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MaineDOT TRAFFIC CALMING PROCESSES AND PROCEDURES

Background

Likelihood of death for people walking if hit at these speeds
Source: AAA Foundation, Tefft, B.C. (2011)

Maine has seen an increase in both pedestrian and bicyclist fatalities in recent years. The Figure to the left, shows how travel speed impacts the survival rate when a vehicle strikes a pedestrian. These crashes can be attributed to many factors: distracted driving, inattention, weather, roadway geometry, and improper speed.

Many Village areas offer drivers little to no visual cues as they enter the more built-up sections. MaineDOT's goal is to provide options to municipalities to help make their village area feel less like an open road and more like the municipality's vision for the area. One way to enhance a village area is to incorporate some type of speed control into the roadway template.

MaineDOT is developing a toolbox of lower-cost options to help encourage drivers to reduce speed. The solutions shown below in this document can be used independently of one another or in conjunction with many or all the proposed solutions.

Municipalities may not know what may or may not work within their community and may not want to spend a lot of money installing permanent devices. MaineDOT has created a program for municipalities to demonstrate how each of the possible solutions could work using temporary devices. A municipality wanting more information on this subject can contact the Department and ask for the Regional Traffic Engineer or Planner.

MaineDOT has put into place processes and procedures to aid in deciding when, where, and how to control speeding and cut-through traffic on state and state aid highways. MaineDOT will follow the process and procedures below when making determinations on individual traffic calming or gateway treatment requests. This document describes these.

Definitions:

AASHTO GREEN BOOK- A nickname for the AASHTO publication "A Policy on Geometric Design of Highways and Streets" containing the current design research and best practices for highway and street geometric design.

Applicant - The person or group requesting Traffic calming or Demonstration project.

Complete Streets - is a policy and design approach that requires streets to be planned, designed, operated, and maintained to enable safe, convenient, and comfortable travel and access for users of all ages and abilities regardless of their mode of transportation.

Context Classifications – A method of classifying roads based on land-use data and defining how users expect to move in and around an area.

Demonstration project - A demonstration project means "a temporary project conducted by a municipality or a special interest group", to determine whether the implementation of a specified device, proposed traffic calming, proposed multi-modal addition or other change in roadway cross-section meets the desired goals of the group proposing the project.

Experimentation – Experimentation is a MUTCD term used for devices/concepts that haven't yet been accepted by FHWA through the MUTCD. This would require a formal request to FHWA to test a new traffic control device/concept that is either: 1) Not in the 2009 MUTCD and has not been tested or 2) is in the 2009 MUTCD, but the device would be used in a new way (different size, type, or location) that has not been tested.

HCP – Highway Corridor Priority is the terminology used by MaineDOT to categorize our roadways by relative importance (numbered 1, 2, 3, 4, and 6).

Interim Approval – Interim Approval is an MUTCD term for a device/concept that hasn't been adopted in the MUTCD, but that FHWA/MUTCD officials find promising. This would be a formal request to FHWA for approval to allow the interim use, pending official rulemaking of a new traffic control device, a revision to the application, or manner of use of an existing traffic control device.

MUTCD – Manual of Uniform Traffic Control Devices is a set of national standards used by road managers nationwide to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public travel.

National Association of City Transportation Officials (NACTO) - NACTO's mission is to build cities as places for people, with safe, sustainable, accessible, and equitable transportation choices that support a strong economy and vibrant quality of life.

Retroreflectivity – the ability of a a surface, material, or device (retroreflector) that reflect light to its source.

Tactical Urbanism - an umbrella term used to describe a collection of low-cost, temporary changes to the built environment, usually in cities, intended to improve local neighborhoods and city gathering places.

Urban Compact Municipality – a MaineDOT designation placed on 45+ communities within the state of Maine based on meeting certain criteria. The municipalities have maintenance responsibilities on the roadways within the Urban Compact area.

Part A – Traffic Calming Overview

Section 1- WHAT IS TRAFFIC CALMING AND WHY DO WE USE IT?

For policy purposes, MaineDOT will use the following definition of traffic calming established by the Institute of Transportation Engineers:

> *"**Traffic calming** is the combination of measures that reduce the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users."*

MaineDOT believes that traffic calming, as defined by the Institute of Transportation Engineers, is a valid and useful approach to traffic management.

Since Complete Streets and the Safe Systems Approach policies are important tools in the designer's toolbox, guidelines are necessary to indicate options available and the limits of acceptance/use of certain traffic calming features on Maine roadways.

Maine's arterial and major collector systems provide a network for the safe and efficient inter-regional movement of people, goods, and services between and through major urban centers and municipalities. This sometimes causes conflicts with local needs, such as the compatibility of traffic calming objectives with the prime mobility function of arterial highways. The primary goal of traffic calming is to reduce vehicular speed to a more consistent and acceptable level with secondary gains of reduced crashes and a safer roadway for all users.

Section 2- APPLICABILITY OF TRAFFIC CALMING

Traffic calming is intended for use on all of MaineDOT's Context Classification Types (Rural, Rural Village, Suburban, Urban). The objectives of certain traffic calming techniques may not be compatible with all Context Classifications. This guideline will set forth criteria for traffic calming techniques and MaineDOT's Municipal Traffic Calming Request Review Committee will decide on a case-by-case basis whether a traffic calming technique is eligible for certain roadways due to specific circumstances. Unintended consequences could be undesirably high operating speed, documented high crash locations, and/or documented bicycle/pedestrian safety issues along the corridor.

Section 3 – DEVELOPMENT OF A MUNICIPAL TRAFFIC CALMING PLAN

It is recommended that a Municipality considering traffic calming measures develop a traffic calming master plan that documents the needs of corridors or corridor sections and specifies the areas where traffic calming may be appropriate to address the municipality's needs. These plans should be for current roadway contexts and not aspirational contexts for future needs in the municipality.

The municipality's plan should be reviewed and approved by the responsible municipal/regional authority (council/select board) and MaineDOT (this only applies to municipalities with plans to use traffic calming on state or state-aid roadways). Possible exceptions to the policy on arterial traffic

calming should be identified in these plans and reviewed on a case-by-case basis to identify the most appropriate treatment to solve the problem. Any proposed treatments must minimize potential conflicts between the objectives of traffic calming and the overall mobility function of roadways.

Please note that traffic calming may cause traffic diversion into unwanted/unintended areas. These ramifications should be identified and weighed before indiscriminately using a traffic calming technique.

Section 4 – POTENTIAL FUNDING OPPORTUNITIES

MaineDOT is offering a Village Program to partner with municipalities to help with potential roadway improvements that can aid in transforming the roadway to a condition that is more expected in a Village-type area. Other MaineDOT programs may be available including the Municipal Partnership Initiative (MPI) and the Business Partnership Initiative (BPI), depending on the circumstances of the request.

Part B – MaineDOT Traffic Calming Processes

Section 1- PROJECT DEVELOPMENT PROCESS

Any entity wishing to install traffic calming on state or state-aid roadways within their community must apply to MaineDOT before constructing it. If the entity requesting the traffic calming is not a municipality, that entity must ask the municipality to contact the Department. Requests for traffic calming may be submitted by filling out the form below. Before allowing any traffic-calming construction, MaineDOT requires the proposal to be vetted through a public process where road users, neighborhood residences, and businesses can express their support or concerns for the project.

Traffic calming projects can be funded in many ways:

1) A municipally or privately funded project.
2) Through the application of a Planning Partnership Initiative (PPI) project which can be used to pay for a feasibility study to determine which traffic calming methodologies may work for the community. The municipality could then apply for a Municipal Partnering Initiative (MPI) Grant, a Business Partnering Initiative (BPI) grant, or through the Village Program.
3) Through a Demonstration Project (See Part C)
4) Other Federal or State Programs.

Section 2 - PUBLIC INVOLVEMENT AND PROJECT APPROVAL

Maine DOT's Municipal Traffic Calming Request Review Committee will review the municipality's traffic calming plan for each proposed project. MaineDOT staff can assist with preparing a traffic calming plan for the project impact area. The Municipality's Traffic Calming Team must be represented equitably. It should incorporate community members, including residents appointed by the municipality, interested citizens, business owners within the impacted area, emergency services, the local school district, the bicycling community, public works, legislators if interested, and any transit providers.

The Municipality's Traffic Calming team will be expected to meet with the Department, as necessary, to collaborate in evaluating known traffic issues, identifying and evaluating potential solutions, and recommending a preferred solution. The Municipality Traffic Calming Team is responsible for keeping their respective communities informed of their efforts and should assist the Department with presenting the proposed solutions and answering questions at any formal or informal public meetings on the project.

Once a traffic calming plan is finalized, selected by the Traffic Calming Teams, and vetted through a public process, MaineDOT requires a formal sign-off by the Municipality's governing board (Council, select board, manager, or administrator) indicating support for the proposed traffic calming. MaineDOT then works with the municipality to find temporary funding to test the traffic calming measures through the Demonstration Project process or to construct a permanent solution.

Section 3 - MUNICIPAL TRAFFIC CALMING TEAM

The Municipal Traffic Calming Team is responsible for coming up with the Purpose and Need for the proposed project, (i.e., the problem that needs to be solved). The Team will review pertinent information and make recommendations for proposed solutions to the problem statement. At a minimum, the team should have traffic counts (including pedestrians and bicycles) for the area being reviewed, crashes (including pedestrians and bicycles) along the section, and vehicular travel

speed data in the area. This data is required to document the existing traffic conditions and provide important information on follow-up studies to determine the effectiveness of the traffic calming project if it is constructed. The Department can assist in explaining how to obtain this information.

Section 4 – MAINTENANCE RESPONSIBILITIES

Municipalities may be required to maintain certain traffic calming devices as part of the process. Each project will require the development of a MaineDOT Cooperative Agreement which at a minimum shall specify cost-sharing (if any), maintenance obligations, and the parties responsible for the obligations.

Section 5 – PROJECT EVALUATION

The Department or the municipality shall assess the performance of traffic calming measures after approximately one year after permanent installation to assess their effectiveness and acquire impact data to use in subsequent project planning. At a minimum, speed and volume measurements should be taken after permanent installation to permit before-and-after comparisons. Crash data and resident satisfaction survey data may also be gathered.

PART C – DEMONSTRATION PROJECTS

SECTION 1 - PROCEDURES FOR APPROVALS FOR IMPLEMENTING DEMONSTRATION PROJECTS

MaineDOT has developed the following set of criteria for implementing Complete Streets Concepts and temporary traffic calming via Demonstration Projects:

1) The applicant must develop some sort of written plan/schematics for review by the municipality. The plan at a minimum shall include the following:
    a. If the plan introduces new conflict points (change in traffic control (such as signal, yield, and stop control), signal retiming, reduction in number of lanes, etc), either a memo documenting the scope of the demonstration project and explaining its impacts on the traveling public or a plan with a Professional Engineers (P.E.) stamp shall be provided to Maine DOT.

Bangor -State St - Radius Flattening and Crosswalk Bump-Outs

    b. Plan shall include materials to be used on the project.
        i. Any AASHTO-approved category 1 and 2 traffic control device (drums, cones, tubular markers, temp. curb, etc.) is approved for use on the project.
        ii. Municipality sign-off on materials to be used on the project
        iii. If the project is in for an overnight period or longer, materials must be retroreflective
        iv. The plan shall include how materials will be removed after the project
        v. Removal plans shall be developed in a manner that material removal does not harm existing infrastructure
    c. Plan shall include a proposal for installation
        i. Maintenance of Traffic plan during installation
        ii. Safety plan – (varies by complexity of the project) includes the time of day for installation, protection for/of installers, and safety of the traveling public
        iii. Personnel safety – Personal Protective Equipment (PPE)
        iv. Expected duration for the installation (proposed date of installation, proposed date of removal, is demonstration being done during the peak period of traffic?)
    d. Plan shall include a maintenance plan
        i. The contact information of the person who will be monitoring the installation to ensure it stays intact or remove knockdowns from the roadway
        ii. Detail what the response time will be to fix knockdowns (nights/weekends)
    e. Plan shall set forth goals of the project

i. What are the performance metrics for the project? (reduce speed,bicycle-ped safety, etc)
ii. What are the performance standards that need to be met? (documented speed reduction, have bicycle-ped conflicts been reduced, etc)
iii. Describe how the public weighs in.

f. Plan shall include a public relations strategy
i. Press release
ii. Contact person for comments
iii. How will the municipality determine whether the public finds the project effective

2) The applicant must get a formal written sign-off (letter of support) from the municipality in which the project is being requested.
   a. The plan needs to be approved and signed off on by the Town Manager or Administrator or equivalent. While it is recommended that the town council or equivalent review and approve the project, the signature of the town manager shall be sufficient for the project to move forward.
3) Once the municipality signs off on the project, MaineDOT will review the application.
4) If the demonstration project uses a device/concept that needs interim approval or experimentation status and the performance leads to permanent use of the treatment, the applicant will be responsible for the following:
   a. If the device/concept needs interim approval from FHWA, the applicant shall apply for interim approval.
   b. If the project requires experimentation status through FHWA, the applicant shall apply for and receive experimentation approval.
   c. The Applicant shall develop the goals of the experiment
   d. Comply with all FHWA criteria for experimentation
   e. Develop a report for FHWA
5) MaineDOT may reject an application if it deems the project unsafe.

North Yarmouth Route 9 Lane Narrowing Demonstration Project

6) All applications shall be submitted to the Region Traffic Engineer at the MaineDOT Region office that has jurisdiction over the municipality.

SECTION 2 - PROCEDURES FOR APPROVALS FOR IMPLEMENTING TRAFFIC CONTROL DEVICE CHANGES ON STATE OR STATE-AID ROADWAYS

MaineDOT staff and municipal staff on occasion, have been tasked with making minor changes (striping layouts, changes in type of traffic control, signal changes, etc) to the existing highway infrastructure. These changes shall be reviewed and documented as follows:

1) The Department/Municipal staff must develop some sort of written plan/schematics for review by the municipality. The plan at a minimum shall include the following:

a. If the plan introduces new conflict points (change in traffic control, signal retiming, reduction in number of lanes, etc), either a memo documenting the scope of the demonstration project and explaining its impacts on the traveling public or a plan with a Professional Engineers (P.E.) stamp will be required. MaineDOT and the municipality shall agree on the changes being put forward.

Brunswick - Route 24/Federal St Radius Flattening

b. The responsible party will be required to develop the installation plan, maintenance of traffic plan, and Job Safety Analysis (JSA) for the project.
c. Projects that would have significant public interest (changing from 2-way to 4-way stop control, changing the number of lanes, etc) shall require a meeting with the public. At a minimum, this should include meeting with the municipality's council/selectboard.

PART D - TRAFFIC CALMING SOLUTIONS FOR STATE OR STATE AID ROADWAYS

SECTION 1 - LOW-COST SOLUTIONS

A) Turtles

In neighborhood settings, the use of fluorescent green turtles can help alert drivers' attention that they need to slow down. These turtles are accessorized with orange flags and have the word "SLOW" stenciled across the body. The added verticality to the side of the road is an indication to go slow when driving on streets where this is placed. It has a lightweight design that allows easy set-up. For optimal effectiveness, removal is recommended when children are finished so this figure is only visible during times children are present.

Application:

Types of Roads	Residential Neighborhoods
Posted Speed	20, 25 and 30 mph
Design Vehicles	Passenger cars and light trucks
Grades	Any

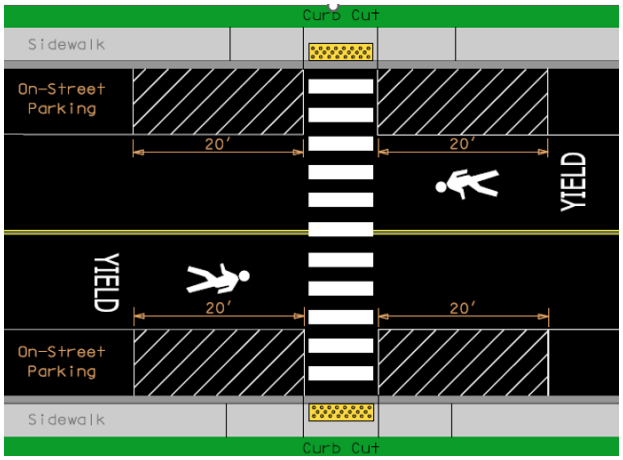
Pro's	Cons
Easy set-up and take-down	Easily blown over by vehicular draft at higher speeds.
Lightweight design	Should be taken down when not in use to maximize effectiveness
Low cost	Need multiple installations to increase effectiveness.
Highly visible	

B) Striping

Pavement striping can be used as a means of controlling speed. Striping that is used for traffic calming purposes can include adding centerline and/or edge line stripes, crosswalks, word and symbol stencils, optical speed bars and stop bars.

Centerline stripes can be used to add definition to residential streets that normally wouldn't have striping. It can be an effective channelizing device used to help reduce speeds. Changing centerline striping widths can aid in providing additional contrast to convey the message for vehicles to slow down.

Edge line striping is also effective in residential areas to narrow the lanes and/or provide additional delineation for other uses, including parking, bike lanes, and shared pedestrian facilities. Using chevron-type markings between white edge lines can provide further traffic calming especially when reducing lane widths. The narrowness can be further enhanced by using optical speed bars in selected locations.



Marked crosswalks are important safety features for pedestrians. MaineDOT promotes the use of high-visibility crosswalks, particularly the Continental (piano key) style. Painted crosswalks alone may not provide the desired level of protection or call sufficient attention to pedestrians to allow them to safely cross a roadway. Appropriate signage and additional yield bar markings may be needed to provide additional delineation to promote safety. Crosswalks help give a roadway pedestrian context.

Word and symbol stencils can be used in a travel lane to bring added context to the roadway. Words such as stop, stop ahead, school or no parking help raise driver awareness of what may be in the area. Stenciled markings such as the pedestrian symbol, route shields, speed limit stencils, or hospital symbol also provide valuable context information to motorists.

Optical speed bars are used as transverse markings off of the center and edge lines spaced at gradually decreasing distances. The rationale for using optical speed bars is to increase drivers' perception of their travel speed and cause them to slow down.

Stop bars should be installed at all intersection legs where traffic is required to stop to provide a visual cue for motorists in addition to the existing stop signs. Sope bars should be either 12 inches or 24 inches wide. Stop bars will not be installed without a STOP sign, and any new STOP signs must comply with the warrants and the latest edition of the MUTCD.

Application:

Types of Roads	All roadways
Posted Speed	All posted Speeds
Design Vehicles	All vehicles
Grades	All grades

Pro's	Cons
Relatively inexpensive	Requires yearly maintenance
Variety of solutions	Novelty wears off
Increase Driver Awareness	False sense of security

C) Signing

Wayne - Route 133 Flashing LED "Village Ahead Reduce Speed" Sign

Signing is a low-cost traffic calming tool and should be considered as the first line of defense as we strive to provide context to our roadways. Signing should convey a clear and concise message and can be the primary mode of traffic calming or can be used to supplement another traffic calming feature. In all cases, signage is needed to convey the intended message. Signs need to be of sufficient size to convey their intent and can be supplemented with flashing lights, colorful borders, and flags. Signs can be mounted overhead or on the ground and can be installed on both sides of a roadway when we are truly emphasizing a message.

D) In-Street Pedestrian Crosswalk Signs

In-Street Pedestrian Crosswalk Signs are intended for use at un-signalized crosswalks to provide an additional measure of safety. Signs in the street are more noticeable than signs by the side of the road. These low-cost signs provide verticality to the crosswalk. Maine State Law requires drivers to yield to pedestrians in the crosswalk. These signs need to be used in the center of the roadway and should be put on the side of the crosswalk that is least likely to be struck by turning traffic. These signs alert motorists to local laws concerning yielding to or stopping for pedestrians in crosswalks and are ideal for mid-block crosswalk identification.

TAPCO an In-Street Pedestrian Crosswalk Sign supplier indicates the effectiveness of this unit has been repeatedly supported by independent testing to demonstrate distinct changes in motorist behavior and accident occurrence following installation.

Types of Roads	All roadways
Posted Speed	40 mph and under
Design Vehicles	All vehicles
Grades	All grades

Pro's	Cons
Relatively inexpensive	Signs get struck by traffic often and need to be replaced.
Provides verticality at the crosswalk locations	Very heavy to pull into the street
Increase Driver Awareness	Needs other efforts to support its efficacy

E) Speed Limit Signs

MaineDOT’s goal with traffic calming is to slow vehicular speeds on our roadways. MaineDOT has increased the size of our standard speed limit sign size along the roadway: 1) For 40 mph and below (30” x 36”) and 2) for 45 mph and above (36” x 48”). One potential tool to further call attention to our signs is to increase conspicuity through oversizing or enhancing with colored borders or orange flags. MaineDOT has experimented with red borders on speed limit signs and is also looking into testing a blue border. MaineDOT has also used speed limit signs with flashing LED lights on the border. These signs add additional conspicuity to an important regulatory sign.

Types of Roads	All roadways	
Posted Speed	All posted Speeds, no limitations.	
Design Vehicles	All vehicles	
Grades	All grades	

Pro’s	Cons
Inexpensive	Flashing signs require routine maintenance – solar array, batteries, Flashing LEDs
Cost-effective when compared to the construction of traffic calming	Can suffer from overuse in certain locations
Increase Driver Awareness	Needs other efforts to support its efficacy

The speed limit signs with the flashing LED borders are solar-powered and can be used as part of a gateway transition into a village area.

F) Speed Feedback Signs

Speed Feedback Signs are used to provide feedback to motorists traveling along the roadway. These signs are comprised of an electronic radar detection device inside a small message board, mounted with a static sign indicating the legally posted speed limit. The signs are placed along a road to increase motorists' awareness of their speed when traveling through a corridor. The radar speed sign measures an approaching car's speed and displays it in large, lighted numbers. The technology MaineDOT is using records the data gathered by the radar for future use by MaineDOT staff, municipal staff, or law enforcement. These devices do not gather personal identification data such as license plate numbers or pictures of violators.

Types of Roads	All roadways
Posted Speed	All posted Speeds, no limitations.
Design Vehicles	All vehicles
Grades	All grades

Pro's	Cons
Provides immediate feedback to the driver, MaineDOT can collect data from signs.	Requires yearly maintenance- solar array, batteries, and alignment
Cost-effective when compared to the construction of traffic calming	Can suffer from overuse in a particular location
Increase Driver Awareness	Needs other efforts to support its efficacy

G) School Zone Signs

School zones are a particular area that would benefit from increased driver attention. The introduction of flashing school zone signage enhanced with speed feedback signs provides a way to dynamically capture a driver's attention. According to recent statistics from Callrainwater.com, more than 100 schoolchildren are injured every single year in accidents that occur inside school zones. Additionally, CBSNEWS.com reports that the Transportation Research Board reports that over 100 children are killed annually while walking to and from school, with approximately 25,000 reported injuries nationwide. It's crucial to prioritize safety measures in school zones to protect our young pedestrians. MaineDOT has undertaken a program to provide School zone flashing lights with speed feedback signs to communities, school districts, and private schools. MaineDOT program is for solar-powered school zone signs. The lights are programmed to flash only when schools are in session. The school can download their school calendar so that the signs do not flash during school breaks and teacher workshop days. These are a valuable asset to protect students in school zones.

Types of Roads	All roadways, with schools
Posted Speed	All posted Speeds, only in school zones
Design Vehicles	All vehicles
Grades	All grades

Pro's	Cons
Provides immediate feedback to the driver	Requires yearly maintenance – solar array, batteries, updating school calendar
Slows traffic by most vulnerable users	Can suffer from overuse in certain locations
Increase Driver Awareness	Needs other efforts to support its efficacy
	Can only be used in school zones, during school hours

H) Rectangular Rapid Flashing Beacons (RRFB's)

Marked pedestrian crossings provide a place for pedestrians to cross a roadway. MaineDOT requires that all crosswalks be marked with one of the accepted crosswalk pavement markings in the MUTCD as well as MUTCD-compliant pedestrian signage. Sometimes marked crosswalks are not enough to capture a driver's attention. The 2023 version of the MUTCD now lists the RRFB as an accepted practice and no longer is governed by FHWA's Interim Approval process. RRFBs are push-button activated crosswalk devices comprised of two, rectangular-shaped yellow indications, each with a light-emitting diode (LED)-array. The RRFBs remain "dark" until a pedestrian initiates the call button to activate the flashing lights. The lights flash in an irregular flash pattern that is similar to emergency flashers on first responders' vehicles. The flashing lights are intended to attract the driver's attention and reinforce the driver's duty to yield to pedestrians in the marked crosswalk. MaineDOT has undertaken a program to provide RRFB signs to communities to aid them in providing safety devices for their constituents.

Types of Roads	All roadways
Posted Speed	40 mph or less
Design Vehicles	All vehicles
Grades	All grades

Pro's	Cons
Provides immediate feedback to the driver	Requires yearly maintenance – checking solar array, batteries, alignment, push buttons
Cost-effective when compared to the construction of traffic calming	Can suffer from overuse in a particular location
Increase Driver Awareness	Needs other efforts to support its efficacy

I) Tubular Markers

Tubular markers are channelizing devices used for general traffic control purposes. Often, MaineDOT uses tubular markers as a traffic calming device on the roadway. They can be used on top of raised islands to add to the verticality along the roadway or along the edge line and centerline

of a roadway to add a vertical dimension to make the roadway feel narrower for motorists. They can be used to enhance existing crosswalks in the form of using them to build temporary bump-outs or to delineate a bike lane from a travel lane along the roadway. Tubular marker colors should match the line color of where they are being used, or for the case of using along a bike lane can be green. Tubular markers must conform to the requirements of the MUTCD and meet NCHRP 350/MASH crash testing standards. They must be the appropriate color for the situation at hand, with a two-inch diameter and 42-inch height. Tubular markers must be circular or elliptical in cross-section. They shall be attached to the pavement via a mounting base and affixed via bolts or butyl pads.

Westbrook - Giles St - Bump-Outs

Types of Roads	All roadways	
Posted Speed	All posted Speeds, no limitations.	
Design Vehicles	All vehicles	
Grades	All grades	

Pro's	Cons
Inexpensive and easy to install – can be used for multiple temporary strategies.	Getting struck by vehicles often, need to be maintained.
Cost-effective when compared to the construction of traffic calming	Need to be removed in winter as they do not stand up to plows
Increase Driver Awareness	Traffic can learn to drive through areas after getting used to them.

Ellsworth Route 1/3 - Using Tuff Curb to Block Town Way and Protect Crosswalk

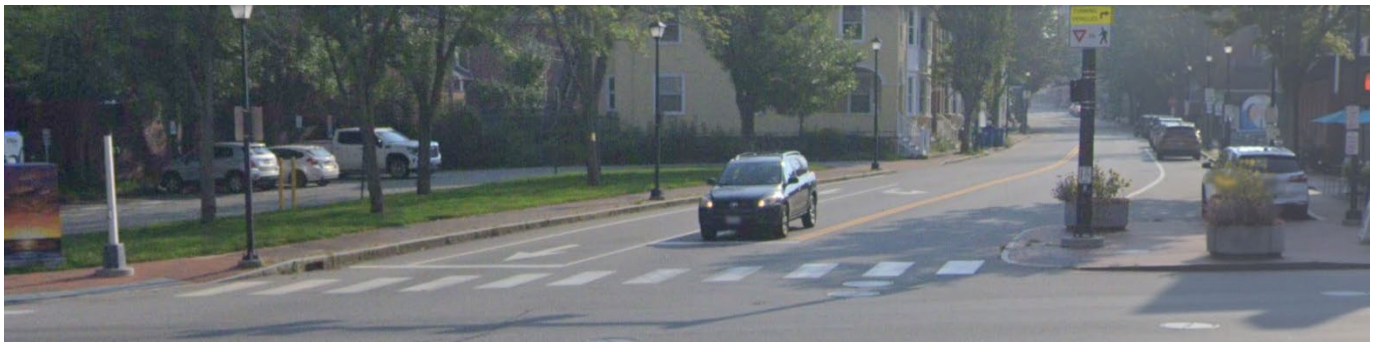
SECTION 2 - HORIZONTAL TRAFFIC CALMING SOLUTIONS

Horizontal traffic calming solutions are physical features built along the roadway that either reduce vehicle speeds or vehicular volume on a section of roadway by altering their direction of travel or reducing the effective width of the traveled way. Modifications may be made to the overall street width, lane width, and/or lane alignment. These changes are traditionally made through the addition of Intersection islands, edge islands, shifts in pavement markings, and the modification of curbs, typically resulting in either the redirection or slowing of traffic. In some cases, physical islands and/or barriers are used to completely close a street to one direction of travel. Horizontal traffic calming solutions can be effective in the reduction of speed and in diverting unwanted traffic from neighborhood streets. Horizontal traffic calming solutions can be used as standalone applications or as part of a series of traffic calming measures. Horizontal traffic calming solutions may be combined with vertical traffic control measures to solve specific traffic issues. This section presents specific horizontal traffic calming solutions. May require analyzation of traffic diversion.

Portland - High and Congress -Bump-Out/ Choker

A) Chokers (Neckdowns)

A Choker narrows the travel lanes of a road by bringing the existing curbs closer to the centerline of the road. A two-lane choker in residential areas can be as little as 20 ft wide (curb-to-curb) at its narrowest point. On higher volume roads consideration should be given to the volume of traffic and plowing, specifically the plow crossing centerline. Chokers should extend toward the centerline beyond any parking lanes. While the typical curb-to-curb width of a two-lane choker is significantly less than most streets, there is sufficient width for vehicles to pass each other. As a result, speed reductions will be modest. The length of a choker can vary depending on the location of driveways and curbside parking but should be at least 20 feet be an effective traffic calming feature. Chokers may also present a favorable location to install a mid-block crosswalk (either raised or level with the roadway) as crossing distances are reduced and vehicular speeds are lower. Also, the combination of design elements will draw greater visual attention to the crossing location. Chokers can be created by either curb extensions or edge islands. Edge islands are less aesthetic (unless open for planting) but leave existing drainage channels open. They also make it possible to provide bicycle bypass lanes on streets without curbside parking. Chokers can cause a problem for bicyclists getting squeezed by motorists in areas with higher traffic volumes. In such cases, bicycle bypass lanes should be considered.



Portland - Spring St/High St - Intersection Choker

The choker's main use is to provide speed reduction via lane narrowing. Speed reduction is vastly dependent on the extent of narrowing, as well as the volume and distribution of traffic. Chokers lose effectiveness when the directional distribution of traffic is significantly higher in one direction than the other or when there are low traffic volumes with minimal chance of friction from opposing vehicles. A choker can contribute to traffic diversion from one street to another based on the level of speed reduction, increase in travel time, and proximity to more convenient alternate routes.

As with other traffic calming applications, when a choker is used as part of a series of traffic calming measures, its efficacy in reducing roadway travel speeds and diversion of cut-through traffic from a street will increase. Chokers and bump-outs are very similar in nature, chokers tend to reduce turning radii when placed at intersections, whereas bump-outs are used purely to shorten pedestrian crossings.

Types of Roads	Collectors and local Roads
Posted Speed	35 mph or less
Design Vehicles	Same as design vehicles for the roadway
Grades	< 6%

Pro's	Cons
Provides effective speed control	Need for overhead lighting or other forms of delineation.
Emergency vehicles are minimally impacted.	Forces plows over the centerline when plowing.
Provides a place for plantings to further encourage traffic calming by introducing verticality	Needs other efforts to support its efficacy

B) Bump-Outs

Bump-outs are a type of curb extension, usually located at roadway intersections. Curb extensions can be used to flatten sharper radii, shorten pedestrian crossings, or reduce the 20-foot setback from marked parking stalls to a crosswalk. Bump-outs should have a tapered transition into and out of the bump-outs to make them easier to plow.

Bangor Main St Bump-Out – View From Sidewalk

Bangor Main St Bump-Out-Shoulder View Showing Tapered Transition

Types of Roads	All roadways
Posted Speed	40 mph and below
Design Vehicles	Design vehicle used in the original design
Grades	All grades

Pro's	Cons
Shorter pedestrian crossings	Can cause drainage/utility impacts
Speed reduction and increased pedestrian safety	Forces bicycles into a travel lane.
Can provide landscaping opportunities and ancillary structure apparatus	Need for overhead lighting

A typical installation of a bump-out is designed such that the design vehicle doesn't cross the centerline when making a right turn. The bump-outs should include MUTCD-compliant signage and/or landscaping to provide further context for the vehicular driver. Drainage should be a major consideration when designing a bump-out as additional drainage structures may be needed. The location of existing utilities should be considered when performing design as they might be required to move. Bump-outs are frequently designed in conjunction with vertical speed reduction devices (raised intersections or raised crosswalks) to increase the likelihood of lower vehicle speeds and to help visually define the crossing.

C) Median Island

Median islands are raised islands built in the center of the roadway, usually at a mid-block location. Median islands cause a visual anomaly for the driver causing them to slow. In addition to slowing traffic, Median islands provide opportunities to create a pedestrian refuge area, landscaping, or install gateway signs. MaineDOT's typical median island is raised, typically with TYPE 5 (sloped granite) curbing. Adding vertical features to the islands such as plantings and/or tubular markers also aids in slowing vehicular traffic down. Some median treatments are constructed flush to the pavement or one inch raised with a beveled edge. The flush islands often incorporate textured pavements and/or are painted solid, red, green, or yellow to provide contrast.

Bangor Main St Median Island Shown From Sidewalk

Bangor Main St Median Island- View From Island Showing Lighting Standards

Types of Roads	All roads
Posted Speed	Usually 35 mph or less but have been used up to 55 mph in the right context.
Design Vehicles	All vehicles
Grades	< 6%

Pro's	Cons
Provides effective speed control	Need for overhead lighting or other forms of delineation.
Emergency vehicles are minimally impacted.	Increases the need for some hands-on snow removal of snow from the island
Provides a place for plantings to further encourage traffic calming by introducing verticality	Increased maintenance of signage on the islands, possible ADA issues

Median islands can be used to narrow lanes or push traffic over from its original course. They can be used to form a two-part pedestrian crossing, providing pedestrians with the opportunity to make a two-part crossing as well as crossing at an area where there may be reduced speed.
Speed reduction and pedestrian safety are the anticipated goals in the construction of median islands. Lane width narrowing at spot locations encourages motorists to reduce their speeds in the narrowed lanes. Speed reduction is dependent on the degree of narrowing, as well as the volume of traffic.

Care must be taken in designing median island locations so that the islands do not negatively impact existing driveways and should be accompanied by either optical speed bars off of edge and center lines or some kind of painted stamped pavement treatment on the shoulders. The median islands should include MUTCD-compliant signs to alert motorists of the presence of the median island. Signs may be supplemented by landscaping; however, preference should be given to low-lying, slow-growing shrubs or herbaceous perennial plants to maintain adequate sight lines and minimize maintenance costs. Median Islands can be designed in conjunction with vertical speed reduction devices (raised crosswalks) to increase the likelihood of lower vehicle speeds and to help visually define the crossing. Designers should review potential impacts on bicycles, plowing, and whether lighting or some other retro-reflective treatment is needed. To properly delineate the island at night.

D) Chicanes

Chicanes are a combination of curb bump-outs and median island extensions that force vehicles off their desired path and then back onto their original course. The purpose of a chicane is to introduce horizontal deflection to the road, slowing traffic by diverting that vehicle's path. In some cases, a path can be built behind the measure to accommodate bicycle and pedestrian traffic and separate them from vehicular traffic.

Types of Roads	All roads
Posted Speed	Usually, 35 mph or less but have been used up to 55 mph in the right context.
Design Vehicles	All vehicles
Grades	< 6%

Pro's	Cons
Provides effective speed control	Need for overhead lighting or other forms of delineation.
Emergency vehicles are minimally impacted.	Increases the need for some additional snow removal from the island
Provides a place for plantings to encourage traffic further calming by introducing verticality	Higher cost. Limited use in areas with a lot of driveways.

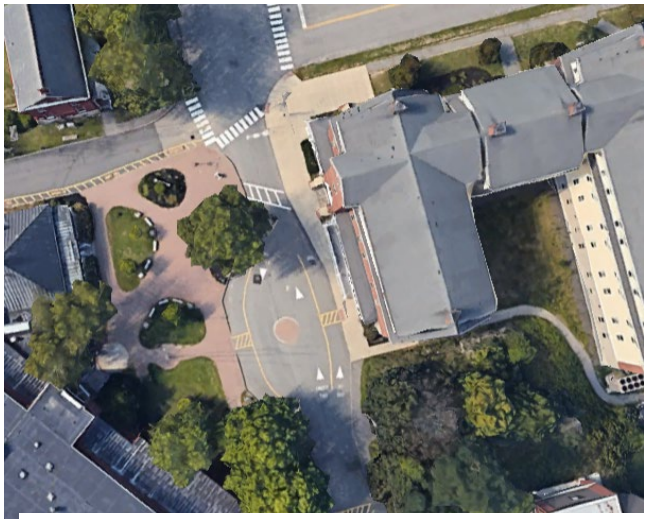
While speed reduction is the goal in the construction of a chicane, designers should ensure there is sufficient lane width available for all vehicles (including plows) throughout the chicane. Horizontal deflection through the chicane encourages motorists to reduce their speed and that reduction is dependent on the extent of the curvature and alignment. Chicanes may cause traffic diversions if there are more convenient routes available. Traffic calming should be looked at on those routes to discourage traffic diversion. As with other traffic calming applications, using a chicane as one of a series of traffic calming measures will likely be more effective in reducing travel speed along a corridor and diverting unwanted traffic from a street. Curbing within the extent of the chicane shall be mountable Type 5 granite curbing.

E) Partial Closures

Partial closures are usually created with a bump-out that blocks travel in one direction for a short distance on otherwise two-way streets. In some cases, a path can be built behind the measure to accommodate bicycle and pedestrian traffic and separate them from vehicular traffic.

Types of Roads	Local, subdivision, collectors
Posted Speed	35 mph and below
Design Vehicles	All vehicles
Grades	< 6%

Pro's	Cons
Can deter cut-through traffic	Need for overhead lighting or other forms of nighttime delineation.
Emergency vehicles are minimally impacted, as they can travel counter flow if necessary.	Causes local traffic to detour to make certain roadway connections (circuity of route)
Provides a place for plantings to further encourage traffic calming by introducing verticality	Traffic diversion to other streets on the network; need to review those streets for traffic calming.



South Portland - SMCC Campus - Partial Closure

Speed limits on roadways utilizing partial closures should be 35 mph or less. The primary purpose of a partial closure is to reduce traffic volumes and not speed reduction. Research has shown that a 35 to 40% reduction in daily traffic volume may result from the installation of partial closures. Designers should consider where the diverted traffic is likely to go, the traffic impact on those streets, and if there are traffic calming measures needed there.
Partial closures should be placed on the entering portion of the intersection. Partial closures placed on the exiting lane could end up unable to turn around except in local driveways.
Partial closures should be constructed with barrier-type curbs to discourage unwanted vehicles from traversing them.

F) Diagonal Diverters

Diagonal diverters are raised barriers placed diagonally across an intersection, to divert through traffic. Diagonal diverters can be built with a small pass-through area for bicycles and pedestrians to travel through. The diverters should have signage and landscaping to add verticality to the islands.

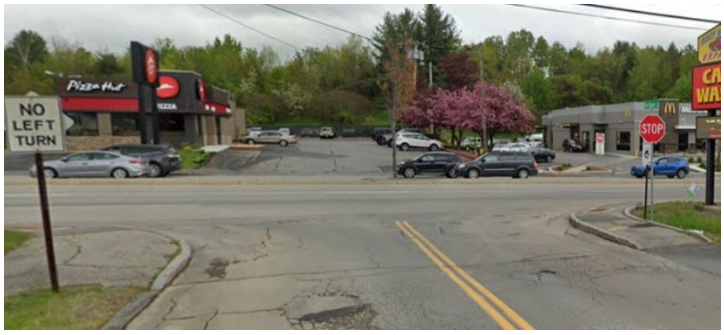
Types of Roads	Local, subdivision, collectors
Posted Speed	25 mph and below
Design Vehicles	All vehicles
Grades	< 6%

Pro's	Cons
Can deter cut-through traffic	Need for overhead lighting or other forms of nighttime delineation.
Speed reduction	Causes local traffic to detour to make certain roadway connections (circuity of route)
Provides a place for plantings to further encourage traffic calming by introducing verticality	Traffic diversion to other streets on the network; need to review those streets for traffic calming.

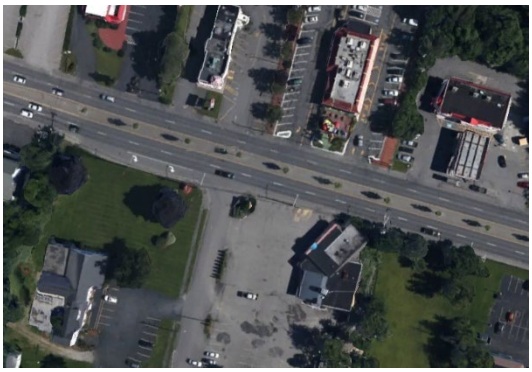
The primary goal of a diagonal diverter is volume reduction, usually that of cut-through vehicles. All through traffic is redirected from the streets they are on. Designers should take into consideration where the traffic is diverted to. Traffic calming should be considered for the parallel streets where diverted traffic may wind up.

G) Intersection Barriers

Intersection barriers are raised median islands located along the centerline of a street and continuing through an intersection to block through and left turn movements at a cross street. Intersection barriers differ from Median islands in that they are intended to force or prevent a turning movement rather than narrow the road like a median island.



Western Ave in Augusta – Intersection Barrier Viewed From Side Street



Western Ave. - Intersection Barrier Viewed From Above

Types of Roads	All Roads
Posted Speed	All speeds
Design Vehicles	All vehicles
Grades	< 6%

Pro's	Cons
Reduces left turn crashes out of the minor leg	Need for overhead lighting or other forms of nighttime delineation
Diverts unwanted traffic	Causes local traffic to detour to make certain roadway connections (circuity of route)
Provides a place for plantings to further encourage traffic calming by introducing verticality	Traffic diversion to other streets on the network; need to review those streets for traffic calming.

Curb radii, specifically for the right turn need to be designed to accommodate the design vehicle. Speed reduction is not the primary goal in constructing intersection barriers, volume reduction is. All through traffic is redirected from the streets they are on. Designers should take into consideration where the traffic is diverted to. Traffic calming should be considered for the parallel streets where diverted traffic may wind up.

Intersection barriers can be landscaped for aesthetic reasons and to reduce jaywalking. They should be built with sloped vertical granite curbing to allow emergency vehicles to traverse if necessary.

H) Mini-Roundabout

Mini-roundabouts and neighborhood traffic circles are small roundabouts with traversable central islands. Mini-Roundabouts generally have an inscribed circle that is small enough to stay within the existing right-of-way (or within the existing curb lines if adequate space is available). For a small, modern roundabout, the center island is not traversable and can be landscaped but a Mini-Roundabout is fully traversable. While they are similar in design, neighborhood traffic circles are smaller and, therefore, are slightly different in the way vehicles operate through them. Typically, neighborhood traffic circles do not raise any portion of the central island and are installed without diverter islands on the approaches. Mini-roundabouts are distinguished from neighborhood traffic circles primarily by their traversable islands and yield control on approaches, which allows them to function as other roundabouts do. Neighborhood traffic circles are typically built at the intersections of local streets for reasons of traffic calming and/or aesthetics and generally operate under full stop-control on all legs of the intersections. Neighborhood traffic circles usually do not include raised channelization islands to guide approaching traffic into the circulatory roadway. At some neighborhood traffic circles, left-turning vehicles must turn in front of the central island, conflicting with other circulating traffic. Mini-Roundabouts are typically intended for use on residential streets with operating speeds of 30 mph or less and low volumes.

Mini-Roundabouts

Types of Roads	Collector roads
Posted Speed	30 mph and below
Design Vehicles	All vehicles
Grades	< 6%

Pro's	Cons
Reduces traffic speeds at the circle	Need for overhead lighting or other forms of nighttime delineation.
Diverts unwanted traffic	Potential loss
Reduces crashes	Traffic diversion to other streets on the network; need to review those streets for traffic calming.

Neighborhood Traffic Circles

Types of Roads	Local Roads and sub-divisions
Posted Speed	25 mph and less
Design Vehicles	Original design vehicle for the neighborhood/sub-division
Grades	< 6%

Pro's	Cons
Reduces traffic speeds at the circle	Need for overhead lighting or other forms of nighttime delineation.
Diverts unwanted traffic and can be built into existing intersection footprint	Emergency response times need to be considered in the design.
Reduces crashes	Snow removal becomes more difficult.

The traditional design vehicle for the mini-roundabout neighborhood traffic circle is the passenger car although single-unit trucks and larger trucks can pass through the intersection, but in most cases will need to mount the apron of the center island at a slower speed. The center island of a mini-roundabout and a neighborhood traffic circle must be a different pavement type than the

surrounding roadways to increase their visibility. Most often concrete or textured pavements are used to distinguish the central island from surrounding pavement. This pavement will be raised for mini-roundabouts and at existing street grades for neighborhood traffic circles. For drainage, the circulating lane of a Mini-Roundabout will ordinarily slope away from the center island of the traffic circle at a slope of 1 to 2 percent. Neighborhood traffic circles maintain all existing street grades and drainage is typically not an issue. Appropriate MUTCD signage and striping shall be installed.

Portland - Neighborhood Roundabout - Elizabeth Rd and Bolton St

SECTION 3 - VERTICAL SOLUTIONS

Vertical traffic calming measures are applications that change the existing vertical geometry to help calm traffic. The elevation changes are traditionally 3 to 4 inches in height and are designed to cause discomfort to motorists when they travel over the traffic calming measure above the desired speed. Depending on the length over which the vertical change is made, some low-profile vehicles may also “bottom out” when crossing the measure at an excessive speed. Transit, emergency vehicles, and bicycles need to be taken into account during the planning and design process to ensure that those vehicles are adequately accommodated. They can be effective in reducing speed and diverting unwanted traffic from neighborhood streets. Vertical traffic calming can be used as either standalone applications or as part of a series of traffic calming measures and may also be combined with Horizontal traffic calming and/or Non-Construction techniques.

A) Speed Humps

Speed humps are elongated mounds installed across the pavement and can be either temporary or permanent in nature. Individual designs may vary slightly, but typically they are approximately 3 to 4 inches in height, parabolic in shape, and between 12 and 14 feet in length. The profile of a 3- to 4-inch-high speed hump is gentle enough to provide a comfortable ride when traversed at a speed of approximately 20 mph and becomes more uncomfortable for motorists to drive over the speed humps at higher speeds. To reduce speeds over a longer distance, several speed humps can be installed.

Speed Hump Spacing	
Posted Speed	Distance between speed tables
25	250
30	375

Typical construction material for a speed hump is asphalt although temporary rubber speed bumps can be used. Pavement markings (striping, arrows, etc.), in accordance with the MUTCD.

Types of Roads	Local roadways and subdivisions
Posted Speed	30 mph and below
Design Vehicles	All vehicles
Grades	All grades

Pro's	Cons
Provides immediate feedback to the driver	Requires yearly maintenance
Proven speed reduction measure	Can suffer from overuse in a particular location
Increase Driver Awareness	Needs other efforts to support its efficacy

Speed reduction is the anticipated goal in the construction of speed humps. Vertical deflection encourages motorists to reduce their speeds through the sections of the street where speed humps are located. Speed reduction is dependent on the height of the speed hump and its length. Speed humps generally have a design crossing speed of 20 to 25 mph for automobiles, while larger vehicles typically cross at lower speeds. Installation of a series of speed humps along several blocks tends to yield the greatest benefits. Speed humps can contribute to the diversion of traffic from a street. As with other traffic calming applications, using speed humps in a series along several blocks, or as one measure within a series of traffic calming measures, will likely be more effective in diverting unwanted traffic from a street.

B) Speed Cushions

Speed cushions are a traffic calming device similar to speed humps, except that they have gaps, that allow emergency and transit vehicles with wider axles and bicycles to pass by the speed cushion without any vertical deflection. These gaps are positioned such that a passenger vehicle cannot pass through the speed cushion without traveling over a portion of the raised pavement, while bicycles and wider vehicles can pass relatively unimpeded. Speed cushions are typically approximately 3 to 4 inches in height and 12 feet long but differ from speed humps in that they contain a level area on top of the cushion. The vertical rise for a speed cushion has a constant or parabolic slope within the first 3 feet, with a level area of 6 feet on top of the speed cushion. The profile of a speed cushion is designed to provide a comfortable ride when traversed at a speed of approximately 20 to 25 mph and less comfortable at higher speeds. Speed cushions like other traffic calming devices are effective at reducing speed at the point of installation. In order to reduce speeds over a longer distance, a number of speed cushions should be installed, with a typical spacing of 250 to 500 feet depending on the posted speed.
Typical construction material for a speed cushion is asphalt, although prefabricated speed cushions are available. Durable white pavement markings (striping, arrows, etc.) should be added to all speed cushion installations to increase visibility and warn drivers of their presence.

Preformed Rubber Speed Cushions

Types of Roads	All roadways
Posted Speed	35 mph and below
Design Vehicles	All vehicles
Grades	All grades

Pro's	Cons
Speed reduction for passenger car vehicles	May increase emergency response time and impact snowplowing
Durable/long life span	Potential for increased noise, due to braking and load shift
Provides a visual deterrent to speeding	Needs other efforts to support its efficacy Vehicles may cross the centerline to avoid hitting the hump

C) Raised Intersections

Raised intersections are a traffic calming device that spans through an entire intersection including all crosswalks. Raised intersections are constructed similarly to speed tables/raised crosswalks in that they are traditionally 3 to 4 inches higher than the existing roadway and have 6-foot-long ramps that transition up to the raised intersection. This provides some level of traffic calming to all approaches. The raised intersection can be designed in a way to minimize the impact on parking. A typical installation would be at an all-way stop or signalized intersection with significant pedestrian volumes. Raised intersections can help in defining the All-Way stop condition, or in the case of signalized intersections, the need to slow down and watch for pedestrians. Raised intersections tend to have a significant impact on drainage systems and utilities and are a significant cost when taking drainage alterations into account.

Auburn - Elm and High St. -Raised Intersection

Types of Roads	All roadways
Posted Speed	30 mph and below
Design Vehicles	All vehicles
Grades	All grades

Pro's	Cons
Speed reduction for passenger car vehicles	This may increase emergency response time and have minor impacts on snowplowing.
Durable/long life span	Potential for increased noise, due to braking and load shift
Provides a visual deterrent to speeding	Potential for drainage issues and ADA issues if not considered

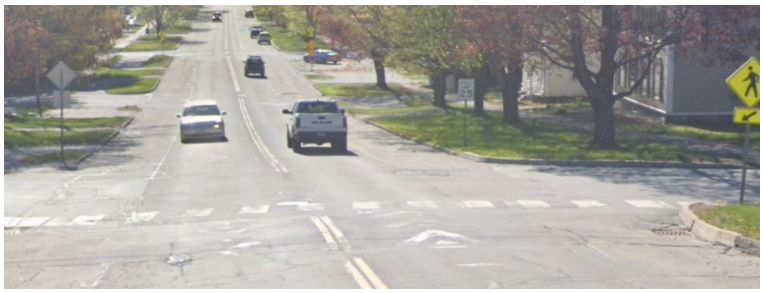
Raised intersections are effective at reducing vehicle speeds on all intersection approaches, particularly on approaches that are not already stop-controlled. Raised intersections may cause unwanted traffic to divert to other routes, especially when used in a series or in combination with other traffic calming devices. They may be used as an alternative to speed humps and speed cushions, especially in urban areas where parking space is limited. Raised intersections improve pedestrian safety, facilitate crossing by the disabled and elderly, and increase pedestrian visibility. Raised intersections can serve as a form of gateway treatment, but generally require a major, costly redesign of storm drainage systems. Raised intersections can cause increased difficulty for large turning vehicles. They require additional signage and should be accompanied by durable pavement

markings. Raised intersections should not be installed where there is a high volume of large turning vehicles. Aesthetic treatments such as textured pavement surfaces help reinforce the concept of “calmed” area and can help promote lower speeds.

D) Speed Tables/Raised Crosswalks

Speed Tables/Raised crosswalks are similar in nature to both speed humps and speed cushions. They typically span close to the full width of the roadway, typically touching down a foot from the curbline or edge of pavement to allow gutter line water to flow by. Speed tables are typically 3 to 4 inches in height a 10-foot level area at the top and two 6-foot ramps leading up to the top on either side covering a total distance of 22 feet. Speed tables will often be co-located with a crosswalk, not only providing speed reduction but also a potentially safer place for a pedestrian to cross. When co-located with a crosswalk, the speed table often is referred to as a raised crosswalk. While the 4-inch height is MaineDOT's standard for most locations, a lower reveal speed table can be used in areas where there is a higher percentage of trucks. While not as effective as the 4-inch versions, they still provide speed reduction. If mid-block pedestrian crossings are an issue, the use of a raised mid-block crosswalk may be an appropriate treatment to lower vehicle travel speeds where pedestrians enter the street. When constructing a raised crosswalk care should be taken to ensure that the transverse slope of the speed table meets ADA/PROWAG standards. Speed table signs and advisory speed placards shall be installed at each speed table/raised crosswalk location. Additional pedestrian signage shall be installed for each raised crosswalk.

Augusta - Speed Table - Winthrop St. With Proper Markings



Augusta -Speed Table -Winthrop St Worn Pavement Markings

Asphalt is the typical construction material for speed tables and raised crosswalks, although prefabricated speed tables are available. Durable white pavement markings (striping, arrows, etc.) shall be added to all speed table and raised crosswalk installations to increase visibility and warn drivers of their presence.

Types of Roads	All roadways
Posted Speed	35 mph and below
Design Vehicles	All vehicles
Grades	All grades

Pro's	Cons
Speed reduction for passenger car vehicles	This may increase emergency response time and have minor impacts on snowplowing.
Durable/long life span	Potential for increased noise, due to braking and load shift
Provides a visual deterrent to speeding	Potential for drainage issues and ADA issues if not considered

Raised crosswalks/speed tables have a design crossing speed of 20 to 25 mph for automobiles, while larger vehicles can typically navigate comfortably at lower speeds. Previous studies have shown up to an 8 mph reduction in the 85th percentile speed because of installing raised crosswalks and speed tables, although those studies also indicate that travel speeds generally increase by approximately 0.5 to 1 mph for every 100 feet of additional spacing between raised crosswalks and speed tables (beyond 200 feet).

Speed Table Spacing	
Posted Speed	Distance between speed tables
25	250
30	375
35	500

Speed tables are a proven and relatively low-cost traffic-calming solution for passenger vehicles without increasing crash rates. Raised crosswalks improve pedestrian safety as they provide higher visibility and lower overall vehicular travel speeds. Speed tables may cause unwanted traffic to divert to other routes, especially when used in a series or in combination with other traffic calming devices. Before installing speed tables, designers should work with emergency services for the community to obtain buy-in for traffic-calming installations. ITE reports that there is an approximate delay of between 3 to 5 seconds per installation for fire apparatus.

Part E- MaineDOT Gateway Treatments

SECTION 1 - BACKGROUND

Maine has seen an increase in both pedestrian and bicyclist fatalities in recent years. These crashes can be attributed to many factors: distracted driving, inattention, weather, roadway geometry, and improper speed.

Municipalities may not know what may or may not work within their community and may not want to spend a lot of money installing permanent devices. MaineDOT and their partners from the Bicycle Coalition of Maine have created a program for municipalities to demonstrate how each of the possible solutions could work using temporary devices (See Part C Demonstration Projects). A municipality wanting more information on this subject can work with the Region Traffic engineer out of the region office or with the regional planner assigned to your area.

SECTION 2 - WHAT IS A VILLAGE AREA?

A village area is a densely built-up area along a state highway with a posted speed limit of 35 mph or less. To qualify for the Village Program, the built-up area would need to be at least a half mile in length and offer a mixture of residential and commercial activities. Usually, there is on-street parking located in the vicinity as well as pedestrian activities (although a sidewalk is not required to be considered a village). Areas posted at 40 and 45 mph are also eligible for the village program if the municipality can demonstrate that their Village proposal can bring the operating speed down to at least 35 mph. This can be done through testing in a demonstration project as shown above, or via another similar project that showed an appropriate operating speed reduction.

SECTION 3 - STEP DOWN SPEED

One of the simplest solutions is to provide a step down in the posted speed limit entering a village area. MaineDOT's speed zone guidelines were developed to set speed limit drops of 10 mph or less heading into a built-up area. In areas where larger speed differentials are heading into a village area, MaineDOT will strive to create the proper stepdown speeds to facilitate a reduction in operating speed. The new stepdown speed zone should be created by shortening the higher speed limit and rather than lengthening the lower village speed limit. While this may not be the most successful strategy in slowing traffic down, it does give advanced warning to the driver and any bit of speed reduction is worthwhile however it is accomplished. (See Figure 1 below).

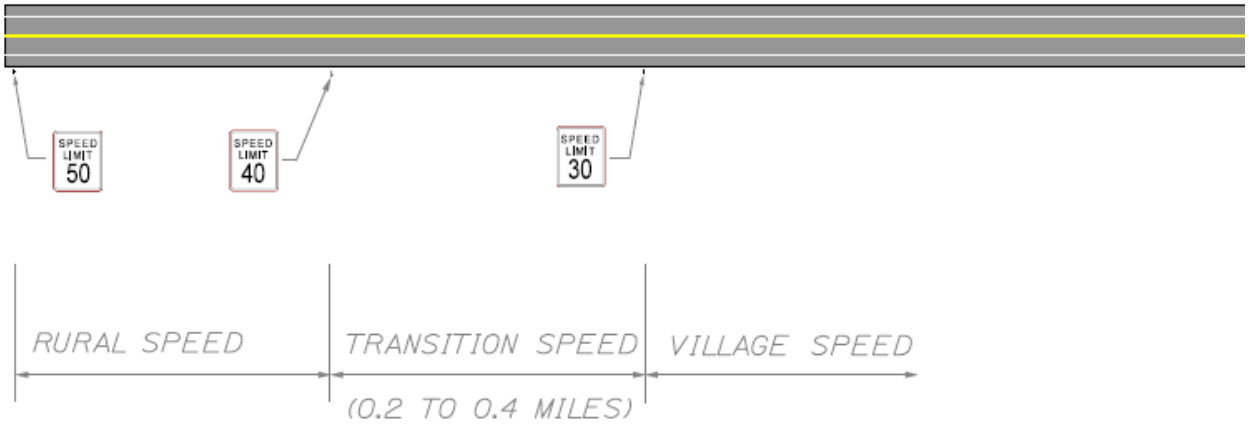


Fig.1 - Step Down Speed

SECTION 4 -PAINTED MARKINGS

Painted stencil markings or performed thermoplastic shields may be used on the roadway to further call attention to the posted speed limit. These markings, mostly because of their size, further reinforce the posted speed to vehicular drivers. This is a fairly low-cost treatment but requires continuing maintenance.

SECTION 5 - SPEED LIMIT SIGN ENHANCEMENTS (DYNAMIC SIGNS)

Sometimes even developing a new stepdown speed is not enough to create the operating speeds desired for a village area. The typical black-on-white speed limit sign may need some additional enhancements to achieve the desired conspicuity. There are several ways to bring attention to a step-down speed. Adding orange flags to the speed zone signs is a low-cost solution to help capture a driver's attention. Other low-cost solutions (< $1,000) include oversizing the speed limit or adding a red border around the sign. Many dynamic solutions would be considered medium-cost ($1,000 to $10,000) available to municipalities trying to get motorists to slow down. The addition of flashing LED lights around the sign may increase conspicuity. These signs are often solar-powered and need to be installed in areas of full sun. The addition of a solar-powered LED flashing sign indicating "Village Area" can also help to further notify the driver they are entering an area where slower speeds are appreciated. The most expensive of the medium-cost treatments is the installation of a dynamic speed feedback sign. These signs provide operating speed feedback to the driver. MaineDOT guidelines require that the signs flash the vehicle's speed if it is 1 mph to 10 mph over the posted speed limit and flash "Slow Down" for those traveling over 10 mph. (See Figure 2)

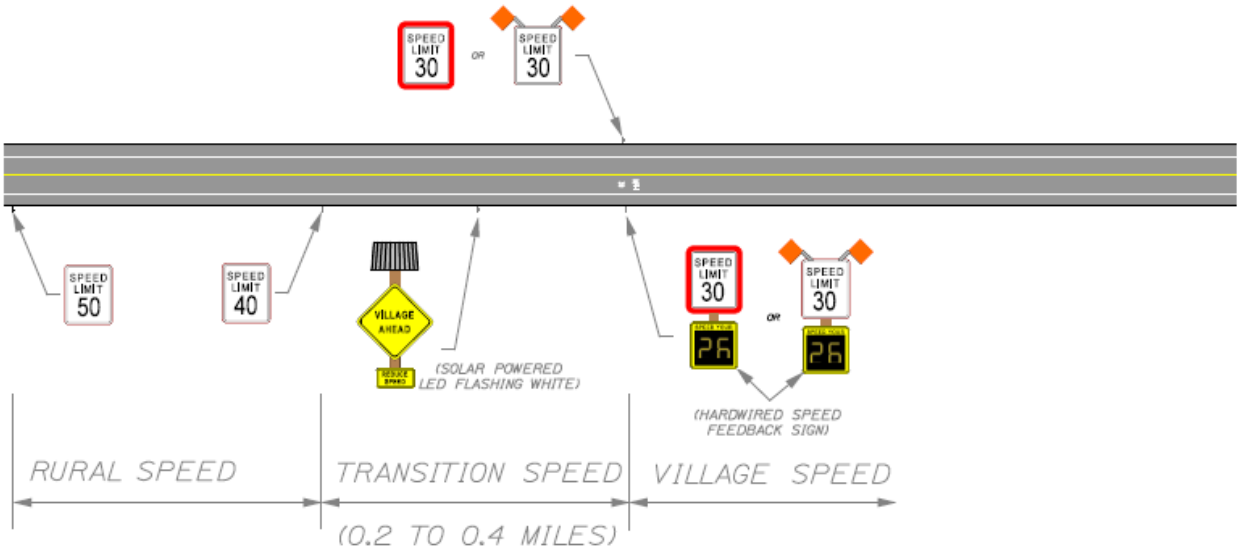


Fig.2 - Dynamic Signs

SECTION 6 - CENTER ISLANDS AND OPTICAL SPEED BARS

There are many instances where the roadway template outside a village area looks the same as the template within the village area. There are no visual cues for the driver to want or need to slow down. Traffic calming measures may be used to help with the visual cues. Often traffic calming involves the construction of physical obstructions to help facilitate lower speeds. Construction of a center island whether painted, modified sloped granite curb like that used in a roundabout apron or typical type 5 sloped curb will provide the visual cue for a driver to slow down. These islands can be accompanied by tubular markers for added verticality. Chevron striping can be added in advance of the island and optical speed bars painted adjacent to the island to further add visual stimuli to the driver. Center islands should be designed in such a manner that they are not used in super-elevated sections to avoid water being trapped in the center of the road. Painted partial chevrons may be added on the shoulder adjacent to the area where the center island has been constructed. These partial chevrons should extend a minimum of 1 foot into the travel lane and give the optical illusion that the road is narrowing down (See Figure 3)

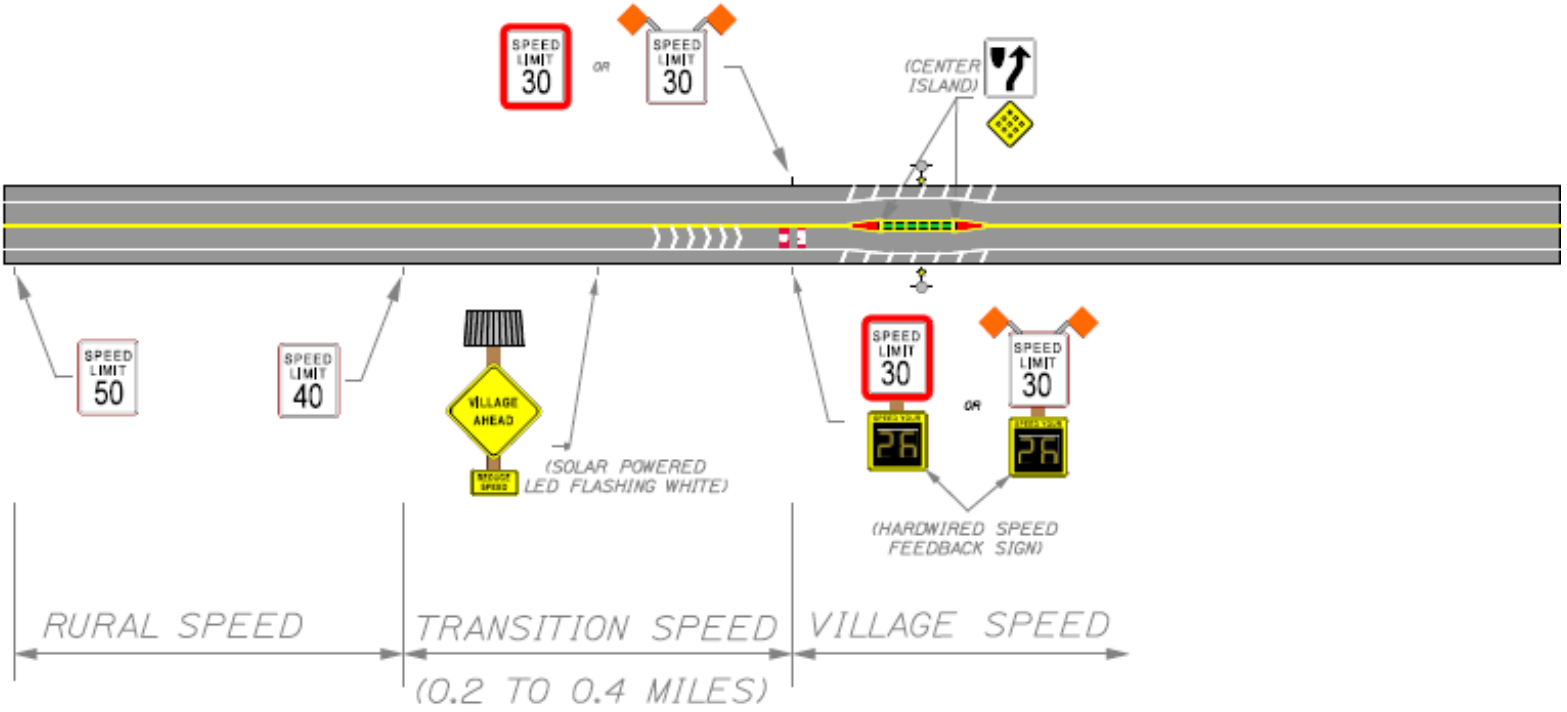


Fig.3 - Center Island

SECTION 7 - BUMP-OUTS

There are many locations where a center island may not be a potential solution due to Right-of-way constraints or roadway widths confined by structural elements such as buildings and bridges. Bumpouts may be installed instead. A bump-out is a physical obstruction built on the shoulder of the roadway to make the roadway feel more constricted to the vehicular driver. Bump-outs may be painted, modified sloped granite curbs like that used in a roundabout apron, typical type 5 sloped curb, or with vertical curb depending on the individual site's characteristics. (See Figure 4) Both bump-outs and center islands may cause issues for plowing. Painted bump-outs or those with lower reveal curbing, such as the type installed for roundabout center islands, will make it easier for maintenance forces to plow over and around the bump-out or center island. Painted chevrons may be stenciled in advance of the bump-out as well as painted stencil speed markings could also help reinforce the suggested speed reduction. Bump-outs built with typical type 5 sloped granite curb or vertical curb may have additional vertical features such as tubular markers to help further indicate the need to slow down.

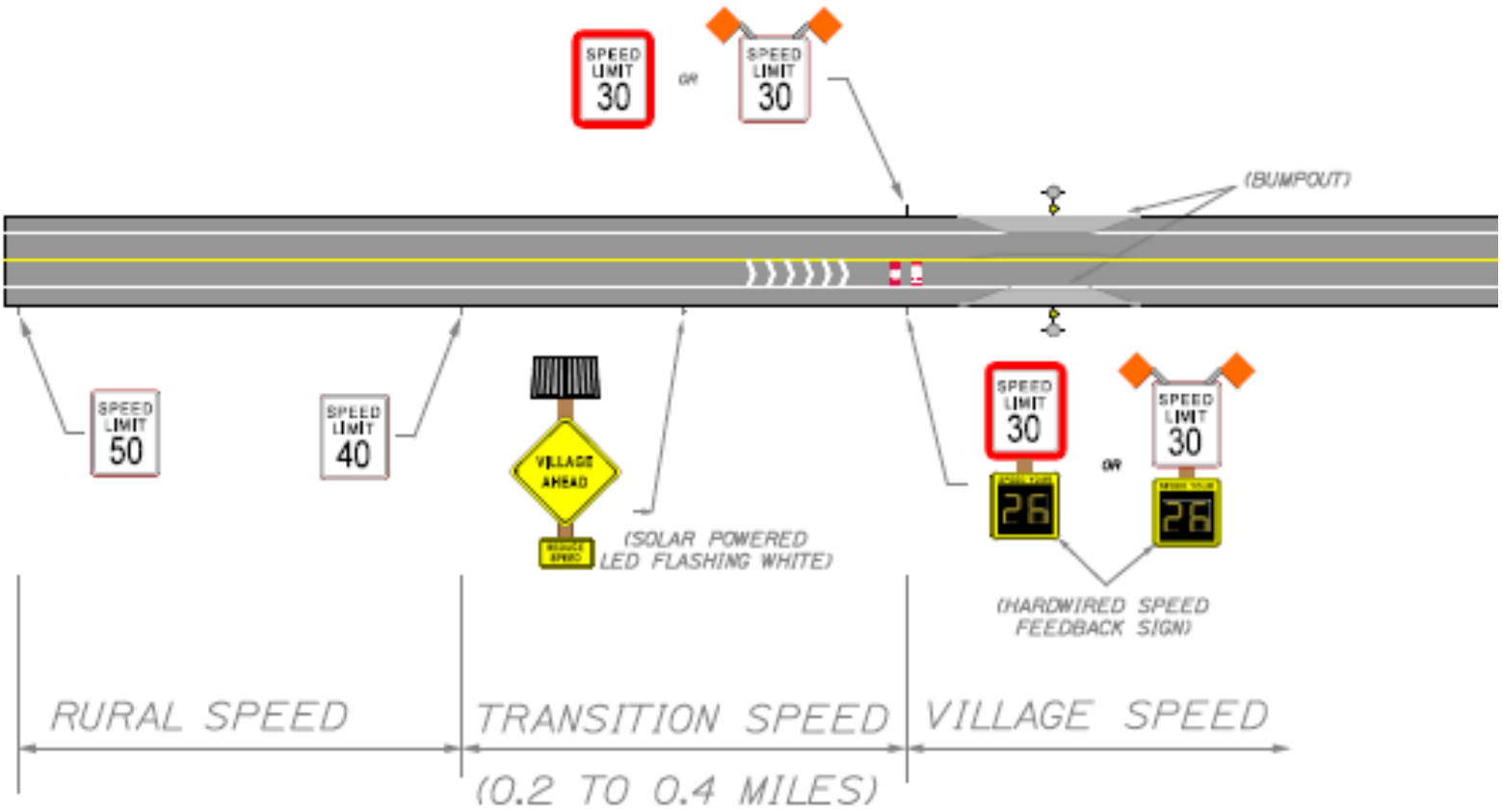


Fig.4 - Bump Outs

SECTION 8 - SPEED TABLES

The most aggressive in road treatment that can be used to slow traffic is the installation of speed tables. MaineDOT's typical speed table design is constructed as a 4-inch high tabletop a minimum of 10 feet in length (along the center line) with 6-foot-long ramps on either side. Speed tables typically stretch the full width of the travelway plus most of the shoulder. The tables typically taper down on the shoulder within a foot of the curb line to ensure that drainage is maintained, and that surface water can reach existing catch basins. Speed tables need to have painted chevrons in advance of the table and painted chevrons on the ramps All speed tables are required to have "Speed Table" signage with speed advisory signs installed in advance of each table. In order to be effective, more than one speed table may need to be installed on longer stretches of roadway. Speed tables currently cannot be used on arterial roadways without a special exception. Speed tables can also be used in conjunction with crosswalks to further help provide more conspicuity for pedestrians. The current traffic calming policy does not allow speed tables on certain classifications of roadway. Exceptions may be granted in select locations. (See Figure 5)

Designers should work closely with municipal fire and safety to ensure that they are on board with the installation of these features. Typically, they result in only a few seconds of delay. Speed tables can be either permanent or temporary. Many entities manufacture temporary molded rubber segmental tables that lag screw down into the roadway. These would be used when the need for traffic calming is seasonal such as in heavily touristed areas.

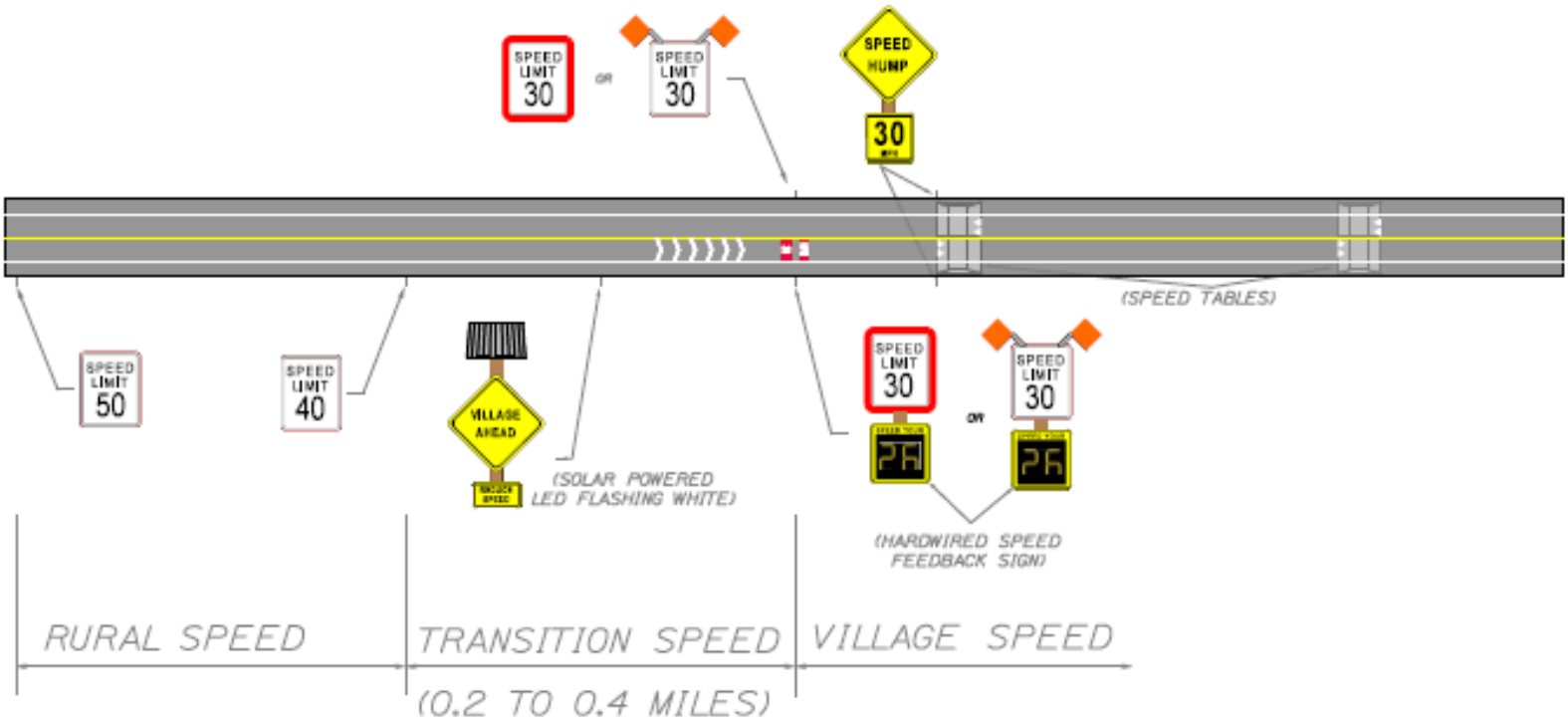


Fig.5 - Speed Tables

SECTION 9 - BICYCLE SYMBOLS AND SHARROWS

Another indication of a village area is the inclusion of bicycles along with pedestrians. Simply stenciling a bike symbol and a sharrow can help make an area feel more village-like. These symbols should be painted at least every quarter mile to remind vehicular drivers that bicyclists may be traveling in the lane. (See Figures 6 and 7.)

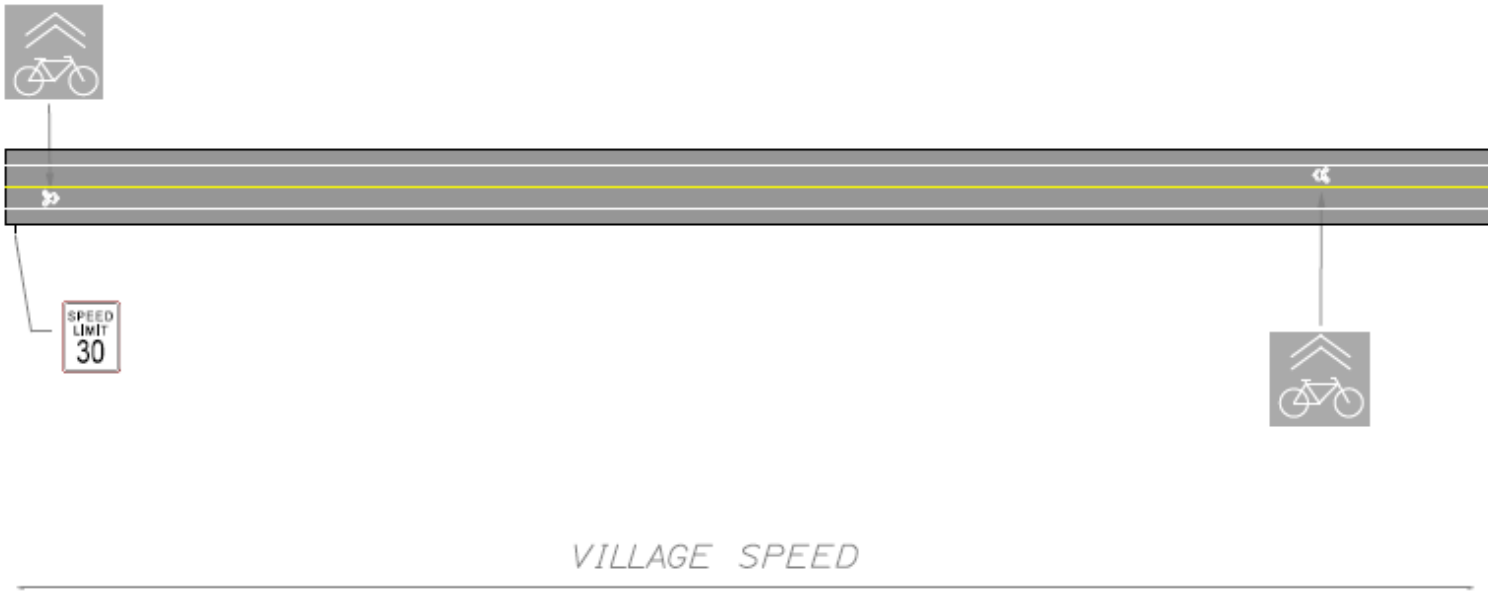


Figure 6 - Bicycle Symbol and Sharrows

Figure 7 – Assorted Bicycle signage to promote safety and reinforce village setting

Signage should be used in conjunction with the bicycle symbol and sharrows. These signs provide further guidance to the driver and provide verticality to the facility.

SECTION 10 - SIDEWALK CONSTRUCTION, ON-STREET PARKING, CROSSWALKS, STENCILING AND OTHER LIGHTED DEVICES

The addition of sidewalks can also help in reducing speed through a village area. A sidewalk provides visual cues to the driver that the setting has changed. Sidewalks tend to make the roadway feel narrower, tending to result in slower speeds. The addition of on-street parking further helps reduce the speed when vehicles are actually parked along the roadway. Sidewalks also provide the ability to add crosswalks and assorted signs and stenciling associated with those facilities. The added markings and signs serve as further visual cues to the driver. Additional features such as Flashing pedestrian signs, Rectangular Rapid Flashing Beacons (RRFBs), Pedestrian Hybrid Beacons, In-Crosswalk lighting, Overhead lighting, and bollard lighting, all would provide varying degrees of impact to the driver. (See Figures 8, 9, 10, 11,12 and 13)

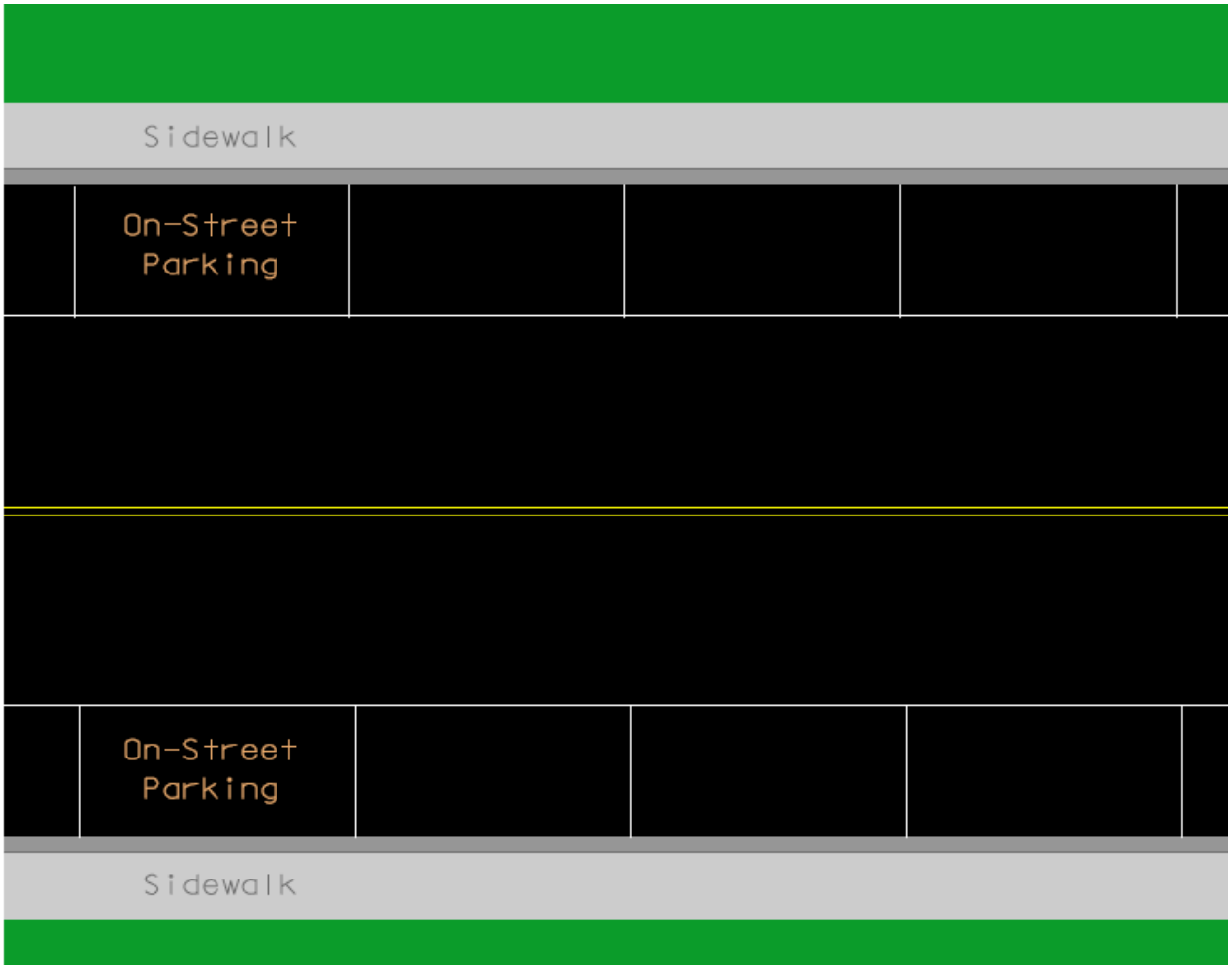


Figure 8 –Sidewalk and On-Street Parking

Side friction is an effective tool for slowing speeds along the roadway. Sidewalks and On-Street Parking are one way of slowing traffic through a village area. Adding crosswalks to the equation, along with crosswalk signage adds further evidence of a village setting. Visual cues are paramount to getting drivers to slow down in village areas.

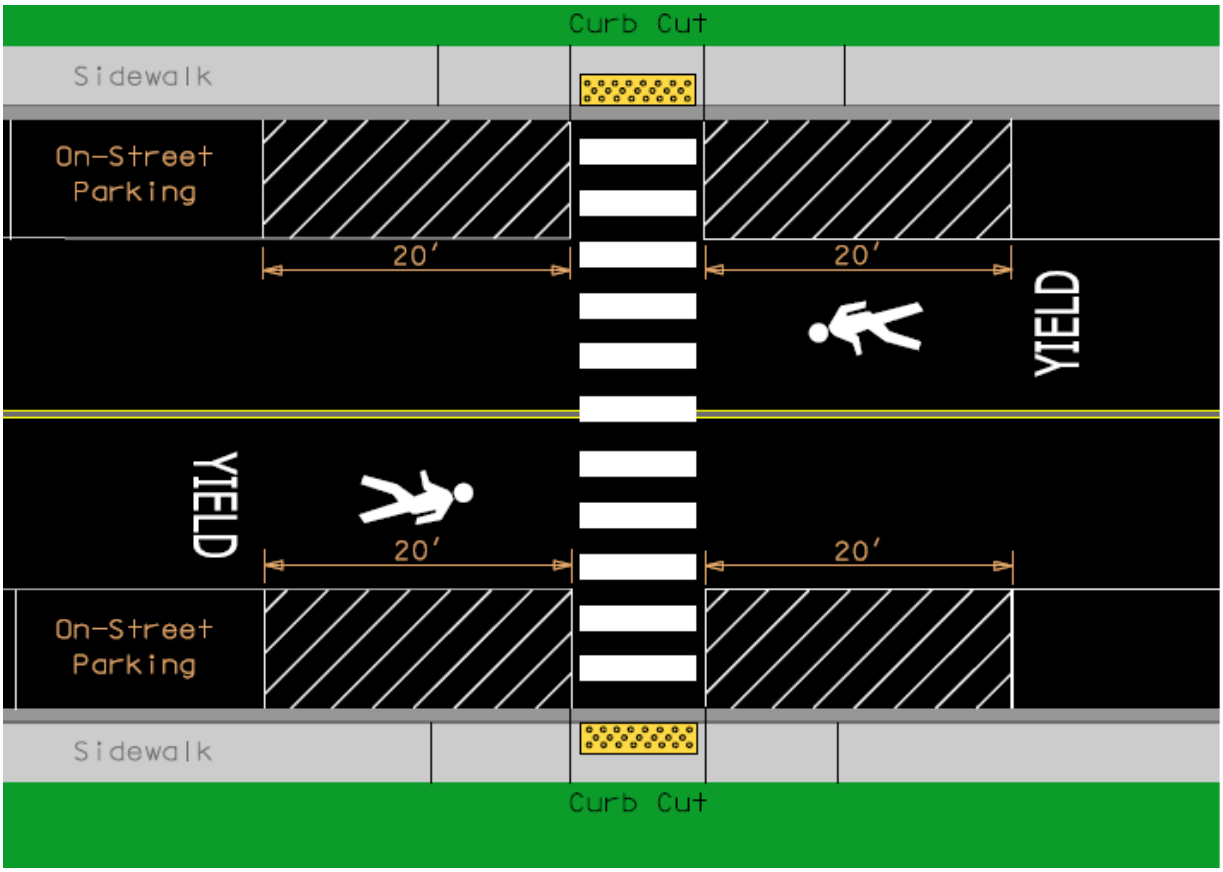
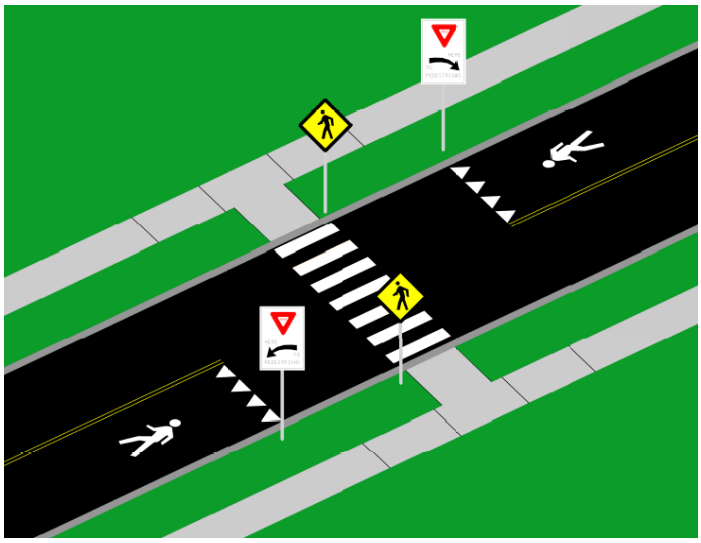


Figure 9 – Sidewalk with Crosswalk and Associated Stenciling



Adding yield bars and signage are another indication that a driver is in an area where they need to mitigate their speed to meet the usage in the surrounding area. Without visual cues, (stencil and signage) driver's cues are only the two-dimensional crosswalks. The addition of the third dimension is imperative to get drivers to recognize the situation that they are encountering.

Figure 10 – Croswalks with Yield Bars and Enhanced Signage

Figure 11 – Pedestrian Hybrid Beacon (PHB)

Pedestrian hybrid beacons (PHBs) are another form of visual stimuli to alert the driver to alert them that they are in an area where they need to slow down. These lights are pedestrian-activated. A PHB is an all-red indication that stops traffic to allow pedestrians to cross a roadway. They are mostly used in areas with more than two lanes, high traffic volumes, and higher speeds. They should not be looked at as a solution at posted speeds higher than 45 mph.

In-Road pedestrian signals are another tool that can be used to pass along information to the driver that a pedestrian may be crossing the roadway. These lights are pedestrian-activated and flash while a pedestrian is crossing the roadway.

Figure 12 – In-Road Pedestrian Lights

Rectangular Rapid Flashing Beacons (RRFBs) are push-button activated flashing crosswalk signs. They are extremely bright and can be seen for miles. They help convey the message that the area is built up and has pedestrian activity. RRFBs have been shown to have a significant compliance rate (88 % +/-).

Figure 13 -Rectangular Rapid Flashing Beacons (RRFB)

Lighting is another indicator of a village's location. Lighting can be either for vehicles or pedestrian-level lighting. Care should be taken to have lights placed to front light pedestrians as they enter a crosswalk. Bollard lighting can be a lower-cost lighting solution for some municipalities.

Figure 14 – Pedestrian Lighting

Temporary Gateways can also be constructed out of temporary equipment such as tubular markers, rubber curb stops, temporary speed tables/humps, signage, etc., to help try out an idea before something is permanently constructed. This allows time for constituent feedback, constructive criticism, and potential redesign to test additional iterations. MaineDOT will work with municipalities to perform the work.

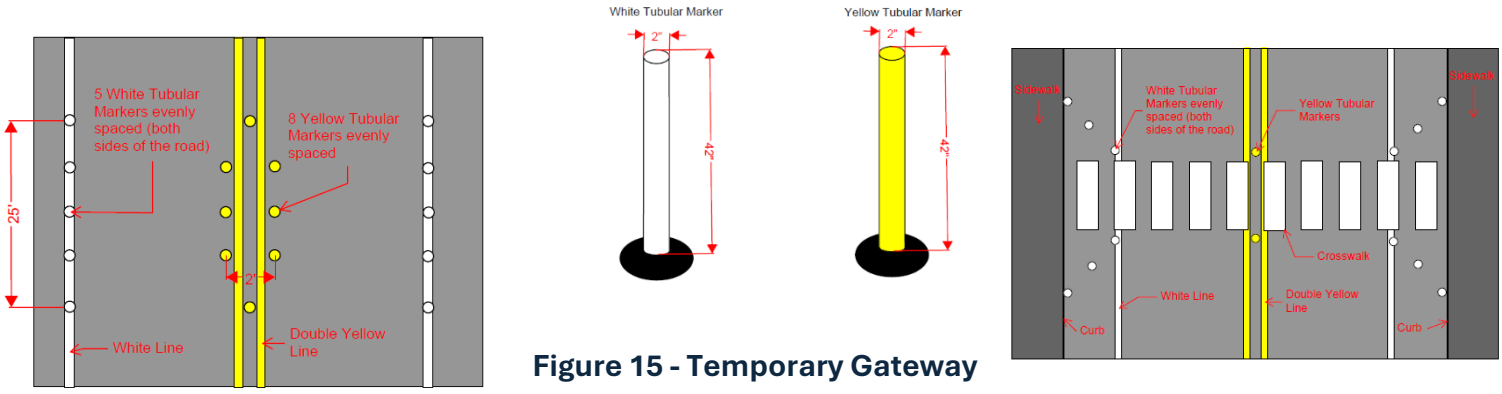


Figure 15 - Temporary Gateway Treatments

Appendix A

Optical Speed Bar Spacing

Total Length (40-45 mph) 526 ft

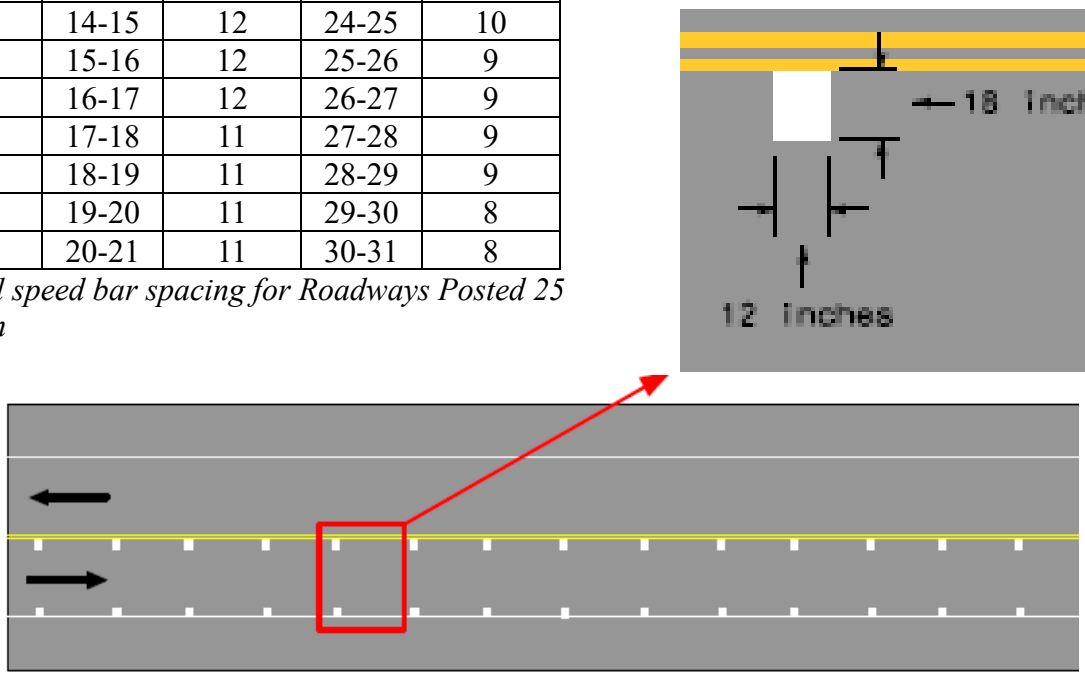
Total Length (25-35 mph) 344 ft

Spacing Between Optical Speed Bars (40-45 mph)					
Bars	**Spacing (Ft)**	**Bars**	**Spacing (Ft)**	**Bars**	**Spacing (Ft)**
1-2	24	11-12	19	21-22	15
2-3	23	12-13	19	22-23	15
3-4	23	13-14	18	23-24	14
4-5	22	14-15	18	24-25	14
5-6	22	15-16	18	25-26	13
6-7	22	16-17	17	26-27	13
7-8	21	17-18	17	27-28	13
8-9	21	18-19	16	28-29	12
9-10	20	19-20	16	29-30	12
10-11	20	20-21	16	30-31	12

Table 1 – Optical speed bar spacing for Roadways Posted 40 to 45 mph

Spacing Between Optical Speed Bars (25-35 mph)					
Bars	**Spacing (Ft)**	**Bars**	**Spacing (Ft)**	**Bars**	**Spacing (Ft)**
1-2	18	11-12	13	21-22	10
2-3	16	12-13	13	22-23	10
3-4	16	13-14	13	23-24	10
4-5	16	14-15	12	24-25	10
5-6	15	15-16	12	25-26	9
6-7	15	16-17	12	26-27	9
7-8	15	17-18	11	27-28	9
8-9	14	18-19	11	28-29	9
9-10	14	19-20	11	29-30	8
10-11	14	20-21	11	30-31	8

Table 2 – Optical speed bar spacing for Roadways Posted 25 to 35 mph

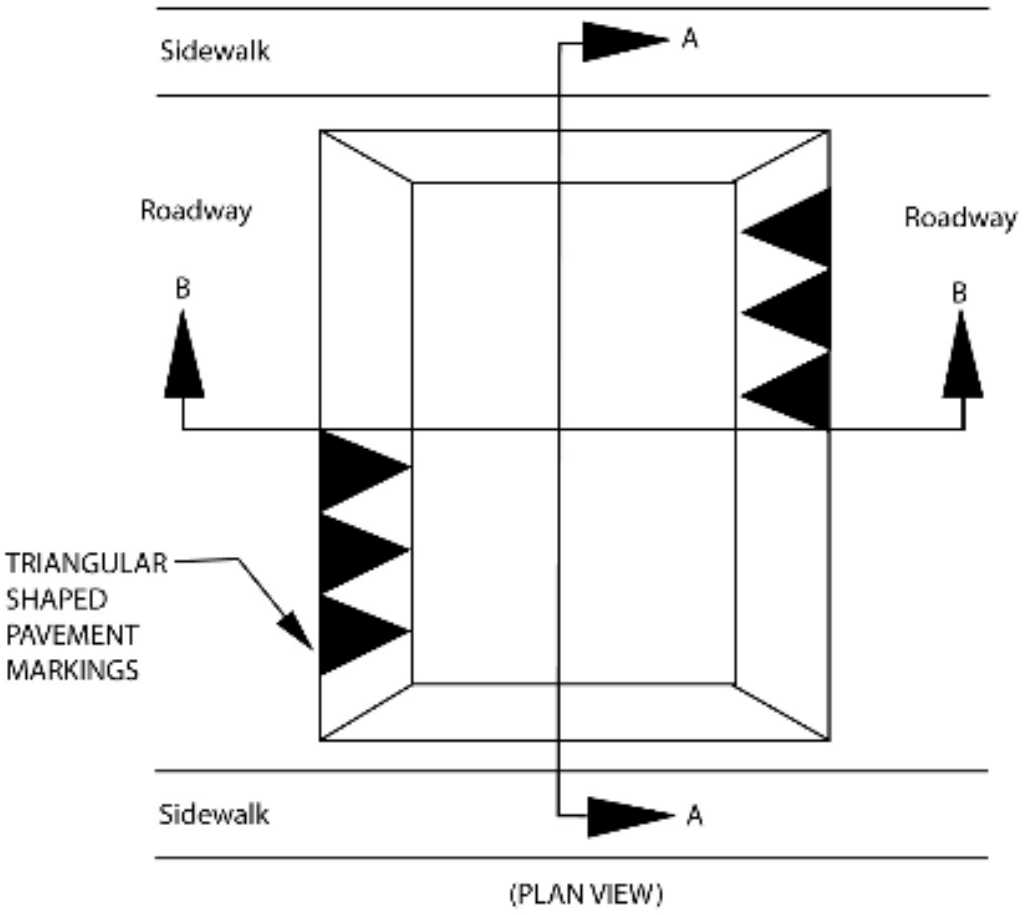


1Appendix A Figure 1 – Typical optical speed bar dimensions – spacing as shown in tables above.

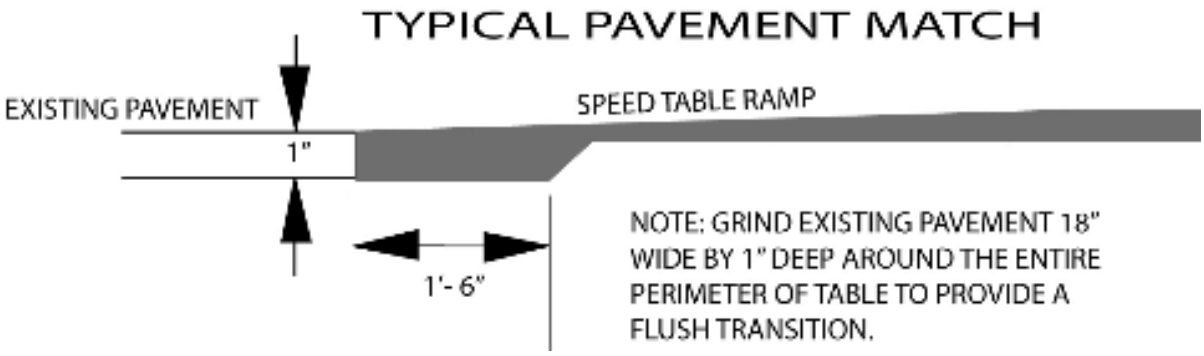
Appendix B

Speed Table Design

-

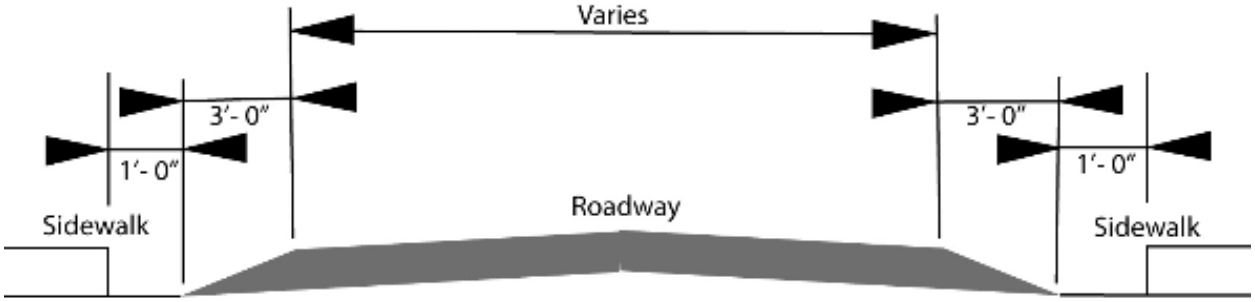


(PLAN VIEW)

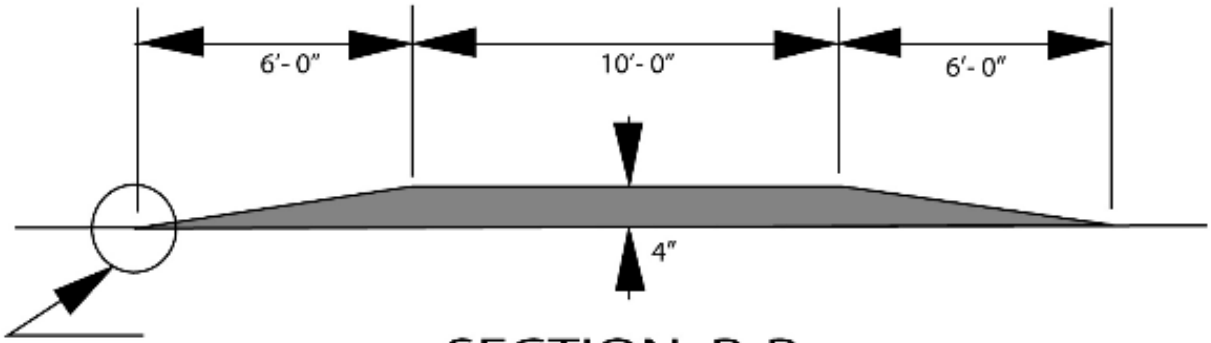


Appendix B (cont'd)

Speed Tables



SECTION A-A

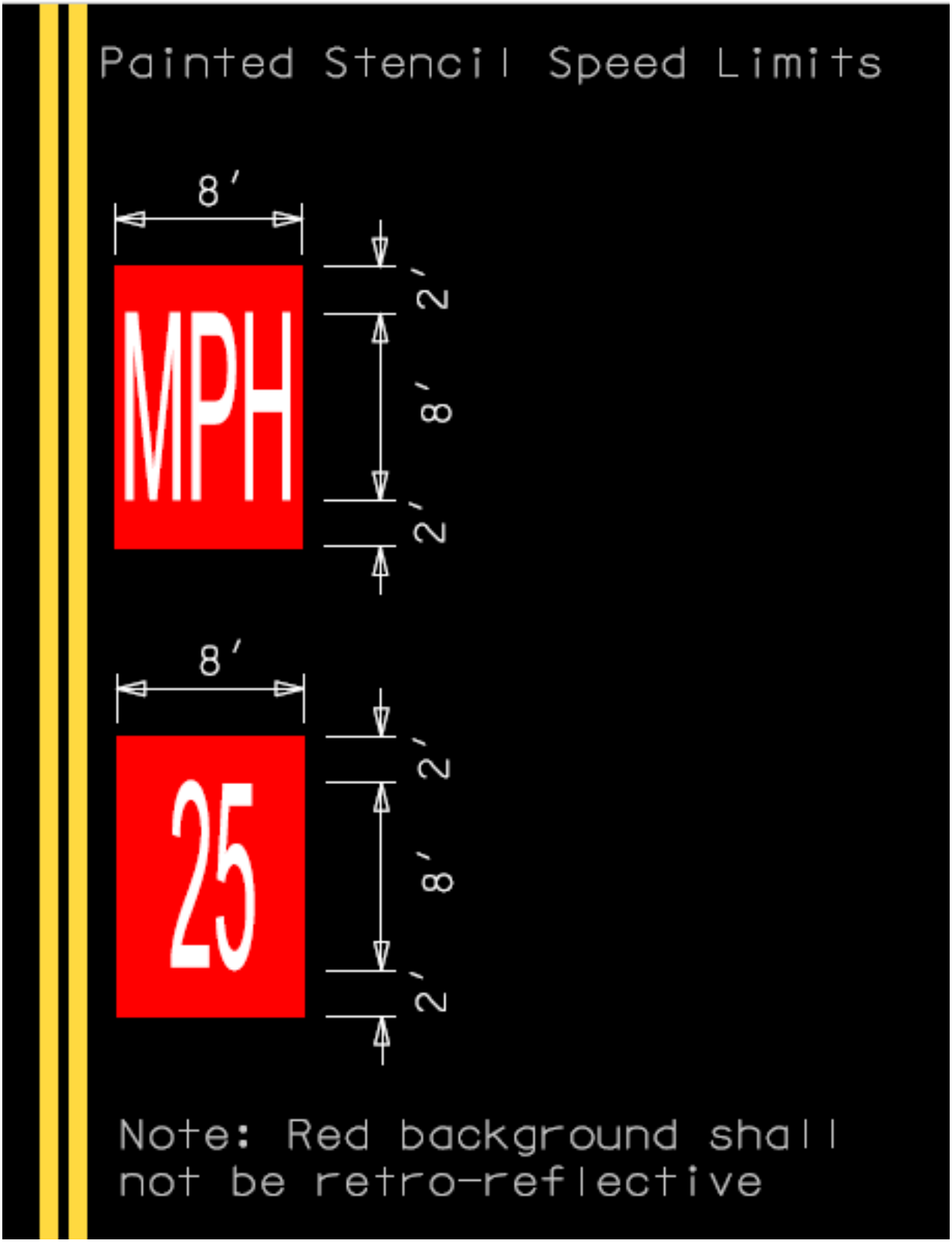


FLUSH PAVEMENT MATCH
(TYPICAL) See Detail

SECTION B-B

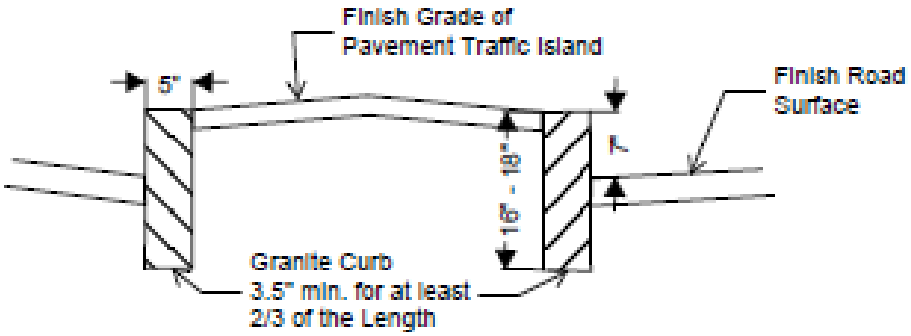
Appendix C

Painted Stencil Speed Limits

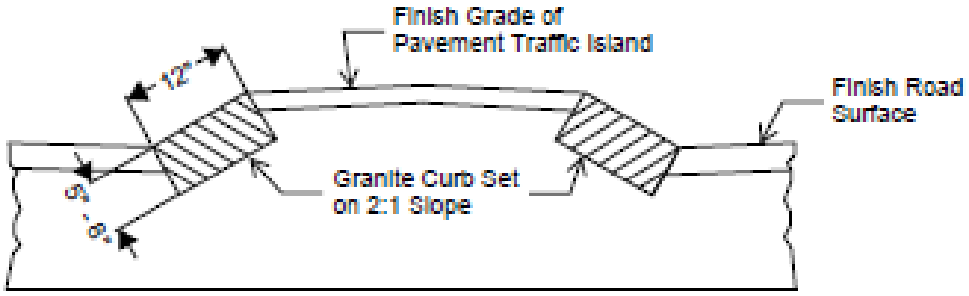


Appendix D

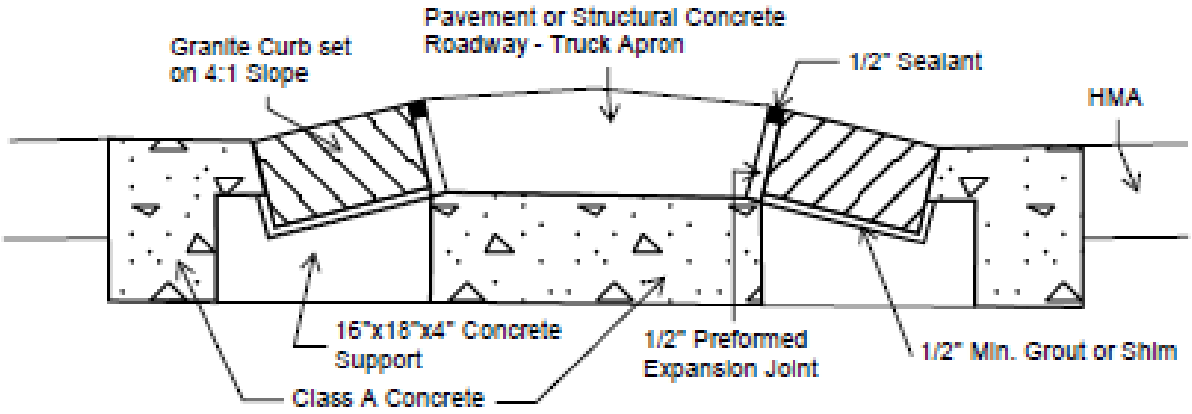
Curbing Options for Center Islands and Bump-outs



Traditional Vertical Curb - Type 1



Traditional Curb - Type 5

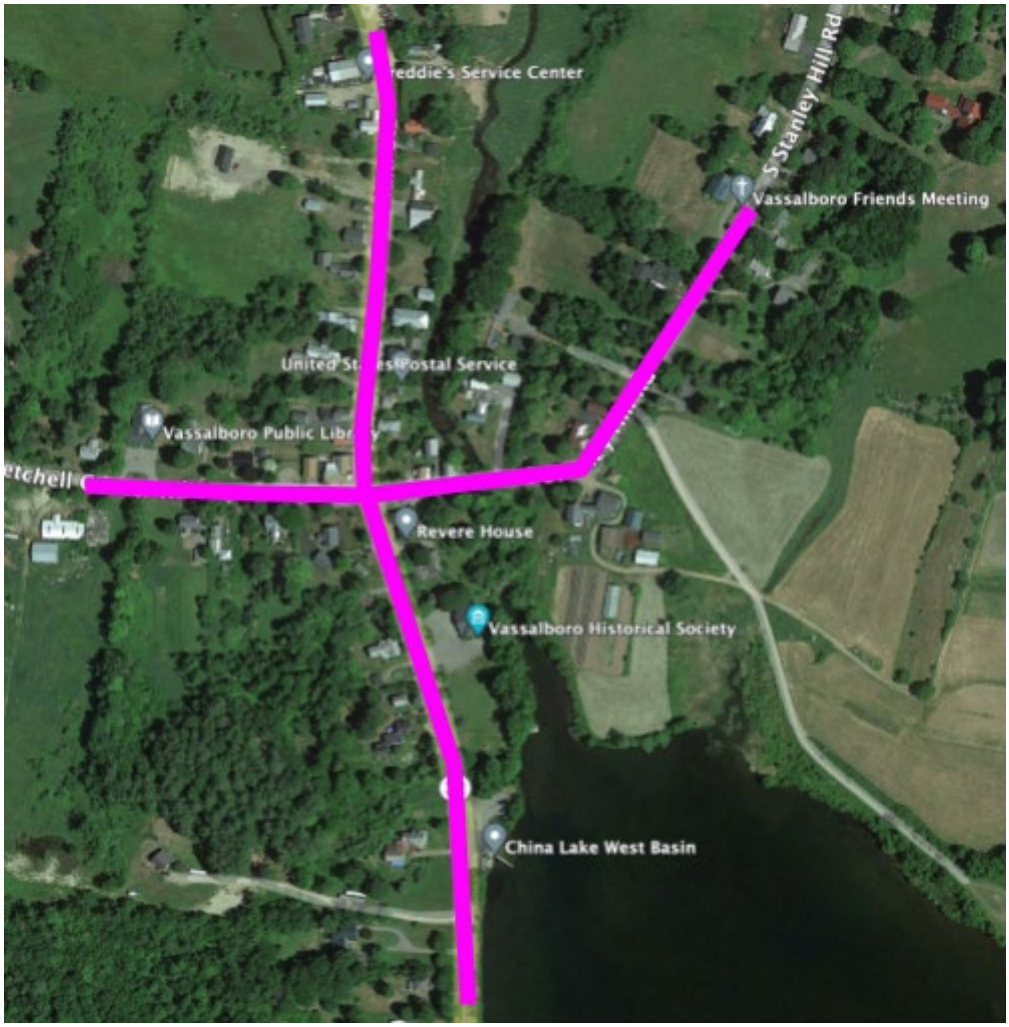


Low Reveal Curb - Type 5

Appendix E

Sample Demonstration Proposal

Demonstration Project Proposal: Vassalboro June 2024



Summary

The Town of Vassalboro is seeking to slow and calm traffic on the roadways approaching to the village center at the intersection of Route 32 and Bog (Getchell Corner)/Stanley Hill Roads to enhance the safety of all users. Secondary aims are to prevent illegal queuing and parking on the segment of Route 32 near the boat landing for China Lake and prevent crossing double yellow lines in the 2 blind spots in the village. The project area is approximately bounded by the locations of the signs posting 25 mph speed limits on the approaches to the village: near Sawmill Road on

the north, near the boat launch on the south; near the Vassalboro Public Library on the west; and by the Friends Meeting House on the east.

This project is intended to test the effectiveness of low cost measures to reduce the speed of cars approaching the village and to improve compliance with no parking zones. The project also seeks to test improvements for pedestrian mobility in anticipation of hardscape planning and changes within the next 5-10 years. The installations could include:

1. Freestanding gateways using tubular delineators on all four approaches to the village. (See *Figure 1*)
2. A visually separated shoulder created using tubular delineators on the fog line from the boat landing to the historic society parking lot and tubular delineators on double yellow centerline
3. Approved temporary materials to create demonstration crosswalks on at least the north and west approaches to the intersection, where there is enough shoulder on the right of way to provide safe landings.

The installations will seek to slow motorist traffic to the posted speed limit; speed studies will be conducted prior to and with the installation in place.

The project is temporary and would be removed as soon as winter weather threatens.

As per MaineDOT guidance, we are submitting this proposal for review by the Regional Engineer.

Purpose

- To test whether gateway treatments can enhance safety for all users by lowering traffic speeds to comply with posted limits..
- To test whether low cost safe landing and visibility measures can be used to support crosswalks and provide improved pedestrian access.
- To test whether low cost measures can discourage parking in areas where it is prohibited
- To study whether these changes impact traffic speeds.
- To study whether centerline Tuff curbs or tubular delineators can keep drivers from crossing over double yellow lines at blind spots.

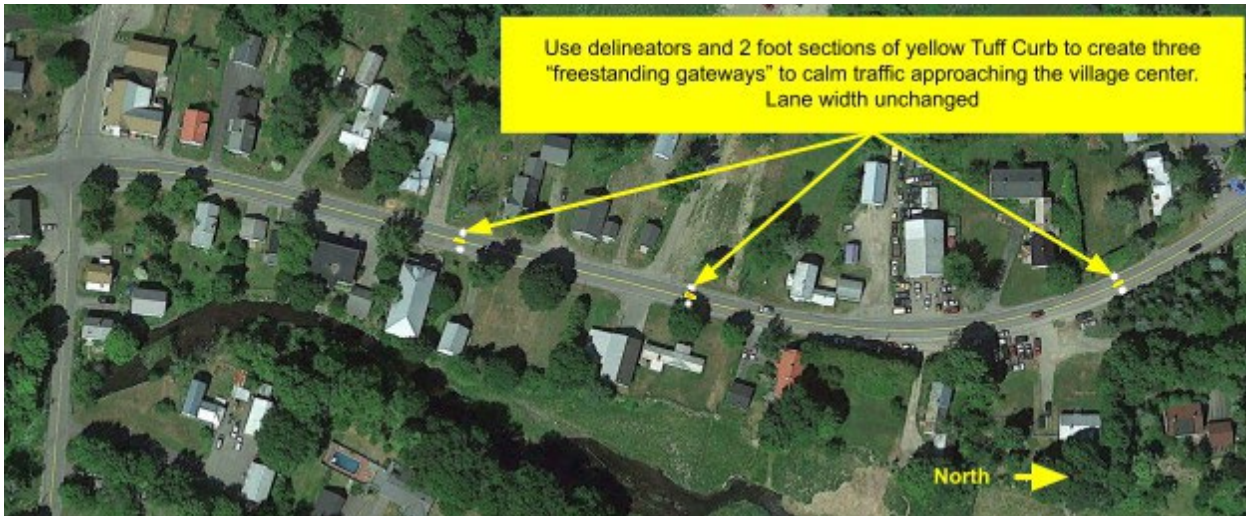
Need

The Town of Vassalboro has long been concerned about traffic speeds in the East Vassalboro Village. After extensive study of the problem, in 2013 the town was awarded an approximate $700,000 in Fed DOT Transportation Enhancement 80/20 grant to improve safety and build a pedestrian bridge on South Stanley Hill Rd. Unfortunately in April 2014, the town attorney disagreed with the MMA attorney as to needing to go back to the Town to request the matching money, and the funding was turned down by voters. Since then the town has been engaged in trying to find a solution and the residents in the village agreed at a village meeting to test a strategy for reducing speeds before paying for hardscape improvements.

Vassalboro Conceptual Designs

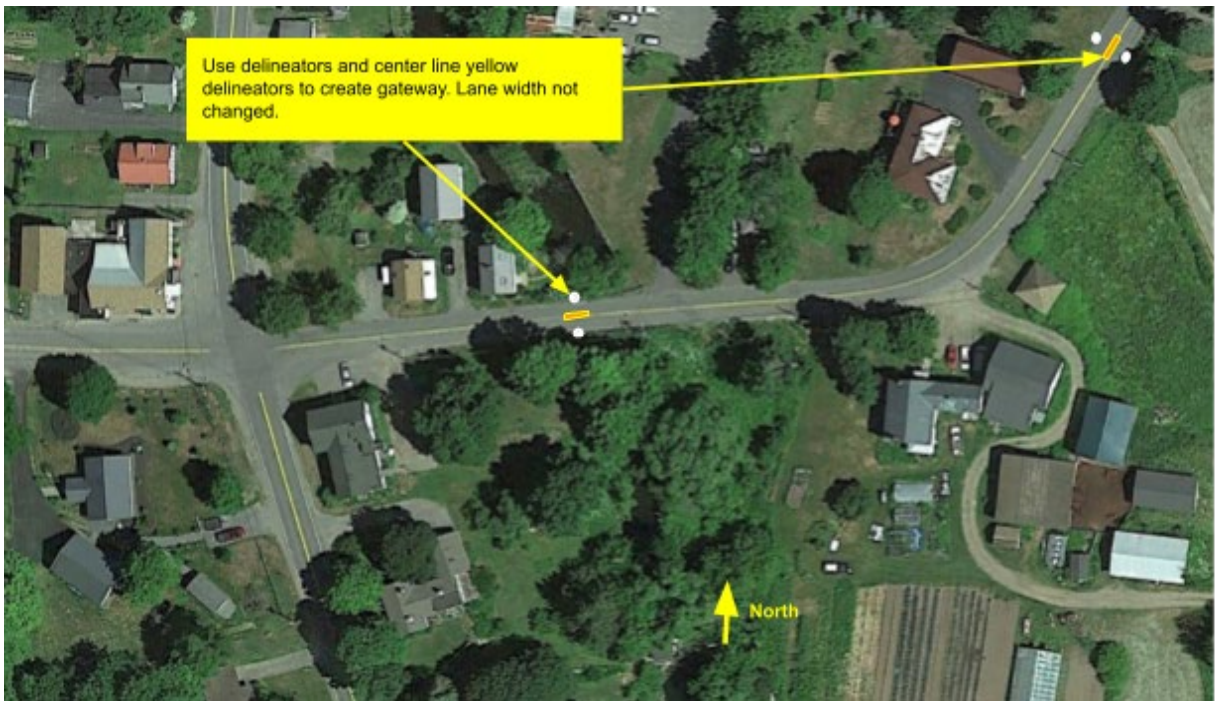
(road elements not to scale; final position subject to engineering judgment)

Rte 32 North of Village Intersection



Bog Road, West

South Stanley Hill Road, East



Rte 32 South

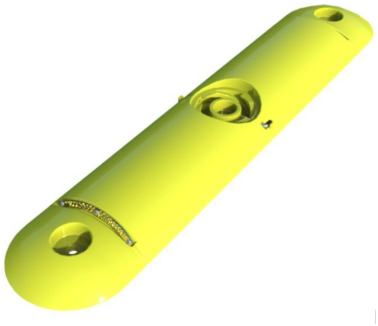
Project Description

Freestanding gateways

To calm traffic on roadway approaches, "Freestanding gateway" treatments should be considered. These consist of up to three white Pexco DP 236 (or equivalent) 36" tubular delineators with bases and caps on the right and left hand fog lines, with a 2' segment of yellow Tuff Curb placed on the centerline. In three locations the yellow flex posts would replace the Tuff Curb at the center line. This new design option is proposed to address fire truck access concerns, but to retain the yellow delineators for the 2 blind spots above boat landing and the curve at S. Stanley Hill Rd. (See figure 3 below). Delineators shall be attached with butyl adhesive or equivalent. The goal is to create a feature in the roadway that creates visual friction and encourages drivers to slow down. Travel lane width will not be reduced; delineators will be on the reference lines.

Figure 3--Freestanding gateway installation in Mount Vernon, 2021-2023.
A short segment of Tuff Curb (see below) can be used instead of the two yellow posts depicted here.

Short segment of Tuff Curb to be used with/instead of a flex-post



The delineators or Tuff Curb used shall have retro-reflective tape on them for visibility during nighttime hours.

The proposed gateway treatments are adaptations of crosswalk treatments and “chokers.”

Visually Separated Shoulder

The “visually separated shoulder” could consist of up to 20 white 36” Pexco DP 236 tubular delineators with bases and caps (or equivalent, see Figure 4) affixed with butyl along the right hand fog line on Route 32 Northbound. Space between delineators shall be 15-25 feet. This shall create a visual barrier separating the shoulder from the traffic lane, and will discourage illegal parking. A long term solution might be to place large boulders on the edge of the road to create the same effect, but concerns with plowing and the presence of immovable deadly objects in the right of way would need to be addressed.

Figure 4–Visual barriers with vertical Flex Posts, Bethel, 2023

Traffic Safety During Installation and Removal

Vassalboro DPW will use OSHA approved "Road Work" signs in advance of the project area, and cones as needed near any area where people are working. MUTCD guidance for work areas will be followed. All persons on site during installation and removal will wear high vis vests. There will be minimal impact on vehicular traffic at the sites during installation or removal.

Timeframe

The installations would be installed after pre-installation speed data has been obtained by the town.

Metrics

The effectiveness of the installation will be measured by assessing whether the installation slowed vehicle traffic or whether it decreased rates of crossing the double yellow line at the S. Stanley Hill blind curve and at the rise up from the boat landing from baseline studies. Studies will be conducted before and during the installation. A survey to collect public reaction will be created and shared.

Maintenance Plan

The project will be monitored on a daily basis by Vassalboro DPW staff, and any knocked down delineators will be removed or replaced by project team members within 48 hours of a report. Elements that are regularly getting hit/damaged may be removed.

Public Notification

Good public notification will help ensure that people understand the need and intent for this project. Vassalboro will issue a press release, and will inform and work with local businesses on the planned roadway changes.

Authorization Process

The project will not move forward without Vassalboro and MaineDOT approval.

Cost

A ROUGH estimate of materials and labor to effect these changes is $6300-7000

50 white delineators at $50 each:	2500
10 2’ segments of Tuff Curb	1800
Paint	1000
Labor	1000 (this will be mostly in-house)

Purchase of Materials

TBD

Liability

The project described above shall be understood as a planning exercise undertaken by the town of Vassalboro with the full permission and approval of municipal government and the MaineDOT.

Contact

For more information, please contact Aaron Miller, town manager