Appendix E
Highway Incident Operations

Traffic Control is a function to be performed at a highway incident, in the same category as extrication, patient treatment, or accident investigation. The Traffic Control Supervisor (TCS), or Leader, or Director, or Responder, as explained is that single individual who establishes and enforces special traffic rules that limit or restrict traffic movement through the Temporary Traffic Control Zone around a highway incident. The TCS has the inherent authority that is necessary to accomplish his job, delegated to him by the Incident Commander upon his assignment to the position. The TCS is empowered to direct the movement of vehicles and take other direct actions as may be necessary to:

- Protect responders and those in their care from the hazards of moving traffic
- Facilitate emergency response through traffic in the vicinity of an incident
- Prevent further incidents involving vehicles in the vicinity of an incident
- Facilitate traffic flow past the incident

This Appendix provides guidance on several important aspects of traffic control in and around a highway incident. A brief description of the Temporary Traffic Control Zone is followed by a discussion of emergency vehicle positioning at the scene of a highway incident. Suggested ways to use traffic control devices to warn and guide traffic in the vicinity of a highway incident are covered next. The last two sections in this appendix both cover specific traffic challenges that are commonly faced by responders to highway incidents.

The Temporary Traffic Control Zone (TTCZ)

The TTCZ is that highway area where special traffic rules apply, limiting or restricting traffic. Traffic movement in the TTCZ is directed by personnel reporting to the Traffic Control Supervisor (TCS), using the authority delegated to him by the Incident Commander in accordance with the applicable state and local statutes.

Traffic control devices are comprehensively described in the MUTCD, although the manual may be further adapted for use somewhat differently in different regions. The temporary traffic control devices that are most commonly employed traffic control device in the TTCZ at highway incidents consist of emergency vehicle lights, flares, and traffic cones; as well as flashlights, flags, and hand signals.
Figure E.1

All traffic control devices used on street and highway construction, maintenance, utility, or incident management operations shall conform to the applicable provisions of this Manual.

Note that this is a mandatory requirement!

The TTCZ is often subdivided into components as an aid in conversation and planning. The MUTCD divides the TTCZ in the following manner:
Figure E.2  Temporary Traffic Control Zone Management Areas

Proceeding from the upstream (bottom of illustration) end, these components are:

- The Advance Warning Area is an important consideration, as motorists are warned of upcoming traffic problems. These warnings are the primary means of preventing secondary crashes where oncoming traffic collides with queued traffic. To be effective, oncoming traffic must be given ample opportunity to slow and/or stop.

- In the Transition Area, traffic is shifted or merged into a new traffic pattern around the incident. Consideration should be given
to position a flagger at each significant change to normal traffic flow.

• The Activity Area is the primary focus of the highway incident response. This area encompasses the crash vehicles (or other primary focus of a highway incident), as well as the working area around them. There may be several response vehicles within the Activity Area as well.

• The Termination Area provides for the gradual and orderly return of traffic into the normal traffic pattern and flow. Response vehicles including EMS vehicles transporting patients, towing and recovery vehicles that are towing inoperative vehicles, units returning to service, and passing traffic depart the scene through the termination area.

• Lateral and Longitudinal Buffer Spaces provide the separation between responders working at the scene and moving traffic.

A great deal of additional guidance regarding temporary traffic control in the Temporary Traffic Control Zone can be found in Section 6 of the MUTCD.

**Highway Incident Geography**

Emergency vehicle positioning is a critical factor in both effectively using response resources and in scene safety. Due to their bulk, warning lighting, and on-board supplies and equipment, fire apparatus make useful traffic barriers. They can also make for troublesome traffic obstacles, and their emergency lighting can be a hazardous distraction to passing motorists. The first consideration for the Incident Commander is to deploy the response assets where they can be best utilized for emergent incident operations. The next immediate considerations should be, however, for scene safety and facilitating traffic flow. Ideally, Resource Officers should position their apparatus to enable them to both meet their primary assignment and to provide protection to their crews from oncoming traffic. This is especially important during the initial scene setup, where the apparatus and the part-time attention of the apparatus driver may provide the only protection available until full traffic control can be established.

The following general guidelines are designed to balance the utilization of the capabilities of response resources, scene safety, and traffic flow:

• Position the ICP vehicle on the shoulder at a detached vantage point where the Incident Commander can view the entire scene, as well as approaching traffic. The ideal location is immediately upstream of the scene, on the shoulder.

• Position EMS vehicles close downstream of the scene, with a clear egress route. This should be done as a matter of standard operating procedure, requiring no special coordination. They will be handling the most vulnerable personnel on the scene — the patients. Avoid EMS vehicle congestion by staging later arriving units. Ferry additional medical personnel to the scene as required.
• Position fire and rescue apparatus upstream of the scene, angled across traffic lanes with the driver capable of directly observing the scene from his primary operating position at the apparatus. This should also be done as part of normal and standard operating procedures, without additional on-scene coordination. Place apparatus with the shortest reach closest to the scene, regardless of their order of arrival. Stagger apparatus on alternate lanes with sufficient spacing to allow later passage between them by other emergency vehicles, if needed.

• Assign a Staging Manager as soon as possible and assign him as appropriate within the IMS organization. His initial task should be to establish a Staging Area at a position that is protected from oncoming traffic, ideally out of the right-of-way or along the shoulder, upstream of the scene. He should immediately determine the best ingress route from staging to the scene. As traffic congestion worsens, he should standardize ingress routes through the queued traffic to the Staging Area.

• As early as practical, appoint a Traffic Control Supervisor (TCS) and assign him as appropriate within the IMS organization. Assign the TCS with the initial task of clearing uninvolved vehicles from the scene vicinity, then (working with the Operations Section Chief, the Safety Officer, and the Staging Manager) of implementing a Temporary Traffic Control Plan for the duration of the incident.

• Where practical, utilize law enforcement chase vehicles to stop and cite vehicle operators who behave hazardously within the TTCZ.

Warning Approaching Traffic
Secondary collisions between oncoming traffic approaching a blocking highway incident and the queued vehicles stopped or slowed due to the incident is an all to common occurrence, and one where courts have found that the Incident Commander’s agency may be liable. Stabilizing and containing the overall traffic situation should be regarded as an integral part of stabilizing and containing the incident itself. Indeed, traffic managers would view the extended traffic effects as part of the incident.

The MUTCD covers the design and use of traffic warning devices, including their placement and spacing upstream of work zones. The warning distances are dependent upon approaching traffic speed, and their placement is well established and supported by both field experience
and scientific research. The guidance does presume a static traffic flow situation and fixes their distances from the work zone. This is not applicable to highway incidents, since traffic responds differently to them than to construction work zones. Incidental congestion is characterized by rapidly growing and slowly shrinking queues of blocked vehicles. Table E.1, adapted from the MUTCD, shows the recommended placement of three warning signs for highway incidents under various traffic situations. For freeway traffic flows, even without any traffic backup at the scene of the incident, the Advance Warning Zone can extend a full mile upstream of the incident!
At some point, progressing further and further upstream into the regional highway transportation system, responsibility should pass (in a coordinated manner, of course) from the Incident Commander to regional resources better equipped to deal with the problem. Detour management, for example, would usually fall under a Traffic Management Center, as would signal system adjustments and other means of regulating traffic flow over a broad area. The determination of both the separation and the interaction between incident and regional traffic control is one of the tasks of the Liaison Officer.

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Distance Between Signs (feet)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Rear of queue &amp; Last warning sign</td>
</tr>
<tr>
<td>Urban (low speed)</td>
<td>100</td>
</tr>
<tr>
<td>Urban (high speed)</td>
<td>350</td>
</tr>
<tr>
<td>Rural</td>
<td>500</td>
</tr>
<tr>
<td>Expressway/Freeway</td>
<td>1,000</td>
</tr>
</tbody>
</table>

Table E.1

Taper and Merge Layout

The following guidelines were adapted from the MUTCD and information contained in Table E.2 concerning the length of tapers set up for traffic control around highway incident activities that are blocking traffic. Note that the original table was based upon highway work zone criteria, which sought to maximize traffic flow around a relatively long duration blockage. This is much different than the environment around a shorter duration highway incident, where the safety of responders, patients, and other personnel in and around the scene assumes paramount importance, followed by considerations for the safety of passing motorists with traffic flow and motorist convenience ranked far down the list of priorities being considered by the Incident Commander.

These factors have led the authors of this Guide to adapt the original table into the following form, with traffic passing speeds lowered to the 25-35 mph range. Note that traffic passing speed greatly affects the

<table>
<thead>
<tr>
<th>MUTCD Table 6C-2</th>
<th>Length of Taper (feet)</th>
</tr>
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<tr>
<td>Taper Length Criteria</td>
<td></td>
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<tr>
<td>for Temporary Traffic Control Zones</td>
<td></td>
</tr>
<tr>
<td>Speed of Approaching Traffic</td>
<td>25 mph</td>
</tr>
<tr>
<td>Merging (per lane)</td>
<td>125</td>
</tr>
<tr>
<td>Shifting (per lane)</td>
<td>63</td>
</tr>
<tr>
<td>Shoulder</td>
<td>42</td>
</tr>
<tr>
<td>One-Lane, Two Way (max)</td>
<td>100</td>
</tr>
<tr>
<td>Downstream (per lane)</td>
<td>100</td>
</tr>
</tbody>
</table>

Table E.2
required traffic control taper lengths, since only a 10 mph increase in approaching traffic speed roughly doubles their recommended length.

In addition, the MUTCD specifies that the spacing between individual channelizing devices should be no more than the distance in feet equal to the speed limit in mph. The authors of this Guide recommend spacing flares, cones, or other channelizing devices much closer together. A spacing of approximately a car length between devices provides clear directional guidance to passing motorists. However, where emergency vehicles must cross the channelizing barrier, spacing should be double the width of the largest apparatus. Avoid forcing vehicles to drive over lighted flares.

In a typical highway incident situation on a four-lane highway, where the Incident Commander has directed that passing traffic through
the TTCZ be limited to 25 mph and where traffic is queued (slowing or stopping vehicles prior to entering the TTCZ) on either approach, the TTCZ might be set up as shown Figure E.4. As a guide, with the objective of protecting against the highest hazards first, the TCS should accomplish the following tasks in the specified order.

Stop traffic only as necessary to ensure the safety of responders and vehicle occupants while constructing a Temporary Traffic Control Zone (TTCZ) around the incident scene.

Traffic must not be released past the scene after it has been halted for any reason without the direct approval of the TCS, who should request further permission from the Operations Section Chief and the Safety Officer. A general announcement of the pending traffic release should be broadcast to all responders prior to its actual release.

1. **Set up the TTCZ.** The Activity Area is the highest priority, followed by the Advance Warning Area, then the Transition Area, and finally the Termination Zone. This is a high-risk activity, with responders, motorists, and pedestrians exposed to the serious hazards of an unstable traffic situation. Stop traffic as necessary to prevent further incidents.

2. **Determine the need for expanding the TTCZ** to the opposite travel lanes or other nearby highways by repeating Steps 1 and 2. Rubbernecking may cause additional traffic congestion in lanes that are not directly affected by on-scene activities but that are still needed for responders’ ingress to the scene or egress from the scene.

3. **Adjust and modify the TTCZ** as the work space needs of the incident dictate, as determined by the Operations Section. Protect both road users in the TTCZ and responders working in the Activity Area by maintaining a safe separation between moving traffic and response activities. Be alert for unexpected intrusions of response activities into traffic and for passing vehicles that unexpectedly intrude into the Activity Area.

4. **Remove the TTCZ** when no longer needed. Dismantle the Termination Area, then the Activity Area, then the Transition Area, then the Advance Warning Area. Maintain the Advance Warning Area as long as the traffic queue remains, which could be four to six times as long as the duration of the original traffic blockage.

### Clearance of Stranded Vehicles

One of the most difficult traffic control challenges at a highway incident is clearing the immediate scene of uninvolved vehicles to allow responders to deal with the emergent aspects of the incident. These vehicles are often trapped by the blocking incident ahead of them and the backed-up traffic behind them. The task is complicated by several factors, including the fact that responding emergency vehicles are ar-
Riving at the scene at the same time as the clearance is needed. Since the scene is either uncontrolled or in the early stages of the formation of the IMS organization, motorists are often faced with a bewildering and confusing onslaught of loud sounds, bright lights, and distraught passengers. If responders are not careful, these drivers can be given conflicting direction. The result is too often chaotic and dangerous maneuvering of civilian and emergency vehicles, resulting in secondary crashes and further deterioration of the situation.

The previous two illustrations show ways that may be used by the TCS to better organize the simultaneous clearance of trapped uninvolved vehicles and arrival of emergency response vehicles. Figure E.5 is meant to illustrate a two-way highway, and Figure E.6 a one-way traffic situation (such as one side of a freeway). They are intended to highlight the following principles:

- Direct emergency response vehicles onto emergency ingress and egress routes that are separate from normal or clearing traffic.
- Avoid establishing emergency vehicle routes that run against normal traffic (counterflow).
- Provide at least two lanes’ width for U-turning motorists.
Traffic control in these early stages can demand considerable manpower. The TCS should be alert to the possible need to evacuate vehicle occupants as hazard conditions change. Evacuees will require evacuation transportation, temporary shelter during the incident, and transport back to their vehicles, which can require considerable resources to accomplish. If immovable vehicle occupants are to be sheltered in place, additional resources will be needed to monitor and protect them. These can present considerable obstacles to the beginning emergent operations and should be quickly reported to the Incident Commander.

If vehicles cannot maneuver to clear the scene, they may have to be temporarily abandoned in place. If vehicles are abandoned, their drivers should leave them unlocked with keys in the ignition, which imposes an obligation on the Incident Commander to ensure their security, possibly necessitating additional law enforcement resources. If these abandoned vehicles must be removed, especially under hazardous conditions, other qualified drivers must be used. If these vehicles cannot be removed under their own power, an additional towing and recovery operation must be launched.

In situations where volunteer or other individual responders make their way directly to the scene, abandon their vehicles, and then report on foot to the ICP or work area, they should not worsen the traffic control problem around the incident. The best procedure is for volunteers to park their vehicles in the staging area. The Staging Manager may need to move them and should be given custody of the vehicle keys. A less desirable procedure would be for individual responders to park their vehicles out of traffic, downstream of the incident. Anything that results in abandoned and locked responders’ vehicles blocking incident operations or traffic flow past the incident should be avoided. If they need to be moved later, they may need to be towed.

**Highway Incident Complications**

**Secondary Incidents**

Should a secondary crash occur, it could become an incident in its own right and should be dealt with according to its seriousness. These are “secondary” only because they are related in some way to the primary incident. They may be located far from the primary, and the Incident Commander of the primary incident may be completely unaware of their occurrence. They may take on any character, emergency (crashes with injury, fires, spills) or nonemergency (traffic congestion, mechanical breakdown). They all require attention and may be more serious than the primary incident. For extreme situations, the activation of an Emergency Operations Center or heightened involvement of a Traffic Management Center may be necessary.

The Incident Commander already has control of the nearest response resources; however, they are most likely already fully engaged in the primary incident. They are the best available to respond to the secondary incident, at least to perform the initial size-up.
There can be no presumption of the relative importance of the primary and secondary incidents, and there can be no preemption of the Incident Commander’s judgment of how best to initially handle the new incident.

The Incident Commander of a highway incident where a secondary crash has occurred should: (1) handle the secondary crash as part of the original incident by assigning additional Divisions, Groups, or Branch; or (2) request a separate dispatch assignment for a completely new incident.

**Frustrations**

The delay caused by highway incidents can place motorists under a great deal of stress, and some may strongly disagree with the manner in which traffic controllers impede their freedom of movement. Some may challenge or circumvent traffic direction in unexpected and dangerous ways. Commercial carriers faced with late delivery penalties, motorists late for important appointments, and frustrated commuters may consider their needs to be paramount and have little regard for other considerations. Confrontations can quickly spiral out of control and turn violent. Law enforcement may be the only response resource equipped to deal with violence, but all responders should practice civility and patience when dealing with the frustrated motorist.

**Exposure**

Risks to motorists must also be reduced from both the causes and the consequences of the highway incident (including vehicular traffic, weather, road conditions, fire, hazardous materials spill, etc). For example, weather factors, such as snowstorms, fog, or heavy rain, that are commonly associated with highway incidents can rapidly exacerbate a benign traffic queue behind a simple motor vehicle accident into a mass-casualty incident. Secondary crashes caused by these factors are all too common at highway incidents. This sort of situation can escalate into a major evacuation and shelter operation that far exceeds the parameters of the original incident(s).

**Pedestrians**

Occupants of vehicles that are stopped for extended periods at highway incidents are prone to engage in unusual and dangerous actions outside of their vehicles. Personnel responsible for traffic control should be alert for occupants leaving their vehicles at unexpected times. They may be retrieving items from the trunks of their vehicles, relieving themselves, or simply stretching their legs. Curiosity can draw them to the scene for a closer look, abandoning their vehicles. Crowd control can quickly turn into a major problem as the broadcast media publicize the incident, and a significant law enforcement effort may be required to maintain scene security. Sightseeing traffic (or fleeing motorists) can also transform a minor congestion problem into regional gridlock, which would call for extraordinary regional traffic management measures.
Inattention
Motorists may become inattentive to traffic control measures after extended waits in traffic queues at highway incidents. Truck drivers may take advantage of being stopped and nap in their sleeper cabs. Other motorists may simply fall asleep at the wheel, daydream, or become immersed in cellular phone conversations. Unresponsiveness may even be the result of carbon monoxide poisoning caused by exhaust leakage from idling engines into the passenger compartment. Traffic flow can therefore be difficult to smoothly restart after protracted stoppages.

End Notes
1. MUTCD, Sect. 6F.01, p 6F-1.
2. MUTCD, Section 6C, Figure 6C-1, p 6C-4.
3. Engines generally have the longest reach, since they can lay hoses to the scene. Heavy rescue apparatus have a medium reach, due to their need to connect tools to electrical, pneumatic, and hydraulic power units on the vehicle.
4. MUTCD, Sect. 6C.08.