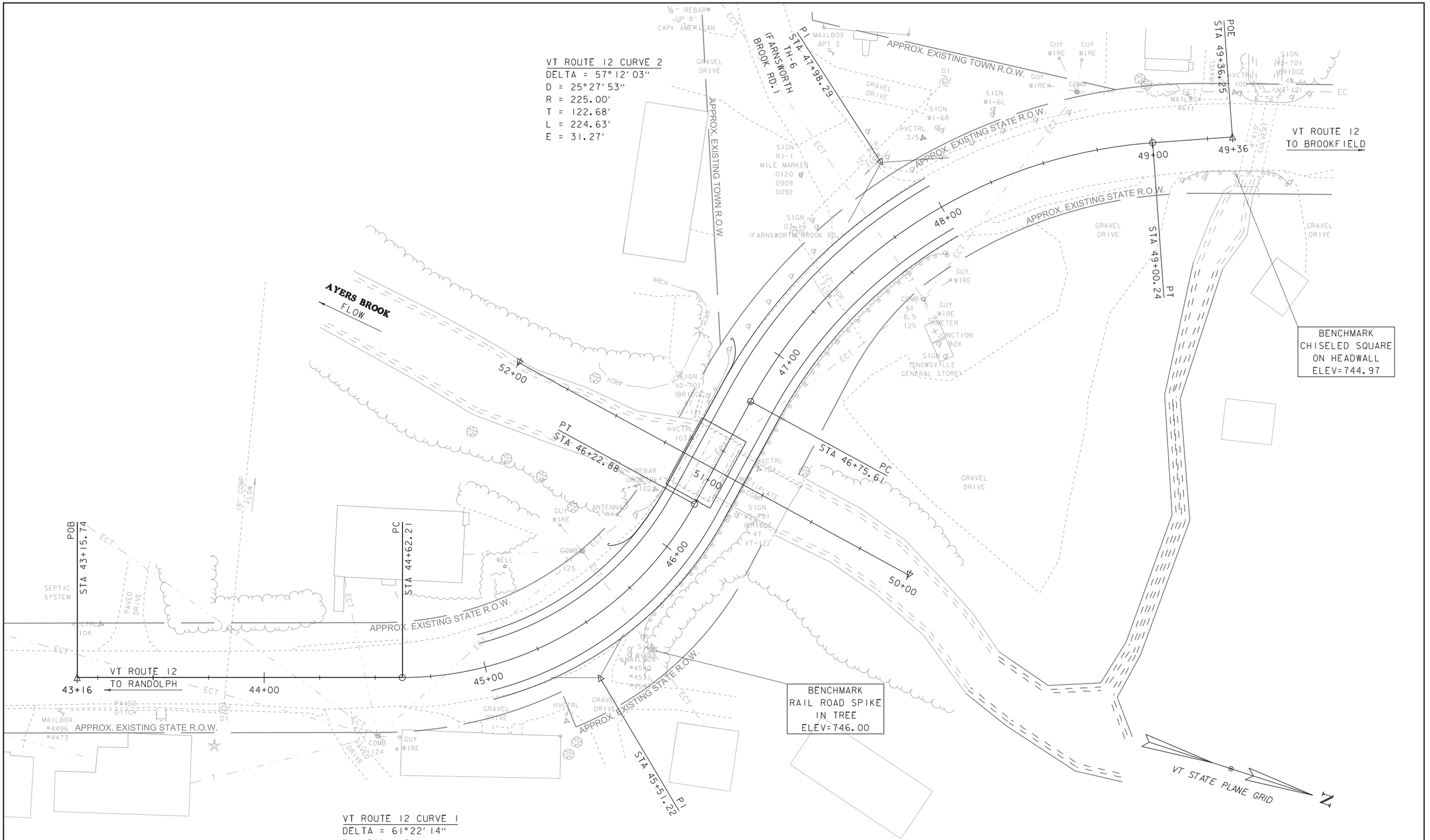


FLOW

PARTIAL SUPERSTRUCTURE REPLACEMENT TYPICAL SECTION

SCALE 3/8" = 1'-0"

PROJECT NAME:	BRAINTREE
PROJECT NUMBER:	BF 0241(51)
FILE NAME: l2c578\sl2c578typ.dgn	PLOT DATE: 05-FEB-2019
PROJECT LEADER: N.WARK	DRAWN BY: D.D.BEARD
DESIGNED BY: L.J.STONE	CHECKED BY: L.J.STONE
PARTIAL SUB REPLACEMENT TYP SEC	SHEET 3 OF 14



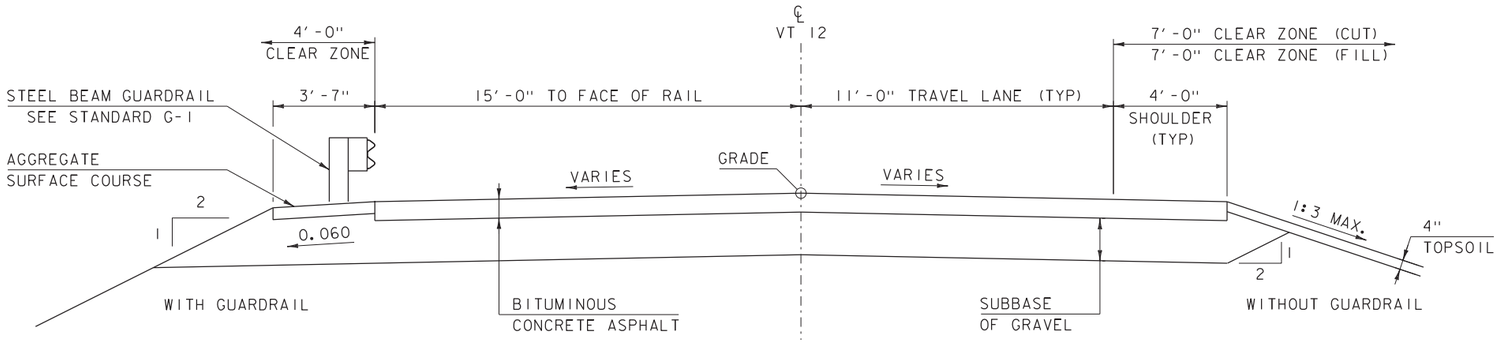
VT ROUTE 12 CURVE 1
DELTA = 61°22'14"
D = 38°11'50"
R = 150.00'
T = 89.01'
L = 160.67'
E = 24.42'

EXISTING BRIDGE INFORMATION
T-BEAM BRIDGE BUILT 1928
MULTI PLATE ARCH ADDED 1969
SPAN LENGTH 33'-0"

PARTIAL SUPERSTRUCTURE REPLACEMENT LAYOUT

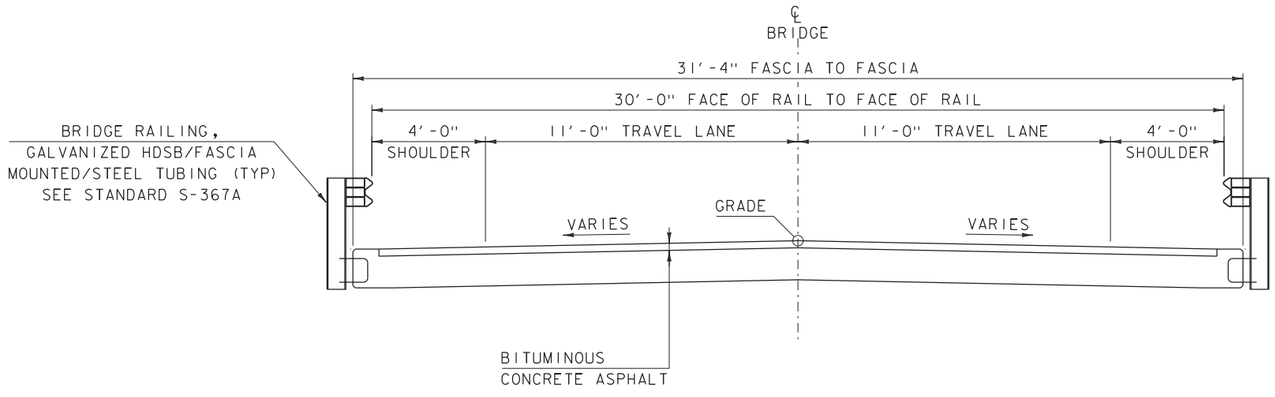
SCALE 1" = 20'-0"
20 0 20

PROJECT NAME:	BRAINTREE
PROJECT NUMBER:	BF 0241(51)
FILE NAME:	I2c578/sI2c578border.dgn
PROJECT LEADER:	N.WARK
DESIGNED BY:	L.J.STONE
PART SUPER REPLACEMENT LAYOUT SHEET	
PLOT DATE:	05-FEB-2019
DRAWN BY:	D.D.BEARD
CHECKED BY:	L.J.STONE
SHEET	4 OF 14



PROPOSED VT 12 TYPICAL SECTION

SCALE 3/8" = 1'-0"



FLOW

FULL BRIDGE REPLACEMENT BRIDGE TYPICAL SECTION

SCALE 3/8" = 1'-0"

PROJECT NAME:	BRAINTREE
PROJECT NUMBER:	BF 0241(51)
FILE NAME: 12c578\sl2c578typ.dgn	PLOT DATE: 05-FEB-2019
PROJECT LEADER: N.WARK	DRAWN BY: D.D.BEARD
DESIGNED BY: L.J.STONE	CHECKED BY: L.J.STONE
FULL BRIDGE REPLACEMENT TYPICAL SECTION	SHEET 5 OF 14

VT ROUTE 12 CURVE 2
DELTA = 57°12'03"
D = 25°27'53"
R = 225.00'
T = 122.68'
L = 224.63'
E = 31.27'

VT ROUTE 12 CURVE 1
DELTA = 61°22'14"
D = 38°11'50"
R = 150.00'
T = 89.01'
L = 160.67'
E = 24.42'

EXISTING BRIDGE INFORMATION
T-BEAM BRIDGE BUILT 1928
MULTI PLATE ARCH ADDED 1969
SPAN LENGTH 33'-0"

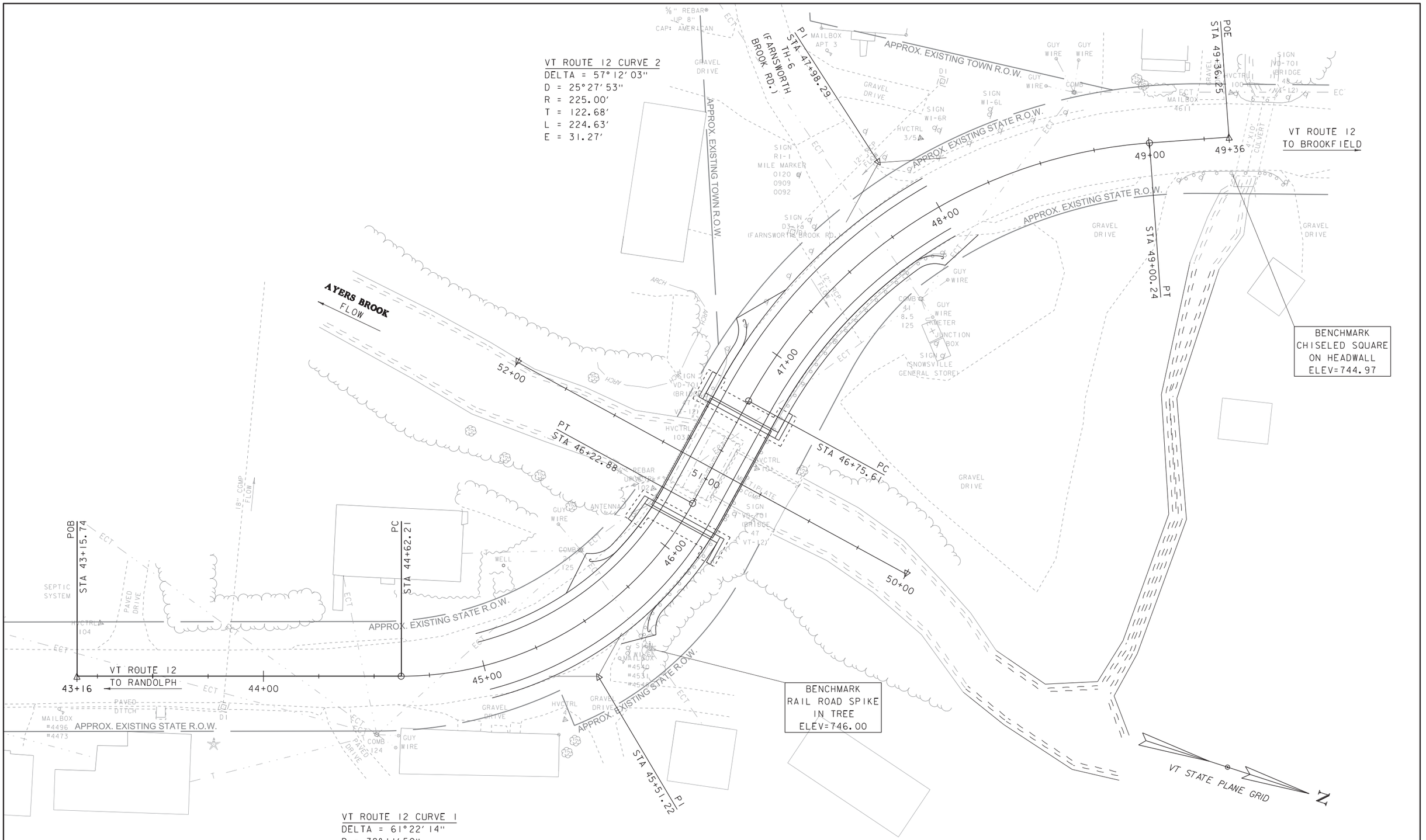
INTEGRAL ABUTMENT - FULL BRIDGE REPLACEMENT LAYOUT

SCALE 1" = 20'-0"
20 0 20

BENCHMARK
CHISELED SQUARE
ON HEADWALL
ELEV=744.97

BENCHMARK
RAIL ROAD SPICE
IN TREE
ELEV=746.00

PROJECT NAME:	BRAINTREE
PROJECT NUMBER:	BF 0241(51)
FILE NAME:	I2c578/sI2c578border.dgn
PROJECT LEADER:	N.WARK
DESIGNED BY:	L.J.STONE
INT ABUT-BRIDGE REPLACE LAYOUT SHEET	
PLOT DATE:	05-FEB-2019
DRAWN BY:	D.D.BEARD
CHECKED BY:	L.J.STONE
SHEET	6 OF 14



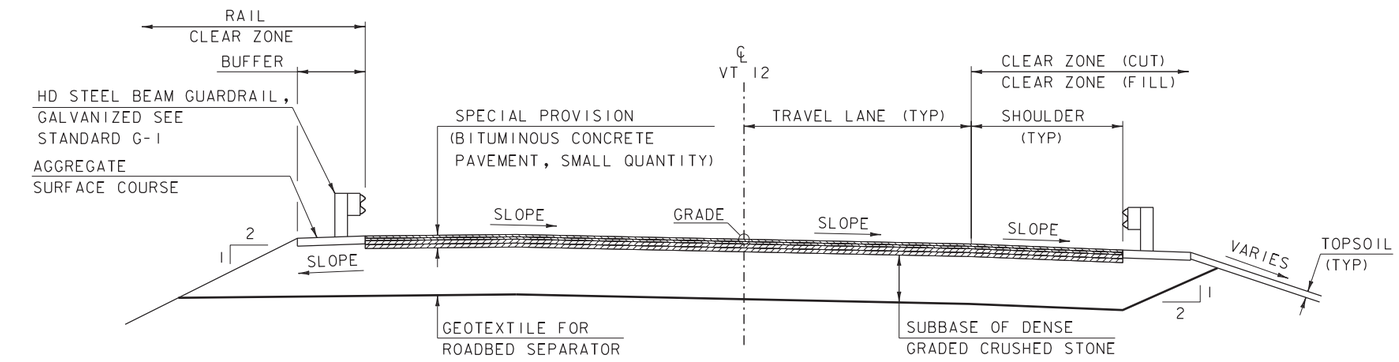
VT ROUTE 12 CURVE 1
DELTA = 61°22'14"
D = 38°11'50"
R = 150.00'
T = 89.01'
L = 160.67'
E = 24.42'

EXISTING BRIDGE INFORMATION
T-BEAM BRIDGE BUILT 1928
MULTI PLATE ARCH ADDED 1969
SPAN LENGTH 33'-0"

SPREAD FOOTING - FULL BRIDGE REPLACEMENT LAYOUT

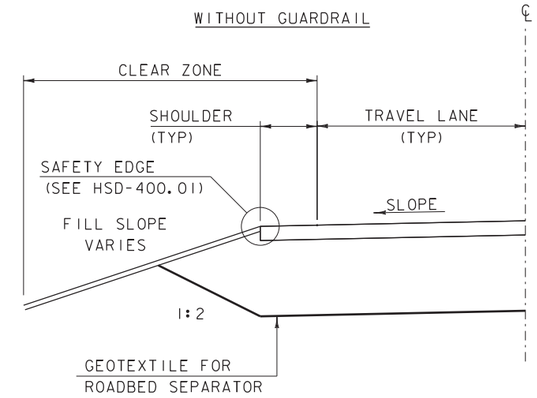
SCALE 1" = 20'-0"
20 0 20

PROJECT NAME:	BRAINTREE
PROJECT NUMBER:	BF 0241(51)
FILE NAME:	I2c578/sI2c578border.dgn
PLOT DATE:	05-FEB-2019
PROJECT LEADER:	N.WARK
DRAWN BY:	D.D.BEARD
DESIGNED BY:	L.J.STONE
CHECKED BY:	L.J.STONE
SPREAD FOOT-BRIDGE REPLACE LAYOUT SHEET	SHEET 7 OF 14



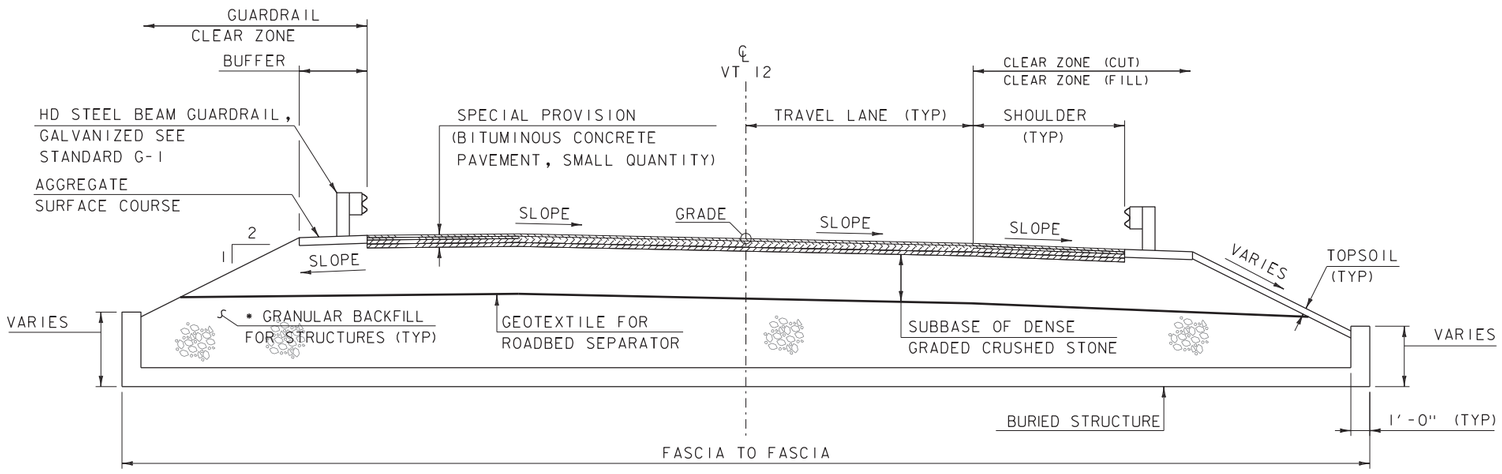
VT ROUTE 12 TYPICAL SECTION

SCALE: 1/4" = 1'-0"



ROADWAY TYPICAL SECTION

NOT TO SCALE



BURIED STRUCTURE REPLACEMENT TYPICAL SECTION

SCALE: 1/4" = 1'-0"

ROAD TYPICAL INFORMATION

	LEFT		RIGHT	
	WIDTH	SLOPE	WIDTH	SLOPE
TRAVEL LANE	11'-0"	VARIES	11'-0"	VARIES
SHOULDER	4'-0"	VARIES	4'-0"	VARIES
BUFFER	3'-7"	-0.060	3'-7"	-0.060
FILL SLOPE	---	VARIES	---	VARIES
CLEAR ZONE (CUT)	7'-0"	---	7'-0"	---
CLEAR ZONE (FILL)	7'-0"	---	7'-0"	---
CLEAR ZONE (GUARDRAIL)	4'-9"	---	4'-9"	---

MATERIAL INFORMATION

	THICKNESS	TYPE
WEARING COURSE	1½"	SPECIAL PROVISION (BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY) (TYPE IVS)
BINDER COURSE	1½"	SPECIAL PROVISION (BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY) (TYPE IVS)
BASE COURSE #2	2½"	SPECIAL PROVISION (BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY) (TYPE IIS)
BASE COURSE #1	2½"	SPECIAL PROVISION (BITUMINOUS CONCRETE PAVEMENT, SMALL QUANTITY) (TYPE IIS)
BUFFER	8"	AGGREGATE SURFACE COURSE
SUBBASE	XX"	SUBBASE OF DENSE GRADED CRUSHED STONE
TOPSOIL	4"	TOPSOIL

TACK COAT: EMULSIFIED ASPHALT IS TO BE APPLIED AT A RATE OF 0.025 GAL/SY BETWEEN SUCCESSIVE COURSES OF PAVEMENT AND 0.080 GAL/SY ON COLD PLANED SURFACES AS DIRECTED BY THE ENGINEER.

MATERIAL TOLERANCES

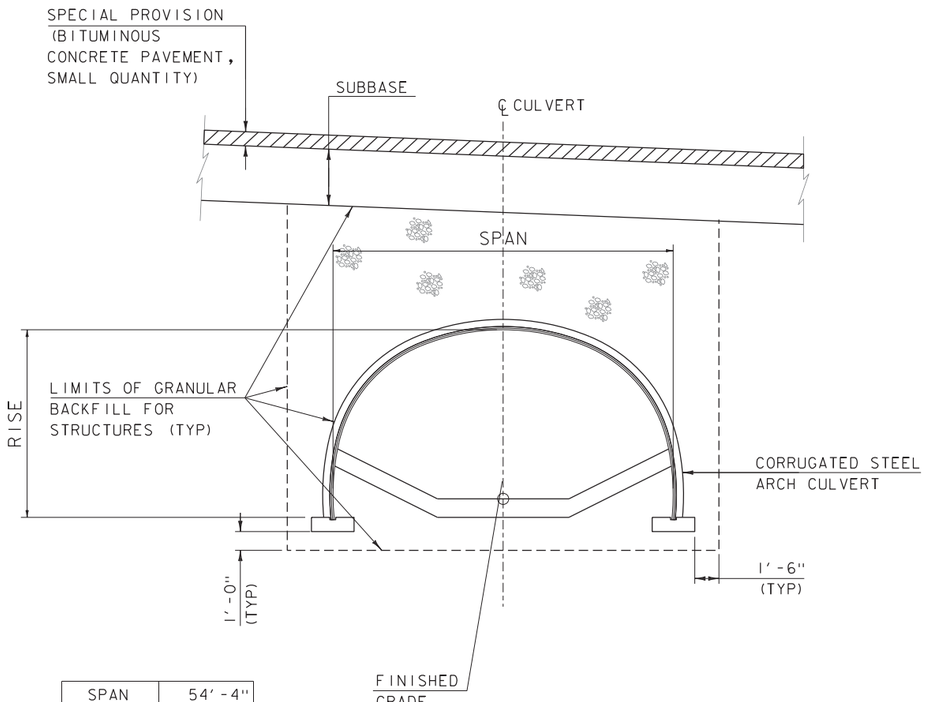
(IF USED ON PROJECT)

SURFACE	
- PAVEMENT (TOTAL THICKNESS)	+/- 1/4"
- AGGREGATE SURFACE COURSE	+/- 1/2"
SUBBASE	+/- 1"
SAND BORROW	+/- 1"

PROJECT NAME: BRAINTREE
PROJECT NUMBER: BF 024I(51)

FILE NAME: I2c578\sI2c578typ.dgn
PROJECT LEADER: N.WARK
DESIGNED BY: L.J.STONE
CULVERT REPLACEMENT TYP SEC SHEET 1

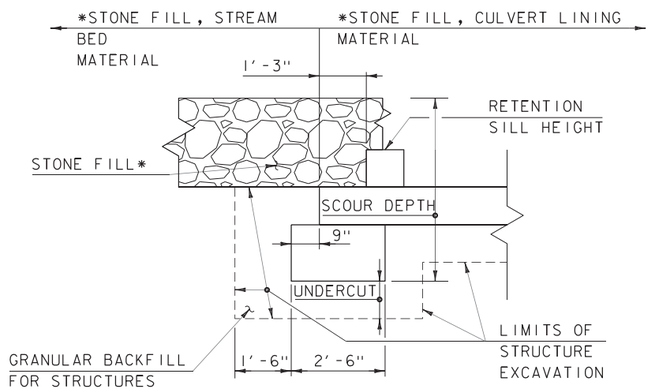
PLOT DATE: 05-FEB-2019
DRAWN BY: D.D.BEARD
CHECKED BY: L.J.STONE



SPAN	54'-4"
RISE	27'-2"
LENGTH	77'-0"

ARCH CULVERT TYPICAL SECTION

NOT TO SCALE



CUTOFF WALL TYPICAL SECTION

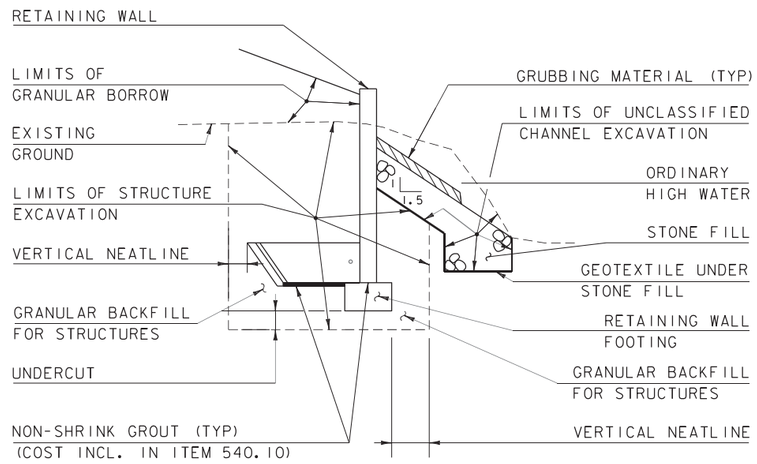
NOTE:

NOT TO SCALE

THE CUTOFF WALL MAY BE OMITTED IF THE DEPTH OF CULVERT LINING MATERIAL PLUS THE THICKNESS TO THE BOTTOM OF THE BOX MEETS OR EXCEEDS THE LISTED SCOUR DEPTH.

CUTOFF WALL - CRITICAL DIMENSIONS

	DIMENSION
SCOUR DEPTH	4'-0"
RETENTION SILL HEIGHT	1'-0"
UNDERCUT	1'-0"

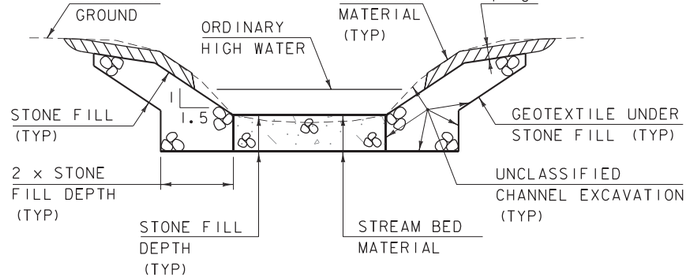


RETAINING WALL EARTHWORK TYPICAL SECTION

NOT TO SCALE

NOTE:

TOP OF RETAINING WALL FOOTING SHALL BE AT OR BELOW BOTTOM OF BOX CULVERT.



TYPICAL CHANNEL SECTION

(NOT TO SCALE)

1) WHENEVER CHANNEL SLOPE INTERSECTS ROADWAY SUBBASE, GRUBBING MATERIAL SHALL BEGIN AT THE BOTTOM OF SUBBASE.

2) THE CONTRACTOR SHALL CREATE A LOW FLOW CHANNEL IN THE STREAM BED MATERIAL AS DIRECTED BY THE ENGINEER.

3) GRUBBING MATERIAL SHALL BE PLACED UNDERNEATH STRUCTURES WHERE THERE IS MORE THAN 6 FEET VERTICALLY FROM ORDINARY HIGH WATER (OHW) TO THE BOTTOM OF SUPERSTRUCTURE AND MORE THAN 6 FEET HORIZONTALLY FROM OHW LINE TO FRONT FACE OF ABUTMENT. THIS MATERIAL SHALL START JUST ABOVE THE OHW ELEVATION AND TERMINATE 3 FEET HORIZONTALLY FROM THE FRONT FACE OF THE ABUTMENT. THIS MATERIAL SHALL NOT BE PLACED UNDERNEATH DOWNSPOUTS. SEE THE CHANNEL SECTIONS FOR ADDITIONAL DETAILING.

MATERIAL INFORMATION

	THICKNESS	TYPE
STONE FILL	3'-0"	TYPE III
STONE FILL, CULVERT LINING	2'-0"	E-STONE TYPE II
STONE FILL, STREAM BED MATERIAL	2'-0"	E-STONE TYPE II

RETAINING WALL - ASSUMED DIMENSIONS

LEVELING PAD	
	DIMENSION
WIDTH	2'-6"
TOE	0'-9"
HEEL	0'-9"
THICKNESS	1'-0"
UNDERCUT	1'-0"
WALL	
THICKNESS	1'-0"
HEIGHT	VARIES
EXCAVATION LIMITS	
VERTICAL NEATLINE	1'-6"
UNDERCUT	1'-0"

PROJECT NAME: ENOSBURG
PROJECT NUMBER: BF 0283(42)

FILE NAME: l2c584/sl2c584typ.dgn
PROJECT LEADER: N. WARK
DESIGNED BY: L.J.STONE
ALTERNATIVE 2 TYPICAL SECTION SHEET 2

PLOT DATE: 05-FEB-2019
DRAWN BY: D.D.BEARD
CHECKED BY: L.J.STONE
SHEET 9 OF 14

VT ROUTE 12 CURVE 2
DELTA = 57°12'03"
D = 25°27'53"
R = 225.00'
T = 122.68'
L = 224.63'
E = 31.27'

VT ROUTE 12 CURVE 1
DELTA = 61°22'14"
D = 38°11'50"
R = 150.00'
T = 89.01'
L = 160.67'
E = 24.42'

EXISTING BRIDGE INFORMATION
T-BEAM BRIDGE BUILT 1928
MULTI PLATE ARCH ADDED 1969
SPAN LENGTH 33'-0"

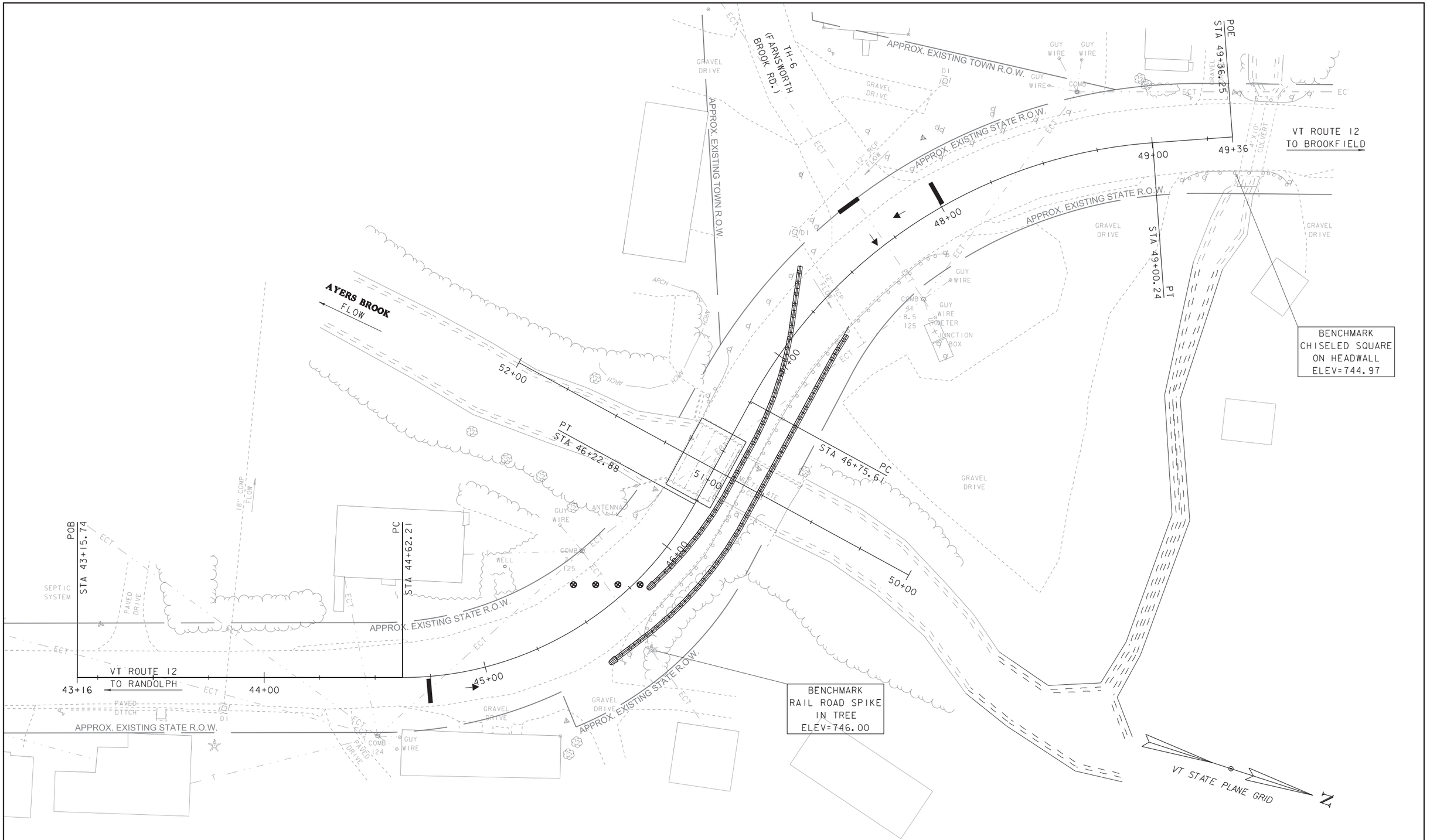
BENCHMARK
CHISELED SQUARE
ON HEADWALL
ELEV=744.97

BENCHMARK
RAIL ROAD SPIKE
IN TREE
ELEV=746.00

BURIED STRUCTURE - FULL BRIDGE REPLACEMENT LAYOUT

SCALE 1" = 20'-0"
20 0 20

PROJECT NAME:	BRAINTREE
PROJECT NUMBER:	BF 0241(51)
FILE NAME:	I2c578/sI2c578border.dgn
PROJECT LEADER:	N.WARK
DESIGNED BY:	L.J.STONE
BURIED STRUCTURE REPLACE LAYOUT SHEET	
PLOT DATE:	05-FEB-2019
DRAWN BY:	D.D.BEARD
CHECKED BY:	L.J.STONE
SHEET	10 OF 14

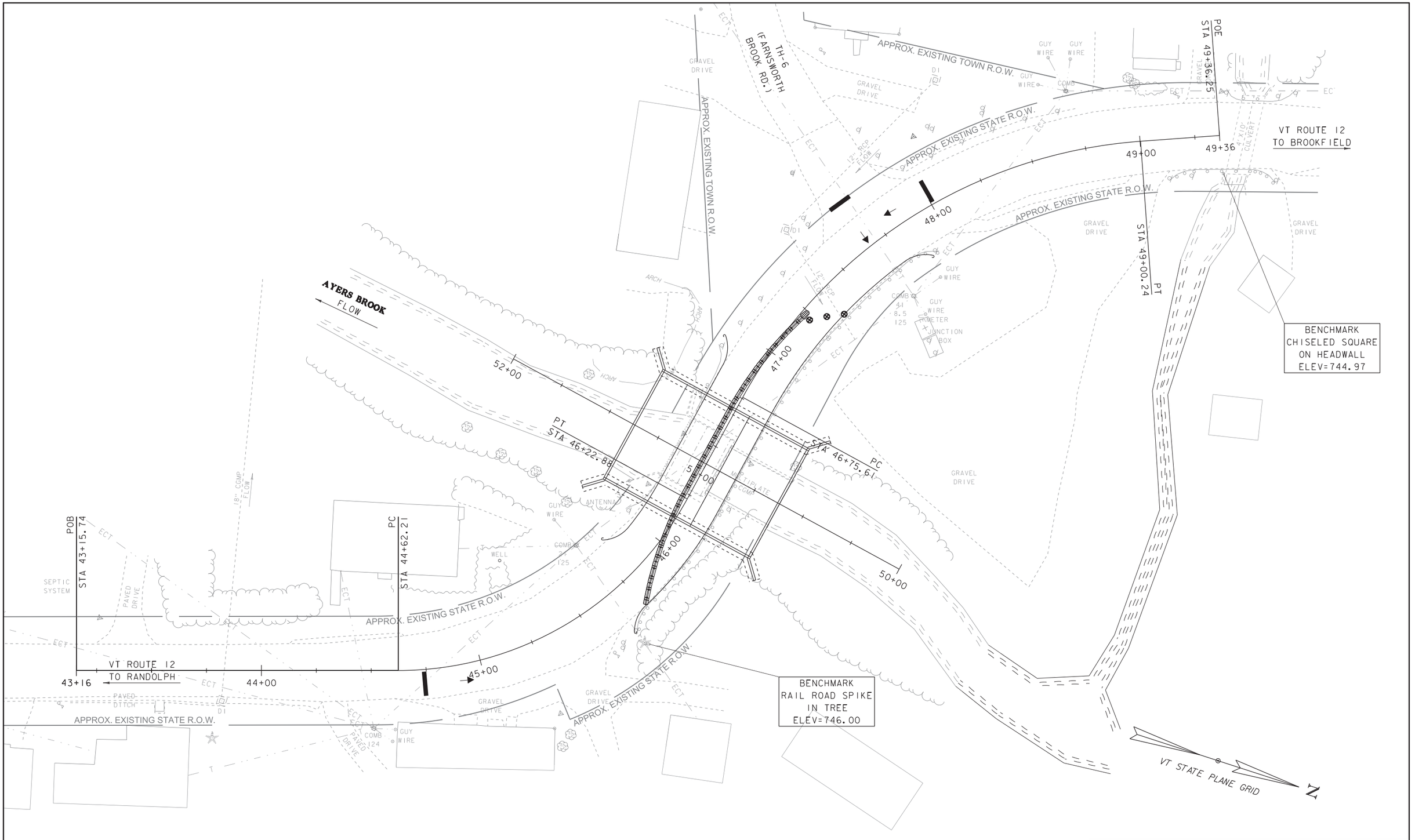


EXISTING BRIDGE INFORMATION
T-BEAM BRIDGE BUILT 1928
MULTI PLATE ARCH ADDED 1969
SPAN LENGTH 33'-0"

PHASE I LAYOUT

SCALE 1" = 20'-0"
20 0 20

PROJECT NAME:	BRAINTREE
PROJECT NUMBER:	BF 0241(51)
FILE NAME:	I2c578/sI2c578TCborder.dgn
PROJECT LEADER:	N.WARK
DESIGNED BY:	L.J.STONE
PHASE I LAYOUT SHEET	
PLOT DATE:	05-FEB-2019
DRAWN BY:	D.D.BEARD
CHECKED BY:	L.J.STONE
SHEET	II OF 14



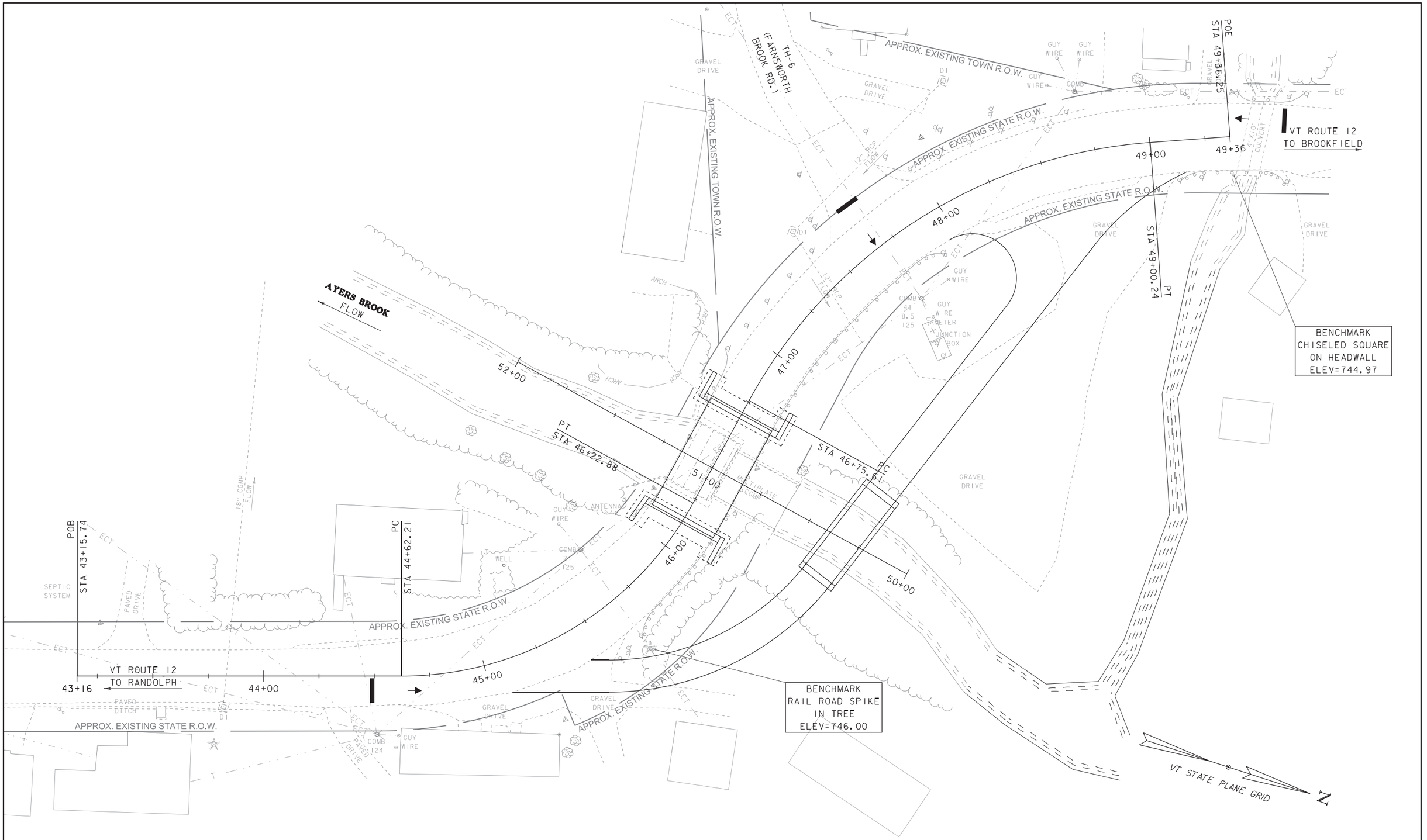
PHASE 2 LAYOUT

SCALE 1" = 20'-0"

20 0 20

EXISTING BRIDGE INFORMATION
T-BEAM BRIDGE BUILT 1928
MULTI PLATE ARCH ADDED 1969
SPAN LENGTH 33'-0"

PROJECT NAME:	BRAINTREE
PROJECT NUMBER:	BF 0241(51)
FILE NAME:	12c578/sl2c578TCborder.dgn
PROJECT LEADER:	N.WARK
DESIGNED BY:	L.J.STONE
PHASE 2 LAYOUT SHEET	
PLOT DATE:	05-FEB-2019
DRAWN BY:	D.D.BEARD
CHECKED BY:	L.J.STONE
SHEET	12 OF 14

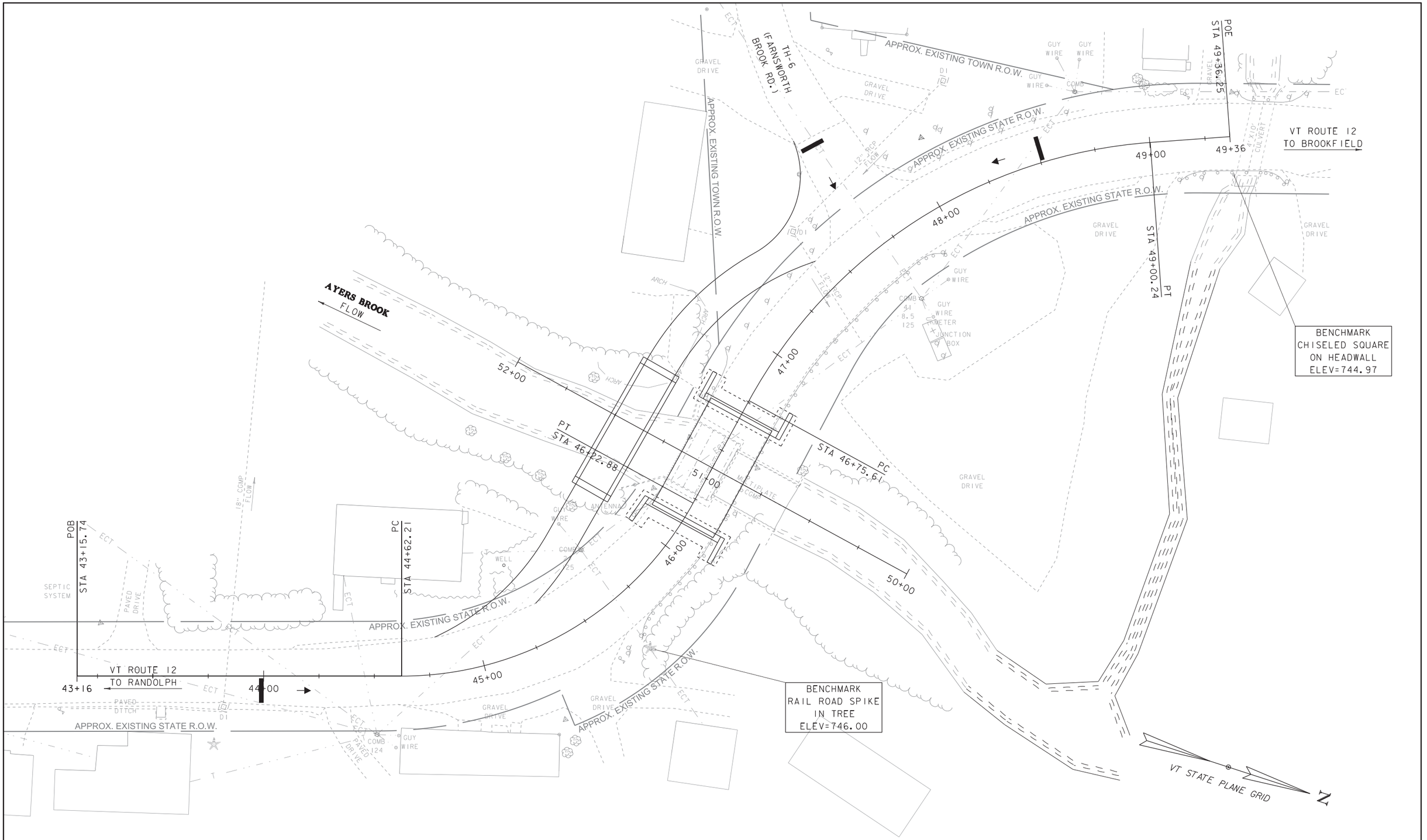


UPSTREAM TEMPORARY BRIDGE LAYOUT

SCALE 1" = 20'-0"
20 0 20

EXISTING BRIDGE INFORMATION
T-BEAM BRIDGE BUILT 1928
MULTI PLATE ARCH ADDED 1969
SPAN LENGTH 33'-0"

PROJECT NAME:	BRAINTREE
PROJECT NUMBER:	BF 0241(51)
FILE NAME:	I2c578/sI2c578TCborder.dgn
PROJECT LEADER:	N.WARK
DESIGNED BY:	L.J.STONE
UPSTREAM TEMP BRIDGE LAYOUT SHEET	
PLOT DATE:	05-FEB-2019
DRAWN BY:	D.D.BEARD
CHECKED BY:	L.J.STONE
SHEET	13 OF 14



DOWNSTREAM TEMPORARY BRIDGE LAYOUT

SCALE 1" = 20'-0"
20 0 20

EXISTING BRIDGE INFORMATION
T-BEAM BRIDGE BUILT 1928
MULTI PLATE ARCH ADDED 1969
SPAN LENGTH 33'-0"

PROJECT NAME:	BRAINTREE
PROJECT NUMBER:	BF 0241(51)
FILE NAME:	12c578/sl2c578TCborder.dgn
PROJECT LEADER:	N.WARK
DESIGNED BY:	L.J.STONE
DOWNSTREAM TEMP BRIDGE LAYOUT SHEET	
PLOT DATE:	05-FEB-2019
DRAWN BY:	D.D.BEARD
CHECKED BY:	L.J.STONE
SHEET	14 OF 14