WORK ZONE PROTECTION & TRAFFIC CONTROL

This section provides information on typical traffic control and work zone protection devices. Such devices include, but are not restricted to flaggers, signs, cones, and flashing arrow panels. The National Manual on Uniform Traffic Control Devices (MUTCD), NYS Supplement and NYS DOT Work Zone Traffic Control Manual (WZTCM) provide information on and minimum requirements for the proper use of these devices. The high speed and high traffic volume conditions on many State highways may warrant additional devices beyond those indicated in the MUTCD and, in many cases, the WZTCM will provide appropriate guidance. Much of the information in this section is based on that document. If additional information is required, refer to the MUTCD, WZTCM, or contact the Regional Safety Representative.

Work Durations

Long-Term Stationary: Work that occupies a location more than 3 consecutive days or nights.

Intermediate-Term Stationary: Work that occupies a location more than one daylight period up to 3 consecutive days, or nighttime work lasting more than 1 hour.

Short-Term Stationary: Daytime work that occupies a location for more than 1 hour within a single daylight period.

Short Duration: work that occupies a location up to 1 hour.

Mobile: work that moves intermittently (less than 15 minutes) or continuously.

ADVANCE WARNING DEVICES

SIGNING

All work zone signing (ground or truck mounted) shall conform to the MUTCD and/or WZTCM. Special conditions or emergencies may require additional signing. Refer to the MUTCD and/or WZTCM for guidance on the proper location, message, spacing, sequence, mounting height and size of signs used for traffic control.

Materials

Rigid and flexible “roll-up” signs may be used. Rigid signs must be mounted at least 5 feet above grade (7 feet where there are pedestrians or parked cars) for visibility and to avoid windshield penetration if they are impacted. Flexible signs must be mounted at least one foot above grade. Mesh signs shall not be used. Use reflectorized rigid signs for night work because they present a flat, uniform reflective surface. Sign stands must meet NCHRP 350 testing standards.
Installation

All signs should face at approximately right angles to on-coming traffic and be as close to vertical as possible to avoid reflecting sun glare into the driver’s eye.

In mobile and short-duration work zones, signs may be mounted on vehicles.

Credibility

Signs shall be maintained, clean and with the legend fully intact. They shall remain in place only when needed. Signs which do not reflect actual conditions promote driver disobedience of all signs and therefore should be covered, removed or turned away so they are not visible to traffic at any travel lane. Sign covers must be opaque, and cover the sign face completely. Partially visible signs may divert attention away from traffic and other devices. If unneeded signs are to be stored at roadside, try to store them out of the clear zone or as far from traffic as practical. If stored close to traffic, lay the signs flat and fold up the legs of the sign supports.

Where operations are performed in stages, only use those devices that apply to the conditions present during the stage in progress. Signs set up over a long distance should be periodically checked.

Signing Guidance

1. Install one or more work zone warning signs whenever the work results in a changed condition which may require a higher level of driver caution. One sign (usually “Road Work Ahead”) may be adequate for minor changes such as removed guide rail, removed edge line or roadside work which does not encroach on the shoulder or travel lane. Use “Road Work Ahead” as the first sign in a warning sign series on minor side roads where distance information is not necessary. Use more signs as the impact on traffic increases. Work zones that obstruct traffic generally require a series of three signs (see WZTCM typicals). The first gives a general warning, the second warns of a specific condition and the third advises motorists of actions to be taken.

2. General warning signs such as “Road Work XX Ft” should be limited to the first sign of a series. Subsequent warning signs in that series should identify specific conditions. Use signs shown in the MUTCD/WZTCM for lane and shoulder closure, alignment and intersection signs, flagger and worker symbol signs, road closed, detour, etc.

3. Location of advance warning signs should consider exiting and entering traffic. Advance posting distances in the MUTCD & WZTCM are starting points and should be adjusted as appropriate for site-specific conditions. Avoid starting a warning sign series upstream from a major exit or intersection, except when it is desirable to divert traffic off the route at that point or where the intersection is within 1000 feet of the work site.
4. Where single advance warning signs are provided on ramps or minor intersecting roads, the "Ahead" wording rather than a specific distance is preferred because it is easier to adapt to site conditions and reduces sign inventory needs.

5. Warning signs must be located to provide adequate visibility distance to drivers; not blocked by foliage, roadway features, or other signs and traffic control devices; and not located where glare from light sources behind the sign may reduce visibility. Actual distance from a warning sign to the condition should be close to the stated distance on the sign, but accuracy should not be at the expense of sign visibility.

6. Signs must be adequately spaced to provide time for the driver to read each one. Sign spacing varies with the type of highway and the prevailing speeds and is specified in the MUTCD and WZTCM.

**Regulatory and Guide Signs**

Requirements and guidance for regulatory and guide signs shall conform to Chapter 2 of the MUTCD. When guide signs are used to alert drivers and provide information on road and ramp closures, sign messages must be legible. If temporary guide signs are used for a work zone, they shall be black on orange signs. Messages must be simple and concise to be read at prevailing speeds. Messages of more than a few words must be split between two or more signs placed at least 500 ft. apart. No intervening signs should be placed between the two, and distance between the signs should not be extended such that connection between the two is lost. Cover or remove unneeded or inapplicable signs.

**Variable Message Signs (VMS)**

These devices provide added (supplemental) warning and real-time information concerning changing conditions.

- Use VMS, if available, on high-speed, high-volume roadways (and on other roadways as needed) to supplement static signs to alert drivers to nighttime maintenance activities, road closures and workers exposed to traffic. VMS shall not be used by themselves except in emergencies. Radar-equipped VMS should also be deployed in major active work zones wherein workers are exposed to traffic on high speed, limited access highways for a minimum of four hours.

- Place VMS well upstream of work areas, road closures or detours to allow time for driver response or diversion to other routes.

- Simple, specific messages are essential to ensure that they can be read and understood. Provide specific instructions and information ("Paving Ahead / Right Lanes Closed", or "Exit 45 Closed / Use Exit 46"). Consult the "Policy and Guidance
for use of VMS manual available from the Regional Traffic Safety & Mobility Office for standard messages.

- Limit messages to 2-part, 3-word text if possible. Longer messages cannot be read at typical freeway speeds. Don't display general messages ("Drive Safely" or "Have A Nice Day") or cautionary messages ("Caution" or "Road Work Ahead").

- When not needed, turn off VMS, and, if possible, store outside the clear zone.

**FLASHING ARROW PANELS**

Flashing arrow panels are generally used for lane closures, roadway diversions, and slow-moving maintenance activities. Use flashing arrow panels for all lane closures on highways where the posted speed limit equals or exceeds 45 mph or in heavy traffic where the arrow panels can enhance visibility of the lane closure.

The arrow display should **never** be used on two-lane two-way roads. Arrow displays should only be used where traffic can be moved to another lane without danger of meeting oncoming traffic - - - multi-lane, single direction roadways. The four corner caution flash mode may be used to provide additional advance warning where an arrow display is not appropriate. "Flashing bar" displays are prohibited and shall not be used.

Locate, level, and aim arrow panels to maximize the distance between the arrow panel and the point where drivers first see and understand the arrow. Provide at least ½ mile legibility (more if possible) for highways with speed limits of 45 mph or greater. Trailer mounted arrow panels should be 4 feet high by 8 feet wide. Provide at least 1500 foot legibility if used where speed limits are below 45 mph.

For stationary lane closures, place the arrow panel on the shoulder inside the taper near the beginning of the taper. Avoid placing it near ramps, median crossovers, and intersections where it may confuse drivers. Use only one arrow panel for each stationary lane closure. Too many arrow panels can encourage drivers to change lanes unnecessarily.

For moving maintenance activities where a lane is closed, an arrow panel must be placed in the closed lane at the rear of the activity. If possible, use two arrow panels for moving work zones; one on the first shadow/barrier vehicle in the closed lane, and the second on a shadow or barrier vehicle, pick up truck or trailer providing advance warning on the shoulder upstream of the first one. The arrow panel should be placed on a vehicle separate from a work vehicle and positioned between the last work vehicle and approaching traffic.

In areas of restricted sight distance, it may be necessary for the arrow panel vehicle to lag behind or stop and wait behind the activity to maintain optimal visibility to approaching traffic. As sight distance improves behind the activity, the arrow panel
vehicle should close the gap. However, the distance between the arrow panel vehicle and the work activity should be kept short enough to discourage drivers from re-entering the lane.

CHANNELIZING DEVICES

Channelizing devices are used to guide the motorists through the work area. Cones, drums and vertical panels are the most common channelizing devices. Cones are most frequently used due to the ease of transport, set up and cost. The MUTCD details requirements for their size, shape, color, reflectivity and placement.

- Use channelizing devices to delineate the travel path, to mark the location of hazards and to separate opposing or adjacent travel lanes, and to separate traffic and pedestrians.

- Channelizing devices must be used in a stationary work zone where a lane or shoulder is occupied by vehicles or personnel to separate the work zone from the travel lane over the entire duration of the work area and to guide traffic into any new travel path.

- At stationary work zones where no workers are exposed to traffic or no workers are present, the spacing of channelizing devices shall not exceed 80 ft.

- Where workers are present and exposed to traffic, space channelizing devices shall be spaced no more than 40 feet apart.

- Type III barricades are required for road closures and must be equipped with flashing lights.

- Type C steady burning low intensity warning lights are not to be used on reflectorized channelizing devices unless justified by reduced visibility conditions such as heavy fog.

- Type B flashing warning lights may be used on channelizing devices marking a point hazard, and for additional emphasis of lane closure tapers.

- Flashing warning lights are not to be used on channelizing devices or traffic barrier in a longitudinal series along the path of traffic. Type C steady burn lights provide useful delineation on non-reflectorized roadside features such as temporary barrier, bridge rail or similar objects located close to travel lanes.

- Traffic cones shall be 28" - 36" (36" for high speed roads) in height, orange with two white reflectorized bands (for night use) at the top as per the MUTCD, and may be supplemented with orange flags. For nighttime use, cones may be equipped with
lighting devices and must be 36 inches high.

- Drums shall be plastic and orange with at least two horizontal, reflectorized white stripes, 4-6 inches wide. Weighted rings should be used. Never place weight on top of a drum or use large loose objects such as rocks for ballast since they can become dangerous projectiles if the drum is hit.

- Other guiding devices such as raised reflective pavement markers, post-mounted delineators, and vertical panels may be used to mark travel paths.

- Adequate ballast must be provided to ensure devices are not dislodged.

Flag trees may also be used upstream of channelizing devices to provide additional advance warning.

Tapers

Channelizing devices (usually cones) placed in a taper are used to shift traffic laterally at the beginning of a stationary work zone where a lane is occupied by vehicles or personnel. The standard lengths of channelizing tapers are specified in the MUTCD and WZTCM. To create a taper, the apparent transverse spacing of channelizing devices must not exceed four feet. The longitudinal device spacing in feet should not exceed the speed limit (55 feet for 55 mph and 40 feet for 40 mph). This is a minimum standard; devices can be closer if needed. Where workers are exposed to traffic, and upstream tapers are within 500 feet of the work site (1000 feet for high speeds), the device spacing should be 40 feet in the taper regardless of the spacing indicated in the MUTCD for that type of taper.

There are five types of tapers; merging, shifting, shoulder, downstream and one-lane two-way.

See appropriate work zone typical in the MUTCD or WZTCM for guidance regarding taper types and lengths for your specific application.

WORK AREA TRAFFIC CONTROL

FLAGS/STOP-SLOW PADDLES

Flagging or the use of stop-slow paddles at highway work zones protects employees and the traveling public from conflicts between traffic and the work operation and between conflicting traffic movements. The person using a stop-slow paddle, flag, or operating a portable signal is referred to as a traffic controller. The traffic controller's only job is work zone protection and traffic control. The traffic controller must never assist the crew with work activities, or engage in any distraction, and must remain on
duty until properly relieved. Employees shall use stop-slow paddles, where and whenever feasible. Flags may be used at intersections or where the back-side message on a stop/slow paddle is inappropriate for opposing traffic and where conditions such as very high wind make the use of a paddle impractical. Refer to the current Transportation Maintenance Instruction for more information.

The supervisor is responsible for the traffic controller, regardless of the distance between the traffic control station and the work area. The supervisor must make sure the traffic controller has been instructed in proper procedures, is performing properly, is alert, properly attired, and periodically relieved.

Traffic controllers are required in the following situations:

- One lane is alternately used for both directions of traffic.
- The roadway is closed for a brief period.
- Traffic speeds need to be substantially reduced.
- Inadequate motorist sight distance hinders sufficient advance warning.
- Information, such as changing conditions, needs to be conveyed to motorists.
- Opposing traffic needs to be controlled at an intersection.
- Installing and removing other traffic control devices.
- Where conditions require unusual precautions.
- Entrance and exit of vehicles/equipment into/out of traffic.

Personal Characteristics of Traffic Controllers

- Have good judgment.
- Be alert and in good physical condition.
- Be decisive.
- Be reliable.
- Be authoritative, yet courteous.

Traffic controllers shall use the following equipment and personal protective gear:

- Hard hat (Department issued [orange]).
- Department-approved high visibility apparel (DCT Design-standard).
- 24" Stop/Slow paddle w/6' staff (preferred) or approved rec flag (24" x 24").
- A red wand flashlight, if working at night and portable lighting is unavailable.

Traffic controllers must:

- Always face oncoming traffic.
- Never leave their position until relieved.
- Know where crew members and equipment are, be aware of changes, and never
stand among workers and equipment.
- Be courteous, yet authoritative.
- Minimize conversations with motorists and pedestrians.
- Be positioned to compensate for limited sight distance, to provide maximum
  advance warning, and remain clearly visible to traffic at all times.
- Try to maintain color contrast with background; consider sun glare on motorists.
- Establish eye contact with drivers to whom they must give direction.

**TRAFFIC CONTROL STATION**

Factors such as visibility, speed limit, traffic volume, road conditions, work performed,
and nature of the obstacle must be considered in determining the appropriate distance
between the traffic controller and the work site. Refer to the MUTCD/DOT WZTCM for
typical applications.

The traffic controller's station shall be preceded by the typical 3 advanced warning sign
series: "Road Work Ahead", "One Lane Road Ahead" and the "Flagger Ahead" symbol
sign warning of the presence of a controller ahead. The signs shall be promptly
removed, covered or turned away from traffic whenever the traffic controller is not in
position.

A flag tree shall be placed at ½ the distance between the "Flagger Ahead" sign and the
traffic controller unless the operation is constantly moving or only in one location for no
more than a few minutes. Centerline channelizing devices are optional and may be
eliminated where space constraints exist.

**TRAFFIC CONTROL PROCEDURES**

There are four basic directions a traffic controller provides: stop, slow, proceed and
change lanes.

**Stop** - The traffic controller shall face traffic, holding the paddle or flag in the hand
closer to traffic. If using a stop/slow paddle, the traffic controller must be sure the
"STOP" legend is fully facing motorists. If a flag, it shall be extended horizontally and
held in a stationary position over the affected travel path so that the full flag area is
visible. For emphasis, the traffic controller's free arm may be raised with the open palm
of the hand facing traffic.

**Proceed** - When it is safe to allow traffic to proceed, the traffic controller shall
completely turn the paddle to show the "SLOW" legend to traffic, or remove the flag and
motion traffic ahead with the free hand. The traffic controller shall not wave traffic
ahead with the paddle or flag.

132
Slow - The traffic controller shall face approaching traffic holding the paddle or flag in the hand closer to traffic. If using a paddle, display the "SLOW" legend, being sure the legend is fully facing motorists. If using a flag, move it slowly up and down, but never above the waist. For emphasis, the traffic controller may slowly raise and lower the free hand with the palm down.

Move Over - The traffic controller shall motion oncoming traffic slowly, with the free hand, moving in the desired direction away from the body. He or she may also point in that direction. If using a paddle, the traffic controller may display the "SLOW" legend as he or she directs traffic to move in a particular direction.

If necessary to control traffic at night, the traffic controller station must be illuminated. Refer to the Department's construction specifications for more information on illumination. In emergencies where illumination is not possible, use a lighted red wand flashlight and wear Department-approved high-visibility apparel. Paddles or flags may only be used at illuminated traffic controller stations. If lighted stop/slow paddle(s) are available, they may be used. Make sure that any lighting does not impair the vision of approaching drivers.

TRAFFIC CONTROLLER COORDINATION

When more than one traffic controller is used, use one of the following methods to coordinate control of traffic through the work zone.

Visual Communication - Use clear verbal or hand signals to communicate between two or more traffic controllers who can see each other. Signals must be different from traffic control directions to avoid confusing motorists. An intermediate traffic controller may provide a visual link between traffic controllers not visible to one another. Do not use paddles or flags to communicate to another traffic controller.

Radio Communication - Radios are effective in controlling traffic when traffic controllers are not visible to one another. Give an accurate description of the last vehicle through to ensure that two-way traffic is not proceeding thru the area at one time. If there is any doubt as to which direction has the right-of-way, stop all traffic immediately.

Pilot Car - When traffic controllers at opposite ends of a work zone are not visible to one another, and a single lane is used for alternate two-way traffic, and two-way communication is not available, a pilot vehicle may be used to lead traffic thru the work area.

Flag Retrieval - One traffic controller gives the driver of the last vehicle through the work zone a flag or marker, with instructions to present it to the traffic controller at the other end.
SHADOW / BARRIER VEHICLES

For purposes of this policy, a shadow/barrier vehicle is defined as a vehicle used to protect employees within a given work area. A shadow vehicle is used for mobile or short duration (up to 1 hour) operations. A barrier vehicle is used for stationary shoulder closures, lane closures and other stationary work of more than 1 hour duration.

Shadow/barrier vehicles shall only be a heavy dump truck or a large stake/rack truck (in that order) depending on availability. Pickup trucks shall never be used in a travel lane as shadow/barrier vehicle but may be used on shoulders as advanced warning vehicles. The WZTCM provides specific information on shadow and barrier vehicle requirements along with typical mobile and stationary work zone set-ups.

Shadow vehicles are required for all mobile or short duration maintenance work. Mobile work is defined as work that moves intermittently (up to 15 minutes) or continuously. Short duration work is stationary work that lasts up to 1 hour curing daytime hours.

Truck mounted arrow panels shall be utilized in conjunction with shadow/barrier vehicles in accordance with the MUTCD/WZTCM. When barrier vehicles need to be left running to operate the arrow panel for extended periods of time, the barrier vehicle shall be unoccupied, left running in neutral gear with the parking brake on and the front wheels turned away from oncoming traffic and employees in the work area.

Each worker or work operation shall be made highly visible to approaching traffic. Use vehicle equipment, flaggers, other traffic control devices or a combination of methods to warn approaching traffic.

Shadow/barrier vehicles shall be placed between the workers and approaching traffic. Shadow/barrier vehicles shall be positioned close enough to work crews to discourage vehicles from straying into the work area, but far enough from the crews so that the shadow/barrier vehicle, if hit, will not roll into the work area. For stationary operations, shadow/barrier vehicles shall be left in low or reverse gear with parking brakes set, and front wheels shall be turned away from oncoming traffic and away from the employees in the work area.

Shadow/barrier vehicle spacing may be found in the WZTCM typical diagram for each specific situation.

Shadow/barrier vehicle weight and loading shall be to impact attenuator manufacturer recommendations.
All shadow vehicles that are operating totally or partially in a traffic lane and that are directly exposed to approaching traffic, shall be equipped with a truck mounted or trailer mounted impact attenuator (TMIA). Pavement marking operations should use a TMIA equipped heavy dump, when available, as the last vehicle in the pavement marking train on multi-lane highways.

Barrier vehicles that are placed closest to active traffic are required to be equipped with a TMIA. Additional barrier vehicles used in lanes or shoulders adjacent to this vehicle are recommended to also have TMIA’s, but are not required. See the WZTCM for more specific requirements.

TMIA’s are recommended, but not required on shadow/barrier vehicles used for shoulder work where shoulders are 8 ft. or greater.

Since TMIA’s are designed, tested and approved for specific impact speeds, be sure to use a TMIA which is approved for a Test Level (1, 2 and 3) appropriate for the type of highway. Test level 3 TMIA’s are approved for 65 mph speeds and are recommended on interstates. Test Level 2 TMIA’s are approved for speeds up to 55 mph and are appropriate for the majority of applications. Refer to Department design guidance (Highway Design Manual and related EIs and EBs) for more information.

Refer to the latest guidance on moving work zones available from the Regional Traffic Engineer and in the Highway Design Manual guidance on shadow/barrier vehicle, arrow panel and TMIA placement for various types of moving work operations.

**WORK ZONE INTRUSION COUNTERMEASURES**

Traffic control around work zones with exposed workers should, if practicable, use one or more of the work zone intrusion countermeasures listed below. Exposed workers are workers in or adjacent to travel lanes, but not protected by traffic barrier or other positive means that physically prevent vehicles from intruding into the work space. The countermeasures are primarily intended for workers who are exposed for more than a brief period and cannot constantly observe traffic as they perform their duties. The objective of the countermeasures is to reduce the risk of intrusion accidents by alerting drivers to the presence of work activities in or near the travel lanes. For more information on the countermeasures, refer to the most recent Department guidance or consult with the Regional Traffic Safety & Mobility Group.

The countermeasures include

1) Rumble Strips
   - Rumble strips provide audible and tactile (felt by motorists) warnings of an approaching work zone. Installations should follow the most recent guidelines and specifications.
- Install rumble strips at maintenance sites such as paving, bridge repairs and other sites where temporary traffic controls will be in place for more than two nights.

- Rumble strips should be installed upstream of advance warning signs.

- Do not use rumble strips where they will create operational problems, or where they will provide no or little additional warning. Rumble strips should not be used in the following situations:
  - Highways with a 65 mph speed limit, unless a reduced speed limit is in effect.
  - Near residences or businesses where noise may be objectionable.
  - On milled surfaces or very rough pavement.

2) Channelizing Device Spacing Reduction
   - Channelizing devices shall be spaced 40 feet apart at stationary work sites where workers are exposed to traffic.

   - The spacing should be maintained a reasonable distance upstream of the workers and may be used throughout the work zone.

   - Where tapers are located less than 500 feet from the work site (1000 feet for high speeds - 50 mph and higher), the 40 foot spacing should be used in the taper as well.

   - Drums or vertical panels are preferred for long duration work zones, and at any locations where the risk of intrusion is high. Traffic cones are normally adequate for work zones set up and removed on a daily basis.

   - In long lane or shoulder closures, place at least two channelizing devices transversely at maximum 750 feet intervals to discourage traffic from driving through the closed lane.

   - For paving operations on 2-lane, 2-way roadways, longer device spacings may be used where a pilot vehicle is used, or where setting and retrieving the additional devices does not provide any significant safety improvement.

3) Flagger Station Enhanced Setups

   - Additional cones and a flag tree are to be used upstream of flagger stations except where the work is constantly moving or the devices will be in use at one location for no more than a few minutes.

4) Work Zone Speed Limit Reductions

   Consult current Office of Traffic Safety and Mobility guidance.
5) Police Enforcement

As a result of the 2005 Work Zone Safety Act, NYS Regulations currently require that active police enforcement be established where practicable on Department Major Active Work Zones. As of June 1, 2008 the New York State Police have provided NYSDOT with 100 troopers statewide that are specifically dedicated to work zone enforcement. These troopers will now be funded by the Division of State Police. Highest priority in requesting police should be given to all Major Active Work Zones defined by the following criteria:

- Night work.
- Freeways and expressways when workers are exposed to traffic.
- Other high speed roadways when workers are exposed to traffic.
- Other work sites where traffic conditions present a high risk for workers and the traveling public.

TM supervisors should be familiar with their Regional process for requesting police presence and should initiate any requests. To maintain credibility with the police, avoid excessive requests for specific services.

6) Variable Message Signs

Variable Message Signs (VMS) are used to provide advance warning to drivers on high speed roadways where work activities will require stopping, slowing, merging or other maneuvers that require a specific driver reaction. However, avoid overuse of VMS, since excessive VMS use reduces their effectiveness as drivers tend to stop reading them. Priority use of VMS is as follows:

- Advance warning on high speed expressways and rural arterials where workers are exposed to traffic.

- VMSs may be used for slowly moving and mobile operations if there is adequate shoulder width to permit a truck mounted VMS at least one half mile upstream of the operation.

- Because they are easily transported, portable VMSs may be used to protect short-duration maintenance activities where workers are exposed on high speed highways.

- Department owned VMSs not in use for incident management and other operational purposes should be made available for maintenance activities as needed.
TEMPORARY PAVEMENT MARKINGS

If the original pavement markings are covered or removed by the work, and the pavement will be used by traffic, either temporary pavement markings (as defined by the Standard Specifications) or permanent pavement markings should be installed by the end of the work day. Two-lane, two-way highways may be left unmarked for a maximum of three calendar days provided that NO CENTER STRIPE (W8-12) and DO NOT PASS (R4-1) signs are used in conjunction with centerline “tracks” consisting of reflective yellow, temporary pavement marking tape, a minimum of 4” square, raised reflectorized yellow markers or pop-up tabs, installed 80’ apart. Never leave a highway completely unmarked.

- Maintain signs and delineation in good condition until full permanent markings are applied.

- Apply complete permanent markings within two weeks of paving completion.

SHOULDER WORK

Stationary work on the shoulder requires a formal shoulder closure in accordance with the MUTCD and WZTCM. Shoulder closures should include “ROAD WORK AHEAD”, “RIGHT/LEFT SHOULDER CLOSED AHEAD” and/or "SHOULDER WORK" or “RIGHT/LEFT SHOULDER CLOSED” advance warning signs (see appropriate WZTCM typical), a shoulder closure taper approaching the work area, and channelizing devices along the length of the edge of pavement between traffic and the work area. Where employees are working "on foot", at least one, and perhaps some combination of the following procedures should be used to enhance the safety of crew members. These actions should be considered in priority order, based on conditions and available resources.

- Place a shadow/barrier vehicle on the shoulder between the end of the shoulder closure taper and the work space. This vehicle shall preferably be a large dump, small dump, or stake/rack truck; or as a last resort, an unoccupied pickup. Amber flashing lights shall be displayed. Where shadow/barrier vehicles are used, they shall be equipped with an arrow panel operating with 4 corner flashing caution mode.

- For stationary shoulder work, any buffer space provided in advance of the barrier vehicle will add to the safety of the work area (see WZTCM typical set-ups). Where barrier vehicles are not required the minimum buffer space shall be used instead. Buffer space shall be extended to account for poor horizontal or vertical sight distances.
− Use a spotter, perhaps with an air horn, or radio activated audible and/or visible signal, to warn workers of any work zone intrusions. A "FLAGGER AHEAD" sign is not required when the spotter is not controlling traffic.

− Use an audible/visible alarm, which may be self-activated, or activated by a crew member. The effectiveness and appropriateness of the system use will depend on the type of work performed, and proper placement of the sensors for self-activated systems.

− Place portable rumble strips placed on the shoulder in advance of the work area.

Use of these procedures or devices shall be dictated by conditions which include highway configuration, sight distance, shoulder width and type, task performed, team size, fleet availability, etc. Transportation Maintenance managers should review shoulder operations performed in their Region, and decide the appropriate work zone treatment.

PEDESTRIAN AND BICYCLE TRAFFIC

Pedestrian and/or bicycle traffic must be safely and continuously maintained through or around a work zone on highways or streets where pedestrians and/or bicyclists are not prohibited. If a safe and accessible path for pedestrians cannot be maintained continuously through the work site, a safe continuous detour must be furnished. Signs and fencing should be used to direct pedestrians away from unsafe areas. Pedestrian and bicycle traffic needs should be considered when planning the work and addressed in accordance with current Department guidance.

PLANNED OR SCHEDULED NIGHTTIME MAINTENANCE

Night work is intended to accomplish the work when traffic volumes are lowest to minimize traffic congestion. Night maintenance activities entail tradeoffs, particularly increased difficulty in ensuring safe traffic flow through the work zone. A number of factors make it more difficult to ensure safe traffic flow at night:

− Visibility is greatly reduced, both for drivers and workers.
− Speeds are frequently higher because volumes are lower.
− Confusion and lessened visibility tend to reduce lane capacity below daytime levels.
− Impaired drivers (alcohol, drugs, fatigue) are a greater concern.
− Some drivers may be unaccustomed to encountering maintenance at night.
− Workers may be more prone to fatigue.
− Coordination with supervisory and support staff is more difficult.

To ensure night work is done in a manner that provides a safe environment for workers and travelers, high-quality Work Zone Traffic Control (WZTC) is essential. Not only
must it adhere to established standards, procedures, and principles that apply to all Department operations, WZTC for night maintenance must be enhanced to address factors listed above.

WZTC must be designed, implemented, and managed in a uniform, consistent manner to provide a high level of traffic safety for workers and the traveling public, and minimize delays and inconvenience to travelers, and disruptions to the community where work is done. Traffic Control Plans (TCPs) for night operations are to be carefully designed to meet all of these goals.

**Planning for Nighttime Maintenance**

Two approaches may be considered for normal night work:
- Lane closures using traffic barriers.
- Lane closures using only channelizing devices.

It is preferable to provide as much separation as possible between maintenance activities and traffic, while providing all necessary information and guidance for drivers to safely traverse the detour or travel through the work zone. Lane closures using channelizing devices provide the least separation. For typical night maintenance operations such as paving and pavement/joint repairs, the work area is not fixed, and it becomes necessary to rely on channelizing devices to form temporary lane closures nightly.

**Managing and Supervising Nighttime M&PT**

The Resident Engineer or Bridge Maintenance Engineer is responsible for developing and overseeing all details of scheduled night work zones. Nighttime operations frequently entail more complex WZTC and higher risks if the TCP is not constantly maintained at a high quality level. It is essential to establish clear-cut responsibilities for managing and supervising nighttime WZTC. A dedicated person or team should be provided for WZTC and to also patrol closures and correct deficiencies.

**General Requirements**

The Regional Traffic Safety & Mobility Engineer shall review all night work traffic control plans, identify permissible hours for night operations in the TCP, and which nights work will be permitted.

Determine where a road or highway serves substantial nighttime work or commuter traffic (24th or 3rd shifts, etc.) and plan to minimize inconvenience.