**STATE OF VERMONT**
**AGENCY OF TRANSPORTATION**

# Transportation Management Plan

**FOR**

# Woodstock Village BF 020-2(43)

## US ROUTE 4, BRIDGE 51 OVER KEDRON BROOK

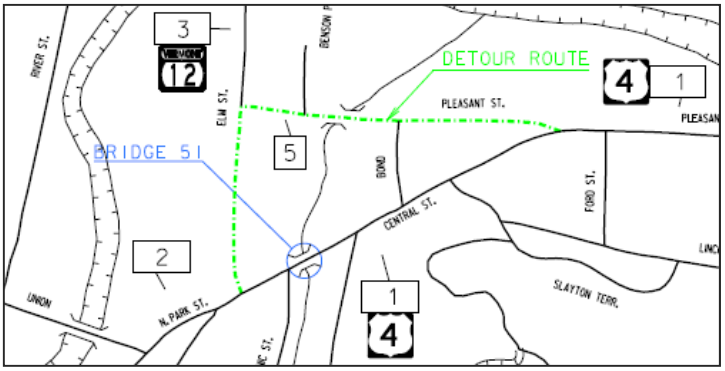
June 20, 2017


**This document shall be provided to the Resident Engineer prior to the preconstruction meeting.**

# Table of Contents

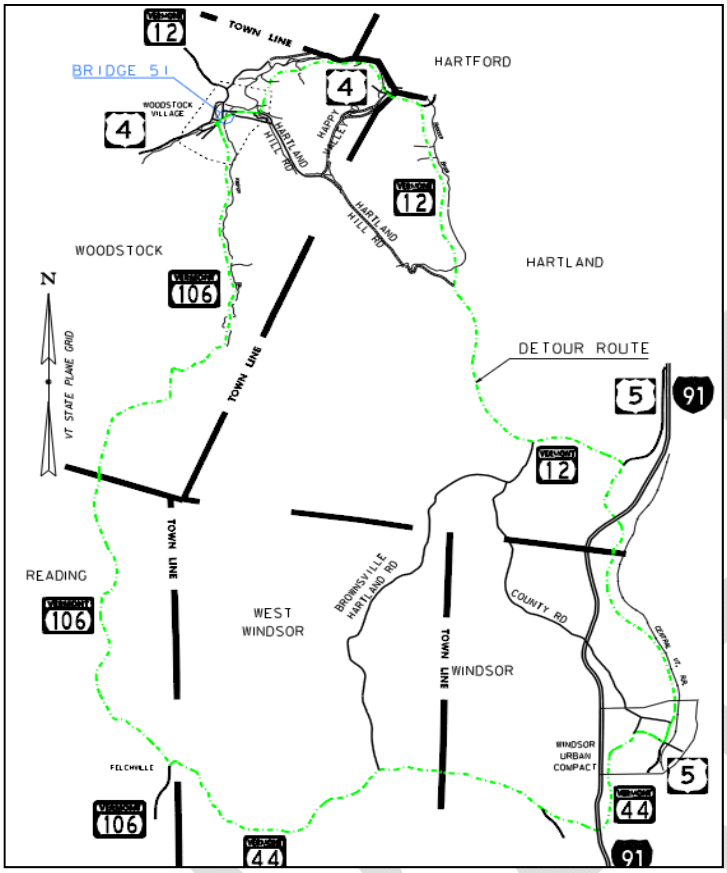
# 1.0 Project Description

- **Project Location**
  - Village of Woodstock in Windsor County on US Route 4 over the Kedron Brook. The bridge is located approximately 0.2 miles east of the intersection of US Route 4 and Vermont Route 106.
- **Work zone limits**
  - Station 333+90 (Begin Approach) to Station 335+40 (End Approach)
- **Project background information.**
  - The Woodstock Village Bridge 51 project will replace the existing concrete T-beams, which are in fair condition with a new superstructure matching the existing geometry. The existing bridge is hydraulically inadequate which will remain substandard, due to site constraints. The existing bridge is a historic single-span concrete T-beam bridge with an ornamental concrete parapet railing constructed in 1935. Bridge 51 is nominally 34-feet long and has a deck and superstructure that are in fair condition and a substructure that is in good condition.
  - The new superstructure will be erected using prefabricated bridge elements to reduce onsite construction time and bridge closure period. Prefabricated bridge structures have comparatively low construction and maintenance costs. The new superstructure will be the same length and 56-feet wide to match the existing cross section. There will be two 11-foot travel lanes, 8' parking lane on the left, 8'-6" parking lane on the right, 8'-6" sidewalk on the left, and 7' sidewalk on the right. The new superstructure will feature a bridge and approach railing that compliments the Woodstock Village Historic District. The existing bridge seats will be cut down and new bridge seats will be cast-in-place to accommodate the new superstructure. Additionally, several drainage inlets will be adjusted as part of this project.
- **Specific traffic restrictions expected on major roadways during the work**
  - There will be an allowable 21 day road closure on US Route 4. In the seven days prior to the bridge closure period, traffic may be limited to a minimum of one lane, two-way traffic. Closure of the bridge on US Route 4 will directly impact truck traffic trying to get to Vermont Route 12. The sidewalks on both sides of the bridge may be closed for an additional two weeks prior to and three weeks after the bridge closure period. Parking spaces on each side of the bridge do not have to be restored until three weeks after the end of the bridge closure period.
- **Specific roadways that will be directly affected by the project work zones.**




o Local Passenger Car Detour Route

US Route 4 to Pleasant St/VT-12, and Elm Street, back to US Route 4




Regional Truck Detour

US Route 4, to VT Route 12, US Route 5, VT Route 44, VT Route 106, back to US Route 4

- **Regional projects that may impact each other**
  - The Killington BF 020-2(42) project is located on US Route 4 approximately 1.0 mile west of the intersection of US Route 4 and VT Route 100. The Killington project will replace Bridge 33 during a 10 day closure period and will likely be constructed in the summer of 2018. The regional detour for bridge 33 will be US Route 4, to VT Route 12, VT Route 107, VT Route 100, back to US Route 4.
  - The Woodstock STP SRIN(44) project is located on US Route 4 in Woodstock. As part of the project new sidewalks, pedestrian islands, and speed feedback signs will be installed between the months of January and July in 2018. Contact Tina Bohl for updates on the project.
  - The Woodstock NH SCRP(16) project is located approximately 600 feet to the east of the intersection between US 4 and Valley View Rd. The culvert replacement is scheduled for the summer of 2019. Contact Bruce Martin for updates on the project.
  - The Hartland STP FPAV(8) project is located along VT 12 in Hartland. Between US Route 5 and Us route 4 are to be Paved. Currently this project is scheduled for the Fall of 2017. Contact Jonathan Harrington for updates on the project.
- **Project schedule**
  - Target Construction Schedule: Construction activities will likely take place beginning in April 2018 and last one construction season.

- Traffic Maintenance: The bridge will be closed for three weeks, and traffic will be maintained on an offsite detour. The local and regional detours will be signed and maintained by the Agency of Transportation.

## 2.0 TMP Team—Roles and Responsibilities

Defining roles and responsibilities from the initial stages of a project helps to coordinate all the activities related to TMP development, implementation, and monitoring. This section includes contact information and roles and responsibilities for major personnel involved in the project.

- **TMP Development Managers**—Agency/Contractor personnel with the primary responsibility for developing the TMP.
- **TMP Implementation Managers**—Agency/Contractor personnel primarily responsible for implementing the TMP.
- **TMP Implementation Task Leaders**—Agency personnel/Contractor personnel who manage, complete, oversee, or assist in specific transportation management tasks (examples include TTC inspection/supervision, PI Officer, etc.) during the work.
- **Public Information Officer**—Agency personnel who provide real-time public awareness of the work zone, including detection, prevention, and response to incidents.
- **Emergency Contacts**—Public or semi-public agencies (e.g., hospitals, schools) that need to be kept informed about work zone activities, especially in case of a road closures.

Contact information and roles and responsibilities of major personnel involved in the project. (These tables can be modified to meet agency needs.)

| **TMP Development Managers** | |
|---|---|
| **Agency of Transportation (AOT) DPM** | **Consultant** |
| Name/Title: Rob Young<br>Unit: Structures<br>Phone: 802-828-0052<br>Email: rob.young@vermont.gov | Name/Title: TBD<br>Unit:<br>Phone:<br>Email: |
| **Roles and Responsibilities:** Development of the Traffic Management Plan | |
| **TMP Implementation/Monitoring Managers** | |
| **AOT Resident Engineer** | **Consultant** |
| Name/Title: TBD<br>Unit:<br>Phone:<br>Email: | Name/Title: TBD<br>Unit:<br>Phone:<br>Email: |
| **Roles and Responsibilities:** Implementing the Traffic Management Plan | |

| **TMP Implementation Task Leaders** |
|---|

| AOT Regional Construction Engineer | Consultant |
|---|---|
| Name/Title:<br>Unit: Construction<br>Phone:<br>Email: | Name/Title: TBD<br>Unit:<br>Phone:<br>Email: |
| **Roles and Responsibilities:** | |

| Public Information Officer | |
|---|---|
| **AOT** | **Consultant** |
| Name/Title: TBD<br>Unit:<br>Phone:<br>Email: | Name/Title: Joanne Frascella/Senior Supervising Planner<br>WSP \| Parsons Brinckerhoff<br>75 Arlington Street, 9th Floor<br>Boston, MA 02116<br>Office Phone: 617 960 4948<br>Mobile Phone: 978 500 5455 Phone: 617-960-4948<br>Email: Frascella@pbworld.com |
| **Roles and Responsibilities:** | |

| Emergency Service Contacts | |
|---|---|
| **Fire and Emergency Medical Services (FEMS)** | **Woodstock Police Department (PD)** |
| Name/Title: Town of Woodstock Fire Department<br>Address: 454 Woodstock Rd., Woodstock, VT 05091<br>Phone: 802-457-2337<br>Email: | Name/Title: Robbie Blish/Chief of Police<br>Address: 454 Woodstock Rd., Woodstock, VT 05091 Phone: 802-457-1420<br>Email: |
| **Roles and Responsibilities:** | |

| Contractor | |
|---|---|
| **Contractor** | **Superintendent** |
| Name/Title: TBD<br>Address: | Name/Title: TBD<br>Unit: |

| | |
|---|---|
| Phone:<br>Email: | Phone:<br>Email: |
| **Roles and Responsibilities:** | |
| **Contractors Competent Person** | **Contractors Safety Officer** |
| Name/Title: TBD<br>Unit:<br>Phone:<br>Email: | Name/Title: TBD<br>Unit:<br>Phone:<br>Email: |
| **Roles and Responsibilities:** | |

## 3.0 Preliminary Work Zone Impact Assessment

This preliminary assessment of work zone impacts should be developed in the early planning stages of the project to help identify issues or uncover problem areas that should be considered during project development.

**Preliminary assessment of work zone impacts questionnaire:**

Does the project include a long-term closure and/or an extended weekend closure? If Yes, what is/are the applicable type of facility(ies)?

- Yes, this project includes a 3 week bridge closure on a Principal Arterial. The AADT on US Route 4 is 10,000 vehicles/day. The closure of US 4 will directly impede the ability of trucks to get to VT 12 depending on the direction they are coming from. Additionally, this is a high pedestrian usage bridge, with sidewalks on either side and they will be closed for a period of 8 weeks.

Can traffic be detoured?

- The regional detour route is 39.7 miles end-to-end and adds 31.7 miles to travel distance. The regional detour route would be appropriate for trucks.
- The local detour route is entirely paved and is in good condition.
- The local detour route is 0.56 miles end-to-end and adds 0.06 miles to travel distance. While there may be traffic delays, emergency personnel will not experience a significance increase in additional travel distance. Early coordination with the police and fire departments will result in the greatest success of the project closure.
- There are no load limit restrictions on either the local detour or the truck detour.
- The local detour route is not appropriate for large trucks. There is not enough turning radius available for large trucks to navigate the local detour route and as such should be prohibited from this route.

Is the existing shoulder sufficient to support traffic during construction?

- There is currently no shoulder on the existing roadway. There is an 8 foot wide parking lane. This width is insufficient to accommodate one lane of traffic, a minimum width of 14' is required.

Is additional width required on culverts or bridges to maintain traffic?

- Due to tight site constraints (buildings on either side of the road), it is not possible to widen the bridge.

Is there a pedestrian/bicycle facility that must be maintained?

- Yes, there are sidewalks on both sides of the bridge. There are sidewalks the entire length of the local passenger car detour route for pedestrians and bicycles to use during the bridge closure. This route is 0.56 miles end-to-end. Before and after the bridge closure the sidewalks will be closed to perform work. It is believed that the parking spaces on each side of the bridge can be used as a temporary pedestrian walkway while this work is occurring. Another option to decrease the duration of the sidewalk closure is to phase the work.

Would a temporary structure(s) be required?

- The existing site constraints do not allow room to build a temporary bridge.

Would a median crossover be needed?

- N/A

Would there be a need to maintain railroad traffic?

- N/A

Could maintenance of traffic have an impact on existing or proposed utilities?

- There are extensive underground utilities located in the project area. To limit the impact on maintenance of traffic these utilities are to be lowered or removed during the bridge closure period. The proposed detours will not impact any utilities, so MOT will not have an impact on the existing or proposed utilities.

Does it appear that maintenance of traffic will require additional right-of-way?

- No, detouring traffic will not require additional right-of-way.

Can the contractor restrict the roadway during the time periods listed?

- a.m. peak hours, one direction - No, due to the high AADT, one way traffic will not be permitted at any time outside the BCP
- p.m. peak hours, one direction - No, due to the high AADT, one way traffic will not be permitted at any time outside the BCP
- a.m. peak hours, both directions - only during the allotted 3 week closure period
- p.m. peak hours, both directions - only during the allotted 3 week closure period
- Overnight - only during the allotted 3 week closure period
- Local celebrations - the closure period will be chosen based on Woodstock's schedule of events (see next question for a listing of dates)
- Holidays or weekends - the closure period will be chosen based on Woodstock's schedule of events (see next question for a listing of dates)
- Sporting events/other special events - the closure period will be chosen based on Woodstock's schedule of events (see next question for a listing of dates)

Will project timing (for example, start or end date) be affected by special events?

- Yes, the bridge closure should not occur during holidays or any other special events. The following dates should be taken into consideration when choosing the bridge closure window.
    - Holidays: Memorial day, 4th of July, Labor Day
    - Special events: There are many special events that happen in Woodstock during the summer. The following listing is based on 2014's schedule but it will be similar during the construction year

- May 19-20: Woodstock Sidewalk Sale Days (third weekend)
- May 27: Memorial Day Parade
- June 3: Covered Bridges Half-Marathon
- June 17: Woodstock Alumni Day Parade
- July 27-29: Bookstock Weekend
- Early August: Woodstock Summerfest (Closes Elm Street)
- August 18-19: Naked Table Project
- September 7-8: Woodstock's Art and Wine Festival on the Green
- Fall Foliage Season

Are there any projects to be considered along the corridor or in the region?

- Roadwork in the immediate area that may affect traffic or the contractor's operations?
    - The Woodstock STP SRIN(44) project is located on US Route 4 in Woodstock. As part of the project new sidewalks, pedestrian islands, and speed feedback signs will be installed between the months of January and July in 2018. Contact Tina Bohl for updates on the project.
- Roadwork on other roads that may affect the use of alternate routes?
    - None known of at this time

Are there other maintenance of traffic issues? If so, specify.

- During the design phase, a traffic study for the intersection of Elm Street and Pleasant Street should be conducted. Based on the LOS calculated during the closure period, a temporary traffic signal may be necessary to alleviate congestion.

This project is located in a congested urban area with high daily traffic volumes. Additionally, the bridge is located in the heart of the Village and surrounded by many businesses including the federal post office building. The project should include a quantitative analysis (level of service analysis, signal timing, etc.) to determine the impact levels. Quantitative analysis may indicate the need for some additional analysis and/or strategies to assess and manage the impacts, or it may indicate that impacts are relatively low and few strategies are required beyond the temporary traffic control (TTC) plan.

# 4.0 Existing Conditions

This section provides an overview of the existing conditions within the project area, and includes:

- Roadway characteristics (history, roadway classification, number of lanes, geometrics, urban/suburban/rural).
    - Roadway Classification: Rural Principal Arterial (Class 1 Town Highway on NHS)
    - Roadway/Bridge Lane and Shoulder Widths: 11'/0' (22') with 8' parking lane left and 8'-6" right, and with 8'-6" sidewalk left and 7' right
    - Located in a village setting.
- Historical traffic data (volumes, speed, capacity, volume/capacity, percent trucks, queue length, peak traffic hours).
    - A traffic study of this site was performed by the Vermont Agency of Transportation. The traffic volumes are projected for the years 2017 and 2037.

| TRAFFIC DATA | 2017 | 2037 |
|---|---|---|
| AADT | 10,000 | 10,600 |
| DHV | 1,100 | 1,200 |
| ADTT | 450 | 700 |
| %T | 3.1 | 4.6 |
| %D | 55 | 55 |

  - Posted/Design Speed: 25 mph

- Traffic operations (signal timing, traffic controls).
  - There are no signals located in the project area
  - There are several crosswalks located on US Route 4 in the Project area between Elm Street and Pleasant Street.
- Crash data.
  - The stretch of US Route 4 through the project area has had 22 crashes recorded in the last five-year period. The VTrans Traffic Safety Engineer analyzed the crash data and it was found that the two crosswalks on US 4 at the intersection with Elm Street were the scene of a large proportion of the rear-end crashes that are listed under this HCL Section. The typical crash happened as a pedestrian was crossing US 4 in one of the two crosswalks on US 4 at Elm Street, when a vehicle stopped for the pedestrian and this vehicle got rear-ended by a vehicle that was following from behind. The majority of these crashes were in the westbound direction. Two happened when it was dark (these same two crashes also happened during winter when the crosswalk may not have been visible due to slush or snow).
- Pedestrian/bicycle facilities.
  - There are sidewalks on both sides of the roadway through the project area with heavy pedestrian traffic.
  - There are currently no bicycle facilities through the project area.
- Transit facilities.
  - There is an intercity bus route in the planning phase. This route will run between Rutland and White River Junction and be operated by Premier Coach.
  - There are currently no public transit routes scheduled through the project area.
- Truck routes.
  - US Route 4 is a major connecting route across Vermont between New York and New Hampshire. The truck traffic volume through the project area is 450 trucks per day. During the closure period, trucks must take a regional truck detour, since the local route is not appropriate for trucks. As such, it is recommended that a Public Outreach Coordinator is involved at an early stage to warn truckers ahead of the closure period of the appropriate alternative routes to take. Portable Changeable Message Signs will also be placed before the closure period to warn trucks to find alternate routes depending on where they are driving to.
- Local community and business concerns/issues.

- Comments/concerns regarding traffic operations, delays, access/egress, etc., that have been received from community, business representatives, and stakeholders during the planning and design stages of the project development:
  - The bridge is right in the heart of the village along with key businesses in town. It is adjacent to the post office.
- Specific concerns on pedestrian, bicycle, transit facilities, etc.:
  - None noted at this time

The table below summarizes pertinent project information related to the routes affected by the bridge closure.

| Roadways Affected By Local Passenger Car Detour Route—Summary | | | | | | |
|---|---|---|---|---|---|---|
| Roadway/Street Name | Classification | ADT | Capacity | Peak Hour Volume | Existing LOS | Proposed LOS |
| US Route 4 (Elm ST to Pleasant ST) | Principal Arterial | 10,200 | | 1,100 | | |
| Pleasant Street | Local | 2455 | | 326 | | |
| Elm Street (US 4 to Pleasant St) | Major Collector | 1900 | | 214 | | |

| Roadways Affected By Regional Truck Detour Route—Summary | | | | | | | |
|---|---|---|---|---|---|---|---|
| Roadway/Street Name | Classification | ADT | ADTT | Capacity | Peak Hour Volume | Existing LOS | Proposed LOS |
| US Route 4 | Principal Arterial | 10,200 | 450 | | 1,100 | | |
| VT Route 12 | Major Collector | 2500 | | | | | |
| VT Route 44 | Major Collector | 2300 | | | | | |
| US Route 5 | Major Collector | 6800 | | | | | |
| VT Route 106 | Major Collector | 3200 | | | | | |

# 5.0 Operational Analysis

*This section is intended to provide information on safety and mobility aspects within the project influence area, including traffic safety, data collection and modeling approach, traffic analysis, and other issues and concerns. This operational analysis will help identify potential work zone impacts and guide selection of TMP strategies.*

The VTrans Traffic Research Unit has conducted a Level-of-Service analysis for the local detour route at the intersection of Elm Street and Pleasant Street. An analysis was performed under a no detour scenario, using year 2017 Design Hour Volumes, and then another analysis was performed using year 2017 Design Hour Volumes, and under the assumption that Bridge #51 on US 4 is closed, and detour traffic routed through the Elm Street/Pleasant Street intersection.

As the results of the table below show, control delay, queue length and volume to capacity ration on the westbound (stop controlled) leg of the intersection are heavily impacted.

| Elm Street / Pleasant Street – Westbound Leg | | |
|---|---|---|
| | **Without Detour** | **With Detour** |
| **Volume to Capacity Ratio (v/c)** | **0.22** | **1.69** |
| **95% Queue Length (veh)** | **0.86** | **156.50** |
| **Control Delay (s/veh)** | **10.3** | **1282** |
| **Level of Service (LOS)** | **B** | **F** |
| **Notes:** | | |

Under the current stopped condition, the LOS of F would be expected during peak hours. The LOS for eastbound traffic will remain unchanged. This intersection should be evaluated for a temporary traffic control light to optimize the flow of traffic through the intersection. Currently this is to be addressed by adding a three way stop sign at the intersection.

## 5.1. Safety Analysis

*A safety analysis will help identify the potential locations for monitoring and/or other strategy deployments during construction to help manage work zone safety. Ongoing monitoring of the potential locations for any increase in crashes is important while the TTC, TOP, and PI&O are implemented.*

The stretch of US Route 4 through the project area has had 22 crashes recorded in the last five year period. The VTrans Traffic Safety Engineer analyzed the crash data and it was found that the two crosswalks on US 4 at the intersection with Elm Street were the scene of a large proportion of the rear-end crashes that are listed under this HCL Section. The typical crash happened as a pedestrian was crossing US 4 in one of the two crosswalks on US 4 at Elm Street, when a vehicle stopped for the pedestrian and this vehicle got rear-ended by a vehicle that was following from behind. The majority of these crashes were in the westbound direction. Two happened when it was dark (these same two crashes also happened during winter when the crosswalk may not have been visible due to slush or snow).

There are other crosswalks on US 4 within this HCL section. However, they are not causing this type of crash.

The crosswalks along this section of VT 100 are contrasting well with the road surface but they do not have pedestrian signs (W11-2) with a down arrow plaque (W16-7p). Pedestrian signs with down arrows are recommended in the MUTCD but they are not required. However, the Agency "Guidelines for Pedestrian Crossing Treatments" required that they be installed at each end of a crosswalk location.

Installing these signs would bring this section up to standard in regards to crosswalk safety. To some extent, the signs could help make motorists more aware of the possibility of vehicles ahead of them stopping for pedestrians, or make the lead vehicle more aware of pedestrians and stop less abruptly for a pedestrian in the crosswalk.

The crosswalks at the Elm Street intersection are along the local passenger car bridge project. As such, the above recommendations should be taken into consideration as part of a future project.

The table below summarizes crash data (from 01/01/2008 – 12/31/2012) by intersection or control section. *The table can be modified based on needs/standards.*

| Summary of Crashes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Intersection Name/ Control Section** | **Total** | **Injuries** | **Fatalities** | **Work Zone** | **Type of Crashes** | | | |
| | | | | | **Pedestrian** (at sidewalk location) | **Bicycle** | **Rear-End** | **Left-Turn** |
| **US Route 4** – MM 6.25 – MM 6.55 Section between Elm Street and Pleasant Street | **23** | **2** | **0** | | | | **8** | **3** |
| | | | | | | | | |

## 5.2. Traffic Analysis

### 5.2.1. Data Collection and Traffic Modeling

Based on the type and complexity of the analysis to be conducted, data collection/gathering may include:

- Traffic counts (vehicles, bicycles, pedestrians, trucks).
- Speed survey (counts, posted and 85$^{th}$ percentile speeds, etc.).
- Intersection control.
- Land use.

Measures of effectiveness (MOEs) are usually determined for the primary/critical roadway segments. The type of analysis greatly depends on agency policies and practices, and complexity of the project.

MOEs can include:

- Delays
- Queue Lengths
- LOS
- Travel Time
- V/C Ratio
- Congestion/User cost

The use of traffic analysis tools depends on the roadway classification (corridor/freeway/freeway surface street interchange) and level of complexity of the project. Specific tools available for use in modeling include the following:

- SYNCHRO
- HCS
- Quick Zone
- QUEWZ
- CA4PRS
- DYNASMART- P
- Lane Closure Analysis Program (LCAP)/Charts
- VISSIM
- CORSIM
- Quadro

The VTrans Traffic Research Unit has conducted a Level-of-Service analysis for the local detour route at the intersection of Elm Street and Pleasant Street.

An analysis was performed under a no detour scenario, using year 2017 Design Hour Volumes, with the following results:

## TWO-WAY STOP CONTROL SUMMARY

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | *Colin Philbrook* | Intersection | *Elm St. & Pleasant St.* |
| Agency/Co. | *VTrans Traffic Research* | Jurisdiction | |
| Date Performed | *1/23/2015* | Analysis Year | *2017* |
| Analysis Time Period | *2017 PM DHV w/o Detour* | | |

| | |
|---|---|
| Project Description | *Woodstock Village BF 020-2(43)* |
| East/West Street: *Pleasant St (TH 5)* | North/South Street: *VT 12 (Elm Street)* |
| Intersection Orientation: *North-South* | Study Period (hrs): *1.00* |

### Vehicle Volumes and Adjustments

| Major Street | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|
| Movement | 1 | 2 | 3 | 4 | 5 | 6 |
| | L | T | R | L | T | R |
| Volume (veh/h) | | *85* | *40* | *110* | *70* | |
| Peak-Hour Factor, PHF | *1.00* | *1.00* | *1.00* | *1.00* | *1.00* | *1.00* |
| Hourly Flow Rate, HFR (veh/h) | *0* | *85* | *40* | *110* | *70* | *0* |
| Percent Heavy Vehicles | *0* | -- | -- | *1* | -- | -- |
| Median Type | *Undivided* | | | | | |
| RT Channelized | | | *0* | | | *0* |
| Lanes | *0* | *1* | *0* | *0* | *1* | *0* |
| Configuration | | | *TR* | *LT* | | |
| Upstream Signal | | *0* | | | *0* | |

| Minor Street | Eastbound | | | Westbound | | |
|---|---|---|---|---|---|---|
| Movement | 7 | 8 | 9 | 10 | 11 | 12 |
| | L | T | R | L | T | R |
| Volume (veh/h) | | | | *25* | | *170* |
| Peak-Hour Factor, PHF | *1.00* | *1.00* | *1.00* | *1.00* | *1.00* | *1.00* |
| Hourly Flow Rate, HFR (veh/h) | *0* | *0* | *0* | *25* | *0* | *170* |
| Percent Heavy Vehicles | *0* | *0* | *0* | *0* | *0* | *3* |
| Percent Grade (%) | | *0* | | | *0* | |
| Flared Approach | | *N* | | | *N* | |
| Storage | | *0* | | | *0* | |
| RT Channelized | | | *0* | | | *0* |
| Lanes | *0* | *0* | *0* | *0* | *0* | *0* |
| Configuration | | | | | *LR* | |

### Delay, Queue Length, and Level of Service

| Approach | Northbound | Southbound | Westbound | | | Eastbound | | |
|---|---|---|---|---|---|---|---|---|
| Movement | 1 | 4 | 7 | 8 | 9 | 10 | 11 | 12 |
| Lane Configuration | | *LT* | | *LR* | | | | |
| v (veh/h) | | *110* | | *195* | | | | |
| C (m) (veh/h) | | *1468* | | *872* | | | | |
| v/c | | *0.07* | | *0.22* | | | | |
| 95% queue length | | *0.24* | | *0.86* | | | | |
| Control Delay (s/veh) | | *7.7* | | *10.3* | | | | |
| LOS | | *A* | | *B* | | | | |
| Approach Delay (s/veh) | -- | -- | *10.3* | | | | | |
| Approach LOS | -- | -- | *B* | | | | | |



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Another analysis was performed using year 2017 Design Hour Volumes, and under the assumption that Bridge #51 on US 4 is closed, and detour traffic routed through the Elm Street/Pleasant Street intersection, with the following results:

## TWO-WAY STOP CONTROL SUMMARY

| General Information | | Site Information | |
|---|---|---|---|
| Analyst | *Colin Philbrook* | Intersection | *Elm St. & Pleasant St.* |
| Agency/Co. | *VTrans Traffic Research* | Jurisdiction | |
| Date Performed | *1/23/2015* | Analysis Year | *2017* |
| Analysis Time Period | *2017 PM DHV-w/ Detour* | | |

Project Description *Woodstock Village BF 020-2(43)*

East/West Street: *Pleasant St (TH 5)* | North/South Street: *VT 12 (Elm Street)*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

### Vehicle Volumes and Adjustments

| Major Street | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|
| Movement | 1 | 2 | 3 | 4 | 5 | 6 |
| | L | T | R | L | T | R |
| Volume (veh/h) | | *85* | *546* | *110* | *70* | |
| Peak-Hour Factor, PHF | *1.00* | *1.00* | *1.00* | *1.00* | *1.00* | *1.00* |
| Hourly Flow Rate, HFR (veh/h) | *0* | *85* | *546* | *110* | *70* | *0* |
| Percent Heavy Vehicles | *0* | -- | -- | *1* | -- | -- |
| Median Type | *Undivided* | | | | | |
| RT Channelized | | | *0* | | | *0* |
| Lanes | *0* | *1* | *0* | *0* | *1* | *0* |
| Configuration | | | *TR* | *LT* | | |
| Upstream Signal | | *0* | | | *0* | |

| Minor Street | Eastbound | | | Westbound | | |
|---|---|---|---|---|---|---|
| Movement | 7 | 8 | 9 | 10 | 11 | 12 |
| | L | T | R | L | T | R |
| Volume (veh/h) | | | | *560* | | *170* |
| Peak-Hour Factor, PHF | *1.00* | *1.00* | *1.00* | *1.00* | *1.00* | *1.00* |
| Hourly Flow Rate, HFR (veh/h) | *0* | *0* | *0* | *560* | *0* | *170* |
| Percent Heavy Vehicles | *0* | *0* | *0* | *0* | *0* | *3* |
| Percent Grade (%) | | *0* | | | *0* | |
| Flared Approach | | *N* | | | *N* | |
| Storage | | *0* | | | *0* | |
| RT Channelized | | | *0* | | | *0* |
| Lanes | *0* | *0* | *0* | *0* | *0* | *0* |
| Configuration | | | | | *LR* | |

### Delay, Queue Length, and Level of Service

| Approach | Northbound | Southbound | Westbound | | | Eastbound | | |
|---|---|---|---|---|---|---|---|---|
| Movement | 1 | 4 | 7 | 8 | 9 | 10 | 11 | 12 |
| Lane Configuration | | *LT* | | *LR* | | | | |
| v (veh/h) | | *110* | | *730* | | | | |
| C (m) (veh/h) | | *956* | | *431* | | | | |
| v/c | | *0.12* | | *1.69* | | | | |
| 95% queue length | | *0.39* | | *156.50* | | | | |
| Control Delay (s/veh) | | *9.3* | | *1282* | | | | |
| LOS | | *A* | | *F* | | | | |
| Approach Delay (s/veh) | -- | -- | *1282* | | | | | |
| Approach LOS | -- | -- | *F* | | | | | |



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### 5.2.2. Alternatives/Impact Assessment

A work zone impact assessment is the process of understanding the safety and mobility impacts of a road construction, rehabilitation, or maintenance projects. The analysis compares and documents various work zone options and associated maintenance of traffic constraints, including staging/phasing options as well as temporary traffic control options, for each project and work zone design alternative. Performing an alternatives analysis during the preliminary stages of the project helps in selecting the best option going forward.

Under the current stopped condition at the Elm Street/Pleasant Street intersection, a LOS of F would be expected during peak hours. The LOS for eastbound traffic will remain unchanged. This intersection should be evaluated for a temporary traffic control light to optimize the flow of traffic through the intersection.

The table below provides a comparison of MOEs for the different alternatives:

| Summary Of MOEs For Alternatives – Westbound Leg | | | |
|---|---|---|---|
| **MOEs** | **Existing** | **Alternative 1 – Stop Sign at Elm/Pleasant Intersection** | **Alternative 2 – Traffic Light at Elm/Pleasant Intersection** |
| **Volume to Capacity Ratio (v/c)** | **0.22** | **1.69** | |
| **95% Queue Length (veh)** | **0.86** | **156.50** | |
| **Control Delay (s/veh)** | **10.3** | **1282** | |
| **Level of Service (LOS)** | **B** | **F** | |
| | | | |
| | Indicates Selected Alternative | | |

**Additional Considerations**
It is recommended to include a short narrative on the reason for the selected alternative.

This section can also include a brief review of the impact assessment of the selected construction alternative in different areas such as:

- Community Accessibility—Impact on access/egress of the community and businesses around the work zones (if any).
    - Access shall be maintained for most businesses in the project area during construction.
    - Access to Collective the Art of Craft will not be maintained for approximately eight weeks.
- Pedestrians and Bicyclists—Safety and accessibility of pedestrians with respect to sidewalk/crosswalk closures, ADA compliance, feasibility, safety of pedestrian detours, temporary crosswalks, etc.

- The pedestrian detour route will be the same as the local passenger car detour route. This route has raised sidewalks and crosswalks the entire length of the detour.
- A number of rear end crashes have occurred at the sidewalk at the intersection of US Route 4 and Elm Street. Prior to the project, this intersection should be evaluated to minimize these accidents during the construction period.

- Public Transportation—Work zone impact on the existing bus routes and bus stops. If any alternate bus stops are provided, are the routes to, as well as the bus stops ADA compliant?
  - There are currently no bus routes or bus stops along US Route 4 in Woodstock Village.
- Commercial Vehicles—Measures considered to reduce/detour the commercial vehicles (in case of significant impact operating in and around the work zones).
  - There will be a separate regional truck detour route.
- Utilities—Major utility projects could impact the roadway traffic. It is important to identify the utility projects scheduled to take place during the construction period and consider them while developing the TMP.
  - Utilities will be moved or removed during the closure period.

# 6.0 Work Zone Impact Management Strategies

This section provides an overview of various strategies to be deployed to improve the safety and mobility of the work zone and reduce the work zone impacts on the road users, community, and businesses.

The strategies are grouped according to the following three categories.

1. Temporary Traffic Control (TTC)
2. Transportation Operations (TO)
3. Public Information and Outreach (PI&O).

In addition to traditional TTC strategies, TO and PI mitigation measures must be used for this significant project. TO and PI strategies to be used include:

- Enhanced sign and pavement markings.
- Increased police enforcement.
- Real-time traffic information and updates on project delays.

## 6.1. Temporary Traffic Control (TTC)

A TTC plan describes temporary traffic control measures to be used for facilitating road users through a work zone or an incident area. The TTC plan plays a vital role in providing continuity of reasonably safe and efficient road user flow and highway worker safety when a work zone, incident, or other event temporarily disrupts normal road user flow. The TTC plan shall be consistent with the provisions of the MUTCD and AASHTO Roadside Design Guide.

| Temporary Traffic Control (TTC) | √ |
|---|---|
| **Control Strategies** | |

| | |
|---|---|
| 1. Construction phasing/staging | **X** |
| 2. Full roadway closures | **X** |
| 3. Lane shifts or closures | |
| 4. One-lane, two-way controlled operation | |
| 5. Two-way, one-lane traffic**/**reversible lanes | |
| 6. Ramp closures/relocation | |
| 7. Freeway-to-freeway interchange closures | |
| 8. Night work | **X** |
| 9. Weekend work | **X** |
| 10. Work hour restrictions for peak travel | |
| 11. Pedestrian/bicycle access improvements | |
| 12. Business access improvements | |
| 13. Off-site detours/use of alternate routes | **X** |
| **Traffic Control Devices** | |
| 14. Temporary signs | **X** |
| 15. Arrow boards | |
| 16. Channelizing devices | |
| 17. Temporary pavement markings | |
| 18. Flaggers and uniformed traffic control officers | **X** |
| 19. Temporary traffic signals | |
| 20. Lighting devices | |
| **Project Coordination Strategies** | |
| 21. Other area projects | **X** |
| 22. Utilities | **X** |
| 23. Right-of-Way | **X** |
| 24. Other transportation infrastructure | |
| **Innovative Contracting Strategies** | |
| 25. Design-Build | |
| 26. A+B Bidding | |
| 27. Incentive/Disincentive clauses | **X** |
| 28. Lane rental | |
| 29. Performance specifications | |
| **Innovative or Accelerated Construction Techniques** | |
| 30. Prefabricated/precast elements | **X** |
| 31. Rapid cure materials | **X** |

## 6.2. Transportation Operations (TO)

*The TO component shall include the identification of strategies to mitigate impacts of the work zone on the operation of the transportation system within the work zone impact area. The work zone impact area consists of the immediate work zone as well as affects to the surrounding roadways and communities. Additional information can be acquired from the "Workzone Safety and Mobility Guidelines" (WSMG) and "Appendix A" in the WSMG document:*

*Examples of practices that may be used to satisfy the TO component may be found at: http://www.ops.fhwa.AOT.gov/wz/rule_guide/sec6.htm#sec63*

| Transportation Operations (TO) | √ |
|---|---|
| **Demand Management Strategies** | |
| 1. Transit service improvements | |
| 2. Transit incentives | |
| 3. Shuttle services | |
| 4. Parking supply management | |
| 5. Variable work hours | |
| 6. Telecommuting | |
| 7. Ridesharing/carpooling incentives | |
| 8. Park-and-Ride promotion | |
| **Corridor/Network Management Strategies** | |
| 9. Signal timing/coordination improvements | |
| 10. Temporary traffic signals | **X** |
| 11. Street/intersection improvements | **X** |
| 12. Bus turnouts | |
| 13. Turn restrictions | |
| 14. Parking restrictions | |
| 15. Truck/heavy vehicle restrictions | **X** |
| 16. Reversible lanes | |
| 17. Dynamic lane closure system | |
| 18. Ramp closures | |
| 19. Railroad crossing controls | |
| 20. Coordination with adjacent construction site(s) | **X** |
| **Work Zone ITS Strategies** | |
| 21. Late lane merge | |
| 22. PCMS with speed display | |
| 23. Travel time estimation system | |

| | |
|---|---|
| 24. Advanced speed information system | |
| 25. Advanced congestion warning system | |
| 26. Conflict warning system (e.g., construction vehicles entering roadway) | |
| 27. Travel time monitor system | |
| 28. Freeway queue monitor system | |
| 29. CCTV monitoring | |
| 30. Real-time detour | |
| **Work Zone Safety Management Strategies** | |
| 31. Speed limit reduction/variable speed limits | |
| 32. Temporary traffic signals | |
| 33. Temporary traffic barrier | **X** |
| 34. Movable traffic barrier systems | |
| 35. Crash cushions | |
| 36. Temporary rumble strips | |
| 37. Intrusion alarms | |
| 38. Warning lights | |
| 39. Automated flagger assistance devices (AFADs) | |
| 40. Project task force/committee | |
| 41. Construction safety supervisors/inspectors | **X** |
| 42. Road safety audits | |
| 43. TMP monitor/inspection team | **X** |
| **Incident Management and Enforcement Strategies** | |
| 44. ITS for traffic monitoring/management | |
| 45. Traffic Message Channel (TMC) | |
| 46. Surveillance (e.g., CCTV) | |
| 47. Traffic Screens (to prevent rubbernecking) | |
| 48. Mile-post markers | |
| 49. Tow/freeway service patrol | |
| 50. Total station units | |
| 51. Photogrammetry | |
| 52. Media coordination | **X** |
| 53. Local detour routes | **X** |
| 54. Contract support for incident management | |
| 55. Incident/Emergency management coordination | **X** |
| 56. Incident/Emergency response plan | **X** |

| | |
|---|---|
| 57. Dedicated (paid) police enforcement | |
| 58. Cooperative police enforcement | **X** |
| 59. Automated enforcement | |
| 60. Increased penalties for work zone violations | |
| 61. Emergency pull-offs | |

*Contingency/Incident Management Plans*—Consider developing a contingency plan that addresses specific actions that will be taken to restore or minimize impacts on traffic when the congestion or delay exceeds original estimates due to unforeseen events. This includes work-zone crashes, traffic volumes higher than predicted traffic demand, delayed pick-up of lane closures, etc.

It is best to develop the Contingency/Incident Management plan as a collaborative effort with the emergency response and the public safety community. Development of such a plan is crucial in the early phases to properly integrate the concerns of the first responder personnel. It is recommended that agencies consider key components, such as the following six items, in developing the plan:

(1) Incident Detection and Verification; (2) Incident Classification and Response; (3) Site Management; (4) Site Clearance; (5) Motorist Information; (6) Evaluation.

## 6.3. Public Information and Outreach (PI&O)

*The PI component shall include communication strategies that seek to inform the general public of work zone impacts and the changing condition of the project. The general public may include road users, area residences and businesses, and other public entities. Examples of communications strategies that may be used to satisfy the PI component may be found at:*
*http://www.ops.fhwa.AOT.gov/wz/rule_guide/sec6.htm#sec63.*

Public Information and Outreach is critical to the success of this ABC project. This project will create a short term impact to travelers, businesses, residents, and truckers. Properly informing these stakeholders of what to expect during construction will ensure proper public support and reduce problems during construction. It is important to be upfront and clear on the impacts that this project will have on the community, and as such the following measures are recommended:

- Project Website
    - A project website can be used to show the detour routes, describe the project and why it is taking place, and answer other frequently asked questions about the project.
- Factsheets
- Truck routes
    - During the closure, trucks will have to take a regional truck detour, since the local route is not appropriate for trucks. As such, it is recommended that a Public Outreach Coordinator is involved at an early stage in order to warn truckers ahead of the closure period of the appropriate alternative routes to take. Portable Changeable Message Signs may also be placed ahead of the closure period in order to warn truck to find alternate routes depending on where they are driving to.
- Business concerns/issues
- Public Input and Surveys

- Social Media to inform the public

| Public Information and Outreach (PI&O) | √ |
|---|---|
| **Public Awareness Strategies** | |
| 1. Branding | |
| 2. Press kits | |
| 3. Brochures and mailers | |
| 4. Press releases/media alerts | **X** |
| 5. Mass media (earned and/or paid) | |
| 6. Paid advertisements | |
| 7. Project Information Center | |
| 8. Telephone hotline | |
| 9. Planned lane closure website | |
| 10. Project website | **X** |
| 11. Public meetings/hearings, workshops | **X** |
| 12. Community task forces | |
| 13. Coordination with media/schools/business/emergency services | **X** |
| 14. Work zone education and safety campaigns | |
| 15. Work zone safety highway signs | **X** |
| 16. Rideshare promotions | |
| 17. Visual information | |
| **Motorist Information Strategies** | |
| 18. Radio traffic news | **X** |
| 19. Changeable message signs | **X** |
| 20. Temporary motorist information signs | |
| 21. Dynamic speed message sign | |
| 22. Highway Advisory Radio (HAR) | |
| 23. Extinguishable Signs | |
| 24. Highway information network (web-based) | |
| 25. Traveler information systems(wireless, handheld) | |
| 26. Transportation Management Center (TMC) | |
| 27. Live traffic camera(s) on a website | |
| 28. Project information hotline | |
| 29. Email alerts | |

## 7.0 Notes

*Any additional notes on selected strategies, the TMP in general, or any item requiring special attention for the project can be provided in this section.*

*This section should include meeting notes or conversation notes where decisions pertaining to the TMP are made.*

## 8.0 TMP Implementation/Monitoring

The TMP needs to be implemented in the field, as specified, unless any changes have been approved by the agency. To help ensure appropriate implementation, 23 CFR 630 Subpart J §630.1012(e) requires that the State/Agency and the contractor each designate a trained person at the project level who has the primary responsibility and sufficient authority for implementing the TMP and other safety and mobility aspects of the project.

Monitoring the performance of the TMP during the construction phase is important to establish whether the predicted impacts closely resemble the actual conditions in the field, and whether the TMP strategies are effective in managing the impacts. TMP monitoring is needed for both oversight and evaluation purposes, such as:

- Monitoring and documenting TMP changes during construction.
- Preparing an evaluation of the TMP, including lessons learned.
- Refining work zone impact analysis processes and models based on outcomes.

TMP monitoring includes details of any specific observational, logging, and/or recording activities conducted during the project for work zone performance measurement purposes. Examples of possible performance measures for TMP monitoring include:

- Volume
- LOS
- Queue length
- Delay
- Travel time
- Number of crashes/incidents
- Incident response and clearance times
- Type and frequency of legitimate complaints received.

**Additional Considerations**

Agencies use different methods to monitor and assess performance, such as portable sensors or floating car methods to measure queues and travel times, and video cameras with detection capabilities for real time measurements.

It is helpful for the TMP Implementation/Monitoring Managers to meet with the Project Manager on a regular basis to discuss and assess the safety and mobility impacts of the project work zone to date. This helps to assess how well the TMP is managing the project impacts, and can help identify and address issues before they become problems. It also provides the opportunity to verify that all key stakeholders and project officials have been receiving timely notifications where required.

# 9.0 TMP Summary

This summary should include a brief description of the traffic management strategies selected for use on the project as well as important contact information. This summary should be included in the contract documents.

**TMP Summary**

- The following temporary traffic control (TTC) measures have been identified for use though the construction area.
  - Control Strategies: There will be a three week closure with night work and weekend work allowed. A local offsite detour for cars will be signed by the State of Vermont, as well as a regional detour for trucks. The sidewalks will be closed for two weeks prior to and three weeks after the bridge closure.
  - Traffic Control Devices: Traffic Barriers, "Road Closed" signs, and "sidewalk Closed" signs will be deployed during the closure to protect cars and pedestrians from driving into the construction site.
  - Project Coordination Strategies: Right-of-Way acquisition and fencing shall be carried out prior to the closure. Utility relocation and removal shall occur during the bridge closure.
  - Innovative or Accelerated Construction Techniques: Prefabricated superstructure and approach slab elements shall be used to reduce the closure duration.
- The following transportation operations (TO) measures have been identified for use for mitigation of impacts to the workzone and the surrounding roadway network
  - Corridor/Network Management Strategies: A temporary traffic signal shall be placed at the Intersection of Elm street and pleasant street, and shall be timed to optimize the intersection performance during the closure period. Trucks shall be prohibited from using the elm street/pleasant street local route and should be required to use a regional truck detour. Coordination shall be made with the Killington BF 020-2(42) project as an overlapping detour could occur.
  - Incident Management and Enforcement Strategies: The media should be coordinated with to inform the public of any delays that occur due to unexpected incidents, Emergency response personnel should be aware of the local routes available in case of emergency, and an Incident/Emergency response plan should be drafted and coordinated with emergency personnel.

**Public Information and Outreach Summary**

The following measures are recommended to warn the public of the possible impacts to them:

- Public meetings prior to the closure should be held to notify the public what to expect during the closure, and to hear concerns.
- Project Website
  - A project website can be used to show the detour routes, describe the project and why it is taking place, and answer other frequently asked questions about the project.
- Factsheets
- Truck routes

  - During the closure, trucks will have to take a regional truck detour, since the local route is not appropriate for trucks. As such, it is recommended that a Public Outreach Coordinator is involved at an early stage in order to warn truckers ahead of the closure period of the appropriate alternative routes to take. Portable Changeable Message Signs may also be placed ahead of the closure period in order to warn truck to find alternate routes depending on where they are driving to.
- Business concerns/issues
  - Coordination with the businesses in Woodstock Village is important. A separate meeting with business owners is encouraged.
- Public Input and Surveys
- Social Media to inform the public of upcoming impacts

**Other Towns affected by the closure**

The regional truck detour goes through the Towns of Reading, West Windsor, Windsor, and Hartland. The project manager should coordinate with these towns during the design phase, and similarly the regional construction engineer should coordinate with these towns during the construction phase to inform them of the impacts that are expected in their town. The following is a contact list for the effected towns:

Reading: Calista Brennan (Town Clerk/Treasurer), 802- 484-7250
West Windsor: Cathy Archibald (Town Clerk/Treasurer), 802-484-7212
Windsor: Tom Marsh (Town Manager) 802-674-6786
Hartland: Robert Stacey (Town Manager) 802-436-2119

**Contacts**

Design Project Manager: Rob Young, 802-828-0052
Resident Engineer: TBD
Regional Engineer: Ann Gammell, 802-281-5000
Public Information Officer: TBD
Fire and Emergency Medical Services: Town of Woodstock Fire Department, 802-457-2337
Woodstock Police Department (PD): Robbie Blish (Chief of Police), 802-457-1420
Contractor: TBD
Superintendent: TBD
Contractors Competent Person: TBD
Contractor Safety Officer: TBD

# 10.0 TMP Review/Approvals

TMPs, and changes to TMPs, must be approved by the AOT before they are implemented. As part of this process, many agencies conduct a TMP review, either by a designated individual or a team. A TMP review is particularly important for higher impact projects, and will help with future revisions of the TMP and performance monitoring. The TMP approval is then based on the TMP review.

The approval of the TMP should be based on conformance of the TMP with the Work Zone Safety and Mobility Guide.

| Regional Construction Engineer | | | Traffic Operations Engineer | | | Project Manager | | |
|---|---|---|---|---|---|---|---|---|
| **All approvals must be obtained prior to the start of work** | | | | | | | | |
| Signature:<br>Name:<br>Date: | | | Signature:<br>Name:<br>Date: | | | Signature:<br>Name:<br>Date: | | |
| Rev # | Initials | Date | Rev # | Initials | Date | Rev # | Initials | Date |
| 1 | | | 1 | | | 1 | | |
| 2 | | | 2 | | | 2 | | |

# 11.0 Appendices

- Traffic Counts
- Traffic Analysis (Existing compared with future)

Future appendices should include:

- Temporary Traffic Control Plans
- Public Information and Outreach Plan
- TMP Review Notes
- Project Monitoring Form or Post-Project Evaluation Form.