

Temporary Traffic Control Guidance for Safety Service Patrol Response to Minor Incidents

Final Report

Prepared by: Parr, Scott A.

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This report examines temporary traffic control practices used by Safety Service Patrol programs during minor incidents and short-duration service calls. The findings synthesize current agency practices, transferable case study examples, and MUTCD-related considerations to support practical, scalable, and decision-based SSP temporary traffic control guidance.

TTC Guidance for SSP Response to Minor Incidents

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The Eastern Transportation Coalition is a partnership of 20 states and the District of Columbia focused on connecting public agencies across modes of travel to increase safety and efficiency. Additional information on the Coalition, including other project reports, can be found on the Coalition's website: www.tetcoalition.org

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Executive Summary

Safety Service Patrols play an important role in traffic incident management by assisting motorists, supporting responders, removing minor incidents and obstructions, and helping reduce the likelihood of secondary crashes. Because SSP operators often arrive early at incident scenes and may be working alone with only the equipment carried on a service vehicle, they must make rapid decisions about temporary traffic control under constrained field conditions.

Temporary traffic control for SSP response differs from planned work zone traffic control in several important ways. SSP incidents are typically unplanned, dynamic, and short in duration. Operators may have limited time, limited equipment, limited shoulder space, and limited support. In some cases, the time required to deploy traffic control devices may exceed the time needed to clear the incident. In other cases, the act of deploying devices may expose the operator to greater risk than the incident itself. These conditions make it important for SSP-specific guidance to be practical, scalable, and decision-based.

The project was completed through three related tasks. Task 1 synthesized current SSP temporary traffic control devices, technologies, deployment practices, written guidance, and cone deployment procedures across participating member agencies. Task 2 developed case studies of selected agency practices related to cone deployment warrants and procedures, advanced temporary traffic control technologies and operational strategies, and SSP operator training. Task 3 reviewed commonly reported SSP temporary traffic control devices, techniques, strategies, and operational approaches in relation to the Manual on Uniform Traffic Control Devices. Together, these tasks provide a foundation for developing practical SSP-specific temporary traffic control guidance for minor incidents and short-duration service calls.

Current Practice Findings

The Task 1 synthesis showed that SSP programs rely on a common set of traffic control tools, but the policies and procedures governing their use vary considerably across agencies. The survey produced 18 individual responses representing approximately 15 unique responding states or agencies. Cones were the only temporary traffic control device reported as available in all responses and were also the most commonly reported device used during minor incidents and service calls. Truck-mounted changeable message signs or message boards, flashing arrow panels, warning lights, flares, digital flares or beacons, and other supplemental devices were also reported, although their use varied by agency and incident type.

The findings show that SSP temporary traffic control decisions are primarily field driven. Operators are often the first to assess whether traffic control is needed and whether devices can be deployed safely. These decisions are influenced by lane blockage, traffic speed and volume, roadway geometry, shoulder width, sight distance, weather, lighting, expected incident duration, queue formation, responder or motorist exposure, and the availability of law enforcement, traffic management center, supervisor, or incident command support.

The written document review found that some agencies have SSP-specific manuals, standard operating procedures, or field training guides that provide practical direction for minor incident response. Other agencies rely on general temporary traffic control, maintenance of traffic, work zone, traffic incident management, training, contract, or procurement documents. These materials provide useful traffic control principles, device standards, and training expectations, but they often require interpretation before they can be applied to one-person SSP operations during short-duration incidents.

Cone deployment emerged as one of the most important and challenging SSP practices. Cones can improve visibility, define a work area, provide channelization, and help motorists understand

how to move around an incident scene. However, cone deployment often requires the operator to exit the vehicle and work near live traffic. As a result, cone guidance must account for both the safety benefits of deployment and the exposure created by placing and retrieving cones.

Transferable Case Study Findings

The Task 2 case studies examined selected agency practices in greater operational detail. Four agencies participated in the case study process: CTDOT/CHAMP, GDOT/HERO, NCDOT/IMAP, and TDOT/HELP. The case studies were organized by topic rather than by agency to emphasize transferable practices that may be useful to other SSP programs.

For cone deployment, the case studies support a warrant-based framework. Cone deployment should be considered when an incident blocks or encroaches into a travel lane, when the expected scene duration is long enough for cones to provide a meaningful benefit, when responders or motorists will be on foot near traffic, when sight distance or visibility is limited, or when the work area needs to be defined or expanded. However, meeting a cone deployment warrant should not automatically require deployment. Operators must also determine whether cones can be placed and retrieved safely under the specific field conditions.

The case studies also showed that cone deployment should be treated as a safety-critical procedure, not simply as a layout. Operators need practical procedures for scene size-up, vehicle positioning, warning-device activation, communication with the traffic management center or operations center, personal protective equipment use, cone placement, traffic monitoring, and controlled retrieval. Cone storage and accessibility also affect field performance. Cones that are difficult to reach or require the operator to climb into the vehicle or turn away from traffic may reduce both safety and consistency.

For advanced temporary traffic control technologies and operational strategies, the case studies showed that the SSP vehicle itself is often the initial traffic control platform. Vehicle positioning, emergency lighting, message boards, arrow boards, cameras, communications systems, and onboard equipment provide the first layer of warning and support before other devices are deployed. Supplemental tools such as digital flares, Pi-Lit/PILITS-type sequential lighting, responder lighting, vehicle smart lighting, cameras, automated vehicle location, advanced traffic management system access, drones, responder-to-vehicle alerts, and navigation-app integration can improve visibility and situational awareness when they solve a clearly defined operational problem.

The case studies also reinforced that quick clearance should be treated as an operational traffic control strategy. In many minor incidents, the safest way to reduce exposure is to remove the hazard, relocate the vehicle, or clear the lane before a larger traffic control setup becomes necessary. Quick clearance, push/pull/drag practices, debris removal, and coordination with law enforcement can reduce scene duration, limit queue growth, and reduce the need for broader traffic control escalation when supported by appropriate authority, training, and procedures.

For operator training, the case studies showed that written guidance alone is not sufficient. Effective SSP temporary traffic control requires staged onboarding, supervised field exposure, equipment familiarization, scenario-based learning, ride-alongs, refresher training, and supervisor or trainer sign-off before independent patrol. The strongest training approaches use demonstrated competency rather than time alone as the basis for release. Operators should be able to assess scene conditions, position the vehicle safely, communicate with the traffic management center or dispatch center, use warning and messaging devices, deploy and retrieve cones when appropriate, recognize when deployment is unsafe, support quick clearance, coordinate with other responders, and make sound decisions under changing field conditions.

MUTCD Consistency Findings

The Task 3 review found that many commonly reported SSP temporary traffic control practices are generally consistent with the MUTCD when applied appropriately. The MUTCD recognizes that traffic incidents are variable, that minor incidents are often short in duration, that full lane-closure temporary traffic control is not always practical, and that responders may use the devices available during the initial response when those devices do not create unnecessary additional hazards. This framework supports many SSP practices, including vehicle positioning, cones, vehicle-mounted message boards, portable changeable message signs, emergency lighting, flares, quick clearance, upstream warning, and traffic management center support.

The primary MUTCD concerns identified in the review are associated with specific applications where the device function, display mode, or operational context may be unclear. The most significant issue involves arrow-board displays for shoulder incidents. Current MUTCD language connects directional arrow and chevron displays to lane closures and identifies caution mode for shoulder-related conditions. However, SSP shoulder incidents may involve exposed responders, disabled vehicles, or motorists in situations where agencies may want a more direct driver-action message. This creates a practical need for clarification on how arrow-board displays should be used for shoulder-based traffic incident management areas when no travel lane is closed.

The review also found that SSP minor-incident response would benefit from more explicit MUTCD guidance. Existing MUTCD principles support flexible initial response, use of devices on hand, and quick clearance, but the guidance is not written specifically around the conditions faced by SSP operators. Additional clarification could help agencies apply MUTCD principles to one-operator deployment, short-duration service calls, scalable cone patterns, vehicle-mounted messaging, upstream warning, and escalation to additional support.

Other clarification topics include incident-related speed management and nontraditional vehicle-mounted equipment. Variable speed limits and speed-management displays can support incident response, but their use depends on agency authority, message coordination, and whether the display is regulatory or advisory. Nontraditional vehicle-mounted equipment, such as inflatable side arms, may support responder safety but should be evaluated based on whether the device functions only as vehicle equipment or whether it warns, guides, channelizes, blocks, or directs road users in a way that makes it a traffic control device or application.

Overall Findings and Guidance Implications

The combined findings support development of SSP-specific temporary traffic control guidance that is scalable, practical, and decision-based. Guidance should recognize that SSP operators often work alone, respond to short-duration incidents, and operate with limited equipment under high-speed and space-constrained conditions. It should provide clear decision criteria while preserving the field judgment needed to adapt to changing roadway, traffic, and incident conditions.

Practical SSP-specific guidance should help operators determine whether an incident can be cleared quickly, whether a travel lane is blocked or encroached upon, whether responders or motorists will be on foot, whether sight distance or visibility is limited, whether queues are forming, and whether additional support is needed. It should also help agencies define when cones should be considered, when cones may add more exposure than benefit, when vehicle-mounted warning is sufficient, when upstream warning or queue protection is needed, and when quick clearance is the safest strategy.

The findings also show that implementation requires more than written guidance. Agencies should consider equipment storage, cone accessibility, vehicle design, message libraries, technology

maintenance, training, refresher instruction, field evaluation, supervisor oversight, and coordination with traffic management centers and other responders. SSP-specific guidance will be most effective when it is tied to field training, demonstrated competency, and practical procedures that operators can apply during real incidents.

The project provides a foundation for guidance that can improve consistency without ignoring the realities of SSP operations. Effective SSP temporary traffic control depends on more than the availability of devices. It requires sound field judgment, clear procedures, practical training, appropriate vehicle equipment, effective communication, quick clearance, upstream warning, and coordination with partner agencies. By organizing guidance around these principles, agencies can better support SSP operators as they manage minor incidents and short-duration service calls under demanding roadway conditions.

1. Introduction

Safety Service Patrols (SSPs) play an important role in traffic incident management by assisting motorists, supporting responders, removing minor incidents and obstructions, and helping reduce the likelihood of secondary crashes. SSP operators are often among the first personnel to arrive at minor incident scenes and are frequently required to make rapid decisions about temporary traffic control (TTC) under constrained field conditions. These conditions may include high-speed traffic, limited shoulder width, limited vehicle storage capacity, short incident duration, and one-person deployment.

Temporary traffic control for SSP operations differs from planned work zone traffic control in several important ways. SSP responses are usually unplanned, dynamic, and short in duration. Operators may be working alone, with only the equipment carried on a patrol vehicle, and may need to decide quickly whether to deploy cones, use vehicle-mounted warning devices, request additional support, provide upstream warning, or clear the incident before a larger TTC setup can be established. In many cases, the safest and most practical response may involve a combination of vehicle positioning, warning lights, message boards, cones, quick clearance, traffic management center coordination, and field judgment.

The Eastern Transportation Coalition initiated this project to better understand how member agencies currently approach TTC for SSP response to minor incidents and short-duration service calls. The project focused on current practices, transferable agency approaches, and the relationship between commonly used SSP TTC practices and the Manual on Uniform Traffic Control Devices (MUTCD). The overall goal was to support the development of practical, scalable, and SSP-specific TTC guidance that reflects real-world operating conditions while remaining consistent with broader traffic control principles.

1.1. Project Purpose

The purpose of this project was to examine how SSP programs deploy temporary traffic control during minor incidents and service calls, identify common practices and differences across agencies, and develop a foundation for practical guidance that can support safer and more consistent SSP operations. The project was focused particularly on minor incidents, shoulder stops, lane-blocking events, debris events, disabled vehicles, and short-duration responses where full work-zone-style TTC is often impractical or not possible before the incident is cleared.

The project was designed to address several recurring questions faced by SSP programs. These include what TTC devices and technologies are available on SSP vehicles, which devices are most commonly used, how agencies decide when to deploy or increase TTC, how cones are used during minor incidents, how operators are trained to make field decisions, and where additional MUTCD clarification may be useful for SSP-specific applications. The project also considered how emerging tools, vehicle-mounted technologies, upstream warning, quick clearance, and traffic management center support can be integrated into a practical TTC strategy for SSP operations.

1.2. Project Objectives

The project was organized around three primary objectives.

First, the project documented current SSP TTC practices across participating member agencies. This included identifying the TTC devices and technologies available on SSP vehicles, determining which devices are commonly deployed during minor incidents and service calls,

summarizing TTC decision-making practices, reviewing cone deployment policies and procedures, and identifying written standards, training materials, manuals, and other guidance used by agencies.

Second, the project examined selected agency practices in greater operational detail through case studies. These case studies focused on three topic areas that emerged from the initial synthesis: cone deployment warrants and procedures, advanced TTC technologies and operational strategies, and SSP operator training for incident-scene traffic control. The case studies were organized by topic rather than by agency so that the findings could emphasize transferable practices that may be useful to other SSP programs.

Third, the project reviewed commonly reported SSP TTC devices, techniques, strategies, and operational approaches in relation to the MUTCD. This review was conducted as a screening-level consistency review rather than as a legal opinion or formal compliance determination. The intent was to identify practices that appear generally consistent with the MUTCD when applied appropriately, as well as applications that may warrant additional attention, risk mitigation, agency review, or future MUTCD clarification.

1.3. Scope and Limitations

This report focuses on SSP response to minor incidents and short-duration service calls. The report is not intended to address all traffic incident management activities, all work zone TTC applications, or all major incident response scenarios. The primary focus is on the types of incidents commonly encountered by SSP operators.

The findings are based on agency survey responses, interviews, case study discussions, and supporting materials provided during the project. Because the level of detail varied across agencies and documents, the findings should be interpreted as a synthesis of reported and documented practices rather than as a statistical evaluation of safety performance. The case studies are qualitative practice examples and are intended to identify transferable approaches, not to rank agencies or establish a single preferred operating model.

The MUTCD consistency review presented in this report is a screening-level review. It is not a legal opinion, formal compliance determination, or certification of any individual state or agency practice. Agencies remain responsible for interpreting and applying the MUTCD, state requirements, agency policies, engineering judgment, and applicable laws within their own operating environments.

1.4. Report Organization

This report is organized into five chapters and supporting appendices.

Chapter 1 introduces the project background, purpose, objectives, approach, scope, and organization.

Chapter 2 presents the Task 1 synthesis of current SSP TTC devices, technologies, deployment warrants, procedures, written guidance, and cone deployment practices. It summarizes the survey findings, document review, and cross-cutting implications for SSP-specific TTC guidance.

Chapter 3 presents the Task 2 case studies of transferable practices. The chapter is organized around cone deployment warrants and procedures, advanced TTC technologies and operational strategies, and SSP operator training for incident-scene traffic control.

Chapter 4 presents the Task 3 MUTCD consistency review of common SSP TTC practices. The chapter reviews devices, strategies, and operational approaches in relation to MUTCD provisions and identifies potential clarification concepts for SSP minor-incident response.

Chapter 5 presents final findings and guidance implications from the overall project. It synthesizes the results of the three tasks and identifies practical considerations for developing scalable, decision-based SSP TTC guidance.

The appendices provide the survey materials, survey results, case study questionnaires, and supporting materials reviewed during the project.

2. Synthesis of Temporary Traffic Control Devices, Technology, and Deployment

This chapter presents the Task 1 synthesis of current TTC devices, technologies, deployment warrants, and procedures used by SSP programs. The task included developing and distributing a survey to member agencies, collecting information on current practices, and summarizing trends across responses. The specific objectives of Task 1 were to:

- Identify which TTC devices and technologies are available on SSP vehicles.
- Determine which TTC devices are most commonly used during minor incidents and service calls.
- Document how agencies decide when to deploy TTC and when to increase TTC deployment.
- Summarize cone deployment policies, cone quantities, decision-making procedures, and implementation challenges.
- Identify written standards, procedures, or training materials that agencies use to guide TTC deployment.
- Identify emerging TTC technologies and practices that informed the case study analysis, MUTCD consistency review, and guidance development presented later in this report.
- Establish a basis for selecting agencies and topics for the case study analysis presented in Chapter 3.

The remainder of this chapter is organized to move from data collection methods to findings, synthesis, and implications for later guidance development. Section 2.1 describes the survey development, administration, document review, and analysis approach used to collect and synthesize information from participating agencies. Section 2.2 summarizes the survey results, including SSP program characteristics, TTC devices available and commonly deployed, TTC decision-making, advanced technologies, deployment time, and agency-identified needs related to guidance and MUTCD Chapter 6O. Section 2.3 reviews the written standards, manuals, SOPs, training materials, contract documents, and related guidance provided by agencies to determine how directly those materials support SSP TTC deployment during minor incidents. Section 2.4 provides a focused synthesis of cone deployment practices, including deployment triggers, cone quantities, decision-making, procedures, and operational challenges. Section 2.5 synthesizes cross-cutting findings and explains how the Task 1 results establish a foundation for the case study analysis, MUTCD consistency review, and development of practical SSP-specific TTC guidance presented later in this report.

2.1. Task 1 Survey, Document Review, and Analysis Approach

This section describes the methods used to collect, review, and synthesize information for the Task 1 synthesis. The methodology included two primary activities: a survey of member agencies to document current SSP temporary traffic control practices, and a review of written standards, manuals, training materials, contracts, and related guidance provided by agencies. Together, these activities were used to identify current TTC devices and technologies, deployment decision-making practices, cone deployment procedures, written guidance, and gaps that inform the development of SSP-specific TTC guidance.

2.1.1. Survey Development and Administration

A survey questionnaire was developed to collect information from member agencies regarding TTC practices used by SSPs during incidents and service calls. The survey was designed to capture both quantitative response categories and open-ended descriptions of agency practice. This structure allowed the research team to summarize common practices while also preserving agency-specific details about decision-making, operating constraints, technologies, and procedural differences.

The survey asked respondents to provide information on SSP program structure, roadway coverage, operating schedules, TTC terminology, written standards, available TTC devices, commonly deployed devices, TTC decision-making, cone deployment policies, advanced TTC technologies, deployment times, cost-benefit analyses, MUTCD-related needs, and interest in follow-up interviews. The survey form is provided in Appendix A.

The survey was distributed to member agencies for completion by personnel familiar with SSP operations, TTC deployment, training, or traffic incident management practices. Responses were reviewed and summarized at the response level. Where duplicate responses were submitted from the same state or agency, the duplicate responses were retained in the response-level summaries because they may reflect different program perspectives, districts, operating areas, or personnel roles. Agency-level interpretations should therefore consider that 18 individual responses represent approximately 15 unique responding states/agencies.

2.1.2. Survey Questionnaire Rationale

The survey was structured to collect information in six primary areas: SSP program characteristics; available and commonly deployed TTC devices; TTC decision-making and deployment triggers; cone deployment policies and procedures; advanced TTC technologies; and agency needs related to guidance, training, and MUTCD Chapter 6O. These topic areas were selected to support the Task 1 objective of synthesizing current TTC devices, technologies, deployment warrants, and field procedures used by SSP programs during minor incidents and service calls. A detailed mapping of survey questions to Task 1 objectives is provided in Appendix A.

2.1.3. Document Review Approach

In addition to the survey, written standards and guidance materials provided by agencies were reviewed to determine how directly they support SSP TTC deployment during minor incidents. The reviewed materials included SSP operations manuals, standard operating procedures, field training guides, general TTC or work zone manuals, TIM guidance, training and certification documents, contract or procurement documents, and technology-focused materials.

Because the documents varied widely in purpose and level of detail, the review focused only on information relevant to SSP field deployment. Each document was reviewed for its applicability to minor incidents, shoulder stops, lane-blocking incidents, disabled vehicles, debris events, short-duration responses, cone deployment, vehicle positioning, warning devices, escalation procedures, training requirements, MUTCD or state TTC references, and practical constraints such as one-person deployment, limited vehicle storage, short clearance times, and operator exposure.

The document review was used to supplement the survey findings and identify whether written guidance provides practical direction to SSP operators about when TTC should be deployed, which devices should be used, how cones or other devices should be placed, and when additional support should be requested.

2.1.4. Survey and Document Review Analysis

Survey responses were reviewed using descriptive statistics and qualitative synthesis. Multiple-choice and select-all-that-apply questions were summarized using response counts. Open-ended responses were reviewed thematically to identify recurring practices, concerns, decision factors, deployment triggers, and implementation challenges. Because several questions allowed multiple selections, totals may exceed the number of responses.

The analysis retains response-level results unless otherwise noted. This is appropriate for Task 1 because different responses from the same state may reflect different program areas, districts, or interpretations of agency practice. However, duplicate state responses should be considered when interpreting response percentages or comparing state-by-state practices.

The written document review was analyzed qualitatively by grouping materials according to their applicability to SSP operations. Documents were categorized as directly applicable, partially applicable, general background only, or not identified, depending on whether they provided SSP-specific or incident-response-specific guidance. Findings from the survey and document review were then synthesized to identify cross-cutting themes, gaps, and practical considerations for developing SSP-specific TTC guidance.

2.2. Survey Findings: Current SSP TTC Practices

This section summarizes the survey findings related to current SSP temporary traffic control practices. The results are organized around major themes rather than the order of the survey questions, including responding agency context, TTC devices available and commonly deployed, deployment decision-making, advanced technologies, and agency needs related to future guidance. A detailed response-level summary matrix of survey findings is provided in Appendix B.

2.2.1. Response Rate and Responding Agencies

The survey produced 18 individual responses representing approximately 15 unique responding states/agencies. Duplicate responses were received from Maryland, Pennsylvania, and Virginia. The survey was distributed to the 20 states and the District of Columbia that comprise The Eastern Transportation Coalition membership; therefore, the responses represent approximately 71.4 percent jurisdictional coverage at the unique state/agency level.

The responding agencies or jurisdictions included Alabama DOT, Connecticut DOT, Delaware Department of Transportation, Florida DOT, Georgia Department of Transportation, Maine DOT, Maryland DOT, North Carolina DOT, New Hampshire, New Jersey DOT, New York DOT, Pennsylvania DOT, South Carolina, Tennessee Department of Transportation, and Virginia DOT. Because some states submitted more than one response, results are summarized at the response level unless otherwise noted.

The responses reflect a diverse range of SSP program structures and operating environments. Most programs represented in the survey are operated through or overseen by state DOTs, although staffing models vary. Eleven responses included state DOT in-house employees, seven included state DOT contract employees, and two referenced private contractor operation. Several responses also described mixed or special arrangements, such as regional differences, toll road operations, or city-specific deployments.

Respondents reported that SSPs operate on a variety of roadway types. Twelve responses reported service on urban freeways, nine reported service on rural highways, and seven reported service on toll roads. Several agencies also referenced limited-access highways, controlled-access facilities, interstates, U.S. routes, arterials, special event locations, and construction-

related deployments. Service schedules also varied, with some agencies providing 24/7 coverage in all or selected areas, while others reported weekday, peak-period, extended weekday, weekend, or region-specific service.

The most common terminology used for traffic control at incidents was “Temporary Traffic Control.” Thirteen responses selected or used Temporary Traffic Control (TTC), while other responses used terms such as Emergency Traffic Control, Incident Traffic Control, or broader safety-related terminology. This suggests that TTC is the dominant term across responding agencies, but terminology is not fully standardized.

2.2.2. TTC Devices Available and Commonly Deployed

The survey results show that SSP programs rely on a combination of physical channelization, vehicle-mounted warning systems, and emerging digital or connected technologies. Cones were the only TTC device reported as available in all 18 responses and were also the most commonly reported device for minor incidents and service calls. Truck-mounted CMS/message boards, flashing arrow panels, warning lights, and flares were also commonly available, but their routine deployment varied by agency and incident type.

Table 2-1 summarizes the TTC devices and practices reported as available on SSP vehicles and those most commonly deployed during minor incidents and service calls. The table distinguishes between equipment availability and routine field use, showing that some devices are widely carried but deployed more selectively depending on incident conditions, lane impacts, duration, and operator exposure.

Table 2-1: TTC Devices Available on SSP Vehicles and Commonly Deployed for Minor Incidents

TTC Device / Practice	Available on SSP Vehicles	Commonly Deployed for Minor Incidents	Interpretation
Cones	18	18	Cones are the universal SSP TTC device and the most consistently used device for minor incidents and service calls.
Truck-mounted CMS	15	13	Truck-mounted messaging is widely available and commonly used to provide approaching drivers with warning or lane-use information.
Flashing arrow panels	11	6	Arrow panels are commonly available but appear to be used more selectively, especially where lane blockage or lane guidance is needed.
Flares	11	2	Flares are available in many programs but were less commonly reported as routinely deployed for minor incidents.
Additional LED warning lights	8	3	Supplemental lighting is used by some agencies to improve vehicle and scene visibility, but it is not as commonly reported as cones or truck-mounted CMS.
Digital flares / beacons	6 digital flares; 2 electronic beacons	Mentioned in open-ended responses	Digital flares and beacons are emerging tools, but their use appears less uniform across agencies.
Portable VMS / portable signs	Mentioned in open-ended responses	1	Portable signing and VMS may be useful for longer or more complex incidents but are not commonly reported for routine minor service calls.
Vehicle positioning / shielding with no additional TTC	Not applicable as carried equipment	Mentioned in open-ended responses	For very short stops or situations where the operator remains in the vehicle, some agencies rely primarily on vehicle positioning, warning lights, and quick clearance rather than deploying additional TTC devices.
Other devices or equipment	Several responses	Varies	Other reported equipment included emergency scene ahead signs, synchronized lights, green/amber lighting, Pi-Lit-type devices, truck-mounted attenuators, and other vehicle-mounted tools.

The combined results show that cones, truck-mounted CMS/message boards, arrow panels, and vehicle warning systems form the core TTC toolkit for SSP minor incident response. However, the results also show that device availability and device deployment are not the same. Several agencies carry multiple devices but deploy them selectively depending on incident duration, lane impact, traffic conditions, operator exposure, and available support.

2.2.3. TTC Deployment Decision-Making and Warrants

TTC deployment decisions are primarily field driven. Sixteen responses identified the SSP operator as a decision-maker for TTC deployment. Eight responses identified pre-established agency policy or protocol, three referenced the incident commander, and two referenced the Traffic Management Center. Some responses noted that TTC is deployed every time service is rendered, while others indicated that deployment depends on incident conditions.

The results indicate that the SSP operator is typically the first person assessing whether TTC is needed. However, deployment decisions may also be influenced by agency protocols, TMC staff, supervisors, law enforcement, incident command, or unified command. This shared decision-making structure becomes more important as incidents increase in duration, complexity, lane impact, or responder exposure.

Respondents identified several common factors that justify deploying or increasing TTC:

- Traffic volume and operating speed.
- Time of day, lighting conditions, and weather.
- Type, size, and severity of the incident.
- Whether a travel lane is blocked.
- Number of lanes blocked.
- Expected incident duration.
- Roadway geometry and available sight distance.
- Queue formation or driver behavior observed in the field or by CCTV.
- Availability of additional personnel, SSP units, law enforcement, or incident command resources.

These findings suggest that agencies generally scale TTC based on exposure, complexity, and expected duration. Minor shoulder stops may require only vehicle positioning and warning lights, while lane-blocking or longer-duration incidents may require cones, arrow boards, truck-mounted CMS, additional units, or law enforcement support.

The survey also showed that most TTC deployments for minor incidents occur quickly. Seventeen responses addressed TTC deployment time: six reported less than two minutes, nine reported two to five minutes, one reported five to 10 minutes, and one indicated unknown. Among responses that provided a time category other than unknown, 15 of 16 reported deployment times of five minutes or less. This reinforces the need for guidance that recognizes the short-duration and fast-moving nature of SSP response.

Cone deployment was identified as a central component of SSP TTC practice and is examined in detail in Section 2.4. In summary, survey responses showed that cone deployment practices vary substantially across agencies. Some agencies deploy cones for nearly every stop, while others deploy cones primarily for lane-blocking incidents, longer-duration events, extended shoulder responses, or when requested by law enforcement or incident command. Because cones were universally available and frequently deployed, but also associated with operator exposure and storage limitations, cone deployment warrants and procedures warrant separate treatment.

2.2.4. Advanced TTC Technologies

Agencies reported using or exploring a range of advanced and supplemental TTC technologies. The most common advanced technology category was real-time incident notification systems, selected in 11 responses. Digital flares or beacons were selected in seven responses. Other examples included HAAS-type alerts, Pi-Lit LED flares, digital messaging, connected work zone technologies, LaneBlade-type systems, TIM roll-up signs, overhead VMS, foldable cones with optional LED attachments, smart arrow boards, iCones, ATMS integration, and navigation-app integration.

Fourteen respondents answered whether their agency is piloting new TTC technologies. Five answered yes, nine answered no, and four did not answer. Technologies described as being piloted or considered included side-mounted buffer arms, LaneBlade systems, tethered drones for observation, dash cameras, Waze integration, in-dash ATMS data entry, HAAS-type systems

for additional vehicles, smart arrow boards or iCones connected to ATMS systems, lane reservation systems, lift-and-tow systems, and Guardian Angel-type lighting.

Ten respondents completed the ranking question on factors that influence advanced TTC deployment. Type of incident was the strongest-ranked factor, with eight of the 10 ranking responses listing it first and an average rank of 1.5. Traffic volume, roadway speed, and weather conditions were generally ranked in the middle. Time of day was generally ranked lower than the other factors.

The main barriers to advanced TTC deployment included safety risk, limited storage, lack of time, lack of formal guidance, funding or acceptance, technology integration knowledge, and reliance on other units or maintenance contractors to deploy advanced TTC upstream. These barriers suggest that technology adoption is not only a matter of device availability; it also depends on training, integration, policy, vehicle capacity, operational acceptance, and whether the device can be deployed safely during short-duration incidents.

2.2.5. Agency Needs and MUTCD Chapter 6O Comments

The survey responses indicate that agencies are interested in practical, SSP-specific guidance that reflects actual field conditions. Thirteen respondents provided comments on changes to MUTCD Chapter 6O that would help SSPs. Several recurring themes emerged:

- Guidance should better reflect what is physically realistic for one truck to carry and one operator to deploy.
- More SSP-specific TTC guidance is needed.
- Emergency traffic control guidance should be clearer and easier for operators and maintenance personnel to understand.
- Guidance should allow flexibility for operators to adapt to field conditions.
- MUTCD Chapter 6O should be better coordinated with TIM training and real-world responder practices.
- State MUTCD or state-level guidance may need to be updated to align with Chapter 6O.
- Some respondents suggested greater use or clarification of emergency incident signage, including fluorescent pink signs.
- Some respondents indicated that enforcement, driver behavior, distracted driving, or rear-facing blue light laws may also influence responder safety.

Respondents also identified strategies they believe are effective for improving safety. Common themes included truck-mounted message boards, VMS, cones, arrow boards, vehicle positioning, operator training, digital alerts, navigation-app integration, improved visibility, multiple-unit response for larger incidents, debris removal, active patrol, and camera systems. These responses suggest that agencies generally favor a layered approach rather than relying on a single device or practice.

Several agencies also expressed interest in learning from peer programs. Fourteen respondents described how the survey results could support their agency, including identifying best practices, reviewing standards or SOPs from other agencies, supporting standardization, strengthening funding requests, improving training, and giving SSPs more direct consideration in TTC guidance. Seventeen respondents answered the follow-up interview question; 16 indicated willingness to participate in a follow-up interview, one declined, and one response was blank.

Overall, the survey findings show that agencies want guidance that is operationally realistic, scalable, and tailored to SSP response. The responses repeatedly emphasized the need to account for short-duration incidents, limited vehicle storage, one-person deployment, rapid

clearance expectations, operator exposure, and the practical differences between planned work zone traffic control and incident response.

2.3. Review of Written Standards and Documentation for TTC Deployment

This section reviews the written standards, manuals, standard operating procedures, training materials, contract documents, and guidance materials provided for review as part of Task 1. The documents vary widely in purpose, format, authority, and applicability to SSP operations. Some documents are SSP-specific operations manuals or field training guides, while others are general TTC, maintenance of traffic (MOT), work zone, traffic incident management (TIM), training, or procurement documents.

The purpose of this review is not to summarize each document in full. Instead, the review focuses on whether the written material gives practical guidance to SSP operators about when, how, and with what devices to deploy TTC during minor incidents, including disabled vehicles, debris events, shoulder stops, short-duration lane blockages, and other SSP service calls. In particular, the review considers whether the documents help an SSP operator make field decisions about cone deployment, vehicle positioning, warning devices, escalation, and coordination with law enforcement, transportation management centers, supervisors, or incident command.

2.3.1. Review Framework

Each document was reviewed for information relevant to SSP TTC deployment during minor and short-duration incidents. The review focused on the following elements:

- Document type, authority, and date or version.
- Whether the document is SSP-specific, TIM-specific, or general work zone/TTC guidance.
- Applicability to minor incidents, shoulder stops, lane closures, disabled vehicles, debris, and TIM areas.
- TTC deployment warrants, triggers, or decision factors.
- Cone deployment requirements, quantities, spacing, tapers, layouts, or procedures.
- Other TTC devices and technologies, including arrow boards, truck-mounted CMS, flares, digital flares, warning lights, signs, attenuators, LaneBlade, PILITS, smart lighting, CCTV, tablets, drones, connected alerts, and related tools.
- Vehicle positioning and blocking guidance.
- Decision authority, escalation guidance, and when additional resources should be requested.
- Duration thresholds.
- Training requirements.
- MUTCD, state MUTCD, Part 6, Chapter 6I/6O, TIM, or state TTC references.
- Practical constraints such as one-person deployment, limited storage, short clearance time, and operator exposure.
- Best practices and gaps.

2.3.2. Document Inventory

The provided document set included a mix of SSP-specific manuals, general TTC/work zone manuals, TIM guidance, training materials, and procurement documents. Several documents are directly applicable to SSP field operations, particularly the CTDOT, GDOT, NCDOT, and TDOT materials. MaineDOT and NYSDOT provided SSP-related contract/procurement documents that define patrol duties, equipment, and some coordination requirements, but they do not provide the same level of field deployment detail as the SSP operations manuals. Other documents provide

useful TTC principles, device standards, training requirements, or work zone layouts, but require interpretation before they can be applied to SSP minor-incident operations.

Table 2-2 summarizes the written standards, manuals, training materials, contract documents, and related guidance reviewed for each state or agency. The table identifies the document type, date or version, and whether the material appears to be directly SSP-specific, partially applicable, or general TTC/work zone guidance. This inventory provides the basis for the synthesis of written TTC guidance presented in the remainder of Section 2.3.

Table 2-2: Document Inventory for Written TTC Guidance Review

State / Agency	Documents Reviewed	Document Type	Date / Version	SSP-Specific
Alabama DOT	ALDOT Construction Manual, Procedure for Traffic Control through Construction Work Zones	General construction/work zone TTC and device quality guidance	2024	No
Connecticut DOT	CTDOT/Geico Service Patrol Program CHAMP Operations Manual	SSP operations manual	2023	Yes
District DOT	D.C. Temporary Traffic Control Manual	General TTC manual for work area protection, incident management, and special events	2006	No
Florida DOT	TTC Training procedure/chapter; TTC/MOT Training Handbook	TTC training/certification guidance	2024/ 2016	No
Georgia DOT	HERO Standard Operating Procedures	SSP/HERO operations and traffic control SOP	2013	Yes
Maine DOT	Safety Patrol contract/procurement and scope of work	SSP contract / scope of work	2023	Partially
Maryland SHA	Basic Work Zone Training	General work zone training	2025	No
North Carolina DOT	IMAP Technology document; IMAP Field Training Guide for Responders	SSP technology summary and field training manual	2023	Yes
New Jersey DOT / NJ TIM	State of New Jersey TIM Safety Guidelines; NJDOT Work Zone Safety Set-Up Guide	TIM responder guidance and work zone field guide	2016/ 2023	Partially
New York State DOT	IFB for Highway Emergency Local Patrols	SSP procurement/contract requirements	2021	Partially
Pennsylvania DOT	PennDOT Publication 213	General TTC/work zone publication	2022	No
South Carolina DOT	Work Zone Traffic Control Procedures and Guidelines for SCDOT Maintenance Activities	Maintenance work zone TTC manual	2019	No
Tennessee DOT	HELP/TIM Operations Manual	SSP/TIM operations manual	2024	Yes
Virginia DOT	Virginia Work Area Protection Manual	General TTC/work area protection manual with short-duration/mobile and TIM-related content	2026	Partially

2.3.3. Synthesis by Document Type

SSP-Specific Operations Manuals, SOPs, and Field Training Guides

The most directly applicable documents are those written specifically for SSP or freeway service patrol operations. CTDOT, GDOT, NCDOT, and TDOT provide the clearest SSP-specific materials.

CTDOT's CHAMP manual gives practical guidance for vehicle positioning, arrow board use, cone deployment, communication with NOC/BOC, State Police backup, reassessment of TTC, and incident-ahead signs for extended incidents. The manual is particularly useful because it describes how an operator should place the vehicle, when cones should be deployed, how far apart cones should be spaced, and when additional support should be requested.

GDOT's HERO SOP provides a series of practical traffic control applications for shoulder assists, right-lane closures, left-lane closures, center-lane blockages, two-lane blockages, and all-lane blockages. It also recognizes that operators are exposed to hazards while deploying cones and states that, where safe, the incident may be managed with the HERO vehicle's warning lights and arrow/message board if removing or relocating the incident would take less time than setting up traffic control devices.

NCDOT's IMAP Field Training Guide provides a training-based structure for emergency traffic control, temporary lane closures, center-lane closures, queue management, ramps, hills/curves, and push/pull/drag operations. It gives more detailed decision-making guidance than many documents, particularly for center-lane closures. For example, it identifies an expected lane blockage of 15 minutes or more as a threshold for deploying lane-closure temporary traffic control. For center-lane closures specifically, a standard single center-lane closure should be at least 420 ft long and use at least 19 cones.

TDOT's HELP/TIM Operations Manual is also directly applicable to SSP operations. It defines the HELP program as part of Tennessee's TIM effort and identifies duties including directing traffic, removing damaged vehicles and debris, contacting emergency services, placing on-board traffic control devices, and supporting quick clearance. It also identifies current response equipment, including a LaneBlade or push bumper, Haas Alert, changeable message board, emergency lighting, 28-inch reflectorized cones, roadway flares, and PILITS.

General TTC, MOT, and Work Zone Manuals

ALDOT, DDOT, PennDOT, SCDOT, and VDOT primarily provide general TTC or work zone guidance rather than SSP-specific procedures. These documents are valuable for device standards, lane closure layouts, taper concepts, work duration categories, sign spacing, channelizing device requirements, and training expectations. However, they generally assume planned work zones, work crews, approved traffic control plans, and equipment beyond what an SSP operator may have on a single patrol vehicle.

SCDOT is one of the most detailed general TTC sources in the provided set. It defines device use by roadway type, speed class, traffic volume, duration, day/night conditions, and closure type. For example, depending on application and facility type, SCDOT allows standard cones or 42-inch oversized cones for some daytime shoulder closures, while nighttime shoulder closures generally require drums. SCDOT also prohibits 36-inch standard cones for dual lane closures on interstate routes.

VDOT provides useful short-duration and mobile work guidance. For shoulder work, the manual states that for work off the shoulder with a duration of 1–15 minutes, vehicle warning lights may be used with no signs or shadow vehicle required; for work off the shoulder with a duration of 15–60 minutes, warning lights plus a truck-mounted sign or portable sign support are required. It also

includes shadow vehicle and TMA requirements for certain high-speed or limited-access conditions.

TIM and Emergency Responder Safety Guidance

The New Jersey TIM Safety Guidelines provide the clearest TIM responder-focused document in the reviewed set. The guidance addresses incident command, responder roles, roadway agency responsibilities, equipment recommendations, incident duration categories, vehicle positioning, and responder exposure. It classifies incidents as minor, intermediate, or major based on expected clearance time and directs responders to estimate incident magnitude within the first 15 minutes. Minor incidents are identified as 30 minutes or less, intermediate incidents as 30 minutes to 2 hours, and major incidents as more than 2 hours.

This TIM guidance is important because it directly addresses multi-agency response at roadway incidents. It states that traffic control is primarily the responsibility of law enforcement or roadway authorities, but that if those agencies are not present, initial responders are responsible for establishing a safe Traffic Incident Management Area using cones, flares, and/or emergency vehicles until appropriate equipment becomes available.

Training and Certification Documents

FDOT and Maryland SHA provided documents that are primarily training-oriented. FDOT's documents define TTC training categories and certification requirements by job function, including Flagger, Intermediate, Intermediate Refresher, Advanced, and Advanced Refresher TTC certifications. The FDOT materials are useful for understanding how an agency structures TTC competency and responsibility, but they do not provide SSP-specific field guidance for minor incident TTC deployment.

Maryland SHA's Basic Work Zone Training provides a broad overview of work zone traffic control, TTC devices, TTC design principles, SHA-specific requirements, and safety tools. It is useful for general TTC awareness, but the reviewed material does not provide SSP-specific instructions for shoulder stops, disabled vehicles, debris events, or short-duration incident cone deployment.

Contract and Procurement Documents

MaineDOT and NYSDOT provided materials that are partly SSP-specific but are structured as contract or procurement documents rather than field SOPs. MaineDOT's Safety Patrol contract describes duties such as assisting motorists with minor failures and minor crashes, removing vehicles and debris, cleaning up minor spills, sharing information with responders and the TMC, acting as the Department's representative in incident command, and protecting the scene with appropriate TTC devices when necessary. It also identifies the operator's vehicle, 28-inch cones, and flares as available TTC devices and requires TMC consultation for any lane closure.

NYSDOT's IFB defines HELP patrol services as rapid removal of disabled vehicles and vehicles involved in minor/moderate crashes, along with assisting public safety agencies with traffic control. It also identifies required equipment such as 36-inch cones with two reflective stripes and highway flares, and includes operator training, recordkeeping, and readiness inspection expectations. However, the IFB does not include the underlying SOPs needed to determine detailed cone spacing, layout, or deployment warrants.

Technology-Focused Documents

Advanced and supplemental technologies are addressed unevenly across the reviewed documents. NCDOT's technology document identifies tablets with ATMS access, CCTV cameras, smartphones, tethered drones, full-matrix CMS, connectivity, smart responder lighting, and smart vehicle lighting as tools that support IMAP incident management, traffic impact monitoring, emergency traffic control, and adverse weather response.

TDOT's HELP manual identifies several vehicle-mounted technologies and response tools, including a LaneBlade or push bumper, video camera, Haas Alert, changeable message board, white LED area lights, emergency lights, radios, PA/siren, 28-inch cones, roadway flares, and PILITS. MaineDOT identifies the Safety Patrol vehicle, 28-inch cones, and flares as TTC devices, but advanced TTC technologies were not identified in the provided MaineDOT document.

2.3.4. TTC Deployment Warrants Identified

Across the reviewed documents, written TTC deployment warrants are not uniform. The clearest SSP-specific warrants appear in CTDOT, GDOT, MaineDOT, NCDOT, NJ TIM, and TDOT materials. The following warrants or decision factors were identified:

- Travel-lane blockage. CTDOT requires immediate contact with NOC/BOC to request State Police backup if an incident intrudes into any part of the travel lane. NCDOT identifies an expected lane blockage of 15 minutes or more as a threshold for deploying lane-closure temporary traffic control, regardless of which travel lane is affected. MaineDOT requires the Safety Patrol operator to consult the TMC for any lane closure.
- Incident duration. Several documents include duration thresholds. CTDOT requires NOC/BOC notification if an incident will not be cleared within 30 minutes. MaineDOT defines a long-term lane or roadway closure as one that will result in a two-hour closure and requires TMC consultation for any lane closure. NJ TIM guidance uses minor, intermediate, and major incident categories, with minor incidents at 30 minutes or less, intermediate incidents from 30 minutes to 2 hours, and major incidents over 2 hours.
- Speed, sight distance, and roadway conditions. CTDOT states that 100–150 ft may not be enough in high-speed areas or locations with poor sight lines. GDOT states that traffic control applications may need field adjustment based on road configuration, incident location, duration, traffic volume, inclement weather, and time of day/night. SCDOT and VDOT both use speed, roadway type, sight distance, and work duration as core TTC decision factors.
- Queue formation and traffic impacts. GDOT distinguishes lane closure layouts with and without traffic queues and provides longer tapers where queues are present. VDOT Chapter 6O states that responders arriving at an incident should estimate incident magnitude, expected duration, and expected queue length, then set up appropriate temporary traffic controls for those estimates.
- Ramps, side roads, curves, and constrained areas. CTDOT directs CHAMP operators to notify NOC/BOC if side roads or ramps are within or near the incident area so the operations center can determine whether additional TTC is needed. SCDOT provides separate requirements for ramps, shoulder closures, interstate routes, gore areas, and constrained shoulder conditions. VDOT includes additional TTC requirements for sight distance, curves, shoulder operations, and high-speed conditions.
- Operator exposure and practicality. GDOT explicitly recognizes that operators are exposed while installing TTC devices and allows use of the HERO vehicle's emergency warning lights and arrow/message board when it would take longer to deploy devices than to safely remove or relocate the incident. VDOT similarly notes that during short-duration work, it often takes longer to set up and remove a TTC zone than to perform the work, and that workers face hazards in setting up and taking down the TTC zone.
- Requests from incident command, law enforcement, supervisors, or TMC. NCDOT instructs IMAP responders to identify the incident commander, advise the IC of initial actions such as traffic control, work with the IC to prioritize IMAP actions, and call for backup or a supervisor as needed. MaineDOT requires TMC consultation for any lane closure. CTDOT requires NOC/BOC involvement for travel-lane intrusion, ramps/side roads, incidents exceeding 30 minutes, and continuing traffic warning updates.

2.3.5. Cone Deployment Guidance

Cone guidance varies substantially across the reviewed documents. The most practical SSP-specific cone deployment guidance is found in CTDOT, GDOT, and NCDOT. Other SSP-related documents, including MaineDOT, NYSDOT, and TDOT, identify cones as required or available equipment but provide less detail on layout, spacing, or field deployment procedure in the reviewed excerpts.

CTDOT provides the most direct minor-incident cone placement guidance. CHAMP vehicles must carry at least 16 clean reflectorized cones. Operators are instructed to deploy cones in a taper to guide approaching traffic into available lanes, begin deployment at the rear of the CHAMP vehicle, work upstream, start the taper at the farthest point, reinforce and straighten cone lines, face traffic while placing or removing cones, and use 40-ft spacing for traffic speeds over 40 mph. CTDOT also links cone deployment to operational communication by requiring notification to NOC/BOC for nearby ramps or side roads and for incidents that will not be cleared within 30 minutes.

GDOT provides detailed SSP/HERO cone layouts for different incident configurations. The HERO SOP includes shoulder assist, lane closure, center-lane blockage, two-lane blockage, and all-lane blockage examples. It uses minimum taper lengths such as 400 ft without a queue, 660 ft with a queue, and 800 ft for certain two-lane blockage applications. For all lanes blocked and detouring traffic, it identifies an approximate 90-ft taper per travel lane and 4–5 cones per travel lane as an initial setup until backup arrives. GDOT also provides an important practical rule: cones should be placed from the farthest necessary point toward the incident and removed in reverse order, summarized as “first down–last up.”

NCDOT provides detailed cone guidance for center-lane closures. The IMAP Field Training Guide states that a standard single center-lane closure should be at least 420 ft long and use at least 19 cones over 11 skips. It also identifies the cone components of the layout, including a 4-cone taper, 3-cone tail, and buffer sections. NCDOT ties this layout to decision factors such as expected blockage of 15 minutes or more, traffic speed not exceeding 40 mph past the incident, the number of center lanes closed, and whether a full closure would be safer or more effective.

MaineDOT identifies the operator’s vehicle, 28-inch cones, and flares as the TTC devices available to protect the scene when necessary. However, the provided contract language does not specify how many cones are carried or how cones are to be spaced, tapered, or deployed. The strongest operational control in the MaineDOT document is the requirement that the operator consult the TMC for any lane closure and that the TMC determine whether a long-term closure is required.

TDOT identifies 28-inch reflectorized traffic control cones, minimum 20, along with roadway flares and PILITS as required response equipment. This confirms that cone deployment is part of TDOT HELP’s operational capability, but detailed cone spacing, taper length, or layout procedures were not identified in the reviewed excerpts.

NYSDOT’s HELP procurement document requires 36-inch cones with two reflective stripes, quantity 12, and highway flares as part of the HELP vehicle equipment list. However, the IFB does not provide detailed field deployment procedures; it references Department-provided SOPs for more detailed requirements.

Among the general TTC documents, ALDOT and PennDOT provide useful cone quality standards, while SCDOT and VDOT provide detailed work-zone cone and channelizing-device requirements. ALDOT identifies acceptable cone size, color, retroreflective sheeting, and

unacceptable conditions such as fading, damaged sheeting, deformation, dirt, or asphalt splatter. PennDOT provides similar quality categories for 28–36-inch and 42-inch cones. SCDOT provides particularly detailed distinctions between daytime and nighttime cone use, shoulder closures, lane closures, and dual-lane closures, including several situations where standard cones are prohibited and drums or 42-inch oversized cones are required.

Overall, cone deployment guidance is clearest when the document was written specifically for SSP/IMAP/HERO/CHAMP operators. General work zone manuals provide stronger formal TTC standards but are less directly usable for a single SSP operator making rapid decisions at a minor incident or short-duration service call.

2.3.6. Implications for SSP TTC Guidance

The document review shows that written TTC guidance for SSP operations varies widely in specificity and applicability. SSP-specific manuals and field training guides provide the most practical direction for minor-incident response, particularly where they address cone deployment, vehicle positioning, warning devices, lane closure decisions, and escalation procedures. General TTC, MOT, work zone, TIM, training, contract, and procurement documents are also useful, but they often require interpretation before they can be applied to one-person SSP operations during short-duration incidents.

The most important finding from the document review is the need to translate general TTC principles into practical field guidance for SSP operators. Many of the reviewed documents identify relevant factors such as lane blockage, incident duration, traffic speed, visibility, queue formation, roadway geometry, and the need for additional support. However, these factors are not consistently organized into SSP-specific deployment warrants or decision tools.

The review also reinforces that cone deployment, vehicle positioning, warning devices, and quick clearance must be considered together. Formal work-zone-style TTC may not be practical for many minor incidents, but some level of scene protection is still needed when operators, motorists, or other responders are exposed to traffic. SSP-specific TTC guidance should therefore be scalable, realistic for one-person deployment, and based on the equipment typically available on SSP vehicles.

Overall, the written document review supports the need for practical SSP-specific TTC guidance that helps operators and agencies determine when TTC is needed, which devices should be used, how cones should be deployed, and when additional support should be requested.

2.4. Cone Deployment Practices

Cone deployment warrants separate attention because cones were the only TTC device reported as available on all responding SSP vehicles and were also the most frequently reported device used during minor incidents and service calls. Cones are central to SSP temporary traffic control because they can provide visual warning, define a work area, create a buffer, and help channelize traffic around a stopped vehicle, debris, or lane-blocking incident.

However, cone deployment is also one of the most operationally challenging SSP practices. Unlike vehicle-mounted warning lights, arrow boards, or truck-mounted CMS, cone deployment often requires the operator to exit the vehicle and work near active traffic. This creates exposure risk, particularly when the operator is working alone, traffic speeds are high, shoulder width is limited, visibility is poor, or the incident is expected to clear quickly. As a result, cone deployment is not simply a traffic control design issue; it is also a responder safety, staffing, equipment storage, and operational feasibility issue.

The survey results show that agencies generally recognize the value of cones, but they differ substantially in when cones should be deployed, how many cones should be carried, how many

should be deployed initially, who decides when deployment should be expanded, and how operators should place cones near live traffic.

2.4.1. Cone Deployment Triggers and Policy Types

Most respondents indicated that their agency has some form of formal or semi-formal cone deployment guidance. Nine responses reported an agency-specific cone deployment policy, and five reported that cone deployment practices are based on MUTCD guidance. Other responses described hybrid, informal, or scalable approaches, including policies that reference MUTCD principles, fixed-cone approaches, or small initial deployments that are expanded as needed.

The survey responses suggest that cone deployment practices generally fall into five policy types.

- Routine deployment for every stop. Seven responses indicated that cones are deployed every time the SSP vehicle stops on the roadway or shoulder. This approach provides consistency and increases scene visibility, but it may be difficult to apply during very short stops or in conditions where cone deployment itself increases operator exposure.
- Lane-blocking deployment. Eleven responses indicated that cones are deployed for lane-blocking incidents. This was the most common deployment trigger. Under this approach, cones are used primarily when a travel lane is blocked, partially blocked, or when traffic must be guided away from an obstruction or response activity.
- Duration-based deployment. Eight responses indicated that cone deployment is tied to incident duration or extended shoulder activity. Some agencies do not require cones for brief shoulder stops but use cones when the event is expected to last longer, when the shoulder activity becomes extended, or when the incident cannot be cleared quickly.
- Request- or command-based deployment. Six responses indicated that cones may be deployed when requested by law enforcement. Other responses referenced the incident commander, supervisors, TMCs, or unified command. This approach reflects the shared nature of incident scene management, where the SSP operator may initiate a basic deployment but expand or modify the setup based on direction from other responders or agency personnel.
- Scalable deployment based on incident complexity. Several responses suggest that agencies use a flexible deployment model in practice. Operators may begin with a small cone setup and expand it based on lane impacts, traffic speed, traffic volume, sight distance, weather, queue formation, incident duration, and the availability of additional support. This model appears especially relevant to SSP operations because it allows deployment to match the actual risk and practical constraints of the scene.

2.4.2. Cone Quantities and Scalable Deployment

The number of cones carried on SSP vehicles varied widely across agencies. Reported values ranged from approximately five cones to as many as 40 cones, with many agencies reporting values in the 10-to-30 cone range. Several agencies reported different cone quantities depending on vehicle type or equipment configuration. For example, some vehicles may carry fewer cones when equipped with lift-and-tow devices, LaneBlade-type systems, or other specialized equipment.

Initial cone deployments were generally smaller than the total number of cones carried. Many agencies reported initial deployments in the four-to-10 cone range, with expansion based on lane blockage, incident duration, traffic conditions, or incident complexity. Examples included four cones, five cones, five to 10 cones, nine cones, 10 cones, and structured deployments such as smaller deployments for shoulder closures and larger deployments for single-lane or multi-lane closures.

These findings suggest that many agencies use, or would benefit from, a scalable cone deployment approach. Under this model, the operator deploys a basic cone pattern when conditions warrant and then expands the setup if the incident becomes longer, more complex, lane-blocking, or higher risk. Scalable deployment is important because SSP vehicles have limited storage capacity and SSP incidents are often short in duration. A full formal lane-closure setup may not be realistic for many minor incidents, but a small, targeted cone deployment may still improve visibility and provide a defined work area.

2.4.3. Deployment Procedures and Decision Authority

Open-ended responses showed variation in cone deployment procedures, but several common elements were identified. Many agencies described positioning the SSP vehicle upstream of the incident, activating vehicle warning devices, using the SSP vehicle as initial protection, deploying cones to create a taper or buffer, and maintaining awareness of oncoming traffic throughout the deployment.

Several responses described operators starting near the rear of the SSP vehicle and working upstream or backward to create a taper. Others described walking along the shoulder first, placing the farthest cone, and then tapering the remaining cones back toward the SSP vehicle. Some procedures emphasized facing oncoming traffic while placing or removing cones, using pavement markings or skip lines as spacing references, and retreating to the shoulder after cone placement.

Common procedural elements included:

- Placing the SSP vehicle upstream of the incident.
- Activating warning lights, arrow boards, or message boards before exiting the vehicle.
- Establishing a buffer between the SSP vehicle and the assisted vehicle, debris, or incident area.
- Deploying cones to form a taper, buffer, or shoulder/lane closure.
- Using skip-line spacing or other visual references where applicable.
- Facing traffic while placing or removing cones.
- Removing cones in the reverse order of deployment.
- Requesting additional help when cone deployment cannot be performed safely.

Decision authority also varies by agency and incident type. The SSP operator is usually the first decision-maker because the operator is on scene and can assess immediate traffic, roadway, and incident conditions. However, supervisors, TMC staff, law enforcement, state police, incident commanders, unified command, or incident management coordinators may influence or direct cone deployment, particularly for longer-duration incidents, lane closures, larger incident footprints, or higher-risk operating conditions.

2.4.4. Operational Challenges

Cone deployment challenges were among the most consistent themes in the survey. Ten responses identified safety concerns, and four identified limited storage space. Other responses referenced time constraints, truck capacity and weight, proper training, SOP compliance, lack of formal requirements, uncertainty about how many cones are needed, and the risk of turning away from traffic during deployment.

The most significant challenge is operator exposure. Deploying cones requires the operator to leave the relative protection of the SSP vehicle and move near active traffic. This exposure is especially concerning on high-speed roadways, at locations with limited shoulder width, during low-light or poor-weather conditions, near curves or ramps, or when driver behavior is unpredictable.

Storage and vehicle capacity are also recurring constraints. SSP vehicles must carry motorist-assist equipment, communications equipment, safety gear, emergency supplies, and other tools. Carrying enough cones for larger lane closures may not be practical on all vehicle types. This is particularly important when vehicles are also equipped with lift-and-tow systems, LaneBlade-type devices, or other specialized response equipment.

Time is another key constraint. Many SSP incidents are short-duration events, and several agencies reported that minor TTC deployment often occurs in five minutes or less. In some cases, the incident may be cleared before a more formal cone setup can be completed. This creates a practical tension between deploying additional TTC and clearing the incident quickly to reduce exposure and restore traffic flow.

2.5. Synthesis Findings and Guidance Implications

Task 1 established that SSP temporary traffic control practices for minor incidents are highly practical, field-driven, and shaped by the operating realities of short-duration incident response. Across the survey findings, written document review, and cone deployment analysis, agencies reported using a common set of tools, particularly cones, vehicle positioning, warning lights, arrow boards, truck-mounted message boards, flares, and emerging digital notification systems. However, the policies and procedures governing use of these tools vary considerably across agencies.

A central finding is that SSP operators are often responsible for making rapid TTC decisions under constrained field conditions. These decisions are influenced by lane blockage, traffic speed and volume, roadway geometry, visibility, weather, incident duration, queue formation, responder exposure, and the availability of law enforcement, TMC, supervisor, or incident command support. While many agencies have written standards or related guidance, the review showed that only some documents provide SSP-specific direction for minor incidents. Many available documents are general work zone, TTC, TIM, training, or procurement materials that require interpretation before they can be applied to one-person SSP operations.

Cone deployment illustrates this issue most clearly. Cones are universally available among the responding agencies and are widely used during minor incidents and service calls, but agencies differ in deployment triggers, cone quantities, initial deployment practices, decision authority, and field procedures. The most common trigger for cone deployment is a lane-blocking incident, but agencies also use duration thresholds, shoulder service activity, law enforcement or incident command requests, and operator judgment. Cone use can improve visibility, channelization, and scene definition, but it can also increase operator exposure when deployment occurs near live traffic. This finding reinforces the need for guidance that recognizes both the safety benefits and operational risks of cone deployment.

The results also show that advanced and supplemental technologies are becoming part of SSP incident response, but adoption is uneven. Tools such as real-time alerts, vehicle-mounted CMS, digital flares, Pi-Lit/PILITS-type devices, LaneBlade systems, smart lighting, cameras, drones, and navigation-app integration may improve upstream warning and situational awareness. However, these tools do not eliminate the need for clear field guidance on when TTC is needed, how devices should be used, and when additional support should be requested.

Overall, Task 1 supports the development of practical SSP-specific TTC guidance for minor incidents. This guidance should bridge the gap between formal work-zone TTC standards and the realities of short-duration service patrol response. It should be scalable, realistic for one-person deployment, and based on the equipment typically available on SSP vehicles. It should also help agencies and operators determine when cones are beneficial, how many cones are appropriate for different minor-incident scenarios, when deployment should be expanded, when

vehicle positioning or quick clearance may be the more appropriate response, and when additional support should be requested.

The Task 1 findings established the foundation for the case study analysis presented in Chapter 3 and the MUTCD consistency review presented in Chapter 4. Agencies with strong cone deployment procedures, advanced TTC technologies, and structured SSP operator training informed the selection of case study topics and helped identify transferable practices for later guidance development. In this way, the Task 1 synthesis functions as the baseline for understanding current practice, identifying gaps, and developing practical SSP-specific TTC guidance in the following chapters.

3. Case Studies of Best Practices

Task 2 builds on the Task 1 synthesis by conducting focused case studies of selected SSP programs. Rather than producing broad agency profiles, Task 2 examines transferable practices related to three key topics identified during Task 1: cone deployment warrants and procedures, advanced TTC technologies and operational strategies, and SSP operator training for incident-scene traffic control. The intent is to provide more detailed insight into how agencies make decisions, how procedures are applied in the field, and what practices may be most useful for developing SSP-specific TTC guidance.

The case studies are organized by topic rather than by agency to emphasize transferable practices. Four agencies participated in the case study process: CTDOT/CHAMP, GDOT/HERO, NCDOT/IMAP, and TDOT/HELP. Each agency was selected because its Task 1 survey response, written materials, or follow-up discussions provided useful information for one or more of the case study topics.

Task 2 focuses on practical implementation questions. For cone deployment, the case studies examine when cones are warranted, when deployment may introduce unnecessary exposure, when cones may be beneficial but unsafe to deploy, and how cones should be placed, retrieved, stored, and coordinated with vehicle positioning and other warning devices. CTDOT/CHAMP and GDOT/HERO provide examples of how agencies define deployment thresholds, manage low-risk and high-risk scenarios, and maintain consistency in cone use.

For advanced TTC technologies and operational strategies, the case studies explore how SSP programs use supplemental tools to improve warning, visibility, situational awareness, queue protection, and coordination. These tools may include truck-mounted message signs, arrow boards, enhanced lighting, digital flares, sequential lighting, responder-to-vehicle alert systems, cameras, drones, AVL, ATMS integration, and TMC coordination. NCDOT/IMAP and TDOT/HELP provide examples of how these technologies are selected, deployed, maintained, and evaluated for effectiveness and cost. Quick clearance is also considered as an operational TTC strategy that reduces exposure duration.

For SSP operator training, the case studies examine how operators are prepared to make safe decisions in the field, how they learn to deploy TTC devices, and how agencies verify competency. NCDOT/IMAP, GDOT/HERO, and TDOT/HELP provide examples of training approaches that combine classroom instruction, field training, mentoring, scenario-based learning, and refresher training. Emphasis is placed on how operators are trained to assess incident conditions, apply TTC measures appropriately, recognize unsafe deployment situations, and coordinate with other responders.

Together, these case study topics provide a foundation for developing practical, scalable SSP-specific TTC guidance that reflects real-world operating conditions and supports safe, consistent incident response.

3.1. Case Study Findings and Transferable Practices

This section synthesizes insights from the Task 2 case studies, focusing on practical applications and lessons learned across three topic areas: cone deployment warrants and procedures, advanced TTC technologies and operational strategies, and SSP operator training for incident-scene traffic control. The findings are presented by topic to highlight actionable practices and considerations that can inform SSP operations in a variety of contexts.

The case study findings show that effective SSP TTC practices are not based on a single device, layout, or procedure. Instead, effective practices combine field decision-making, vehicle

positioning, advance warning, cone deployment, quick clearance, operator training, and coordination with TMCs and other responders. Across the agencies reviewed, the most useful practices were those that were simple enough for field use, flexible enough to account for changing roadway and traffic conditions, and realistic for one-person or limited-staff SSP operations.

3.1.1. Case Study Selection, Interviews, and Materials Review

Each case study included a structured interview and review of supporting materials provided by the agency. The interviews were conducted using topic-specific questionnaires, which are provided in Appendix C through Appendix F. These questionnaires included prompts related to program context, field decision-making, device use, training, implementation challenges, and transferable practices. Supporting materials reviewed for the case studies are summarized in Appendix G and included operations manuals, standard operating procedures, field training guides, equipment lists, technology summaries, quick clearance materials, and other agency documentation.

The case study findings should be interpreted as qualitative practice examples. They reflect agency-reported practices, written procedures, and interview discussions rather than independent field observations or a statistical evaluation of safety performance. The findings are intended to support guidance development by identifying practical approaches that agencies have used to address recurring SSP TTC challenges.

3.1.2. Cone Deployment Warrants and Procedures

Cone deployment is one of the most common and visible TTC practices used by SSP operators, but it is also one of the most dangerous. Cones can improve visibility, provide channelization, define a work area, and help approaching motorists understand how to move around an incident scene. At the same time, deploying cones requires the operator to exit the vehicle and work near live traffic. For short-duration incidents, the safety benefit of cones must therefore be weighed against the exposure created by deploying and retrieving them.

The case studies reinforced that cone deployment guidance should not be framed as a simple yes-or-no rule. Instead, agencies need a practical decision framework that considers incident duration, lane impact, responder exposure, roadway geometry, traffic speed, traffic volume, shoulder width, sight distance, weather, lighting, and available support. The most transferable practices were those that helped operators distinguish among three types of situations: incidents where cones are clearly warranted, incidents where cones may add more exposure than benefit, and incidents where cones may be beneficial but unsafe for the operator to deploy without additional support.

Cone Deployment Warrants

The case studies indicate that SSP cone deployment guidance can be structured using a warrant-based framework. The warrants are intended to identify conditions where cone deployment should be considered because cones may provide a meaningful safety or traffic-control benefit. However, satisfying one or more warrants does not automatically require cone deployment. The operator must still determine whether cones can be deployed and retrieved safely under the specific field conditions.

The cone deployment warrants should be applied as a risk-benefit decision. Cones should be deployed when they are expected to reduce risk more than the deployment and retrieval process adds risk. Conversely, cones may not be appropriate when the incident can be cleared more quickly than cones can be deployed, or when the operator would be exposed to unacceptable risk while placing or retrieving cones. In those cases, the operator should rely on vehicle positioning,

warning lights, arrow boards, message boards, TMC support, upstream warning, quick clearance, or additional responders as appropriate.

Warrant 1. Lane-Blocking or Lane-Encroaching Incident

Cone deployment should be considered when an incident blocks or encroaches into a travel lane and cannot be immediately cleared. This includes disabled vehicles, crashes, debris, or response activity that occupies part or all of a lane. In these situations, cones can help define the occupied lane, guide approaching motorists away from the incident, and create a more recognizable traffic-control pattern.

This warrant is strongest when the lane blockage is expected to remain in place long enough for a cone taper or simplified cone setup to provide a meaningful benefit. GDOT/HERO described this concept through a practical “time, speed, and space” framework. If the incident will take time to resolve, if traffic speed and available gaps allow deployment to be performed safely, and if there is enough space to establish a taper or work area, cones are generally warranted. TDOT/HELP similarly indicated that cones are expected for lane-blocking incidents and may be expanded based on the number of lanes blocked, traffic speed and volume, and line of sight.

Warrant 2. Expected Scene Duration

Cone deployment should be considered when the expected duration of the stop or incident is long enough that cones will provide a safety or traffic-control benefit. For very short-duration activities, the exposure required to deploy and retrieve cones may exceed the benefit provided by the cones. For longer-duration incidents, cones become more valuable because they provide continued channelization and warning throughout the event.

CTDOT/CHAMP described this as a practical duration-based decision. If a quick assist, such as providing a small amount of fuel, can be completed faster than a minimum cone setup can be deployed and retrieved, the operator may rely on the vehicle’s warning systems and clear the scene quickly. However, if the operator expects to remain on scene for more than a brief period, a minimum cone deployment is expected. NCDOT/IMAP described a similar decision process through an initial assessment period used to determine whether the incident can be cleared quickly or whether emergency traffic control should be deployed.

Warrant 3. Responder or Motorist Exposure on Foot

Cone deployment should be considered when the SSP operator, another responder, or a motorist will be on foot near traffic. This may include tire changes, vehicle checks, vehicle relocation, debris removal, crash response, or other activities that require people to stand, walk, or work near the shoulder or travel lane. In these situations, cones can provide a visual buffer and help define the work area for approaching motorists.

This warrant is not based only on the presence of a stopped vehicle. It is based on the exposure of people outside vehicles. If the operator can complete the response from within the vehicle, communicate using the public address system, or quickly move the vehicle to a safer location, cones may not be necessary. If work on foot is required and the scene will remain active, cones may provide an important layer of protection.

Warrant 4. Limited Sight Distance or Reduced Visibility

Cone deployment should be considered when approaching motorists may have limited time to detect and react to the incident. This may occur on curves, hills, ramps, gore areas, bridges, narrow shoulders, nighttime conditions, rain, fog, glare, or other visibility-limited conditions. In these situations, cones can improve conspicuity and help approaching motorists recognize that the shoulder or lane area is occupied.

This warrant must be applied carefully because the same conditions that increase the need for cones may also increase the risk of deploying them. If limited sight distance, high speed, or poor visibility makes it unsafe for the operator to place cones, the operator should not deploy cones alone. Instead, the operator should use vehicle-mounted warning devices, request upstream warning, notify the TMC, request law enforcement or another SSP unit, or wait until traffic conditions allow deployment to be performed safely.

Warrant 5. Need to Define or Expand the Work Area

Cone deployment should be considered when the operator or incident commander needs to define a work area, separate responders from traffic, guide traffic around an obstruction, or expand an initial vehicle-based warning setup. This may occur when the incident grows in complexity, additional responders arrive, a tow or recovery operation begins, debris removal is needed, or the scene changes from a brief service call to a longer-duration incident.

Under this warrant, cones are used to clarify the scene for motorists and responders. The cone setup should be scaled to the conditions and should be coordinated with vehicle positioning, arrow boards, message boards, lighting, flares, digital flares, or other warning devices. If the needed setup exceeds what one SSP operator can safely deploy, the operator should request additional support rather than attempting to establish a larger traffic-control area alone.

Conditions Where Cones May Not Be Warranted

Cones may not be warranted when the incident can be cleared more quickly than cones can be deployed and retrieved, when the vehicle is fully on a wide shoulder and the operator will have little or no exposure on foot, when vehicle-mounted warning devices provide adequate warning for a brief stop, or when quick clearance can remove the hazard before a cone setup would provide meaningful benefit. In these situations, the operator should focus on safe vehicle positioning, warning-device use, communication with the operations center, and rapid scene clearance.

Conditions Where Cones May Be Warranted but Unsafe to Deploy

Some incidents may satisfy one or more cone deployment warrants but still be unsafe for a single operator to deploy cones. Examples include a disabled vehicle in a middle lane, a vehicle on a narrow left shoulder with high-speed traffic, a scene on a blind curve, a location with no refuge area, or a condition that would require the operator to walk far upstream in live traffic. In these cases, the correct response may be to remain in the vehicle, activate warning systems, notify the TMC, request law enforcement or another SSP unit, provide upstream warning, or wait for traffic to slow before deploying cones.

Overall, the warrant framework should help operators make consistent decisions while preserving field judgment. The purpose is not to require cones at every incident, but to identify when cones should be considered, when cones may be unnecessary, and when cones may be needed but cannot be safely deployed without additional protection or support.

Standardize Safe Cone Deployment, Retrieval, and Coordination with Vehicle Positioning

When cones are deployed, the case studies support the need for standardized safe deployment and retrieval practices. A recurring theme was that operators should maintain awareness of traffic, minimize walking in live traffic, avoid turning their backs to approaching vehicles, and coordinate cone placement with vehicle position, arrow board use, lighting, message boards, and other warning devices.

CTDOT/CHAMP provides a practical example of a shoulder-based deployment method. Operators are trained to place cones along the shoulder first and then move them outward to

create the taper while facing traffic. Cone spacing may use the roadway striping pattern as a field reference, with 40-foot spacing corresponding to one cone per skip line on higher-speed facilities. This approach gives operators a simple distance reference that can be applied in the field without measuring devices.

GDOT/HERO emphasizes a similar safety principle through its “first down, last up” approach. Under this approach, cone deployment is sequenced so that the farthest upstream cone is the first cone placed, and that same cone is the last cone removed during retrieval. Before entering the travel lane or shoulder line, the operator arranges the cones on the shoulder in the order they will be deployed and spaces them out to their appropriate intervals. The farthest upstream cone is placed first, effectively along the shoulder line or edge of the taper, and the operator then works progressively downstream toward the incident vehicle or blocking vehicle. Each subsequent cone is walked out from the shoulder into position, with the final cone placed near the back of the vehicle or the protected work area. This allows the taper to be built from the upstream end toward the protected scene while limiting unnecessary movement in or near live traffic.

The same principle applies during retrieval, but in reverse. Cones are removed so that the taper remains in place as long as it is needed and traffic is not reopened in an uncontrolled manner. After the incident has cleared, the SSP vehicle is moved to the shoulder or an appropriate termination point so the operator can continue retrieving cones while working back toward a protected location. The farthest upstream cone, which was the first cone deployed, is the last cone retrieved. This sequencing helps ensure that the operator does not end the retrieval process exposed upstream of the vehicle or in a live lane without protection.

This concept is especially useful because it treats both deployment and retrieval as safety-critical tasks. Removing cones can expose the operator just as much as placing them, and poor retrieval sequencing can reopen traffic in an uncontrolled way. The transferable principle is that deployment and retrieval should be planned as a single process. Operators should stage cones before walking them into position, deploy from the farthest upstream point back toward the vehicle, retrieve in a sequence that preserves traffic guidance, and end the retrieval process at the vehicle, on the shoulder, or at another protected location rather than exposed in or near a live lane.

Vehicle positioning is also central to cone deployment. Agencies differed in how strongly they allow SSP vehicles to block or occupy lanes, but the case studies consistently showed that vehicle position is the first layer of scene protection. The vehicle provides early warning, carries the arrow board or message board, supports communications, and may provide limited shielding depending on agency policy, vehicle design, and scene conditions. Cones should therefore be viewed as part of a larger TTC system rather than a stand-alone solution.

The transferable practice is to standardize a simple cone deployment and retrieval sequence that begins with scene size-up, vehicle positioning, activation of warning devices, communication with the TMC or operations center, use of personal protective equipment (PPE), cone placement from the safest available location, continuous monitoring of traffic, and controlled retrieval. This sequence should be short enough to train and remember, but clear enough to promote consistency across operators.

Improve Cone Accessibility, Storage, and Field Deployability

Cone deployment is affected not only by policy, but also by vehicle design and equipment storage. If cones are difficult to reach, require the operator to climb into the truck bed, or force the operator to turn away from traffic, operators may be less likely to deploy them or may be exposed to additional risk during deployment. Conversely, cone storage systems that make cones easy to access from a protected position can reduce exposure and make safe deployment more likely.

The CTDOT discussion highlighted this issue through the example of a rear-mounted cone storage concept used by TxDOT, shown in Figure 3-1. The TxDOT SSP vehicle uses a receiver-hitch-mounted rear rack or similar device that places cone stacks near the rear of the vehicle, allowing the operator to access cones from behind or beside the vehicle rather than climbing into the truck bed. The design also functions as a step, improving access to the vehicle while keeping cones organized and readily available. While the specific design would require agency review for fleet compatibility, operator safety, crashworthiness, and liability considerations, the underlying principle is transferable. Cone storage should be designed so that operators can retrieve and stow cones quickly, from a protected position when possible, and without adding unnecessary climbing, reaching, or exposure near live traffic.



Figure 3-1: TxDOT SSP vehicle with rear-mounted cone storage rack and access step concept. Image provided by CTDOT during the case study interview.

Cone quantities also influence field practice. CTDOT/CHAMP, GDOT/HERO, NCDOT/IMAP, and TDOT/HELP each reported or documented different cone quantities, ranging from smaller shoulder deployments to larger quantities capable of supporting lane closures. However, a higher cone quantity is only useful if cones can be accessed and deployed safely. For SSP operations, the practical question is not only how many cones are carried, but how many can be safely deployed by one operator under field conditions.

The transferable practice is to consider cone storage and access as part of TTC guidance. Agencies developing SSP cone procedures should review whether operators can access cones quickly, whether they can do so while maintaining awareness of traffic, and whether the storage configuration supports the type of deployment expected in the field. Improving cone accessibility may be a low-cost way to improve both consistency and safety.

3.1.3. Advanced TTC Technologies and Operational Strategies

Advanced TTC technologies, supplemental devices, and operational strategies can improve incident-scene safety by increasing visibility, extending warning upstream, improving situational awareness, supporting TMC coordination, and reducing the duration of exposure. The case studies showed that these tools are most effective when they support, rather than replace, sound field decision-making. Operators still need to assess the scene, position the vehicle appropriately,

communicate with the TMC or operations center, and determine whether additional TTC or responders are needed.

The agencies reviewed used a range of advanced tools, supplemental devices, and operational practices, including truck-mounted message boards, arrow boards, enhanced lighting, digital flares, sequential lighting, responder-to-vehicle alert systems, cameras, drones, AVL, ATMS integration, TMC coordination, navigation-app information sharing, queue protection, and quick clearance practices. The key finding is that technology should be evaluated based on operational value, not novelty. The most useful tools were those that were easy to deploy, frequently used, durable, understandable to motorists, and integrated into agency procedures.

Use Vehicle-Mounted Warning and Messaging as the Initial TTC Layer

Vehicle-mounted warning and messaging systems are one of the most important TTC layers available to SSP operators. These systems are immediately available when the operator arrives, can be activated without leaving the vehicle, and can provide warning before cones or other devices are deployed. For minor incidents, the vehicle-mounted warning system may be the primary TTC measure. For more complex incidents, it becomes the first layer of a larger traffic-control setup.

TDOT/HELP emphasized the importance of high-visibility truck-mounted message and arrow boards. TDOT described selecting brighter, higher-performing boards because they improve the ability of approaching motorists to understand the scene in both daytime and nighttime conditions. Although these boards are more expensive than some alternatives, TDOT viewed them as one of the most effective tools on the vehicle because they directly improve visibility and driver comprehension.

TDOT also described the nighttime benefit of using Pi-Lit devices with traffic cones. In addition to their use as sequential warning lights, TDOT noted that placing a Pi-Lit inside a traffic cone can illuminate the entire cone, making the cone much more visible to approaching motorists at night. This practice provides a relatively simple way to increase the visibility of standard cone deployments without changing the basic field setup. The transferable principle is that advanced TTC devices do not always need to replace conventional devices; in some cases, they can enhance the effectiveness of basic tools such as cones, particularly under nighttime or low-visibility conditions.

NCDOT/IMAP also identified the transition to truck-mounted changeable message signs (CMS) as an important improvement. Vehicle-mounted messaging provides greater flexibility than static warning devices and allows operators to communicate incident-specific information to approaching motorists. The primary benefit is providing clear, actionable information about roadway conditions and the appropriate driving response, such as moving over, changing lanes, or preparing for stopped traffic. When combined with emergency lighting, arrow displays, and TMC support, truck-mounted CMS can improve advance warning and help motorists navigate incident scenes safely.

The transferable practice is to treat the SSP vehicle as a mobile TTC platform. Agencies should specify when and how operators use arrow boards, message boards, lighting modes, and shoulder warning messages. The message or arrow display should be selected based on incident location, lane impact, shoulder conditions, and expected motorist behavior. Operators should also be trained that brighter or more visible warning is not always better if it creates confusion, glare, or unnecessary congestion. The goal is to provide clear, appropriate, and timely information to approaching motorists.

Extend Advance Warning Upstream of the Incident Scene

Another transferable practice is to treat upstream advance warning as a scalable level of temporary traffic control rather than a default requirement for every minor incident. For very short-duration shoulder assists or low-risk stops, the exposure created by deploying additional cones, signs, or upstream warning may outweigh the safety benefit, particularly when the SSP vehicle's lighting, positioning, arrow board, or message board provides sufficient warning for the expected duration of the activity. In these situations, additional upstream warning may not be warranted because it may add unnecessary operator exposure without substantially improving scene safety.

However, the need for upstream warning increases when the risk shifts from the immediate service activity to approaching traffic or the back of the queue. Advance warning becomes more important when queues are forming, sight distance is limited, traffic speeds are high, visibility is poor, the incident blocks or encroaches on a travel lane, or the incident is expected to last longer than a brief service stop. Upstream warning can be provided through a second SSP unit, a vehicle staged near the back of the queue, portable signs, permanent dynamic message signs (DMS), TMC messaging, navigation-app integration, or responder-to-vehicle alerts.

TDOT/HELP described its Protect the Queue practice as a major element of incident response. Under this approach, a responding unit or another available responder may be positioned upstream or near the back of the queue to warn approaching traffic. This is particularly important at night, during high-speed conditions, or when a closure or major incident creates an unexpected queue. TDOT also uses emergency scene-ahead signs and digital traveler information tools to support upstream warning.

GDOT/HERO also provides examples of upstream warning through its SOP and field practices. For incidents that require advance warning, the HERO vehicle message board may be used to display an advance-warning message, and operators staged upstream may relocate farther back if the queue approaches their location. The TMC may also support the response through camera monitoring and upstream CMS when available.

CTDOT/CHAMP uses incident-ahead signs for extended incidents and coordinates with the operations center when incidents are expected to last longer or involve ramps or side roads. This approach recognizes that SSPs may not be able to provide all necessary TTC at the immediate scene and that upstream warning may need to be coordinated with the TMC, law enforcement, or maintenance forces.

The transferable practice is to include upstream warning as a scalable response option that is based on the relative risk of the incident, the expected duration, queue conditions, and the operator exposure required to deploy additional devices. For a very short shoulder assist, vehicle-mounted warning may be sufficient. For a lane-blocking, longer-duration, low-visibility, or queue-forming incident, agencies should consider whether the greater risk is at the incident scene or at the back of the queue. SSP-specific TTC guidance should help operators and TMCs decide when vehicle-mounted warning is sufficient, when to protect the queue, when to place advance warning, and when to request additional resources because additional TTC would be beneficial but unsafe for a single SSP operator to deploy.

Use Sequential Lighting, Digital Flares, and Enhanced Lighting to Improve Visibility

Digital flares, sequential lighting, and enhanced responder or vehicle lighting were identified as promising supplemental tools. These devices may be especially useful at night, during low-visibility conditions, or when an agency needs to improve the conspicuity of a taper or incident scene without deploying a larger work-zone-style setup.

TDOT/HELP identified Pi-Lit type sequential lighting as a particularly useful and cost-effective tool. Sequential cone lighting can make a cone taper more visible and can provide a directional

visual cue to approaching motorists. TDOT noted that these devices may be especially valuable at night because they can make the cones more visible and can help the taper appear more organized and intentional. TDOT also described these devices as a strong "best bang for the buck" measure because the purchase cost is relatively modest compared with larger vehicle systems, and the operational benefit can be high for night or extended lane-blocking incidents.

NCDOT/IMAP's technology materials identify smart lighting for both responders and vehicles. Responder lighting, such as Guardian Angel personal warning lights, improves the visibility of operators working outside the vehicle. Vehicle smart lighting synchronizes warning lights across multiple responder vehicles to provide a coordinated and more recognizable warning to approaching motorists. Together, these technologies can enhance responder visibility and improve motorist awareness of incident response activities, particularly in high-traffic or limited-visibility conditions.

The transferable practice is to use supplemental lighting where it solves a specific field problem. Sequential lighting may be most useful when cones are already being deployed and the agency wants to improve taper visibility. Personal responder lighting may be most useful when operators are working on foot near traffic. Synchronized vehicle warning lights may be most useful when multiple responder vehicles are operating at the same incident and coordinated lighting can improve motorist awareness. Agencies should avoid treating lighting as a stand-alone solution and should instead integrate lighting into guidance for vehicle positioning, cone deployment, arrow/message use, and incident duration.

Improve Situational Awareness Through Cameras, AVL, ATMS, and TMC Integration

Situational awareness is critical for SSP TTC decision-making. Operators see the scene from the field, while the TMC may see upstream traffic, queues, approaching responders, or hazards that the operator cannot see from the vehicle. Advanced technology can improve this shared picture and help agencies make better deployment and escalation decisions.

NCDOT/IMAP provided a strong example of technology integration. NCDOT identified tablets with ATMS access, vehicle-mounted CCTV cameras, smartphones, tethered drones, full matrix CMS, connectivity, responder smart lighting, and vehicle smart lighting as technologies that support incident management and emergency traffic control. Tablets can provide mobile access to ATMS, support real-time information sharing, and improve coordination with the TMC. Vehicle-mounted CCTV and tethered drones can provide additional views in areas where fixed camera coverage is limited.

TDOT/HELP also highlighted the value of cameras, AVL, and TMC integration. TDOT vehicles use systems such as HAAS Alert and Samsara, which support vehicle location, motorist alerting, camera feeds, and vehicle diagnostics. TDOT also described the value of tethered drones for incidents or events where continuous overhead situational awareness is needed, particularly in areas with limited fixed camera coverage.

These tools are valuable because they help close the information gap between the field and the TMC. They can help determine whether queues are forming, whether a responder is positioned safely, whether additional warning is needed, and whether an incident is escalating. They may also support after-action review and training by allowing supervisors to evaluate real incidents and identify lessons learned.

The transferable practice is to treat situational-awareness technology as part of TTC decision support. Cameras, AVL, tablets, and ATMS access do not directly channelize traffic, but they can help agencies make better decisions about when and where TTC is needed. Agencies should consider how field and TMC information will be shared, who is responsible for monitoring

technology, how operators will use the information, and how privacy, data storage, and maintenance issues will be managed.

Treat Quick Clearance as an Operational TTC Strategy

A major cross-cutting finding is that quick clearance can function as an operational TTC strategy. In many minor incidents, the safest outcome is not to expand TTC but to remove the hazard, relocate the vehicle, or clear the lane as quickly as practical. This is especially true when the incident can be moved safely and when a longer scene would expose operators, motorists, and other responders to unnecessary risk.

NCDOT/IMAP provided an important example of using interagency agreements to support quick clearance in the field. NCDOT described a process of developing memoranda of understanding with law enforcement agencies along IMAP routes. These MOUs identify North Carolina's quick clearance authority and are signed by the head of each law enforcement agency. Copies are printed and retained by IMAP operators so they can be referenced at the scene when a vehicle needs to be removed, including situations where the vehicle owner does not consent to the removal. NCDOT indicated that this process has helped ensure that officers on scene understand and support the use of quick clearance authority, which has substantially reduced the time between determining that push, pull, or drag is appropriate and receiving support to proceed. NCDOT noted that developing and maintaining these MOUs requires dedicated support from internal staff and a high level of inter-agency cooperation. NCDOT reported that this investment has increased the use of authority-based vehicle removal, reduced exposure for SSP operators and other responders, and improved clearance times.

CTDOT/CHAMP also emphasized moving vehicles out of the roadway when possible. The CTDOT interview described push, pull, or drag as an early option for lane-blocking incidents when the vehicle can be moved safely. This reflects a practical understanding that the safest TTC decision may be to eliminate the need for TTC by clearing the hazard.

The transferable practice is to include quick clearance in SSP TTC guidance. Guidance should not treat TTC deployment and quick clearance as competing objectives. Instead, operators should be trained to determine whether the incident can be safely cleared before a larger TTC setup is needed. When safe and authorized, quick clearance can reduce exposure time, prevent queue growth, reduce secondary crash potential, and limit the need for broader TTC escalation.

Balance Effectiveness, Cost, Maintenance, and Ease of Deployment

The case studies showed that agencies should distinguish between the most effective TTC measure and the best value measure. The most effective tool may be more expensive, more complex, or more difficult to maintain, while the best value tool may provide a meaningful benefit at lower cost and with fewer implementation barriers.

TDOT/HELP provided a useful example of this distinction. TDOT viewed high-performance truck-mounted message boards as highly effective because they improve motorist understanding and vehicle conspicuity across a wide range of conditions. However, TDOT also identified Pi-Lit/PILITS-type sequential lighting as a strong value because it is relatively inexpensive, useful for nighttime visibility, and easy to deploy as part of a cone taper. Tethered drones may provide substantial situational-awareness benefits, but they are more expensive and may be better suited for selected regions or incident types rather than universal deployment.

NCDOT/IMAP's technology approach also illustrates the need to consider lifecycle and integration issues. Tablets, ATMS access, cameras, drones, smart lighting, and connectivity can improve operations, but they also require data service, maintenance, training, device management, cybersecurity review, replacement planning, and integration with existing systems. A device that works well in a pilot may require additional support before it can be scaled statewide.

The transferable practice is to evaluate technologies using both operational and practical criteria. Agencies should consider the field problem the device solves, how often it will be used, how easily operators can deploy it, whether it improves safety or operations, how much training it requires, whether it depends on subscriptions or connectivity, how it will be maintained, and whether it can be integrated into existing policies. The most promising technologies are those that solve a clearly defined problem and can be sustained over time.

3.1.4. SSP Operator Training for Incident-Scene Traffic Control

The case studies reinforced that written guidance alone is not sufficient for SSP incident-scene traffic control. SSP operators work in dynamic environments where incidents rarely match standard diagrams. Operators must understand the purpose of TTC, recognize hazards, choose appropriate devices, position the vehicle, communicate with the TMC or dispatch center, coordinate with other responders, and decide when not to deploy devices because doing so would increase exposure.

Training is therefore a central component of SSP TTC practice. The strongest training models do not simply teach operators to follow a standard layout. They use staged onboarding, supervised field exposure, equipment familiarization, scenario-based learning, and supervisor sign-off to prepare operators to make safe decisions under changing field conditions. Across the agencies reviewed, the most transferable practices were those that established clear release benchmarks, required operators to demonstrate competency in the field, and reinforced training after the operator began working independently.

Training Timelines and Release Benchmarks

The agencies reviewed use different training timelines, but each relies on a staged progression before an operator is released to work independently. This progression generally includes initial classroom or orientation training, vehicle and equipment familiarization, supervised field exposure, observed operation, and a final release decision by a supervisor, field training officer, or statewide trainer. The timeline varies by agency, but the common principle is that operators are not released solely because a fixed amount of time has passed. They are released after demonstrating that they can safely perform the work.

NCDOT/IMAP uses the most formalized training sequence identified in the case studies. New IMAP responders attend a centralized four-week training program in Raleigh. The first week is primarily classroom-based and includes exposure to the telecommunications function so responders understand how dispatchers and TMC staff support field operations. The following three weeks are conducted on the TIM training track and emphasize hands-on practice. This includes tire changes, vehicle and equipment use, emergency traffic control, lane closures, traffic control on curves, hills, and barrier-constrained locations, defensive driving, skid pad training, fire response, and other situations responders may encounter in the field. NCDOT described the training model as a learn-demonstrate-do process: responders are taught the practice, shown how it should be performed, and then required to demonstrate the skill themselves.

After the centralized training, NCDOT responders return to their region and work with field training personnel. This field training period may last approximately one to two weeks or longer, depending on the trainee's readiness. After that period, the responder may begin limited independent field work. However, the release process does not end there. After approximately one to three months of field operation, a statewide trainer conducts a three-day ride-along evaluation to determine whether the responder is following IMAP rules, procedures, and traffic-control expectations. If the responder does not demonstrate the required competency, they may be sent back through additional training. If they pass, they receive certification. The NCDOT process therefore includes both an initial release point and a later certification benchmark after the responder has demonstrated performance in actual field conditions.

GDOT/HERO also uses a staged progression, although the timeline is more dependent on the trainee's development. New candidates first complete background checks, physical assessments, and medical screening. They then receive an orientation that provides a realistic overview of the job and its risks. Candidates who continue through the process are issued basic training equipment and begin classroom instruction. This instruction includes topics such as SOPs, liability, program history, operator roles and responsibilities, roadway jurisdiction, expressway features, vehicle equipment, tools, protocols, scene assessment, and the expectations of working on the interstate system.

GDOT then gradually integrates trainees into vehicle and field operations. Ride-alongs typically begin around the third week as a familiarization activity. As the trainee progresses, they begin building trucks, which requires them to place tools and equipment into the correct compartments according to the vehicle configuration. This functions as an equipment competency benchmark because the trainee must learn what equipment is carried, where it belongs, and how to access it. The trainee then moves into the passenger seat with a senior operator, observes field operations, begins assisting with equipment retrieval and scene support, and eventually takes over radio traffic. Radio operation serves as another benchmark because the trainee must understand dispatch procedures, TMC communication, route knowledge, incident codes, and how to respond to calls. Only after demonstrating these abilities does the trainee move into the driver's seat while still accompanied by a seasoned operator.

GDOT releases operators only after they demonstrate smooth, consistent performance in the field. The trainee must show that they can handle calls, navigate the route, communicate with the TMC, operate the vehicle, assess scenes, use equipment, and respond appropriately to changing incident conditions. Before release, a supervisor or assistant commander rides with the trainee for approximately two or three days to verify that the trainee performs as reported by the training paperwork and field training feedback. GDOT described the overall training-to-release period as typically about one to two months, although the timeline varies by operator readiness, experience, and other requirements such as CDL completion.

TDOT/HELP uses an extended on-the-job training model. New operators first complete onboarding and a classroom or orientation component. This includes program history, program structure, incident types, expected timelines for minor incidents, safety hazards, and how HELP fits within the broader traffic operations, incident management, and TSMO program. TDOT indicated that this classroom component is smaller than the field component, but it provides the structure needed before the trainee enters roadway operations.

After the initial orientation, TDOT trainees ride as passengers with experienced operators for approximately three weeks to one month. Because operators rotate routes weekly, the trainee is exposed to multiple routes, different operators, and different operating styles. The intent is not simply to observe incidents, but to learn the roadway network, understand regional differences, build relationships with the team, and see how experienced operators make decisions under different conditions. Once the trainer and regional management believe the trainee is ready, the trainee transitions into the driver's seat while an experienced operator observes. TDOT indicated that this driving-under-observation phase commonly lasts another month or two, depending on how quickly the trainee develops.

TDOT uses progress sheets or checkout sheets to document exposure to specific incidents, tasks, and skills. These forms can include detailed scenario exposure, such as split-scene crashes, multi-vehicle crashes, vehicle relocation, cone deployment, and other field activities. During the later phase of training, the trainee is expected to run the call while the field training officer observes. The trainee must demonstrate that they can pull up on a scene, position the vehicle, deploy cones, change a tire or provide other service, relocate vehicles when appropriate, communicate with the TMC, and manage the incident safely. Once the field training officer

believes the trainee has completed the required checklist items and is ready to be evaluated, a supervisor conducts the final ride-along. TDOT described this final supervisor evaluation as lasting approximately one week or several days. The supervisor makes the final decision to release the operator to work independently. Under the traditional HELP model, the overall process averages approximately three to four months before the operator is fully released, although TDOT noted that recent contractor deployment demands have compressed some timelines during the statewide expansion.

Across the agencies, the transferable practice is not a single training duration, but the use of defined release benchmarks. Before working independently, operators should demonstrate that they can inspect and operate the vehicle, locate and use required equipment, communicate with the TMC or dispatch center, understand their patrol area, position the vehicle safely, deploy and retrieve cones when appropriate, use arrow boards or message boards, recognize when traffic control is unsafe to deploy, coordinate with other responders, support quick clearance, and make sound decisions under changing field conditions. Supervisor or field training officer sign-off provides an important final checkpoint, but that sign-off is strongest when it is supported by documented field exposure, skills checklists, and observed performance over time.

Decision-Based Field Training

A consistent finding across the case studies is that SSP operators must be trained to make decisions, not simply reproduce standard layouts. Minor incidents are highly variable. Shoulder width, traffic speed, curve alignment, sight distance, congestion, weather, lighting, motorist behavior, incident duration, and the presence of other responders can all change the appropriate response. A standard setup may provide a starting point, but operators must understand when to modify it, scale it down, scale it up, or request additional support.

GDOT/HERO's "time, speed, and space" framework provides a useful example of decision-based training. Operators are trained to consider whether the incident will take enough time to justify a traffic-control setup, whether traffic speed allows deployment to be performed safely, and whether there is enough physical space to establish the needed traffic control. This framework helps operators determine whether cones should be deployed, whether the vehicle and message board are sufficient, whether quick clearance is the better option, or whether the scene exceeds what one operator can safely manage.

CTDOT/CHAMP also emphasizes scene assessment before the operator exits the vehicle. CHAMP operators are expected to notify the operations center, conduct a windshield size-up, evaluate whether it is safe to exit, and adjust their actions based on traffic conditions and scene risk. When exiting the vehicle is unsafe, operators may use the vehicle's public address system to communicate with the motorist or provide instructions without adding unnecessary exposure. This reinforces the idea that TTC decisions begin before the operator leaves the vehicle.

TDOT/HELP similarly relies on operator judgment in the field. Operators may use cones, flares, Pi-Lit type devices, message boards, warning lights, or other tools depending on traffic speed, location, duration, visibility, and available space. TDOT provides guidance in its operations manual, but the case study discussion emphasized that each scene is different and that operators must decide which tool or combination of tools is appropriate for the conditions they are facing.

The transferable practice is to incorporate decision-making directly into TTC training. Operators should be trained to ask whether the incident can be cleared quickly, whether cones would reduce risk, whether cone deployment would add more exposure than benefit, whether traffic speed or sight distance makes deployment unsafe, whether vehicle-mounted warning is sufficient, whether upstream warning is needed, and whether another unit, law enforcement, or fire/EMS support is required. This decision-based approach is especially important for SSP operations because many

incidents are short-duration events managed by one operator with limited equipment and limited time.

Required Incident-Scene Traffic Control Competencies

The case studies show that written manuals, SOPs, and field training guides provide an important baseline, but release to independent patrol should be based on demonstrated competency. Operators need to know what the agency expects, but they also need to show that they can apply those expectations in the field. This requires training programs to identify the specific skills that operators must demonstrate before release.

At a minimum, operators should be able to inspect and prepare the vehicle, verify equipment readiness, locate and deploy required devices, communicate with the TMC or dispatch center, conduct a scene size-up, position the vehicle safely, activate appropriate warning devices, use arrow boards or message boards, deploy and retrieve cones when warranted, recognize when cones or other devices are unsafe to deploy, support quick clearance, coordinate with law enforcement and other responders, monitor upstream traffic and queues, and terminate the scene safely. These skills are interconnected and should be trained as part of an integrated incident response process rather than as isolated tasks.

NCDOT/IMAP's field training guide provides a strong example of integrated competency development. The guide includes modules on vehicle positioning, emergency traffic control, temporary lane closures, rolling roadblocks, motorist cooperation, hills and curves, center-lane closures, ramps, queue management, push/pull/drag operations, debris removal, vehicle fires, hazardous materials, adverse weather, and other operational conditions. This structure recognizes that an operator may need to move from traffic control to vehicle relocation to queue management during the same incident.

TDOT/HELP also emphasizes integrated competencies. HELP operators may provide initial traffic control, support other responders, assist with quick clearance, operate vehicle-mounted warning systems, use cones or flares, and coordinate with the TMC. TDOT's manual and field training process address incident levels, vehicle positioning, emergency equipment use, communications, incident clearance, response equipment, and equipment readiness. TDOT also emphasized that the truck functions as the operator's mobile work environment, making inventory and readiness part of safe field performance.

GDOT/HERO provides detailed traffic-control typical applications and emphasizes coordination with the TMC and other HERO operators. The SOP establishes baseline expectations, while the field training process teaches operators to adjust those expectations to actual conditions. GDOT's use of truck-building, radio training, ride-alongs, and supervisor verification supports competency in both equipment use and operational decision-making.

The transferable practice is to define release requirements as demonstrated competencies rather than only classroom completion or minimum time in training. Operators should be released when they can apply TTC, quick clearance, vehicle positioning, communications, and responder coordination skills under realistic field conditions. This approach gives agencies a clearer basis for release decisions and helps ensure that operators are prepared for the varied conditions they will encounter during independent patrol.

Refresher Training, Oversight, and Continuous Improvement

Operator release is not the end of training. SSP operators continue to learn through field experience, but agencies also need formal mechanisms to reinforce good practices, correct unsafe habits, introduce new equipment, and communicate policy changes. Refresher training, recertification, in-service training, field checks, supervisor ride-alongs, camera review, after-action discussions, and safety briefings can all support consistency over time.

NCDOT/IMAP requires recurring recertification and continuing training. This helps maintain statewide consistency and ensures that operators revisit key skills after gaining field experience. Recertification also provides a mechanism for updating operators on changes in procedures, equipment, or expectations. NCDOT also described field auditing and trainer ride-alongs as ways to observe whether operators are applying the program's rules and traffic-control expectations in the field.

TDOT/HELP described the development of statewide in-service training so that operators across all regions receive consistent information. TDOT also emphasized equipment readiness, truck inventory, checklists, and accountability. This reinforces the idea that training is not limited to traffic-control layouts or emergency response tactics; it also includes the daily habits that make operators ready to respond safely.

CTDOT/CHAMP described recurring training and review as a way to maintain consistency across operators. The agency brings operators back for refresher discussions, reviews SOP issues, addresses recurring problems, and uses examples of good practice to reinforce desired behavior. This approach is practical because it uses actual operations and observed behavior to support continuous improvement.

GDOT/HERO also uses continuing education and specialized training to reinforce operator capability. Annual and recurring training topics include emergency medical response, hazardous materials, TIM-related activities, and specialized program responsibilities. These continuing education activities help maintain operator readiness and support the broader role HERO operators play at incident scenes.

The transferable practice is to create a feedback loop between field experience and training. Agencies should use refresher training to reinforce core TTC principles, discuss near misses or challenging incidents, introduce new devices, and update procedures. Supervisors should have a role in observing field practice and providing feedback before unsafe habits become normalized. When supported by documentation, field observation, and periodic retraining, this feedback loop can improve consistency and keep training aligned with actual roadway conditions.

3.2. Case Study Findings and Guidance Implications

The Task 2 case studies show that practical SSP temporary traffic control guidance should be organized around field decisions rather than fixed layouts alone. SSP operators must determine whether an incident can be cleared quickly, whether TTC devices would provide a meaningful safety benefit, whether those devices can be deployed safely, and whether additional support is needed. Across the case studies, the most transferable practices were those that supported clear decision-making while preserving operator judgment for short-duration, high-speed, and space-constrained incident scenes.

For cone deployment, the case studies support a warrant-based framework. Cone deployment should be considered when an incident blocks or encroaches into a travel lane, when the expected scene duration is long enough for cones to provide a meaningful benefit, when responders or motorists will be on foot near traffic, when sight distance or visibility is limited, or when the work area needs to be defined or expanded. However, meeting a cone deployment warrant should not automatically require cone deployment. Operators must also consider whether cones can be deployed and retrieved safely under the specific field conditions. SSP-specific TTC guidance should therefore recognize situations where cones are warranted, situations where cones may add more exposure than benefit, and situations where cones may be warranted in principle but unsafe for a single operator to deploy without additional support.

The case studies also show that safe cone deployment depends on more than the warrant decision. When cones are used, they should be deployed and retrieved using a consistent

sequence that minimizes walking in live traffic, keeps the operator oriented toward approaching vehicles, and coordinates cone placement with vehicle positioning, arrow boards, message boards, warning lights, and other devices. Cone quantity, storage, and accessibility also affect field performance. Cones are more likely to be used consistently and safely when they are easy to access, can be deployed from a protected position, and are integrated into the vehicle design and operating procedure.

For advanced TTC technologies and operational strategies, the case studies show that the SSP vehicle itself is the first TTC layer. Vehicle-mounted warning lights, arrow boards, message boards, and other onboard devices provide immediate warning before the operator exits the vehicle or deploys additional devices. For longer-duration incidents, lane-blocking events, limited sight distance, nighttime conditions, or queue formation, upstream warning and queue protection may become equally or more important than additional devices at the immediate scene. Supplemental tools such as digital flares, sequential lighting, enhanced responder lighting, cameras, AVL, ATMS access, drones, and TMC integration can improve visibility and situational awareness when they solve a defined operational problem and can be sustained through training, maintenance, funding, and agency procedures.

The case studies also support treating quick clearance as an operational TTC strategy. In many SSP responses, the safest way to reduce exposure is to remove the hazard, relocate the vehicle, or clear the lane before a larger TTC setup becomes necessary. Interagency agreements, clear quick clearance authority, push/pull/drag training, and coordination with law enforcement can reduce delays at the scene and support faster removal of vehicles and hazards. This reinforces that TTC deployment and quick clearance should not be treated as competing actions. Instead, operators should be trained to determine whether the safest TTC strategy is to deploy additional devices, provide upstream warning, request support, or clear the incident quickly.

For operator training, the case studies show that agencies should not rely on written guidance alone. Effective training uses staged onboarding, field exposure, equipment familiarization, ride-alongs, scenario-based learning, and supervisor or trainer sign-off before independent patrol. The specific timeline varies by agency, but the common transferable practice is the use of release benchmarks based on demonstrated competency. Operators should be able to inspect and operate the vehicle, locate and use required equipment, communicate with the TMC or dispatch center, assess scene conditions, position the vehicle safely, deploy and retrieve cones when appropriate, recognize when deployment is unsafe, use warning and messaging devices, support quick clearance, coordinate with other responders, and make sound decisions under changing field conditions.

Overall, the Task 2 case studies support development of SSP-specific TTC guidance that is scalable, practical, and decision-based. The guidance should recognize the unique operating environment of SSP programs, including short-duration incidents, limited staffing, variable roadway conditions, and the need for rapid clearance. It should provide operators with clear decision criteria, practical examples, and safe alternatives when a standard deployment is not appropriate. It should also support agency-level decisions related to equipment, vehicle design, training, technology investment, and coordination with TMCs and other responders.

These findings inform the MUTCD consistency review presented in Chapter 4 and support the development of practical SSP-specific TTC guidance. The case study results identify the types of content that guidance should include, such as cone deployment warrants, safe deployment and retrieval practices, examples of low-risk and high-risk scenarios, upstream warning

considerations, quick clearance decision points, technology selection considerations, and training benchmarks for operator release.

4. MUTCD Consistency Review of Common SSP Temporary Traffic Control Practices

Building on the Task 1 synthesis and Task 2 case study findings, this chapter reviews commonly reported SSP TTC devices, techniques, strategies, and operational approaches in relation to the Manual on Uniform Traffic Control Devices (MUTCD). The purpose of this review is not to evaluate every agency practice individually, but to identify where commonly reported SSP practices appear consistent with the MUTCD and where certain applications may require additional attention, clarification, or risk mitigation.

The MUTCD provides the national standard for traffic control devices on public roadways. For this review, the most relevant provisions are located in Part 6, which addresses temporary traffic control, and Chapter 6O, which addresses traffic control for traffic incident management areas. Other relevant MUTCD provisions include those related to short-duration activities, channelizing devices, arrow boards, changeable message signs, emergency-vehicle lighting, and the use of traffic control devices in temporary conditions.

The MUTCD recognizes that traffic incidents differ from planned work zones because they are unexpected, variable, and often require immediate field decisions. Minor incidents and short-duration service calls are especially important for SSP operations because they often involve disabled vehicles, minor crashes, debris, or other short-term hazards that must be addressed quickly. In these situations, the time required to deploy and remove TTC devices may be substantial relative to the total incident duration, and the act of deploying devices can create additional exposure for the responder. As a result, SSP operators often rely on a combination of vehicle positioning, warning lights, vehicle-mounted message boards, cones, arrow boards, quick clearance, and field judgment to manage the scene until the incident is resolved or additional support arrives.

This context is central to the Chapter 4 review. The MUTCD provides the governing framework for traffic control device use, but SSP minor-incident response often occurs in conditions where full temporary traffic control layouts are not practical or necessary. The review therefore focuses on how commonly reported SSP practices align with relevant MUTCD provisions and where SSP-specific implementation issues may benefit from clarification.

This chapter provides a screening-level review of commonly reported temporary traffic control devices, techniques, strategies, and operational approaches used by Safety Service Patrol programs during minor incidents and short-duration service calls. The review is based on available survey responses, case study interviews, and supporting materials, which varied in level of detail, format, and completeness across agencies. As a result, this chapter does not provide a legal opinion, formal compliance determination, or certification of any individual state or agency practice. Instead, the review identifies areas where commonly reported SSP practices appear consistent with the MUTCD, as well as areas where implementation may warrant additional attention, clarification, or risk mitigation.

Rather than attempting a state-by-state compliance determination, the review is organized by TTC device, technique, strategy, or operational approach. For each item, the report identifies relevant MUTCD provisions, summarizes how those provisions relate to SSP minor-incident operations, identifies potential areas of concern, and discusses practices that may help reduce implementation risk.

Section 4.1 presents the MUTCD consistency review for commonly reported SSP TTC devices, techniques, strategies, and operational approaches. Section 4.2 identifies potential MUTCD

clarification or revision topics that could better address SSP minor-incident response. Section 4.3 summarizes the review findings and guidance implications.

4.1. Screening-Level MUTCD Consistency Review by Device and Strategy

This section reviews commonly reported Safety Service Patrol temporary traffic control devices, techniques, strategies, and operational approaches in relation to relevant provisions of the Manual on Uniform Traffic Control Devices. The purpose of this review is to identify potential areas of MUTCD consistency, uncertainty, or implementation risk for devices and practices used during minor incidents and short-duration service calls. The review is not intended to provide a legal opinion, formal compliance determination, or certification of any individual state or agency practice.

The review uses three screening-level risk categories. A low-risk item is a device, strategy, or operational approach that appears generally consistent with MUTCD provisions when used as described and implemented through appropriate agency procedures. A medium-risk item is a device, strategy, or operational approach that may be consistent with the MUTCD in some applications but could create concern depending on message content, field placement, operating mode, duration, or whether the device is being used as a substitute for another required traffic control device. A high-risk item is a device, strategy, or operational approach that appears to conflict with a clear MUTCD limitation or that may require agency review, interpretation, experimentation, or modification before being used as a traffic control device or traffic control application.

Several MUTCD provisions are particularly important for SSP minor-incident response. Chapter 6O addresses traffic control through traffic incident management areas. Section 6O.04 recognizes that minor traffic incidents typically involve disabled vehicles or minor crashes with lane closures of less than 30 minutes. It also recognizes that traffic diversion is often not needed or is needed only briefly, and that it is generally not possible or practical to set up a full lane closure with traffic control devices for a minor traffic incident. Section 6O.04 further states that when a minor traffic incident blocks a travel lane, the vehicles involved should be moved from the blocked lane to the shoulder as quickly as possible. This language is central to SSP operations because many SSP activities are intended to reduce exposure by resolving or relocating incidents quickly rather than maintaining a long-duration temporary traffic control setup.

Section 6O.05 is also important because it addresses emergency-vehicle lighting. The MUTCD recognizes that emergency-vehicle lighting is essential, especially during the initial stages of an incident, but it also states that emergency-vehicle lighting provides warning only and provides no effective traffic control. This distinction is important for SSPs because many minor incidents begin with vehicle positioning, emergency lighting, and vehicle-mounted warning displays before cones or other channelizing devices are deployed. For purposes of this review, emergency lighting alone is treated as warning, while emergency lighting combined with message boards, arrow boards, cones, or other devices may function as part of an initial TTC strategy depending on how those devices are used.

Other relevant MUTCD provisions include Chapter 6K on channelizing devices, Chapter 6L on other TTC zone devices such as portable changeable message signs, arrow boards, flashing beacons, and warning lights, Chapter 6N on types of TTC zone activities and work duration, and Chapter 6P on typical applications. Chapter 6P is especially relevant because it recognizes that typical applications do not address every field condition and that TTC plans may be adapted to site conditions. This does not eliminate the need for MUTCD consistency, but it supports the

general principle that minor incidents and short-duration service calls may require scalable traffic control strategies rather than full work-zone-style layouts.

4.1.1. Cones and Channelizing Devices

Cones are one of the most commonly reported SSP TTC devices. Survey responses and case study materials indicate that agencies use cones to define the work area, guide traffic around a disabled vehicle or incident, provide a buffer between approaching traffic and the activity area, and support lane-blocking or lane-encroaching incidents. Agencies also reported that cone deployment decisions are influenced by incident type, lane blockage, roadway speed, traffic volume, shoulder width, sight distance, expected duration, weather, time of day, and whether the operator or motorist will be on foot near traffic.

The primary MUTCD provisions related to cones are located in Chapter 6K, including Section 6K.03, which addresses cones as channelizing devices. Cones are standard TTC devices and are generally a low-risk practice when used to channelize road users, define a work area, or supplement an incident scene in a manner consistent with MUTCD principles. The MUTCD also recognizes through Section 6O.04 that minor traffic incidents often cannot support a full lane-closure setup and through Chapter 6P that TTC applications may be adapted to field conditions. This supports the concept of scalable cone deployment for minor incidents, provided that the deployment is appropriate for the incident conditions and does not create a greater hazard for the operator.

The most important implementation issue is taper length and device spacing for short-duration incidents. Several SSP programs carry a limited number of cones, and a single operator may not be able to safely deploy a full work-zone-style taper during a minor incident. The MUTCD provides some flexibility for traffic incident response by allowing responders to use the TTC devices that are on hand for the initial response, provided those devices do not create unnecessary additional hazards. This language is important for SSP operations because minor incidents often require an immediate response using the devices available on the SSP vehicle rather than a full work-zone deployment.

In those cases, the MUTCD risk is generally low to medium. It is low when cones are used as a short-duration, initial, or supplemental channelizing treatment for a minor incident where full diversion is not required and where the cone pattern improves visibility or defines the work area without creating additional exposure. It becomes medium when a shortened cone pattern is used to function as a lane closure, especially on high-speed facilities, without adequate advance warning, vehicle positioning, additional support, or escalation procedures. The practical distinction is that using the devices on hand for initial incident response is supported by the MUTCD, but those devices still need to be applied in a way that is appropriate for the incident conditions and does not create a new hazard.

A related issue is the use of lights on or inside cones. Cone-mounted lights, internally illuminated cones, or Pi-Lit-style devices placed within cones can improve cone visibility, especially at night or during low-visibility conditions. When these devices are used to make standard cones more visible as part of the initial response, the MUTCD risk is generally low. The risk increases to medium if the lighting pattern is used to communicate a directional traffic control message or to substitute for a required taper, arrow board, or other TTC device. The distinction is important: lighting that improves visibility of a channelizing device is different from lighting that attempts to direct traffic in a way that may need to be evaluated as a traffic control device or traffic control application.

Risk mitigation practices include using cones based on defined warrants, training operators to avoid unnecessary exposure, establishing minimum and scalable cone deployment patterns for

common minor-incident scenarios, and requiring escalation when the scene requires more TTC than a single operator can safely deploy. Agencies should also distinguish between cone visibility enhancements and directional or sequential displays that may communicate an independent traffic control message. Where shortened tapers or reduced cone quantities are used, the practice should be described as an initial minor-incident treatment and paired with procedures for requesting additional support when the incident duration, traffic conditions, lane blockage, or queueing condition increases.

4.1.2. Flares, Light Sticks, Digital Flares, and Sequential Lighting

Flares, light sticks, digital flares, and Pi-Lit-style sequential lighting systems were identified in the survey and case study materials as supplemental warning and visibility devices. These devices are commonly used to improve conspicuity, mark an incident scene, supplement cones, or provide additional warning under nighttime or low-visibility conditions. They are especially attractive for SSP operations because they can often be deployed more quickly than larger traffic control devices and may be easier for a single operator to carry and place.

Relevant MUTCD provisions include Chapter 6L, which addresses other TTC zone devices, including flashing beacons and warning lights, and Chapter 6O, which addresses traffic incident management areas. These devices should generally be viewed as warning or supplemental visibility devices rather than complete traffic control systems. Section 6O.05 is relevant because it distinguishes warning from effective traffic control. Although that section specifically addresses emergency-vehicle lighting, the same concept is useful for evaluating flares and digital warning devices: they can warn road users and increase visibility, but they do not automatically create an adequate lane closure or channelization pattern.

The MUTCD risk for conventional flares and light sticks used as warning devices is generally low. The risk for digital flares and Pi-Lit-style devices is low to medium, depending on how they are used. If digital flares are used to supplement cones, improve visibility, or provide initial warning while additional TTC is established, the risk is generally low. If sequential lighting is used to create a directional pattern, imply a lane shift, or function as a substitute for an arrow board, taper, or approved channelizing layout, the risk becomes medium and may require additional agency review.

To reduce risk, agencies should define these devices as supplemental warning or visibility tools unless they have been reviewed and approved for a more formal traffic control function. Sequential lighting should be coordinated with the cone deployment pattern and should not create a confusing or conflicting message. Agencies should also specify acceptable colors, flash patterns, spacing, and use conditions, especially where devices are used at night or in combination with vehicle-mounted displays. When used with cones, this section should not be read as a separate substitute for the cone guidance discussed in Section 4.1.1; rather, flares and digital lighting devices should enhance the visibility of the channelizing treatment already selected for the incident.

4.1.3. Vehicle Positioning and Initial Scene Protection

Vehicle positioning is one of the most important operational practices used by SSP operators during minor incidents. Survey responses, case study discussions, and agency materials indicate that SSP vehicles are often used as the initial warning platform at a scene. Vehicle positioning may include stopping behind a disabled vehicle, positioning upstream of a lane-blocking incident, remaining on the shoulder during a motorist assist, or establishing an early-warning position farther upstream when the incident requires additional visibility or support.

Vehicle positioning is not governed by a single MUTCD section in the same way as cones or arrow boards. However, it is closely related to Chapter 6O on traffic incident management, Section

6O.05 on emergency-vehicle lighting, and the general MUTCD principles for warning road users and managing temporary conditions. The MUTCD recognizes that incident scenes are variable and that on-scene responders are responsible for traffic control at minor incidents. It also recognizes that emergency lighting is important for warning but does not by itself provide effective traffic control.

The MUTCD consistency risk for vehicle positioning is generally low when the SSP vehicle is used as an initial warning platform and when the positioning supports quick clearance, motorist assistance, or safe deployment of additional TTC devices. The risk becomes medium when the vehicle is used in a way that could be interpreted as substituting for a full lane closure or when the vehicle is positioned in active traffic without adequate warning, protection, or escalation. The risk is primarily operational rather than a direct MUTCD device issue, but the consequences can be significant because the vehicle may be the first and most visible element approaching motorists encounter.

A key distinction is whether the SSP vehicle is being used for warning, for service, or as a physical blocking or protection vehicle. Many SSP vehicles are not designed as protection vehicles. If an agency uses a vehicle to block or protect an activity area, it should ensure that the practice is supported by agency policy, operator training, appropriate vehicle equipment, and procedures for requesting additional support when needed. Vehicle-mounted lighting, message boards, and arrow boards should be used in a way that supports the positioning strategy without sending conflicting messages.

Risk mitigation practices include training operators on direct-service positioning, early-warning positioning, shoulder positioning, buffer space, wheel alignment, approach from the non-traffic side, and when not to exit the vehicle. Agencies should also distinguish between vehicle positioning for warning and vehicle positioning for physical protection. Where the vehicle is positioned in or near active traffic, operators should have clear escalation procedures for requesting law enforcement, a second SSP unit, a shadow vehicle, a truck-mounted attenuator, or maintenance support.

4.1.4. Vehicle-Mounted CMS, Message Boards, Arrow Boards, and Portable CMS

Vehicle-mounted changeable message signs, truck-mounted message boards, flashing arrow panels, arrow boards, and portable changeable message signs are among the most important and most complex devices used in SSP minor-incident response. Survey responses and case study materials indicate that agencies use these devices to warn approaching drivers, identify incidents, support lane-blocking conditions, provide shoulder warnings, display Move Over or Slow Down messages, and communicate information to approaching traffic before cones or other devices are deployed.

The MUTCD treats changeable message signs and arrow boards differently, and this distinction is central to the review. Portable changeable message signs are addressed in Section 6L.05. That section supports the use of portable changeable message signs for incident management, unexpected situations, lane or roadway closures, queueing, delays, and other temporary traffic control purposes. It also recognizes the use of changeable message signs on service patrol trucks and other incident response vehicles, including provisions for smaller letter heights where appropriate. Based on these provisions, the use of vehicle-mounted CMS or message boards for incident warning, shoulder incident messages, lane-blocking messages, and short-duration SSP service calls is generally low risk when the messages are clear, traffic-related, legible, agency-approved, and appropriate for the conditions.

Arrow boards are addressed separately in Section 6L.06. The key issue is that directional arrow or chevron displays are intended to indicate lane closures on multilane roadways. For shoulder work, blocking the shoulder, roadside work near the shoulder, or situations where only a caution advisory is appropriate, the MUTCD requires the arrow board to be used in caution mode. In practice, this is often described as four-corner lights, four dots, or an alternating diamond display. This creates an important distinction for SSP operations. If an SSP vehicle is blocking or protecting a travel lane, the use of a directional arrow or chevron display may be appropriate because traffic is being directed away from a lane closure. If the SSP vehicle is stopped on the shoulder and no travel lane is closed, a directional arrow display creates a higher MUTCD consistency risk because it may imply a lane closure or required merge where none exists.

This issue is especially important for shoulder incidents. Agencies may reasonably want to communicate to approaching drivers that they should move over or slow down when an SSP vehicle is stopped on the shoulder. However, the MUTCD risk differs depending on how that message is communicated. A text-based CMS or message-board display such as “SHOULDER INCIDENT,” “RESPONDER AHEAD,” “MOVE OVER,” or “SLOW DOWN” is generally lower risk if it is agency-approved and consistent with message principles. A directional arrow display used from the shoulder when no lane is closed is higher risk because the MUTCD limits directional arrow and chevron modes to lane closure applications and requires caution mode for shoulder-related conditions. The concern is not that a shoulder incident is unimportant; the concern is that the display mode may communicate a traffic control instruction that is not supported by the actual lane configuration.

The four-dot or caution-mode display also creates an operational concern. Several SSP operators and agencies have noted that a four-dot display may not provide a clear enough instruction to drivers approaching a shoulder incident, especially where responders are exposed or shoulder width is limited. This is a legitimate operational issue, but under the current MUTCD it is better treated as a topic for clarification, interpretation, research, or future revision rather than as a simple workaround. The current lower-risk workaround is to use caution mode for the arrow-board function while using a text CMS or message board to communicate the specific driver action.

Risk mitigation practices include separating message-board guidance from arrow-board direction, using directional arrows only when a travel lane is actually closed or being closed, using caution mode for shoulder incidents without a lane closure, and developing agency-approved message libraries for shoulder incidents, responder presence, blocked lanes, and minor incidents. Agencies should also avoid combining a directional arrow with a text message that could create conflicting instructions. If an agency believes shoulder incidents require a directional display due to responder exposure or Move Over expectations, the lower-risk path would be to pursue an official interpretation, approved experimentation, or a future MUTCD clarification rather than treating directional arrow use on the shoulder as a routine practice.

4.1.5. Permanent DMS and Network-Level Traveler Information

Permanent dynamic message signs are used by transportation management centers and roadway agencies to provide network-level warning and traveler information. For SSP minor incidents, permanent DMS can be used to warn approaching drivers of an incident ahead, lane blockage, queue, delay, shoulder activity, or responder presence. Unlike vehicle-mounted message boards, permanent DMS are typically controlled through agency or TMC procedures and are often part of a broader corridor management system.

Relevant MUTCD provisions include Chapter 2L, which addresses changeable message signs, and Part 6 provisions related to temporary traffic control, incident management, and motorist warning. The primary MUTCD issue is not whether DMS can be used for incidents; rather, it is whether the message content, timing, location, and priority are appropriate. DMS messages

should provide clear traffic operational, warning, regulatory, or guidance information and should not displace higher-priority safety or operational messages.

The MUTCD risk for permanent DMS used for incident warning or queue warning is generally low. The risk becomes medium when DMS are used for broad public-awareness messages, non-specific safety campaigns, or messages that are not tied to an immediate traffic condition, especially during periods when real-time traffic information may be more important. The risk also increases when a message is vague, too long, not actionable, or inconsistent with the actual roadway condition.

Risk mitigation practices include using agency-approved message libraries, prioritizing real-time safety and operational messages, coordinating messages through the TMC, and removing or updating messages promptly when the condition changes. For SSP minor incidents, permanent DMS are best used to support upstream warning, queue protection, and corridor-level situational awareness rather than to duplicate every message displayed on an SSP vehicle.

4.1.6. Upstream Warning and Queue Protection

Upstream warning and queue protection were identified in the survey and case study materials as important strategies for improving responder and motorist safety. These strategies may include placing a second SSP vehicle upstream, positioning a vehicle near the back of a queue, using a vehicle-mounted message board on the shoulder, deploying an emergency scene-ahead sign, activating permanent DMS, or coordinating with the TMC to warn approaching drivers through multiple channels.

The MUTCD strongly supports the general concept of advance warning for traffic incident management areas. Chapter 6O recognizes the importance of managing traffic approaching an incident scene, and Chapter 6P allows TTC applications to be adapted to field conditions. The key MUTCD principle is that road users should receive warning and guidance that allows them adequate time to respond to the condition ahead. This is especially important on freeways and high-speed roadways where queues can form quickly and where the back of queue may become a secondary crash risk.

The MUTCD risk for upstream warning and queue protection is generally low when the strategy uses standard warning devices, appropriate message signs, safe vehicle positioning, and agency-approved procedures. The risk becomes medium if an upstream warning vehicle is placed in a hazardous shoulder location, if its display sends a directional message that is not consistent with the roadway condition, or if the vehicle creates confusion by appearing to establish a lane closure when no lane closure exists.

Risk mitigation practices include using text-based warning messages, caution-mode displays where appropriate, safe shoulder positioning, coordination with the TMC, and escalation when a queue grows or becomes unstable. Agencies should define when an upstream warning vehicle is appropriate, how far upstream it should be placed, what messages or displays are approved, and when the operator should remain in the vehicle rather than deploying additional devices on foot. For extended or higher-risk incidents, upstream warning should be coordinated with incident command or the TMC so that warning coverage does not create gaps in scene management.

4.1.7. Navigation App and Responder-to-Vehicle Alerts

Navigation app alerts, HAAS-style digital alerts, Waze or Google integrations, connected-vehicle notifications, and responder-to-vehicle alerts were identified by several agencies as current or emerging tools. These systems can notify approaching drivers that an incident response vehicle is ahead, that a lane or shoulder is affected, or that drivers should use caution before they reach

the incident area. These tools are especially valuable because they can reach drivers before the incident scene is visible.

These systems are not addressed in the MUTCD in the same way as roadside signs, cones, arrow boards, or changeable message signs. In most SSP applications, they should be treated as supplemental traveler information rather than as replacements for required TTC devices. Their MUTCD risk is generally low when they provide supplemental warning and do not replace field devices needed for channelization, lane closure, or scene protection. The risk becomes medium if an agency relies on the alert as the primary or only traffic control measure, if the alert is inaccurate or stale, or if the message conflicts with field conditions.

Risk mitigation practices include treating navigation and responder-to-vehicle alerts as supplemental, establishing data quality and message expiration rules, coordinating alerts through the TMC or approved vendor systems, and verifying that alerts are updated when the incident clears. Agencies should also monitor false alerts, wrong-location alerts, wrong-direction alerts, and stale alerts because inaccurate information can reduce driver trust and create operational confusion.

4.1.8. Cameras, AVL, ATMS, Tablets, and Recording Systems

Cameras, automated vehicle location systems, advanced traffic management systems, tablets, dash cameras, and body cameras were identified as tools that support SSP operations. These technologies are generally used for situational awareness, dispatch, documentation, performance monitoring, incident verification, after-action review, and communication between field operators and the TMC. Some agencies also use cameras or tablets to improve reporting and to support decisions about escalation or additional TTC.

These tools are generally not traffic control devices under the MUTCD when they are used internally by the agency or operator. As a result, the MUTCD consistency risk is generally low. Their primary value is that they help operators and TMC staff understand the incident, identify queues, monitor traffic behavior, determine whether additional support is needed, and document what occurred. They can support better TTC decisions, but they do not themselves provide traffic control to approaching road users unless they are connected to traveler information systems or message displays.

The risk becomes medium only if these systems are used to communicate traffic control instructions directly to road users without appropriate message approval or if they distract the operator during driving or on-scene activities. For example, a tablet used for reporting is not a MUTCD concern, but requiring an operator to interact with a tablet while driving or while exposed near traffic could create an operational safety concern.

Risk mitigation practices include limiting operator interaction while the vehicle is moving, using TMC staff to support message posting and incident monitoring, defining approved workflows for tablets and ATMS entry, and using recordings for training and quality improvement rather than as a substitute for field supervision. These systems should be described as decision-support and documentation tools rather than as TTC devices.

4.1.9. Variable Speed Limits and Speed Management

Variable speed limits and speed-management strategies may be used to reduce approach speeds near incidents, queues, or congested corridors. In SSP operations, speed management is typically controlled by the roadway agency or TMC rather than by the individual SSP operator. Variable speed limits may be regulatory or advisory depending on state authority, sign design, and agency procedures.

The MUTCD risk for variable speed limits is medium because these systems involve regulatory or advisory speed displays and require clear authority, correct sign operation, and consistency with the actual roadway condition. If a variable speed limit is part of an approved agency traffic management system and is operated under established procedures, the MUTCD consistency risk can be low. If speed displays are changed informally, without proper authority, or in a way that conflicts with field conditions, the risk increases.

For minor incidents, variable speed limits are most defensible when they are used as a corridor-level speed-management tool during congestion, queue formation, reduced visibility, or lane blockage. They are less appropriate as an ad hoc substitute for incident-scene TTC. Speed management can support SSP response, but it does not replace the need for appropriate warning, channelization, vehicle positioning, or quick clearance at the incident scene.

Risk mitigation practices include using variable speed limits only through approved TMC or agency procedures, distinguishing between regulatory and advisory displays, documenting activation criteria, coordinating speed messages with DMS and incident alerts, and returning speeds to normal when conditions clear. Agencies should avoid having SSP operators independently set or request speed changes outside established protocols.

4.1.10. Quick Clearance, Vehicle Removal, and Debris Clearance

Quick clearance is one of the strongest MUTCD-supported SSP strategies for minor traffic incidents. Survey responses and case study materials indicate that SSP programs often emphasize moving disabled or crashed vehicles out of travel lanes, reducing time on scene, and limiting the duration of exposure for responders and motorists. In minor incident response, quick clearance is closely related to temporary traffic control because clearing the lane or removing the hazard may reduce the need for a longer-duration TTC setup.

Section 6O.04 directly supports this concept for minor traffic incidents. It states that when a minor traffic incident blocks a travel lane, the vehicles involved should be moved from the blocked lane to the shoulder as quickly as possible. This is important because it recognizes that, for many minor incidents, quickly relocating the vehicle or removing the obstruction may be more practical and effective than establishing a full lane-closure TTC layout. In this way, quick clearance functions as an operational traffic control strategy by reducing the duration of the hazard, restoring travel lanes, and limiting responder exposure.

Push, pull, or drag practices are one example of quick-clearance implementation. These practices may allow SSP operators, often in coordination with law enforcement or under agency policy, to relocate disabled or crashed vehicles from a travel lane to the shoulder or another safer location. The MUTCD consistency risk for this general approach is low because it supports the minor-incident objective of clearing blocked lanes quickly. However, the primary concerns are agency authority, liability, operator training, coordination with law enforcement, and the conditions under which a vehicle should or should not be moved. For example, push, pull, or drag actions may not be appropriate where there are injuries, fire, hazardous materials, major vehicle damage, uncertain vehicle stability, or insufficient traffic control support.

Debris clearance is also part of quick clearance. LaneBlade-style debris-removal systems are relevant in this context because they allow operators to remove debris from the roadway while remaining inside the vehicle cab. This distinction is important. LaneBlade is not a warning device, channelizing device, message device, or automated TTC deployment system. It is an operational debris-removal tool intended to reduce the need for an SSP operator to exit the vehicle and walk in or near active traffic. When used solely for debris removal, the MUTCD consistency risk is generally low because the device is not communicating a warning, regulatory, or guidance

message to road users and is not intended to create a taper, close a lane, or substitute for cones or other TTC devices.

Risk mitigation practices include written quick-clearance and debris-removal procedures, operator training, coordination with law enforcement where needed, and clear criteria for when an operator should remove a vehicle or debris versus request additional support. Agencies should distinguish between actions that remove a hazard and devices that provide traffic control. Push, pull, drag, and debris-removal tools can reduce the need for extended TTC, but they should be supported by agency procedures that address operator safety, traffic conditions, vehicle or debris type, roadway location, and escalation when the situation exceeds what a single SSP operator can safely manage.

4.1.11. Shadow Vehicles and Truck-Mounted Attenuators

Shadow vehicles and truck-mounted attenuators are used to provide additional protection, especially when an incident blocks a travel lane, requires workers or responders on foot, creates a queue, or is expected to last long enough that the initial SSP vehicle and warning devices are not sufficient. Some SSP programs use vehicles with attenuators, while others rely on maintenance, contractor, or law enforcement support for higher-risk scenes.

The MUTCD includes broader provisions related to temporary traffic control safety devices, positive protection, crash cushions, and typical applications that often show shadow vehicles or protective vehicles in work-zone contexts. For SSP minor incidents, the MUTCD issue is generally not whether a shadow vehicle or attenuator can be used, but whether the device is used in a manner consistent with agency policy, vehicle design, operator training, and the temporary traffic control function it is intended to serve.

The MUTCD consistency risk is generally low to medium. It is low when a shadow vehicle or truck-mounted attenuator is used as part of an agency-approved TTC or incident management procedure. It becomes medium when an unequipped SSP vehicle is treated as if it provides the same protection as a truck-mounted attenuator, or when blocking practices are used without clear guidance on spacing, buffer areas, vehicle orientation, and escalation.

Risk mitigation practices include distinguishing between warning vehicles, blocking vehicles, shadow vehicles, and attenuator-equipped vehicles. Agencies should define which vehicles may be used for each role, what spacing and positioning are required, when an attenuator is needed, and when additional support should be requested. Operators should be trained that a standard SSP vehicle may provide warning and presence but may not provide physical protection equivalent to a purpose-built attenuator or shadow vehicle.

4.1.12. Drones and Tethered Drones Systems

Drones and tethered-drone systems were identified as emerging tools for situational awareness. These systems can provide overhead views of incident scenes, queues, lane blockages, debris fields, and responder activity areas. They may be especially useful for larger or more complex incidents where the TMC or incident command needs a broader view than fixed cameras or field reports can provide.

From an MUTCD perspective, these systems are generally low risk when used for situational awareness only. They are not traffic control devices unless they are used to communicate regulatory, warning, or guidance messages to road users. Their primary value is in improving incident assessment, supporting command decisions, documenting conditions, and identifying whether additional TTC or upstream warning is needed.

The MUTCD risk becomes medium if a drone-mounted display, light, or other feature is used to communicate traffic control information to drivers, or if the system distracts drivers near the

incident scene. Other concerns, such as FAA rules, privacy, data retention, evidence handling, and operator certification, are important but are outside the MUTCD-focused review.

Risk mitigation practices include limiting drones and tethered systems to situational awareness, keeping them clear of traffic control messaging unless specifically approved, coordinating use through incident command or agency procedures, and addressing non-MUTCD requirements through separate aviation, privacy, and data policies. For SSP minor incidents, drones are likely most appropriate for complex, extended, or high-impact incidents rather than routine short-duration motorist assists.

4.1.13. Emerging or Nontraditional Deployment Devices

Several emerging or nontraditional devices were identified in the survey and case study materials, including automatic cone deployment systems and inflatable side-arm concepts. These devices are generally intended to reduce responder exposure, support faster deployment of temporary traffic control devices, create additional lateral presence near stopped response vehicles, or reduce the need for an operator to walk along the roadway or shoulder.

The MUTCD risk for these devices depends on how the device functions. If the device is simply equipment that helps deploy standard MUTCD-recognized traffic control devices, such as an automatic cone deployment system placing standard cones in an approved pattern, the risk may be low. The risk relates primarily to whether the resulting cone placement is appropriate and whether the equipment can be used safely in traffic. If the device itself communicates a warning, regulatory, or guidance message to road users, physically directs traffic, creates a new channelizing treatment, or changes how drivers are expected to behave, the risk becomes medium to high unless the device or application is already recognized, approved, or evaluated through appropriate agency or FHWA processes.

Inflatable side arms create particular uncertainty because they may function as vehicle-mounted warning devices, lateral separation devices, or nontraditional channelizing devices depending on how they are used. If they are used only as supplemental conspicuity or as an equipment aid that does not replace standard TTC devices, the risk may be medium. If they are used to substitute for cones, arrow boards, lane closures, or other recognized TTC devices, the risk may be high without additional review.

Risk mitigation practices include clearly defining whether the device is an equipment aid, a supplemental warning device, or a traffic control device. Agencies should avoid using nontraditional devices as substitutes for MUTCD-recognized traffic control devices unless the device has been reviewed through appropriate channels. Where uncertainty exists, agencies should consider engineering review, controlled pilot testing, official interpretation, experimentation, or future MUTCD change requests. For automatic cone deployment, agencies should focus on whether the system places standard cones safely, consistently, and in a pattern consistent with the intended TTC application.

4.1.14. Screening-Level Risk and Mitigation Matrix

Table 4-3 summarizes the screening-level MUTCD consistency review for the devices, techniques, strategies, and operational approaches discussed in this chapter. The risk ratings are intended to identify where implementation may warrant additional attention. They should not be interpreted as legal conclusions or formal compliance determinations.

Table 4-3: Summary of MUTCD Risk and Mitigation Practices for Common SSP TTC Devices and Strategies

Device, technique, or strategy	Common SSP use	Primary MUTCD location	Screening-level risk	Possible mitigation practices
Cones and channelizing devices	Define work area, create short taper, support lane-blocking or lane-encroaching minor incidents	Chapter 6K; Section 6K.03; Chapter 6O; Chapter 6P	Low to medium	Use warrant-based deployment, scalable patterns, operator safety rules, and escalation when full TTC is needed.
Modified cone taper lengths for short-duration incidents	Provide practical short-duration channelization when full taper is not feasible	Chapter 6O; Chapter 6P	Low to medium	Treat as initial/minor-incident treatment, document agency procedures, and request additional support when incident duration or complexity increases.
Lights on or inside cones	Improve nighttime or low-visibility cone conspicuity	Chapter 6K; Chapter 6L	Low to medium	Use as visibility enhancement, not as an independent directional traffic control message unless reviewed.
Flares and light sticks	Provide quick warning and scene visibility	Chapter 6L; Chapter 6O	Low	Use as supplemental warning; do not treat as full channelization when cones or other TTC are needed.
Digital flares and Pi-Lit-style devices	Supplement cones, provide sequential or enhanced warning	Chapter 6L; Chapter 6O	Low to medium	Define as supplemental warning, control colors and flash patterns, and avoid conflicting directional messages.
Vehicle positioning	Provide initial warning, support motorist assistance, create early-warning position	Chapter 6O; Section 6O.05	Low to medium	Train operators on positioning, buffer space, non-traffic-side approach, and escalation.
Vehicle positioning in active traffic	Protect or warn at lane-blocking incidents	Chapter 6O; Chapter 6P	Low to medium	Use only when necessary, request support, provide advance warning, and distinguish warning vehicles from protection vehicles.
Vehicle-mounted CMS/message boards	Display incident, shoulder, lane-blockage, or driver-action messages	Section 6L.05; Chapter 2L	Low	Use approved message libraries, clear traffic-related messages, and appropriate legibility.
Arrow boards for lane closures	Direct traffic away from a blocked or closed travel lane	Section 6L.06	Low	Use arrow or chevron mode only when a lane is actually closed or being closed.
Arrow boards in caution mode for shoulder incidents	Provide non-directional warning when stopped on or near the shoulder	Section 6L.06	Low	Use caution/four-dot/diamond display when no travel lane is closed.
Directional arrow from the shoulder with no lane closure	Encourage drivers to move over from a shoulder incident	Section 6L.06	High	Use text message boards instead; pursue interpretation, experimentation, or future MUTCD clarification if directional display is desired.
Move Over or Slow Down message on vehicle-mounted CMS	Communicate driver action near shoulder incident or responder presence	Section 6L.05; Chapter 2L	Low to medium	Use agency-approved text messages and avoid pairing with a directional arrow unless a lane is closed.
Portable CMS	Provide temporary incident, queue, lane, or shoulder information	Section 6L.05	Low	Use approved messages, proper placement, and prompt removal when no longer needed.

Device, technique, or strategy	Common SSP use	Primary MUTCD location	Screening-level risk	Possible mitigation practices
Permanent DMS	Provide network-level warning, queue, lane closure, or incident messages	Chapter 2L; Part 6	Low to medium	Coordinate through TMC, use approved messages, and prioritize real-time operational needs.
Upstream warning and queue protection	Warn approaching drivers before the back of queue or incident area	Chapter 6O; Chapter 6P	Low	Use safe vehicle positioning, DMS/CMS messages, and TMC coordination.
Upstream warning vehicle with DMS/CMS on shoulder	Provide mobile advance warning upstream of incident or queue	Section 6L.05; Chapter 6O	Low to medium	Use text warning, caution mode as appropriate, safe placement, and avoid implying a lane closure if none exists.
Navigation app and responder-to-vehicle alerts	Notify drivers through HAAS, Waze, Google, Apple, or connected-vehicle systems	Not directly governed as roadside TTC devices	Low to medium	Treat as supplemental, manage stale alerts, and coordinate data through approved systems.
Cameras, AVL, ATMS, tablets, dash cameras, and body cameras	Support dispatch, situational awareness, documentation, and after-action review	Generally outside direct MUTCD device provisions	Low	Treat as decision-support tools and avoid operator distraction.
Variable speed limits	Reduce speeds upstream of incidents, queues, or congestion	MUTCD speed and changeable-message provisions; agency authority	Medium	Operate through approved TMC procedures and distinguish regulatory from advisory displays.
Quick clearance	Move disabled or crashed vehicles from travel lanes to shoulder	Section 6O.04	Low	Support with training, policy, law enforcement coordination, and clear operator authority.
Push, pull, or drag vehicle removal	Relocate vehicles quickly when they block travel lanes	Section 6O.04; state/agency authority	Low to medium	Use written policy, MOUs, training, and restrictions for injuries, fire, HazMat, or unsafe conditions.
Truck-mounted attenuators and shadow vehicles	Provide added protection for lane-blocking, long-duration, or high-risk scenes	Chapter 6M; Chapter 6P	Low to medium	Define vehicle roles, spacing, equipment requirements, and operator training.
Drones & tethered drones systems	Provide overhead situational awareness	Generally outside direct MUTCD device provisions	Low	Use for observation only unless traffic-control messaging is separately approved.
LaneBlade-style devices	Remove roadway debris	Chapter 6O TIM principles; Section 6O.04 quick clearance	Low	Treat as an operational quick-clearance/debris-removal tool, not as a traffic control device. Use agency policy and operator training to define when debris can be removed safely and when additional TTC is needed.
Automatic cone deployment	Deploy standard cones while reducing operator exposure	Chapter 6K; Chapter 6P	Low to medium	Ensure standard cones are placed in approved patterns and operators are trained.
Inflatable side arms	Create visible lateral extension or buffer from SSP vehicle	Part 1 device approval principles; Part 6 depending on use	Medium to high	Treat as vehicle-mounted equipment unless engineering review determines that it functions as a traffic control device or application.
Operator TTC training and decision-making	Teach operators when and how to deploy devices safely	Chapter 6O; general MUTCD TTC principles	Low	Tie training to MUTCD principles, agency SOPs, field judgment, and escalation procedures.

4.2. MUTCD Clarification Needs for SSP Minor-Incident Response

This section discusses MUTCD-related issues identified through the survey responses, case study materials, and the screening-level review in Section 4.1. The purpose is to identify where additional MUTCD clarification, guidance, or revision could help agencies apply temporary traffic control principles to Safety Service Patrol minor-incident response. Section 4.2.1 summarizes the relevant agency input, Section 4.2.2 discusses the issues from Section 4.1 that warrant further consideration, and Section 4.2.3 presents potential MUTCD-style language that could address those issues.

4.2.1. Agency Input

The survey responses, case study discussions, and supporting materials identified several MUTCD-related topics that are relevant to Safety Service Patrol response to minor incidents and short-duration service calls. These comments generally focused on the practical application of temporary traffic control in the field rather than on broad changes to the MUTCD.

A recurring theme was the desire for more SSP-specific guidance. Agencies noted that SSP operators often respond to minor incidents with limited personnel, limited devices carried on the vehicle, and limited time to make decisions. Several comments pointed to the need for guidance or best practices that better reflect what SSP operators can realistically deploy during short-duration service calls, lane-blocking incidents, shoulder incidents, and other minor traffic incidents.

Agencies also raised concerns about the practicality and safety of one-operator deployment. Survey and case study materials noted that cone deployment can expose operators to traffic, especially on high-speed facilities, in limited shoulder areas, or where a long taper would require the operator to walk a significant distance upstream. Related comments emphasized that the number of cones or devices carried on one vehicle may limit what can be deployed during the initial response. These comments suggest that agencies are looking for guidance that recognizes the difference between a full temporary traffic control setup and the initial response that can be safely provided by a single SSP operator.

Vehicle-mounted message boards and arrow boards were another recurring topic. Agencies reported using truck-mounted message boards, arrow boards, and similar displays to warn approaching drivers and support incident response. One issue raised in the project materials was whether current shoulder-related display practices, such as caution mode or four-dot displays, provide enough information to approaching drivers during shoulder incidents involving responders, disabled vehicles, or motorists. This issue was discussed in relation to how drivers should be alerted when an SSP vehicle is stopped on or near the shoulder and no travel lane is closed.

Some agencies also identified speed management and variable speed limits as part of their broader incident response environment. These comments generally related to the ability of traffic management centers or roadway systems to reduce approach speeds or provide upstream warning during incidents, weather events, or other conditions that affect traffic operations.

Finally, the materials included discussion of newer or nontraditional vehicle-mounted equipment, including inflatable side-arm concepts. These comments were framed around responder safety, lateral presence, and reducing close-passing risk near stopped response vehicles. Agencies also noted the importance of operator training, field judgment, and practical language that can be understood and applied by SSP operators, maintenance personnel, supervisors, and traffic management center staff.

4.2.2. Key MUTCD Clarification Issues

The Section 4.1 review identified most commonly reported SSP devices and strategies as low or low-to-medium risk when used as initial, supplemental, or agency-approved tools for minor incident response. However, several issues warrant further MUTCD discussion because the potential risk was elevated, the agency comments indicated a recurring need for clarification, or both.

The first and most significant issue is arrow-board use for shoulder incidents. Under the current MUTCD structure, arrow or chevron displays are associated with lane closures, while caution mode is used for shoulder work, roadside work near the shoulder, or conditions where a directional lane-control message is not appropriate. For routine work-zone conditions, this distinction is logical because a directional arrow can imply that a lane is closed or that traffic must merge. For SSP shoulder incidents, however, the operational context may be different. The incident may involve an exposed responder, pedestrian, or disabled vehicle on the shoulder, and approaching drivers may be expected to move over or slow down. In those situations, agencies may find that the caution-mode display does not communicate enough information to approaching drivers.

This issue appears to be the strongest candidate for MUTCD clarification. The question is whether a shoulder incident involving a responder, pedestrian, disabled vehicle, or authorized service patrol vehicle should always be treated the same as shoulder work for purposes of arrow-board display. If the answer is yes, then the MUTCD could clarify that directional arrows remain inappropriate unless a travel lane is actually closed or being closed, and that the preferred compliant approach is to use caution mode with a text message such as “MOVE OVER,” “SLOW DOWN,” or “RESPONDER AHEAD” on a vehicle-mounted message board. If the answer is no, then the MUTCD may need an explicit exception, option, or new standard allowing a directional display for certain shoulder-based traffic incident management conditions. Because current language is relatively clear for shoulder work, this is not simply a training issue. It may require an official interpretation, guidance clarification, or standard change.

The second issue is SSP-specific guidance for minor incidents and one-operator deployment. The MUTCD already recognizes that minor traffic incidents are often short in duration, that traffic diversion may not be needed or may only be needed briefly, and that a full lane-closure setup may not be practical. It also recognizes that responders may use the devices available on hand for initial response, provided those devices do not create unnecessary additional hazards. These provisions are highly relevant to SSP operations. However, they are not presented in a way that fully explains how a single SSP operator should translate those principles into practical decisions at a minor incident.

This issue is best understood as a guidance gap rather than a conflict with the MUTCD. The survey and case study findings suggest that agencies are already making these decisions, but the MUTCD could better support them by explicitly addressing SSP-type responders and short-duration service calls in Chapter 6O.

The third issue is variable speed limits and speed-management displays during incidents. Speed management can support responder safety by reducing approach speeds upstream of an incident, queue, or lane blockage. However, the risk depends on how the system is implemented. Variable speed limits may be regulatory or advisory, may be activated by the TMC or another authorized agency function, and may require specific procedures to ensure that displayed speeds are appropriate for the current field condition. Because SSP operators generally do not control these systems directly, this issue should not be framed as an SSP device-use concern. Instead, it should be framed as a coordination issue between incident management, TMC operations, and speed-management authority.

The fourth issue is inflatable side arms or similar nontraditional vehicle-mounted devices. These devices are different from standard TTC devices because their function is not clearly defined in MUTCD terms. If an inflatable side arm is only vehicle-mounted equipment intended to create additional lateral presence or discourage close passing, it may not be functioning as a traffic control device. If it is used to guide, channelize, block, or direct road users, then it begins to function more like a temporary traffic control device or application. The MUTCD would benefit from clarification on how agencies should evaluate nontraditional vehicle-mounted equipment that supports responder safety but may be interpreted by drivers as a traffic control treatment.

4.2.3. Potential MUTCD Clarification Concepts

The following potential MUTCD clarification concepts are presented as conceptual MUTCD-style language for consideration. They are not intended as final proposed MUTCD text. The purpose is to identify the type of clarification, guidance, option, or exception that could help agencies apply MUTCD principles more consistently during SSP minor-incident response.

Potential update 1: Shoulder arrow-board displays

The purpose of this update would be to clarify how arrow-board displays should be used for shoulder-based traffic incident management areas when no travel lane is closed. Two possible approaches are provided. The first would clarify the current restriction. The second would create a limited exception if FHWA determines that certain shoulder incidents warrant a more actionable directional display.

Option A: Clarify the current restriction

Support:

Shoulder-based traffic incident management areas can involve exposed responders, pedestrians, disabled vehicles, or authorized incident response vehicles at unexpected locations. In these conditions, road users may need advance warning and clear driver-action information before reaching the incident area.

Guidance:

For a shoulder-based traffic incident management area where no travel lane is closed, a vehicle-mounted changeable message sign or other approved message display should be used to provide driver-action messages, such as MOVE OVER, SLOW DOWN, RESPONDER AHEAD, or SHOULDER INCIDENT, when such messages are appropriate for the condition.

Standard:

A directional arrow or chevron display shall not be used to indicate a lane closure unless a travel lane is actually closed or in the process of being closed.

Guidance:

When an arrow board is used for a shoulder-based traffic incident management area where no travel lane is closed, the arrow board should be operated in caution mode. Driver-action information should be provided through an approved message display rather than through a directional arrow or chevron display.

Option B: Create a limited exception for certain shoulder incidents

Support:

Some shoulder-based traffic incident management areas involve exposed responders, pedestrians, disabled vehicles, or authorized incident response vehicles in locations where a caution-mode display might not provide sufficient driver-action information.

Option:

When an authorized incident response vehicle is stopped on the shoulder and responders, pedestrians, or disabled vehicles are present on or near the shoulder, an agency-approved directional or driver-action display may be used to supplement caution-mode warning if the agency determines that the display is needed to improve responder or road user safety.

Guidance:

A directional or driver-action display used under this option should not be used in a manner that implies that a travel lane is closed unless a travel lane is actually closed. The display should be consistent with the roadway condition, applicable agency procedures, and other traffic control devices used at the incident scene.

Guidance:

Agencies using this option should establish procedures for when the display may be used, what display messages or patterns are allowed, how the display will be distinguished from a lane-closure display, and what operator training is required.

Potential update 2: SSP minor-incident guidance

The purpose of this update would be to make existing Chapter 6O principles more explicit for safety service patrols and similar responders managing minor incidents and short-duration service calls with limited personnel and equipment.

Support:

Highway agency service patrols, safety service patrols, freeway service patrols, and similar incident response programs frequently provide the initial response to minor traffic incidents and short-duration service calls. These responses often involve limited personnel, limited devices carried on the response vehicle, and rapidly changing field conditions.

Guidance:

For minor traffic incidents and short-duration service calls, SSP operators should use field judgment to determine the appropriate initial temporary traffic control treatment based on the location of the incident, lane blockage, shoulder width, sight distance, traffic speed, traffic volume, expected duration, visibility, queue formation, and whether responders or road users will be on foot.

Option:

Initial temporary traffic control for SSP minor-incident response may include vehicle positioning, emergency lighting, vehicle-mounted changeable message signs, arrow boards used in the appropriate display mode, cones, flares, light sticks, portable signs, quick clearance actions, or requests for additional support.

Guidance:

SSP operators should not deploy cones, flares, signs, or other devices on foot when the act of deployment would create a greater hazard than the incident condition being addressed. In such cases, the operator should consider remaining in the vehicle, using vehicle-mounted warning or message displays, notifying the traffic management center, and requesting law enforcement, maintenance, another SSP unit, or other appropriate support.

Guidance:

Agencies should establish procedures identifying when an SSP operator may manage a minor incident using the devices available on the response vehicle and when the incident should be escalated to additional traffic control support. Escalation should be considered when the incident blocks or encroaches on a travel lane, creates a queue, has limited sight distance, occurs under reduced visibility, exposes responders or road users on foot, or is expected to exceed a short-duration response.

Potential update 3: Incident speed management

The purpose of this update would be to clarify how variable speed limits or speed-management displays may be used to support incident response, queue management, and upstream warning.

Support:

Variable speed limits and speed-management displays can be used to support traffic incident management by reducing approach speeds upstream of an incident, queue, lane blockage, or other temporary condition.

Guidance:

Variable speed limits or speed-management displays used for traffic incident management should be activated only under approved agency procedures and should be consistent with the actual field condition, roadway operating conditions, and other traffic control messages displayed to road users.

Guidance:

Agencies should distinguish between regulatory and advisory speed displays and should identify the authority responsible for activating, modifying, and deactivating incident-related speed-management messages.

Support:

Speed-management displays can supplement incident-scene temporary traffic control, upstream warning, queue management, and quick-clearance operations. They do not replace the need for appropriate warning, channelization, vehicle positioning, or other traffic control measures at the incident scene.

Potential update 4: Nontraditional vehicle-mounted equipment

The purpose of this update would be to clarify how agencies should evaluate nontraditional vehicle-mounted equipment, including inflatable side arms or similar devices, when used during traffic incident management.

Support:

Agencies may use vehicle-mounted equipment to support responder safety during traffic incident management activities. Some equipment may increase lateral presence, reduce close-passing exposure, or support field operations without functioning as a traffic control device.

Guidance:

Agencies should evaluate nontraditional vehicle-mounted equipment based on the function it performs in the field. Equipment that is used only as vehicle equipment should be addressed through agency vehicle, safety, and operational procedures. Equipment that is used to warn, regulate, guide, channelize, block, or direct road users should be evaluated as a traffic control device or traffic control application.

Guidance:

Inflatable side arms or similar devices should not be used as a substitute for approved channelizing devices, tapers, signs, arrow boards, or other temporary traffic control devices unless the device or application has been reviewed and approved through appropriate agency or FHWA procedures.

Option:

Agencies may conduct engineering review, controlled pilot testing, official interpretation requests, or experimentation for nontraditional vehicle-mounted equipment when the device is intended to function as part of a temporary traffic control treatment.

These potential updates would not require the MUTCD to provide detailed layouts for every SSP scenario. Instead, they would clarify how existing MUTCD principles apply to the conditions most common to SSP minor-incident response. The goal would be to preserve national consistency while giving agencies clearer guidance for short-duration incidents, shoulder-based response, one-operator deployment, speed-management coordination, and emerging vehicle-mounted equipment.

4.3. MUTCD Review Findings and Guidance Implications

This chapter reviewed commonly reported Safety Service Patrol temporary traffic control devices, techniques, strategies, and operational approaches in relation to the Manual on Uniform Traffic Control Devices. The review was conducted as a screening-level consistency review, not as a legal opinion or formal compliance determination for any individual state or agency. Because available survey responses, case study interviews, and supporting materials varied across agencies, the review focused on the practices most commonly identified through the project rather than attempting a detailed state-by-state compliance assessment.

Overall, the review found that many SSP practices used during minor incidents and short-duration service calls are generally consistent with the MUTCD when applied appropriately. The MUTCD recognizes that traffic incidents are variable, that minor incidents are often short in duration, that full lane-closure temporary traffic control is not always practical, and that responders may use the devices available during the initial response when those devices do not create unnecessary additional hazards. This framework supports many of the practices reported by agencies, including vehicle positioning, cones, vehicle-mounted message boards, portable changeable message signs, emergency lighting, flares, quick clearance, upstream warning, and the use of traffic management center support.

The review also found that the primary MUTCD concerns are not associated with the general use of SSP temporary traffic control devices, but with specific applications where the device function, display mode, or operational context may be unclear. The most significant issue involves arrow-board displays for shoulder incidents. Current MUTCD language clearly connects directional arrow and chevron displays to lane closures and identifies caution mode for shoulder-related conditions. However, SSP shoulder incidents may involve exposed responders, disabled vehicles, or motorists in situations where agencies may want a more direct driver-action message. This creates a practical need for clarification on how arrow-board displays should be used for shoulder-based traffic incident management areas when no travel lane is closed.

A second key finding is that SSP minor-incident response would benefit from more explicit guidance in the MUTCD. Existing MUTCD principles support flexible initial response, use of devices on hand, and quick clearance, but the guidance is not written specifically around the conditions faced by SSP operators. In many cases, a single operator must make rapid decisions using limited equipment while balancing the benefits of deploying devices against the exposure created by exiting the vehicle. Additional guidance that explicitly addresses SSP minor incidents, short-duration service calls, scalable device deployment, and escalation to additional support would help agencies apply MUTCD principles more consistently.

The review also identified variable speed limits and speed-management displays as an area where clarification may be useful. These systems can support incident response by reducing approach speeds upstream of an incident, lane blockage, or queue. However, their use depends on whether the display is regulatory or advisory, who has authority to activate it, and how it is coordinated with field conditions and other traffic control messages. This issue is not primarily an SSP operator concern, but it is relevant to the broader incident management environment in which SSPs operate.

Finally, the review identified a need for clearer treatment of nontraditional vehicle-mounted equipment, such as inflatable side arms or similar devices. These devices do not fit neatly into traditional MUTCD categories. If used only as vehicle equipment to increase lateral presence or reduce close-passing exposure, they may be primarily an agency vehicle-safety and operational issue. If used to channelize, guide, block, or direct road users, they may need to be evaluated as traffic control devices or traffic control applications. Additional guidance would help agencies determine how such equipment should be classified and reviewed.

The potential MUTCD language presented in Section 4.2.3 is intended to support later discussion and agency consideration, not to serve as final proposed MUTCD text. The language focuses on clarification rather than wholesale changes to the MUTCD. In particular, the potential updates would clarify shoulder incident display options, make SSP minor-incident guidance more explicit, describe appropriate use of incident speed management, and provide a framework for evaluating nontraditional vehicle-mounted equipment.

The MUTCD provides a strong foundation for SSP temporary traffic control during minor incidents, but several SSP-specific applications would benefit from clearer guidance. The most important opportunities are to better address short-duration, one-operator incident response; clarify arrow-board and message-display practices for shoulder incidents; define how speed-management systems support incident response; and provide guidance for emerging vehicle-mounted equipment. Addressing these areas would help agencies maintain MUTCD consistency while supporting practical, safe, and efficient SSP response to minor traffic incidents.

5. Final Findings and Guidance Implications

This project examined temporary traffic control practices used by Safety Service Patrol programs during minor incidents and short-duration service calls. Across the three project tasks, the findings show that SSP temporary traffic control is a highly practical, field-driven activity shaped by the realities of short incident duration, limited vehicle storage, limited staffing, high-speed traffic, variable roadway geometry, and the need for rapid clearance. SSP operators often make initial traffic control decisions before additional responders arrive and must balance the safety benefits of deploying TTC devices against the exposure created by exiting the vehicle and working near live traffic.

The project also showed that agencies share many common tools and operational goals, but differ in how those tools are applied. Cones, vehicle positioning, warning lights, truck-mounted message boards, arrow boards, flares, digital warning devices, quick clearance, TMC coordination, and upstream warning are all part of the SSP TTC environment. However, agency policies, cone quantities, deployment triggers, training approaches, vehicle equipment, and written guidance vary considerably. This variation does not mean that one approach is correct for all agencies. Rather, it shows the need for scalable guidance that can support consistent decision-making while still allowing operators and agencies to adapt to different roadway, traffic, staffing, and equipment conditions.

5.1. Current Practice Findings

The Task 1 synthesis established the baseline for understanding how participating agencies currently approach SSP temporary traffic control. The survey results showed that cones are the most universal and commonly deployed TTC device, but they are only one part of the broader response strategy. Agencies also rely heavily on vehicle positioning, vehicle-mounted warning systems, truck-mounted message boards, arrow boards, flares, digital flares or beacons, TMC support, and emerging connected technologies. In many minor incidents, the SSP vehicle itself functions as the first TTC platform because it provides warning, carries the message board or arrow board, supports communication, and may provide limited protection depending on agency policy and scene conditions.

A central finding from Task 1 is that TTC decisions are primarily field driven. Operators must assess whether the incident blocks or encroaches into a travel lane, how long the scene is expected to last, whether a responder or motorist will be on foot, whether sight distance or visibility is limited, whether queues are forming, and whether additional support is available. Effective field decision-making requires substantial training, practical experience, and demonstrated competency to ensure operators can evaluate changing conditions and make appropriate TTC decisions. Written guidance exists in many agencies, but the level of SSP-specific detail varies. Some agencies have manuals, SOPs, and field training guides that directly address SSP operations, while others rely on general TTC, work zone, TIM, training, contract, or procurement documents that require interpretation before they can be applied to minor incident response.

The document review reinforced the need to translate general TTC principles into practical field guidance for SSP operators. General work-zone guidance is valuable for device standards, taper concepts, spacing, duration categories, and traffic control principles, but it often assumes more time, more personnel, more equipment, and more predictable conditions than are available during a minor SSP response. SSP-specific guidance should therefore focus on practical decisions that can be made by one operator at a short-duration incident using the equipment carried on the response vehicle. A recommended practice is to establish an SSP-specific, scenario-based decision framework that helps operators determine when vehicle-mounted warning is sufficient, when additional TTC devices should be deployed, when quick clearance should take priority, and when additional support is needed.

5.2. Transferable Case Study Findings

The Task 2 case studies provided more detailed insight into how selected agencies address three priority topics: cone deployment warrants and procedures, advanced TTC technologies and operational strategies, and SSP operator training. The case studies showed that the most transferable practices are not fixed layouts alone, but decision frameworks, deployment sequences, training benchmarks, and operational strategies that can be adapted to different agencies.

For cone deployment, the case studies support a warrant-based approach. Cone deployment should be considered when an incident blocks or encroaches into a travel lane, when the expected duration is long enough for cones to provide a meaningful benefit, when responders or motorists will be on foot near traffic, when sight distance or visibility is limited, or when the work area needs to be defined or expanded. However, meeting a warrant should not automatically require cone deployment. Operators must also determine whether cones can be deployed and retrieved safely. Guidance should therefore distinguish among situations where cones are warranted, situations where cones may add more exposure than benefit, and situations where cones may be beneficial in principle but unsafe for one operator to deploy without additional support.

The case studies also showed that safe cone deployment depends on procedure, storage, and vehicle design. Operators need a clear sequence for scene size-up, vehicle positioning, activation of warning devices, communication with the TMC or operations center, use of personal protective equipment, cone deployment, traffic monitoring, and cone retrieval. Cone accessibility is also important. If cones are difficult to reach or require the operator to climb into the vehicle or turn away from traffic, deployment may become slower and less safe. Improving cone storage and access may be a practical way to improve both consistency and safety.

For advanced TTC technologies and operational strategies, the case studies showed that technology is most useful when it solves a defined operational problem. Vehicle-mounted message boards, higher-visibility arrow and message displays, digital flares, Pi-Lit/PILITS-type sequential lighting, smart lighting, cameras, AVL, ATMS access, drones, responder-to-vehicle alerts, and navigation-app integration can all support incident response. However, these tools should supplement, not replace, field judgment, vehicle positioning, clear messaging, TMC coordination, and quick clearance. Agencies should evaluate technologies based on operational value, ease of deployment, maintenance needs, training burden, cost, durability, and integration with existing procedures.

The case studies also reinforced that quick clearance should be treated as an operational TTC strategy. For many minor incidents, the safest way to reduce exposure is to remove the hazard, relocate the vehicle, or clear the lane before a larger TTC setup becomes necessary. Quick clearance, vehicle relocation, debris removal, and push/pull/drag practices can reduce exposure time and limit the need for broader TTC escalation when they are supported by authority, training, interagency coordination, and clear operating procedures.

For training, the case studies showed that written guidance alone is not sufficient. SSP operators need staged onboarding, supervised field exposure, equipment familiarization, scenario-based learning, ride-alongs, refresher training, and supervisor or trainer sign-off before independent patrol. The strongest training models use demonstrated competency rather than time alone as the basis for release. Operators should be able to assess scene conditions, position the vehicle safely, communicate with the TMC or dispatch center, use warning and messaging devices, deploy and retrieve cones when appropriate, recognize when deployment is unsafe, support quick clearance, coordinate with other responders, and make sound decisions under changing field conditions.

5.3. MUTCD Consistency Findings

The Task 3 review found that many SSP TTC practices used during minor incidents and short-duration service calls are generally consistent with the MUTCD when applied appropriately. The MUTCD recognizes that traffic incidents are variable, that minor incidents are often short in duration, that full lane-closure TTC is not always practical, and that responders may use the devices available during the initial response when those devices do not create unnecessary additional hazards. This framework supports many commonly reported SSP practices, including vehicle positioning, cones, vehicle-mounted message boards, portable changeable message signs, emergency lighting, flares, quick clearance, upstream warning, and TMC support.

The primary MUTCD concerns identified in the review are not associated with the general use of SSP TTC devices, but with specific applications where the device function, display mode, or operational context may be unclear. The most significant issue involves arrow-board displays for shoulder incidents. Current MUTCD language connects directional arrow and chevron displays to lane closures and identifies caution mode for shoulder-related conditions. However, SSP shoulder incidents may involve exposed responders, disabled vehicles, or motorists in situations where agencies may want a more direct driver-action message. This creates a practical need for clarification on how arrow-board displays should be used for shoulder-based traffic incident management areas when no travel lane is closed.

The MUTCD review also identified a need for more explicit SSP minor-incident guidance. Existing MUTCD principles support flexible initial response, use of devices on hand, and quick clearance, but the guidance is not written specifically around the conditions faced by SSP operators. Additional clarification could help agencies determine how to apply MUTCD principles to one-operator deployment, short-duration service calls, shortened or scalable cone patterns, vehicle-mounted messaging, upstream warning, and escalation to additional support.

Other clarification topics include incident-related speed management and nontraditional vehicle-mounted equipment. Variable speed limits and speed-management displays can support incident response, but their use depends on agency authority, message coordination, and whether the display is regulatory or advisory. Nontraditional vehicle-mounted equipment, such as inflatable side arms, may support responder safety but should be evaluated based on whether the device functions only as vehicle equipment or whether it warns, guides, channelizes, blocks, or directs road users in a way that makes it a traffic control device or application.

5.4. Practical Guidance Implications

The combined findings support development of SSP-specific TTC guidance that is scalable, decision-based, and realistic for field use. Guidance should not assume that every minor incident can be managed with a full work-zone-style setup. It should recognize that many SSP responses are brief, that operators may be working alone, and that the act of deploying devices can create exposure. At the same time, guidance should provide enough structure to improve consistency and help operators identify when additional TTC, upstream warning, or support is needed.

The first practical implication is that guidance should begin with field decision-making. Operators should be trained to ask whether the incident can be cleared quickly, whether a travel lane is blocked or encroached upon, whether anyone will be on foot near traffic, whether sight distance or visibility is limited, whether the scene is expected to last long enough to justify additional TTC, whether queues are forming, and whether additional resources are needed. This decision framework should help operators select among vehicle positioning, warning devices, cones, upstream warning, quick clearance, additional units, law enforcement, maintenance, or other support.

The second implication is that cone guidance should be warrant-based and safety-focused. Cones should be treated as valuable but not automatic. Guidance should identify when cones should be considered, how many may be appropriate for common minor-incident scenarios, how deployment should be scaled, and when cone deployment may be unsafe. Safe deployment and retrieval procedures should be included because retrieval can expose the operator just as much as deployment.

The third implication is that the SSP vehicle should be recognized as the initial TTC platform. Vehicle positioning, lighting, message boards, arrow boards, communication systems, cameras, and onboard equipment are central to SSP response. Guidance should help agencies define how the vehicle should be positioned, which displays should be used for lane-blocking versus shoulder incidents, how messages should be selected, and when the vehicle is providing warning versus physical protection.

The fourth implication is that upstream warning and quick clearance should be integrated into the same decision process as TTC deployment. In some cases, the greatest risk is not at the immediate incident scene but at the back of the queue or upstream of a curve, hill, or visibility-limited location. In other cases, the best TTC strategy is to clear the incident quickly before a larger scene develops. Guidance should help operators and TMCs decide when vehicle-mounted warning is sufficient, when queue protection is needed, when additional warning should be placed upstream, and when quick clearance is the safest response.

The fifth implication is that equipment and technology should be evaluated for field deployability and sustainability. Agencies should consider not only whether a device improves visibility or warning, but also whether operators can deploy it safely, whether it is understandable to motorists, whether it requires subscriptions or connectivity, whether it can be maintained, whether it integrates with TMC procedures, and whether it can be supported through training and policy. Simple improvements, such as better cone access, clearer message libraries, enhanced cone visibility, or better use of vehicle-mounted CMS, may provide substantial value when they are consistently applied.

The sixth implication is that training must be part of implementation. SSP-specific TTC guidance will only be effective if operators are trained to apply it under realistic field conditions. Training should include classroom instruction, field demonstration, supervised practice, scenario-based decision-making, equipment readiness, communication procedures, quick clearance, cone deployment and retrieval, vehicle positioning, and recognition of unsafe deployment situations. Agencies should also use refresher training, supervisor observation, after-action review, and feedback from field experience to keep guidance aligned with actual operating conditions.

5.5. Final Statement

SSP programs operate in a challenging environment where minor incidents can create immediate safety risks for responders, motorists, and approaching traffic. The findings from this project show that effective SSP temporary traffic control depends on more than the availability of devices. It requires sound field judgment, clear agency procedures, practical training, appropriate vehicle equipment, effective communication, and coordination with TMCs and other responders.

The project findings support a practical path forward. SSP-specific TTC guidance should preserve flexibility while providing clearer decision criteria for common minor-incident scenarios. It should help operators determine when to deploy cones, when to rely on vehicle-mounted warning, when to protect the queue, when to request additional support, and when quick clearance is the safest strategy. It should also help agencies evaluate technologies, improve cone storage and access, develop training benchmarks, and address MUTCD-related clarification needs.

Overall, the project provides a foundation for guidance that can improve consistency without ignoring the realities of SSP operations. By organizing guidance around field decisions, scalable

deployment, operator safety, quick clearance, upstream warning, and demonstrated competency, agencies can better support SSP operators as they manage minor incidents and short-duration service calls under demanding roadway conditions.

Appendix A: Survey Questionnaire and Rationale Table

This appendix provides the survey instrument used to collect information on temporary traffic control practices for Safety Service Patrols during minor incidents and service calls. The survey was designed to document agency practices related to SSP program structure, available TTC devices, commonly deployed devices, deployment decision-making, cone deployment policies and procedures, advanced TTC technologies, and agency needs related to guidance and training. The appendix also includes a question rationale table that explains how each survey topic supports the Task 1 objective of synthesizing current TTC devices, technologies, deployment warrants, and field practices.

Survey Instrument

Survey Title:
TTC Practices for Safety Service Patrols (SSPs) – Survey

Introductory Text:
This survey is intended for SSP program administrators or individuals with direct knowledge of TTC deployment practices. Responses will help the research team understand how agencies approach temporary traffic control at incident scenes. All responses will remain confidential and will be used only for research purposes.

Agency and Program Information

1. Name of Agency / State
Open-ended response.

2. Name of person(s) completing survey
Open-ended response.

3. Contact email
Open-ended response.

4. What type of entity operates your SSP?
Select all that apply.

- State DOT in-house employees
- State DOT contract employees
- Local agency/city or county
- Private contractor
- Law enforcement agency
- Other

5. What types of roadways does your SSP serve?
Select all that apply.

- Urban freeways

- Rural highways
- Toll roads
- Arterial roads
- Other

6. What is the typical service schedule of your SSP?
If the service schedule varies between districts/regions, select all that apply.

- 24/7
- Weekday only, 24 hours
- Extended weekday hours, e.g., 6:00 AM–10:00 PM
- Weekday peak hours only
- Reduced weekend hours
- Other

7. What terminology does your agency use to describe TTC at incidents?

- Temporary Traffic Control (TTC)
- Emergency Traffic Control
- Incident Traffic Control
- Other

Written Standards and Available TTC Devices

8. Does your agency provide written standards or documentation for TTC deployment at incidents or service calls?

- Yes
- No

9. If yes, please provide a link to where this information can be found
Open-ended response.

10. Which TTC devices are available on SSP vehicles?
Select all that apply.

- Cones
- Flares
- Truck-mounted CMS/changeable message signs
- Additional LED warning lights, other than vehicle-mounted warning lights
- Retractable barriers
- Electronic beacons
- Digital flares
- Flashing arrow panels
- Other

11. Which TTC devices are most commonly deployed for minor incidents and service calls?
Select all that apply.

- Cones
- Flares
- Truck-mounted CMS/changeable message signs
- Additional LED warning lights, other than vehicle-mounted warning lights
- Retractable barriers
- Electronic beacons
- Digital flares
- Flashing arrow panels
- Other

TTC Deployment Decision-Making

12. Who decides when to deploy TTC at an incident scene?
Select all that apply.

- SSP operator, discretionary
- Traffic Management Center (TMC)
- Incident commander
- Pre-established agency policy/protocol
- Other

13. What factors justify increasing TTC deployment?
Examples include traffic volume, roadway speed limit, time of day, weather conditions, type of incident, etc.
Open-ended response.

Cone Deployment Policies and Practices

14. Does your agency have a formal policy on cone deployment?

- Yes — based on MUTCD guidance
- Yes — agency-specific policy
- No formal policy
- Other

15. Under what conditions are cones deployed?
Select all that apply.

- Every time the SSP vehicle stops on the roadway/shoulder
- Only for lane-blocking incidents
- Only if duration exceeds a threshold
- When requested by law enforcement
- Other

16. How many cones are typically carried on SSP vehicles?
Provide an exact number or range of values.
Open-ended response.

17. How many cones are typically deployed initially?
Provide an exact number or range of values.
Open-ended response.

18. How is the decision made to increase cone deployment?
Open-ended response.

19. Who makes the decision to increase cone deployment?
Open-ended response.

20. Describe your agency's standard procedure for cone deployment.
For example, describe the steps taken by SSP operators when deploying cones on an active lane of traffic.
Open-ended response.

21. What challenges does your agency face in cone deployment?
Select all that apply.

- Limited storage space
- Time constraints
- Safety concerns
- No formal requirements
- Other

Advanced TTC Technologies

22. Which advanced TTC technologies does your agency use?
Select all that apply.

- Digital flares or beacons
- Real-time incident notification systems
- Automated cone deployment systems
- Vehicle-mounted retractable barriers
- My agency does not use advanced TTC technologies
- Other

23. Is your agency piloting any new TTC technologies?

- Yes
- No

24. If yes, describe.
Open-ended response.

25. What influences your decision to deploy advanced TTC?
Please rank the following.

- Traffic volume
- Roadway speed

- Time of day
- Weather conditions
- Type of incident

26. What are the main barriers to deploying advanced TTC?
Select all that apply.

- Lack of time
- Limited storage
- Safety risk
- No formal guidance
- SSP does not make decisions on deploying advanced TTC; this question does not apply to my agency
- Other

TTC Deployment Time, Cost-Benefit Analysis, and Recommendations

27. How long does it take SSP to deploy TTC at minor incidents or service calls?

- Less than 2 minutes
- 2–5 minutes
- 5–10 minutes
- More than 10 minutes
- Not routinely deployed
- Unknown

28. Has your agency completed a return on investment (ROI) or cost-benefit analysis of SSP?

- Yes
- No

29. If yes, please provide a link to where this information can be found
Open-ended response.

30. What TTC strategies are most effective for improving safety?
Open-ended response.

31. What changes to MUTCD Chapter 6O would help SSPs?
Open-ended response.

32. Any additional comments or recommendations?
Open-ended response.

33. How can these survey results support your agency?
What would you like to gain from this study?
Open-ended response.

34. Would you participate in a follow-up interview?

- Yes
- No

Survey Question Purpose and Rationale

Table A-4 provides the rationale for each survey topic included in the Task 1 questionnaire. The table links the survey questions to the information needed to document current SSP temporary traffic control practices, including program characteristics, available devices, deployment decision-making, cone deployment procedures, advanced technologies, and agency needs related to future guidance.

Table A-4: Survey Question Purpose and Rationale

Survey Topic	Survey Questions	Purpose and Rationale
Respondent and agency identification	Q1–Q3	These questions identified the responding agency/state, the person completing the survey, and contact information. This information was needed for response tracking, clarification, and potential follow-up interviews. Contact information is not summarized in this public-facing report narrative.
SSP operating model	Q4	This question identified whether the SSP is operated by state DOT employees, contract employees, private contractors, local agencies, law enforcement, or another model. Operating model can influence training, equipment, policy control, and decision authority.
Roadway coverage	Q5	This question identified the types of roadways served by each SSP, including urban freeways, rural highways, toll roads, arterials, and other facilities. Roadway type is important because operating speed, traffic volume, shoulder conditions, and incident exposure vary considerably by facility type.
Service schedule	Q6	This question documented whether SSP coverage is 24/7, weekday-only, peak-period-only, weekend service, or variable by district/region. Service schedule helps explain differences in program purpose, staffing, and operational readiness.
TTC terminology	Q7	This question identified whether agencies use terms such as temporary traffic control, emergency traffic control, incident traffic control, or other terminology. Terminology differences can affect training, policy interpretation, and comparison across agencies.
Written TTC standards or documentation	Q8–Q9	These questions identified whether agencies have written standards, SOPs, manuals, training materials, or other documentation for TTC deployment, and asked respondents to provide links or documents where available. These materials supported the review of agency standards and comparison with MUTCD Chapter 6O.
TTC devices available on SSP vehicles	Q10	This question identified the equipment carried on SSP vehicles, including cones, flares, truck-mounted CMS, LED warning lights, retractable barriers, electronic beacons, digital flares, flashing arrow panels, and other tools. This establishes what devices are practically available for field deployment.
TTC devices commonly deployed	Q11	This question distinguished between equipment available on the vehicle and equipment most commonly deployed during minor incidents and service calls. This distinction is important because not all available devices are routinely used in short-duration responses.
TTC deployment decision-making	Q12–Q13	These questions documented who decides when TTC is deployed and what factors justify increasing TTC deployment. Decision-making authority is central to understanding whether deployment is driven by operator discretion, TMC direction, incident command, law enforcement, or agency policy.
Formal cone deployment policy	Q14	This question asked whether agencies have a formal cone deployment policy and whether it is agency-specific, based on MUTCD guidance, or informal. Cones were expected to be a common device, so formal policy status was needed for comparison.
Conditions for cone deployment	Q15	This question identified whether cones are deployed every time an SSP vehicle stops, only for lane-blocking incidents, only after a duration threshold, when requested by law enforcement, or

Survey Topic	Survey Questions	Purpose and Rationale
		under other conditions. This question directly supports the project focus on deployment warrants.
Cone quantities carried and initially deployed	Q16–Q17	These questions documented the number of cones typically carried on SSP vehicles and initially deployed. These values help evaluate the feasibility of TTC layouts and the storage constraints of SSP vehicles.
Increasing cone deployment	Q18–Q19	These questions asked how and by whom decisions are made to increase cone deployment. They help identify whether cone deployment is scaled based on lane impacts, incident duration, severity, supervisor direction, law enforcement request, or operator judgment.
Standard cone deployment procedure	Q20	This open-ended question collected agency procedures for deploying cones on or near active traffic. It was included to identify practical field procedures, taper practices, buffer practices, operator movement, and safety practices.
Cone deployment challenges	Q21	This question identified barriers such as storage limitations, time constraints, safety concerns, and lack of formal requirements. These responses help explain why cone deployment may differ from idealized TTC diagrams.
Advanced TTC technologies	Q22–Q25	These questions identified advanced TTC technologies currently used or being piloted, as well as factors influencing advanced TTC deployment. Examples include digital flares, real-time incident notification systems, automated cone deployment systems, retractable barriers, LaneBlade-type systems, HAAS/Waze/Google integrations, and connected work zone technologies.
Barriers to advanced TTC	Q26	This question identified barriers such as time, storage, safety risk, lack of guidance, technology integration issues, cost, and agency adoption challenges.
TTC deployment time	Q27	This question estimated how long it takes SSP operators to deploy TTC at minor incidents or service calls. This is important because short-duration incidents may clear before more formal TTC can be deployed.
ROI or cost-benefit analysis	Q28–Q29	These questions identified whether agencies have completed SSP return-on-investment or cost-benefit analyses and requested links or documentation. These analyses may help support funding and implementation recommendations.
Effective TTC strategies	Q30	This open-ended question allowed agencies to identify strategies they view as most effective for improving safety. Responses help identify practices that may be candidates for case studies or best-practice recommendations.
MUTCD Chapter 6O needs	Q31	This question asked what changes to MUTCD Chapter 6O would help SSPs. It was included to identify perceived gaps, unclear language, or unrealistic expectations in current national guidance.
Additional recommendations	Q32	This question allowed respondents to provide additional comments not captured elsewhere.
Usefulness of survey results	Q33	This question identified what agencies hope to gain from the study, including best practices, standardization, funding support, and examples from other agencies.
Follow-up interview interest	Q34	This question identified agencies willing to participate in follow-up interviews or case studies in later project tasks.

Appendix B: Survey Results

This appendix provides a detailed response-level reference to support the thematic findings presented in Chapter 2. The matrix consolidates findings across major survey areas, including responding agencies, SSP operating characteristics, TTC devices, deployment decision-making, cone deployment practices, advanced TTC technologies, deployment challenges, and agency needs. Table B-5 provides a detailed summary of the Task 1 survey results.

Table B-5: Detailed Survey Results Summary Matrix

Survey Area	Summary of Results	Interpretation
Survey responses	18 individual responses were received, representing approximately 15 distinct states/agencies. Duplicate responses were received from Maryland, Pennsylvania, and Virginia.	The response set provides broad coverage of SSP practices, but results should be interpreted at the response level rather than as one response per state.
Responding agencies	Responses included Alabama, Connecticut, Delaware, Florida, Georgia, Maine, Maryland, North Carolina, New Hampshire, New Jersey, New York, Pennsylvania, South Carolina, Tennessee, and Virginia.	The survey reflects a diverse cross-section of eastern U.S. SSP programs.
SSP operating entity	11 responses included state DOT in-house employees; 7 included state DOT contract employees; 2 included private contractors; several noted mixed or special arrangements.	Most programs are DOT-led or DOT-overseen, but staffing models vary, which may affect training, equipment, and deployment authority.
Roadways served	12 responses reported urban freeways, 9 rural highways, and 7 toll roads. Several also noted limited-access highways, arterials, interstates, special-event routes, and major construction deployments.	SSPs operate across varied roadway environments, so TTC guidance must be flexible enough for urban, rural, high-speed, and toll-road settings.
Service schedule	Service schedules varied widely, including 24/7 coverage, weekday peak-period service, extended weekday service, weekend coverage, and region-specific schedules.	TTC practices may vary within the same agency depending on staffing, region, corridor priority, and time-of-day coverage.
Terminology used	13 responses used “Temporary Traffic Control”; 2 used “Emergency Traffic Control”; 1 used “Incident Traffic Control”; others used broader or mixed terminology.	TTC is the dominant term, but terminology is not fully standardized across agencies.
Written TTC standards/ documentation	14 responses reported written standards or documentation; 3 reported no written documentation; 1 response was blank.	Most agencies have some form of written guidance, but the content, specificity, and SSP applicability vary and require further review.
TTC devices available on SSP vehicles	Cones were available in all 18 responses. Other common devices included truck-mounted CMS/changeable message signs (15), flares (11), flashing arrow panels (11), additional LED warning lights (8), digital flares (6), and electronic beacons (2).	Cones are the universal TTC device, while truck-mounted warning and messaging systems are also widely used.
Devices commonly deployed for minor incidents/service calls	Cones were mentioned in all responses either directly or in narrative form. Truck-mounted CMS/message boards were commonly reported (12+ responses), followed by flashing arrow panels (6), additional LED warning lights (3), and flares (2).	Minor incident TTC relies primarily on cones, vehicle-mounted warning, and message/display systems rather than full formal lane-closure setups.
TTC deployment decision authority	16 responses identified the SSP operator as a decision-maker; 8 referenced agency policy/protocol; 3 referenced the incident commander; 2 referenced the TMC.	TTC deployment is primarily field-driven, with operator discretion supported by policy, supervision, TMC input, or incident command.

Survey Area	Summary of Results	Interpretation
Factors used to increase TTC deployment	Common factors included traffic volume, roadway speed, time of day, weather, incident type, number of lanes blocked, incident duration, sight distance, queues, and available resources.	Agencies generally scale TTC based on exposure, complexity, and expected duration of the incident.
Formal cone deployment policy	9 responses reported an agency-specific cone policy; 5 reported MUTCD-based guidance; others described hybrid, informal, or scaled approaches.	Cone deployment guidance exists in many agencies, but the degree of specificity and SSP tailoring varies.
Conditions for cone deployment	11 responses referenced lane-blocking incidents; 8 referenced duration thresholds or extended shoulder responses; 7 reported cones for every SSP stop; 6 referenced law enforcement request.	Cone deployment policies range from routine deployment at every stop to selective deployment for lane-blocking or longer-duration events.
Number of cones carried	Reported cone quantities ranged from approximately 5 to 40 cones, with many responses in the 10–30 cone range.	Cone-carrying capacity varies substantially and affects what TTC layouts are realistic for SSP vehicles.
Initial cone deployment	Many agencies reported initial deployments in the 4–10 cone range, with expansion based on lane blockage, duration, traffic conditions, or incident complexity.	Many agencies appear to use a scalable cone deployment model rather than a single fixed layout.
Cone deployment challenges	10 responses identified safety concerns; 4 identified limited storage; others noted time constraints, training, SOP compliance, truck capacity/weight, and difficulty judging the proper number of cones.	Cone deployment is both a traffic control practice and a responder exposure issue, especially for one-person SSP operations.
Advanced TTC technologies	11 responses reported real-time incident notification systems; 7 reported digital flares or beacons. Other examples included HAAS-type alerts, Pi-Lit devices, LaneBlade systems, connected work zone technology, smart arrow boards, and navigation-app integration.	Advanced TTC technologies are emerging but unevenly deployed across agencies.
Piloting new TTC technologies	5 responses reported piloting new TTC technologies; 9 reported no current pilots; 4 were blank.	Several agencies are testing new tools, but widespread deployment is still limited.
Barriers to advanced TTC	Common barriers included safety risk, limited storage, lack of time, lack of formal guidance, funding/acceptance, technology integration, and reliance on other units for upstream TTC.	Adoption barriers are practical and institutional, not just technological.
TTC deployment time	6 responses reported less than 2 minutes; 9 reported 2–5 minutes; 1 reported 5–10 minutes; 1 reported unknown; 1 was blank.	Most minor-incident TTC deployments are reported as taking 5 minutes or less, reinforcing the short-duration nature of SSP response.
ROI or cost-benefit analysis	9 responses reported that an ROI or cost-benefit analysis had been completed; 7 reported no; 2 were blank.	Many agencies have some basis for documenting SSP value, but availability and comparability of those analyses vary.
Effective TTC/safety strategies	Respondents emphasized message boards, cones, arrow boards, vehicle positioning, operator training, digital alerts, navigation-app integration, improved visibility, and multiple-unit response for larger incidents.	Agencies generally favor layered safety strategies rather than reliance on one device or practice.

Survey Area	Summary of Results	Interpretation
MUTCD Chapter 6O needs	Respondents requested more practical SSP-specific guidance, clearer emergency traffic control language, flexibility for field conditions, and recognition of limited space, time, equipment, and staffing.	A major finding is the need for TTC guidance that reflects real-world SSP operations during short-duration incidents.
Follow-up interview interest	16 responses indicated willingness to participate in a follow-up interview; 1 declined; 1 was blank.	The response set provides a strong pool of agencies for Task 2 case study interviews.

Appendix C: CTDOT/CHAMP Case Study Questionnaire

CTDOT / CHAMP Case Study Meeting Questionnaire

Case Study Focus: Cone Deployment Warrants and Procedures

Suggested Meeting Length: 60 minutes

Meeting Purpose

The purpose of this meeting is to understand how CTDOT/CHAMP approaches cone deployment and short-duration incident-scene traffic control. The interview is designed to capture the decision logic for when cones are warranted, when cones are not warranted because deployment would add unnecessary exposure, and when cones would be beneficial but are too dangerous for the operator to deploy. The meeting will also address safe cone deployment and retrieval, coordination with vehicle positioning and other TTC measures, and practices that may be transferable to other TETC agencies.

60-Minute Agenda

Agenda Topic
Introductions, project purpose, and recording permission
CHAMP program overview and role at minor incidents
Cone deployment decision logic, including low-risk/no-cones and high-risk/too-dangerous-to-deploy scenarios
Safe cone deployment/retrieval, coordination with vehicle positioning and other TTC, and consistency across operators
Transferable practices and advice for other TETC agencies
Document/material requests and closing clarification

Opening Script

Before we begin, do we have your permission to record this meeting for note-taking and report-development purposes? The recording and transcript will be used to accurately summarize your agency's practices for this project. We may attribute information to the agency or program in the report, but we will not attribute individual comments by name unless you specifically approve that. Please let us know if any comments or materials should be treated as background only.

Interview Questions

The numbered questions are the primary prompts. Use the follow-up questions as needed based on the discussion and available time.

1. Can you briefly describe the CHAMP program, including coverage area, hours of operation, staffing model, and typical incidents handled?

Is the program operated by DOT staff, contractors, or a combination?

How are operators dispatched or notified of incidents?

What role does the TMC play?

What types of minor incidents are most common?

2. What is the expected role of CHAMP operators at minor incidents?

Scene protection, motorist assistance, quick clearance, traffic control, responder support, or some combination?

How does the operator role change when law enforcement, fire/EMS, towing, or maintenance is already on scene?

Are there incident types where operators are instructed not to exit the vehicle or not to deploy traffic control?

3. How do operators decide whether cones are warranted at a minor incident?

What safety or traffic-control benefit must be present before cones are worth deploying?

Is the decision based on incident type, lane blockage, shoulder width, traffic speed, traffic volume, visibility, expected duration, queueing, or responder activity on foot?

Are there written warrants, standard triggers, or is the decision primarily based on field judgment?

4. Can you describe low-risk or very short-duration situations where cones are generally not warranted because deployment would add more exposure than benefit?

For example, a vehicle fully on a wide shoulder, a very brief assist, or a scene where the SSP vehicle, lighting, or arrow board provides sufficient warning.

Is there a time threshold or practical duration threshold where cones are not worth deploying?

How do operators avoid adding unnecessary exposure for incidents with minimal traffic or responder risk?

5. Can you describe high-risk situations where cones would be beneficial, but it is too dangerous for the operator to exit the vehicle and place them?

For example, a stalled vehicle in a middle lane, heavy high-speed traffic, no refuge area, limited sight distance, or a narrow shoulder.

What should the operator do instead of placing cones?

Do they rely on vehicle positioning, arrow board, emergency lighting, TMC notifications, law enforcement, maintenance, or additional responders?

Are operators specifically trained that “cones may be needed, but not safe to deploy” in some scenarios?

6. When cones are used, are operators trained to use standard cone layouts or simplified field setups?

Are there separate setups for shoulder incidents, lane-blocking incidents, ramps, gore areas, bridges, or curves?

Are cone spacing and taper length based on MUTCD concepts, agency-modified spacing, or operator judgment?

Are setups intentionally simplified for short-duration SSP incidents?

7. How many cones do vehicles carry, and how does that affect field practice?

Is the number standardized across the fleet?

Does cone capacity limit what operators can realistically deploy?

Are cones used with arrow boards, lighting, flares, signs, or other devices?

8. How are cones coordinated with vehicle positioning and other TTC measures?

Is the SSP vehicle considered the primary protection or advance-warning device?
Are operators trained on fend-off, blocking, or protective positioning before deploying cones?
How are arrow boards, message boards, lighting, signs, and cones used together?
Who decides whether the traffic-control setup needs to be expanded beyond what the SSP operator can provide?

9. What safe cone deployment practices are taught or expected?

What is the sequence: scene size-up, vehicle position, lights/arrow board, PPE, cone placement, communication with TMC or responders?
Are operators limited in how far upstream they may walk?
Are they allowed to cross live lanes or place cones in active traffic?
Are there special practices for nighttime, rain, heavy traffic, curves, or limited shoulders?

10. What safe cone retrieval practices are taught or expected?

When are cones removed, and who is responsible for removal?
Is retrieval done upstream-to-downstream, downstream-to-upstream, or based on the scene?
Are cones retrieved only after the disabled vehicle is moved, lanes are reopened, or another responder provides protection?
Are there situations where cones are left for another DOT unit or responder to retrieve?

11. Can you walk through two example incidents: one where cones are not warranted because the risk is low, and one where cones would help but deployment is too dangerous?

What does the operator do first in each scenario?
How is the vehicle positioned?
What other warning or protection is used?
How is the scene terminated?

12. How is consistency maintained across operators?

Written SOPs, field training, supervisor ride-alongs, refresher training, incident reviews, camera review, or operator reports?
How are near misses or unsafe deployments reviewed and incorporated into training?

13. What advice would you give another DOT developing SSP cone deployment guidance?

What should be kept simple?
What mistakes should agencies avoid?
What parts of your approach are most transferable to agencies with different staffing, traffic, or equipment levels?

Materials to Request

Operator manual or SOP sections related to traffic control, scene protection, cones, vehicle positioning, incident response, or scene safety.
Cone deployment diagrams, field cards, visor cards, quick-reference materials, or simplified short-duration layouts.
Training slides or lesson plans related to cones, temporary traffic control, emergency traffic control, vehicle positioning, and responder coordination.
Vehicle equipment list showing cones, arrow boards, signs, flares, lights, and other TTC equipment.

Photos of vehicles, cone setups, arrow boards, or other traffic-control equipment.
Incident response checklists, operator field checklists, or supervisor review forms.
Any policy describing when cones should be deployed, when cones are not warranted, or when cones would help but are too dangerous to deploy.

Common Closing Questions

1. Is there anything we discussed that should be treated as background only and not included in the report?

2. Are there any documents, manuals, training materials, photos, diagrams, or checklists you can share after this meeting?

3. Are there other people in your agency we should speak with to better understand this topic?

4. What is the most important lesson other DOTs should take from your program's experience?

5. If another TETC agency wanted to improve SSP temporary traffic control within the next year, what is the first thing you would recommend they do?

Survey Response Summary

The following table summarizes the Task 1 survey response for the participating case study agency and provides context for the case study discussion.

CTDOT/CHAMP

Survey Area	Response
Operating entity	State DOT in-house employees
Roadways served	Urban freeways; rural highways
Service schedule	Weekdays, 5:00 AM-7:00 PM
TTC terminology	Temporary Traffic Control
Written standards/documentation	Yes; respondent indicated the SSP SOP would be emailed.
TTC devices available	Cones; flares; truck-mounted CMS/changeable message signs; additional LED warning lights; electronic beacons; flashing arrow panels; Pi-Lit electronic flares
Devices commonly deployed	Cones; flashing arrow panels
Who decides TTC deployment	SSP operator, Traffic Management Center, pre-established agency policy/protocol, and incident commander
Factors for increasing TTC	Traffic volume, roadway speed, weather conditions, type of incident, and time of day. Respondent noted that operators receive TIM training every two years and that TTC is covered in detail.
Cone policy	Yes - agency-specific policy
Cone deployment conditions	Every time the SSP vehicle stops on the roadway/shoulder
Cones carried / initially deployed	Response indicates approximately 3-5 cones for short-term shoulder deployments and 5-10+ for longer lane deployments; initial deployment appears as 3-5 in the export.
Decision to increase cones	Potential entry into the scene, conditions on scene, need to close lanes, and other field factors
Who increases cone deployment	Driver, State Police request, incident commander, or TMC if traffic behavior is observed on CCTV
Cone deployment procedure	Operators space cones in the shoulder as far away from the vehicle as planned, then move cones outward into the lane while facing traffic to create a taper. The operator retreats to the shoulder after moving each cone and always faces oncoming traffic.
Cone deployment challenges	None reported
Advanced TTC technologies	Digital flares/beacons; real-time incident notification systems; Pi-Lit LED flares; HAAS Alert on all trucks
Piloting new TTC technologies	No
Barriers / implementation notes	Longer-term incidents may require dispatching other staff.
TTC deployment time	Less than 2 minutes
ROI or cost-benefit analysis	No
Effective strategies identified	Driver training to understand the need for TTC and proper deployment
MUTCD Chapter 6O comments	None noted
Follow-up interview interest	Yes

Appendix D: GDOT/HERO Case Study Questionnaire

GDOT / HERO Case Study Meeting Questionnaire

Case Study Focus: Cone Deployment Warrants and Procedures; SSP Operator Training for Incident-Scene Traffic Control

Suggested Meeting Length: 60 minutes

Meeting Purpose

The purpose of this meeting is to understand GDOT's approach to cone deployment and SSP operator training through the HERO program. The interview is designed to capture both field decision-making and the training system used to prepare operators for incident-scene traffic control, including the distinction between low-risk situations where cones may not be warranted and high-risk situations where cones may be beneficial but unsafe to deploy.

60-Minute Agenda

Time	Topic
0-5 min	Introductions, project purpose, and recording permission
5-12 min	HERO program overview and operational roles
12-35 min	Cone deployment decision logic and field practices
35-52 min	Operator training, continuing education, and competency development
52-57 min	Transferable practices and advice for other TETC agencies
57-60 min	Document/material requests and closing clarification

Opening Script

Before we begin, do we have your permission to record this meeting for note-taking and report-development purposes? The recording and transcript will be used to accurately summarize your agency's practices for this project. We may attribute information to the agency or program in the report, but we will not attribute individual comments by name unless you specifically approve that. Please let us know if any comments or materials should be treated as background only.

Interview Questions

The numbered questions are the primary prompts. Use the follow-up questions as needed based on the discussion and available time.

1. Can you briefly describe the HERO program, including coverage areas, staffing, and operating hours?

- How do HERO and CHAMP roles differ?
- Are both programs expected to provide incident-scene traffic control?
- How are incidents assigned or dispatched?

2. What is the expected role of HERO operators at minor incidents?

- Scene protection, motorist assistance, quick clearance, traffic control, responder support, or some combination?
- How does the operator role change when law enforcement, fire/EMS, towing, or maintenance is already on scene?

- Are there incident types where operators are instructed not to exit the vehicle or not to deploy traffic control?

3. How do operators decide whether cones are warranted at a minor incident?

- What safety or traffic-control benefit must be present before cones are worth deploying?
- Is the decision based on incident type, lane blockage, shoulder width, traffic speed, traffic volume, visibility, expected duration, queueing, or responder activity on foot?
- Are there written warrants, standard triggers, or is the decision primarily based on field judgment?

4. Can you describe low-risk or very short-duration situations where cones are generally not warranted because deployment would add more exposure than benefit?

- For example, a vehicle fully on a wide shoulder, a very brief assist, or a scene where the SSP vehicle, lighting, or arrow board provides sufficient warning.
- Is there a time threshold or practical duration threshold where cones are not worth deploying?
- How do operators avoid adding unnecessary exposure for incidents with minimal traffic or responder risk?

5. Can you describe high-risk situations where cones would be beneficial, but it is too dangerous for the operator to exit the vehicle and place them?

- For example, a stalled vehicle in a middle lane, heavy high-speed traffic, no refuge area, limited sight distance, or a narrow shoulder.
- What should the operator do instead of placing cones?
- Do they rely on vehicle positioning, arrow board, emergency lighting, TMC notifications, law enforcement, maintenance, or additional responders?
- Are operators specifically trained that “cones may be needed, but not safe to deploy” in some scenarios?

6. When cones are used, are operators trained to use standard cone layouts or simplified field setups?

- Are there separate setups for shoulder incidents, lane-blocking incidents, ramps, gore areas, bridges, or curves?
- Are cone spacing and taper length based on MUTCD concepts, agency-modified spacing, or operator judgment?
- Are setups intentionally simplified for short-duration SSP incidents?

7. How many cones do vehicles carry, and how does that affect field practice?

- Is the number standardized across the fleet?
- Does cone capacity limit what operators can realistically deploy?
- Are cones used with arrow boards, lighting, flares, signs, or other devices?

8. How are cones coordinated with vehicle positioning and other TTC measures?

- Is the SSP vehicle considered the primary protection or advance-warning device?
- Are operators trained on fend-off, blocking, or protective positioning before deploying cones?
- How are arrow boards, message boards, lighting, signs, and cones used together?
- Who decides whether the traffic-control setup needs to be expanded beyond what the SSP operator can provide?

9. What safe cone deployment practices are taught or expected?

- What is the sequence: scene size-up, vehicle position, lights/arrow board, PPE, cone placement, communication with TMC or responders?
- Are operators limited in how far upstream they may walk?
- Are they allowed to cross live lanes or place cones in active traffic?
- Are there special practices for nighttime, rain, heavy traffic, curves, or limited shoulders?

10. What safe cone retrieval practices are taught or expected?

- When are cones removed, and who is responsible for removal?
- Is retrieval done upstream-to-downstream, downstream-to-upstream, or based on the scene?
- Are cones retrieved only after the disabled vehicle is moved, lanes are reopened, or another responder provides protection?
- Are there situations where cones are left for another DOT unit or responder to retrieve?

11. Can you describe the overall training process for a new SSP operator?

- Classroom training, field training, ride-alongs, mentoring, written tests, skills demonstrations, certification, or probationary period?
- What must be completed before an operator works independently?

12. What specific training is provided on temporary traffic control, emergency traffic control, cone deployment, device use, vehicle positioning, and responder coordination?

- How are MUTCD concepts or agency procedures translated into practical short-duration incident practices?
- Do operators practice field setups or only review them in classroom materials?
- How are operators taught to decide when not to deploy cones or other devices?

13. How are operators trained to make safe decisions under field conditions that do not match a standard setup?

- Scenario-based exercises, tabletop examples, field demonstrations, ride-along coaching, review of real incidents, or supervisor feedback?
- Are operators trained to distinguish between low-risk/no-cones situations and high-risk/too-dangerous-to-deploy situations?

14. How is operator competency verified before independent patrol?

- Skills checklist, field training officer sign-off, minimum hours, written exam, scenario evaluation, supervisor ride-along, or remedial training?
- Are TTC and incident-scene traffic-control skills specifically evaluated?

15. What continuing education or refresher training is provided after the initial training period?

- Annual refresher, TIM refresher, TTC refresher, new equipment training, safety meetings, roll-call briefings, post-incident reviews, or LMS modules?
- How are policy changes, equipment changes, or lessons learned communicated to existing operators?

16. What parts of your training model would be most useful for other agencies to replicate?

- Low-cost or scalable elements such as a field training checklist, scenario library, supervisor ride-alongs, annual refresher, competency sign-off, safety bulletins, or after-action reviews?
- What training elements have been most effective in improving operator consistency and safety?
- What would you recommend to an agency with limited training time or budget?

Materials to Request

- Operator manual or SOP sections related to traffic control, scene protection, cones, vehicle positioning, incident response, or scene safety.
- Cone deployment diagrams, field cards, visor cards, quick-reference materials, or simplified short-duration layouts.
- Training slides or lesson plans related to cones, temporary traffic control, emergency traffic control, vehicle positioning, and responder coordination.
- Vehicle equipment list showing cones, arrow boards, signs, flares, lights, and other TTC equipment.
- Photos of vehicles, cone setups, arrow boards, or other traffic-control equipment.
- Incident response checklists, operator field checklists, or supervisor review forms.
- Any policy describing when cones should be deployed, when cones are not warranted, or when cones would help but are too dangerous to deploy.
- Training academy outline, curriculum, training matrix, onboarding checklist, or annual training plan.
- Field training guide, field training officer checklist, ride-along form, or operator competency checklist.
- Training slides related to TTC, emergency traffic control, cone deployment, vehicle positioning, device use, quick clearance, and responder coordination.
- Written tests, scenario exercises, skills evaluation forms, or supervisor sign-off materials, if shareable.
- Refresher training materials, continuing education modules, LMS course list, safety bulletins, tailgate/roll-call briefing materials, or post-incident review templates.
- Contractor training requirements, if applicable.

Common Closing Questions

1. Is there anything we discussed that should be treated as background only and not included in the report?

2. Are there any documents, manuals, training materials, photos, diagrams, or checklists you can share after this meeting?

3. Are there other people in your agency we should speak with to better understand this topic?

4. What is the most important lesson other DOTs should take from your program's experience?

5. If another TETC agency wanted to improve SSP temporary traffic control within the next year, what is the first thing you would recommend they do?

Survey Response Summary

The following table summarizes the Task 1 survey response for the participating case study agency and provides context for the case study discussion.

GDOT/HERO

Survey Area	Response
Operating entity	State DOT in-house employees and State DOT contract employees
Roadways served	Urban freeways; rural highways; toll roads
Service schedule	24/7
TTC terminology	Temporary Traffic Control
Written standards/documentation	Yes; respondent indicated materials would be sent.
TTC devices available	Cones; flares; truck-mounted CMS/changeable message signs; additional LED warning lights
Devices commonly deployed	Cones; flares; truck-mounted CMS/changeable message signs
Who decides TTC deployment	SSP operator
Factors for increasing TTC	Traffic volume, roadway speed limit, time of day, weather conditions, and type of incident
Cone policy	Yes - agency-specific policy
Cone deployment conditions	Lane-blocking incidents; duration threshold; when requested by law enforcement
Cones carried / initially deployed	30 carried; 10 initially deployed
Decision to increase cones	Traffic volume, speed of traffic, road configuration, and incident type
Who increases cone deployment	SSP operator
Cone deployment procedure	Any lane-blocking incident that cannot be immediately cleared requires traffic control to be deployed.
Cone deployment challenges	Safety concerns
Advanced TTC technologies	Real-time incident notification systems
Piloting new TTC technologies	No
Barriers / implementation notes	Safety risk
TTC deployment time	Less than 2 minutes
ROI or cost-benefit analysis	Yes
Effective strategies identified	Deploying cones while walking backward, wearing full protective gear, and using truck lights and message board as initial traffic control
MUTCD Chapter 6O comments	None identified
Desired study benefit	More SSP-specific information/inclusion
Follow-up interview interest	Yes

Appendix E: NCDOT/IMAP Case Study Questionnaire

NCDOT / IMAP Case Study Meeting Questionnaire

Case Study Focus: Advanced TTC technologies and operational strategies; SSP Operator Training for Incident-Scene Traffic Control

Suggested Meeting Length: 60 minutes

Meeting Purpose

The purpose of this meeting is to understand how NCDOT/IMAP uses advanced TTC devices, technologies, and operator training to support incident-scene safety. The interview is designed to capture what devices are used, how they are funded and maintained, what benefits have been observed, which measure is considered most effective, which measure provides the best value for the cost, and which training elements could be replicated by other TETC agencies.

60-Minute Agenda

Time	Topic
0-5 min	Introductions, project purpose, and recording permission
5-12 min	IMAP program overview and incident-scene role
12-35 min	Advanced TTC devices/technologies, funding, continuing costs, benefits, and best value
35-52 min	Operator training, continuing education, and competency development
52-57 min	Transferable practices and advice for other TETC agencies
57-60 min	Document/material requests and closing clarification

Opening Script

Before we begin, do we have your permission to record this meeting for note-taking and report-development purposes? The recording and transcript will be used to accurately summarize your agency's practices for this project. We may attribute information to the agency or program in the report, but we will not attribute individual comments by name unless you specifically approve that. Please let us know if any comments or materials should be treated as background only.

Interview Questions

The numbered questions are the primary prompts. Use the follow-up questions as needed based on the discussion and available time.

1. Can you briefly describe the IMAP program, including coverage area, hours of operation, staffing model, and typical incident types?

- Is the program operated by DOT staff, contractors, or a combination?
- How are operators dispatched or notified of incidents?
- What role does the TMC play?
- What types of minor incidents are most common?

2. How does NCDOT define IMAP's role in emergency traffic control, temporary traffic control, and incident-scene protection?

- Does NCDOT distinguish between emergency traffic control and temporary traffic control?

- At what point does a scene transition from IMAP-supported emergency traffic control to more formal TTC?
- Who makes that decision?

3. What advanced TTC devices or technologies are currently used by your SSP program?

- Arrow boards, truck-mounted message signs, portable signs, enhanced lighting, queue warning, responder-to-vehicle alerts, camera systems, AVL/CAD/TMC integration, automated notifications, or other devices?
- Which devices are standard on every vehicle and which are specialized or limited to certain routes, regions, or incident types?

4. How do operators decide which advanced TTC device or technology to use at an incident?

- Incident type, lane blockage, shoulder width, roadway speed, visibility, expected duration, queue formation, TMC direction, or presence of other responders?
- Are there standard operating procedures or is it based on operator judgment?

5. What is the single most effective advanced TTC measure your program uses, regardless of cost, and why?

- What problem does it solve better than other measures?
- Does it improve advance warning, visibility, queue awareness, responder protection, motorist behavior, or coordination with the TMC?
- What would be lost operationally if this measure were removed?

6. What advanced TTC measure provides the best bang for the buck, and why?

- Is this different from the most effective measure?
- What makes it cost-effective: low purchase cost, low maintenance, ease of training, frequent use, broad applicability, or measurable safety benefit?
- What would you recommend first to an agency with limited funding?

7. How were these advanced TTC devices or technologies funded initially?

- State operations budget, capital/equipment budget, federal funds, safety funds, TIM program funds, grants, pilot projects, contractor-provided equipment, or another source?
- Was procurement handled centrally, by district/region, through fleet, through operations, or through a vendor contract?

8. Are there continuing costs after the initial purchase?

- Software subscriptions, cellular/data service, licensing, cloud services, vendor support, warranties, calibration, maintenance, replacement parts, batteries, replacement cycles, or staff time?
- Who pays for those continuing costs and who is responsible for keeping the devices operational?

9. What benefits have you seen from the advanced TTC measures?

- Anecdotal benefits from operators or supervisors?
- Data-based findings such as secondary crashes, near misses, clearance time, queue management, motorist compliance, responder safety, or equipment uptime?
- Have benefits been documented through incident reviews, TIM meetings, operator feedback, dashboards, or formal evaluations?

10. What implementation challenges or limitations should other DOTs understand?

- Cost, procurement, maintenance, training burden, operator acceptance, message/sign policy, power or connectivity, TMC integration, durability, or vendor dependence?
- Have any devices been tried and discontinued or used less than expected?

11. Knowing what you know now, what would you buy again, scale up, modify, or avoid?

- What would you recommend for a small SSP program?
- What would you recommend for a large urban freeway patrol?
- What should agencies do before committing to a more expensive technology?

12. Can you describe the overall training process for a new SSP operator?

- Classroom training, field training, ride-alongs, mentoring, written tests, skills demonstrations, certification, or probationary period?
- What must be completed before an operator works independently?

13. What specific training is provided on temporary traffic control, emergency traffic control, cone deployment, device use, vehicle positioning, and responder coordination?

- How are MUTCD concepts or agency procedures translated into practical short-duration incident practices?
- Do operators practice field setups or only review them in classroom materials?
- How are operators taught to decide when not to deploy cones or other devices?

14. How are operators trained to make safe decisions under field conditions that do not match a standard setup?

- Scenario-based exercises, tabletop examples, field demonstrations, ride-along coaching, review of real incidents, or supervisor feedback?
- Are operators trained to distinguish between low-risk/no-cones situations and high-risk/too-dangerous-to-deploy situations?

15. How is operator competency verified before independent patrol?

- Skills checklist, field training officer sign-off, minimum hours, written exam, scenario evaluation, supervisor ride-along, or remedial training?
- Are TTC and incident-scene traffic-control skills specifically evaluated?

16. What continuing education or refresher training is provided after the initial training period?

- Annual refresher, TIM refresher, TTC refresher, new equipment training, safety meetings, roll-call briefings, post-incident reviews, or LMS modules?
- How are policy changes, equipment changes, or lessons learned communicated to existing operators?

17. What parts of your training model would be most useful for other agencies to replicate?

- Low-cost or scalable elements such as a field training checklist, scenario library, supervisor ride-alongs, annual refresher, competency sign-off, safety bulletins, or after-action reviews?
- What training elements have been most effective in improving operator consistency and safety?
- What would you recommend to an agency with limited training time or budget?

Materials to Request

- SSP vehicle equipment lists, vehicle specifications, upfitting diagrams, or procurement specifications.
- Device-use policies for arrow boards, message signs, emergency lighting, queue warning, responder alerts, camera systems, or TMC/CAD/AVL integration.
- Training slides or SOPs for advanced TTC devices and technologies.
- Approved message libraries or sign-use policies, if applicable.
- Equipment inspection, daily readiness, preventive maintenance, warranty, or replacement-cycle checklists.
- Funding, procurement, service contract, subscription, licensing, maintenance, or vendor-support information that can be shared.
- Technology pilot summaries, evaluations, dashboards, benefits summaries, operator feedback, or lessons learned.
- Photos of vehicles and advanced TTC devices.
- Training academy outline, curriculum, training matrix, onboarding checklist, or annual training plan.
- Field training guide, field training officer checklist, ride-along form, or operator competency checklist.
- Training slides related to TTC, emergency traffic control, cone deployment, vehicle positioning, device use, quick clearance, and responder coordination.
- Written tests, scenario exercises, skills evaluation forms, or supervisor sign-off materials, if shareable.
- Refresher training materials, continuing education modules, LMS course list, safety bulletins, tailgate/roll-call briefing materials, or post-incident review templates.
- Contractor training requirements, if applicable.

Common Closing Questions

1. Is there anything we discussed that should be treated as background only and not included in the report?

2. Are there any documents, manuals, training materials, photos, diagrams, or checklists you can share after this meeting?

3. Are there other people in your agency we should speak with to better understand this topic?

4. What is the most important lesson other DOTs should take from your program's experience?

5. If another TETC agency wanted to improve SSP temporary traffic control within the next year, what is the first thing you would recommend they do?

Survey Response Summary

The following table summarizes the Task 1 survey response for the participating case study agency and provides context for the case study discussion.

NCDOT/IMAP

Survey Area	Response
Operating entity	State DOT in-house employees and State DOT contract employees
Roadways served	Urban freeways; rural highways; toll roads; some arterials
Service schedule	Varies by location: rural mountain coverage is 24/7; urban areas have extended weekday coverage with limited weekend coverage; I-95 operates seven days/week; rural east/Wilmington operates M-F, approximately 6:00 AM-5:00 PM.
TTC terminology	Emergency Traffic Control
Written standards/documentation	Yes; respondent provided the IMAP Field Training Guide link.
TTC devices available	Cones; flares; portable variable message signs
Devices commonly deployed	Cones; portable variable message signs
Who decides TTC deployment	SSP operator and pre-established agency policy/protocol
Factors for increasing TTC	Traffic speed, roadway geometry/sight distance, and incident duration
Cone policy	Yes - agency-specific policy
Cone deployment conditions	Lane-blocking incidents; duration threshold; when requested by law enforcement
Cones carried / initially deployed	Minimum 27 cones, enough to close three lanes at nine cones per lane; maximum 40; nine initially deployed
Decision to increase cones	Traffic speed, number of lanes closed, and incident duration
Who increases cone deployment	SSP operator and SOP
Cone deployment procedure	Survey response refers to the IMAP Field Training Guide rather than describing the full procedure directly.
Cone deployment challenges	Limited storage space and safety concerns
Advanced TTC technologies	Respondent indicated that supporting documentation would be attached.
Piloting new TTC technologies	Yes; respondent referred to the supporting document.
Barriers / implementation notes	Limited storage. TMCs activate permanent CMS and send incident information to navigation companies.
TTC deployment time	5-10 minutes
ROI or cost-benefit analysis	Yes
Effective strategies identified	Arrow board and cones; fleet transition to truck-mounted CMS, which the agency believes will be more effective
MUTCD Chapter 6O comments	More guidance on emergency traffic control
Additional comments	Changing the shoulder display standard from four dots to an arrow based on TRB research
Follow-up interview interest	Yes

Appendix F: TDOT/HELP Case Study Questionnaire

TDOT/HELP Case Study Meeting Questionnaire

Case Study Focus: Advanced TTC technologies and operational strategies; SSP Operator Training for Incident-Scene Traffic Control

Suggested Meeting Length: 60 minutes

Meeting Purpose

The purpose of this meeting is to understand how TDOT/HELP equips and trains operators for incident-scene traffic control. The interview is designed to capture traffic-control devices and technologies used by HELP, how they are funded and maintained, what benefits have been observed, which measure is considered most effective, which measure provides the best value for the cost, and which training elements could be replicated by other TETC agencies.

60-Minute Agenda

Time	Topic
0-5 min	Introductions, project purpose, and recording permission
5-12 min	HELP program overview and incident-scene role
12-35 min	Advanced TTC devices/technologies, funding, continuing costs, benefits, and best value
35-52 min	Operator training, continuing education, and competency development
52-57 min	Transferable practices and advice for other TETC agencies
57-60 min	Document/material requests and closing clarification

Opening Script

Before we begin, do we have your permission to record this meeting for note-taking and report-development purposes? The recording and transcript will be used to accurately summarize your agency's practices for this project. We may attribute information to the agency or program in the report, but we will not attribute individual comments by name unless you specifically approve that. Please let us know if any comments or materials should be treated as background only.

Interview Questions

The numbered questions are the primary prompts. Use the follow-up questions as needed based on the discussion and available time.

1. Can you briefly describe the HELP program, including coverage areas, hours of operation, staffing model, and typical incidents handled?

- Is the program operated by DOT staff, contractors, or a combination?
- How are operators dispatched or notified of incidents?
- What role does the TMC play?
- What types of minor incidents are most common?

2. What is the expected role of HELP operators at minor incidents?

- Scene protection, motorist assistance, quick clearance, traffic control, responder support, or some combination?

- How does the operator role change when law enforcement, fire/EMS, towing, or maintenance is already on scene?
- Are there incident types where operators are instructed not to exit the vehicle or not to deploy traffic control?

3. What advanced TTC devices or technologies are currently used by your SSP program?

- Arrow boards, truck-mounted message signs, portable signs, enhanced lighting, queue warning, responder-to-vehicle alerts, camera systems, AVL/CAD/TMC integration, automated notifications, or other devices?
- Which devices are standard on every vehicle and which are specialized or limited to certain routes, regions, or incident types?

4. How do operators decide which advanced TTC device or technology to use at an incident?

- Incident type, lane blockage, shoulder width, roadway speed, visibility, expected duration, queue formation, TMC direction, or presence of other responders?
- Are there standard operating procedures or is it based on operator judgment?

5. What is the single most effective advanced TTC measure your program uses, regardless of cost, and why?

- What problem does it solve better than other measures?
- Does it improve advance warning, visibility, queue awareness, responder protection, motorist behavior, or coordination with the TMC?
- What would be lost operationally if this measure were removed?

6. What advanced TTC measure provides the best bang for the buck, and why?

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- What would you recommend first to an agency with limited funding?

7. How were these advanced TTC devices or technologies funded initially?

- State operations budget, capital/equipment budget, federal funds, safety funds, TIM program funds, grants, pilot projects, contractor-provided equipment, or another source?
- Was procurement handled centrally, by district/region, through fleet, through operations, or through a vendor contract?

8. Are there continuing costs after the initial purchase?

- Software subscriptions, cellular/data service, licensing, cloud services, vendor support, warranties, calibration, maintenance, replacement parts, batteries, replacement cycles, or staff time?
- Who pays for those continuing costs and who is responsible for keeping the devices operational?

9. What benefits have you seen from the advanced TTC measures?

- Anecdotal benefits from operators or supervisors?
- Data-based findings such as secondary crashes, near misses, clearance time, queue management, motorist compliance, responder safety, or equipment uptime?

- Have benefits been documented through incident reviews, TIM meetings, operator feedback, dashboards, or formal evaluations?

10. What implementation challenges or limitations should other DOTs understand?

- Cost, procurement, maintenance, training burden, operator acceptance, message/sign policy, power or connectivity, TMC integration, durability, or vendor dependence?
- Have any devices been tried and discontinued or used less than expected?

11. Knowing what you know now, what would you buy again, scale up, modify, or avoid?

- What would you recommend for a small SSP program?
- What would you recommend for a large urban freeway patrol?
- What should agencies do before committing to a more expensive technology?

12. Can you describe the overall training process for a new SSP operator?

- Classroom training, field training, ride-alongs, mentoring, written tests, skills demonstrations, certification, or probationary period?
- What must be completed before an operator works independently?

13. What specific training is provided on temporary traffic control, emergency traffic control, cone deployment, device use, vehicle positioning, and responder coordination?

- How are MUTCD concepts or agency procedures translated into practical short-duration incident practices?
- Do operators practice field setups or only review them in classroom materials?
- How are operators taught to decide when not to deploy cones or other devices?

14. How are operators trained to make safe decisions under field conditions that do not match a standard setup?

- Scenario-based exercises, tabletop examples, field demonstrations, ride-along coaching, review of real incidents, or supervisor feedback?
- Are operators trained to distinguish between low-risk/no-cones situations and high-risk/too-dangerous-to-deploy situations?

15. How is operator competency verified before independent patrol?

- Skills checklist, field training officer sign-off, minimum hours, written exam, scenario evaluation, supervisor ride-along, or remedial training?
- Are TTC and incident-scene traffic-control skills specifically evaluated?

16. What continuing education or refresher training is provided after the initial training period?

- Annual refresher, TIM refresher, TTC refresher, new equipment training, safety meetings, roll-call briefings, post-incident reviews, or LMS modules?
- How are policy changes, equipment changes, or lessons learned communicated to existing operators?

17. What parts of your training model would be most useful for other agencies to replicate?

- Low-cost or scalable elements such as a field training checklist, scenario library, supervisor ride-alongs, annual refresher, competency sign-off, safety bulletins, or after-action reviews?
- What training elements have been most effective in improving operator consistency and safety?

- What would you recommend to an agency with limited training time or budget?

Materials to Request

- SSP vehicle equipment lists, vehicle specifications, upfitting diagrams, or procurement specifications.
- Device-use policies for arrow boards, message signs, emergency lighting, queue warning, responder alerts, camera systems, or TMC/CAD/AVL integration.
- Training slides or SOPs for advanced TTC devices and technologies.
- Approved message libraries or sign-use policies, if applicable.
- Equipment inspection, daily readiness, preventive maintenance, warranty, or replacement-cycle checklists.
- Funding, procurement, service contract, subscription, licensing, maintenance, or vendor-support information that can be shared.
- Technology pilot summaries, evaluations, dashboards, benefits summaries, operator feedback, or lessons learned.
- Photos of vehicles and advanced TTC devices.
- Training academy outline, curriculum, training matrix, onboarding checklist, or annual training plan.
- Field training guide, field training officer checklist, ride-along form, or operator competency checklist.
- Training slides related to TTC, emergency traffic control, cone deployment, vehicle positioning, device use, quick clearance, and responder coordination.
- Written tests, scenario exercises, skills evaluation forms, or supervisor sign-off materials, if shareable.
- Refresher training materials, continuing education modules, LMS course list, safety bulletins, tailgate/roll-call briefing materials, or post-incident review templates.
- Contractor training requirements, if applicable.

Common Closing Questions

1. Is there anything we discussed that should be treated as background only and not included in the report?

2. Are there any documents, manuals, training materials, photos, diagrams, or checklists you can share after this meeting?

3. Are there other people in your agency we should speak with to better understand this topic?

4. What is the most important lesson other DOTs should take from your program's experience?

5. If another TETC agency wanted to improve SSP temporary traffic control within the next year, what is the first thing you would recommend they do?

Survey Response Summary

The following table summarizes the Task 1 survey response for the participating case study agency and provides context for the case study discussion.

TDOT/HELP

Survey Area	Response
Operating entity	State DOT in-house employees
Roadways served	Urban freeways
Service schedule	Extended weekday and weekend hours, 5:00 AM-10:30 PM
TTC terminology	Emergency Traffic Control
Written standards/documentation	Yes; HELP Operations Manual was sent.
TTC devices available	Cones; flares; truck-mounted CMS/changeable message signs; additional LED warning lights; digital flares
Devices commonly deployed	Cones; truck-mounted CMS/changeable message signs
Who decides TTC deployment	SSP operator
Factors for increasing TTC	Traffic volume, roadway speed limit, time of day, weather conditions, type of incident, incident location/sight line, and available personnel
Cone policy	Yes - based on MUTCD guidance
Cone deployment conditions	Always for lane-blocking incidents; sometimes for extended shoulder responses
Cones carried / initially deployed	Minimum 20 cones, with some vehicles carrying more; average 8-10 cones per lane or shoulder blocked
Decision to increase cones	Number of lanes blocked, line of sight, and traffic speed/volume
Who increases cone deployment	SSP operator
Cone deployment procedure	Operator walks down the shoulder, places the farthest cone first, and tapers remaining cones to the rear of the truck and beyond while monitoring traffic flow.
Cone deployment challenges	Safety concerns
Advanced TTC technologies	Digital flares/beacons and real-time incident notification systems
Piloting new TTC technologies	No
Barriers / implementation notes	Safety risk
TTC deployment time	Less than 2 minutes
ROI or cost-benefit analysis	No
Effective strategies identified	Digital flares and cone-mounted sequential lighting, including Pi-Lites
MUTCD Chapter 6O comments	More guidance on TTC, specifically best practices for SSPs
Desired study benefit	Best practices among fellow SSPs
Follow-up interview interest	Yes

Appendix G: Documents and Supporting Materials Reviewed for Case Studies

The following documents and supporting materials were reviewed to support the Task 2 case studies:

- CTDOT/CHAMP materials
  - CTDOT CHAMP-Geico Operations Manual v3 draft V5.pdf
  - Form_819 With January 2025.pdf
  - Cone storage reference image provided during CTDOT/CHAMP follow-up discussion
- GDOT/HERO materials
  - HERO SOP - Tyrone May 2026.pdf
- NCDOT/IMAP materials
  - IMAP Field Training Guide for Responders 2022 Edition.pdf
  - Quick_Clear_MOU_for_Cabarrus_County.pdf
- TDOT/HELP materials
  - HELP Operations Manual_Update - 10.1.24 Unsigned (4).pdf

Appendix H: Source Materials Reviewed

The following source materials were reviewed to support the Chapter 4 MUTCD consistency review.

Federal Highway Administration. Manual on Uniform Traffic Control Devices for Streets and Highways, 11th Edition, December 2023, including Revision 1 dated December 2025. U.S. Department of Transportation, Federal Highway Administration.

Temporary Traffic Control Guidance for Safety Service Patrol Response to Minor Incidents, Task 1 survey responses. Survey responses from participating member agencies of The Eastern Transportation Coalition were reviewed to identify commonly used SSP temporary traffic control devices, technologies, procedures, decision-making practices, training approaches, and agency comments related to MUTCD application.

Temporary Traffic Control Guidance for Safety Service Patrol Response to Minor Incidents, Task 2 case study interviews. Case study interview transcripts and notes were reviewed for selected SSP programs, including CTDOT/CHAMP, GDOT/HERO, NCDOT/IMAP, and TDOT/HELP. These materials were used to identify field practices, operator decision-making considerations, device deployment procedures, training practices, and agency perspectives on MUTCD clarification needs.

Supporting agency documents and materials provided during Tasks 1 and 2. These materials included SSP operations manuals, field training guides, standard operating procedures, case study questionnaires, quick-clearance materials, device descriptions, and other supporting documentation provided by participating agencies. These materials were reviewed to better understand how commonly reported SSP temporary traffic control practices are documented, trained, and implemented in the field.

The materials reviewed varied in level of detail, format, and completeness across agencies. As a result, this review focused on common practices and recurring implementation themes rather than making a formal compliance determination for any individual agency or state program.