New Hampshire Department of Transportation

Guidelines
for
Implementation of the
Work Zone Safety and Mobility Policy

NHDOT Policy #601.01

October 12, 2007

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Section 1. Review of New Hampshire Work Zone Safety and Mobility Policy

a. Introduction / Overview

On September 9, 2004, the Federal Highway Administration (FHWA) published the Work Zone Safety and Mobility Rule *(the Rule)* in the Federal Register (69 FR 54562). This Rule updates and renames the former regulation on "Traffic Safety in Highway and Street Work Zones" in 23 CFR 630 Subpart J. *The Rule* applies to all state and local governments that receive federal-aid highway funding. Transportation agencies are required to comply with the provisions of *the Rule* by October 12, 2007. The changes made to the regulations broaden the former Rule to better address the work zone issues of today and the future.

In an effort to comply with *the Rule* and develop an agency culture committed to providing safe work zones for all workers and road users while considering mobility and access, the New Hampshire Department of Transportation (NHDOT) has developed its Work Zone Safety and Mobility Policy, included as Appendix A, in conjunction with the guidelines for implementation as contained in this document. The intent of this policy is to provide a decision making framework that promotes the systematic consideration and management of work zone impacts related to safety, mobility, and operations, and provide appropriate level training for those implementing the various stages of project development. It will also establish a Department-wide process for project evaluation and implementation to improve overall consistency of, and performance in, work zones. The development of Transportation Management Plan (TMP) components for both federally and non-federally funded activities will address the impacts an activity has on the transportation infrastructure, road users, businesses, and/or local communities during construction and provide mitigation measures to address the impacts. The policy also includes an assessment component to ensure the requirements are effective and that the work zone practices and procedures are continuously reviewed for appropriate updates.

b. New Hampshire Work Zone Safety and Mobility Policy Objectives

The objectives of the New Hampshire Work Zone Safety and Mobility Policy are defined by its comments section and the passage is provided below:

"…..the Department shall develop and maintain:

1. Work Zone Safety and Mobility **training** for Department staff involved in design, construction and maintenance of the highway system,
2. A **compilation** of relevant safety and operational data and information,
3. A **review** process that evaluates the provisions of this policy and related procedures to identify where improvements can be made, and,
4. Procedures to develop a **Transportation Management Plan** for each project and maintenance activity throughout planning, design, and construction."

Each objective of the policy and its implementation are outlined in specific sections of these Guidelines:

1. **Training Requirements** – Section 4
2. **Compilation of Data** – Section 3
3. **Process Review** – Section 5
4. **Transportation Management Plan** – Section 2

c. Purpose of Document

The purpose of this document is to provide guidelines for meeting the NHDOT Work Zone Safety and Mobility Policy objectives. This document provides an outline of the processes and procedures the Department will take to meet these objectives in a systematic manner. It is realized that this is a "living document" that will be revised and amended to meet any changing needs of work zone safety and mobility recognized in the future.

d. Fiscal Acknowledgement

NHDOT believes that it is essential to address public concerns to minimize work zone related delays by increasing mobility and improving safety in the work zone. Furthermore, NHDOT recognizes and accepts that there are projects costs, especially for projects designated as "Significant", that will be associated with efforts. These costs will vary in magnitude with each specific project. In an effort to properly plan / budget for overall project costs it is important to acknowledge these costs.

Section 2. Work Zone Assessment and Management Techniques

a. Requirements

From *the Rule, Section 630.1008(c)*:
"States should develop and implement systematic procedures to assess work zone impacts in project development, and to manage safety and mobility during project implementation. The scope of these procedures shall be based on the project characteristics."

The fundamental tool for managing and minimizing work zone impacts is the development of a Transportation Management Plan (TMP).

b. Guidance for Implementation

NHDOT has previously instituted an informal qualitative process that was committed to work zone safety and mobility. *The Rule* requires that this process include the addition of a quantitative approach that facilitates the measurement of work zone impacts anticipated during design in comparison with work zone impacts experienced during construction. The measurement and comparison of these impacts will provide practical information that will be used to adjust future work zone policies and procedures. Instituting a quantitative approach will perpetuate many of the current NHDOT practices along with providing appropriate documentation.

i. Traffic Control Committee (TCC)

The Traffic Control Committee is an established multi-disciplinary team comprised of representatives from various Bureaus of NHDOT and is tasked with the overall guidance and implementation of *the Rule*. This committee is chaired by the Director of Project Development and includes personnel from the various stages of project development including but not limited to Planning, Design, Construction, Maintenance, Turnpikes, and Traffic. The members of the TCC should be leaders within NHDOT who are dedicated to improving work zone safety and mobility. Members should encourage growth and advancement of the NH Work Zone Safety and Mobility Policy and Implementation Guidelines. The TCC convenes quarterly to, among other tasks, review and decide items associated with the implementation of *the Rule*.

The TCC, with feedback from various bureaus, will provide the judgment necessary for the following major items:

- Determination of acceptable work zone impacts,
- Determination of anticipated work zone impacts for a specific project,
- Determination of Significant Projects,
- Selection of Transportation Management Plan (TMP) Strategies,
- Evaluation of individual TMP performance, and,
- Revise and modify the Work Zone Policy and Guidelines as necessary.

ii. Work Zone Impacts

Work zone impacts refer to work zone-induced deviations from the normal range of safety and mobility. The extent of these impacts vary based on many factors such as, road characteristics, type

of area (urban, suburban, or rural), traffic volumes and travel characteristics, type of work being performed (construction, maintenance, utility work), time of construction (day/night), and complexity of the project.

The anticipated Work Zone impacts from a proposed project need to be identified and assessed throughout the development of the design. The anticipated impacts may change as details of the design are revised and refined. Identifying anticipated impacts enables the Department to mitigate and manage them by employing a TMP. Estimations of anticipated work zone impacts should be developed with consideration of the magnitude, location, duration, and costs of the project. Discussions should include topics such as the following:

- Safety and Mobility impacts of the project at both the corridor and network levels.
- The combined impacts of projects conducted concurrently in a location near each other or on potential alternate route.
- Impacts on nearby intersections and interchanges, railroad crossings, public transit, and other junctions in the network.
- Impacts on affected public property (parks, recreational facilities, etc.)
- Impacts on affected businesses and residences.
- Impacts on pedestrians and bicyclists.

Previously, NHDOT assessed and managed work zone impacts without a formal set of criteria. A broad, subjective approach to assessing work zone impacts had been established through the use of institutional knowledge and past experience. This approach does consider such ideas as lane capacity, the effects of major local events such as races at the New Hampshire International Speedway (NHIS), seasonal fluctuations of traffic, project location, and tolerance of delay by area residents and businesses, as well as thresholds determined by the project design team. This subjective approach has often led to varying levels of acceptable work zone impacts. Although NHDOT will continue to determine acceptable work zone impacts on a project specific basis, the TCC will strive to establish a consistent determination of those impacts. The depth and detail of the work zone assessment should be appropriate for the type and complexity of each project. As experience with work zone impact assessment increases, the TCC will continue to develop clear, consistent criteria and guidelines to aid in future assessment procedures.

iii. Determination of Significant Projects – the Rule, Section 630.1010

Given the variety and differing complexity of projects, some projects are likely to have much greater effects on traffic conditions than others. Recognizing that not all projects cause the same level of work zone impacts, it is reasonable to identify those that will have the greatest impacts such that the appropriate resources can be allocated. *The Rule* establishes a category of projects called "Significant Projects". A significant project is defined as one that, alone or in combination with other concurrent projects nearby, is anticipated to cause sustained work zone impacts that are greater than what is considered tolerable based on State policy and/or engineering judgment.

a. What is the purpose of identifying Significant Projects?

Consideration of work zone impacts at or prior to the Preliminary Design level (either on a network-wide basis or corridor basis) can have several positive effects. For example, in cost

estimation and budgeting for projects, an understanding of the expected level of work zone impacts of the project will help in deciding what transportation management strategies are likely and to what extent a Public Outreach (PO) campaign is required. This understanding can then serve as the basis for developing reliable cost estimates that are commensurate with the impacts of the project. Furthermore, the analysis of the cumulative impacts of concurrent projects will help better manage overlapping construction activities, thereby minimizing the impacts on road users, businesses, and other affected parties.

b. Who is responsible for identifying Significant Projects?

Design / Construction Projects

The Department's Traffic Control Committee (TCC) will review projects to determine if they are considered significant projects in terms of work zone impacts using the criteria outlined in *Section 2.b.iii. Determination of Significant Projects.* Preliminary Design will support the TCC in making this determination by providing appropriate project information for review.

Division of Operations Projects

Districts or Bureaus within the Division of Operations will review maintenance related projects to determine Significant Projects Status. It should be noted that though maintenance projects are not likely in themselves to be considered significant, when combined with other projects in a given area they may become significant. Non-Significant projects are not required to be reviewed by the TCC, whereas Significant Projects should be reviewed by the TCC with input from the sponsoring District or Bureau to determine required TMP strategies.

c. When should Significant Projects be identified?

Significant projects should be identified as early as feasible in the project development, prior to the development of alternatives. During subsequent project development stages, the significant project status should be reconfirmed. Likewise, non-significant projects should be evaluated from time to time during the development process to reaffirm their status. As more information becomes available for making project-specific decisions, certain projects that were thought to be significant may no longer be significant as a result of change in certain circumstances, and vice-versa.

d. How is a Significant Project defined?

A "Significant" project/activity is one that, alone or in conjunction with other projects/activities, is anticipated to cause sustained work zone impacts to the road users, businesses, or local communities during construction or one that will substantially relieve existing congestion on the highway network upon its completion.

Sustained work zone impacts refer to work zone-induced deviations from the normal range of transportation system safety and mobility. The extent of the work zone impacts may vary based on factors such as road characteristics, area type, (urban, suburban and rural), traffic volumes and travel characteristics, type of work being performed, time of day/night, and complexity of the project/activity. These impacts may extend beyond the physical location of the work zone itself, and may occur elsewhere on the roadway on which the work is being performed, as well as other highway corridors or other modes of transportation.

Per *the Rule, Section 603.1010*, all Interstate projects/activities that occupy a location for more than three days with either intermittent or continuous lane closures and are within a Transportation Management Area (TMA) shall be considered a "Significant" project/activity. A TMA is defined as an area with populations greater than 200,000. As of 2007, Interstates meeting this description in New Hampshire are limited to I-93 from the Massachusetts border to Exit 3 and I-95 from the Massachusetts border to Exit 2. The limits of the TMA are subject to change every ten years with each United States Census.

In addition to the FHWA requirement, NHDOT has established two levels of criteria to identify if a project should be considered Significant. A project may be comprised of one or multiple construction contracts. The initial set of criteria is the Primary Level Criteria. A project must satisfy **all** of the criteria to be considered Significant. The Primary Level Criteria include the following:

1. An estimated construction cost greater than $15 million,
2. Within or affecting communities of over 35,000,
3. On the Interstate or NHS system, and,
4. Anticipated to create sustained WZ Impacts, separately or in combination with other activities.

If a project does not meet the above listed criteria, it may still be considered a Significant Project through the application of the Secondary Level Criteria. The Traffic Control Committee will review the project considering the following, individually or collectively, to make a determination if the project should be considered significant:

1. Time and duration,
2. Nature of work,
3. Traffic volume,
4. Regional significance, and,
5. Anticipated to create sustained WZ Impacts, separately or in combination with other activities.

It is recognized that the listed items above are somewhat subjective and it will require a level of engineering judgment to determine if an item alone, or in combination with others items, may make a project significant. Below is a partial list of the aspects of each of these items which should be considered:

Time: The time of day construction activities occur, especially compared to anticipated traffic volumes during those times. The timing of special events, seasonal traffic and other local activities should be explored.

Duration: The likely duration of construction activities that would affect traffic on any given day. The duration of the overall project itself and/or the duration of activities affecting traffic should also be considered. This item would also include frequent intermittent traffic interruptions that could be a safety concern.

Nature of work: The type of construction work or activities that would likely have a direct, or indirect (e.g., curiosity factor), impact on traffic. This item also includes the required configuration of the work zone geometrically, in traffic control, and such things as lane widths, shy distances, etc.., which impact traffic movement and safety.

Regional Significance: The type of roadway and its significance to the region. Consideration should be given to the availability of alternate routes for traffic to take.

Combination with other Concurrent Projects: Combinations of non-significant, or significant and non-significant, projects in a general area can become a significant traffic issue for the region. This will require looking at the project considerations listed above for all the non-significant projects in a general area to determine if combined in time will make the combined projects "significant" to the region.

Further guidance and clarification of the Secondary Level of Criteria will be developed following the initial implementation of the Rule.

The determination of whether a project is considered significant should be reviewed during each stage of the design process. A project that was initially considered to be Non-Significant may later be determined as a Significant Project due to changes in the secondary criteria or project design.

The flowchart provided on page 16, entitled *Determination of a Significant Project*, illustrates the determination process.

e. What happens when a project is identified as a Significant Project?

For significant projects, a TMP shall be developed to improve the safety and mobility of workers and road users and must consist of the following strategy components:

- Traffic Control Plan (TCP) - provides detailed construction sequencing as well as illustrating measures that will be used to help guide and direct road users through a work zone.
- Transportation Operations (TO) – identification of strategies that will mitigate impacts of the work zone on the Transportation Network. Example strategies may include Intelligent Transportation Systems (using existing ITS) devices, employing Smart Work Zones (SWZ), revised traffic signal timings, and coordination with the Transportation Management Center (TMC).
- Public Outreach (PO) – communication strategies that inform affected road users, the general public, area businesses, and appropriate public entities about the project.

In addition to the strategies listed above, the TMP may also include contingency plans, incident management plans, detailed roles and responsibilities of key personnel, and implementation costs.

Non-Significant Projects are also required to have a TMP, but that TMP is not required to include TO or PO strategies; only a TCP. However, such projects may still benefit from the

incorporation of certain TO and PO strategies, as determined by the applicable parties outlined in this document.

iv. Development and Implementation of Transportation Management Plans - the Rule, Section 630.1012

For all projects, attention must be given to traffic control from the early stages of project development through the completion of construction. Work Zone impacts and issues vary; therefore, it is important to develop a project specific TMP that best serves the safety and mobility needs of the traveling public, communities, and highway workers. A TMP is required for all projects (Significant or Non-Significant) and outlines a set of coordinated strategies that describe how to manage the work zone impacts of the project. The proposed TMP must comply with the current NHDOT Work Zone Policy and its scope, content, and level of detail will vary based on the anticipated work zone impacts of the project. TMP development should begin during project planning (if applicable) and evolve throughout the design process and construction phase. It should then be reviewed following the completion of the project to determine its success.

Although the final TMP is not completed until the final design phase, conducting certain TMP analyses during early design phases will help ensure that the TMP development and implementation costs are included in the project budget. At an early stage in project development, more alternatives for addressing work zone impacts are available, so a broader range of strategies can be chosen. Work zone impacts must be considered during the evaluation and selection of design alternatives. For some projects, it may be possible to choose a design alternative that alleviates many work zone impacts. This is why identification of significant projects at an early stage is important. Early TMP development efforts will also help with scheduling and coordinating projects to minimize the cumulative work zone impacts of multiple projects along a corridor or in a region.

TMP Documentation / Reporting

Below is a comprehensive list of the components that could be included in a TMP. The order, terminology and inclusion of components may vary from project to project. The level of detail of the TMP will reflect the level of potential work zone impacts of the project.

TMP Component	✓
1. Introductory Material	
▪ Cover Page	☐
▪ Table of Contents	☐
▪ List of figures	☐
▪ List of tables	☐
▪ List of abbreviations and symbols	☐
▪ Terminology	☐
2. Executive Summary	☐
3. TMP Roles and Responsibilities	
▪ TMP Coordinator	☐
▪ TMP Team	☐
▪ TMP Implementation Task Leaders	☐
▪ Approval Contact(s)	☐
▪ Emergency Contacts	☐
4. Project Description	
▪ Project background	☐
▪ Project type	☐
▪ Project area / corridor	☐
▪ Project goals and constraints	☐
▪ Proposed construction phasing/staging	☐
▪ General schedule and timeline	☐
▪ Need for detours	☐
▪ Related projects / activities	☐
5. Existing and Future Conditions	
▪ Data collection and modeling approach	☐
▪ Existing roadway characteristics (roadway classification, # lanes, geometry, etc.)	☐
▪ Existing and historical traffic data (volumes, speed, capacity, v/c ratio, truck percentages, congestion, peak traffic hours)	☐
▪ Existing traffic operations (signal timing, traffic controls)	☐
▪ Crash data	☐
▪ Stakeholder concerns/issues	☐
▪ Traffic predictions during construction (volume, delay, queues)	☐

6. Work Zone Impacts Assessment Report	
▪ Qualitative summary of anticipated work zone impacts	☐
▪ Impacts assessment of alternative project design and management strategies	☐
- Construction approach/phasing/staging strategies	☐
- Work zone impacts management strategies	☐
▪ Traffic analysis results	☐
- Traffic analysis strategies	☐
- Measures of effectiveness	☐
- Analysis tool selection methodology and justification	☐
- Analysis results	☐
▪ Selected Alternative	☐
- Construction approach/phasing/staging strategy selected	☐
- Work zone impacts management strategies selected	☐
7. TMP Monitoring	
▪ Monitoring requirements	☐
▪ Evaluation report	☐
8. Public Information and Outreach Plan	☐
9. Incident Management	
▪ Trigger points	☐
▪ Decision and phone tree	☐
▪ Contractor's contingency plan	☐
▪ Standby equipment or personnel	☐
10. TMP Implementation Costs	
▪ Itemized costs	☐
▪ Cost responsibilities/share opportunities	☐
▪ Funding source(s)	☐
11. Special Considerations (As Needed)	☐
12. Attachments (As Needed)	☐

TMP Development Process

The TCC should utilize information and support provided by different Bureaus to guide the overall TMP development and implementation process. The following steps outline the TMP development process. Note that these steps are part of a cyclical process. As the project progresses through various developmental stages and as more project-specific information becomes available, the type of traffic control selected, work zone impacts, and impact management strategies should be reviewed and revised, as necessary.

Step 1. Compile Preliminary Project Material – (Preliminary Design Phase)
The lead bureau conducting the preliminary design phase of the project will compile available information for the project. Much of this information should be readily available from the early project development phase. This information is to be provided to the TCC in Step 4. Information should include:

- Project scope of work and limits of construction,
- Existing roadway and traffic characteristics,
- Local issues,
- Existing data such as mapping, traffic data, accident data, right-of-way information, environmental maps, and,
- Any preliminary TMP Strategies.

A checklist or summary sheet could be developed by NHDOT to ensure the necessary information is provided in a consistent format.

Step 2. Identify Major Issues – (Preliminary Design Phase)
It is important to identify any existing issues that may affect safety and mobility during construction or that may complicate the construction process. After these issues are identified, additional study; coordination; creative management; design or construction approaches; increased right-of-way or environmental impacts; and/or construction costs may be considered necessary. Major issues should be brought to the attention of the TCC in Step 4. Identifying any major construction issues at this stage is important to avoid costly and time-consuming complications during later steps. Uncovering problem areas prior to developing engineering alternates may also help reduce project costs and potential project delays.

Step 3. Preliminary Determination of Significant Projects – (Preliminary Design Phase)
An initial determination of whether a project is significant is a useful tool in the selection of TMP strategies, as well as the anticipated level of detail and cost of the TMP. Guidance used to determine Significant Project status is provided in *Section 2.b.iii Determination of Significant Projects.* The Preliminary Determination of Significant Project status for each project will be completed by the lead bureau conducting the preliminary design phase of the project and presented to the TCC in Step 4.

The anticipated work zone impacts of a project should be assessed at a ***conceptual level*** during this step.

Step 4. TCC Review – (Preliminary Design Phase)
Information from Steps 1-3 will be provided by the lead bureau conducting the preliminary design phase of the project to the TCC for review and comment. The TCC will confirm the determination of Significant Project status based on this information, or may request additional information and/or analysis from Preliminary Design.

It will be the responsibility of the lead bureau conducting the preliminary design phase of the project to coordinate the need for a project review with the TCC by requesting time on the TCC meeting agenda.

Step 5. Evaluation of Alternatives / Determine TMP needs – (Preliminary Design Phase)
Developing and evaluating the best alternative combination of construction phasing/staging, project design options, temporary traffic control, transportation operations strategies, and public outreach strategies will yield a more comprehensive TMP. This evaluation of alternatives should compare work zone options for each design alternate and document maintenance of traffic constraints for each option. This evaluation should address the benefits and problems for each option, and should include recommendations for each design alternative. Before the final alternative is selected, the TCC along with appropriate representatives from other Bureaus should review and comment on it.

During this step, anticipated work zone impacts of a project should be assessed at a ***project specific level*** and the confirmation of Significant Project status should be completed. Work Zone Impacts are assessed using the following process:

- *Maintenance of Traffic Alternative Analysis (MOTAA)* – This qualitative analysis should compare work zone options, including phasing scenarios, lane / road closure, and alternate traffic routes. This analysis should be conducted at the earliest phase to select feasible project alternatives, estimate associated costs, and highlight environmental, right-of-way, and construction issues.
- *Guidelines for Lane Closures* – This guideline would detail a quantitative assessment of work zone impacts by providing a determination process of allowable lane closures beyond the standard 1500 vehicles/hour/lane. These guidelines could establish values for the following:
    - Maximum allowable delays measured in distance or time for different road types with the use of queue length analysis,
    - Minimum Level of Service for work zone intersections and traffic signals,
    - Determination of night work based on traffic, and,
    - Consideration of construction activity (e.g., paving).

  The use of analytical tools may be necessary depending on the degree of impact analysis required. Some tools, such as QuickZone, were specifically designed for work zone related analysis. Other traffic analysis tools, such as Corsim or Synchro, were not designed specifically for work zones but may be useful for analyzing work zone situations.

As NHDOT progresses through the implementation of the Rule, these evaluation processes will require additional guidance as a result of lessons learned and should be formalized into guidelines.

After determining the significant project status, design alternatives, and anticipated work zone impacts, specific TMP strategies for TCP, TO, and PO should be selected. Note that projects designated as Significant require the use of strategies addressing each of these components. Non-Significant Projects only require a TCP component but may benefit from TO and PO strategies.

A detailed listing and description of potential TMP strategies is provided by FHWA and is included in Appendix B.

Step 6. Identify Stakeholders for Input on TMP – (Preliminary Design Phase)

Based on the project size, scope and local impacts, the TCC may decide that input from external stakeholders would be beneficial. The identification of external stakeholders should be done with consideration of the major issues identified in Step 2. Potential stakeholders could include, but are not limited to:

- Planner of Major Events (e.g., New Hampshire International Speedway),
- Local Planning Agencies, and,
- Special Interest Groups.

Step 7. Draft TMP – (Preliminary Design Phase)

During this stage of the preliminary design phase, three (3) important factors affect the TMP:

- The project is getting better defined,
- Environmental mitigation elements (which usually include traffic) are being explored, and,
- There is increased interaction with the local jurisdictions and stakeholders as part of the environmental process.

This is an ideal time to refine the TMP elements that were initially identified in Step 5. This can be particularly important for elements requiring long lead times and/or needing to be established prior to the start of construction, such as a public outreach campaign. If there has been a substantial change in design since Step 5, additional work zone impact assessments and analysis should be performed to address these changes.

The lead bureau conducting the preliminary design phase of the project will coordinate with construction, traffic, and public information officers to jointly identify / confirm the work zone impacts and the proposed work zone impact management strategies.

When developing construction phasing and staging plans, the lead bureau conducting the preliminary design phase of the project should consult with NHDOT Construction staff, as construction phasing and staging can greatly affect the safety and mobility of the work zone. Construction equipment and material access to the site, storage, and staging areas should be addressed at this time, as well as potential infrastructure improvements to accommodate temporarily modified traffic patterns or future projects.

At a minimum, the Draft TMP submittal should include:

- Project summary,
- Anticipated work zone impacts,
- Stakeholders and others impacted by the project,
- Goals and objectives of the TMP,
- Identification of long lead time strategies such as a PO campaign, and,
- Concurrent projects in the vicinity that will require coordination.

Step 8. TCC Review – (Preliminary Design Phase)
The lead bureau conducting the preliminary design phase of the project will provide the TCC with a copy of the Draft TMP for review and approval.

Step 9. Final TMP - (Final Design Phase)
During the final design phase, the TMP is finalized and the Plans, Specifications and Estimates (PS&E) for implementation are developed. It is the responsibility of the lead bureau conducting the final design phase to implement the recommendations set forth in the Draft TMP developed by preliminary design phase. The lead bureau conducting the final design phase may be required to collect additional data and conduct additional analysis, as necessary, to reflect any changes in the project design. The TCC should be consulted when design and TCP decisions dictate a revision to the Draft TMP strategies.

During the Preliminary PS&E (PPS&E) phase of design, a detailed estimate for implementing elements of the TMP should be developed to determine how it may affect the overall cost of the project. Individual projects may have varying bid items for implementing TMP strategies through method based specifications depending on size, complexity and location of the work. Work zone impact management strategies should be shown on the plans where applicable. Special Provisions for non-standard items should also be developed at this time.

Step 10. TCC Review - (Final Design Phase)
The lead bureau conducting the final design phase will provide the TCC with a copy of the final TMP for review and approval.

Step 11. Implement TMP / Monitor TMP / Revise TMP - (Construction / Maintenance Phase)
The TMP will be implemented during construction (some elements may need to be implemented prior to construction, such as Public Outreach efforts or improvements to detour routes to accept additional traffic volumes). Both NHDOT and the contractor must designate a "Responsible Person", as defined in *the Rule, Section 630.1012(e),* at the project level to implement the TMP and other safety and mobility aspects of the project. For NHDOT this person will most likely be the Contract Administrator (CA). For the contractor the title of this person is expected to vary. The designated "Responsible Persons" are responsible for reviewing traffic operations throughout the project limits, including the condition of all traffic control devices, on a regular basis.

NHDOT will review and revise applicable standard specifications to address the requirements of the contractor for implementing a TMP including the designation of a "Responsible Person".

Monitoring the performance of the work zone and of the TMP during construction is important to determine whether the predicted impacts closely resemble the actual conditions in the field and if the strategies in the TMP are effectively managing the impacts.

As discussed in *Section 3. Compilation of Work Zone Data*, the CA is responsible for maintaining ongoing documentation regarding the work zone. Issues such as deficiencies in the implementation of the TMP and how and when they were corrected should be documented with the use of the *Traffic Control Checklist* provided in Appendix D. Traffic crashes occurring within the work zone are to be documented using the *Work Zone Traffic Crash Report* provided in Appendix E. Any major changes or notable items should be identified and brought to the attention of the District Construction Engineer (DCE) for discussion at Bureau of Construction meetings. This information shall also be provided to the TCC upon completion of construction in the post-construction evaluation described in Step12 for the purpose of relaying how well the TMP worked as designed or what needed to be modified during construction.

The Traffic Control Checklist may need to be revised to better address the documentation and reporting needs for implementation of the Rule.

Step 12. Evaluate TMP (Post Construction / Maintenance Phase)

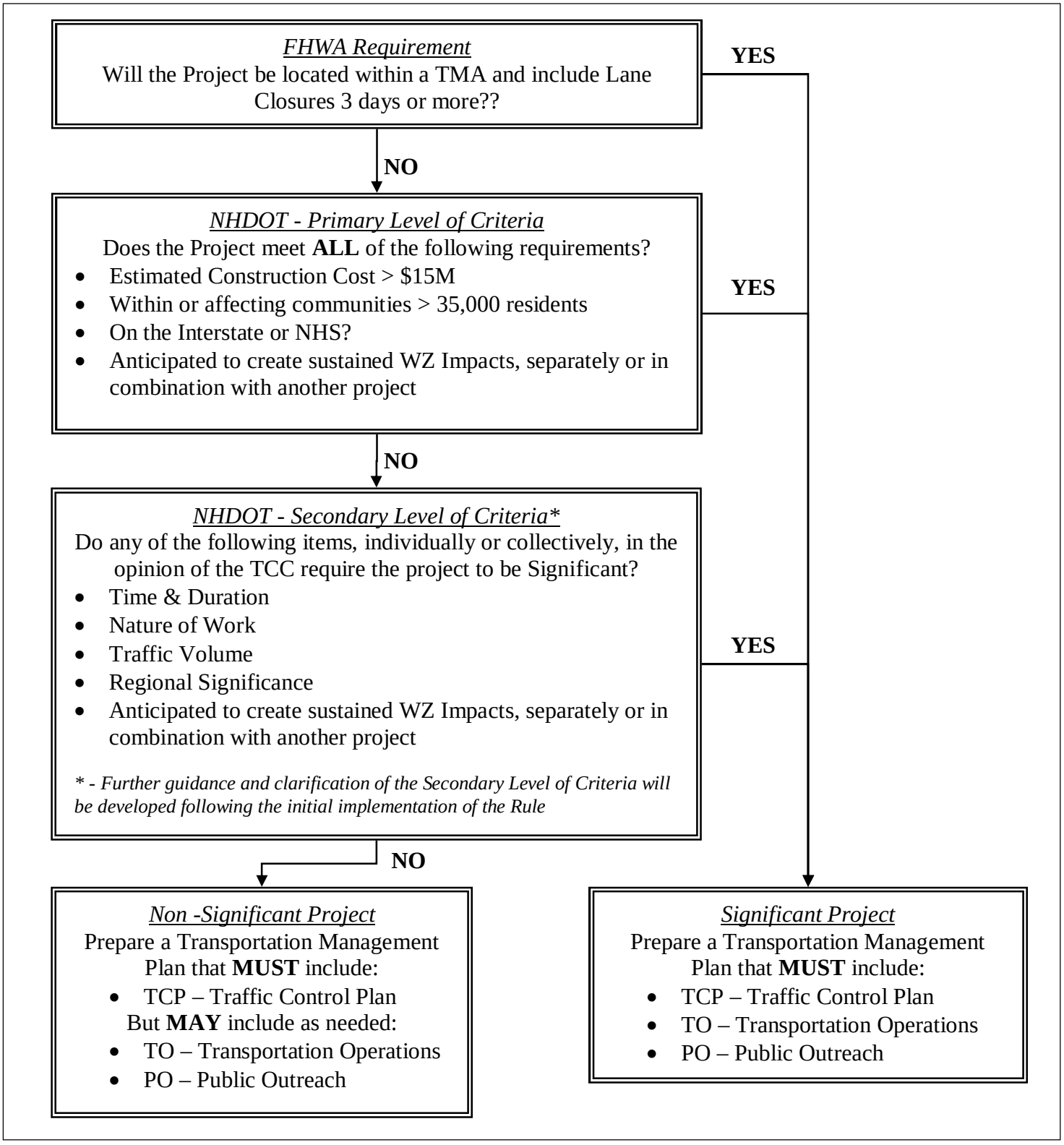
TMP evaluation should focus on the performance of both individual TMP strategies and overall performance of the TMP. Upon completion of construction, an evaluation report should be developed by the Bureau personnel responsible for implementation of the TMP. The report should document lessons learned and provide recommendations on how to improve the TMP process and/or modify guidelines. Elements to consider in the post-project evaluation are:

- Overall statement reflecting the usefulness of the TMP,
- Areas of the TMP that were successfully implemented,
- Changes made to the original TMP and results of those changes,
- Successes and failures,
- Public reaction to the TMP,
- Actual cost versus estimated cost, and,
- Suggested improvements or changes for similar future projects.

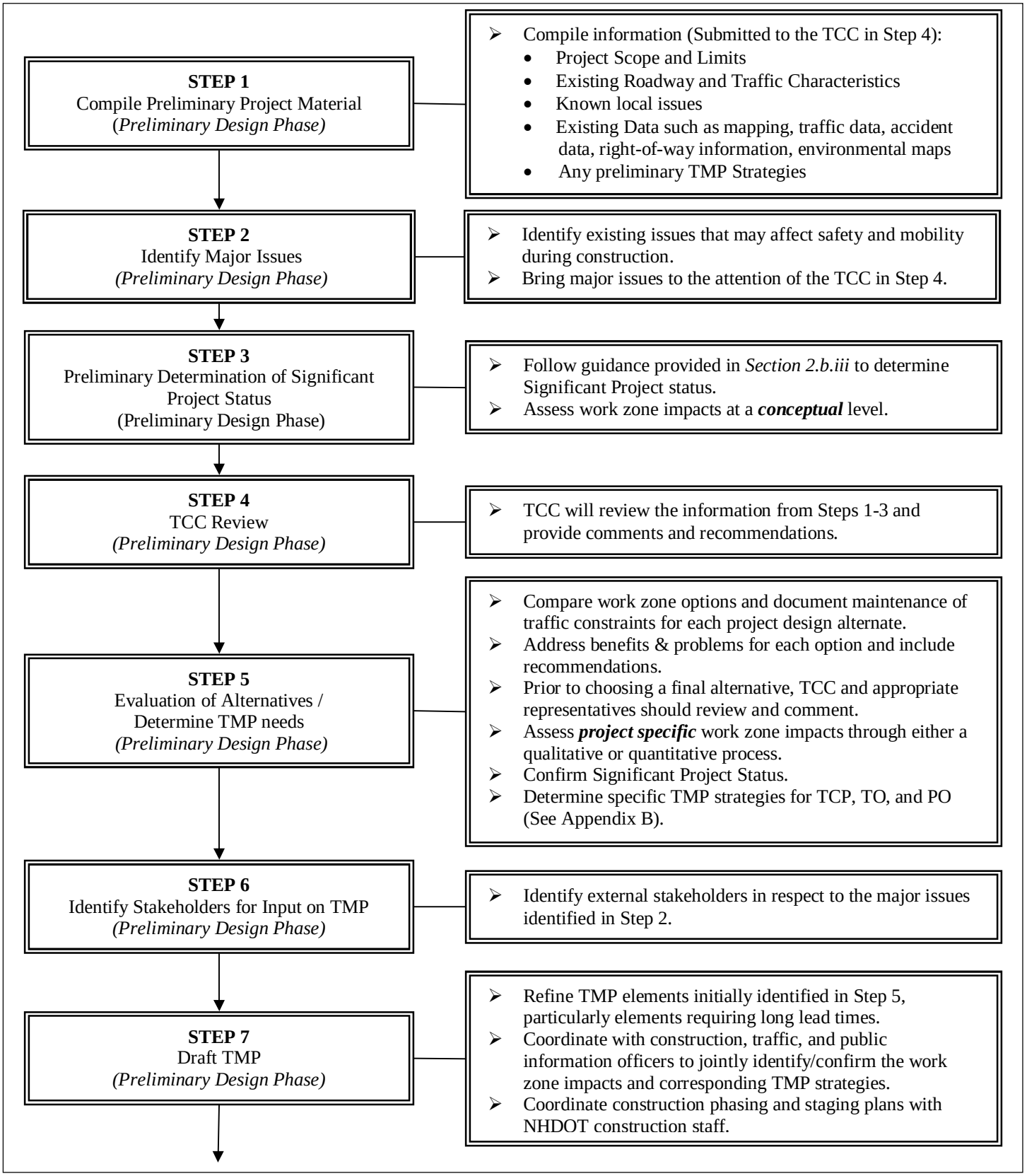
The Evaluation Report should be collected and compiled by the District Construction Engineer or the District Maintenance Engineer as outlined in *Section 3. Compilation of Work Zone Data* and the results provided to the TCC for review.

Determination of a Significant Project

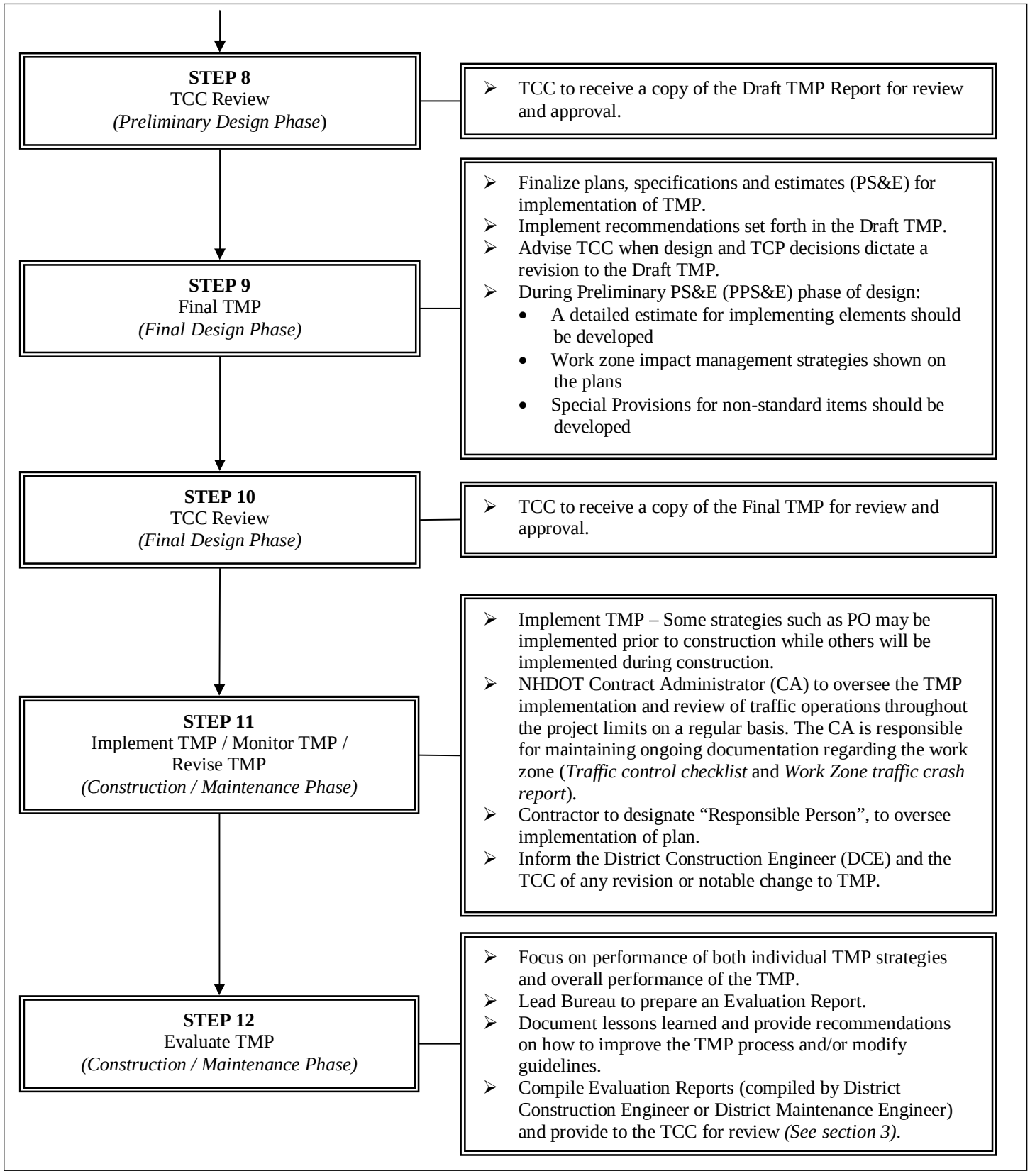
(See Section 3.b.iii. for more information)



TMP Development Process



TMP Development Process



Section 3. Compilation of Work Zone Data

a. Requirements

From *the Rule, Section 630.1008*:
"States shall use field observations, available work zone crash data, and operational information to manage work zone impacts for specific projects during implementation. States shall continually pursue improvement of work zone safety and mobility by analyzing work zone crash and operational data from multiple projects to improve State processes and procedures. States should maintain elements of the data and information resources that are necessary to support these activities."

From NHDOT – Work Zone Safety and Mobility Policy:
"In order to achieve the provisions of this Policy, the Department shall develop and maintain a compilation of relevant safety and operational data and information…"

b. Guidance for Implementation

Work Zone data, as described below, is necessary to make an informed assessment of the success of efforts to manage work zones and their impacts. Work Zone field data also enable agencies to assess how well planning and design estimates of anticipated impacts match what actually happens in the field. Work Zone data supports performance assessments at both the project and state levels. Available data and information provide the basis for assessing performance and taking appropriate actions to improve the performance on projects and maintenance activities as well as overall processes and procedures.

i. Work Zone Traffic Control, Operations, and Safety Inspections

The inspection of work zones must be completed by the CA on a regular basis with an increased effort to formally document these inspections. The inspections should pertain to the placement of traffic control devices, traffic flow through and around the work zone, indications of safety problems, as well as overall work zone operations. The intent of the inspections is to communicate and document issues and experiences as well as to identify that NHDOT and the contractor are properly managing the work zone or identifying where improvements are needed. Inspections should be completed utilizing the *Traffic Control Checklist* provided in Appendix D.

The District Construction Engineers (DCE) should continue to conduct random windshield surveys of projects to reinforce and verify the *Traffic Control Checklists* supplied by the CA. TMP Evaluation Reports as discussed in *Section 2.b.iv. Developing and Implementing Transportation Management Plans, Step 12*, are also to be provided to the DCE by the CA at the completion of each project. DCEs should compile and examine these documents to identify areas of common concern. These areas should be brought to the attention of all DCEs as well as the Bureau of Construction Administrator during their scheduled meetings.

The Bureau of Construction Administrator will report the results of these meetings to the TCC during their quarterly meeting. Work Zone Inspection Reports by other NHDOT personnel as well as FHWA should be included in the discussion and analysis conducted by the Bureau of Construction.

ii. Work Zone Traffic Crash Reports

NHDOT will continue to complete *Work Zone Traffic Crash Reports,* (a sample copy is provided in Appendix E) for each work zone crash. These reports will continue to be distributed to all appropriate personnel including the Bureau of Planning and Assistance for review and immediate corrective action.

The Bureau of Traffic will receive the original of each *Work Zone Traffic Crash Report* as part of the distribution discussed above and will be responsible for compiling and analyzing these reports through a record keeping process. This compilation of reports should be reviewed quarterly for trends such as crash type or common characteristics (month, time of day, location, etc.) and the results of this review presented to the TCC. The Bureau will submit a summary of the *Work Zone Traffic Crash Reports* on an annual basis to the TCC. The TCC address any issues resulting from the review of *Work Zone Traffic Crash Reports*.

iii. Transportation Management Center

The Transportation Management Center (TMC) should be engaged to provide quantitative information regarding existing traffic conditions prior to and throughout the completion of the project. All available instruments of the TMC should be reviewed to determine sources of information that can be applied in the assessment of work zone impacts. Intelligent Transportation System (ITS) and Smart Work Zone (SWZ) components such as Changeable Message Signs (CMS), queue length detectors, and traffic cameras should be examined to determine what applicable information can be generated to aid in the implementation of *the Rule*.

As implementation efforts progress, the role of the TMC should become more clearly defined.

Section 4. Training Requirements

a. Requirements

From *the Rule, Section 630.1008(d)*:
The Rule specifies that agencies require appropriate training for personnel involved in the development, design, implementation, operation, inspection, and enforcement of work zone related transportation management and traffic control. *The Rule* also states that agencies require periodic training updates for these personnel, which should reflect changing industry practices and agency processes and procedures. *The Rule* also clarifies "appropriate training" as training that is relevant to the job decisions that each individual is required to make.

From NHDOT – Work Zone Safety and Mobility Policy:
"In order to achieve the provisions of this Policy, the Department shall develop and maintain:
Work Zone Safety and Mobility training for Department staff involved in design, construction and maintenance of the highway system…."

b. Guidance for Implementation

NHDOT shall develop comprehensive work zone related transportation management and traffic control training programs to meet the intent of *the Rule*. As such programs are developed, consideration should be given to include our partners (cities, towns, consultants, the construction industry, and law enforcement) in the training.

The training programs should accomplish the following:

- Develop a program or method to educate staff at all levels on the policy
- Document and share initiatives as well as "Lessons Learned"
- Develop a program or method to educate staff on how their timely decisions affect work zone safety and mobility, construction duration, and cost

All projects from the simplest maintenance job to a multi-million dollar construction project require traffic control expertise to make the project as safe as possible for the motorist and workers and provide mobility through the work zone. Therefore, personnel involved in the development, design, implementation, operation, inspection, and enforcement of work zone related transportation management and traffic control need to be trained. This includes transportation planners, design engineers, traffic and safety engineers, temporary traffic control designers and program managers, construction managers, construction project staff, maintenance staff, and contractor and utility staff. This may also include executive-level decision-makers, policy-makers, senior managers, information officers, and law enforcement and incident responders.

i. Traffic Control Committee (TCC)

The TCC members should be encouraged to receive training on all aspects of work zone safety and mobility. Some aspects of the training may be in addition to the normal scope of their job responsibility such as a Highway Design representative on the TCC may receive training in aspects customarily given to Construction personnel. Both in-house and external training opportunities may

be used to provide the appropriate level of training for TCC members. Examples of external training opportunities are:

- *Traffic Control Design Specialists (ATSSA)*
- *Traffic Control Supervisor (ATSSA)*

ii. Highway Design / Bridge Design / Traffic / Planning and Community Assistance

The various bureaus listed above may develop an in-house training program for designers, traffic engineers, safety engineers and others in similar positions that are involved in the design of work zone related transportation management and traffic control. As an alternative, external training opportunities include:

- *Advanced Work Zone Management and Design (N.H.I.)*
- *Traffic Control Design Specialists (ATSSA)*
- *Traffic Control Supervisor (ATSSA)*
- *Work Zone Traffic Analysis tools*

iii. Construction

The Rule, Section 630.1012(e) requires the designation by NHDOT, as well as the contractor, of "Responsible Persons" for each project. A "Responsible Person" is defined as the designated trained person at the project level who has the primary responsibility and sufficient authority for implementing the TMP and other safety and mobility aspects of the project.

The Bureau of Construction, in cooperation with the various Districts, shall develop a training program for construction project personnel involved in the implementation, operation, inspection and/or enforcement of work zone related transportation management and traffic control that adequately addresses the requirements for "Responsible Persons".

All personnel involved with a TMP will receive training based on supervisor's review of employee needs through Construction School Presentations and On the Job Training with personnel more experienced with TMP's. Attendance at external training opportunities, such as available NHI or ATSSA courses, may be used to supplement this training. These opportunities include:

Construction Inspectors / Technicians

- *Construction Zone Safety Inspection (N.H.I.)*
- *Design and Operation of Work Zone Traffic Control (N.H.I.)*
- *Traffic Control Technician (ATSSA)*
- *Comprehensive Inspection Training Course (ATSSA – Training CD)*

Construction Project Managers or Project Engineers

- *Advanced Work Zone Management and Design (N.H.I.)*
- *Traffic Control Supervisor (ATSSA)*

iv. Maintenance / Turnpikes / Traffic

The Bureau of Highway Maintenance, the Bureau of Bridge Maintenance, the Bureau of Traffic, and the Bureau of Turnpikes in cooperation with the districts may develop an in-house training program

for personnel involved in the implementation, operation, inspection and/or enforcement of work zone related transportation management and traffic control. This would be accomplished through existing annual District Safety training and would be included in the Maintenance Manual which is to be developed in the future. As an alternative to in-house training, external training opportunities include:

- *Flagger Training / Certification*
- *Low-Speed Lane closures (ATSSA – Training CD)*
- *Moving/Mobile Operations (ATSSA – Training CD)*
- *Basic Worker Safety (ATSSA – Training CD)*
- *Mowing Operations (ATSSA – Training CD)*
- *Truck-Mounted Attenuator Operations (ATSSA – Training CD)*
- *Comprehensive Inspection Training Course (ATTSA – Training CD)*

v. Law Enforcement

NHDOT may choose to coordinate training efforts with various Law Enforcement agencies in an effort to clearly communicate when and how uniformed officers should be used in Work Zones. External training opportunities include:

- *Safe and Effective use of Law Enforcement Personnel in Work Zone*

vi. General Contractors

The Rule, Section 630.1012(e) requires the designation by the contractor, as well as NHDOT, of "Responsible Persons" for each project. A "Responsible Person" is defined as the designated trained person at the project level who has the primary responsibility and sufficient authority for implementing the TMP and other safety and mobility aspects of the project.

Training for contractors should be similar in scope to that of Bureau of Construction and include such activities as implementing or setting up work zone traffic control. NHDOT will not be responsible to train contractors; however, the NHDOT will require contractors to provide "Responsible Persons" through its contracts, by including specifications that require such training.

Section 5. Work Zone Safety and Mobility Policy and Implementation Guidelines Review Requirements

a. Requirements

From *the Rule, Section 630.1008(e)*:
The FHWA requires that the Work Zone Policy / Procedures should be evaluated at least every two years. An evaluation of reported successes and failures of any part to the policy / procedures should be ongoing. Tabulation of this data will be used to help develop and implement future policies / processes. *The Rule* states that the ultimate objective of the process review is to enhance the efforts to address safety and mobility on current and future projects.

From NHDOT – Work Zone Safety and Mobility Policy:
"In order to achieve the provisions of this Policy, the Department shall develop and maintain:
A **review** process that evaluates the provisions of this Policy and related procedures to identify where improvements can be made…."

b. Guidance for Implementation

The TCC currently conducts meetings on a quarterly basis. These meetings present an opportunity to discuss aspects of implementation of *the Rule* and respond to any immediate issues. However, in accordance with *the Rule*, a Process Review Meeting (PRM) will be conducted once every two (2) years, at a minimum. This meeting, or series of meetings, may be part of the normally scheduled TCC meeting or conducted separately, for the sole purpose of reviewing the current NHDOT Work Zone Safety and Mobility Policy and Guidelines for Implementation.

During the PRM, the TCC should review information and analyses provided by the personnel outlined in *Section 3. Compilation of Work Zone Data* which should include information from such areas as:

- *Work Zone Crash Reports* and analyses,
- Work zone operational performance measuring tools such as *Traffic Control Checklists* or windshield survey reports,
- FHWA work zone inspection reports,
- Feedback concerning Public Outreach efforts such as customer satisfaction surveys and website comments,
- "Lessons Learned" regarding implementation of *the Rule.*

Using the information gathered, the TCC should identify areas of the Work Zone Policy and Implementation Guidelines that need revisions or adaptations to be more effective. The four major areas of interest that the review should address are:

- Safety,
- Mobility,
- Construction efficiency and effectiveness, and,
- Public perception and satisfaction.

The following are some questions that the Process Review should attempt to answer:

- Overall, how are work zones performing with respect to safety and mobility?
- Is the process used during the development of a project efficient and effective for the implementation of *the Rule*?
- Should Department Policies or Procedures be adjusted based on what has been observed or implemented?
- Are areas of required improvement readily identifiable?
- Have areas of improvement that have been previously defined been adequately addressed?
- What strategies have succeeded / failed?
- Are there strategies that have not been implemented that should be?

FHWA in conjunction with NHDOT will continue to conduct an annual traffic control review of select work zones throughout the state. These inspections should include work zones that include both daytime and nighttime work operations. Information gathered during these inspections will be used to identify work zone practices and strategies that are successful as well as areas that need improvement.

Supporting Documents

FHWA – Implementing the Rule on Work Zone Safety and Mobility, September 2005

FHWA – Work Zone Impacts Assessment – An Approach to Assess and Manage Work Zone Safety and Mobility Impacts of Road Projects, May 2006

FHWA – Developing and Implementing Transportation Management Plans for Work Zones, December 2005

Manual on Uniform traffic Control Devices for Streets and Highways (MUTCD) 2003 Edition

List of Appendices

Appendix A - NHDOT Work Zone Safety and Mobility Policy

Appendix B – FHWA Work Zone Management Strategies Matrix

Appendix C – Terminology and Concepts

Appendix D – Traffic Control Checklist

Appendix E – Work Zone Traffic Crash Report

Appendix A

NHDOT Work Zone Safety and Mobility Policy

Adopted: October 12, 2007

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION
POLICY 601.01

Title: Work Zone Safety and Mobility for Department Projects and Activities

Statement: It shall be the policy of this Department to maintain the smooth and efficient flow of traffic while providing a safe work environment and safe travel for motorists at all State work zones.

Comments:

1. The Project Development process shall comply with the provisions of this Policy to achieve an appropriate balance of the following objectives:

    a) Provide a safe environment for workers and the traveling public, and,
    b) Provide a level of transportation management appropriate for the scope of work operations that minimizes delay to the traveling public.

2. In order to achieve the provisions of this Policy, the Department shall develop and maintain:

    a) Work Zone Safety and Mobility training for Department staff involved in design, construction and maintenance of the highway system,

    b) A compilation of relevant safety and operational data and information,

    c) A review process that evaluates the provisions of this policy and related procedures to identify where improvements can be made, and,

    d) Procedures to develop a Transportation Management Plan for each project and maintenance activity throughout planning, design, and construction.

Dated: _____

_____
Charles P. O'Leary, Jr.
Commissioner

Authority:
The Department relies upon *23 CFR Part 630 Work Zone Safety and Mobility* to implement this policy.

Effective Date: October 12, 2007
Revision Note: 2007 New Policy

Appendix B

FHWA Work Zone Management Strategies Matrix

Appendix B – Work Zone Management Strategies Matrix

The information contained in this appendix is intended to support transportation agencies in the selection of work zone management strategies described in Section 2.2.1, Step 4 and Section 3.7 of this document. For the various work zone impact management strategies described in Section 4.0 of this document, Table B.1 presents some guidance for which strategies are anticipated to lead to an improvement in mobility or safety (motorist and worker), what project characteristics may trigger a strategy for consideration, pros and cons associated with the strategy, and other considerations. There may be exceptions; this is intended as guidance. The organization of the matrix is based on a compendium of options table contained in Ohio DOT's Policy No.: 516-003(P) –Traffic Management in Work Zones Interstate and Other Freeways[1] document.

Some of the typical project characteristics that should be considered when selecting work zone impact management strategies for a project include:

- Facility type (freeway, highway).
- Area type (urban, rural).
- Project length.
- Project duration.
- Multiple construction stages/phasing.
- Traffic volume.
- Capacity reductions.
- Expected delay.
- Crash rate.
- Percentage of trucks.
- Available detour route(s).
- Available alternative travel modes.
- Community factors (public exposure, business impacts, and residential impacts).

[1] Ohio Department of Transportation (ODOT) policy on Traffic Management in Work Zones Interstate and Other Freeways, Policy No.: 516-003(P), July 18, 2000. Available online in the Policy section of ODOT's web site. URL: http://www.dot.state.oh.us/Policy/516-003p.pdf (Accessed 09/08/05).

	Management Strategy	Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
I. Temporary Traffic Control (TTC) Strategies					
A. Control Strategies					
IA1	Construction phasing/staging	✓			■ Long project duration
IA2	Full roadway closures Continuous (for a project phase or the entire project)			✓	■ Detour routes available ■ Project needs to be completed in a compressed timeframe ■ Traffic volume through the project can be accommodated on detour route(s) ■ Highway facilities ■ Short project length
	Off-peak/night/weekend	✓		✓	■ Detour routes available ■ High traffic volumes ■ Low traffic volumes during work time period
	Intermittent		✓	✓	■ Short project length ■ Short project duration ■ When work can be accomplished in short periods of time ■ Low traffic volumes ■ Rural areas
IA3	Lane shifts or closures Reduced lane widths to maintain number of lanes (constriction)	✓			■ Long project duration ■ High traffic volumes
	Lane closures to provide worker safety			✓	■ When the remaining lanes provide adequate capacity to handle the traffic demand ■ Minor work with short duration

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation

Potential Pros	Potential Challenges	Other Considerations
■ Less traffic impacts at each construction phase	■ Longer project duration	■ Adequate work areas ■ Extended periods of lane/ramp closures expected ■ When schedule allows
■ Faster construction ■ Easier, more efficient construction – larger workspace with more flexibility ■ No traffic distractions ■ Safer for workers ■ Better construction (e.g., smoother ride) ■ Public feedback often positive ■ Reduces need to set up and take down traffic control	■ May increase cost to motorists (time and fuel) ■ Accessibility to businesses and residences ■ Motorists may get lost ■ May significantly impact local roadways used for detours	■ Public information necessary ■ Signage and/or capacity improvements to detour route(s) may be necessary ■ Need enough labor and materials available for accelerated work
■ Faster construction ■ Less traffic impacts ■ Safer for workers	■ Motorists may get lost	■ Public information necessary ■ Signage and/or capacity improvements to detour route(s) may be necessary ■ Need to schedule around special events
■ Can close as necessary for construction purposes	■ Can result in large delays	■ Public information necessary ■ Detour route(s), with signage, may be needed
■ Can maintain existing number of lanes ■ Easier design ■ Detour route may not be necessary ■ Ramps can remain open	■ Can reduce traffic capacity ■ May interfere with contractor access ■ Narrow lanes (may affect motorist safety) ■ May take longer to construct ■ Barrier could still be required for some drop-offs	■ Less width reductions may be needed if the shoulder has adequate width and structural adequacy ■ May not be feasible where traffic volumes already approach or exceed the capacity of the roadway ■ Sometimes difficult to obtain minimum lane widths ■ Potential conflicts between width of roadway and width needed for work
■ Safer for workers ■ Can provide more work space	■ May interfere with contractor access ■ May sacrifice project quality ■ May cause delays	■ In conjunction with lane shift to shoulder or median

Management Strategy		Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
I. Temporary Traffic Control (TTC) Strategies (Continued)					
A. Control Strategies (Continued)					
IA3	Reduced shoulder width to maintain number of lanes	✓			■ Enough shoulder space available ■ Minor work with short duration
	Shoulder closure to provide worker safety			✓	■ Enough shoulder space available ■ Minor work with short duration
	Lane shift to shoulder/median to maintain number of lanes	✓			■ High traffic volume ■ Enough shoulder space available ■ Where bridges can accommodate use
IA4	One-lane, two-way operation[2]				■ Highway type facilities ■ Rural areas ■ Short-term project covering a short distance ■ Traffic volume through the project is not high
IA5	Two-way traffic on one side of divided facility (crossover)			✓	■ Long project duration ■ Projects with multiple construction stages/phasing ■ Concerns for worker safety ■ When detour routes and/or median or shoulder is not available
IA6	Reversible lanes	✓			■ Where there are capacity limitations and no alternate routes ■ Significant directional peaking of traffic ■ Long project duration
IA7	Ramp closures/relocation	✓	✓		■ Alternative ramps/routes available ■ Shorter construction period required ■ High traffic volumes
IA8	Freeway-to-freeway interchange closures		✓		■ Alternative routes available
IA9	Night work	✓			■ Urban area ■ High traffic volume

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

[2] This strategy is most often used when access must be maintained, there are no feasible diversion routes available, or to avoid diverting traffic a long distance. Agencies are more likely to use this strategy out of necessity rather than to bring about mobility and safety improvements.

Potential Pros	Potential Challenges	Other Considerations
■ Traffic remains on routes	■ May interfere with contractor access ■ May compromise safety	■ In conjunction with lane shift to shoulder or median
■ Traffic remains on routes	■ May interfere with contractor access ■ May affect motorist safety ■ No room for breakdowns	■ Avoid in high incident areas
■ Traffic remains on routes ■ Low cost ■ Allows wider work area or maintains capacity	■ May interfere with contractor access ■ May compromise safety ■ No room for breakdowns ■ May damage the shoulder/median	■ May need to upgrade shoulder/median ■ Adequate structural capacity to carry traffic mix (including heavy trucks) is necessary
■ Easy to set-up	■ May result in long delays	■ Flaggers or temporary/portable traffic signals are typically used to control traffic ■ May be necessary to perform the work
■ Provides a more efficient work space ■ Can reduce construction period ■ Safer for workers	■ Additional cost to construct crossovers and separations between opposing traffic ■ Difficulty handling ramps	■ Shoulders and/or lane width reductions may be used to maintain an adequate number of lanes ■ Positive separations are required ■ Where roadway geometry makes the construction of crossovers practical
■ Accommodates peak traffic flow	■ May be labor intensive ■ Confusing to motorists ■ Cost of positive separation	■ Best serves commuter traffic ■ For high speed roadways, a movable barrier system or other form of positive separation is typically used to separate and direct traffic
■ Faster construction ■ Reduces mainline and cross road traffic congestion ■ May simplify the work zone	■ Diverts congestion elsewhere ■ Increases cost to motorists (time and fuel) ■ Motorists may get lost	■ Public information necessary
■ Construction duration can be reduced ■ May simplify the work zone	■ May significantly affect facility capacity ■ Additional signage to route motorists	■ In conjunction with accelerated construction/contracting techniques ■ Public information necessary
■ Maintains normal capacity during the day ■ Fewer delays	■ May be less safe due to lighting distractions, higher speeds, and increased driver impairment ■ Costly for labor ■ Possible reduced quality of work ■ May extend project duration	■ Where feasible to carry out work in nightly increments ■ Where traffic controls can be reconfigured on a nightly basis ■ Urban noise ordinances ■ Need enough resources and laborers available for night work

	Management Strategy	Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
I. Temporary Traffic Control (TTC) Strategies (Continued)					
A. Control Strategies (Continued)					
IA10	Weekend work	✓			■ High traffic volume ■ Commuter traffic is significant
IA11	Work hour restrictions for peak travel	✓			■ Urban areas ■ High traffic volume ■ Significant peaking of traffic ■ Where significant capacity reductions are necessary
IA12	Pedestrian/bicycle access improvements	✓	✓		■ Long project duration ■ Significant pedestrian/bicyclist activities ■ Existing sidewalks traverse the work zone ■ A school route traverses the work zone
IA13	Business access improvements	✓			■ Long project duration ■ Where access to businesses may be reduced ■ Anticipated impacts to businesses
IA14	Off-site detours/Use of alternate routes	✓	✓		■ Where significant reduction in capacity is necessary in one or both directions ■ When a full road closure is being used to perform the roadwork ■ Long project duration ■ High traffic volume ■ Detour routes with capacity available
B. Traffic Control Devices[3]					
IB1	Temporary signs Warning	✓	✓	✓	■ In a situation that may not be readily apparent (e.g., speed reductions, road or lane narrows, etc.)
	Regulatory	✓	✓	✓	■ When necessary to inform road users of traffic laws or regulations
	Guide/information	✓	✓		■ When off-site detours are being used ■ When advanced notice is necessary for road users to choose an alternate route

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

[3] A wide range of other safety devices are described in Part 6 of the Manual on Uniform Traffic Control Devices (MUTCD) and are widely used to enhance safety and mobility in highway work zones. These devices, such as temporary traffic barriers and crash cushions, are included in the Work Zone Safety Management Strategies category.

Potential Pros	Potential Challenges	Other Considerations
■ Maintains normal capacity during weekdays ■ Fewer delays	■ May extend project duration	■ Need to consider special events when scheduling ■ Need enough resources and laborers available for weekend work
■ Maintains normal capacity during traffic peak times ■ Fewer delays	■ May extend project duration	■ Duration of work restrictions will vary by location
■ Safer for pedestrians and bicyclists	■ Additional cost to build alternate paths for pedestrians/bicyclists	■ Need local jurisdiction support ■ Improvements to the detour route may be needed to accommodate the diverted traffic including capacity and geometric improvements, signal retiming and coordination, signing and pavement markings, parking restrictions, and CMS to provide detour information
■ Accessibility to businesses ■ Positive community relations	■ Additional cost	
■ More efficient utilization of existing transportation facilities ■ May reduce motorist delays	■ May require additional cost ■ May significantly impact roadways used for detours ■ Motorists may get lost	
■ Reduces potential for incidents	■ May be ignored or missed by motorists when much signage is present	
■ Encourages reduced speeds ■ Reduces incident potential	■ May be ignored or missed by motorists when much signage is present	
■ Provides alternate route and work zone information to road users	■ May be ignored or missed by motorists when much signage is present	

Management Strategy		Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
I. Temporary Traffic Control (TTC) Strategies (Continued)					
B. Traffic Control Devices (Continued)					
IB2	Changeable message signs (CMS)	✓	✓		■ When work zone information is subject to frequent changes ■ Projects with multiple construction stages/phasing ■ Detour routes with capacity available
IB3	Arrow panels	✓	✓	✓	■ Lane closures, particularly on high-speed roadways
IB4	Channelizing devices	✓	✓	✓	■ All work zone types ■ When changes to the road configuration or potential hazards necessitate their use
IB5	Temporary pavement markings	✓	✓	✓	■ Long project duration ■ When additional markings are necessary to guide road users through the work zone
IB6	Flaggers and uniformed traffic control officers		✓		■ Low traffic volume projects ■ Rural areas ■ One-lane, two-way operations
IB7	Temporary traffic signals	✓	✓	✓	■ Where the work zone operations disrupt normal traffic patterns ■ One-lane, two-way operations ■ For longer-term projects ■ When additional capacity is needed
IB8	Lighting devices		✓	✓	■ When night work is being conducted ■ Long project duration ■ High traffic volume

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Effective way to communicate real-time information to road users ■ Allows road users to adjust travel plans based on information ■ Draws special attention to key information	■ May be ignored or missed by motorists when much signage is present ■ Additional cost	■ Used to supplement normal static work zone signs ■ Needs a means of controlling/updating signs, such as a TMC
■ Assists motorists in navigating and merging through and around the work zone ■ Effective method to alert motorists of lane closures ■ Highly visible ■ Encourages smooth merging behavior	■ Additional cost	■ Used to supplement conventional traffic control devices
■ Helps to direct road users through the work zone ■ Delineates potential work zone hazards ■ Easy to set-up	■ Errant vehicles are not prevented for intruding beyond these devices	
■ Provides guidance and information for road users through the work zone	■ Visibility of the markings may be limited by weather conditions and debris	■ Need to obliterate obsolete markings to minimize possibility of misleading road users
■ Helps to alert road users to the presence of work operations	■ Reduces safety for road workers	■ In conjunction with intermittent closure
■ Helps improve ramp and/or detour capacity ■ Improves traffic flow through and near the work zone ■ Improves safety	■ Changes traffic patterns on the cross road ■ Cost	■ Signal installation should be warranted
■ Enhances visibility of devices and delineations in the work zone ■ Improves worker safety ■ Guides road users through the work zone particularly during night and under adverse conditions	■ May be distracting to motorists	

	Management Strategy	Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
I. Temporary Traffic Control (TTC) Strategies (Continued)					
C. Project Coordination, Contracting and Innovative Construction Strategies					
IC1	Project coordination Coordination with other projects	✓			■ May be beneficial to any project
	Utilities coordination	✓			■ May be beneficial to any project
	Right-of-way coordination	✓			■ May be beneficial to any project
	Right-of-way coordination	✓			■ May be beneficial to any project
IC2	Contracting Strategies Design-build	✓			■ High traffic volume ■ When project acceleration is desirable
	A+B bidding	✓			■ High traffic volume ■ Where significant reduction in capacity is anticipated ■ Projects with significant impacts to traffic flow, businesses, and/or the community
	Incentive/disincentive clauses	✓			■ High traffic volume ■ Where significant reduction in capacity is anticipated ■ Projects with significant impacts to traffic flow, businesses, and/or the community ■ When an out-of-service facility needs to be replaced ■ No good alternate routes available

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Reduces motorist delay ■ Minimizes impacts to potentially affected businesses and communities ■ Reduces exposure time to road work ■ May increase efficiencies	■ May be difficult to identify potential projects to coordinate with	■ Routine agency meetings may address coordination at the project level, corridor level, district region level, and at the State level
■ Reduces construction duration and delay ■ May reduce number of work zones and exposure to road work	■ May be difficult to identify potential projects to coordinate with	■ Development of training, education, and auditing standards for utility work can further minimize traffic impacts
■ Reduces construction duration and delay	■ May be difficult to identify coordination opportunities	■ Considering right-of-way issues early in project development can minimize traffic impacts
■ Minimizes potential impacts on other transportation facilities	■ May be difficult to identify coordination opportunities	
■ Shorter project duration ■ Less traffic impacts ■ May reduce administrative costs ■ Provides a single point of contact for design and construction issue ■ Allows for flexibility for innovative designs, materials, and construction techniques	■ May pay more for the actual construction	
■ Reduces construction time ■ Less traffic impacts	■ May pay more for the work ■ potential for disagreement ■ Issues must be resolved quickly	■ If a project has significant issues with utilities, time-based bidding may be difficult; it may be possible to separate that portion of the project
■ Reduces construction time ■ Less traffic impacts ■ Early project completion may result in significant cost savings	■ Potential arguments for time extensions ■ Issues must be resolved quickly	■ If a project has significant issues with utilities, time-based bidding may be difficult; it may be possible to separate that portion of the project

	Management Strategy	Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
I. Temporary Traffic Control (TTC) Strategies (Continued)					
C. Project Coordination, Contracting and Innovative Construction Strategies (Continued)					
IC2	Incentive/disincentive clauses	✓			■ Urban area ■ High traffic volume ■ For paving freeways ■ No good alternate routes available
IC3	Innovative construction techniques (precast members, rapid cure materials)	✓			■ High traffic volume ■ Where traffic restrictions need to be minimized ■ When work activities need to be completed during night or weekend periods
II. Public Information (PI) Strategies					
A. Public Awareness Strategies					
IIA1	Brochures and mailers	✓	✓	✓	■ Urban area ■ Long project duration ■ Alternate travel modes available ■ High public exposure ■ Significant business impacts ■ Significant residential impacts
IIA2	Press releases/media alerts	✓	✓	✓	■ Large projects ■ Projects with multiple phases/construction stages ■ High public exposure ■ Significant business impacts ■ Significant residential impacts
IIA3	Paid advertisements	✓	✓	✓	■ Alternate routes available ■ High public exposure ■ Significant business impacts ■ Significant residential impacts

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Less traffic impacts ■ Lanes only closed for short periods, when truly needed	■ Requires careful timekeeping ■ Potential for disagreements	
■ Reduces construction time ■ Less traffic impacts		
■ Condensed format of brochures lends itself to brief, high-impact messages ■ Brochures have a relatively long shelf life, which is useful for projects of long duration ■ Low cost ■ Easy to distribute	■ Information (e.g., dates of road closures) may change and not be reflected in the printed materials ■ Often targets local motorists only	■ Used in conjunction with other elements in the TMP ■ Most useful if it gives people an alternative to driving alone through the work zone – transit, ridesharing, alternate route
■ Cost effective if it uses free publicity to inform	■ Often targets local motorists only	■ For larger projects, announcements may include project start ups, periodic progress reports, and major traffic pattern changes
■ Gives travelers advanced warning to plan for delays or alternate routes ■ Covers a large or multi-jurisdictional area ■ Reinforces public awareness of the project ■ Can reach many people at one time	■ Requires advanced planning ■ Additional cost ■ May only target local motorists ■ Newspaper readers may skip over ads	■ Advance planning prior to the start of construction is essential to develop and schedule the needed advertisements

Management Strategy		Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
II. Public Information (PI) Strategies (Continued)					
A. Public Awareness Strategies (Continued)					
IIA4	Public information center	✓	✓	✓	■ Urban area ■ Long project duration ■ Projects with multiple phases/construction stages ■ High public exposure ■ Significant business impacts ■ Significant residential impacts
IIA5	Telephone hotline	✓	✓	✓	■ Urban area ■ Long project duration ■ Projects with multiple phases/construction stages ■ Detour routes available ■ High public exposure ■ If frequent land and/or ramp closures are expected
IIA6	Planned lane closure web site	✓	✓	✓	■ Long project duration ■ Projects with multiple phases/construction stages ■ Detour routes available ■ High public exposure ■ Project includes lane closures
IIA7	Project web site	✓	✓	✓	■ Urban area ■ Long project duration ■ High public exposure ■ Project and traffic information changes frequently
IIA8	Public meetings/hearings	✓	✓	✓	■ Long project duration ■ High public exposure ■ Significant business impacts ■ Significant residential impacts
IIA9	Community task forces	✓	✓	✓	■ Long project duration ■ High public exposure ■ Significant business impacts ■ Significant residential impacts

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Single, centralized access point to information about project ■ Provides direct access to information and people to talk to about the project	■ Additional cost of staffing and leasing office space and equipment	■ Project is localized ■ Construction zone is near major activity centers ■ Plan to have an information hotline ■ Center located near construction
■ Provides commuters with up-to-date traffic/construction information and demand management information ■ Information can be accessed whenever it is needed ■ May be easy to update	■ Pre-recorded messages may not contain all the information that travelers need ■ Needs to be accurate information, otherwise the information is not credible	■ Part of incident management ■ Can include prerecorded messages and/or real time interactive response information
■ Information can be posted for the construction season	■ The web site would need to be publicized for people to use	■ This web site is usually done for the entire region or State
■ Single access point to find out all the information for a particular project ■ May be easy to update	■ Web site would need to be maintained for effectiveness	■ Includes both static and/or real-time interactive information ■ Audience needs to be made aware of the web site ■ Cost will vary based on the complexity of the site
■ Community and stakeholders can feel informed and involved in the project ■ Opportunity to find out the information that stakeholders need	■ Stakeholder may feel frustrated if they feel that their inputs were not considered	■ Need to be wary of making "empty promises"
■ Gets buy-in from different stakeholders	■ Requires coordination beforehand ■ May not be cost effective	■ Best if developed early in planning for the project and continue meeting through design, construction, and project assessment

Management Strategy		Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
II. Public Information (PI) Strategies (Continued)					
A. Public Awareness Strategies (Continued)					
IIA10	Coordination with media/schools/ businesses/emergency services	✓	✓	✓	■ Long project duration ■ High crash rate ■ High public exposure ■ Significant business impacts ■ Significant residential impacts
IIA11	Work zone education and safety campaigns	✓	✓	✓	■ High traffic volume ■ Long project duration ■ Projects with multiple phases/construction stages ■ High crash rate
IIA12	Work zone safety highway signs		✓	✓	■ High traffic volume ■ Long project duration ■ Projects with multiple phases/construction stages ■ High crash rate
IIA13	Rideshare promotions	✓			■ Urban area ■ Long project duration ■ High expectation of delay ■ Where advantages to carpools exist (parking cost reductions, HOV lanes, HOV bypass lanes)
IIA14	Visual information (videos, slides, presentations) for meetings and web	✓	✓	✓	■ Projects with multiple phases/construction stages ■ High public exposure ■ Significant impact on businesses ■ Significant residential impacts

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Travelers at major activity centers can plan in advance to take alternate routes		■ Requires advanced planning and coordination with these activity centers ■ Proximity to schools
■ May reduce the number of fatalities and injuries in work zones ■ Encourages general safety when driving around work zones ■ Help travelers know what signs mean and what resources there are for advanced planning	■ Results are harder to quantify	
■ Increases driver awareness to work zone safety concerns ■ May encourage speed reduction	■ Highway signs should be maintained – if there is no work zone, signs should be taken down	
■ May reduce the number of vehicles traveling through the work zone ■ Access to HOV lanes (if that exists) ■ May reduce delays	■ Cost of promotion and initial coordination effort ■ Need enough participation in order to make a difference	■ Works with large employment centers
■ Increases community awareness and understanding of the project	■ Publicity needed for travelers to visit the web site and view the visual information ■ May be expensive to produce	■ Supports public meetings, information center, or press releases ■ In conjunction with project or agency web site ■ Requires preparation, up front planning

	Management Strategy	Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
II. Public Information (PI) Strategies (Continued)					
B. Motorist Information Strategies					
IIB1	Traffic radio	✓	✓	✓	■ Long project duration ■ Projects with multiple phases/construction stages ■ Detour routes available ■ Alternate travel modes available ■ High public exposure
IIB2	Changeable message signs (CMS)	✓	✓	✓	■ Projects with multiple phases/construction stages ■ Alternate routes available ■ When work zone conditions are subject to frequent or on-going changes (e.g., lane and/or ramp closures expected)
IIB3	Temporary motorist information signs	✓	✓	✓	■ All situations – Advanced warning/public information and signage is generally always beneficial
IIB4	Dynamic speed message sign		✓	✓	■ High crash rate
IIB5	Highway advisory radio (HAR)	✓	✓		■ When longer, more detailed messages than can be provided using signage are necessary ■ Alternate routes available ■ Long project duration ■ Projects with multiple phases/construction stages ■ Frequent lane and/or ramp closures expected

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Can reach many commuters over a wide area ■ Little to no cost ■ Targets people who are likely to use the information	■ "Old" information is no longer useful	■ Coverage more likely for major projects
■ Provides real time information to motorists ■ Gives public advance warning to make decisions ■ Provides information to motorists directly affected by the project	■ Needs to be accurate information, otherwise the information is not credible	■ Needs means of controlling/updating messages, such as a TMC ■ Supports incident management ■ Need to keep information up to date and useful
■ Provides information to motorists ■ Warns motorists of potential hazards	■ If project is delayed, sign is wrong	■ Need to keep information up to date
■ Enhances safety by reducing speeding and speed variability		■ May not be effective without enforcement ■ May not be effective over a long work zone length and duration
■ Provides current information directly to motorists ■ Allows for longer, more detailed messages regarding a work zone incident ■ Promotes diversion of traffic to alternate routes when appropriate ■ Traffic patterns may resume to normal patterns more quickly ■ Easy to access	■ Limited range ■ Typically low utilization rates	■ Signs are used to inform road users of the HAR radio ■ Information needs to be current/ real-time ■ Newer technologies based on in-vehicle navigation systems and cell phones are replacing HAR usage ■ Motorists may not be aware of the HAR

	Management Strategy	Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
II. Public Information (PI) Strategies (Continued)					
B. Motorist Information Strategies (Continued)					
IIB6	Extinguishable signs	✓	✓		■ When HAR is available or proposed ■ Long project duration ■ Projects with multiple phases/construction stages ■ Alternate routes available
IIB7	Highway information network (web-based)	✓		✓	■ Urban area ■ Long project duration
IIB8	511 traveler information systems (wireless, handhelds)	✓	✓	✓	■ Urban area ■ Long project duration ■ Detour routes available ■ Alternate travel modes available
IIB9	Freight travel information	✓	✓	✓	■ Urban area ■ Long project duration ■ Moderate to high percentage of trucks traveling through the work zone
IIB10	Transportation management center (TMC)	✓	✓	✓	■ Project located on a freeway in an urban area ■ Long project duration ■ Projects with multiple phases/construction stages ■ Delay highly expected for the project ■ High public exposure

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Makes motorists aware that current information is available	■ Additional cost of maintenance and operation	■ Used in conjunction with HAR
■ Provides helpful information to motorists in one place ■ Convenient way to share information among stakeholders	■ Requires advanced planning	■ Information should be up-to-date
■ Provides motorists with current information ■ Information can be accessed whenever it is needed ■ May be easy to update	■ Can be distracting to the driver if used on the road ■ Road users must have these personal devices	■ General public awareness of 511 is needed
■ Provides useful information to freight stakeholders ■ May improve safety (e.g., reduce rear end collisions) by raising awareness before a work zone	■ Additional cost of coordination and disseminating information to select group	■ Work with the freight community to find out what information would be helpful ■ Can be provided to a central location (e.g., trucking company) or to truckers approaching work zone via CB radio
■ Have access to real-time information on traffic and incidents and relay that to the traveling public through different media outlets	■ Costly to build and operate ■ Detectors may be difficult to maintain while the work zone is taking place	

	Management Strategy	Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
III. Transportation Operations (TO) Strategies					
A. Demand Management Strategies					
IIIA1	Transit service improvements	✓			■ Transit exists with capacity and frequency ■ Where transit use is likely to be adequate to make the improvements worthwhile
IIIA2	Transit incentives	✓			■ Where adequate transit routes and frequencies exist that serve major origins and destinations for motorists that would normally drive through the work zone if transit options were not available
IIIA3	Shuttle services	✓			■ Long project duration ■ High expectation for delay ■ Large amounts of similar origins and destinations
IIIA4	Ridesharing/carpooling incentives	✓			■ Long project duration ■ High expectation for delay ■ Few or no alternate routes ■ Where ridesharing has the potential to reduce travel volumes ■ Commuter traffic is significant
IIIA5	Park-and-ride promotion	✓			■ Long project duration ■ High expectation for delay ■ Alternative travel modes are available ■ Good parking sites are available ■ Commuter traffic is significant
IIIA6	High-occupancy vehicle (HOV) lanes	✓			■ Urban area ■ Long project duration ■ High traffic volume ■ High expectation for delay ■ Alternative travel modes are available

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Shifts some demand from highway while it is under construction	■ Requires advance planning and coordination	■ In conjunction with transit incentives
■ Shifts some demand from highway while it is under construction	■ Requires advance planning and coordination	■ In conjunction with transit service improvements
■ Reduces vehicle trips and traffic in the work zone	■ Can be costly	■ Service would need to provide a benefit in terms of reduced travel time, travel and parking costs, etc. to attract users ■ Providing express shuttles from a few key locations may increase use
■ May reduce vehicle trips and traffic	■ Need many people participating in order for it to be cost effective	■ In conjunction with HOV lanes and/or parking management ■ Major activity and employment centers exist and can be targeted
■ Can be very cost-effective to commuters ■ May reduce the number of vehicles traveling through the work zone		■ In conjunction with rideshare programs, transit service available at lot, HOV lanes, and/or parking management ■ Good promotion of program is needed
■ Better roadway efficiency (move more people per lane)	■ Needs a high amount of similar origins and destinations and/or incentives ■ Taking a lane for HOV is likely to be controversial	■ In conjunction with HOV bypass and ramp metering, express transit, park and ride, and other demand management strategies ■ Enforcement needed

Management Strategy		Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
III. Transportation Operations (TO) Strategies (Continued)					
A. Demand Management Strategies (Continued)					
IIIA7	Toll/congestion pricing	✓			■ Project is on a freeway ■ High traffic volume ■ Long project duration ■ Significant reductions in capacity are anticipated
IIIA8	Ramp metering	✓	✓		■ Long project duration ■ Project is on a freeway ■ There are a number of entrance ramps near the work zone
IIIA9	Parking supply management	✓			■ Urban area ■ Long project duration ■ Alternate travel modes are available ■ Limited supply of on-site and off-site parking lots
IIIA10	Variable work hours	✓			■ Long project duration ■ High traffic volume ■ Employment and activity center along corridor and alternate routes ■ Commuter traffic is significant ■ Significant traffic increases during peak hours
IIIA11	Telecommuting	✓			■ Urban area ■ High traffic volume ■ Long project duration ■ High expectation for delay ■ When significant reduction in capacity anticipated

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Reduces peak-period vehicle trips	■ Lane(s) will need to be temporarily set aside	■ Enforcement needed
■ Maintains safe and smooth freeway operations ■ Controls entrance of vehicles to the roadway	■ May cause vehicles to idle too long ■ May result in ramp queues on local streets ■ Cost	■ Queues onto local streets may cause a problem depending on their extent ■ Can be used during peak periods or continuously ■ Secondary effect of diverting traffic to alternate routes
■ Cost-effective ■ Decreases single occupancy vehicle use when implemented in conjunction with other elements and incentives	■ Difficult to implement unless the responsible agency owns the lot and/or parking supply is limited	■ In conjunction with other demand management strategies
■ Distributes peak hour commuting over longer time period, thereby reducing travel demand during the peak periods	■ Effort to convince employers of the benefits	■ Needs to be supported by businesses and community
■ Reduces vehicle trips	■ Effort to convince employers of the benefits ■ May effect businesses, such as restaurants that are near employment centers	■ Needs to be supported by businesses and community

Management Strategy		Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
III. Transportation Operations (TO) Strategies (Continued)					
B. Corridor/Network Management Strategies					
IIIB1	Signal timing/coordination improvements	✓	✓		■ Long project duration ■ High traffic volume ■ When additional capacity is needed through the intersection in the work zone or on nearby roadways during construction
IIIB2	Temporary traffic signals	✓	✓	✓	■ Long project duration ■ High traffic volume ■ High expectation for delay ■ When safety needs to be improved for new (temporary) turning movements through the work zone ■ When additional capacity is needed
IIIB3	Street/intersection improvements	✓	✓		■ Long project duration ■ High expectation for delay ■ When work zone results in major congestion that can be alleviated by street/intersection improvements
IIIB4	Bus turnouts	✓	✓		■ Long project duration ■ High occurrence of bus traffic and stops
IIIB5	Turn restrictions	✓	✓		■ Long project duration ■ High expectation for delay ■ When turning vehicles are causing unreasonable delays or crash potential in the work zone ■ When the geometric design or the available sight distance at the intersection does not adequately provide for a safe turning movement
IIIB6	Parking restrictions	✓			■ Long project duration ■ When significant reduction in capacity anticipated ■ When traffic demand at the location can be reduced by parking restrictions ■ When parking spots can be converted to an additional travel lane ■ When restricting parking spots can improve work zone access and quicken work zone activity

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Increases throughput of the roadway ■ Improves traffic flow ■ Optimizes intersection capacity ■ Reduces frequent stops ■ Improves driver safety by smoothing the flow through work zone bottlenecks	■ Cost of estimating new saturation flow rates and demand	■ Estimating both potential demand and capacity constrained volumes for obtaining the optimal coordination
■ Improves traffic flow through and near the work zone ■ Helps achieve re-routing of traffic from project location ■ Improves driver safety by separating conflicting movements ■ Improves worker safety	■ Cost of signal design, placement, and operation ■ Changes traffic patterns on cross-roads	■ Signals should be warranted as per the Agency's signal warrant requirements
■ Provides increased capacity ■ Improves motorist safety	■ Cost ■ Time to design and construct	■ Need to plan ahead to complete these before the main roadwork
■ Improves traffic flow and safety by minimizing traffic conflicts	■ Cost ■ Time to design and construct	■ Provision of gaps and sight distance for the buses to re-enter the traffic stream
■ Simple, cost-effective ■ Increases roadway capacity ■ Reduces potential congestion and delays ■ Improves safety	■ Additional delays for turning vehicles ■ Turning vehicles need to re-route	
■ Simple, cost-effective solution ■ Increases roadway capacity ■ Reduces traffic conflicts ■ Quickens work zone activity by improving access ■ Reduces duration of the work zone	■ Affects local parking ■ Will need flaggers if parking is converted to travel lane ■ Will need barricades if parking is closed, requiring additional setup time and cost	■ Impact to local businesses must be considered ■ May need to improve intersection geometrics to accommodate additional or relocated lanes ■ Can limit use to peak travel periods

Management Strategy		Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
III. Transportation Operations (TO) Strategies (Continued)					
B. Corridor/Network Management Strategies (Continued)					
IIIB7	Truck/heavy vehicle restrictions	✓	✓		■ Projects with high truck volume ■ When significant reduction in capacity anticipated ■ When the location has heavy truck traffic but also has potential alternate truck routes ■ When capacity/safety concerns exist for truck movements through work zone ■ Passenger cars are expected to be significantly delayed due to truck traffic
IIIB8	Separate truck lanes	✓	✓		■ Long-duration projects with high truck volume ■ High expectation for delay ■ When significant reduction in capacity anticipated ■ When capacity/safety concerns exist for truck movements through work zone ■ Passenger cars are expected to be significantly delayed due to the trucks (e.g., areas with major inclines)
IIIB9	Reversible lanes	✓			■ Where there are capacity limitations in the direction of travel and no alternate routes ■ Long project duration ■ Significant peaking of traffic ■ Communter traffic is significant
IIIB10	Dynamic lane closure system	✓	✓	✓	■ Long project duration ■ Projects with multiple construction stages/phasing ■ Moderate traffic volume and congestion ■ When needed capacity can be gained ■ When frequent lane closures are anticipated
IIIB11	Ramp metering	✓	✓		■ Long project duration ■ During mainline paving of basic freeway lanes where freeway demand needs to be metered to control congestion ■ Project is on a freeway ■ There are a number of entrance ramps near the work zone

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Improves passenger car flow through the work zone by removing trucks from the traffic stream	■ Provision of an alternate truck route may adversely affect other traffic or roads ■ Requires additional signage/ personnel to enforce truck restrictions	■ Availability and sustainability of alternate routes for the trucks must be considered ■ Federal, State, and/or local ordinances that govern truck traffic access must be considered ■ Appropriate design and geometric concerns related to trucks would need to be addressed ■ Noise and business impacts from use of detour route may need to be considered
■ Can increase capacity of the roadway	■ Requires additional signage/p ersonnel to enforce separate truck lane	■ Design of the dedicated truck route ■ State and/or local ordinances that govern truck traffic need to be considered ■ If shoulder is used, may need to improve it first
■ Accommodates peak traffic flow	■ Safety concerns ■ Cost of positive separation and/or additional pavement markings and signs ■ Confusing to infrequent road user	■ Works well with commuter traffic ■ For high speed roadways, a movable barrier system or other form of positive separation is typically used to separate and direct traffic
■ Enhances mobility and safety ■ Controls vehicle merging at the approach ■ Reduces vehicle conflicts ■ Construction time can be reduced with additional contractor area	■ Cost of dynamic message signs or other messaging devices is not available in-house	■ Can be used in conjunction with reversible lane
■ Maintains safe and smooth freeway operations ■ Controls entry of vehicles to the roadway ■ Improves safety by matching gaps between freeway and on-ramp vehicles ■ May help spread traffic to other roads	■ May result in ramp queues backing onto local streets ■ Cost	■ Potential impacts on local streets need to considered before introducing ramp metering ■ Various ramp metering strategies should be considered ■ Can be used during peak periods or continuously

Management Strategy		Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
III. Transportation Operations (TO) Strategies (Continued)					
B. Corridor/Network Management Strategies (Continued)					
IIIB12	Temporary suspension of ramp metering	✓			■ At the end of a detour where it is advantageous to get traffic onto the freeway quickly
IIIB13	Ramp closures	✓	✓	✓	■ High traffic volume ■ If accelerated construction at the ramps is required ■ Where work zone activity requires work space associated with the ramps ■ Where freeway volumes at the ramp location have to be controlled ■ When alternate ramps/routes are available close by
IIIB14	Railroad crossings controls		✓		■ Long project duration ■ When work zone stops and delays have potential of forcing vehicles to stop on railroad tracks
IIIB15	Coordination with adjacent construction site(s)	✓			■ Whenever multiple work zone projects are in close proximity of each other or impact the same region

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Simple, cost-effective solution for improving traffic flow through the detour	■ Can lead to a potential downstream freeway bottleneck	■ Downstream freeway volumes must be evaluated before suspending ramp metering
■ Cost-effective ■ Can pave/repair the full width of the ramp ■ Better, faster construction ■ Can provide work access within the work zone ■ May improve traffic flow on the mainline ■ Reduces crossroad congestion ■ Easy to sign in rural areas	■ Potential impact to business and community access ■ Blocks traffic pattern and forces new traffic pattern ■ Moves congestion elsewhere ■ May have negative impact on local streets in high density locations	■ It might affect motorist mobility adversely ■ Impact to local businesses should be considered ■ The strategy is inexpensive if only signs are used but will cost more if alternate route modifications are required ■ Adequate driver information signs and clearly marked detour routes need to be provided
■ Enhances motorist safety ■ Enhances rail safety	■ Cost	■ Requires understanding on the traffic dynamics of the specific location ■ State and/or local ordinances that govern railroad traffic control
■ Minimizes the combined impacts on road users ■ Potential for cost savings to road users, community, and agency ■ Addresses the need to maintain adequate capacity in the system ■ Evaluates the complete city-wide street network for capacity needs rather than individual work zones ■ Maintains system-wide mobility	■ Complexity of coordinating adjacent work zones ■ Cost	■ Accommodate anticipated travel demand by not implementing work zones on parallel highways or complementary or alternate routes ■ Requires good communication within and across various agencies ■ Some work, such as utility work, may be done by other agencies

Management Strategy		Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
III. Transportation Operations (TO) Strategies (Continued)					
C. Work Zone Safety Management Strategies					
IIIC1	Speed limit reduction/variable speed limits		✓	✓	■ Where significant reduction in capacity is anticipated ■ When turning/merging conflicts exist that cannot be otherwise resolved ■ When there are lane or shoulder closures, traffic shifts, or other changes in geometry ■ On detours where traffic volumes and conflicts are increased ■ When work is adjacent to the traffic lane
IIIC2	Temporary traffic signals	✓	✓	✓	■ Long project duration ■ High traffic volume ■ When safety needs to be improved (e.g., for temporary turning movements) ■ When additional capacity is needed on a temporary basis during construction ■ When high delays are expected on ramps/detour routes ■ One-lane, two-way operations
IIIC3	Temporary traffic barrier		✓	✓	■ Long project duration ■ When long-term work zone activity is next to the travel lanes ■ When high-speed opposing travel lanes are present
IIIC4	Movable traffic barrier systems	✓	✓	✓	■ Long project duration ■ Projects with multiple construction stages/phasing ■ High traffic volume ■ When roadway capacity can be gained ■ Roadways with capacity limitations in the direction of travel and no alternate routes ■ When repeated barrier shifts are needed ■ When frequent lane closures are anticipated ■ When reversible lanes are used

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Enhances motorist and worker safety	■ Traffic mobility ■ Compliance with speed limit reductions is often poor	■ Additional enforcement and/or increased penalties might be needed for motorist compliance with the reduced speed limits ■ Can be continuous, or intermittent (e.g., only when workers are present)
■ Improves worker safety by replacing flaggers with temporary signals ■ Improves driver safety by separating conflicting movements ■ May increase capacity	■ Cost of signal design, placement, and operation ■ Changes traffic patterns on cross-roads	■ Signals should be warranted as per the agency's signal warrant requirements ■ May lead to re-routing of traffic from project location
■ Enhances safety to workers by the physical separation of the motorists from work zone ■ Enhances motorist safety by physically separating traffic traveling in opposite directions	■ Barrier system reduces saturation flow rates of travel lanes	■ Temporary barrier usage should be based on length of the work zone project, volume and speeds in the location, and agency practices ■ Screens may be mounted on the top of temporary traffic barriers to discourage gawking and reduce headlight glare
■ Rapid and safe reconfiguration of the traffic barrier system ■ Can provide additional space for the contractor to work ■ Enhances motorist safety by clearly delineating direction of travel	■ Cost ■ Labor for movement of barrier	■ More effective when there is a majority commuter traffic and/or fluctuating demand on the roadway ■ Shift distance must be constant

Management Strategy		Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
III. Transportation Operations (TO) Strategies (Continued)					
C. Work Zone Safety Management Strategies (Continued)					
IIIC5	Crash-cushions		✓	✓	■ Long project duration ■ High traffic volume ■ High crash rate ■ When temporary hazards (e.g., work zone vehicles and other work zone-related barriers) are in close proximity to motorists
IIIC6	Temporary rumble strips		✓	✓	■ Long project duration ■ High crash rate ■ When the work zone occurs on an open stretch of highway where drivers may tend to lose alertness ■ Where the traffic pattern has been changed ■ Where there is alternating one-way traffic with a temporary traffic signal
IIIC7	Intrusion alarms		✓	✓	■ Long project duration ■ High crash rate ■ In locations where worker safety is of particular concern ■ Areas where sight distance is limited (e.g., after curves)
IIIC8	Warning lights		✓	✓	■ Long project duration ■ High crash rate ■ Where attention needs to be drawn to critical information that can lead to potentially severe consequences if missed
IIIC9	Automated Flagger Assistance Devices (AFADs)			✓	■ High crash rate ■ Where flaggers are needed ■ Short-term lane closures
IIIC10	Project task force/committee		✓	✓	■ Long project duration ■ High public exposure/traffic volume ■ High business impacts ■ High residential impacts ■ In locations where worker and motorist safety are of particular concern

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Protects a temporary hazard ■ Prevents vehicle intrusion into the work space ■ Significantly enhances safety of both motorist and worker	■ Cost ■ Space and labor for placement	■ If cushion is struck frequently, replacement and repair costs may be significant
■ Alerts motorists about the presence of work zone ■ Alerts motorists to change in traffic pattern	■ Cost ■ Rumble strips are not as effective in urban settings and are not appropriate for residential areas because of the noise	■ Pavement needs to be prepared for laying rumble strips ■ Implementation of rumble strips must be evaluated on a project-to-project basis
■ Wakens dozing or unalert drivers, who are a cause of roadway and work zone crashes ■ Provides workers with critical reaction time needed to move out of harms way	■ Cost ■ Can startle the errant motorist and also other adjacent vehicles	■ Unreliable and/or frequent false alarms may cause workers to ignore the warning sounds
■ Alerts motorists to critical information that can increase both motorist and worker safety	■ Cost ■ Space and labor for placement	■ Must be used smartly so that motorists will not ignore the lights ■ State and/or local ordinances that govern signage must be considered
■ Improves worker safety by removing worker from the roadway	■ Cost	
■ Develops solutions to safety and traffic flow issues ■ Improves worker and motorist safety due to trained and responsible persons in-charge	■ Cost of training ■ Team dynamics where no one takes responsibility for a particular job	■ Team members must be assigned specific tasks with specific objectives to achieve overall safety during the project

Management Strategy		Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
III. Transportation Operations (TO) Strategies (Continued)					
C. Work Zone Safety Management Strategies (Continued)					
IIIC11	Construction safety supervisors/inspectors		✓	✓	■ Long project duration ■ In locations where worker and motorist safety are of particular concern ■ May be applicable to any work zone
IIIC12	Road safety audits		✓	✓	■ May be performed during any or all stages of a project and on existing roads
IIIC13	TMP monitor/inspection team	✓	✓	✓	■ Long project duration ■ Projects with multiple construction stages/phasing ■ When congestion is a concern ■ In locations where worker and motorist safety are of particular concern
IIIC14	Team meetings		✓	✓	■ Long project duration ■ Where large projects with complex traffic conditions are present
IIIC15	Project on-site safety training			✓	■ Long project duration ■ In locations where worker and motorist safety are of particular concern
IIIC16	Safety awards/incentives		✓	✓	■ Long project duration ■ In locations where worker and motorist safety are of particular concern
IIIC17	Windshield surveys	✓	✓	✓	■ Long project duration ■ In locations where worker and motorist safety are of particular concern

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Improves worker and motorist safety due to trained and responsible person in-charge	■ Cost of training	■ In larger projects more than one person might be needed, while in smaller projects the safety supervisor may have other responsibilities
■ Improves worker and motorist safety due to upfront identification of potential safety hazards for remediation	■ Cost and time to perform audit	
■ Improves worker and motorist safety due to trained and responsible person in-charge ■ Aids in identifying whether the TMP is effective and if changes are needed to improve safety and mobility ■ Provides useful data for improving future TMPs	■ Cost of training	
■ Improves worker and motorist safety	■ Cost and time involved	■ Team dynamics may be challenging ■ Meetings should be regularly held to be effective
■ Improves worker safety due to the clear understanding on safety procedures and specific risks associated with the project by all workers	■ Cost of safety training for all personnel	■ Such trainings must be conducted periodically during the project life
■ Provides an alert work force that is proactively weeding out safety problems	■ Dissention among workers due to not receiving awards	■ Incentives and awards must be judged in an acceptable, non-partial way
■ Identifies and addresses potential safety deficiencies ■ Improves worker and motorist safety due to the proactive approach of identifying potential safety concerns ■ May lead to improved traffic flow	■ Cost and time to perform surveys	■ Such inspections are typically conducted by designated agency staff in cooperation with project staff

Management Strategy		Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
III. Transportation Operations (TO) Strategies (Continued)					
D. Traffic/Incident Management and Enforcement Strategies					
IIID1	ITS for traffic monitoring/management	✓	✓	✓	■ Can be applicable to all situations–to convey messages that communicate accurate, timely, and pertinent information to motorists about prevailing and anticipated traffic conditions ■ Long project duration ■ Presence of permanent ITS deployment and/or TMC ■ High expected delay ■ Projects with multiple construction stages/phasing ■ Available detour routes exist ■ Frequent lane and/or ramp closures expected ■ Existing and potential high incident locations
IIID2	Transportation management center (TMC)	✓	✓		■ Urban area ■ Long project duration ■ Projects with multiple construction stages/phasing ■ High expected delay ■ High public exposure/traffic volume
IIID3	Surveillance [Closed-Circuit Televisions (CCTV), loop detectors, lasers, probe vehicles]	✓	✓		■ Long project duration ■ All situations–advanced warning/public information and signage is generally always beneficial

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Provides real-time information to motorists ■ Enables agency to manage the transportation system in and around the work zone in real-time ■ Provides road users with information to divert or take other appropriate measures in response to an incident ■ Informs drivers of speed limit reductions and enforcement activities ■ Allows motorists to avoid hazards and delays, and respond properly to changing roadway conditions ■ Improves driver guidance and creates safer operations	■ Cost ■ Needs accurate and reliable information that is dependable	■ Needs means of communication to transmit data; communication options may be limited by geography or existing infrastructure ■ Needs an existing or planned TMC or the establishment of one—TMC can be virtual/remote ■ Supports incident management ■ May reduce the impact on businesses created by construction activities and detours
■ Provides centralized coordination and management of incidents ■ Enhances safety and mobility by the use of centralized approach to manage traffic	■ Cost	■ Existing TMC is usually used and is staffed by either contract staff and/or agency personnel
■ Verifies the presence of traffic problems and incidents ■ Helps to determine appropriate response to address an incident ■ Contributes to saving both motorist and worker lives by aiding quick, appropriate response from local incident response agencies	■ If project is delayed, sign is wrong	■ Supports incident management ■ Needs existing, planned, or virtual TMC ■ Requires reliable and timely data ■ Used to provide road user information

Management Strategy		Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
III. Transportation Operations (TO) Strategies (Continued)					
D. Traffic/Incident Management and Enforcement Strategies (Continued)					
IIID4	Helicopter for aerial surveillance	✓	✓		■ Long project duration ■ Projects with multiple construction stages/phasing ■ Large, complex work zone project
IIID5	Traffic Screens	✓	✓	✓	■ High traffic volumes ■ When crash rate is high ■ When headlight glare needs to be reduced ■ When construction is immediately adjacent to traffic
IIID6	Call boxes	✓	✓		■ Rural/low-density highways where help is not readily available ■ Where cell phone coverage is poor
IIID7	Mile-post markers		✓		■ Long project duration ■ May be applicable to any work zone
IIID8	Tow/freeway service patrol	✓	✓		■ Long project duration ■ High public exposure/traffic volume ■ Where incidents can create significant delays ■ Where shoulder width reductions or closures are expected ■ Existing and potential high incident locations

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Aids in quick identification of traffic problems and incidents and quick response ■ Enables excellent coverage of a wide area	■ Cost ■ More often the helicopter is media controlled rather than controlled by the project or incident agency	■ Supports incident management ■ Mostly achieved by cooperation and cost sharing with local media
■ Reduced driver distraction ■ Reduced rubbernecking, which can prevent congestion ■ Reduces headlight glare	■ Additional cost to set up and maintain screens	
■ Provides motorists the means to reach help quickly ■ Expedites response and clearance times for crashes and breakdowns	■ Cost	■ Call boxes must be accessible within walking distance from the incident ■ With increasing use of cell phones and cell phone coverage, call boxes are becoming less common
■ Provides the motorist with the location information critical for getting quick help ■ Aids in responding to incidents or breakdowns ■ Helpful in managing traffic records and subsequent analysis		■ With the E911 mandate and increasing use of cell phones this might not be necessary in the future for pin-pointing incident locations for 911 dispatchers ■ May also be called location reference markers ■ The spacing of the markers is important. Placing markers a tenth of a mile apart rather than a mile apart enables motorists to more easily reference their location ■ Location markers can be helpful in areas where people may become easily confused, such as at a complicated intersection
■ Reduces the time required to remove the incident from the roadway	■ Cost of maintaining dedicated towing equipment and crew	■ Parking areas and turnaround locations are needed for the tow trucks to ensure quick response times ■ Towing services are generally contracted, while freeway service patrols are more likely to be publicly operated

Management Strategy		Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
III. Transportation Operations (TO) Strategies (Continued)					
D. Traffic/Incident Management and Enforcement Strategies (Continued)					
IIID9	Total station units	✓			■ Long project duration ■ High crash rate ■ Where incidents can create significant delays
IIID10	Photogrammetry	✓			■ Long project duration ■ High crash rate ■ Where incidents can create significant delays
IIID11	Coordination with media	✓	✓		■ Long project duration ■ High public exposure/traffic volumes
IIID12	Local detour routes	✓			■ Long project duration ■ High traffic volume ■ High crash rate ■ Where detour routes are available
IIID13	Contract support for incident management	✓	✓		■ Long project duration ■ High crash rate ■ In large urban areas with large and frequent work zone projects

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Reduces incident clearance times	■ Cost ■ Time consuming	■ Photogrammetry or laser measuring units might replace total station units as a cost-effective and time-efficient alternative ■ In order to be most effective, a trained crew should set up and manage these units
■ May reduce incident clearance times	■ Cost ■ Not widely validated for effectiveness in crash investigations	■ Photogrammetry is cost-effective when compared to total station units
■ Procedures to be followed in the event of an incident or major traffic delay are established in advance ■ Helps to ensure the news media is able to convey factual information concerning incidents and traffic delays ■ Provides advance guidance to motorists on major traffic delays and incidents	■ Requires time to develop good relationships and procedures	■ Personnel turnover or extended time between occurrences may mean procedures need to be refreshed
■ Proactive approach helps in having a readily available, well-thought out plan for detours when incidents and major traffic delays happen	■ Cost	■ Requires advance approval or authorization from the local agency for the use of the detour route in the event of an incident ■ Need a means to communicate the alternate routes to travelers when appropriate
■ Provides additional, dedicated personnel for incident management	■ Cost	■ During road projects, it is important to have people available on call who can quickly get to an incident when needed ■ Need to establish means of coordinating with existing/other incident response

	Management Strategy	Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration
III. Transportation Operations (TO) Strategies (Continued)					
D. Traffic/Incident Management and Enforcement Strategies (Continued)					
IIID14	Incident/emergency management coordinator	✓	✓	✓	■ Long project duration ■ Large complex project where on-going incident management is necessary ■ High public exposure/traffic volume
IIID15	Incident/emergency response plan	✓	✓	✓	■ Long project duration ■ Major/complex work zone projects where there is potential for recurring significant incidents ■ High public exposure/traffic volume
IIID16	Dedicated (paid) police enforcement		✓	✓	■ Long project duration ■ High crash rate ■ In large and complex work zone locations where enforcement is an issue or incident support is desired
IIID17	Cooperative police enforcement		✓	✓	■ Long project duration ■ High crash rate ■ In complex work zone locations where enforcement is an issue ■ May be applicable in any work zone
IIID18	Automated enforcement		✓	✓	■ Long project duration ■ Long project length ■ High crash rate ■ Where inadequate off-road space and/or no shoulders are available
IIID19	Increased penalties for work zone violations		✓	✓	■ Long project duration ■ May be applicable in any work zone

Table B.1 TMP Strategy Matrix—Mobility/Safety Improvement and Considerations for Implementation (Continued)

Potential Pros	Potential Challenges	Other Considerations
■ Provides a dedicated, responsible person for managing incidents and ensuring that traffic safety and mobility goals are met	■ Cost	
■ Prompt and appropriate response and clearance of incidents	■ Cost ■ Predicting and planning for potential incidents	■ Multi-agency coordinated effort is needed for identifying potential incidents and planning for them
■ Enhance safety of motorists and workers ■ Supports incident management ■ Promotes orderly traffic flow	■ Cost	■ Police should be adequately trained to perform their duties safely
■ Enhances safety of motorists and workers ■ Supports incident management ■ Promotes orderly traffic flow	■ Enforcement is provided on an as-available basis as reimbursement of enforcement costs is generally not provided	■ Similar to dedicated (paid) police enforcement except for the cost ■ Police should be adequately trained to perform their duties safely
■ May cost less than police ■ Promotes compliance with speed limits and other traffic regulations without the presence of police	■ Political and legal privacy issues limit use of this strategy ■ Cost	■ To effectively provide automated enforcement, a TMC should be present that can centrally coordinate the various technologies available to the agency
■ Improves safety by promoting compliance with work zone regulations		■ Requires enforcement to be effective

Appendix C

Terminology and Concepts

Appendix C - Terminology and Concepts

Detailed Design Alternative – Detailed design alternatives include all alternates retained for detailed study during the project planning process (e.g., bridge replacement in-line with the existing structure or parallel to it, widening 4-lane highway to 6-lane highway, grade separating an at-grade intersection, etc.).

Incident Management Plan (IMP) – An IMP is intended to address unplanned events or incidents for large, complex projects to ensure incident response operations within the work site are managed effectively. It identifies priorities and procedures for detection of and response to incidents with the goal of safeguarding the public and restoring traffic flow as quickly as possible. The plan should define a process of regular review and analysis to identify actions that will reduce incident frequency and severity.

Maintenance of Traffic Alternative Analysis (MOTAA) – The intent of a MOTAA is to identify and compare benefits and functional faults of work zone alternatives. It serves as the basis for scoping the project's work zone design and Transportation Management Plan (TMP). The analysis is performed for each detailed design alternative. It should address the benefits and problems of work zone options and include the design team's recommendation on the preferred type of MOT for each detailed design alternative.

Public Outreach (PO) Strategies – The PO component of a TMP consists of strategies that address communication with the public and concerned stakeholders, before and during the project. This component may include public awareness strategies and motorist information strategies, such as brochures, websites, radio, VMS messages, pre-trip and in-route information, etc. This effort is sometimes referred to as Public Information (PI).

Smart Work Zones (SWZ) – Using intelligent transportation systems (ITS) in work zones has the potential to make traffic flow through and around the work zone safer and more efficient. SWZ involves the use of electronics, computers, and communications equipment to collect information, process it, and take appropriate actions in a work zone. ITS technology can be applied in work zones to accomplish such tasks as monitoring and managing traffic or providing traveler information.

The Rule – The Federal Highway Administration (FHWA) published the Work Zone Safety and Mobility Rule (*the Rule*) on September 9, 2004 in the Federal Register (69 FR 54562). This Rule updates and renames the former regulation on "Traffic Safety in Highway and Street Work Zones" in 23 CFR 630 Subpart J.

Significant Project – Generally speaking, a significant project is one that, alone or in combination with other concurrent activities nearby, is anticipated to cause sustained work zone impacts that are greater than what is considered tolerable. Refer to "Guidance on Identifying Significant Projects" for a more detailed definition.

Traffic Control Committee (TCC) – The multi-disciplinary team that is comprised of representatives from various Bureaus of NHDOT and FHWA that is responsible for guiding the implementation of *the Rule*.

Traffic Control Plan (TCP) – A TCP is a plan that addresses traffic safety and control through the work zone. The TCP will follow NHDOT and MUTCD Guidance for the layout and placement of traffic control devices, signs, and related equipment for the project. The scope may range from a very detailed TCP designed solely for a specific project, to a reference to Typical Temporary Traffic Application from the Work Zone Traffic Control Standard Plans (included as TC sheets in the Book of Standards). It may be a combination of text and drawings that define specifically what traffic control measures will be provided for the project, how they will be implemented, and on what schedule. The degree of detail in the TCP will depend on the project complexity and traffic interface with the construction activity.

Transportation Management Area (TMA) - A TMA is an urbanized area with a population of more than 200,000 residents as defined by FHWA and the U.S. Census.

Transportation Management Plan (TMP) – A TMP details work zone impact management strategies and how they will be implemented. As a minimum, it is comprised of the Traffic Control Plan (TCP), Transportation Operations (TO) strategies and Public Outreach (PO) strategies. These elements are integrated into a single document that addresses site specific issues and project requirements. A TMP will be updated and refined as necessary throughout the project lifecycle to address changing needs.

Transportation Operations (TO) Strategies – The TO component of a TMP consists of strategies that address sustained operations and management of the work zone impact area. This component may include travel demand management strategies, traffic signal timing changes, ITS strategies, Smart Work Zone strategies, safety strategies, enforcement strategies, etc. These strategies are often included in the TCP and in other contract documents.

Windshield Survey – A qualitative analysis of an existing work zone that is conducted with the aid of the Traffic Control Checklist. Results of these inspections should be tabulated and reported on an annual basis to identify areas of potential improvement.

Work Zone Constraint – A work zone constraint is a potential negative impact caused by the work zone design (e.g., increased right-of-way costs, increased environmental impacts, reduced access to businesses, high utility relocation costs, etc.).

Work Zone Impacts - Work zone impacts refer to work zone-induced deviations from the normal range of safety and mobility. The extent of these impacts vary based on many factors such as, road classification, type of area (urban, suburban, or rural), traffic volume and travel characteristics, type of work being performed (construction, maintenance, utility work), time of construction (day/night), and complexity of the project.

Work Zone Incident Management - A mechanism by which the non-contract related traffic disruptions are minimized through foresight. An example is the use of standby tow trucks or vehicles equipped with push bumpers on site or close by to minimize response time and reduce the effect of accidents or breakdowns could have on traffic flow. Such measures shall be approved by the appropriate individual before they are added to the project.

Work Zone Mobility –Work Zone Mobility is the ability of road users to travel efficiently through and around a work zone with minimum delay compared to a baseline travel when no work zone is present.

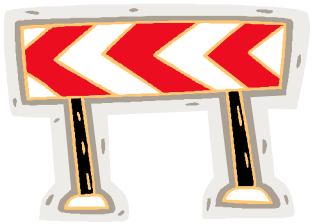
Work Zone Option – Work zone options are maintenance of traffic concepts that address construction staging, phasing and traffic control (e.g., lane closures, full closure of the facility using detour route(s) diversions, reversible lanes, use of temporary structures, etc.). Work zone options should be developed for each detailed design alternative.

Work Zone Safety – The intent of Work Zone Safety is to minimize exposure to potential hazards for users of transportation facilities in the vicinity of a work zone and also for highway workers at the work zone interface with traffic.

Appendix D

Traffic Control Checklist

TRAFFIC CONTROL CHECKLIST



Prepared by:
Bureau of Construction and
Bureau of Traffic

TCC – June 2004

Prior to Construction

- ❑ Determine who is the Contractor's traffic control coordinator or specific traffic control maintainer.
- ❑ Make sure that the proper traffic control documents as stated throughout are being used.
- ❑ Review NCHRP 350 requirements for traffic control devices with the Contractor per Specification section 619.2.1, 2.1.9, & 2.1.10. Have suppliers of traffic control devices supply FHWA's letter certifying that devices meet NCHRP 350 requirements.
- ❑ Discuss possible locations for Portable Changeable Message Signs Arrow Panels, & Trailer Mounted Speed Limit Signs when required, reminding the Contractor that they must be outside the clear zone when not in use per Specification Section 618.3.2.6.3.
- ❑ Review the Contractor's permanent construction sign layout, prior to their erection. Approve only the final product, not the layout. Ensure that Dig Safe has been contacted for the post locations.
- ❑ Ensure the Contractor has the proper operational signs on site to adequately address the construction conditions (i.e. bump, dip, grooved pavement).
- ❑ Inspect the following before implementation:
  - ➢ Sign sheeting intensity, wording, text, size, etc.
  - ➢ Proper posts
  - ➢ Compare the condition of the channelizing devices to the required "Quality Standards for Work Zone Traffic Control Devices" per Specification Section 619.3.2.1.
  - ➢ Check the working conditions of arrow boards and portable changeable message signs. Note: If the arrow boards and/or portable changeable message signs are used at night, they must be dimmable. Check the function of the photo sensor or arrange to have manual operation to switch on and off both evening and daybreak.

Permanent Construction Signs

- Generally listed on the Construction Signs and Warning Devices (CSWD) summary sheet, which is included in the project Contract or Plans.
- Refer to Work Zone Traffic Control Standard Plans TC-2 for typical sign layout. Signs shall not block other roadway signs (see note #2 on TC-1). Refer to MUTCD for conditions not addressed by the TC sheets.
- Sign text shall follow the NHDOT Construction Sign Standards and Standard Highway Signs or contract per Specification Section 2.1.5.
- ROAD WORK (W20-1) and LENGTH OF WORK (G20-1) signs shall be fluorescent orange sheeting and 48"x48" signs unless in urban areas or so noted on the CSWD summary sheet. (See Standard Specifications Section 619.2.1.4.2)
- Generally are mounted on two U-channel posts unless noted differently on the CSWD summary sheet or Prosecution of Work.
- Post shall be flush with the top of the sign or maximum 6 inches below the sign. Post extended over the sign is unaccepted.
- Splicing of U-channel is allowed per NCHRP 350 requirements and shall be installed per manufacturer's instruction. Contractor shall provide certificate of compliance.
- Post shall be embedded at a depth of 2.5 ft.
- For post-mounted signs, signs shall be mounted at a height of 7 ft above EP in urban areas and divided highways. In rural areas signs shall be mounted at a minimum height of 5 ft above the EP.
- Signs when not in use shall be removed or covered completely with an approved material i.e. plywood per Specification Section 619.3.1.3.
- The sign installation shall have posts plumb and the text horizontal per Specification Section 619.3.2.2.

Operational Construction Signs

- Signs shall be mounted on an approved NCHRP 350 portable sign stand and the bottom of the sign shall be mounted a minimum 1 ft above the travelway.
- Cold planned areas should always have the following signs: Motorcycles Use Caution, Grooved Pavement Ahead, Bump or Dip.
- "Be Prepared to Stop" sign should be used along with a "Flagger" sign when the flagger is stopping traffic.

Portable Changeable Message Sign (PCMS)

(Refer to MUTCD Section 6F.55)

- Shall only contain two phases (messages) and the message shall not duplicate a construction sign in the same vicinity.
- If more than two messages are needed, use additional PCMS.
- Message shall consist of up to three lines eight characters per line per Specification Section 619.2.1.7.
- Message can use abbreviations as noted in MUTCD Section 1A.14.
- PCMS shall have adjustable display rates so the entire message can be read at least twice when driving at the posted speed limit.
- Message shall not scroll or travel horizontally or vertically across the face of the sign.
- Shall be mounted at least 7 ft above the EP in urban areas and divided highways and a minimum height of 5 ft in rural areas.
- Shall be delineated with TC devices (barrels).
- The PCMS trailer should be delineated on a permanent basis by affixing retroreflective material (white/red vehicle sheeting).
- Per 619.3.2.6.3 when a PCMS is not in use, it shall be removed from the clear zone unless adequately protected by portable barrier or equivalent and specifically approved.
- When PCMS are not in use and left within the work zone outside of the clear zone, the sign panel should be turned parallel to traffic.
- PCMS shall be placed so it will not block other signs or be blocked by other signs, vegetation, etc.
- All letters shall be at least 18 in per Specification Section 619.2.1.7.

Channelizing Devices

(Refer to MUTCD Section 6F.58)

- Spacing for use in tangents shall not exceed twice the speed limit in distance.
- Spacing on tapers shall not exceed the speed limit in distance.

A. Cones (Refer to MUTCD Section 6F.59)

- Can be used at night only during work hours. Non-work hours cones can be used at night only to supplement other channelizing devices i.e. drums or barricades with the drums & barricades still spaced per the required spacing on Work Zone Traffic Standard Plans TC-1.
- Cones used at night shall be at least 28" in height and shall have two retroreflective bands around the cone. One (1) – 6" band located 3" to 4" from the top of the cone and another 4" band located 2" below the 6" band. See Work Zone Traffic Control Standard Plans TC-1.

B. Drums (Refer to MUTCD Section 6F.62)

- Drums shall be predominately orange per Work Zone Traffic Standard Plans TC-1, Note 5.
- 36" minimum height and 18" minimum diameter.
- Shall have alternating orange and white retroreflective stripes 4" to 6" wide.
- Shall have two orange and white stripes with the top stripe being orange.
- Spaces between the stripes shall not exceed 3 inches.
- Ballast shall not be placed on top of the drum.

C. Barricades (Refer to MUTCD Section 6F.63)

- Stripes on barricades shall be alternating orange and white retroreflective sloping downward at an angle of 45º in the direction road users are to pass.
- Stripes shall be 6 inches wide except when rail lengths are less than 3 ft, where 4-inch stripes may be used.
- Use Type I and II in situations to direct the road users through a work zone.
- Use Type I on conventional roads or urban streets.
- Use Type II barricades on Divided Highways or other high-speed roadways (greater than 45 mph).
- Use Type III for road closures or partial closures.
- Rails are 8" – 12" wide.
- Type I & II rails are 24" minimum in length and the height to the top of rail from the ground is minimum 36".
- Type III rail length is a minimum 4 ft with a minimum height of 5 ft from top of rail to the ground.
- Ballast shall not be placed on the top rail.

Flaggers

(Refer to MUTCD Chapter 6E)

- Check for Flagger Certification.
- Flagger vest apparel shall meet the MUTCD per Section 6F.02 requirements, ANSI 107-1999 Class 2 risk exposure. ANSI 107-1999, Class 3 risk exposure should be used for night work.
- Flagger stop/slow paddle shall be 18 in wide with 6" letters, be retroreflective and octagonal shape.
- "Flagger Ahead" and "Be Prepared to Stop" signs in place and removed if no longer needed.
- Proper Flagger clothing: hard hat or orange baseball cap, shirt, & safety vest.
- Flagger stations shall be clean and without distractions i.e. books, chairs, radios, personnel congregating. Flaggers are allowed to use 2-way radios to control traffic.
- Flagger station shall be on the shoulder of the approaching traffic outside of the lane closure per MUTCD and NHDOT Flagger Handbook. Flagger **shall not** be stationed in the travel lane.
- Flagger stationing shall be reviewed throughout the day for adequate lighting and shadows that may damper their visibility.
- Flagger shall not leave their station for any reason such as picking up signs, barrels, cones, etc.
- Are flaggers using proper flagging etiquette and conducting themselves appropriately to send a clear, respectful message to passing drivers?
- Signaling with hand signals and stop/slow paddles shall follow the NHDOT Flagger handbook and the MUTCD.

- Flagger shall **never** flag from inside a vehicle.
- Flagger shall be informed on what to do if approached by emergency vehicles, in the event of accidents or a vehicle running the flagger station.
- The Contractor shall allow for proper rest breaks, explain the traffic control operation to the flagger and check the visibility of the signs and flaggers on the work area.

Temporary Pavement Markings

(Reference Spec 632, 619, & NHDOT WZTC Standard Plans)

Note: The Department's intent is for permanent pavement markings to be installed as soon as possible, which includes detours & winter binder/base pavement.

- Temporary pavement markings can be paint, tape or removable raised pavement markers placed prior to final markings on wearing course and are subsidiary to Item 619 Maintenance of Traffic.
- Pavement markings installed on detours or winter binder pavements are not considered temporary pavement markings. These markings are paid for under Item 632 and shall follow those specifications.
- Temporary pavement markings shall not be in place for more than 2 weeks, except for temporary raised pavement markers on divided highways, which shall not be in place for more than 1 week.
- All temporary pavement markings shall be maintained. Markings rendered ineffective or dislodged shall be replaced.
- Temporary raised pavement markers shall not be used to supplement or substitute edge lines and non-longitudinal lines e.g. stop lines, railroad crossings, crosswalks, words, symbols, etc.
- Edgelines, channelizing lines, lane reduction transitions, gore markings, and non-longitudinal lines are usually not required for temporary pavement unless directed by the Engineer refer to NHDOT TC Standard plans.
- Raised Pavement Markers spacing for double yellow centerline on two-way roadways is 40 feet. The curve radius or profile of the road may require additional makers at the discretion of the Engineer. These markers shall be yellow double face retroreflectorized markers placed in pairs. At the Engineer's discretion, "Do Not Pass" (R4-1) signs may be installed for added emphasis.
- Raised Pavement Markers on divided highways shall also be spaced at 40 feet for the single broken line. These markers shall be white single face retroreflectorized markers.
- Refer to the NHDOT Qualified Products List for approved raised pavement markers noted under 619 items.
- Pavement markings that are no longer applicable to current condition in the work zone shall be completely removed so that they are not visible either during day or night.
- Perform occasioned drive throughs on the project during the day and night and determine if the markings are no longer visible or if the white markings appear to be white and yellow markings appear yellow, and if they are in "acceptable" condition, if not the Contractor shall repaint the lines. Payment for restriping due to wear & tear or fresh pavement absorption shall be paid under 632 items.
- Prior to implementing a TC package and throughout construction, work zone drive through is important to verify that the markings are per the TCP.

Appendix E

Work Zone Traffic Crash Report

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION
WORK ZONE TRAFFIC CRASH REPORT

(Reports are to be submitted to supervisor within 48 hours of crash)

1. Town or City:

2. Project Name:

3. Project Number:

4. Bureau: ☐ Bridge Maintenance ☐ Bridge Design ☐ Survey/Design ☐ Materials & Research ☐ Construction ☐ Traffic ☐ Highway Maintenance ☐ Turnpikes

5. District/Shed/Contractor:

6. Crash Date:

7. Crash Time: _____ ☐ AM ☐ PM ☐ unknown

8. Number of Vehicles Involved:

9. Number of Persons Injured and Fatalities:

	GENERAL PUBLIC			PROJECT PERSONNEL	
	In Motor Vehicles	Motorcycles Bicyclists	Pedestrians	Operating Equipment	Pedestrians
Injured					
Fatalities					

10. Location of Crash:

OCCURRED ON	DISTANCE AND DIRECTION FROM	INTERSECTING ROAD OR FEATURE
_____ Route No./Street	_____ Distance from (ft.) ☐ north ☐ south ☐ east ☐ west ☐ at intersection	_____ Route No./Street/Feature

11. Type of Crash or Collision with (first harmful event):

☐ frontal/side ☐ rollover ☐ flagger/officer
☐ sideswipe ☐ bicyclist ☐ construction vehicle/equipment
☐ rear end ☐ worker ☐ went over a drop off
☐ head on ☐ pedestrian ☐ fixed object (check box below)
☐ OTHER: _____

Fixed Object:

☐ sign post ☐ channelizing devices ☐ retaining wall
☐ guardrail ☐ changeable message sign ☐ abutment/pier
☐ water ☐ temporary concrete barrier ☐ arrowboard
☐ tree ☐ construction equipment ☐ ledge outcrop
☐ boulder ☐ telephone pole ☐ impact attenuator
☐ light post ☐ construction material stockpile
☐ OTHER: _____

12. Roadway Design: ☐ two way traffic ☐ interstate/divided ☐ one way/ramp ☐ OTHER: _____

13. Road Alignment: ☐ straight and level ☐ intersection ☐ curve and level ☐ straight and on a grade ☐ curve at a hillcrest ☐ straight at a hillcrest

14. Roadway Surface Type:

Travel In.: ☐ asphalt ☐ concrete ☐ grooved pavement ☐ unpaved
Shoulders: ☐ asphalt ☐ concrete ☐ grooved pavement ☐ unpaved

15. Roadway Condition: ☐ normal ☐ rough ☐ wheel ruts ☐ potholes ☐ pavement edge drop offs

16. Surface Conditions: ☐ dry ☐ wet ☐ ice/snow ☐ unknown

17. Light Conditions: ☐ daytime ☐ nighttime ☐ nighttime illuminated ☐ dawn/dusk ☐ unknown

18. Weather Conditions: ☐ clear ☐ cloudy ☐ fog ☐ rain ☐ snow ☐ hail ☐ sleet ☐ freezing rain ☐ high winds ☐ unknown

19. Traffic Vol. : ☐ low ☐ moderate ☐ heavy

20. Posted Speed Limit: mph

21. Traffic Control Package: ☐ in use ☐ not in use

Package Designation:

MUTCD	NHWZTC	OTHER
TA- _____	TC- _____	_____

Condition of devices: ☐ good ☐ fair ☐ poor

Modifications or comments about the package: _____

22. Pavement Markings:

Left TW	Centerline	Right TW
☐ none	☐ none	☐ none
☐ RPM	☐ RPM	☐ RPM
☐ paint	☐ paint	☐ paint
☐ tape	☐ tape	☐ tape

23. Lane Width (feet):

Lanes: ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ 12+ ☐ tapered ☐ unknown
Shdrs.: ☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ tapered ☐ unknown

24. Changeable Message Signs:

☐ none ☐ in place and operating ☐ in place and not operating

MESSAGE

phase 1: _____
phase 2: _____
*phase 3: _____

** FYI - per the MUTCD, message shall consist of only one or two phases*

25. Flaggers: ☐ in use ☐ not in use

26. Uniformed Officers :

☐ with vehicle ☐ without vehicle ☐ not used

27. At the time of the crash was there Work Zone related activity? ☐ yes ☐ no

28. Police Report:

Was a report generated? ☐ yes ☐ no ☐ unknown

Town/City/State Troop No. : _____

Officer Name: _____

Report Number: _____

continued on the back

29. Sketch Required

30. Additional Documentation

☐ daily report ☐ police report ☐ photos ☐ videos ☐ digital photos

**if possible date stamp photos or videos*

31. Crash Description and any Additional Comments:

32. Report generated by:

_____ Date: _____

print name

_____

signature

** Submit this report to supervisor within 48 hours of the crash.*

Distribution: Planning & Community Assistance Traffic Originating Bureau FHWA

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

Work Zone Traffic Crash Report Instructions

The purpose of this report is for the Work Zone Crash Committee to track any and all NHDOT work zone crashes, evaluate the crashes for any common problems, and make recommendations in regards to training and changes to NHDOT Traffic Control Plans or procedures.

A. The Work Zone Traffic Crash Report should be used whenever there is **any** crash within or related to the Work Zone:

- The Work Zone is defined as: The beginning and end of a designated project, or portions thereof, typically designated by construction signing or traffic control devices including approaches.

- This report shall also be filled out whenever a crash occurs outside the Work Zone if the traffic control could be considered as a factor relating to the crash. (i.e. a rear end collision in traffic backed up beyond any traffic control devices).

- A report shall be filled out even when the crash is within the work zone and is unrelated to the traffic control. The report will help provide information about possible contributing factors.

B. If the crash involves an NHDOT employee or NHDOT vehicle, the employee involved must also fill out the necessary vehicle or injury reports.

C. All crash reports must be submitted to your supervisor and/or main office within 48 hours of the accident. Do not hold off submitting reports if you don't have a police report. A police report can be submitted later or the main office will obtain a copy.

D. Some boxes within the Work Zone Traffic Crash Report that may need more clarification are noted below:

- Box #10 Location of Crash – Feature can be a bridge, river, stream etc. Please include name and any identification number of feature.

- Box #11 Type of Crash or Collision – Only check the box relevant to the "first harmful event" or initial crash. In otherwords, if a car hit a temporary concrete barrier and then deflected off the barrier into the opposite lane resulting in a head-on collision with an oncoming vehicle, only check the "fixed object - temporary concrete barrier" boxes. Do not check the "head on" box. The Sketch Required (#29) and Crash Description (#31) on the backside of the form

should be used to detail both the initial hit of the barrier as well as the resulting head on collision.

- Box #15 Roadway Condition – Rough can be defined as pavement patches, several bumps, or dips.

- Box #29 Sketch Required – The following shall be included:
  - Location of construction signing & approx. distances to crash
  - Traffic control devices and signs in immediate area
  - Note the location of accident and direction of travel of each vehicle
  - Roadway and/or shoulder width
  - Spacing of traffic control devices
  - Note work operation area
  - Flagger/uniformed officers location
  - Fixed objects if pertinent
  - North direction arrow

- Box #31, Crash Description and any Additional Comments – Describe crash and include information not covered within the form that will be helpful to understand the crash event. This information should describe the work zone operation(s) and other activities within the area.

E. Supervisor's Responsibilities
- Ensure form is completely filled out, signed, and dated.
- Comment on the event and any discrepancies in traffic control.
- Document any immediate changes to the T.C. and make sure they are/were implemented.

F. Work Zone Crash Committee Responsibilities
- Review and comment on crashes quarterly. (*The actual scheduling to be determined by the TCP Committee.)*
- Track crashes for any trends.
- Make recommendations for any changes to Traffic Control procedures to the Bureau in charge and the T.C. Committee.
- Send out quarterly meeting conference reports to all Department Administrators. Again, timing issue to be resolved by TCP Committee.