

New Hampshire Work Zone ITS Toolbox



Work Zone ITS Guideline for Smart Work Zone System Selection

2011 Edition

Introduction

The Work Zone (ITS) Toolbox has been prepared as a guideline for selecting an appropriate ITS for existing work zone traffic issues and to mitigate anticipated issues on scheduled projects. The WZ ITS System descriptions collected in this toolbox are intended as brainstorming material and should lead to practical solutions to a project's unique problems. **The examples are purposely left void of many dimensions, except when particular distances are highly recommended and engineering judgment is required to customize the system.**

WZ ITS systems may be sorted into three category types based upon detectable stimuli: **Traffic, Vehicle, and Environmental**. The three categories are shown below with their typically associated systems.

Traffic Responsive Systems collect and respond to average traffic characteristics such as speed and volume of a group of vehicles, and then the system reacts to trends of increasing/decreasing values. The combination of these basic systems forms the basis for Route Management Systems (or Traveler Information Systems) by analyzing and reporting information in various ways. These applications may include:

- **Travel Time or Travel Delay Information (Trip Time or Estimated Delay)**
- **Speed Advisory Information**
- **Congestion Advisory**
- **Stopped Traffic Advisory**
- **Early or Dynamic Lane Merge**

Vehicle Responsive Systems collect and respond to individual vehicle characteristics such as speed, dimensions, and location. When adverse conditions are detected by these systems, motorists need immediate warnings for quick response. These applications may include:

- **Excessive Speed Warning**
- **Dynamic Speed Display**
- **Over Dimension Warning**
- **Work Space/Haul Road Intrusion Warning**
- **Construction Vehicle Warnings**

Environmentally Responsive Systems collect and respond to changing non-traffic conditions of weather, roadway or working characteristics such as visibility conditions or roadway surface conditions and hazards. These applications may include:

- **Hazardous Condition Warnings (Flooding, Ice, Fog, Smoke, Dust, etc.)**

The real-time data collected for any of these systems may be combined, averaged, analyzed for trends, and utilized for several informational uses. For example, data collected for a 'Stopped Traffic Warning' may be to control a 'Dynamic Merge' system or to calculate travel-time through a corridor.

Temporary Traffic Control Devices may be equipped with advanced communication and/or remote control capabilities that do not react "intelligently" to detectable field data, but the devices provide safer working conditions or improve incident response. Although these devices may not be "smart," they have been included in the WZ ITS Toolbox as additional safety tools for consideration when a WZ ITS System is being deployed. These applications may include:

- **Changeable Work Zone Signage**
- **Traffic Surveillance Cameras**

Work Zone ITS Introduction

Typical System Components

Each WZ ITS System in the Toolbox is a collection of standard system components which have been combined to produce a useful real-time system. The individual component functions include the collection of data, verifying the accuracy of the data, transmitting the data, storing and managing the data, analyzing the data, and/or providing the data to the motorist.

Detection Components (may include)

- Radar
- Pneumatic Road Tubes
- Light Beams
- Acoustical
- Ultrasonic
- Magnetic
- Piezo-Electric
- Video
- RFID
- Probe Injection Technologies, etc.

System Monitoring Components

Typical redundancies should be built into most systems (based upon risk assessment for the system failure) and the various types of quality control testing or system monitoring may be utilized.

System Communication Components

The typical forms of transmitting data, some of these may include

- Cell phones
- Internet- wireless access points
- Radio
- Optics
- Hard wired

System Analysis Components

Analysis algorithms are designed or modified for each application of a WZ ITS System to fit the conditions of the project. Algorithms can be designed with apparent limitations and strengths, and field testing is necessary to ensure the quality of the data analysis.

Data Management Components

The storage of data and analysis of the data for various trends, events, etc. may utilize many different database systems.

Dynamic Informational Components

Dynamic components provide information to the motorists and may include:

- 511 System (internet & phone/cell phone)
- Changeable message signs (CMS) in dynamic mode
- Remotely activated traffic control devices
- Audible or visual alarms
- Public media announcements
- CB Radio, etc.

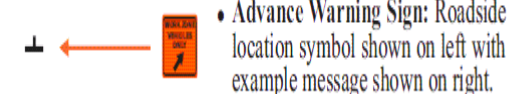
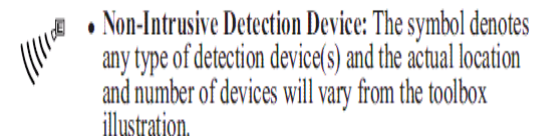
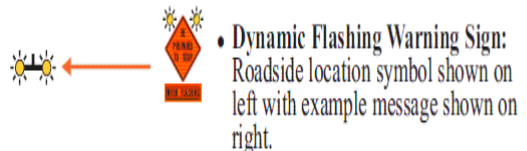
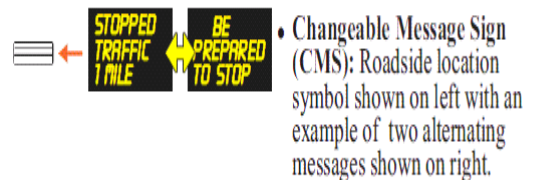
DEFINITIONS FOR USE IN THIS DOCUMENT

- **Changeable Message Signs (CMS)** a sign that is capable of displaying more than one message, changeable manually, by remote control, or by automatic control. The device is considered “portable” when trailer mounted. The device may be operated in one of two modes:
 - **Standard Mode:** message is programmed to remain displayed until changed by the operator or via a timer.
 - **Dynamic Mode:** the message is programmed to respond to traffic operating characteristics or roadway conditions.
- **Static Sign** a message for the motorist is printed on a standard sign, either regulatory, warning, or guide signs.
- **Advisory Speed** a recommended speed for vehicles based on the current roadway conditions or operating characteristics. Advisory Speeds are not enforceable.
- **Speed Limits** the speed applicable to a section of a highway as established by law.
- **Travel Time** the estimated amount of drive time from the motorist’s current location to an identified locations, generally limited to approx 10 miles maximum distance.
- **Travel Delay** the estimated amount of extra time the motorist will incur due to traffic conditions in a work zone located downstream. Generally useful for spot locations at a great distance away from the motorist’s current location, which provides alternate route possibilities.
- **Devices (components)** the individual parts of subsystems that make up a working WZ ITS System. Examples include: cameras, various detectors, signs, data monitoring or recording equipment, communication systems, TTC devices, and remotely activated alarms, etc.
- **SWZ Systems** an automated system of devices that provides motorists and/or workers real-time information for improved safety and mobility through a work zone. The devices are integrated to monitor traffic operating characteristics or roadway conditions and react with a predetermined response.
- **Warrants** conditions which should be satisfied before considering a WZ ITS system for deployment as part of a project’s temporary traffic control plan.
- **Benefits** anticipated affect mobility and safety when the system is properly designed and deployed. Mobility and safety measures may be within the work zone or surrounding network, and may include the public, the workers, or the constructability of the project.
- **Options** various options may be available for portions of the SWZ Systems. The options should be considered when they achieve satisfactory results with lower levels of system complication and cost.

GENERAL WZ ITS TOOLBOX NOTES

- All WZ ITS Guide Signs should be reviewed by the NHDOT Bureau of Traffic for design and message approval.
- Advance warning signs and other standard temporary traffic control devices have not been shown on these figures. Refer to the MUTCD for typical layouts.
- Refer to the Toolbox Definition Section for graphic symbols and terms
- Toolbox illustrations are NOT drawn to scale

SYMBOLS USED IN WZ ITS TOOLBOX ILLUSTRATION



SWZ SYSTEMS LISTED

Traffic Responsive Systems

- Travel Time Information (Trip Time or Estimated Delay)
- Speed Advisory Information
- Congestion Advisory
- Stopped Traffic Advisory
- Dynamic Merge – Late or Early

Vehicle Responsive Systems

- Excessive Speed Display
- Dynamic Speed Display
- Over Dimension Warning
- Work Intrusion Warning
- Construction Vehicle Warning – Merging, Crossing, and Exiting

Environmentally Responsive Systems

- Hazardous Conditions Warning

Temporary Traffic Control Devices

- Changeable Work Zone Signage – Work Zone Speed Limits

Note: The WZ ITS Toolbox Sheets contained within this document are preliminary illustrations and may not accurately represent all WZ ITS Systems as typically deployed.

The systems may be combined, modified, enhanced or simplified as necessary for a particular project. Please use these toolbox sheets to brainstorm WZ ITS possibilities, and consider what conditions may be needed to make the application viable. When a system is deployed, we hope to quantify these conditions further, with refined warrants on the system's toolbox sheet. We also wish to quantify benefits derived from the deployments where ever possible in addition to the intuitive benefits that may be reaped from WZ ITS systems.

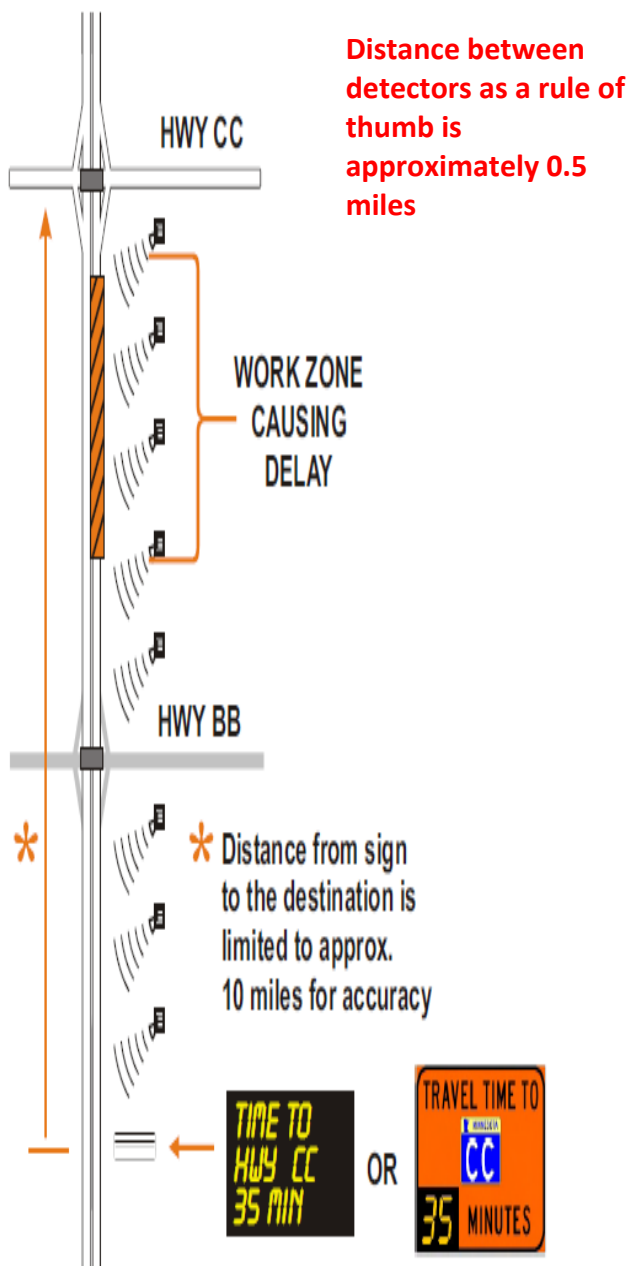
WARRANTS/CONDITIONS

- The work zone may cause regular, recurring, long term delay in excess of 10 minutes.
- The work zone causing the delay is within 10 miles of the CMS location.

BENEFITS

- The system should inform the drivers what the estimated travel time is between their current location and a specific destination beyond them (up to 10 miles maximum).
- The system will give drivers information which will allow them to decide whether to change routes, provide them opportunity to notify others of their estimated arrival time, and generally provides drivers sufficient information to calm tempers.

ESTIMATED TRIP TIME



OPTIONS

- The CMS may be replaced with static warning signs equipped with two (2) CMS characters in dynamic mode. The characters would display the real-time travel time in the work zone downstream.
- Consideration should be given to posting an alternate route and travel time for additional driver information.
- The CMS may be supplemented with other informational devices such as Closed Circuit Television Camera (CCTV)



NOTES

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- All SWZ Guide Signs and CMS should be reviewed by the NH DOT Bureau of Traffic for design and message approval.
- Approved CMS messages may be listed in the POW/Special Provisions, and approx CMS locations may show on the TC plans. All CMS displays should be blank when messages are not warranted.
- Refer to the Toolbox Definitions Section for graphic symbols and terms.

WARRANTS/CONDITIONS

- The work zone may cause 15 minutes or more of additional travel time
- The work zone queue is estimated to slow traffic at least 20 mph below the posted speed limit

BENEFITS

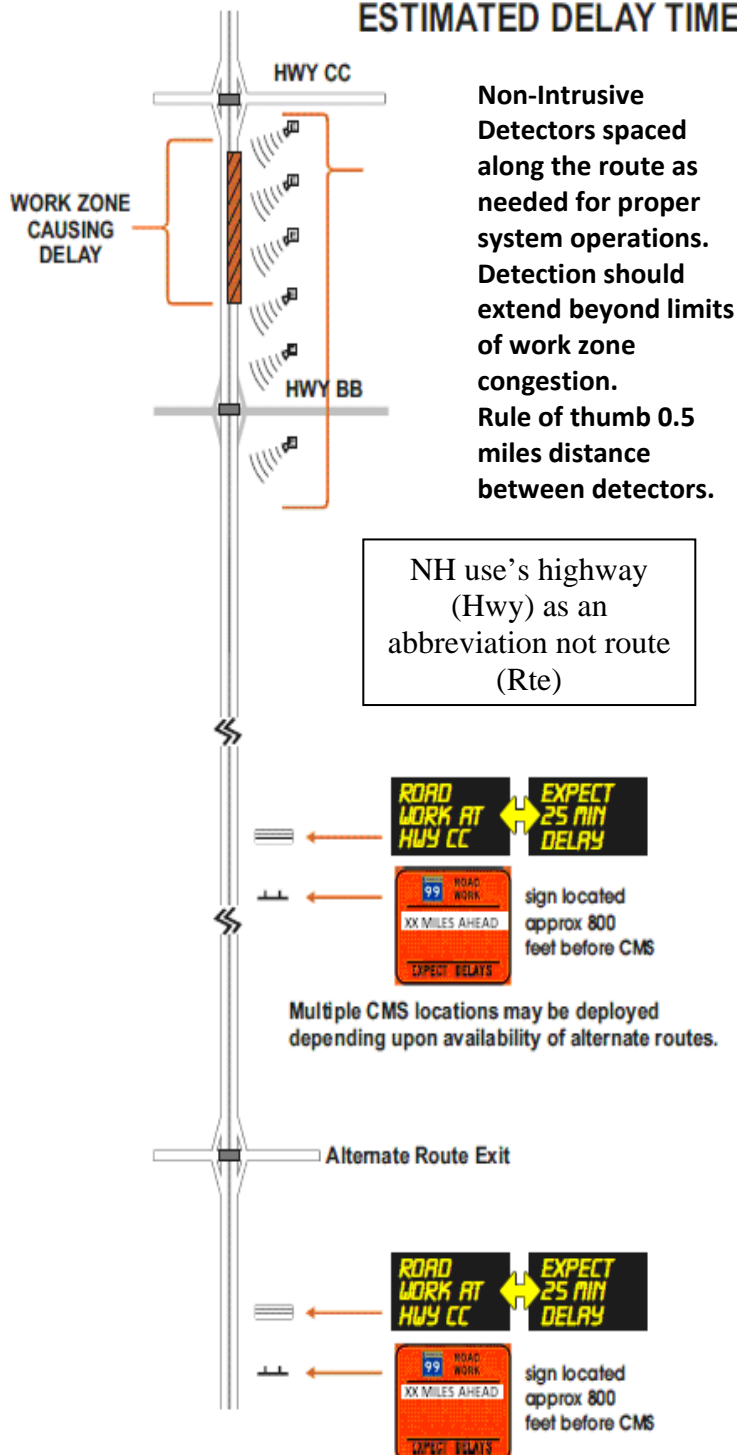
- System should advise drivers of an appropriate vehicle speed to allow them to travel through the work zone with minimal braking.
- The system will give drivers information which will allow them to decide whether to change routes, provide them opportunity to notify others of their estimated arrival time, and generally provides drivers sufficient information to calm tempers when they arrive at the cause of the delay.

OPTIONS

- The CMS may be replaced with static warning signs equipped with two (2) CMS characters in dynamic mode. The characters would display the real-time travel delay in the work zone downstream.
- Consideration should be given to posting an alternative route and travel time for additional driver information.
- The system may be converted to a Travel Time system within 10 miles of the destination location (such as Hwy CC in this example)
- The CMS may be supplemented with other information devices such as closed Circuit TV (CCTV).



ESTIMATED DELAY TIME



NOTES

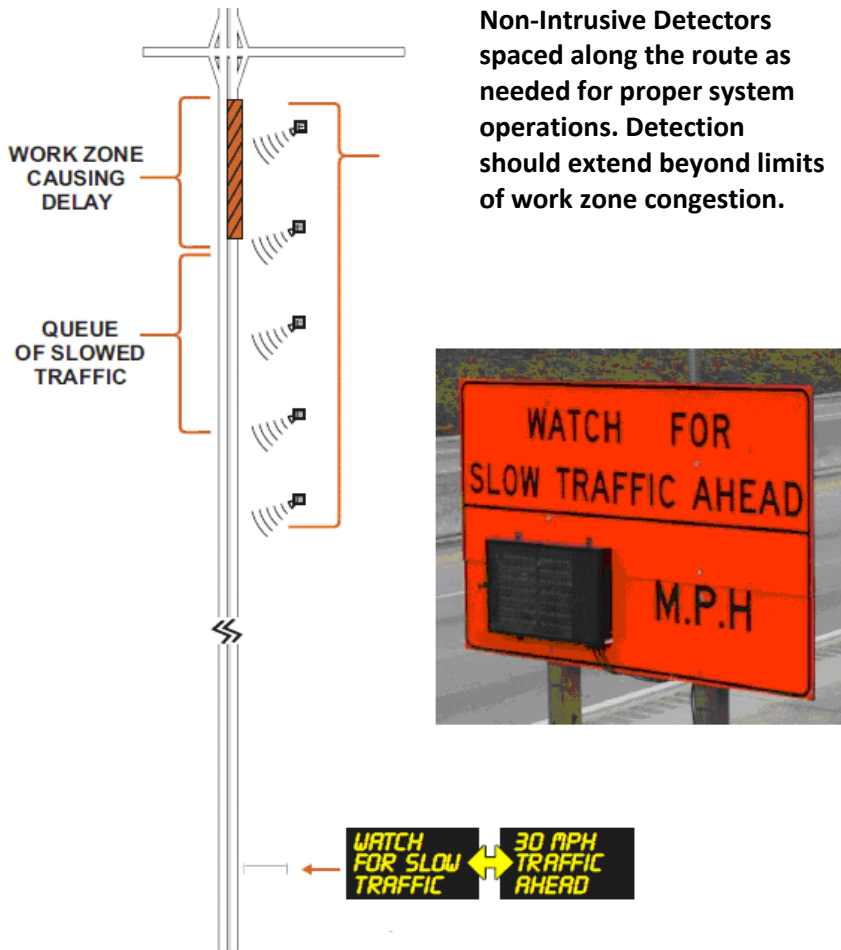
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- Prosecution of work

WARRANTS/CONDITIONS

- The work zone may cause additional delay due to an unexpected decrease in speed in the work zone.
- The work zone queue is estimated to slow traffic at least 20 mph below the posted speed limit.

BENEFITS

- System should advise drivers of an appropriate vehicle speed to allow them to travel through the work zone with minimal braking.
- The system will smooth the transition between faster and slower moving traffic.
- The system should provide an increase in capacity of the roadway through the work zone area.



The CMS should be located 1 mile before the Work Zone, and before the slow traffic queue. The displayed speed is the average speed detected entering the work zone location. Based on this information, the motorist may adjust speed to anticipate the slower traffic.

OPTIONS

- The CMS may be replaced with static warning signs equipped with two (2) CMS characters in dynamic mode. The characters would display the real-time travel delay in the work zone downstream.

OPTIONAL DESIGN: combination of static sign and digital number display



NOTES

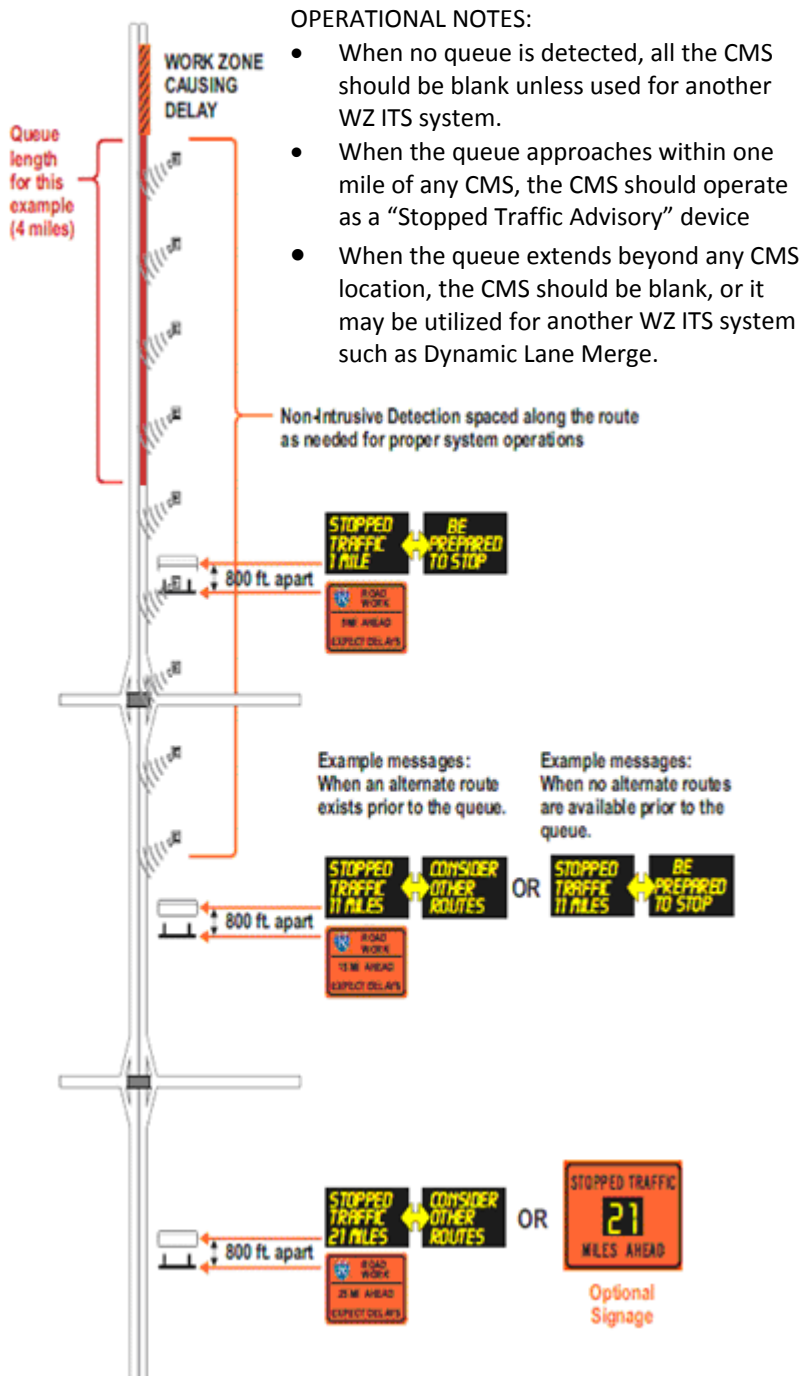
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WARRANTS/CONDITIONS

- Queue lengths are estimated to vary greatly, day-by-day and hour-by-hour such that a suitable location for the TTC advance warning signage can not be predicted. **Note: signs placed more than a mile ahead of confirmation are typically forgotten by the motorist.**
- Queue lengths may encroach upstream beyond a motorist's reasonable expectations for stopped traffic and there is probability that the geometrics (terrain) may cause poor visibility of end of traffic queues, causing short reaction times and panic stopping.
- The queue is estimated to stop downward of the last CMS in the system.

BENEFITS

- The system should alert drivers of an upcoming traffic slow-down or stopped traffic, providing time to determine possible route alternatives, and to be prepared to stop safely.
- Traffic may divert to alternate routes.



OPTIONS

- When queues are estimated to never extend to the CMS location, the CMS may be replaced with a static warning sign equipped with two dynamic CMS characters for mileage. When no queues are detected, the mileage display would correspond with the accompanying guide sign for "Road Work XX Mi Ahead."



- When traffic queue lengths are reasonably predictable, warning motorists of stopped/slowed traffic may be accomplished with the use of typical TC warning signs placed prior to the anticipated beginning of queue.
- The system may be combined with "Dynamic Merge," "Stopped Traffic Warning" and "Travel Time and/or Delay systems."

NOTES

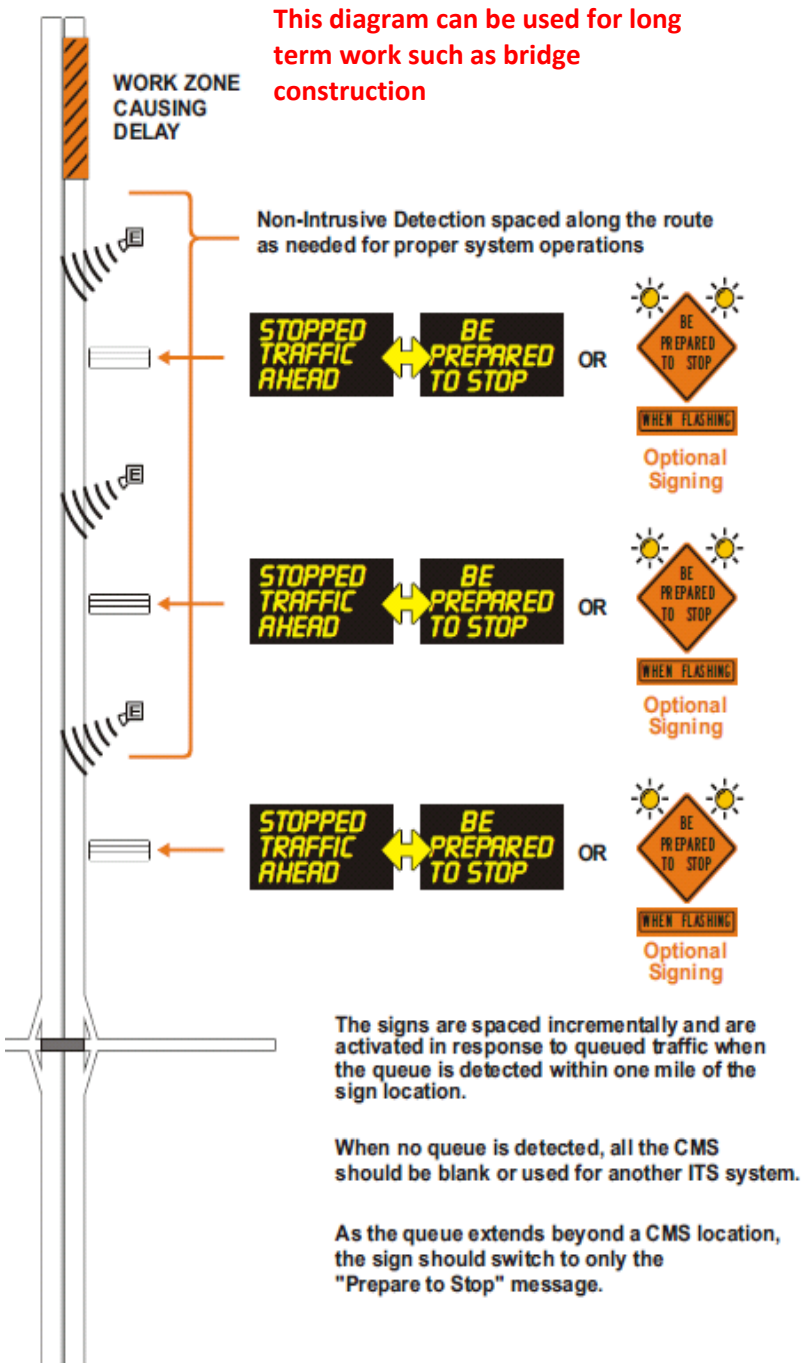
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WARRANTS/CONDITIONS

- Queue lengths are estimated to vary greatly, day-by-day and hour-by-hour such that a suitable location for the TTC advance warning signage can not be predicted. Note: signs placed more than a mile ahead of confirmation are typically forgotten by the motorist.
- Queue lengths may encroach upstream beyond a motorist's reasonable expectations for stopped traffic and there is probability that the geometrics (terrain) may cause poor visibility of end of traffic queues, causing short reaction times and panic stopping.
- Queue initiated on crossroads are estimated to cause traffic conflicts and/or delays on the mainline road, such as backups, beyond the length of ramps, through or around turns in intersections, or other hazardous congestion situations.

BENEFITS

- The system should alert drivers of an upcoming traffic slow-down or stopped traffic, providing time to determine possible route alternatives, and to be prepared to stop safely.
- It is anticipated that the system will reduce rear-end crashers.
- Traffic may divert to alternate routes.



OPTIONS

- The CMS may be replaced with an appropriate warning sign equipped with dynamically automated flashing lights as shown below.



This signage display is recommended for mobile operations such as paving

OPTIONAL SIGN DESIGN

- The static signs are spaced incrementally and the individual flashers are activated in response to queued traffic when the queue is detected within one mile of the sign location.
- When traffic queue lengths are reasonably predictable, warning motorists of stopped/slowed traffic may be accomplished with the typical TC warning signs placed prior to the anticipated beginning of queue.
- The system may be combined with "Dynamic Merge" and "Stopped Traffic Advisory" systems.

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WARRANTS/CONDITIONS

- Two lanes of traffic must merge into one direction. One lane will be closed to traffic and traffic must merge.
- Although queues may develop at low volumes for many reasons, typically the volume must exceed 1500 vehicles/hour to sustain a queue that was caused by merging lanes.
- Estimated queue lengths may encroach beyond an upstream intersection or interchange operations.
- The speeds and lane occupancy volumes are anticipated to vary unpredictably causing the motorist to have trouble identifying the best lane usage practice, such as using both lanes versus moving into the continuous thru-lane.

BENEFITS

- The system should alert drivers of an upcoming traffic slow-down or stopped traffic, and inform them to use both lanes until the designated merge point.
- It is anticipated that the system will reduce the length of the upstream queue by 40%, which may reduce conflicts at nearby intersections.
- By utilizing both traffic lanes, the differential speed between lanes is greatly reduced since both lanes travel at approx the same speed.
- Motorists are given positive directions on lane usage and merging which clears misunderstanding between drivers and reduce road rage.

OPTIONS

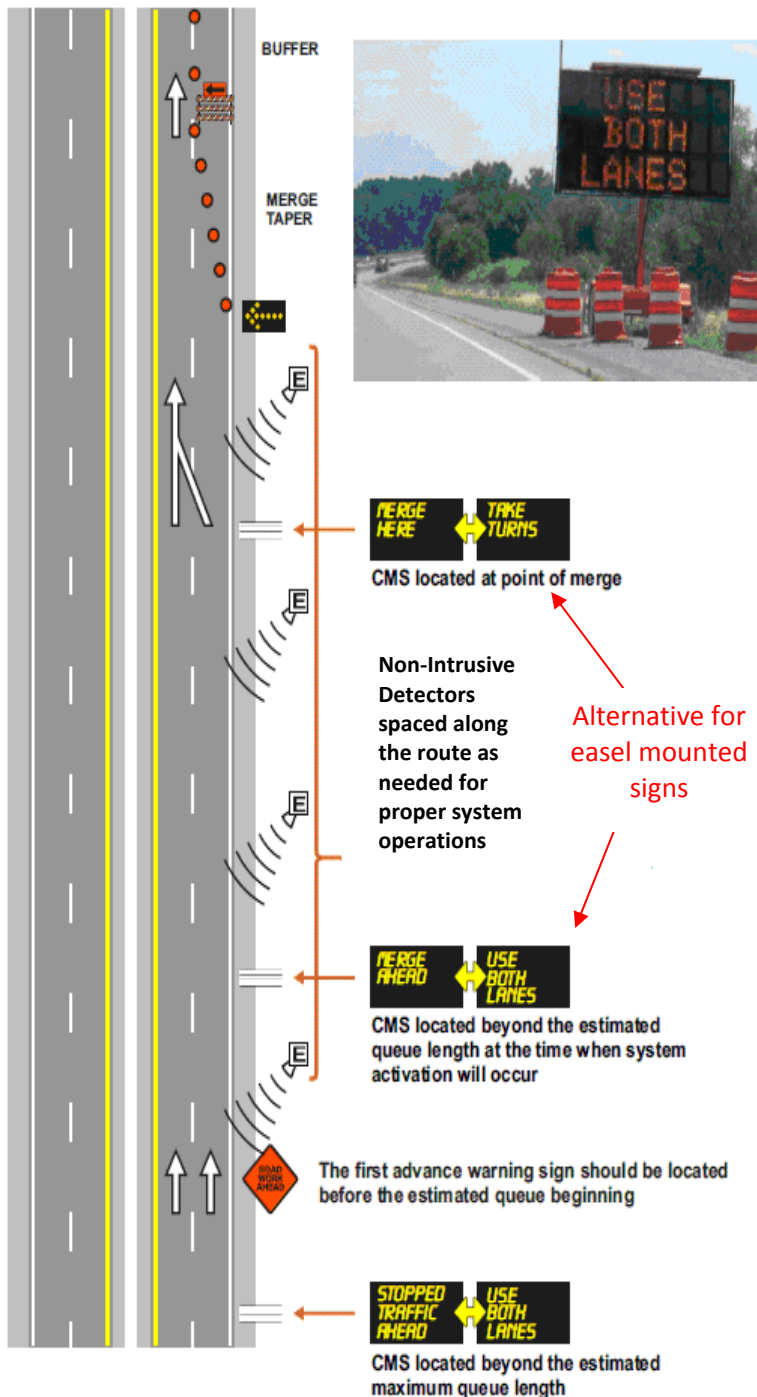
- The dynamic system may be combined with Congestion Warning and Travel Time and/or Delay Systems.
- When the speeds and lane occupancy volumes are anticipated to increase very predictably and hold at that high level, the motorist should have little trouble identifying when the traffic is congesting and begin to follow the posted merging procedure, such as using both lanes. Only clear directions on proper actions are needed by the motorist. Two options:
 - The directions may be supplied on static guide signs posted beyond the anticipated queue length and repeated within the queue area. An example series of **Static Signs** is shown below:



- When the congestion time is highly predictable, the directions may be posted CMS as shown in the illustration, and activated by timers, rather than traffic conditions.
- When traffic queue lengths are reasonably low and predictable, instructing motorists of proper lane usage may be accomplished with the use of typical TC warning signs placed prior to the anticipated beginning of queue or refer to Dynamic Early Merge.

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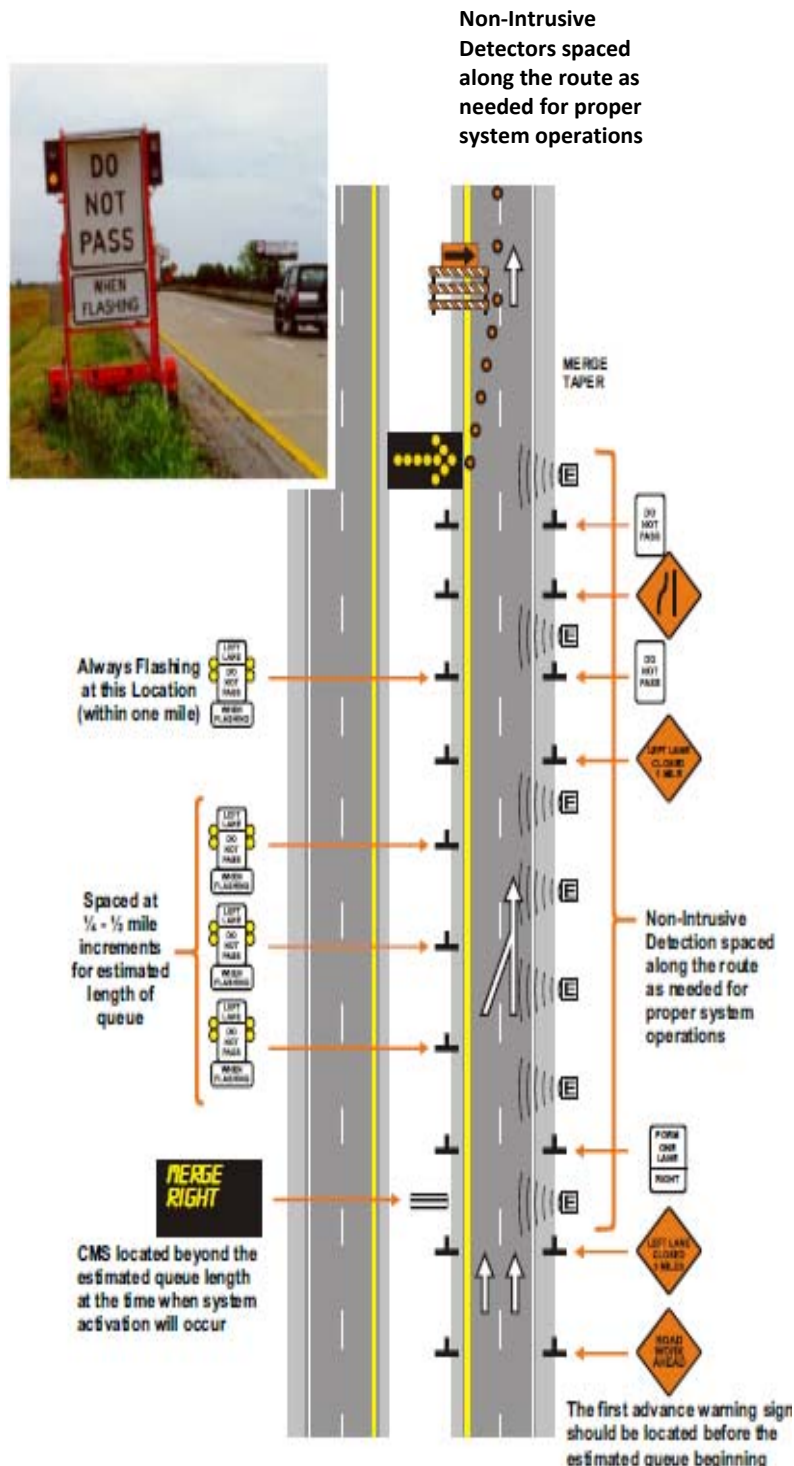


WARRANTS/CONDITIONS

- Two lanes of traffic must merge into one. One lane will be closed to traffic and traffic must merge.
- Notifications of merge are located well before estimated queue length.
- Lower than 1500 vehicles/hour is expected at highway segment so that with early merge there is not an exceeding queue length.
- Estimated queue lengths may encroach beyond an upstream intersection or interchange operations.

BENEFITS

- The system should alert drivers of an upcoming traffic slow-down or stopped traffic, and inform them to use both lanes until the designated merge point.
- Motorists are merged well before point of construction lane usage to ensure safe clear from work zone lane usage.
- Motorists are given positive directions on lane usage and merging which clears misunderstanding between drivers and reduce road rage.



OPTIONS

- The dynamic system may be combined with Congestion Warning and Travel Time and/or Delay Systems.
- When the speeds and lane occupancy volumes are anticipated to increase very predictably and hold at that a high level, the motorist should have little trouble identifying when the traffic is congesting and begin to follow the posted merging procedure, such as using both lanes. Only clear directions on proper actions are needed by the motorist. Two options:
 - The directions may be supplied on static guide signs posted beyond the anticipated queue length and repeated within the queue area. An example series of **Static Signs** is shown below:



- When the congestion time is highly predictable, the directions may be posted CMS as shown in the illustration, and activated by timers, rather than traffic conditions.
- When traffic queue lengths are reasonably low and predictable, instructing motorists of proper lane usage may be accomplished with the use of typical TC warning signs placed prior to the anticipated beginning of queue or refer to Dynamic Late Merge.

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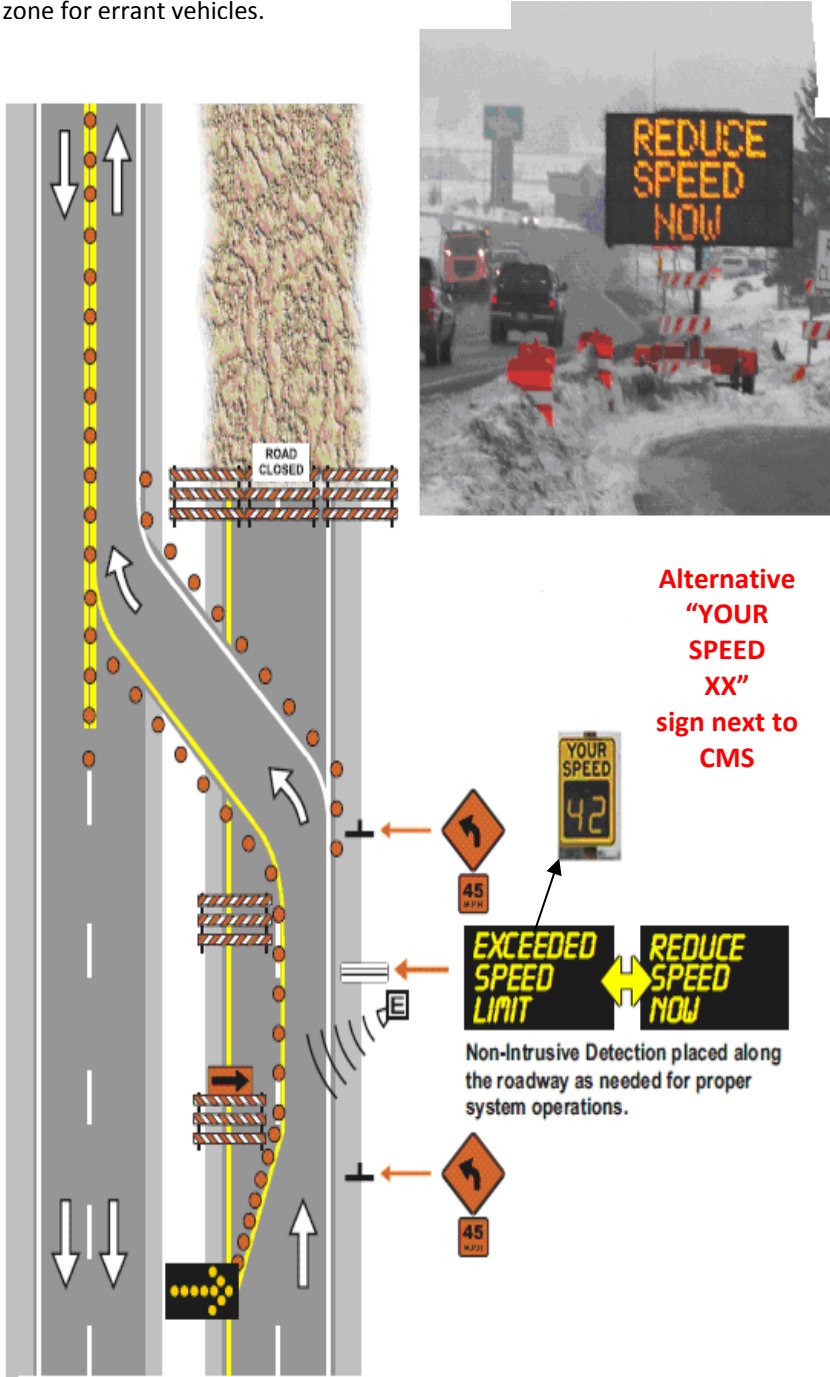
WARRANTS/CONDITIONS

- Traffic must reduce speed to safely negotiate a hazardous condition such as a temporary unusually tight curve, or a rough road surface.
- Buffer spaces and/or clear zones should be analyzed for possible intrusions by vehicles unable to sufficiently slow down in time.

BENEFITS

- System should alert a driver that they have inadvertently entered a portion of the work zone at a speed substantially above the advisory speed limit.
- The system provides sufficient time to slow down for the hazardous condition.

Example shows a reduced advisory speed limit due to sharp curves with either a substandard clear zone or inadequate buffer zone for errant vehicles.



OPTIONS



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WARRANTS/CONDITIONS

- Workers will be located adjacent to the open traffic lane.
- Hazardous roadway conditions require extra driving precautions.

BENEFITS

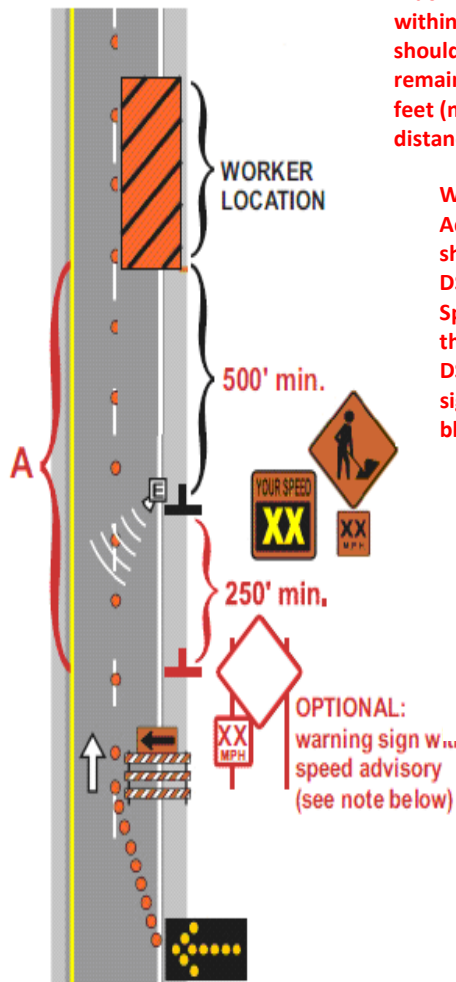
- System should alert a driver of a current speed and what the advisory speed is posted for the situation.
- The system will alert drivers of their speed and provide sufficient time to slow before passing workers or entering a hazardous roadway condition.

NOTE: The changes to this layout (in RED) are recommendations that are currently being studied for optimum sign usage and location. This preliminary layout should be followed until a final

The work crew (or poor road condition) should be visible to the driver from the point of viewing the Advisory Speed Plaque and DSD sign display. Preliminary studies show 500' is the optimum distance for speed reduction; therefore, it's advised to maintain that distance as much as practical. As workers move within the work zone, the DSD location should be re-positioned such that it remains within 500 feet (min) and 2500 feet (max) of the worker location. The distances may be adjusted following

When the DSD sign is utilizing an Advisory Speed Limit, a warning sign shall be displayed adjacent to the DSD sign location. The Advisory Speed Plaque may be attached to the warning sign, or mounted on the DSD sign device. The "YOUR SPEED" sign on the DSD device shall be blank on fluorescent orange.

When utilizing the DSD sign with either a regulatory speed limit, the "YOUR SPEED" sign on the DSD device shall be black on white. The DSD sign shall be either placed adjacent to the posted speed limit sign, or the appropriate speed limit sign shall be mounted to the DSD



When used, the optional advance warning sign with speed advisory should be placed a minimum distance 'A' ahead of the workers and a minimum 250 feet ahead of the DSD device location.

The distance 'A' is the Advance Warning Sign Spacing based upon the Posted Speed Limit and is found in the



MINIMUM SPECIFICATIONS on DSD SIGN EQUIPMENT:

For sign height, follow MUTCD current version.

The static sign (YOUR SPEED) should be black letters on a **fluorescent orange** background when used with a work zone advisory speed plaque. The font should be a minimum of 4" high when used with a 10" display character, and 6" when used with a 14" or greater character display sign.

OPERATIONAL GUIDELINES

The DSD sign should remain blank when no traffic is detected. When traffic speed is detected over the advisory speed plaque, the sign should blink at 50-60 cycles/minute. For speeds detected over a set max speed (generally 10mph over the posted limit on low speed roadways and 20mph over on high speed roadways) the display should light up.

NOTES

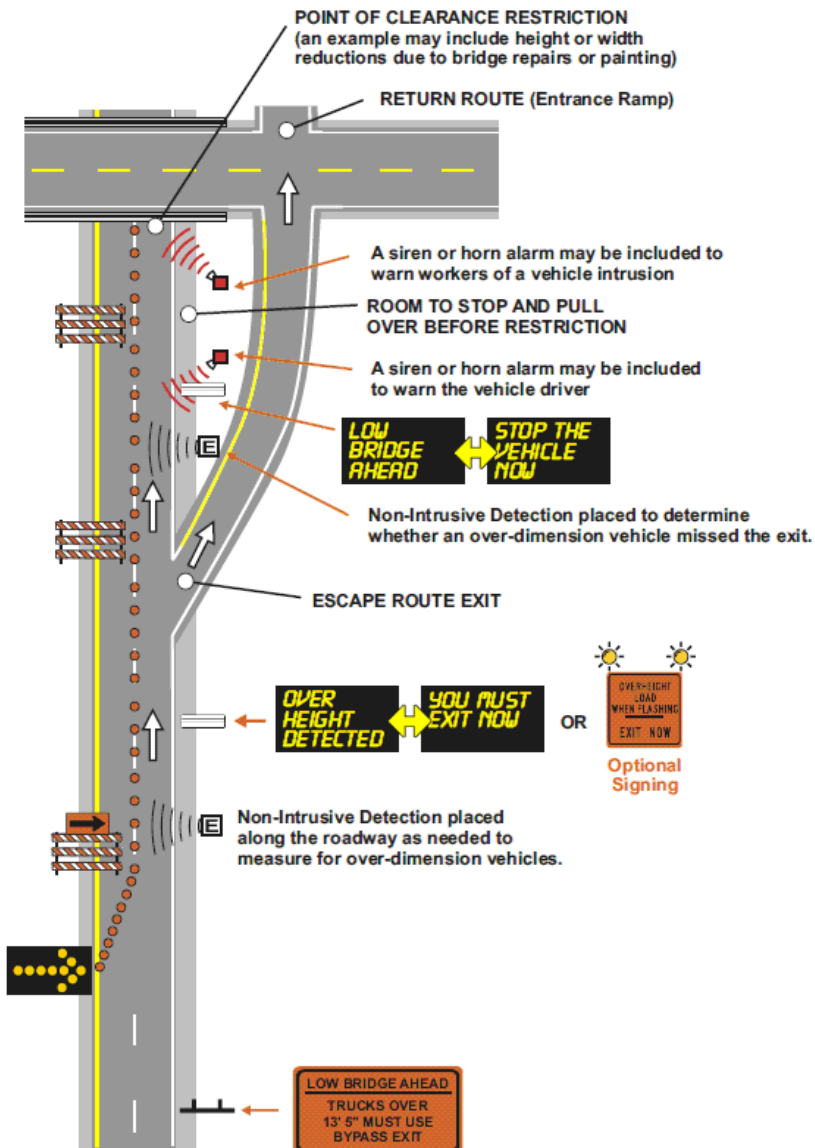
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WARRANTS/CONDITIONS

- Construction causes temporary minimal clearance (or less than minimum) for large vehicles using the roadway.
- A minimal clearance condition exists within a work zone and construction vehicles must be warned of the

BENEFITS

- System should alert a driver that their vehicle is over-dimension and they are required to use an escape route.
- The system will alert drivers of their route mistake and provide sufficient time to conduct the escape maneuver.
- The second portion of the system warns a driver to stop if he failed to use the designated escape route.



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WARRANTS/CONDITIONS

WORK SPACE INTRUSION:

- Vehicles inadvertently fail to follow standard flagging operations.

HAUL ROAD INTRUSION:

- Vehicles inadvertently follow a truck off the roadway.

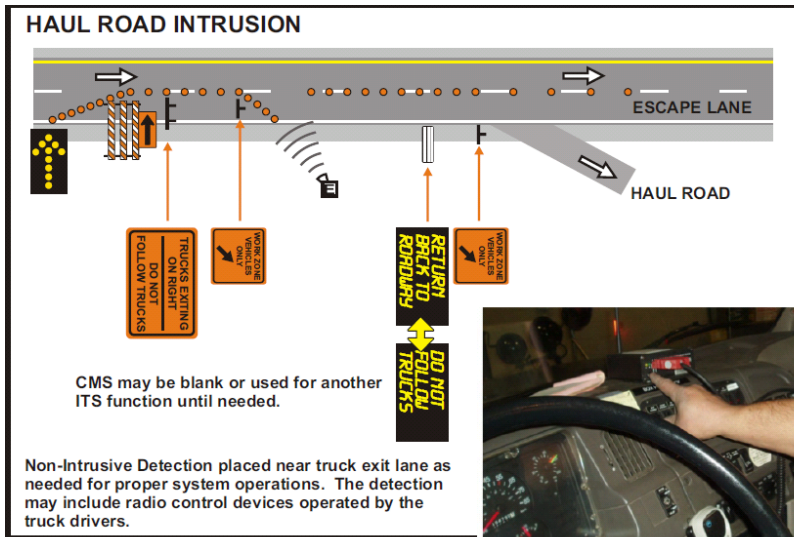
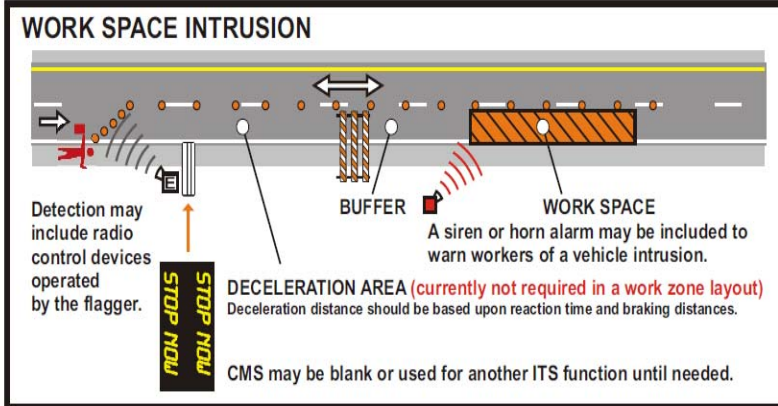
REASONS FOR THE FOLLOWING MAY VARY

- High roadway volume causing tailgating
- Truck exit is difficult to identify

BENEFITS

- The systems should alert a driver that they have inadvertently followed a construction truck into the construction zone or intruded into a work space.
- A work space intrusion system should alert a worker that a vehicle has intruded into the work zone.
- The systems should provide sufficient time for the driver to reach appropriately, such as utilize an escape route back to the roadway traffic.

OPTIONS



Display/alarms activated by truck driver

NOTES

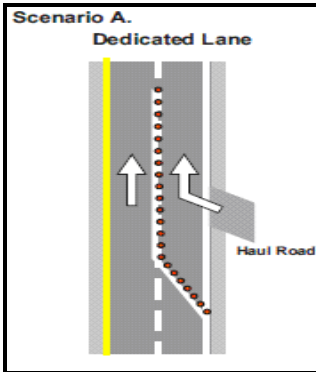
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WARRANTS/CONDITIONS

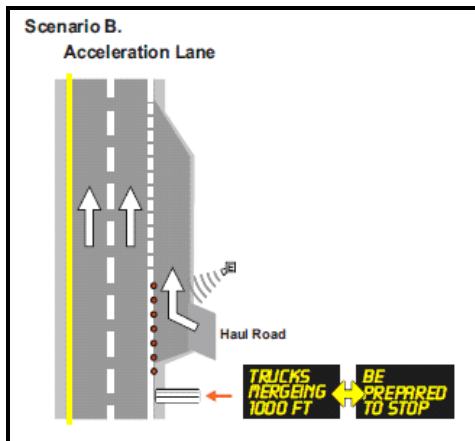
- The trucks must utilize the mainline roadway to accelerate.
- A truck merge lane cannot be provided on the project.
- The haul road entrance is visibly obscured to drivers.
- The ADT on the roadway is above the level where truck drivers can easily find a gap in traffic and accelerate within the traffic lane without causing traffic to suddenly adjust speed or change lanes.

BENEFITS

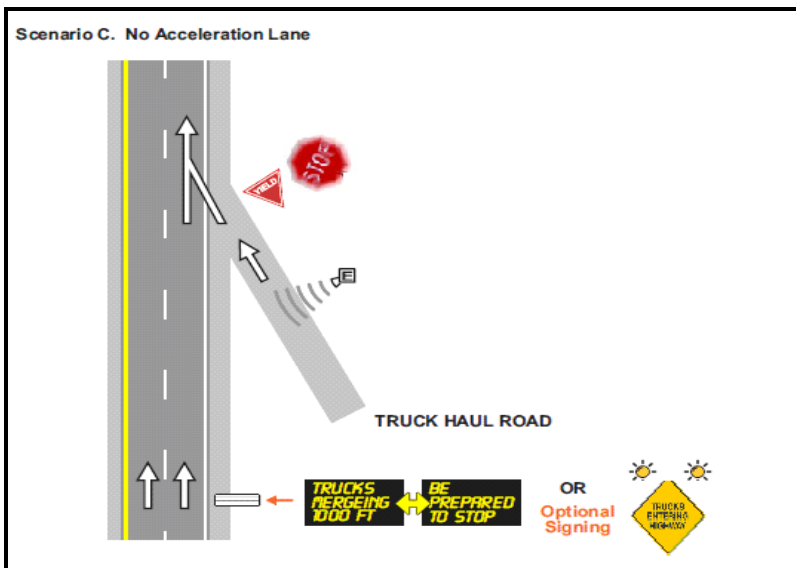
- The system should alert drivers of slowly accelerating trucks entering the faster moving traffic lane.
- The system should provide sufficient time for drivers to react appropriately, such as slowing down or changing lanes.



Typically, WZ ITS Systems are not needed for construction traffic in this scenario.



Although this scenario may operate efficiently without an WZ ITS system installed, higher traffic/truck volumes or a short acceleration lane would warrant the WZ ITS system.



OPTIONS

- A variation of this system may be used to detect work vehicles in the vicinity which may create a traffic hazard. The example shown below warned the motorists when snow plows were clearing the roadway in a restricted section. The signs were activated by radio communications from the plow trucks.



NOTES

- Advance warning signs and other standard temporary traffic control devices have not been shown on this figure. Refer to MUTCD for typical layout examples.
- All WZ ITS Guide Signs and CMS should be reviewed by the NH DOT Bureau of Traffic for design and message approval.
- Approved CMS messages may be listed in the POW/Special Provisions, and approx CMS locations may show on the TC plans. All CMS displays should be blank when messages are not warranted.
- Refer to the Toolbox Definitions Section for graphic symbols and terms.

WARRANTS/CONDITIONS

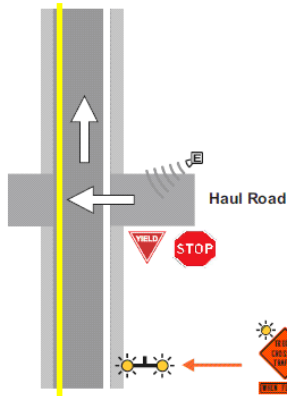
- The ADT on the roadway is at a level where truck drivers can easily recognize a gap in traffic and safely cross without causing conflicts with traffic but there is limited sight distance.

BENEFITS

- The system should alert drivers of a slowly accelerating truck crossing the traffic lane.
- The system should provide drivers sufficient time to react appropriately, such as slowing down.

Scenario D.

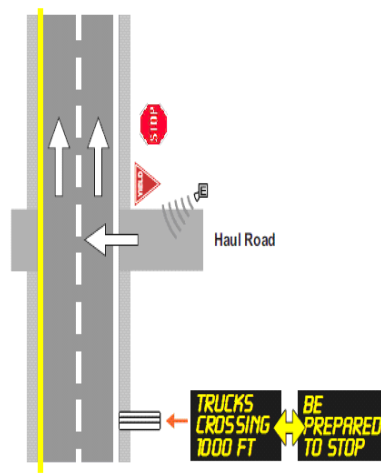
Cross Single Lane



The crossing could be deployed with either the trucks yielding or the traffic yielding, depending upon the volume of each.

Scenario E.

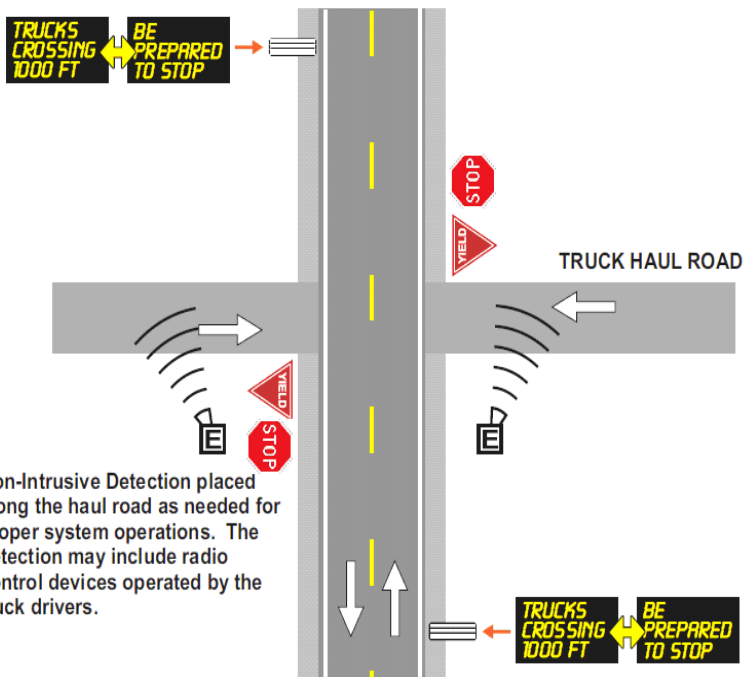
Cross Double Lane



OPTIONS

- When higher ADT conditions exist such that trucks are not able to find a gap in traffic, then additional traffic control systems, such as flaggers, stop signs, or temporary signals, should be utilized to slow or stop traffic.

Scenario F. Cross 2-Lane 2-Way



Non-Intrusive Detection placed along the haul road as needed for proper system operations. The detection may include radio control devices operated by the truck drivers.

NOTES

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- Approved CMS messages may be listed in the POW/Special Provisions, and approx CMS locations may show on the TC plans. All CMS displays should be blank when messages are not warranted.
- Refer to the Toolbox Definitions Section for graphic symbols and terms.

WARRANTS/CONDITIONS

- The trucks must utilize the mainline roadway to decelerate.
- The roadway volume is above the level where the traffic must suddenly adjust speed or change lanes.

BENEFITS

- The system should alert drivers of a slowly decelerating truck exiting the faster moving traffic lane.
- The system should provide drivers sufficient time to react appropriately, such as slowing down or changing lanes if possible.

OPTIONS

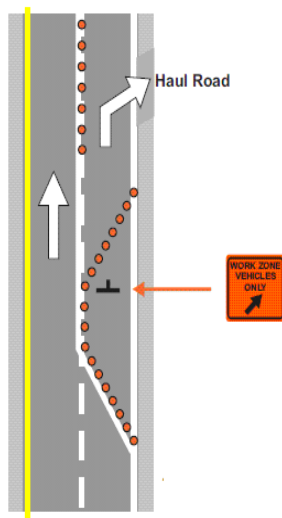


NOTES

- Advance warning signs and other standard temporary traffic control devices have not been shown on this figure. Refer to MUTCD for typical layout examples.
- All WZ ITS Guide Signs and CMS should be reviewed by the NH DOT Bureau of Traffic for design and message approval.
- Approved CMS messages may be listed in the POW/Special Provisions, and approx CMS locations may show on the TC plans. All CMS displays should be blank when messages are not warranted.
- Refer to the Toolbox Definitions Section for graphic symbols and terms.

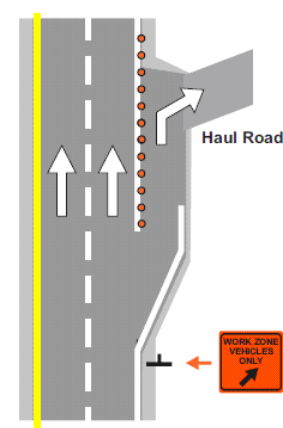
Scenario G.

Dedicated Lane

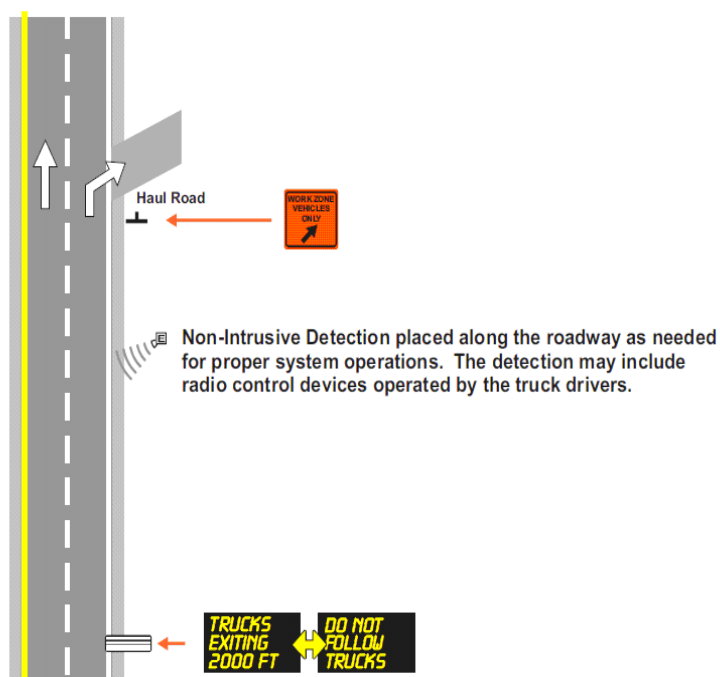


Scenario H.

De-acceleration Lane



Scenario I. No De-acceleration Lane



WARRANTS/CONDITIONS

- The system should be considered for deployment as part of a project's temporary traffic control plan when a temporary situation may cause a hazardous driving condition such as:
 - Flash flooding
 - Visibility (fog, smoke)
 - Slippery or rough conditions
 - Hazards on roadway (falling rock, debris)

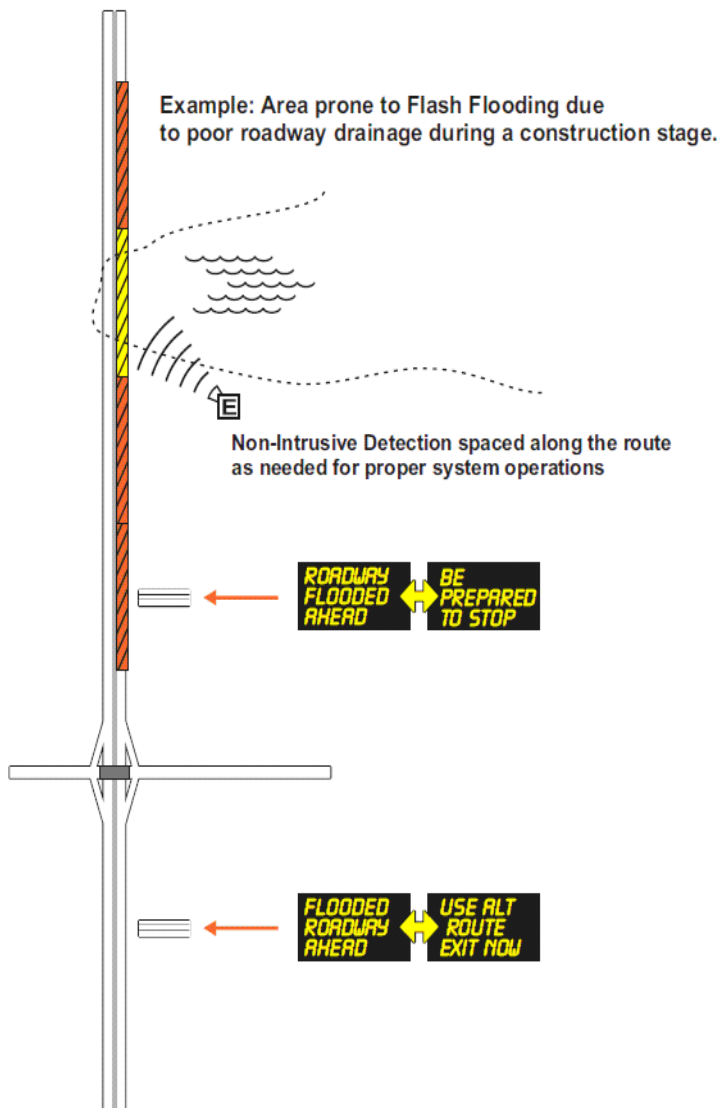
BENEFITS

- The system should alert traffic of a hazardous condition on the roadway ahead and advise traffic of an appropriate action for the situation which may range from stopping, slowing, or diverting traffic.
- The system should notify construction staff of the situation such that corrective actions may begin.

OPTIONS

NOTES

- Advance warning signs and other standard temporary traffic control devices have not been shown on this figure. Refer to MUTCD for typical layout examples.
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- Approved CMS messages may be listed in the POW/Special Provisions, and approx CMS locations may show on the TC plans. All CMS displays should be blank when messages are not warranted.
- Refer to the Toolbox Definitions Section for graphic symbols and terms.



WARRANTS/CONDITIONS

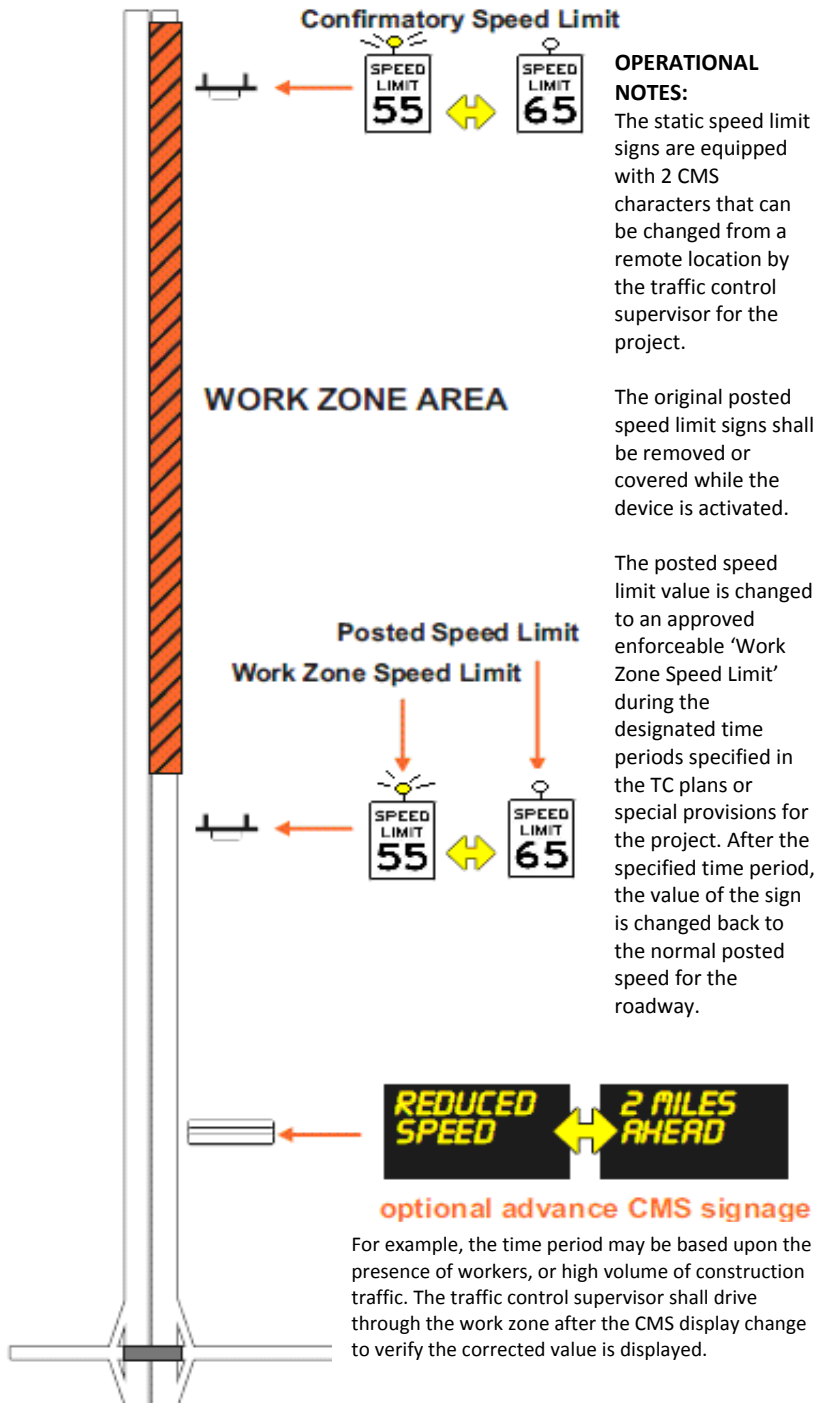
- Refer to the “Guidelines for Establishing Work Zone Speed Limits” for the procedure to change speed limits, the methods or reasoning to lower speed limits may be but is not limited to: advisory speed limits for road conditions, workers at spot locations in the work zone, and/or the entire work zone in general.

BENEFITS

- The traffic control supervisor will be able to change the work zone speed limit easily without manually covering signs.

OPTIONS

- The CMS characters may be replaced with static regulatory speed limits printed with the appropriate speed values. The traffic control supervisor would be responsible to exchange the signs to enable the work zone speed limit to be enforceable and must return the normal posted speed limit following the approved time period. There are variations of covering the existing signs as approved alternatives to removing the signs.



NOTES

- Advance warning signs and other standard temporary traffic control devices have not been shown on this figure. Refer to MUTCD for typical layout examples.
- All SWZ Guide Signs and CMS should be reviewed by the NH DOT Bureau of Traffic for design and message approval.
- Approved CMS messages may be listed in the POW/Special Provisions, and approx CMS locations may show on the TC plans. All CMS displays should be blank when messages are not warranted.
- Refer to the Toolbox Definitions Section for graphic symbols and terms.