Vermont Bicycle and Pedestrian Work Zone Traffic Control Guide

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VTrans Working to Get You There
Vermont Agency of Transportation

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Image Sources: (Clockwise from Top) 1.Nick Fablo (Twitter) 2. Oregon DOT (2016) 3. BikePortland.org 4. BikePortland.org

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1. GLOSSARY

Bicycle Facilities
A general term for denoting improvements and provisions that accommodate or encourage bicycles, including shared roadways not specifically defined for bicycle use (i.e. roadway shoulders)

Bicycle Lane (Bike Lane)
A portion of roadway that has been designated for preferential or exclusive use by bicyclists through pavement markings and, if used, signs.

Bikeway
A generic term for any road, street, path, or way that in some manner is specifically designated for bicycle travel, regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes. Bikeways include shared-use paths, bike lanes, and any road or street with shared lane markings.

Delineator
A retroreflective device mounted on the roadway surface or at the side of the roadway in a series to indicate the alignment of the roadway, especially at night or in adverse weather.

Designated Bicycle Route
A system of bikeways designated by the jurisdiction having authority with appropriate directional and informational route signs, with or without specific bicycle route numbers.

Detectable
Having a continuous edge within 6 inches of the surface so that pedestrians who have visual disabilities can sense its presence and receive usable guidance information.

Flagger
A person who actively controls the flow of vehicular traffic into and/or through a temporary traffic control zone using hand-signaling devices or an Automated Flagger Assistance Device.

Intermediate Duration Work
Stationary work that occupies a location more than one daylight period up to 3 days, or nighttime work lasting more than one hour.

Long Term Work
Stationary work that occupies a location for more than three days.

Mobile Work
Work that moves intermittently or continuously (line striping, sign replacement, etc.)

Pathway
A general term denoting a public way for purposes of travel by authorized users outside the traveled way and physically separated from the roadway by an open space or a barrier and either within the highway right-of-way or within an independent alignment. Pathways include shared use paths, but do not include sidewalks.

Pedestrian
A person on foot, in a wheelchair, on skates, on a skateboard, or using any other type of mobility device.

Pedestrian Access Route
A continuous and unobstructed path of travel provided for pedestrians with disabilities within or coinciding with a pedestrian circulation path.

Pedestrian Circulation Path
A prepared exterior or interior surface provided for pedestrian travel in the public right-of-way.

Shared Roadway
A roadway that is open to motor vehicle travel and upon which no bicycle lane is designated.

Shared-Use Path
A facility used by bicyclists and pedestrians outside the traveled way and physically separated from motorized traffic by an open space or barrier and either within the highway right-of-way or within an independent alignment. Pedestrians include walkers, joggers, skaters, skateboarders, and manual and motorized wheelchair users.

Short Duration Work
Work that occupies a location up to one hour.

Short Term Work
Stationary work that occupies a location for more than one hour within a single daylight period.

Shoulder
The portion of roadway contiguous with the traveled way for accommodation of breakdown vehicles, pedestrians, and bicyclists.

Sidewalk
That portion of a street between the curb line or the lateral line of a roadway, and the adjacent property line or on easements of private property that is paved or improved and intended for use by pedestrians.

2. PREFACE

This document discusses practices relating to the design and implementation of a traffic control plan for pedestrians and bicyclists in work zones. These recommendations and examples apply to construction, maintenance, and utility work and provide information to aid in developing Temporary Traffic Control (TTC) Plans for pedestrians, bicyclists, and persons with disabilities.

Part 6 of the Manual on Uniform Traffic Control Devices (MUTCD) provides the fundamental principles of Work Zone traffic control, including the design of signs, pavement markings and devices. The Vermont Work Zone Safety and Mobility Guidance Document and its Appendix A provides additional information on the use of temporary traffic control devices, flaggers, and uniformed traffic officers to control and minimize worker exposure to traffic hazards and to increase road user safety, and can be accessed at http://vtrans.vermont.gov/docs. A TTC Plan generally includes a constructability assessment led by the designer to ensure the efficacy of the work zone and its traffic control provisions for all roadway users.

3. BICYCLE AND PEDESTRIAN ACCOMODATION

As part of the Vermont Agency of Transportation's commitment to the safety of all roadway users within work zones, the accessibility and safety of bicyclists and pedestrians shall be considered during the planning and development of TTC Plans.

The extent of temporary facilities provided depends on several factors including:

- The type of facility being impacted by construction activities and/or staging (i.e. sidewalk, shoulder, bike lane, etc.)
- The duration of the activity impacting these facilities
- The known and/or projected use of the facility by bicyclists or pedestrians

The highest level of temporary facility will be provided when a facility specifically intended for bicycling or walking is impacted (e.g. sidewalk, bicycle lane or shared-use path).

When sidewalks, shared use paths, or roadway shoulders are closed due to construction, a temporary facility should match (or exceed) the level of accessibility that existed before construction wherever possible or practical.

Chapter 6D of the MUTCD comprehensively addresses pedestrian safety considerations for temporary traffic control. The same level of considerations discussed in the MUTCD for walking is applicable to other modes of transportation through the work zone, including bicycling.

It is important to consider the work zone needs of bicyclists and pedestrians as early as possible in the project development process. A temporary walkway or bikeway may require the use of property outside the existing right-of-way and identifying these needs prior to the right-of-way acquisition process is critical. Although there may be times where it is infeasible to fully meet the needs of bicyclists and pedestrians, every effort should be made to address their access and safety in the TTC plan.

3.1 ACCESSIBILITY REQUIREMENTS

Per the MUTCD Section 6A.01:

> ***The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, or on private roads open to public travel...including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.***

When a work zone disrupts existing pedestrian facilities, an equivalent Temporary Pedestrian Access Route (TPAR) shall be provided. Temporary pedestrian facilities must be accessible to and usable by pedestrians with disabilities. TPARs may include sidewalks, temporary walkways, street crossings, refuge islands, curb ramps, detectable warning surfaces, pedestrian signals and push buttons, and pedestrian route signage.

The TPAR must comply with the MUTCD and shall meet or exceed the level of accessibility present on the current circulation route. Recommendations made by the US Access Board in the Public Right-of-Way Accessibility Guidelines (PROWAG) shall be considered when developing the TTC Plan for any work zone

activity that affects pedestrian facilities within the right-of-way. These considerations include, but are not limited to, the provision of curb ramps, detectable barriers, and detectable warning surfaces in the design of TTC Plans.

Accessibility requirements for temporary pedestrian facilities are described in the PROWAG section R205:

> **"*When a pedestrian circulation path is temporarily closed by construction, alterations, maintenance operations, or other conditions, an alternate pedestrian access route complying with sections 6D.01, 6D.02, and 6G.05 of the MUTCD shall be provided. Where provided, pedestrian barricades and channelizing devices shall comply with sections 6F.63, 6F.68, and 6F.71 of the MUTCD*".**

Details on accessibility elements of a TTC Plan are found in Section 5 of this document. Additional information and requirements on accessible design of sidewalks can be accessed at: https://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way

4. ELEMENTS OF A TEMPORARY TRAFFIC CONTROL PLAN

A TTC Plan describes means and methods for facilitating vehicle, bicycle and pedestrian traffic through a work zone, usually for roadway, maintenance, or utility projects. The degree of detail of the TTC Plan is dependent on the complexity of the situation, i.e. what facilities are being closed or reduced, the work to be performed, the duration of the work, and the volume of traffic through the work zone (vehicles, bicycles, and pedestrians). Some form of a TTC Plan shall be included on all projects. The TTC plan should be developed by someone with engineering expertise and thorough knowledge of the MUTCD.

Ideally, the TTC Plan is developed by the project designer. In the case where a contractor proposes an alternate TTC Plan, the submitted proposal shall include complete details, including all aspects of traffic control, to the same extent provided by the project designer.

The scope of a TTC Plan will vary based on project complexity. Items that may be included in the TTC Plan include:

- **Public Notice:** Through use of a Public Information Officer, Portable Changeable Message Boards, Front Porch Forum, Town websites, or other means, planned closures should be communicated to the traveling public before work commences. This should include information specific to planned closures of sidewalks or bicycle facilities, if applicable. Available detours or alternate routes should also be communicated to reduce traffic flow and delay in and around the work zone.
- **Signs:** Appropriate selection and placement of warning and regulatory signs for vehicles, bicycles, and pedestrians shall be included to warn of a change in conditions and possible diversions or detours. In all cases, signs shall be clear, direct, and consistent throughout the work zone. General guidance on appropriate sign selection and placement can be found in Parts 2 and 6 of the MUTCD.
- **Temporary Facilities:** Temporary pedestrian and bicycle facilities including sidewalks, temporary surfaces, detectable barriers, line striping, curb ramps, and lighting should be included where necessary to ensure the safety of pedestrians and bicyclists traveling on a diverted route. In the case of pedestrian facilities (sidewalks, shared use paths) impacted by construction, routes must meet accessibility standards outlined in the PROWAG and MUTCD.

- **Channelizing Devices:** Channelizing devices may be used to enhance the safety and separation of pedestrians and bicyclists from work zone activities and vehicular traffic through work zones. The type, quantity, and placement of these devices may vary throughout each phase of a project as work zone conditions change; each stage should be accounted for in the TTC Plan. Additional guidance for selection and placement of channelizing devices can be found in Parts 6, 9, and Chapter 2B of the MUTCD.
- **Detours:** The TTC Plan may include a detour for pedestrians and/or bicyclists. This route should be well thought out, with consideration to length, grade, surface condition, drainage and runoff, and connectivity. Alternatives to detours such as shuttle services or work zone escorts may be provided to guarantee pedestrian and bicyclist mobility if a detour exceeds the distance that average pedestrians and bicyclists are likely to travel (half mile for pedestrians and 2 miles for bicyclists.) More on bicycle detours can be found in section 6.2 of this document.

All traffic control devices and methods included in the TTC Plan must adhere to the standards set forth in the MUTCD. This document provides *additional* guidance to enhance the safety of pedestrians and bicyclists in work zone areas. Each phase of construction should be accompanied by a unique TTC Plan that addresses safety and mobility of pedestrians and bicyclists specific to the project area.

5. WORK ZONE DESIGN FOR PEDESTRIANS

Detailed TTC Plans for pedestrians are required when existing sidewalk facilities are disrupted, closed, or relocated in a work zone. The temporary facilities shall be detectable and include accessibility features consistent with the features present in the existing pedestrian facility.

The principles discussed in the MUTCD Chapters 6C, 6D, 6F and 6G address minimal requirements needed to accommodate pedestrians in work zones.

The TTC Plan must provide specific traffic control measures and accessible features to accommodate all pedestrian traffic. Pedestrians require a useable, traversable, clearly defined pathway through or around a work zone. Key components in an accessible pathway include:

- *Accessible Features* – sidewalk curb ramps, landing areas, transit platform edges, etc.
- *Detectable Features* – truncated domes, curbs around fountains or pools, detectable channelizing devices, signs with audible features, etc.

Schools, shopping malls, theatres, arenas and similar pedestrian generators may result in sudden, large volumes of pedestrians in a concentrated section of a work zone. Carefully consider the location and elements of needed temporary pathways to safely and effectively guide pedestrians through or around work zones in these areas.

The preferred pedestrian accommodation (in order) is as follows:

1. Maintain an accessible sidewalk on at least one side of the roadway
2. Maintain an accessible pedestrian access route using road space when available (i.e. shoulder, parking lane, etc.)
3. Provide a pedestrian detour using existing sidewalks
4. Provide alternate means for pedestrians to move through the work zone e.g. escorts or shuttles

For site-specific conditions or configurations not addressed by the MUTCD, the TTC Plan designer must provide additional design details within the TTC Plan.

5.1 PEDESTRIAN ACCOMMODATION PRINCIPLES

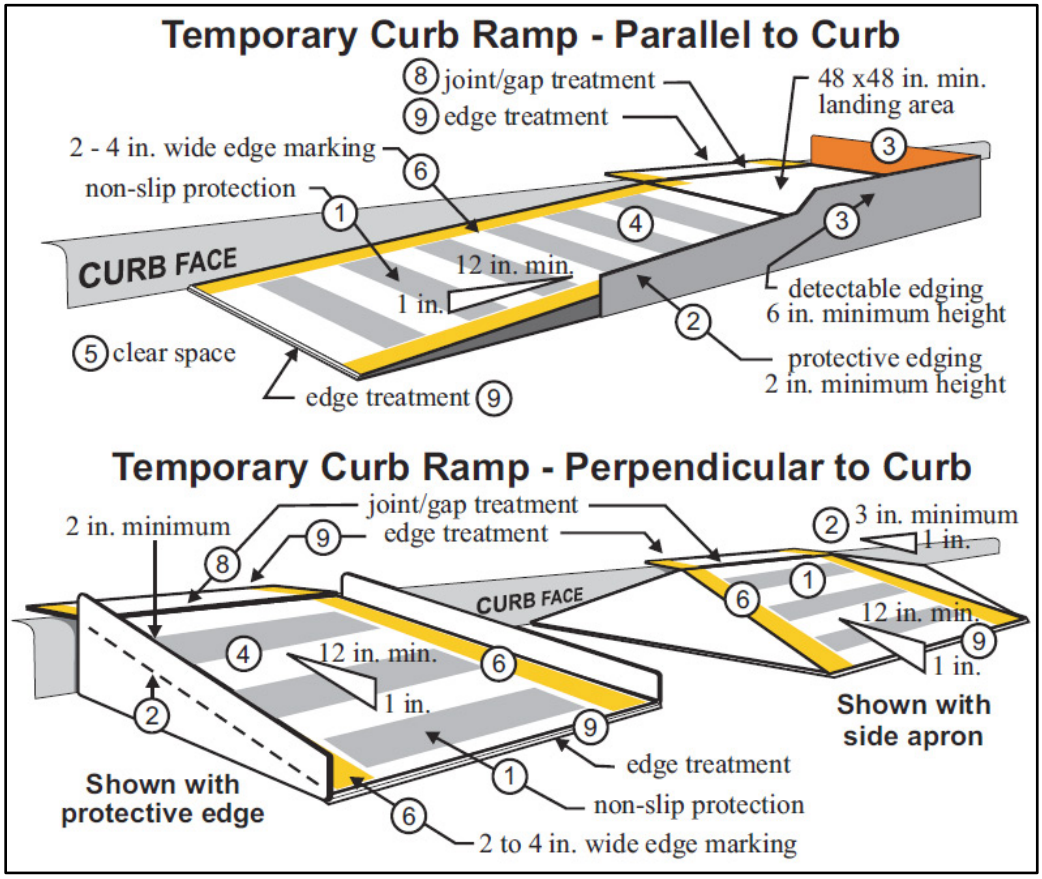
When accommodating pedestrians in work zones and developing a pedestrian-specific TTC Plan, consider the following:

- Do not lead pedestrians into conflicts with traffic, construction vehicles, equipment, operations, or hazardous materials. Ensure protection when holes or trenches are adjacent to existing pedestrian facilities.
- Where practical, when directing pedestrians across a roadway, use existing intersection corners and crosswalks – marked or unmarked. Avoid developing temporary mid-block crossings if possible. An existing marked mid-block crossing may be used to shorten alternate pedestrian routes. The location of crosswalks must include adequate sight lines for motorists and pedestrians.
- Provide a convenient, continuous and accessible path that equals or exceeds, as practical, the existing pedestrian facilities. All surfaces, including temporary walkways, shall be firm, stable, and slip resistant. Routes shall be free of debris or protruding objects that prohibit passage (signs, hoses, barriers, materials, vehicles or equipment.)
- Coordinate with local agencies, as necessary, if alternate pedestrian routes are located on their facilities (including private roadways). Ensure pedestrian access and any traffic control materials (channelizing devices, signs, etc.) on their facilities are approved before the TTC Plan is completed and the project is released for advertisement.
- If work activities displace transit stops and other pedestrian access points, the TTC plan shall address how pedestrians access those points. For instance, flaggers may be used to safely assist pedestrians. However, if the situation will exist during times when workers are not present, the project engineer or supervisor will need to establish a proper diversion path to the transit stop, or relocate the transit stop to a more pedestrian-accessible location and provide sufficient signing/wayfinding information to the new location. This will require that agencies and contractors work with the transit agency to relocate the stop. Pedestrians should not be forced to cross active work spaces to reach bus stops or access points.
- Minimize out-of-direction travel for pedestrians.
- If closing a pedestrian route, sign the closure in ***advance*** at the nearest crossing or diversion point. Avoid having a pedestrian route double back on itself.
- If it is known that pedestrians with visual impairments may be impacted by a work zone, designers should consider the use of signs that provide detailed audible information about the work zone. These audible devices should adhere to the standards found in the MUTCD.
    - *A barrier or barricade detectable by a person with a visual disability is sufficient to indicate that a sidewalk is closed. If the barrier is continuous with detectable channelizing devices for an alternate route, accessible signing might not be necessary. An audible information device is needed when the detectable barricade or barrier for an alternate channelized route is not continuous.* (MUTCD, Section 6F.14)
    - *The most desirable way to provide information to pedestrians with visual disabilities*

that is equivalent to visual signing for notification of sidewalk closures is a speech message provided by an audible information device. Devices that provide speech messages in response to passive pedestrian actuation are the most desirable. Other devices that continuously emit a message, or that emit a message in response to use of a pushbutton, are also acceptable. (MUTCD, Section 6D.02)

- Provide temporary sidewalk facilities that meet accessibility requirements, including the following standards which shall be provided to the maximum extent feasible:
  - Maximum running slope of 8.3% for curb ramps
  - Maximum cross slope of 2.0% on sidewalks, curb ramps and landings
  - 60-in. sidewalk widths; or, 48-in. widths with 60-in. x 60-in. level landings (max. 2% slope) every 200 feet

- VTrans Standards C-3A and C-3B detail sidewalk curb ramps, pedestrian refuge islands, and sidewalk crossings of rail lines. Temporary pedestrian facilities are to be equal to or improve upon existing facilities. All temporary pedestrian facilities shall be accessible.
  - Examples of temporary curb ramp requirements are shown below.
  - Detectable warning surfaces shall meet the requirements of PROWAG section R305.



Temporary Curb Ramp Notes:

1. Curb ramps shall be 48 in. minimum width with a firm, stable, non-slip surface.
2. Protective edging with a 2 in. minimum height shall be installed when the curb ramp or landing platform has a vertical drop of 6 in. or greater or has a side apron slope steeper than 1:3 (33%). Protective edging should be considered when curb ramps or landing platforms have a vertical drop of 3 in. or more.
3. Detectable edging with a 6 in. minimum height and contrasting color shall be installed on all curb ramp landings where the walkway changes direction (turns).
4. Curb ramps and landings should have a 2% max cross-slope.
5. Clear space of 48 in. x 48 in. minimum shall be provided above and below the ramp.
6. The curb ramp walkway edge shall be marked with a contrasting color 2 to 4 in. wide contrasting color marking.
7. Impacts of temporary ramps on drainage shall be considered and their location should not result in ponding in the roadway that may result in a hazard.
8. Lateral joints or gaps between surfaces shall be less than 0.5 in. width.
9. Changes between surface heights should not exceed 0.5 in. Lateral edges should be vertical up to 0.25 in. high, and beveled at 1:2 between 0.25 in. and 0.5 in. height.

Temporary curb ramps may be pre-fabricated, or constructed on site using temporary materials such as plywood (with slip resistant material), bituminous concrete pavement, or compacted aggregate. All curb ramps, whether pre-fabricated or constructed in place shall meet the design requirements listed above.

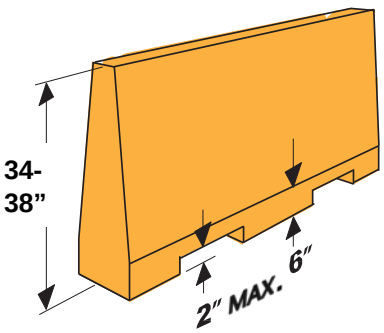
5.2 TEMPORARY PEDESTRIAN SIGNALS

In some cases, it may be necessary to provide a temporary pedestrian signal as part of a TTC Plan. If providing a temporary pedestrian signal, it should include standard accessible features such as accessible pushbuttons as defined in the VTrans Standard Specifications for Construction section 752.14. The timing of the walk phase must be adequate to allow safe crossing by all users. Vulnerable pedestrian populations including children, senior citizens, and people with disabilities have slower walking speeds and if it is known that a crossing will likely serve these populations, additional time in the walk phase may be required.

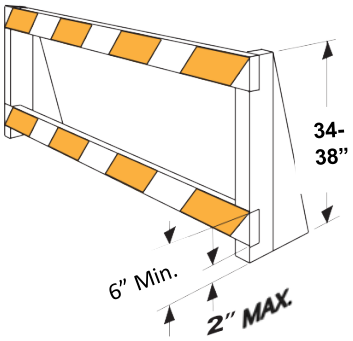
5.3 PEDESTRIAN CHANNELIZING DEVICES (PCD) – SELECTION & PLACEMENT

Providing a well-delineated, accessible walkway is critical in guiding pedestrians safely and effectively through or around the work zone. If the temporary walkway is created using roadway or parking space (i.e. not using existing sidewalks) and pedestrians are being directed to a new path of travel, then Pedestrian Channelizing Devices (PCD) are required. Where PCD are used, they must have a continuous detectable top and bottom edge so that pedestrians with visual disabilities can detect them. The use of cones, barrels, or other intermittent devices with tape is not acceptable as a PCD. Examples of longitudinal channelizing devices and pedestrian barricades are shown below with proper dimensions and placement notes. Barricades are used to block off active work areas and may also be used as a channelizing device. Channelizing devices are used to define temporary walkways and to separate pedestrians from either construction activities or traffic. Additional information on channelizing devices can be found in the MUTCD Chapter 6F. Design details for channelizing devices and pedestrian barricades are provided in Appendix C of this document.

Examples of PCDs



Longitudinal Channelizing Device



Pedestrian Barricade (Type II)

1. To prevent any tripping hazard to pedestrians, ballast shall be located behind or internal to the device.
2. The bottom edge of the bottom detectable edging shall be continuous and no greater than 2 inches above the walking surface and the top of the bottom edging should be at least 6 inches above the surface. PCDs should be orange, white, or yellow and consistent with adjacent devices.
3. Devices should not prevent the drainage of water from the walkway. An opening with a 2 inch maximum height above the walkway surface is allowed for drainage.
4. Longitudinal channelizing devices for pedestrians shall have a minimum height of 32 inches. Longitudinal channelizing devices shall not be installed with a handrail.
5. When hand guidance is required, the top surface of the device shall be in a vertical plane perpendicular to the walkway with a continuous height of 32 - 38 inches.
6. All devices should be free of sharp or rough edges with all fasteners installed below the surface and capped to prevent harm to hands, arms or clothing of pedestrians.
7. All devices used to provide guidance for pedestrians shall interlock to prevent gaps between devices.

5.4 TEMPORARY PATHWAY ALIGNMENTS

Where a TPAR is delineated with PCDs, they may be required on both sides. The PCD on the non-traffic side of the TPAR does not need to be crash-worthy, but the PCD separating pedestrians from adjacent traffic (if applicable) must be crash-worthy.

Use the following factors in determining accommodation plans for pedestrians:

- **Project Duration** – Longer projects may warrant a more comprehensive TTC Plan with several phases of traffic control, thereby justifying placement and cost of more substantial pedestrian control measures.
- **Vehicle and Pedestrian Volumes** – Work zones on high traffic volume facilities, facilities with transit service, and facilities with higher pedestrian volumes warrant more extensive plans for providing pedestrian access and safety.
- **Alternate Pedestrian Routes** – On-site alternate pedestrian routes are preferred over detours due to shorter lengths, consistent terrain, and accessibility. However, where staging impacts on-site routes, local detour routes may be available and can help decrease risks related to exposure to work activities. Both route options must provide for the protection of pedestrians, be properly signed, and accommodate users of all abilities.
- **“Outside the Box” Alternatives** – Occasionally, neither on-site pedestrian routes, nor local detours are viable. In these cases, more creative means of pedestrian transport should be

considered and weighed against traditional traffic control measures. Partnerships with public transit and shuttle services may provide acceptable levels of pedestrian mobility.

- **Available ROW Widths** – Where pedestrian facilities can be accommodated in proximity to the work area and existing facilities, consider including additional width as part of a construction easement. If widened, the additional width could be used for placement of temporary pedestrian facilities.
- **Benefit/Cost Ratios: Device Quantities vs. Other Measures** – While not a primary consideration, costs between measures must be compared and weighed in combination with other issues discussed above.
- **Assigning a Pedestrian Escort** – If it is infeasible to provide either a TPAR or pedestrian detour that is a reasonable length, it is allowable for contractors to assign someone the responsibility to assist pedestrians through the work zone. The person assigned these duties shall not be a flagger who is performing those duties.

5.5 DEVICE PLACEMENT

Placement of pedestrian channelizing devices will vary depending on a number of factors, including the location of pedestrians with respect to the hazard(s) – e.g. traffic, construction activities, surface conditions, work area hazards, etc.

- **Between Pedestrians and Traffic** – In cases where the project affects the existing pedestrian facility and pedestrians are provided access on the same roadway surface as motor vehicles (e.g. a closed lane or shoulder), an NCHRP-350 or MASH compliant crash-worthy barrier system (concrete, steel or plastic (water-filled)) on the roadway surface shall be used to separate vehicles from pedestrians.

Consider providing TPARs through a parking lot or similar areas by means of a construction easement or other agreements with property owners. Use PCD on both sides of the pathway to channelize these temporary pedestrian routes.

Do not specify “Work Area Fencing” to delineate temporary pedestrian routes, or to separate pedestrians from a work area.

Image Source: Oregon DOT

Obsolete "Work Area Fencing" shall **not** be used as channelizing devices. This fencing does not provide pedestrians with adequate protection from work area activities or traveling vehicles and does not provide a continuous, detectable bottom edge.

Plastic, water filled barriers are an appropriate channelizing device for pedestrian facilities. PCD should be used on both sides of the pedestrian route when work area hazards or traffic are present on both sides of the roadway.

- **Between Pedestrians and The Work Area** – Use PCD between pedestrians and the active construction work area when the following conditions apply:
  - Pedestrian traffic must pass alongside the work area. The "work area" may include active or inactive work, the storage of equipment and materials, or empty space for contractor access/staging purposes.
  - If work area hazards are present on both sides of the pedestrian pathway, PCD should be placed on both sides of the pathway, as shown below.

Above, the pedestrian route is delineated on both sides to provide a physical barrier between the pedestrian and the work zone as well as between the pedestrian and vehicle traffic.

5.6 COVERED PATHWAYS

Where work activities are planned to take place above a pedestrian walkway (i.e. bridge work or on a building adjacent to a sidewalk) for an extended period, the TTC Plan shall include means to provide a covered walkway to protect from falling debris. Short-term closures of walkways and provision of

alternate routes shall be provided any time construction materials or operations occur over a pedestrian walkway. In no case shall active construction occur above walkways open to the public. It may be necessary to temporarily restrict pedestrian access while overhead work is occurring, but pedestrians shall never be exposed to overhead hazards.

Covered Walkway Design Elements

1. Specifications and drawings of the covered walkway must be must be stamped and signed by a Professional Engineer licensed in the state of VT.
2. Roofs of covered walkways shall be water tight and designed for adequate live loads.
3. Covered walkways shall have a clear and unobstructed ceiling height of not less than eight feet (8 ft).
4. Covered walkways shall have a clear unobstructed width of not less than five feet.
5. Covered walkways shall not allow unprotected passage along the sidewalk on either side of the covered walkway.
6. The interior of the covered walkway shall be lighted at all times. Lights shall be installed on the ceiling and provide an adequate level of illumination. Lights must be left on overnight. Lighting shall be inspected nightly and burned out or inoperative lights shall be replaced or repaired by the next business day.
7. The structural members of the covered walkway shall be adequately braced and connected to prevent displacement or distortion of the frame work.

A covered walkway protects pedestrians from construction dangers occurring above them including falling debris. Covered walkways shall be lit for nighttime use and include proper barriers along their alignment.

5.7 PATHWAY LIGHTING

Temporary pedestrian facilities should be adequately lit for nighttime use. Existing lighting may be used, but supplemental lighting may be needed for TPARs. Engineering judgement should be used to determine if additional lighting is needed. If the need for additional lighting is identified after work has begun (i.e.

via pedestrian complaint, incident, or otherwise) it shall be provided and installed as soon as is reasonably possible.

The National Cooperative Highway Research Program (NCHRP) Report 476 focuses on nighttime lighting for work zones and may be used as a resource for work zone lighting requirements. Lighting can mitigate factors such as slight changes in level or roughness of the walking surface that can cause trips and falls for pedestrians. Surfaces must be lighted in a way that does not conceal irregularities via shadows or light patterns.

The VTrans Street Lighting Design Guide (2015) and the NCHRP Report 476 should be used as the standard for lighting provisions for work zones. Note that requirements for work zones and pedestrian facilities may differ in these documents; if conflicting, the standard with the highest lighting provision shall be utilized. In any case, the method for achieving minimum illumination should be specified in the TTC Plan's lighting plan. Adequate nighttime lighting must also be provided for all temporary crosswalks. The VTrans Street Lighting Design Guide can be found at http://vtrans.vermont.gov/docs#Guide .

5.8 TEMPORARY SIGNING

Providing **appropriate, complete, and consistent** signing for TPARs is critical in helping to ensure effective pedestrian accommodation in a work zone.

Several standard signs are available for use in signing sidewalk closures, providing direction to crossing points or alternate routes and for pedestrian detours. Designers should use the following resources in developing their pedestrian traffic control sign plan details:

- FHWA Standard Highway Signs and its Supplement
- MUTCD
    - Part 2 – Signs
    - Part 6 – Temporary Traffic Control

In signing a temporary pedestrian facility, designers should focus on six important components:

(1) **Notice of Closure**: When sidewalks are closed, clear signage is needed in advance of the closure. Signs shall be used together with PCD as an effective means for keeping pedestrians from venturing beyond the intended point of closure – especially critical where closure points are immediately adjacent to an active work area, or location that could result in significant injury or death for the pedestrian.

(2) **Detectable Barrier:** PCD are also effective in providing a detectable barrier – a device designed to be detectable to visually impaired pedestrians. Audible signage may be required in addition to detectable barriers to guide visually disabled persons safely through or around the work zone. Audible signs may be utilized whenever detectable barriers are not continuous throughout the length of the work zone, and there is knowledge of visually impaired pedestrians in the area. It is best practice to always provide audible signs, but their use would be more imperative when it is known that an area is traversed by visually impaired pedestrians.

(3) **Positive Guidance**: Through signing and devices, an alternate route must be conveyed to pedestrians. Without adequate, clear direction, pedestrians may choose their own route – a route that may lead them into conflict with construction activities. The use of standard signs, and those displaying regulatory messages is strongly recommended. Warning signs should be used to alert pedestrians of any changed conditions.

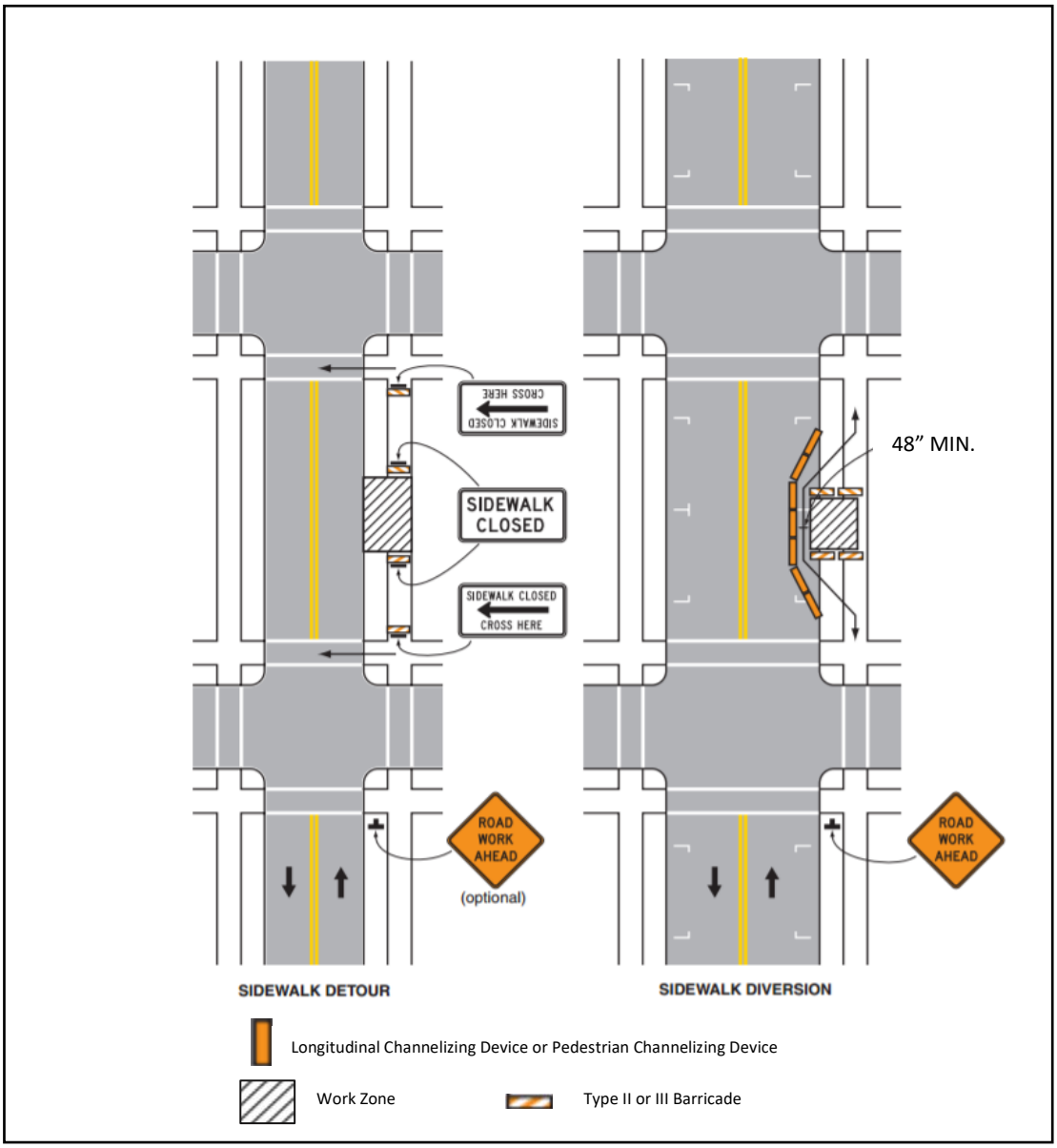
(4) **<u>Continuous Route Signing</u>***:* Adequate, clear pedestrian detour signing must be continued at reasonable intervals along the **entire** alternate route, for **both** directions. Confirmation signing may be needed at each intersection, or at key turns along the route. In some cases, multiple closure points may be necessary to construct a single, desired alternate route for pedestrians.

(5) **<u>Weather Conditions:</u>** All signs and devices within and around a work zone shall be secured against weather related movement. This can be accomplished via sand bags, screwing down delineators to the pavement surface, or other appropriate means to ensure continuous proper placement of signs and channelizing devices. In the case of altered position or removal by weather or traffic, signs and delineating devices shall be returned and secured to their proper position as soon as reasonably possible.

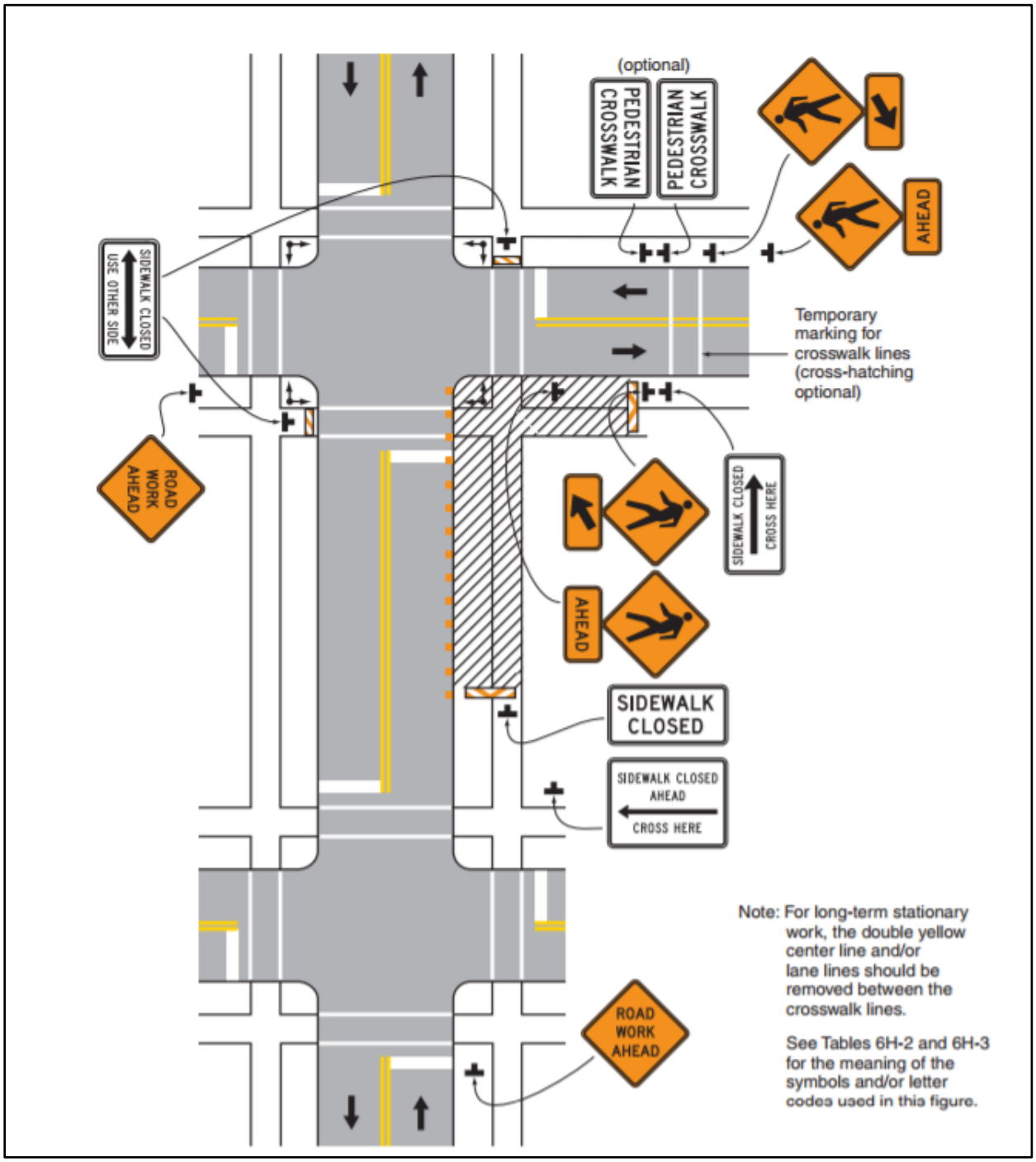
(6) **<u>Location:</u>** Work zone signs should never obstruct existing facilities. Signs obstructing sidewalks that would otherwise be open to the traveling public shall not be used. An example of unacceptable sign placement is shown below.

The above sign places the pedestrian in immediate danger by forcing the pedestrian onto the roadway to navigate around the work zone warning signs. This type of sign placement shall not be used.

Below are examples from the MUTCD regarding pedestrian traffic control in work zones. Specific details on the signs including size and suggested placement can be found in Part 6 of the MUTCD. Sign details are in the Standard Highway Signs Book. Pedestrian detours and diversions are shown. Whether a detour or diversion is used is at the discretion of the designer pending available facilities and physical characteristics of the roadway and surrounding area. In the following figures, only traffic control devices controlling pedestrian movement are illustrated. Additional traffic control devices may be needed to control vehicular traffic on the roadway.



Typical Application 28 from the 2009 MUTCD demonstrates two options for accommodating pedestrians when a sidewalk is closed, a sidewalk detour and a sidewalk diversion. When a sidewalk is present on only one side of the roadway, a sidewalk diversion is the preferred treatment for pedestrian accommodation.



Typical Application 29 from the 2009 MUTCD demonstrates pedestrian accommodation using a temporary mid-block crosswalk as a pedestrian detour.

When existing site conditions make it infeasible to meet the recommended standards for pedestrian accommodation, these conditions shall be documented and maintained in the project files. Conditions may include insufficient width, traffic conflicts, steep grades, etc. The TPAR provided must still meet accessibility requirements to the maximum extent feasible.

The TTC Plan should include bid items and quantities necessary to implement the details shown in the plans. Special Provision 900.645 (Maintenance of Pedestrian Traffic) is available and provides a means to pay for temporary traffic control including channelizing devices, temporary pavement markings, signs, temporary curb ramps, handrails, and detectable warning devices. This special provision provides a lump sum bid item for all materials, installation, relocation, and removal required for maintaining pedestrian traffic through the work zone.

5.9 WORK ZONE DESIGN FOR CONSTRUCTION IN AREAS WITH NO SIDEWALK

In cases where a new sidewalk is being installed, and no pedestrian facility is being closed, it is still important to be aware that pedestrians may utilize the area for travel, and may need some level of accommodation. At a minimum, if the project area is known to have pedestrian traffic, the overall TTC Plan should discuss how pedestrian travel through the work zone is to be treated. While not required when there is no existing facility, designers should consider providing a temporary walkway through the work area so that pedestrians know where to go and are protected from construction activities and adjacent traffic.

For areas where pedestrian use is low, but not restricted (like it would be on a limited access highway), there are still some basic considerations for the occasional pedestrian that may come across the work zone. Contractor's personnel can be assigned the responsibility to escort those pedestrians through the work zone to make sure that they can do so safely, without being exposed to hazards from traffic or construction operations. Flaggers shall not be assigned this as an extra duty.

In either case, if pedestrian traffic is expected, it is recommend that the project plans include the Pedestrian Temporary Traffic Control Notes that have been developed by VTrans and are available here - https://vermontgov.sharepoint.com/sites/VTRANS/VTransIntranetHome/Highway/Ops/TSMO/Shared%20Documents/Forms/AllItems.aspx.

5.10 ROAD CLOSURES

Where a road that includes pedestrian facilities or is known to be used by pedestrians is closed, it may be necessary to include a provision in the contract to shuttle pedestrians from one side of the closure to the other. When considering whether this is the correct treatment, designers should consider the length of detour that a pedestrian would have to walk and the anticipated volume of pedestrians. If a sidewalk is impacted by the closure and the detour is excessive, a shuttle should be provided. In consideration of what length detour is excessive, keep in mind that the average pedestrian trip is ½ mile in length.

6. WORK ZONE DESIGN FOR BICYCLISTS

When a work zone affects the safety, accessibility, or movement of bicyclists, the TTC Plan shall provide traffic control measures to accommodate bicyclists through or around the work zone. Generally, for more rural sections of road with no specific bicycle facility (e.g. a marked bicycle lane or shared use path), TTC Plans for motor vehicle traffic will also serve bicyclists without much additional work or modification. Bicycle volumes should be researched prior to designing the TTC Plan and/or observed prior to the commencement of work to determine the need for specific bicycle facilities through the work zone. Municipalities, Regional Planning Commissions, VTrans, and other similar resources may be helpful in determining the likelihood of bicycle presence on particular roadways.

The VTrans Bicycle Corridor Priority Map can be found in Appendix A of this document. These priorities were determined as part of the VTrans On-Road Bicycle Plan. Data from this plan (found here: http://vtrans.vermont.gov/planning/bikeplan) should be used by designers and contractors as part of the available data to determine the potential presence of bicycles on roadways.

If the existing roadway to be affected by the project includes a marked bicycle lane or if the highway is a signed bicycling route (e.g. the Cross VT Trail or Lake Champlain Bikeway), bicyclists should be provided with a convenient facility that replicates, as nearly as practical, the most desirable characteristics of the existing bicycle facility (i.e. pavement markings, physical delineation, signs).

The continuity of a designated bikeway should be maintained through the work zone whenever possible. The continuity of the bikeway is especially important where bicyclists have been traveling on a shoulder, bike lane, or shared use path adjacent to a high speed (> 35mph) motorized vehicle travel lane. There is a safety concern if bicyclists were to share the travel lane with motorized vehicles through the work zone on these high speed roadways, specifically if a speed reduction is not applied to vehicular travel lanes. If available, a reasonable detour route on a lower speed roadway is preferred over extended lengths of shared lanes on high speed roadways, even if it means some out of direction travel.

6.1 BICYCLE ACCOMMODATION PRINCIPLES

The principles discussed in the VTrans Work Zone Mobility Guide and the MUTCD Part 6 all apply to accommodating bicycles in a work zone with regard to advance notice, use of devices and dimensions. For site-specific conditions or configurations not addressed in those references, the TTC Plan designer should provide additional bicycle-specific details within the TTC Plan.

- Do not lead bicyclists into conflicts with motorist traffic, construction vehicles, equipment, operations or hazardous materials.
- Provide a convenient and continuous bicycle facility with an equal or better degree of bicycle accommodation than the existing facility being disturbed.
- On-road bicyclists should not be directed onto a path or sidewalk intended for pedestrian use except for shared-use paths of adequate width or where no practical alternative is available.

Image Source: Oregon DOT

- If possible, the preferred treatment is to provide separate roadway space (e.g. a minimum 4-foot-wide shoulder or bicycle lane) for bicyclists through work zones. A shoulder or bike lane should be provided on corridors with traffic volumes greater than 5000 AADT or with posted speeds (or construction posted speeds) of 40 MPH or greater. If those conditions exist, channelizing devices shall be used to separate bicycles from traffic if delineating a long-term temporary bicycle facility. Channelizing devices may be used for intermediate or short-term duration work zones.
- For posted speeds during construction of 35 mph or lower, where neither roadway width, nor alternate routes are available, a "shared roadway" condition may be adequate. If the project impacts an existing bike lane or signed bicycle route, the Bicycle warning sign (W11-1) and "Bicycles ON ROADWAY" plaques shall be used to increase awareness of the shared road condition.
- Dismount zones are strongly discouraged as a form of bicycle accommodation. Only in extreme cases where no other option is available should bicycles be forced to dismount to use a pedestrian facility.

6.2 BICYCLE DETOURS

Where an existing bicycle facility is impacted, and roadway width is not available to provide adequate bicycle facilities through a work zone, or where it has been determined that doing so would raise a significant safety concern based on existing vehicle speeds or volumes, detour routes should be considered for bicycle accommodation.

In considering potential detour routes for bicycles, several conditions shall be considered including length, grade, shoulder width, and surface condition of the alternate route. Bicycle detours should utilize existing, nearby bicycle facilities or low volume roads wherever possible. A detour that parallels the existing facility is ideal, but not always possible in rural areas. Engineering judgment shall be used in consideration of the above factors to determine if a detour is reasonable. Designers should consider that the average length of a bicycle trip in the U.S. is approximately 2 miles.

If a detour route is sought, it shall be well documented within the TTC Plan and have a signing plan in place. Coordinate with local agencies if detours are planned on their facilities (i.e. local roads or paths that are not part of the State network). Ensure bicycle traffic and any sign and channelizing device placement on their facilities are approved prior to the project being released for advertisement. Regulatory bicycle exclusion signs may be used to keep bicycles out of the work area and encourage use of the detour route.

If a detour is being provided for all traffic and it makes use of limited access highways where bicycle traffic is not allowed, a separate, signed detour route for bicycles shall be provided. Signs for the main detour route shall clearly indicate that it is not the intended route for bicycle traffic. Public outreach about both detours should also clarify the distinction between the two routes.

The TTC detour plan for the bikeway should include necessary advance warning signs (W-21 series) and detour signs (M4-9 series), as well as any other temporary traffic control devices necessary to guide bicyclists along the detour route.

Public notice for bicycle detours should be posted in advance of any closures. Notice can be posted on project and/or town websites, Front Porch Forum, at local bike shops, etc. to provide advanced warning of affected bicycle routes.

6.3 FLAGGERS

Flaggers can be utilized to aid in bicycle traffic control in work zones where a shared lane configuration exists and traffic is maintained in an alternating one-way pattern. All on-site flaggers should be aware of the TTC Plan's accommodation for bicyclists. It is current best practice to clear the vehicles from an approach first, while bicycles remain halted. Once the vehicles have cleared the queue, or at the flagger's halting of the queue, bicycles will proceed to travel through the work zone. This practice separates the through movements of vehicles and bicycles so that they are not competing for the same space and shall be used when the lane width is 11 feet or less and no dedicated bicycle facility is provided through the work zone. If separate roadway space is provided for bicyclists (i.e. a shoulder or bike lane), they may proceed together with motorized traffic.

6.4 "OUTSIDE THE BOX" ALTERNATIVES

Occasionally, neither on-site roadway width, nor local detours are available. In these cases, more creative means of accommodating bicycles should be considered and weighed against traditional measures. When a reasonable bicycle detour route cannot be determined, a shuttle service or other alternative transport may be provided to safely transport bicyclists around the work zone. Consider temporary bus/shuttle stops, information kiosks, "hotline" phone numbers, etc. to provide an effective transportation means for bicyclists on significant cycling routes.

Coordination with cycling events (e.g. The Vermont Challenge, triathlons, "Bike to School Day" events etc.) is essential when construction is occurring on planned event routes to ensure safety of contractors and event participants. This coordination may include event detours, or a special construction schedule to provide adequate, safe surfaces for cyclists.

6.5 TEMPORARY SIGNING

Bicycle-specific signing shall be used any time construction disrupts a designated bike lane or shared use path. Specific signing may be used when a signed bicycle route (e.g. the Cross VT Trail or Lake Champlain Bikeway) is impacted by construction.

Signing within the work zone should be clear and consistent for the entire length of the work area. The placement of temporary signs should be designed so as not to disrupt traffic flow, and to be easily visible to all users.

The BICYCLES MAY USE FULL LANE (R4-11) sign should be used when the following conditions exist:

- Roadways and street with a construction speed limit of 35 mph or less
- Where the combined travel lane and usable shoulder width is less than 14 feet

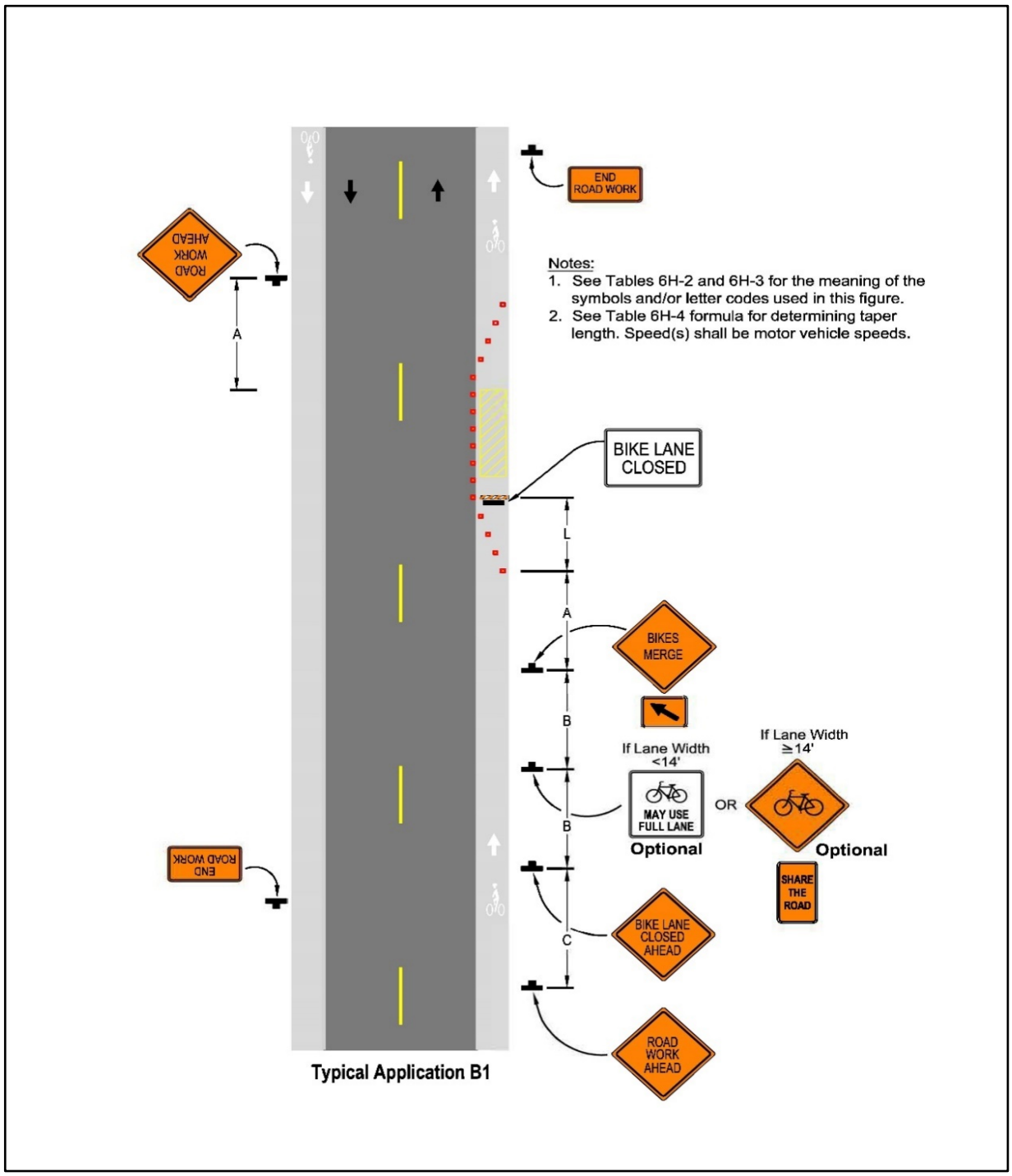
The BICYCLES MAY USE FULL LANE sign should **not** be used on unmarked, undivided roadways.

Include the bicycle warning sign (W11-1) for the conditions described above, and for locations and situations such as:

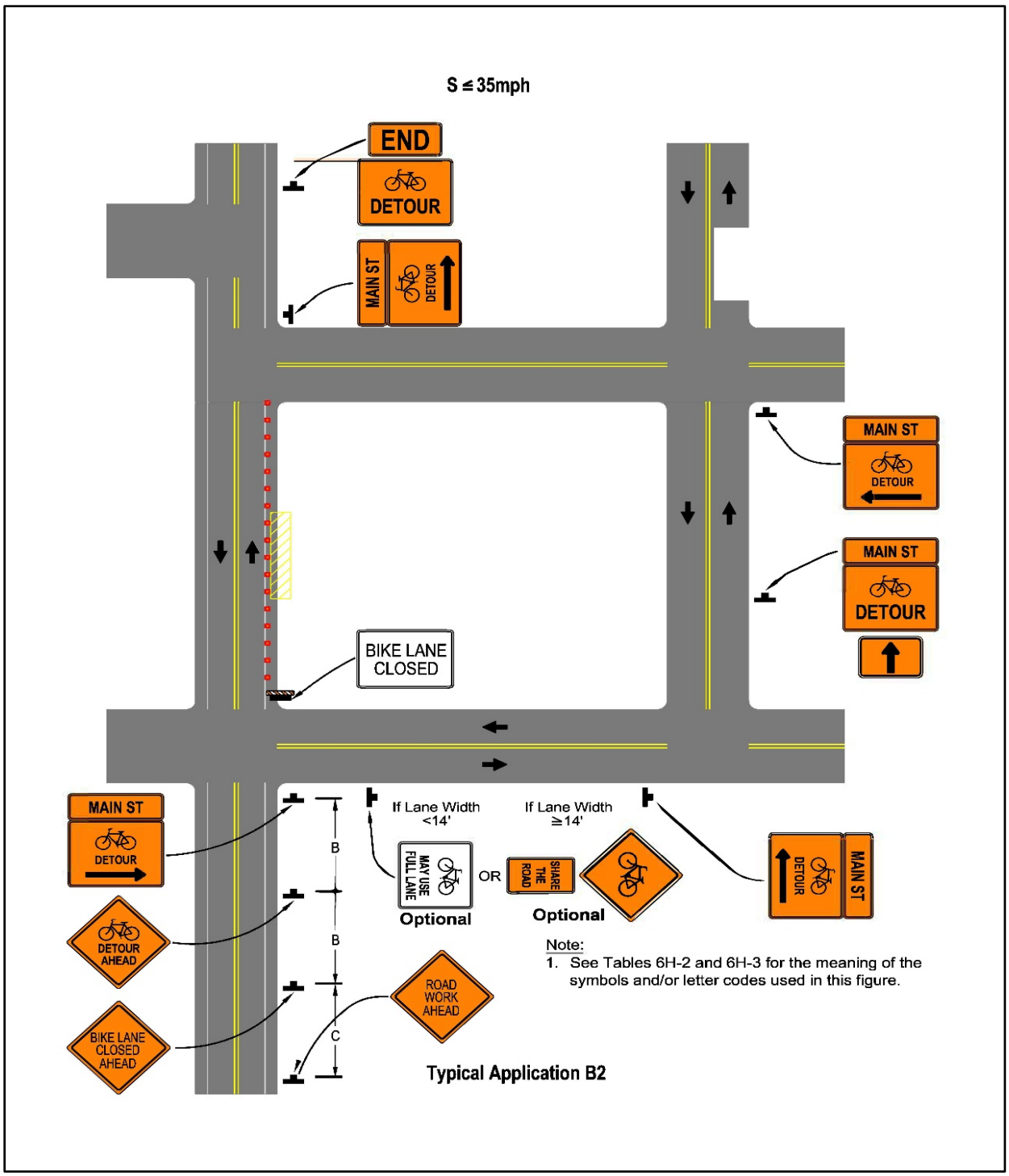
- Shoulders or bike lanes are closed or removed as part of construction activities
- Designated Bicycle Routes: Several highways in Vermont are signed as long-distance bicycle routes.

Temporary signing can also be helpful in identifying the location, or beginning and ending points of a temporary bicycle facility. Temporary warning signs as well as regulatory bicycle traffic control signs may be useful in safely guiding bicycles through or around work zones. While standard sign designs should be considered first, project-specific sign designs may be necessary. Bicycle-specific work zone sign details have been provided in Appendix C of this document.

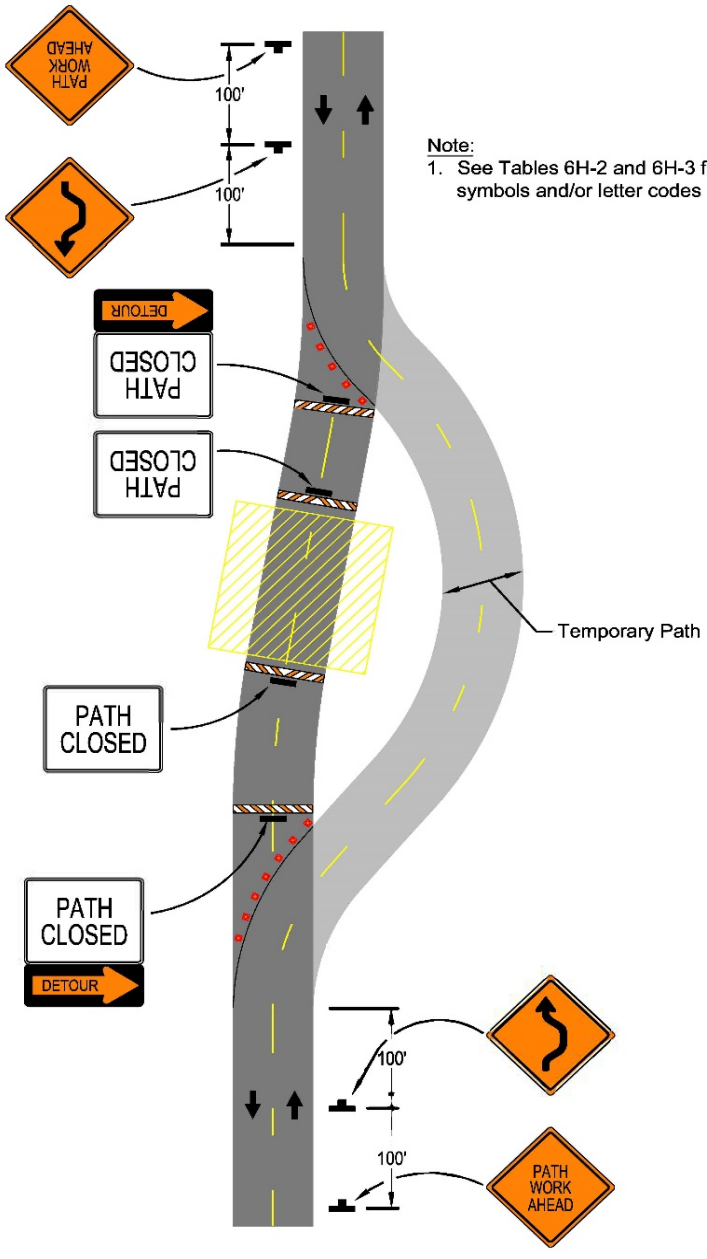
The below sign packages focus on bicycle specific traffic control devices. Signs, lines, and other traffic control devices for vehicular traffic may also be necessary and shall conform to the standards outlined in the latest version of the MUTCD.



Typical Application B1 illustrates a closure of a bike lane where bicycle traffic is expected to share the travel lane with motor vehicles.

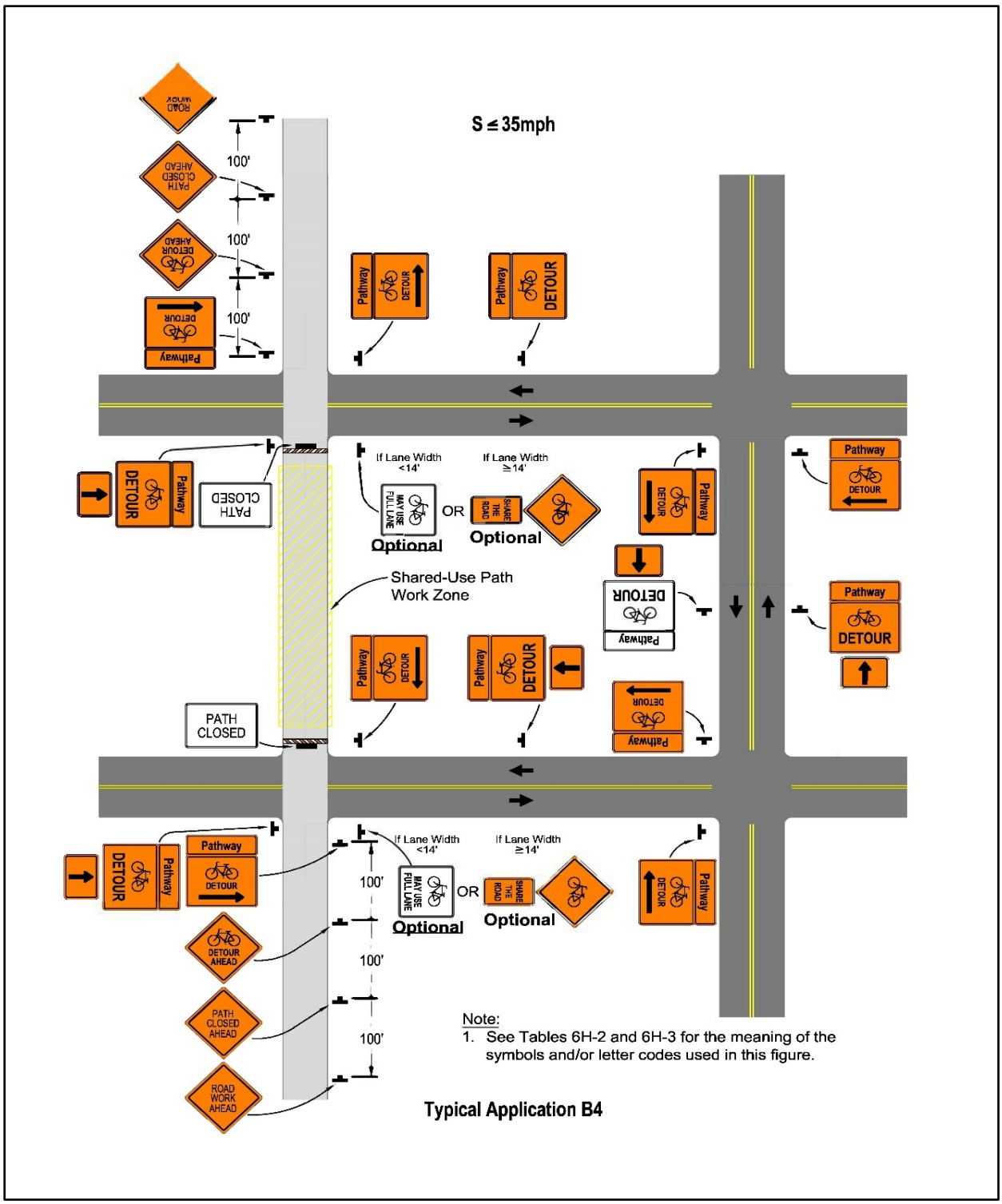


Typical Application B2 illustrates a closed bike lane and a signed bicycle detour.

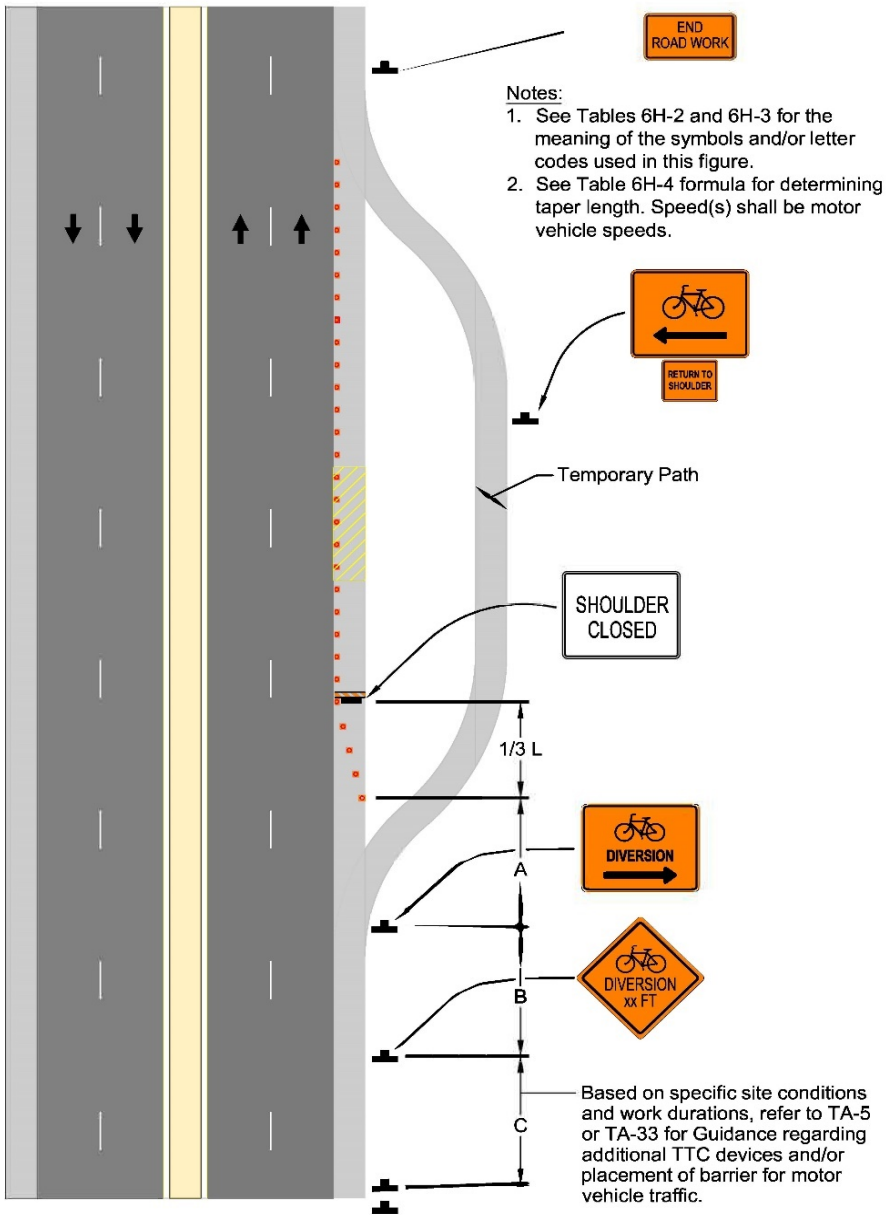


Typical Application B3

Typical Application B3 illustrates a closure of a shared-use path with the provision of a temporary path to provide continued access.

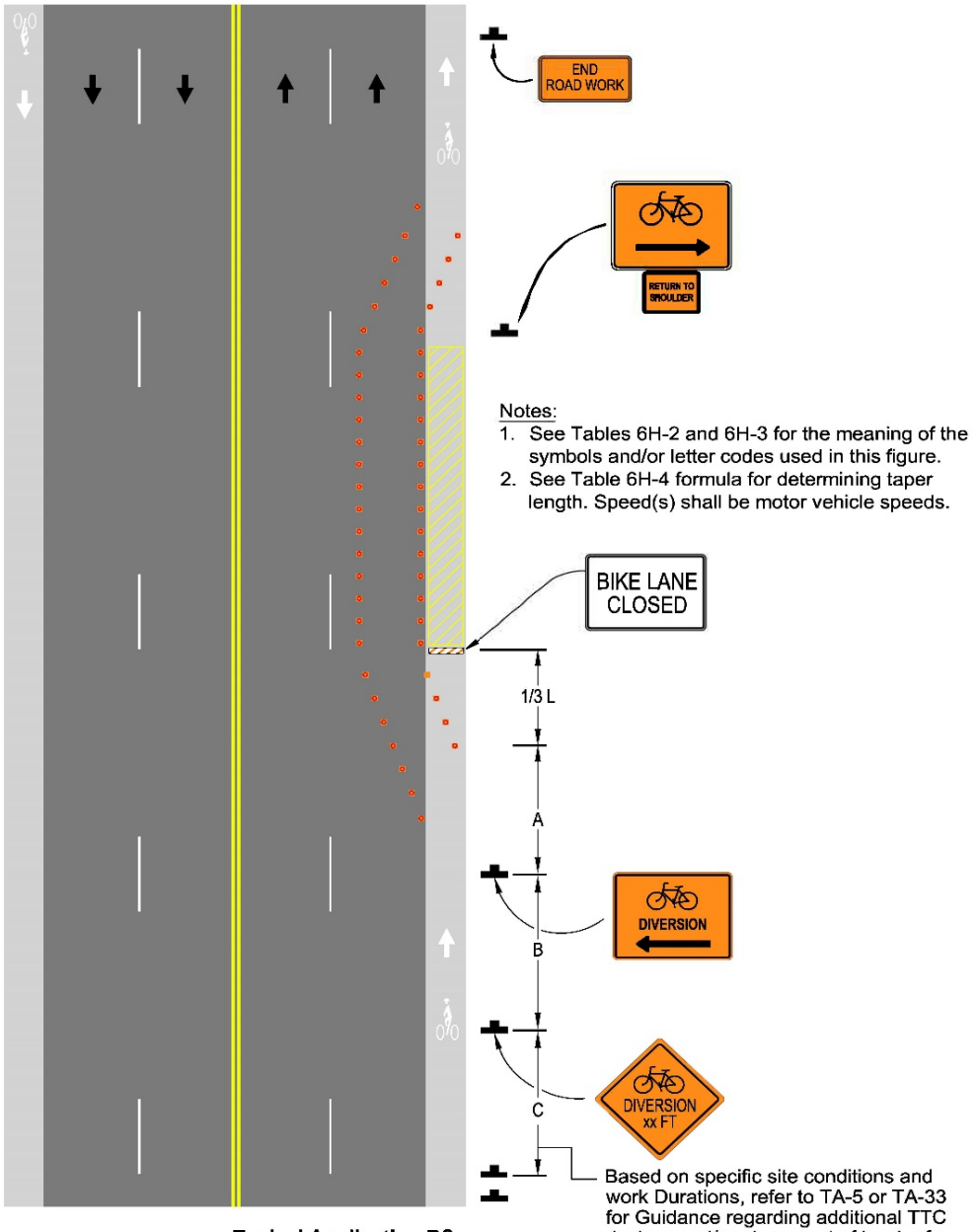


Typical Application B4 illustrates a closure of a shared-use path with the provision of a signed bicycle detour.



Typical Application B5

Typical Application B5 illustrates a closure of a bicycle lane with the provision of a temporary path to provide continued access.



Typical Application B6

Typical Application B6 illustrates a closure of a bicycle lane with the provision of a temporary bike lane with delineation on the adjacent roadway.

6.6 CHANNELIZING DEVICES

Where a shoulder or bike lane of 4-feet or more is to be maintained between a traffic lane and the work area, designers should show enough detail on TTC Plan sheets to clearly convey the proper location of channelizing devices that will separate bicycle traffic from adjacent vehicle traffic and from the work area (if channelizing devices are being used.) Devices immediately adjacent to the work area (e.g. longitudinal saw cut, excavation, pavement overlay edge, etc.), should be located to optimize the width of the shoulder for bicycle traffic.

Include adequate numbers of cross-section details to emphasize the proper placement of devices with respect to the bicycle travel space. Designers should include additional notes or details to clarify the intent of how bicycles are to be accommodated in the work zone. Comments such as "Work zone will remain passable to bicycles at all times" are not acceptable.

As the required level of detail for bicycle and pedestrian accommodation is often higher and more site-specific than it is for motor vehicles, there is a benefit of designers providing bicycle-specific details on the TTC plan sheets.

6.6.1 BICYCLE CHANNELIZING DEVICES (BCD)

Bicycle Channelizing Devices (BCD) may be included in the TTC plan and placed between bicycle traffic and the active work area and/or between bicycle traffic and adjacent vehicle traffic. Depending on what is used for a BCD and site-specific conditions, an end treatment may be needed to ensure the BCD is not a hazard for vehicle traffic. BCD are not required to provide detectability as with PCD, therefore it is acceptable to use cones, flexible delineators or barrels. A clear width of at least 4 feet must be provided from the edge of any BCD to the edge of pavement or other physical object such as a curb or face of guardrail.

Below is an example of an unacceptable scenario where bicycles are entering an unmarked shared lane situation without any channelization or signage, and work zone hazards are present to their immediate right, followed by an example of appropriate device selection and placement.

Image Source: J. Maus/BikePortland

No channelizing devices are provided for cyclists, forcing them to squeeze between the work area and the travel lane for motor vehicles. No signage or bicycle specific accommodations are made.

Channelizing devices are used above to separate bicyclists from vehicle traffic. Barricades are also used to separate bicyclists from work area hazards. Note that a combination of BCDs can be used to enhance visibility, separation, and mobility of bicycles as shown above.

The intent of the BCD is to guide bicyclists along a designated path and encourage them to stay on the roadway and out of the active work area. BCD are placed on the right of a bike lane/shoulder where it is necessary to separate bicyclists from active work areas. BCD are placed to the left of a shoulder/bike lane where traffic speeds and volumes indicate that positive separation between bicycle facilities and travel lanes is needed (see Section 6.1.)

Where a temporary bicycle facility differs from the motor vehicle alignment, BCD placement along the edge of the active work area should be considered. Additional BCDs may be placed on the opposite side of the temporary bicycle pathway to facilitate bicycles entering and exiting the temporary bicycle pathway.

In cases where work zone activities on the roadway occur in proximity to shared use paths, rail trails, or similar facilities, additional flaggers and traffic control management may be required. In areas where these facilities intersect state highways, it should be expected that bicycle and pedestrian volumes will be significantly higher and more frequent than other portions of the roadway.

7. SHARED USE PATHS

Shared use paths present a unique traffic control challenge: ensuring safe travel for both pedestrians and bicyclists. If a shared use path is impacted by construction, guidance through the work zone must be provided for all shared use path users, which may include: pedestrians, bicyclists, in-line skaters, joggers, etc. of all ages and abilities. When a shared use path is closed, pedestrians and bicycles may need to be diverted differently- e.g. pedestrians to the nearest sidewalk and bicyclists to the nearest bike lane. The alternative facility provided for pedestrians must meet accessibility requirements as described in section 5 of this guide.

Another alternative is to provide a temporary path that replicates the features of the path being impacted. With a temporary path, if it is provided using adjacent road space like a parking or travel lane, proper

channelizing devices must be used to separate the path from adjacent traffic. Because pedestrians use shared use paths, the channelizing devices must meet the detectability requirements of a PCD.

When detours are unavoidable, the shortest and most direct route as possible shall be used to safely guide pedestrians and bicyclists around the work zone. Any pedestrian detour shall meet accessibility requirements.

Using the principles and tools outlined for both pedestrians and bicyclists, a TTC Plan for a shared use path closure should be developed. If path users are directed to sidewalks and on-road bicycle facilities, it will be especially important to provide clear route signing for both user groups.

Another unique challenge for a TTC Plan for a shared use path is that paths serve bicycle traffic going both directions on one side of the road. If bicycle traffic is to be diverted onto a roadway to existing shoulders or bike lanes, careful attention must be paid to the transition from path to road and vice versa.

8. OTHER CONSIDERATIONS

The following represent unique environments that designers should be aware of as they begin their TTC Plan designs for bicycle and pedestrian accommodation. Each traffic control measure or work zone condition must consider the needs of bicyclists and pedestrians, or at least identify an alternative means to do so.

- **Temporary and Portable Signals**: Temporary pedestrian signals may be required to regulate temporary crossings on some roadways, especially for long-term work zones. These signals should include accessible pushbuttons and an accessible pedestrian path.
- **Impacts to Existing Pedestrian Signals**: If a crosswalk is closed at a signalized intersection, each applicable Pedestrian Crossing Signal Head should be covered, the existing push-buttons disabled, and the crossing itself should be signed and include detectable channelizing devices for any TPAR that is provided.
- **Urban/Suburban Intersections**: The scope of work for intersection improvements often includes work on all four corners of an intersection(s). In some urban/suburban environments, viable detours, or the location for adequate temporary facilities, may be limited. Consider the use of construction easements to provide the additional space needed to include a temporary pedestrian facility adjacent to the work area – one that would minimize out-of-direction travel and continue to provide good access and safety for pedestrians.
- **Construction Details and Staging Considerations**: TTC plans should provide enough detail to allow for the construction of the project, but also accommodate bicycles and pedestrians. For intersection projects, in particular, the TTC plan should break up intersection work into stages that will minimize out-of-direction pedestrian and bicycle travel. To meet this goal, only one corner of an intersection should be affected at a time.
- **Plan Sheets:** Plans should be developed specifically for pedestrian and bicycle accommodation at a larger scale (e.g. 1”=50’) and should include details for:
    - Location of temporary curb ramps
    - Channelization
    - Closure points
    - Detour routes

- Surfacing design
- Widths of temporary pedestrian or bicycle facilities

For more information on addressing the needs of pedestrians and bicyclists in Work Zones or development of TTC Plans, contact:

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References

- Pedestrian Accommodation in Work Zones: A Field Guide (February 2018)
  https://www.workzonesafety.org/publication/pedestrian-accommodation-in-work-zones/
- City of Seattle Traffic Control Manual for In-Street Work (2012)
  https://www.seattle.gov/transportation/tcmanual/2013/Traffic%20Control%20Manual%20FINAL%202012.pdf
- FHWA Course on Bicycle and Pedestrian Transportation – Lesson 12: Pedestrian and Bicycle Facilities in Work Zones
  https://safety.fhwa.dot.gov/ped_bike/univcourse/pdf/swless12.pdf
- Manual on Uniform Traffic Control Devices (and Revisions) (2009)
  https://mutcd.fhwa.dot.gov/index.htm
- Oregon Department of Transportation Traffic Control Plans Design Manual – 12th Edition (2016)
  http://www.oregon.gov/ODOT/HWY/TRAFFIC-ROADWAY/Pages/TTC PLAN_manual.aspx
- United States Access Board Guide to the ADA Standards:
  https://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-standards/guide-to-the-ada-standards
- United States Access Board Proposed Right-of-Way Accessibility Guidelines:
  https://www.access-board.gov/guidelines-and-standards/streets-sidewalks/public-rights-of-way/proposed-rights-of-way-guidelines
- Virginia Department of Transportation Work Zone Pedestrian and Bicycle Guidance (2016)
  http://www.virginiadot.org/business/resources/wztc/2016_WZ_Ped_BikeGuide.pdf
- Work Zone Safety and Mobility Guidance Document- Appendix A (VTrans) (2011)
  http://vtrans.vermont.gov/docs

APPENDIX A – BICYCLE CORRIDOR PRIORITY MAP

CANADA

NEW YORK

NEW HAMPSHIRE

MASSACHUSETTS

LAKE CHAMPLAIN

VTRANS BICYCLE CORRIDOR PRIORITY

Bicycle Use Categories

Low Use / Priority	744 miles	(30.8%)
Moderate Use / Priority	784 miles	(32.4%)
High Use / Priority	890 miles	(36.8%)

- Highway Interchange
- Interstate Highways
- U.S. Routes
- State Highways
- Class 1 - 2 Town Highways
- Class 3 Town Highways
- Class 4 Town Highways
- Legal Trails
- Long Trail
- Appalachian Trail
- State Airport
- Municipal Airport
- Private Airport
- Railroad
- State Boundary
- County Boundary
- Town Boundary

This map is the result of significant public participation and reflects the current and potential bicycle use on Vermont state roads. The map will be used by VTrans to prioritize improvements in projects and maintenance activities. For more information about the VTrans On-Road Bicycle Plan and how bicycle use was quantified, visit the project webpage (http://vtransplanning.vermont.gov/bikeplan).

COMPILED BY THE VERMONT AGENCY OF TRANSPORTATION
POLICY, PLANNING & INTERMODAL DEVELOPMENT DIVISION
MAPPING SECTION
MONTPELIER, VERMONT 05633
MARCH 2016

1:200,000

0 2.5 5 10 15 20
Miles

0 2.5 5 10 15 20 25 30 35 40
Kilometers

For more information regarding this map, please contact the VTrans Mapping Section at (802) 828-2600 or at VT Agency of Transportation - Mapping Unit, 1 National Life Drive, Montpelier, VT 05633-5001

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 B – PEDESTRIAN AND BICYCLIST TTC CHECKLIST

VTrans Pedestrian and Bicyclist TTC Checklist

Project Name:	
Designer:	

PEDESTRIANS			
	YES	NO	Explanation for "NO" responses
General			
1. Is an existing sidewalk or shared use path going to be impacted by construction? If YES – A Temporary Pedestrian Access Route (TPAR) must be provided. If NO – Ensure that pedestrians are not exposed to construction hazards (equipment, materials, etc.) – At a minimum use TPAR standard notes.			
Signs			
2. Does the Temporary Traffic Control (TTC) plan include adequate construction approach signs? (sidewalk closures, advance notice of closures, temporary crosswalk signs, pedestrian detour routes)			
Barricades			
3. Are detectable barricades called for at the location of closures or to separate pedestrians from active work areas or traffic?			
Pedestrian Channelizing Devices (PCD)			
4. If the TPAR will be created using a portion of roadway, parking area or other area that was not existing sidewalk, are PCD called for?			
5. Do PCDs have a continuous bottom edge and a top rail that is 34" – 38" off the ground?			
TPAR			
6. Is the TPAR clearly delineated on TTC plans?			

	YES	NO	Explanation for "NO" responses
7. Is the "Clear width" a minimum of 48"? (60" preferred).			
8. If TPAR is 48", is a 60" X 60" passing area provided at least every 200 FT?			
9. Are there temporary curb ramps provided where applicable?			
Detours			
10. Has the length of pedestrian detours been minimized (preferred to provide access on the same side of street as the sidewalk closure)?			
11. Is the detour signed adequately in both directions?			
Overhead Work			
12. If overhead work is occurring over an existing or temporary pedestrian route for a long duration, is a covered walkway provided?			
Temporary Pedestrian Signals			
13. Are all accessible pedestrian features included on any temporary ped signals (locator tone, walk signal tone, accessible push button, etc.)?			
Lighting			
14. Is existing lighting adequate for nighttime use of the TPAR? Provide additional lighting as required by NCHRP 476 Guidelines.			
Miscellaneous			
15. If very limited pedestrian traffic is anticipated, is there a provision for pedestrians to be escorted through the work zone by an employee of the contractor (i.e. an off-duty Flagger)?			

	YES	NO	Explanation for "NO" responses
16. Is a road or bridge with an existing sidewalk going to be closed, and the pedestrian detour greater than ½ mile? A shuttle should be provided.			

Project Name:	
Designer:	

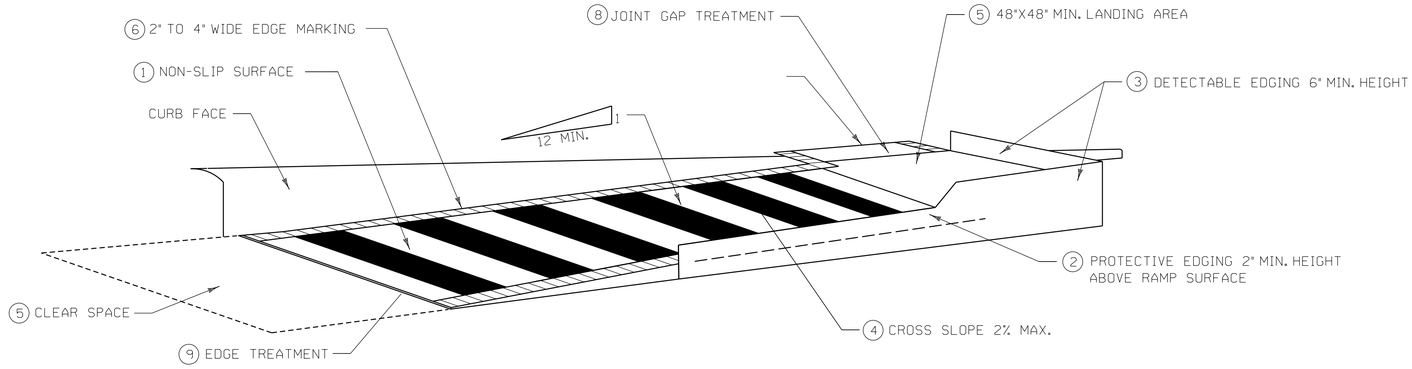
BICYCLISTS			
	YES	NO	Explanation for "NO" responses
General			
1. Is an existing signed bike route, bike lane or shared use path being impacted by construction? If YES – If the construction speed limit is > 30 MPH, provide a delineated shoulder/bike lane through the work zone or use a detour on a lower volume road that does not result in excess out of direction travel. If NO – Bicyclists generally accommodated via the standard work zone TTC plan.			
Signs			
2. Are bicycle specific signs provided as part of the TTC plan? (see Typical Applications B1 – B6 in the VTrans Bicycle and Pedestrian Work Zone Traffic Control Guide)			
3. Will a shared roadway (i.e. no shoulder) replace a signed bike route or a bicycle lane and the speed is ≤35 MPH? Use the "Bicycles on Roadway" sign.			
Barricades			
4. Have barricades been provided at the location of the closure or to separate bicyclists from active work areas or traffic?			
Bicycle Channelizing Devices (BCD)			
5. Have BCD been provided for disrupted bicycle facilities if AADT >5000 or Work Zone speed ≥ 40 MPH?			
Width			
6. Has 4 feet of "Clear Space" been provided for bicyclists?			

	YES	NO	Explanation for "NO" responses
Flaggers			
7. Where a shared roadway is provided through the work zone (i.e. no shoulder), is a note included for flaggers that indicates that bicyclists will be held to the end of the queue of vehicles then released last?			
Detours			
8. Does the overall detour for a project use limited access highways (i.e. no bicyclists allowed)? NO – see guidance above. YES – Provide a separate signed detour for bicyclists			
9. Are bicycle detours signed adequately in both directions using bicycle specific signs and noting all route direction changes (M4-9c sign series)?			
Shared Use Paths			
10. When a shared use path is closed, are bicyclists detoured onto sidewalks not designed for two-way multi-use traffic? This practice is not acceptable or compliant.			
11. Is a temporary shared use path used to bypass the work zone (Typical Application B3)? If so, the temporary path shall be at least 8 feet wide and provide an accessible surface.			
12. Is a road or bridge with an existing bicycle lane or route going to be closed and will the bicycle detour be greater than 2 miles? A shuttle should be provided.			

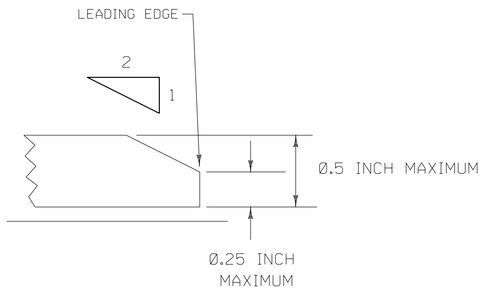
APPENDIX C – WORK ZONE TRAFFIC CONTROL DETAILS

NOTES

1. CURB RAMPS SHALL BE 48" MIN. WIDTH WITH A FIRM, STABLE AND SLIP RESISTANT SURFACE.
2. PROTECTIVE EDGING WITH A 2' MIN. HEIGHT SHALL BE PLACED WHEN A CURB RAMP OR LANDING PLATFORM HAS A VERTICAL DROP OF 6" OR GREATER OR HAS A SIDE APRON SLOPE STEEPER THAN 1:3. PROTECTIVE EDGING SHOULD BE CONSIDERED WHEN CURB RAMPS OR LANDING PLATFORMS HAVE A VERTICAL DROP OF 3" OR MORE.
3. DETECTABLE EDGING WITH 6" MIN. HEIGHT AND CONTRASTING COLOR SHALL BE PLACED ON ALL CURB RAMP LANDINGS WHERE THE WALKWAY CHANGES DIRECTION (TURNS).
4. CURB RAMPS AND LANDINGS SHALL HAVE A 2% MAX. CROSS SLOPE.
5. CLEAR SPACE OF 48"X48" MIN. SHALL BE PROVIDED ABOVE AND BELOW THE CURB RAMP.
6. THE CURB RAMP WALKWAY EDGE SHALL BE MARKED WITH A CONTRASTING COLOR, 2" TO 4" WIDE MARKING. THE MARKING IS OPTIONAL WHERE COLOR CONTRASTING EDGING IS USED.
7. WATER FLOW IN THE GUTTER SYSTEM SHALL NOT BE IMPEDED.
8. LATERAL JOINTS OR GAPS BETWEEN SURFACES SHALL BE LESS THAN 1/2" WIDTH.
9. CHANGES BETWEEN SURFACE HEIGHTS SHALL NOT EXCEED 1/2". LATERAL EDGES SHOULD BE VERTICAL UP TO 1/4" HIGH, AND BEVELED AT 1:2 BETWEEN 1/4" AND 1/2" HEIGHT.
10. CURB RAMPS MAY BE PRE-FABRICATED OR CONSTRUCTED IN PLACE. CONSTRUCTED IN PLACE RAMPS SHALL BE CONSTRUCTED USING PLYWOOD (WITH APPLIED NON-SLIP SURFACE), COMPACTED AGGREGATE, OR TEMPORARY BITUMINOUS CONCRETE.



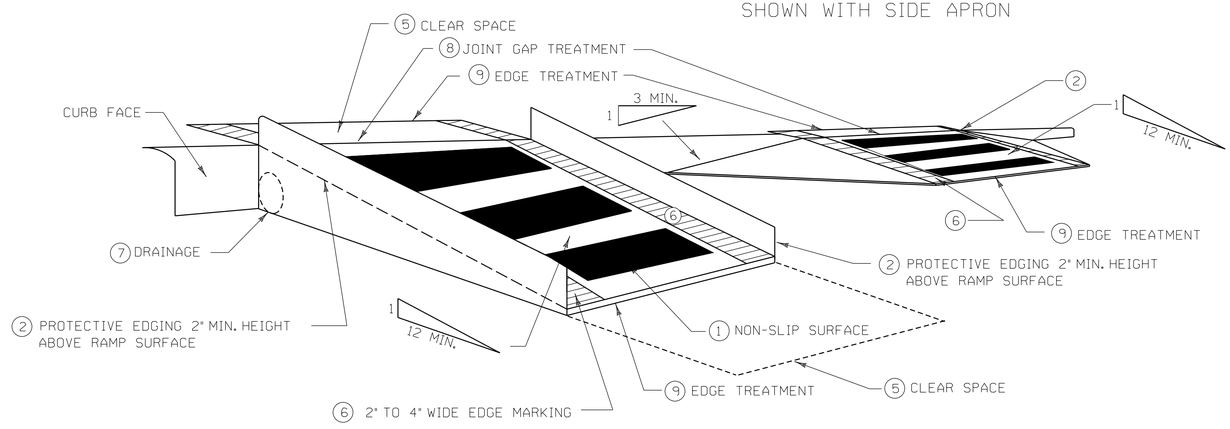
TEMPORARY CURB RAMP
PARALLEL TO CURB



9 EDGE TREATMENT

SHOWN WITH PROTECTIVE EDGE

SHOWN WITH SIDE APRON



TEMPORARY CURB RAMP
PERPENDICULAR TO CURB

REV.	DATE	DESCRIPTION
0	JUNE 9, 2017	INITIAL DRAFTING (PRE-APPROVED)

TEMPORARY CURB RAMPS

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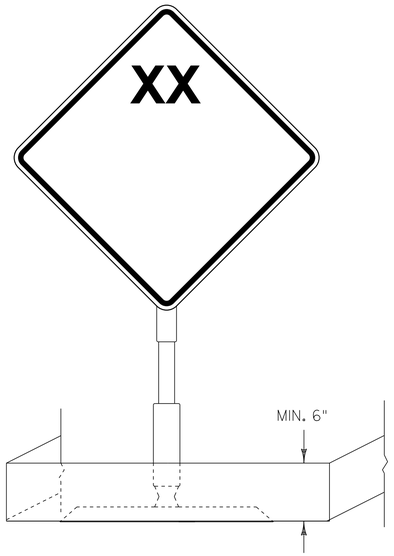
VERMONT AGENCY OF TRANSPORTATION

WORK ZONE
TRAFFIC CONTROL
DETAILS

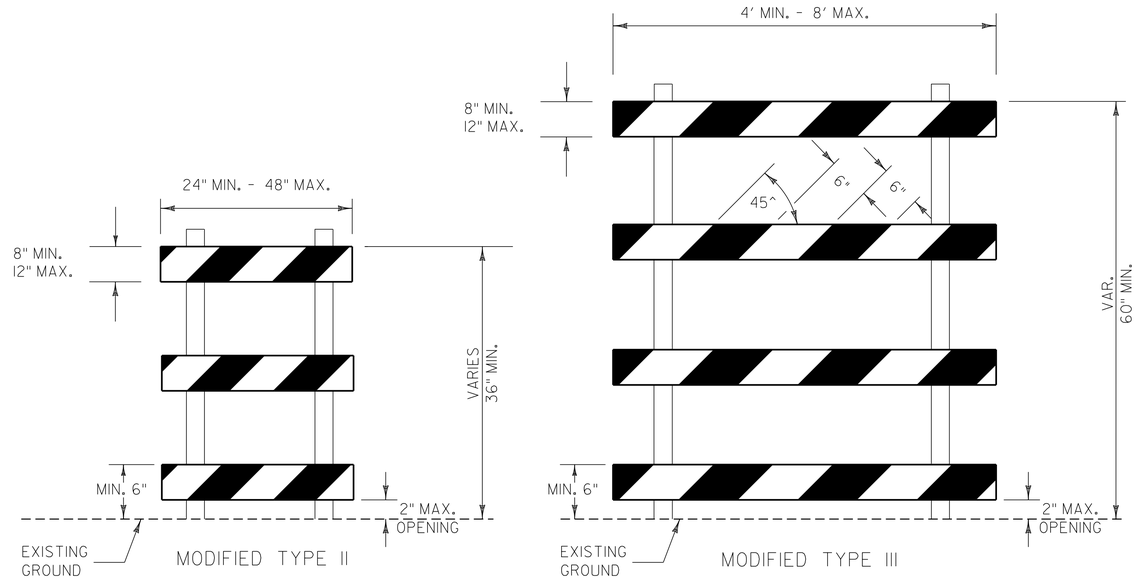


DETECTABLE EDGE FOR PORTABLE SIGN STANDS

NOT TO SCALE

NOTES:

1. A MAXIMUM OPENING OF 2 INCHES ABOVE WALKWAY SURFACE IS ALLOWED FOR DRAINAGE.
2. DETECTABLE EDGE SHALL BE CONTINUOUS AND DETECTABLE.
3. EDGING AROUND PORTABLE SIGN STANDS SHOULD BE USED WHEN SIGN SUPPORTS ARE LOCATED ON A SIDEWALK OR SHARED USE PATH.

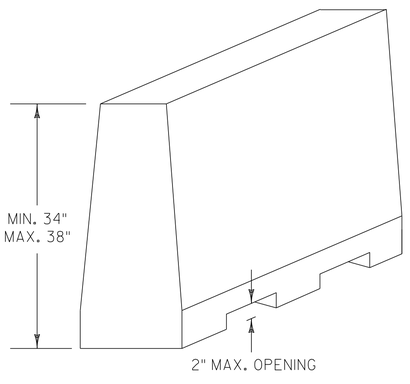


SIDEWALK CLOSURE BARRICADE

NOT TO SCALE

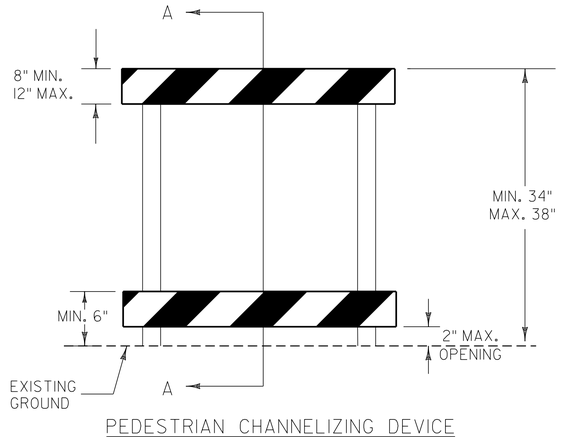
NOTES:

1. STRIPES ON BARRICADE RAILS SHALL BE ALTERNATING ORANGE AND WHITE RETROFLECTIVE STRIPES SLOPING DOWNWARD AT AN ANGLE OF 45 DEGREES IN THE DIRECTION ROAD USERS ARE TO PASS.
2. SANDBAGS MAY BE PLACED ON LOWER FRAME TO PROVIDE REQUIRED BALLAST.
3. BALLAST SHALL NOT EXTEND ABOVE BOTTOM RAIL OR BE SUSPENDED FROM BARRICADE.
4. WHEN RAIL LENGTHS ARE LESS THAN 36 INCHES, 4 INCH WIDE STRIPES MAY BE USED.
5. EACH BARRICADE RAIL SHALL BE 8 TO 12 INCHES WIDE.
6. DO NOT BLOCK BICYCLE LANES OR SIDEWALKS UNLESS THE FACILITY IS PROPERLY CLOSED AND SIGNED ACCORDING TO THE TRAFFIC CONTROL PLAN.
7. A "SIDEWALK CLOSED" SIGN (R9-9) SHOULD BE USED AT THE BEGINNING OF A CLOSED SIDEWALK. IT MAY BE A STANDALONE SIGN OR ATTACHED TO THE TOP OF THE BARRICADE.
8. VERTICAL SPACING OF RAILS IS TO BE EVENLY DIVIDED BETWEEN RAILS.



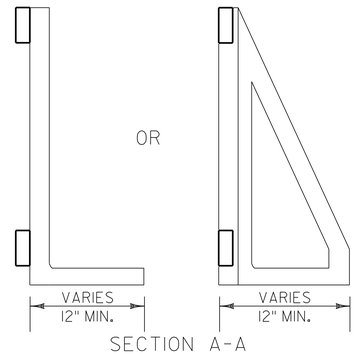
LONGITUDINAL CHANNELIZING DEVICE

NOT TO SCALE



PEDESTRIAN CHANNELIZING DEVICE

NOT TO SCALE



SECTION A-A

NOTES:

1. LONGITUDINAL CHANNELIZING DEVICE MAY BE HOLLOW AND FILLED WITH WATER OR SAND AS BALLAST.
2. DEVICES MAY BE USED AS PEDESTRIAN TRAFFIC CONTROL AND USED INSTEAD OF A LINE OF BARRICADES.
3. WHEN USED TO FORM A CONTINUOUS PEDESTRIAN CHANNELIZER, CONNECTION POINTS SHOULD BE SMOOTH TO OPTIMATE LONG CANE AND HAND TRAILING.
4. THE INTERLOCKING DEVICES SHALL NOT HAVE GAPS THAT ALLOW PEDESTRIANS TO STRAY FROM THE CHANNELIZING PATH.
5. AN OPENING WITH A 2 INCH MAXIMUM HEIGHT ABOVE THE WALKWAY MAY BE PROVIDED TO ALLOW FOR DRAINAGE.
6. PEDESTRIAN CHANNELIZING DEVICES MAY BE PRE-FABRICATED OR CONSTRUCTED ON SITE. ALL DEVICES SHALL BE APPROVED BY THE ENGINEER.

GENERAL NOTES:

1. PEDESTRIAN CHANNELIZING DEVICES MAY BE PAID UNDER ITEM 641.10 TRAFFIC CONTROL OR ITEM 900.645 SPECIAL PROVISION (MAINTENANCE OF PEDESTRIAN TRAFFIC).

REV.	DATE	DESCRIPTION
1	APRIL 4, 2018	DIMENSION AND MISC. NOTE REVISIONS.

PEDESTRIAN TRAFFIC CONTROL DEVICES

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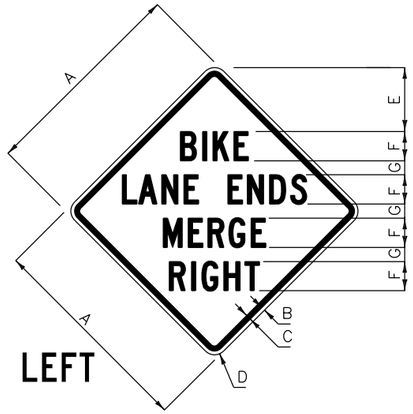
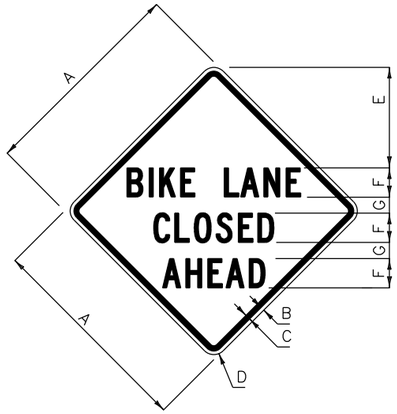
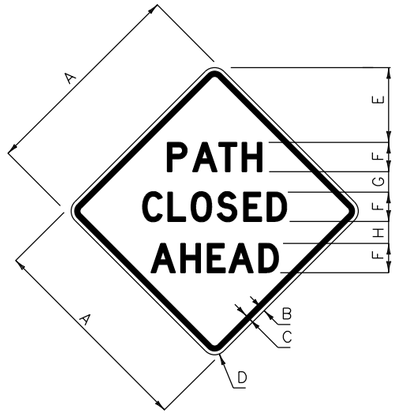
WORK ZONE TRAFFIC CONTROL DETAILS



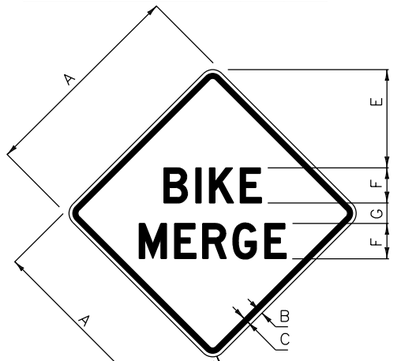
A	B	C	D	E	F	G
36	5/8	7/8	2 1/4	10 11/12	5C	2 5/12
48	3/4	1 1/4	3	16 7/32	6C	3



A	B	C	D	E	F	G
36	5/8	7/8	2 1/4	17 5/32	5C	2 3/4
48	3/4	1 1/4	3	23 3/16	6C	3



A	B	C	D	E	F	G	H
36	5/8	7/8	2 1/4	12 25/32	5D	2 5/12	3 3/4
48	3/4	1 1/4	3	16 7/16	7D	3	3



A	B	C	D	E	F	G
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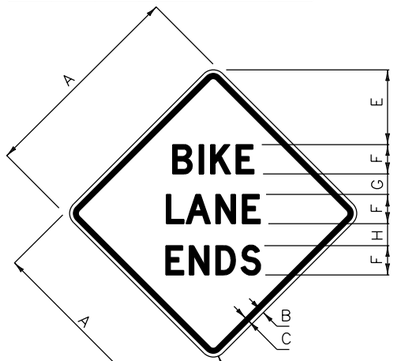
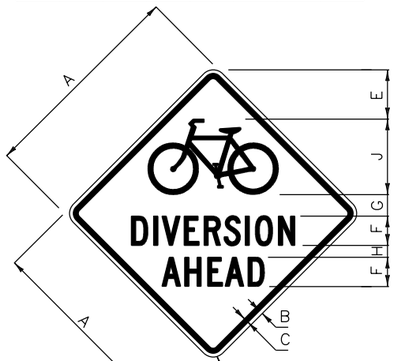
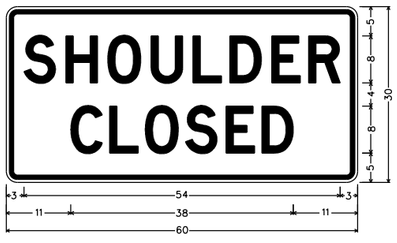
48	3/4	1 1/4	3	22 3/16	8D	5



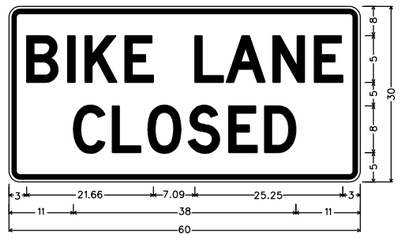
A	B	C	D	E	F	G	H
36	5/8	7/8	2 1/4	12 25/32	5D	3 1/2	3 3/4
48	3/4	1 1/4	3	23 3/16	7D	4 3/4	5 1/4



A	B	C	D	E	F	G	H	J
36	5/8	7/8	2 1/4	8 13/32	5C	3 11/16	2	12 11/12
48	3/4	1 1/4	3	14 7/32	6C	5 3/8	6	17 3/32

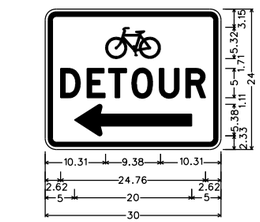


1.88" Radius, 0.75" Border, 0.50" Indent, Black on White:
"SHOULDER" D specified length; "CLOSED" D specified length;

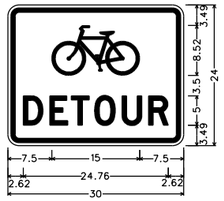


1.88" Radius, 0.75" Border, 0.50" Indent, Black on White:
"BIKE LANE" D specified length; "CLOSED" D specified length;

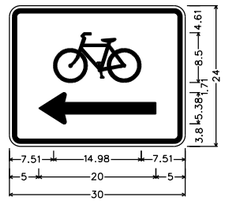
1.88" Radius, 0.75" Border, 0.50" Indent, Black on White:
"PATH" D; "CLOSED" D specified length;



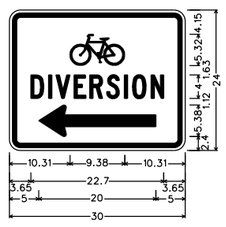
1.88" Radius, 0.75" Border, 0.05" Indent,
Black on Orange;
Symbol RG025: "DETOUR" D;
Standard Arrow Custom 20.00"X5.38" 180°



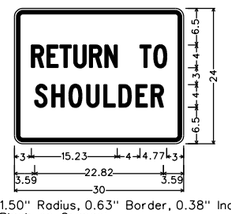
1.88" Radius, 0.75" Border, 0.05" Indent,
Black on Orange;
Symbol RG025: "DETOUR" D;



1.88" Radius, 0.75" Border, 0.05" Indent,
Black on Orange;
Symbol RG025;
Standard Arrow Custom 20.00"X5.38" 180°



1.88" Radius, 0.75" Border, 0.05" Indent,
Black on Orange;
Symbol RG025: "DIVERSION" C;
Standard Arrow Custom 20.00"X5.38" 180°



1.50" Radius, 0.63" Border, 0.38" Indent,
Black on Orange:
"RETURN TO" C specified length;
"SHOULDER" C

NOTES:

1. ALL DIMENSIONS ARE IN INCHES.
2. ALL SIGNS SHALL CONFORM TO THE CURRENT EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES AND ITS LATESt REVISIONS, AND THE VERMONT STANDARD SPECIFICATIONS FOR CONSTRUCTION, DATED AND ITS REVISIONS (ITEM 675- TRAFFIC SIGNS)
3. REFER TO VTRANS STANDARD T-45 FOR SQUARE TUBE SIGN POST AND ANCHOR DETAILS.
4. SIGNS ON THIS SHEET ARE SPECIFIC TO BICYCLE FACILITIES. ADDITIONAL TRAFFIC CONTROL DEVICES MAY BE NEEDED FOR VEHICLES AND PEDESTRIANS IN THE WORK ZONE.

TEXT DESIGN:

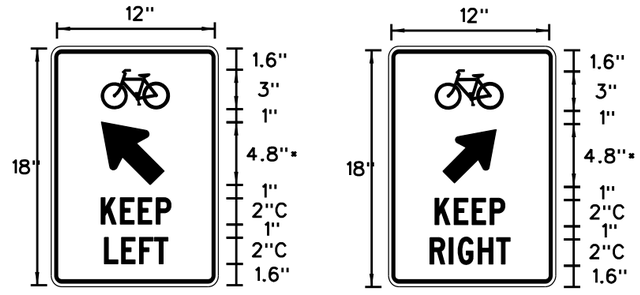
LETTERS, DIGITS, ARROWS, SPACING, AND TEXT DIMENSIONS SHALL CONFORM WITH THE "STANDARD ALPHABET FOR HIGHWAY SIGNS AND PAVEMENT MARKINGS" AND DESIGNS PRESCRIBED IN THE STANDARD HIGHWAY SIGNS AS SPECIFIED IN THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD).

MATERIALS:

THE SIGN BASE MATERIALS USED FOR TRAFFIC SIGN TYPE A SHALL BE FLAT SHEET ALUMINUM MEETING THE FLAT SHEET ALUMINUM THICKNESS CHART ON STANDARD SHEET T-2.

THE REFLECTIVE MATERIAL SHALL BE AASHTO TYPE III MINIMUM REFLECTIVE SHEETING APPLIED TO THE ENTIRE BACKGROUND OF THE SIGN. THE TEXT OF THE SIGNS SHALL BE LETTERING FILM.

ALL SIGN TEXT SHALL BE IN ACCORDANCE WITH THE RESPECTIVE ALPHABET AS IDENTIFIED IN THE CURRENT "STANDARD HIGHWAY SIGNS AND MARKINGS" (SHSM) BOOK AND ITS LATEST REVISIONS.



LEGEND - BLACK (NON-REFLECTIVE)
BACKGROUND - WHITE (REFLECTIVE)

* 4" X 6" ARROWS AT 45 DEGREES
BORDER = 0.625"
INSET = 0.375"
RADIUS = 1.5"

NOTE:
THE SIGN SHOWN ABOVE SHOULD BE USED IN THE EVENT THAT BICYCLE AND PEDESTRIAN TRAFFIC ARE DIVERTED SEPARATELY ON A DIVERSION OR DETOUR FROM A SHARED USE PATH.

REV.	DATE	DESCRIPTION
0		ORIGINAL APPROVAL

OTHER STANDARDS REQUIRED: T-1, T-2
VTRANS AND FHWA APPROVAL ON FILE WITH CONTRACT ADMINISTRATION

BICYCLE AND PEDESTRIAN WORK ZONE SIGNS

VTrans Working to Get You There
VERMONT AGENCY OF TRANSPORTATION

WORK ZONE TRAFFIC CONTROL DETAILS