

701 MAINTENANCE AND PROTECTION OF TRAFFIC

701-1 Description

One of ADOT's primary goals for any construction project is the safe and efficient handling of traffic through and around construction zones with as little inconvenience and delay as possible. The constant watchfulness by the Resident Engineer (RE) and all inspection personnel is necessary to accomplish this goal. The highest concern should always be the safety of the public, workers, and Inspectors. The convenience of the Contractor is never to be placed above safety when planning or approving traffic control. Safety to the general public, mitigation of economic loss as a result of delays, and good public relations are the benefits of diligent, intelligent traffic handling.

Often a traffic control plan will appear in the Project Plans. The Inspector must evaluate the traffic plan based on the conditions found at the work site. The Inspector or Resident Engineer can have the plan reviewed by the Regional Traffic Engineer when a second opinion is needed.

Usually traffic handling needs will depend on the way the Contractor chooses to construct the project. As a result, it may be necessary to plan the traffic control to fit the construction sequencing. The Contractor and ADOT's field staff can use their ingenuity to reduce traffic control clutter, confusion, and cost. An example of this may be to use painted traffic control delineation rather than vertical panels.

Detours

In a construction zone that carries considerable traffic, it is often preferable to provide a route which will take the traffic around the construction zone. When detours are practical but no detour plans are included, or when the detour plans provided must be modified, it may be necessary for the Contractor and the Resident Engineer to take the initiative to design the detour. If the Contractor is proposing a detour as part of his traffic control, the complete design of the detour would be the Contractor's responsibility. It is usually necessary to obtain local government approval when city streets are used for detours.

It is desirable that both ends of the detour are visible to approaching motorists. Transitions should not be in close proximity to horizontal or vertical curves, structures, or any obstruction which would interfere with the motorist's view of the transition. One ideal situation is to locate entering transitions on far sides of sag vertical curves so that the complete detour is visible (like a huge map) to the motorists. Detour plans call for a great deal of thought, planning, and on-the ground investigation. Plans for detours should be drawn to include the applicable standards and submitted for the approval of the Regional Traffic Engineer.

Speed Limits

The District Engineer has the authority to change the legal speed limits in construction work zones. Speed limits should be reduced only to the minimum amount necessary to ensure safe conditions for drivers and workers. Traffic passing through a construction work zone is not a legitimate reason in itself for reducing speeds. Furthermore, speed limits should not be reduced when no hazards or work activities are present.

Flagging

Both the Resident Engineer and the Contractor should be aware that flagging for haul vehicles is set up to reduce the hazard to street traffic caused by crossing vehicles. Although the street traffic is more fully protected from haul traffic when the street traffic is stopped, there is an inherent risk of motor vehicle accidents when frequently stopping traffic. As a result, the flaggers must be instructed not to stop street traffic for any non-haul

vehicles. Non-haul vehicles can cross during the first available gap. Fewer traffic breaks mean a safer cross haul operation. Street traffic stopped for an equipment crossing is more vulnerable to an accident if they have not been warned. Proper warning is of benefit to both the street traffic and the Contractor. No traffic should be stopped until approved warning signs are in place, and warning signs must be removed if no hauling/crossing is in progress.

Traffic Control Documentation

The courts have made it clear that liability will follow if written standards and requirements for traffic control are not followed faithfully. This not only means that the placement of traffic control devices must be correct, but also that the size, physical condition, cleanliness, and every other requirement must be met. Good records of traffic control facilities will include:

- dates and times of day that inspections are made;
- statement of conditions found;
- complete listing of type, size, and location of devices;
- orders to the Contractor to make changes or corrections;
- time and date that devices are removed or modified;
- photographs; and
- comments explaining any variations from standard procedures.

Additionally, it is a good practice to videotape the project traffic control following the initial setup and periodically thereafter. Remember, although traffic control is the responsibility of the Contractor, the State may also incur liability due to its action or inaction. Photographs of accidents are all too often of the accident vehicles themselves. ADOT personnel must develop the habit of photographing all the approaches to the accident site, photographing the signs and conditions on the approaches, and photographing a view backwards along the vehicle paths. As with all photographic documentation, the photographs and film must be logged, referred to in the diary, and filed with the project records. Inspectors must document facts, comments, and observations of the accident, but must be careful not to express individual opinions.

Inspection Guidelines for Traffic Control

- Have traffic control representatives been appointed by the Contractor and the State?
- Is traffic being controlled in accordance with the specifications, special provisions, the *ADOT Traffic Control Design Guidelines* and the MUTCD? Are all local regulations being followed?
- Are flaggers properly outfitted with hard hats and either international orange shirts or vests during daylight hours? Are reflective vests and illumination utilized during poor light?
- Are flaggers properly equipped and trained in conformance to the *ADOT Traffic Control Design Guidelines* and the MUTCD?
- If traffic delay has caused a long line of waiting vehicles, are two flaggers being used for each direction of traffic movement (one at the head and one at the tail)?
- Is traffic being stopped for haul vehicles only?
- Are flaggers informing the public of the reason for the delay and instructing them to stay in line and not pass the vehicle ahead while within the controlled traffic section?
- Are pilot cars being used when required?
- Are the necessary signs being used, and do they conform to the requirements of the *ADOT Traffic Control Design Guidelines* and the MUTCD?
- Are devices being maintained in a clean and legible condition?
- Are signs being installed only when needed and promptly removed or covered when the traffic control setup is taken down?

- When any type of closure or detour of the traveled way has been made, has all conflicting signing and striping that might mislead the traveling public been covered or obliterated?
- Are there any rough spots, loose material, or surprise hazards in the detour or construction zone that should be repaired or more adequately signed?
- Is the Contractor making repairs and checks on their own initiative? Are they ignoring needed work until informed that it must be done? (Document this.)
- If a detour is not paved, is adequate dust palliative being applied for the safety and convenience of the motorists? Is it adequate to prevent a nuisance to residents or a hazard to crops in the area?

701-2 Materials (Equipment, Workers, Devices, and Facilities)

701-2.02 Flashing Arrow Panels

The MUTCD refers to a number of performance values for arrow displays or flashing arrow panels that are not easily verifiable in the field. To document such things as candlepower, dimming range, beam spread, etc.; the Inspector can find this information in the manufacturer's literature which can be obtained from the Contractor. Arrow-boards are not to be used as substitutes for signs, barricades, or other devices, but rather as supplemental devices. Arrowboards should be in good condition, have reliable components, and must not leak lubricants or fuel, both of which are hazardous and detrimental to the pavement. The Contractor will be required to repair any damage caused by the equipment. Diesel generators on arrow-boards are preferred over gasoline generators because diesel generators have a lesser risk of explosion or fire from an impact to the fuel tank.

701-3 Construction Requirements

701-3.01 General

The specifications require that the Contractor provide an employee qualified to implement, monitor, and modify the traffic control plans associated with the project. This employee's name and the means to contact him in the event of an emergency shall be provided to the Resident Engineer at the Preconstruction Conference.

The Resident Engineer should designate a Department employee who will be responsible to monitor the traffic control and ensure that traffic is handled safely and efficiently.

The Standard Specifications allow the Resident Engineer to either suspend the work or have traffic control measures performed by others, at the Contractor's expense, in case of serious or willful disregard for the safety of the public or construction personnel. The Resident Engineer should allow the Contractor every opportunity to take corrective measures prior to taking such action. If it becomes necessary for the Resident Engineer to take action, the actions should be discussed in advance with the District Engineer unless public safety is seriously at risk.

701-3.02 Maintenance and Protection of Traffic

Inspectors and Field Engineers must make sure that the traffic control is maintained in the original condition. Items such as dirty barricades and lights must be cleaned. Flags that have faded from their "International Orange" color must be replaced. Obscured striping must be exposed. Dirt and stones on the roadway must be removed. A good guide for inspection is the ATSSA *Quality Standards for Work Zone Traffic Control Devices*.

Traffic control features must be installed in strict conformance with the MUTCD and the *ADOT Traffic Control Design Guidelines* to enhance safety through consistency and to reduce the risk of liability for both the Contractor and the State. Given the increase in litigation involved with traffic control, all parties must realize that

hasty, undocumented changes of traffic control will increase the legal liability for everyone. Major modifications to the traffic control plans should be reviewed and approved by the Designer prior to implementation. Changes must never be made by personnel not trained in traffic control planning and implementation.

Should a local agency be involved with the project, the Resident Engineer is advised to meet with that local agency to get their interpretation, coordination, and approval for traffic control.

701-3.03 Temporary Concrete Barrier

Construction and installation drawings for concrete barriers are shown in the Project Plans or Standard Drawings. A review of the placement location should be made to ensure the barrier placement allows for drainage.

In order to function as designed, the barrier run must be a reasonably rigid structure. Barrier sections can be "stretched" after pinning to take up any slack in the pin connection. The foundation must be solid and uniform. The flare at the end of the barrier runs must not be installed on top of a curb and gutter. The curb and gutter must be removed to ensure that errant vehicles will not be launched over or into the barrier.

In some cases where a barrier is placed close to a vertical drop-off, it may be desirable to place steel pins at the backside of the barrier to prevent movement when impacted.

Some barrier sections have holes for pins. If pins are driven through the holes on the front face, the pins must not protrude above the front face of the barrier. The barrier sections must have uniform bearing on firm material to function properly. Styrofoam sheets are usually placed under the ends of barrier sections to provide uniform contact pressure when barriers are set on hard surfaces such as pavements.

All previously used barriers should be carefully inspected for badly chipped or cracked areas. Any badly damaged sections should be rejected. Delineation must be placed at proper intervals along the barrier. The barrier must meet the requirements of Signing and Marking Standard Drawing C-3.

End treatments for temporary concrete barrier are either impact attenuation or flared end. The criteria for selecting an end treatment is based on using an end treatment that will give the best protection for the least cost under the given conditions. The first criteria for use of an end treatment should be safety, not convenience or cost.

701-3.04 Temporary Impact Attenuation Devices

Two types of attenuation devices are commonly used by ADOT, an energy absorbing terminal and sand barrels crash cushion.

The energy absorbing terminal is more complicated than sand barrels but is more compact, and can be used where it is important to save space.

The Inspector should obtain a copy of the assembly diagrams and instructions for the installation inspection. The Inspector should see that the replacement parts package is properly stored in a convenient location; the package contains all the necessary parts; and any parts used are replaced in the package. The Standard Specifications require that a complete replacement package be on the project at all times whenever an energy absorbing terminal is being used.

Repair or replacement of an energy absorbing terminal should begin immediately after the damage occurs. When damage occurs at night or during severe weather, the repair or replacement should not be delayed longer than the next day. The Resident Engineer must use some judgment to decide whether a damaged attenuator needs only extra warning signs until normal Contractor personnel are available, or whether to call the Contractor and reimburse him or her premium overtime for immediate repair.

In either case, an attempt must be made to retrieve the money spent to repair the device. Following completion of the repairs, the costs should be calculated by the Resident Engineer and entered on form #58-7902, Damage to State Highway Repair Report.

Energy absorbing terminal devices are anchored to the road surface by bolting them to a concrete slab or by pins when placed on asphaltic concrete. Whichever method of anchoring the device is used, the manufacturer's recommendations are to be followed exactly. Never permit improper installation of safety devices. Escalate the issue to the District level if necessary. If the devices are not installed properly, the facts are to be documented and the Contractor must be notified in writing.

Although the installation of sand barrels is not complicated, it is still important that erection instructions are followed carefully. The foundation must be uniform, the correct interior parts must be used, and barrels containing the right amount of dry sand at each location are to be placed in the specified geometric pattern. All of the above precautions need to be rechecked carefully during repair of damaged installations.

Sand barrels should not be installed and forgotten. They are subject to vandalism, so they should be checked periodically.

701-3.05 Temporary Pavement Markings (Application)

The most commonly used temporary pavement markings are raised markers, paint, and reflective tape. Unless the surveying is done by ADOT, the Contractor is to perform the basic layout.

Control points must be set at a frequency and accuracy that encourages the striping to be placed with uniform, eye-pleasing alignment (normally accomplished in 50-foot [15-meter] intervals). There are no placement tolerances for temporary marking, but this should not be used as an excuse for accepting poor workmanship. It is important for the Inspector to meet with the Contractor's representatives to agree on placement tolerances before any striping work is started.

The first option for temporary pavement marking should be paint since it is less expensive than tape or raised pavement markers. When applying paint as a temporary pavement marking, it should be applied as if it were permanent. Ensure that the correct width, thickness, and bead content are achieved.

When striping with plastic tape, it is sometimes possible to correct the alignment by pulling it up and replacing it, provided that this is done before it has become firmly stuck. The activator used to enhance the adhesive properties in cool weather may help to restore stickiness to the adhesive when the tape has been pulled up.

Delineators and markers used for temporary traffic control may be reused as permanent devices if they are undamaged or if slight damage is adequately repaired. There is no obligation on the part of ADOT to allow the reuse of pavement-marking materials that are not in first-class condition.

Temporary Pavement Marking Procedures

Section D-3 of the ADOT Traffic Control *Design Guidelines* describes ADOT's policy on temporary striping and temporary pavement markings as they apply to construction work. The Department does require some type of

pavement markings to be in place before any section of roadway is opened to traffic. Traffic should not be allowed to run on unmarked pavement.

Permanent pavement markings should be placed as soon as possible. Temporary pavement marking should only be used when weather conditions, scheduling conflicts, or unfinished construction prohibit the placement of the permanent pavement markings.

Use Type II (Temporary-Removal) preformed pavement markings if eventual removal is required. Use Type III (Temporary-Nonremovable) preformed pavement markings, and/or temporary marking paint when removal of markings is not required. For example; Type III preformed pavement markings could be placed on the lower AC lift surfaces, then Type II placed on top of the ACFC, or chip seal surface. The Type II temporary markings would be removed just prior to application of permanent markings.

A 4-foot (1.2 meter) centerline stripe placed at 40-foot (12-meter) intervals must be used for intermediate lifts of overlays. Temporary pavement marker placed in accordance with Standard Signing and Marking Drawing M-20 should be used for temporary pavement markings on chip seal projects. On freeways and interstate highways only temporary painted stripes should be used to delineate lane lines and centerlines. For severe curves, a 2-foot (0.6-meter) stripe placed at 20-foot (6-meter) intervals should be used.

Temporary pavement markings should be used for delineation instead of barricades when the duration will exceed five days, or the lane width is less than 12-feet (3.6-meter).

701-3.06 Obliteration of Existing Pavement Markings

Removal of pavement marking can be done by any means that will not leave an illusion that the pavement marker is still there. Sandblasting or wet blasting are two acceptable methods. Painting or flushing with asphalt will leave a shiny surface that looks like a paint stripe under adverse conditions (usually at times when it is most important that obliteration is complete) and is not an acceptable method.

Areas where pavement markings have been removed should be checked at night and during wet weather to verify that the removal is effective under these conditions.

Removal of lead-based markings is hazardous, and must be done in compliance with 29 CFR for Lead Exposure in Construction. The contractor must submit a lead exposure plan prior to obliterating lead-based markings.

701-3.07 Truck Mounted Attenuator

The purpose of a truck-mounted attenuator (TMA) is to decelerate the impacting vehicle at a rate which prevents serious injury to the vehicle occupants. Each type of TMA has specific vehicle weight requirements in which it will operate in an acceptable manner. The Inspector should check to verify that the truck on which the TMA is mounted is the appropriate weight for the application. The TMA should be positioned a sufficient distance ahead of the workers or equipment to allow for the appropriate vehicle roll ahead (distance the vehicle will move during impact). For stationary operations the TMA should be down and locked, wheels locked, parking brake set, and wheels turned away from the work site and traffic. The vehicle on which the TMA is mounted should not be allowed to be used as a utility vehicle, but dedicated to the purpose of work zone safety.

701-3.08 Changeable Message Board

The benefit of changeable message boards (CMB) is the flexibility to display a variety of messages to fit the needs of the situation. CMBs are called portable changeable message signs (PCMS) in the MUTCD. The CMB

typically consists of the following components: the message panel, control system, and the power source. The CMB should be clearly visible and legible from a distance of at least 800-feet (250-meter) under both day and night conditions.

The primary purpose of the CMB is to alert drivers to unexpected traffic and routing situations.

Typical applications include the following:

- speed of traffic is expected to drop substantially,
- significant delays are expected,
- there are alignment changes, and
- provide advance warning of roadway closures.

The CMB is not to be used as a stand-alone item of traffic control, but rather as a supplement to enhance the existing traffic control. The CMB should be offset at least 8-feet (2.4-meter) from the nearest traffic lane. Turn the message board away from traffic when not in use.

The format of the message is extremely important. No more than two message displays should be used within any message cycle. Each message should convey a single thought and should be as brief as possible. The flash rate should allow the entire message cycle to be read at least twice at the posted speed limit. Messages should be approved by the Regional Traffic Engineer when long duration setups are anticipated.

The acceptable type of CMB and message should be discussed during the pre-construction conference. The contractor must use a CMB on the Department's [Approved Products List](#), or provide Certification of Compliance. See the Standard Specifications for a list of requirements.

701-3.13 Flagging Services

The Department recognizes three types of flaggers: civilian, local law enforcement with vehicle, and Department of Public Safety (DPS) with vehicle. All flaggers serve a similar purpose, to move traffic safely and expeditiously through or around work zones while protecting on site workers and equipment. When the project traffic control plans require the use of a flagger, the Resident Engineer will determine what type of flagger will be used. In the event that an officer and vehicle are required, either a DPS officer or an off-duty local Officer will be used, depending upon what jurisdiction the roadway falls under. Only DPS officers will be used on interstates and urban freeways.

Procurement of both civilian and local law enforcement flaggers is the responsibility of the Contractor. Procurement of DPS officers is the responsibility of the Resident Engineer. If a DPS officer is required, the Contractor must provide the Resident Engineer with a minimum of three working days advance notice.

701-4 Method of Measurement

The contractor will be reimbursed for Traffic Control by one of three ways depending upon how the "Elements of Work" are measured and paid. The inspector must read the project Special Provisions to determine which way is appropriate. The most common way is to require the contractor to bid every traffic control element of work. The next most common way is to use ADOT pre-determined prices for most elements of work and only have the contractor bid a few installation items. Force Account Item 7010001, Maintenance and Protection of Traffic, is used to reimburse the contractor for elements of work that have pre-determined prices. Lump sum bid item 7060006 is used to pay the contractor to Furnish & Install Temporary Traffic Control devices, except Temporary Concrete Barrier (item 7010010) and Temporary Impact Attenuation Devices (Item 7010012). Requiring the

contractor to bid Lump Sum is an uncommon way to reimburse Traffic Control, but it may be used on small jobs. When this method is used Item 7010001, Maintenance and Protection of Traffic is not a Force Account.

There are two basic methods for measuring traffic control "Elements of Work". Some Elements of Work are measured once "Complete-in-Place" after installation and other elements are measured "In-Use" on a periodic basis. Except for Temporary Concrete Barrier and Temporary Impact Attenuators, no measurement for payment is made for relocating Elements of Work. Unit of measure for an In-Use Element will always have a periodic time dimension. For example: "Each-Day" is a common In-Use unit of measure.

701-4.03 Payment Exceptions

It is the intent of the Standard Specifications to reimburse the Contractor for maintenance and protection of traffic, provided that the traffic control plan and required devices are properly maintained and monitored. If the Contractor fails to properly implement the traffic control plan and maintain the required traffic devices, payment may be withheld until such time as deficiencies are corrected. Notification of such action must be in writing.

No payment will be made for traffic control serving a commercial pit or batch plant. Since these commercial operations serve other customers as well as ADOT, an equitable distribution for shared traffic control cost cannot be consistently made.

Hauling vehicles should not use median turnarounds within 1 mile (1.6 kilometers) of a traffic interchange (TI). The Contractor must be encouraged to make maximum use of the TI structure. Existing median turnarounds may be used in other areas, but new median crossings will not be constructed.

If the Contractor fails to work in a diligent manner and is ineffective in his or her use of traffic control devices, the Resident Engineer may determine not to reimburse the Contractor for these elements until proper progress is being made. The Contractor must be notified in writing of any such action.

The Contractor will not be reimbursed for elements of work if work is suspended as a result of the Contractor's fault, or upon expiration of contract time. It is the intent of this subsection that no payment will be made for traffic control during periods of liquidated damages.

Regardless of the circumstances for not reimbursing the Contractor for work elements, the Contractor is responsible for maintaining all traffic control devices in proper functioning condition at all times. Therefore, the Resident Engineer should continue monitoring the project during these times.