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16. Abstract

A transportation management plan (TMP) is a comprehensive program of traffic control, communication, operation, and demand management strategies designed to maintain acceptable levels of traffic flow in work zones. A systematic procedure and/or checklist is needed for developing plans to lessen the impact of construction projects that restore or improve highways. The purpose of this research was to establish guidelines for developing TMPs for construction projects. Three questions were addressed by the guidelines: When should a TMP be developed? How should a TMP be developed? What should be in a TMP?

The Federal Highway Administration published the Final Rule on Work Zone Safety and Mobility on September 9, 2004. It facilitates the comprehensive consideration of the broader safety and mobility impacts of work zones across project development stages and the adoption of additional strategies including TMPs that help manage these impacts during project implementation. Guidelines for TMPs were derived from a draft implementation guide for the final rule with minor revisions.

TMPs may consist of up to three components: (1) a temporary traffic control plan that describes traffic control measures used to facilitate road users through a work zone; (2) transportation operations strategies that will be used to ease work zone impacts; and (3) public information strategies to inform those affected by the project of the expected work zone impacts and changing conditions. At a minimum, each TMP should have a temporary traffic control plan. It is recommended that the Virginia Department of Transportation implement the guidelines developed in this study.

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FINAL REPORT

GUIDELINES FOR DEVELOPING TRANSPORTATION MANAGEMENT PLANS IN VIRGINIA

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(A Cooperative Organization Sponsored by the
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the University of Virginia)

In Cooperation with the U.S. Department of Transportation
Federal Highway Administration

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ABSTRACT

A transportation management plan (TMP) is a comprehensive program of traffic control, communication, operation, and demand management strategies designed to maintain acceptable levels of traffic flow in work zones. A systematic procedure and/or checklist is needed for developing plans to lessen the impact of construction projects that restore or improve highways. The purpose of this research was to establish guidelines for developing TMPs for construction projects. Three questions were addressed by the guidelines: When should a TMP be developed? How should a TMP be developed? What should be in a TMP?

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FINAL REPORT

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INTRODUCTION

State departments of transportation (DOTs) are focusing on maintaining and improving existing facilities instead of building new ones. Consequently, most of the necessary road work is performed with exposure to traffic. In addition, an increasing amount of highway construction work is being performed on major projects with high traffic volumes, especially on interstate highways. The potential impacts of major reconstruction projects are especially acute on such highways in the urbanized areas of the Virginia Department of Transportation's (VDOT) Northern Virginia, Suffolk, and Richmond districts. The challenge is to perform the construction work efficiently and effectively while minimizing the congestion and resulting delays. A transportation management plan (TMP) is one tool that may be used in this effort.

A TMP is a comprehensive program of communication, operation, and demand management strategies designed to maintain acceptable levels of traffic flow during construction.[1] Congestion mitigation plan, transportation system management, and traffic management plan are all synonymous with TMP. Although *traffic management plan* may be the most common term nationally, VDOT commonly uses the term *congestion mitigation plan.* TMP strategies include public information, motorist information, incident management, construction management, demand management, alternative routes, and other strategies. Table 1 presents a list of TMP strategies and their elements developed by Caltrans.[2] Many state DOTs, including VDOT, began using TMPs in the 1970s. When the Shirley Highway (I-395) was rebuilt in the early 1970s, the project was designed to allow for a temporary bus lane through the construction zone.[3] The concept of TMPs gained further acceptance and attention in the mid-1980s when the Federal Highway Administration (FHWA) began promoting this comprehensive concept.[3]

In the mid-1980s, VDOT's Traffic Engineering Division established a committee to review selected construction and maintenance projects that had the potential to create substantial delays due to congestion. The committee made suggestions on strategies such as those listed in Table 1 that should be incorporated in the project to improve traffic flows and minimize delay. More recently, TMPs were incorporated in five VDOT projects: the widening of I-66, the Coleman Bridge, the Springfield Interchange Improvement Project, the James River Bridge reconstruction project, and the Woodrow Wilson Bridge. Elements used in these TMPs are listed in Tables 1 and 2.

Table 1. TMP Strategies and Elements Used by Caltrans[2]

Public Information	**Construction Strategies**
Brochures and Mailers	Incentive/Disincentive Clauses
Media Releases	Lane Rental
Paid Advertising	Off peak/Night/Weekend Work
Public Information Center	Planned Lane/Ramp Closures
Public Meetings/Speaker's Bureau	Project Phasing
Telephone Hotline	Temporary Traffic Screens
Visual Information (videos, slide shows, etc.)	Total Facility Closure
Total Facility Closure	Truck Traffic Restrictions
Local cable TV and News	Variable Lanes
Traveler Information Systems (Internet)	Extended Weekend Closures
Motorist Information Strategies	**Demand Management**
Electronic Message Signs	HOV Lanes/Ramps
Changeable Message Signs	Park-and-Ride Lots
Extinguishable Signs	Parking Management/Pricing
Ground Mounted Signs	Rideshare Incentives
Commercial Traffic Radio	Rideshare Marketing
Highway Advisory Radio (fixed and mobile)	Transit Incentives
Planned Lane Closure Web Site	Transit Service Improvements
Caltrans Highway Information Network (CHIN)	Variable Work Hours
	Telecommute
Incident Management	**Alternate Route Strategies**
Call Boxes	Ramp Closures
Construction or Maintenance Zone Enhanced Enforcement Program – COZEEP or MAZEEP	Ramp Metering
Freeway Service Patrol	Street Improvements
Traffic Surveillance Stations (loop detectors and CCTV)	Traffic Control Improvements
911 Cellular Calls	Reversible Lanes
Transportation Management Centers (TMC)	Temporary Lanes or Shoulder Use
Traffic Control Officers	**Other Strategies**
Traffic Management Teams	Application of new technology
On-site Traffic Advisor	Upgraded equipment
California Highway Patrol (CHP)Helicopter	Staff training and workforce development
CHP Officer in TMC during construction	Improved specifications
	Innovative products

In all cases, TMPs were developed on a case-by-case basis without guidelines, processes, or directions on how to proceed. An FHWA official who participated in the development of the Springfield Interchange TMP concluded that guidelines for TMPs would have been very useful for that effort.

Thus, the Springfield Interchange Improvement Project brought home the need for a systematic procedure and/or checklist that VDOT can follow in developing plans to lessen the impact of construction projects that restore or improve high-volume limited access highways. The need for such plans is increasing as the need to rebuild the aging road system increases. Although VDOT has experience in implementing measures to alleviate congestion caused by

Table 2. Other TMP Strategies and Elements Used by VDOT

Public Information	Project-related email distribution list, information store, billboards, newspapers, VDOT and/or project website
Motorist Information Strategies	#77 signing, 511, fender bender/move it signs
Incident Management	Police photogrammetry units, Virginia State Police, local police, incident management coordinator position, areawide compatible radio/ communication enhancement, HAZMAT response vehicle, real time CCTV images to police/fire/rescue, incident management plan review and update, incident management training, increased police patrols, police mobile command post.
Construction Strategies	A+B bidding, no excuse bonus clauses, incentives/disincentives, milestones, maintaining existing lanes during rush hours, disincentives for lane closures, holiday lane closure restrictions, accident staging areas
Demand Management	Leased park and ride lots, transportation demand management marketing, transit fare buy downs, free transit, additional buses/trains, buses from park and rides to transit facilities, bus pool seat purchase, van seat purchase, express buses, free van pools
Alternate Route Strategies	Retiming signals, coordinated signal timing
Other Strategies	TMP coordinator for major projects
	TMP Evaluation Plan

work zones, there is no formal approach for addressing these plans. Implementation of such guidelines would enable VDOT to develop and deploy TMPs effectively and consistently statewide to reduce congestion created by major construction work zones. Improved planning should help VDOT deliver a top-quality construction program while enhancing the safety and mobility of motorists and personnel. In response to this need, the Virginia Transportation Research Council's Traffic Research Advisory Committee selected guidelines for TMPs as its highest rated research need at its meeting in the fall of 1999.

PURPOSE AND SCOPE

The purpose of this research was to develop guidelines for VDOT to use to establish TMPs. Specifically, three questions were to be addressed in the guidelines:

1. When should a TMP be developed?
2. How should a TMP be developed?
3. What should be in a TMP?

VDOT's Construction Division's Business Process Review has "constructability" as part of what they look at in the design process and includes addressing congestion. Congestion is addressed on a case-by-case basis, and no guidelines are available. Although listed in Table 1, construction management strategies received little attention in this study.

METHODS

Three tasks were carried out to achieve the objectives of this study.

1. *Review the Federal Highway Administration's Final Rule on Work Zone Safety and Mobility.*[4] During the course of this study, there was a major initiative from the FHWA involving TMPs as part of an effort to improve work zones. The Final Rule was the culmination of the effort to mandate and encourage improved work zones.

2. *Gather information on VDOT's project development process.* Information on VDOT's project development process was obtained through meetings and telephone conversations with VDOT staff.

3. *Develop the TMP guidelines.* The TMP guidelines were developed from the best practices of other states, federal directives, and the engineering judgment of VDOT practitioners.

RESULTS AND DISCUSSION

Review of FHWA's Final Rule on Work Zone Safety and Mobility[4]

On September 9, 2004, FHWA published the Final Rule on Work Zone Safety and Mobility (Final Rule) in the *Federal Register* (69 FR 54562).[4] The Final Rule updates and renames the former regulation on "Traffic Safety in Highway and Street Work Zones," under 23 CFR 630 Subpart J. All state and local governments that received federal-aid highway funding are affected by this rule. State DOTs have until October 12, 2007, to comply with its provisions. The Final Rule is available at www.ops.fhwa.dot.gov/wz/resources/final_rule.htm. The Final Rule is discussed here in some detail, and excerpts from an FHWA implementation guide for the rule are provided.[7] As may be seen, guidelines for developing TMPs is a state-level process/procedure for systematic work zone impact assessment, and the development of TMPs is performed as a project-level provision.

> The Final Rule amends the FHWA regulation that governs traffic safety and mobility in highway and street work zones. The changes to the regulation were designed to facilitate comprehensive consideration of the broader safety and mobility impacts of work zones across project development stages, and the adoption of additional strategies that help manage these impacts during project implementation. These provisions will help State DOTs meet current and future work zone safety and mobility challenges, and serve the needs of the motorists.
>
> The regulation addresses the changing times of more traffic, more congestion, greater safety issues, and more work zones. The regulation is broader so as to recognize the inherent linkage between safety and mobility and to facilitate systematic consideration and management of work zone impacts. The regulation can advance the state of the practice in highway construction project planning, design, and delivery so as to address the needs of the traveling public and highway workers. The key features of the Final Rule are:
>
> 1. a policy driven focus that will institutionalize work zone processes and procedures at the agency level, with specific language for application at the project level.

2. a systems engineering approach that includes provisions to help transportation agencies address work zone considerations starting early in planning, and progressing through project design, implementation, and performance assessment.
3. emphasis on addressing the broader impacts of work zones to develop transportation management strategies that address traffic safety and control through the work zone, transportation operations, and public information and outreach.
4. emphasis on a partner driven approach, whereby transportation agencies and the FHWA will work together towards improving work zone safety and mobility.
5. overall flexibility, scalability, and adaptability of the provisions, so as to customize the application of the regulations according to the needs of individual agencies, and to meet the needs of the various types of highway projects.

The Final Rule was written to be flexible, taking into account the different needs for different project types and classes, and the vagaries in the operating circumstances and priorities for different state DOTs in different parts of the country. The provisions in the new rule address the following focus areas that are representative of the way State DOTs execute their functions:

Policy;
Process; and
Project.

As shown in Figure 1, the new rule advocates a systematic approach to managing work zone safety and mobility, with the flow of information from one level to the other, starting at the policy level through the process level and then the project level. Further, the Final Rule advocates the principles of continual feedback from one level to the other for the overall improvement of work zone practices, procedures, processes, and policies.

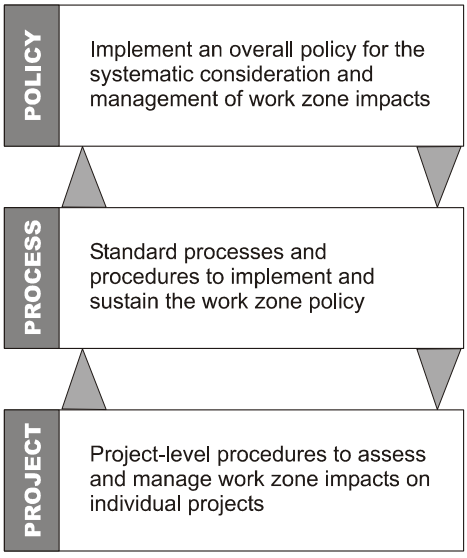

Figure 1. Structural Outline of Final Rule

Within these components are the following key provisions:

Policy-Level Provisions

- Implement an overall policy that facilitates the systematic consideration of work zone safety and mobility.
- Work in partnership with the FHWA to develop and implement the policy.

State-Level Processes and Procedures

- Develop and implement processes/procedures for systematic work zone impact assessment and management
- Use work zone safety and mobility information and data to manage impacts on ongoing projects and to conduct performance assessments at the completion of projects to improve state work zone procedures
- Require training for personnel involved in work zone planning, design, implementation, management, and enforcement
- Conduct process reviews to assess wide scale performance of work zones with the goal of improving work zone processes and procedures.

Project-Level provisions

- Identify significant projects early in the project development process. Significant projects are those anticipated to cause sustained work zone impacts greater than what is considered tolerable based on state policy and/or engineering judgment.
- Develop TMPs that focus on safety and mobility.
  - — TMPs for significant projects must consist of a temporary traffic control (TTC) plan. The TMPs must address transportation operations (TO) strategies that will be used to ease work zone impacts. They must also address public information (PI) strategies to inform those affected by the project of the expected work zone impacts and changing conditions.
  - — TMPs for all other projects must consist at least of a TTC plan and may include TO and PI strategies as well.
- Include appropriate TMP provisions in the plans, specifications, and estimates (PS&Es).
- In the PS&Es, include appropriate pay item provisions for implementing the TMP—either unit pay items or lump sum pay items.
- Assign a responsible person (state and contractor) to monitor the TMP and other safety and mobility aspects of the project.

VDOT's Project Development Process

VDOT's project development concurrent engineering process directs how projects are developed and is inseparable from project management (see Figure 2). The concurrent engineering and preliminary engineering project development processes are described in an Instructional and Information Memorandum from VDOT's Location & Design Division and on a website.[5,6] The term *concurrent engineering* emphasizes the importance of multiple disciplines working simultaneously on individual project-related activities in a coordinated effort. The development phase has three parts:

1. scoping
2. Phase I design (initial plan design)
3. Phase II design (preliminary design and engineering).

The construction program has three parts:

1. Phase III design (final design)
2. Phase IV design (design and engineering to support right-of-way-utility and environmental processes)
3. prepare for advertisement.

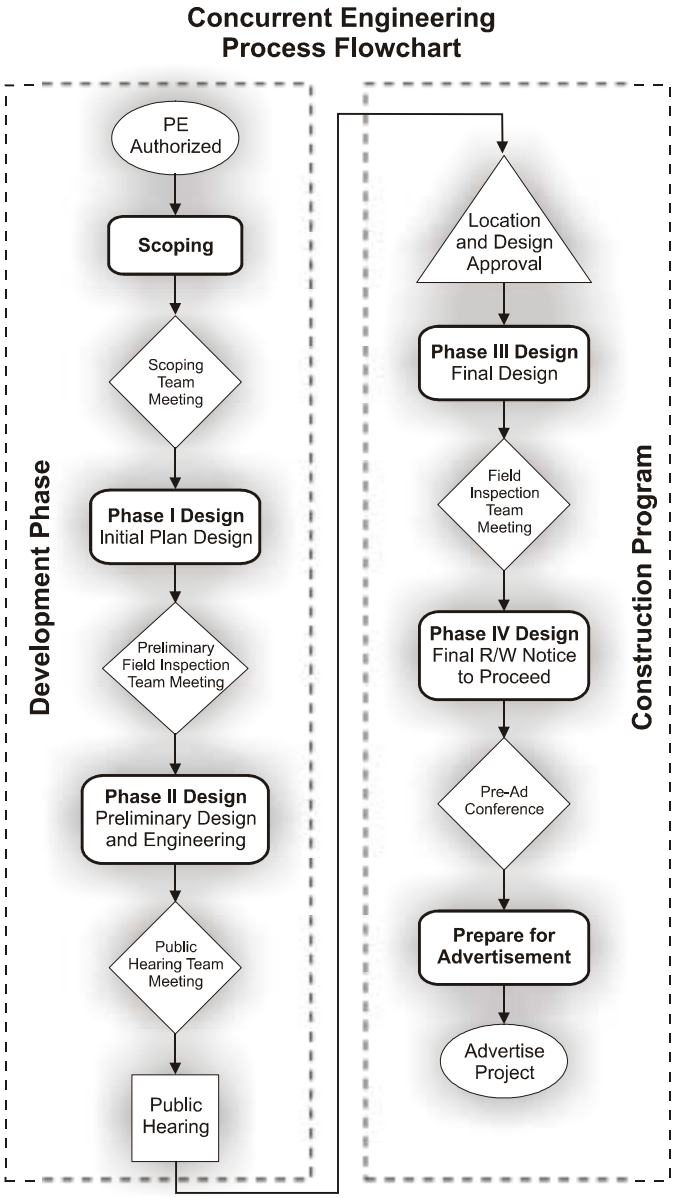

Figure 2. VDOT's Project Development Process

Development of Guidelines

The TMP guidelines presented in the FHWA implementation guide[7] were adopted with minor revisions. Most of the information in the guidelines is based on policies, procedures, guidance, manuals, and other documents from states currently implementing TMPs, or TMP-like components, including California, Indiana, Illinois, New York, Ohio, and Washington. Thus the guidelines are essentially based on best practices.

CONCLUSIONS

- The FHWA's Final Rule on Work Zone Safety and Mobility led to the establishment of proposed TMP guidelines in its implementation guide.

- The proposed TMP guidelines are comprehensive and should be effective in improving safety and mobility in work zones. Minor revisions were made to make the guidelines specific to VDOT.

RECOMMENDATIONS

1. VDOT should adopt the proposed guidelines presented in the Appendix of this report.

2. As VDOT proceeds to adopt other aspects of the FHWA Final Rule, the guidelines should be reviewed and revised by VDOT as needed based on their experience with them and information from other sources. Part of the revision, or more accurately, expansion, should incorporate details of the interaction of the TMP with the project development process.

COSTS AND BENEFITS ASSESSMENT

Expected Benefits

- VDOT will have begun moving toward compliance with the Final Rule.

- VDOT will have a systematic comprehensive process for determining the need for and developing, producing, deploying, and monitoring TMPs effectively and consistently statewide.

- VDOT will reduce congestion created by major construction work zones.

- The motoring public and businesses likely impacted by congestion will benefit from decreased delay.

Potential Costs

- The costs of construction projects will increase depending on the extent to which comprehensive TMPs are required and implemented.

- An additional layer of coordination and the added emphasis on traffic management may result in additional effort, skill, and training for staff involved in the project development process.

IMPLEMENTATION PLAN

VDOT's Traffic Engineering Division should lead the effort to implement the guidelines for TMP as the first step in an incremental approach to complying with the FHWA Final Rule. The Location & Design Division will also have a role in the implementation because it is responsible for the project development process. Other divisions such as Transportation and Mobility Planning and district offices should also be involved in the process. The TTC plans that are being developed should be implemented along with the TMP guidelines.

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APPENDIX

GUIDELINES FOR TRANSPORTATION MANAGEMENT PLANS (TMPs) IN VIRGINIA

INTRODUCTION

The following guidelines were drawn for the most part from the *Work Zone Safety and Mobility Final Rule Implementation Guide* prepared by Cambridge Systematics, Inc., for the Federal Highway Administration in the March 8, 2005 draft.[1] The guidelines were intended to provide general guidance for state DOTs and make frequent references to state and state agencies. Minor changes were made to replace such references to states with "VDOT." In instances where VDOT might not have a policy or procedure in place, the term "agency" was retained. There was some reorganization where the author believed that such a change improved the flow or readability of the guidelines.

OVERVIEW OF TMPs FOR PROJECTS

This section provides an overview and general guidance on developing and implementing TMPs.

Scope, Content, and Degree of Detail

The TMP consists of strategies to manage the work zone impacts of a project. Its scope, content, and degree of detail may vary based on VDOT's work zone policy and the expected work zone impacts of the project. For significant projects, the TMP will consist of a temporary traffic control (TTC) plan and addresses both transportation operations (TO) and public information (PI) components. For individual projects or classes of projects that VDOT determines to have less than significant impacts on work zones, the TMP may consist only of a TTC plan. TO and PI issues should be considered for all projects.

Temporary Traffic Control Plan

The TTC plan describes TTC measures to be used for facilitating road users through a work zone or an incident area. The TTC plan plays a vital role in providing continuity of reasonably safe and efficient road user flow and highway worker safety when a work zone, incident, or other event temporarily disrupts normal road user flow. The TTC plan shall be consistent with the provisions of the *Virginia Work Area Protection Manual* (VWAPM) and the *Manual on Uniform Traffic Control Devices* (MUTCD). In developing and implementing the TTC plan, pre-existing roadside safety hardware shall be maintained at an equivalent or better level than existed prior to project implementation. The scope of the TTC plan is determined by

the project characteristics, and the traffic safety and control requirements identified for the project. The TTC plan shall either be a reference to specific TTC elements in the VWAPM, MUTCD, approved standard TTC plans, TTC manual or be designed specifically for the project.

Transportation Operations Component

The TO component of the TMP includes the identification of strategies that will be used to mitigate impacts of the work zone on the operation and management of the transportation system within the work zone impact area. Typical TO strategies may include, but are not limited to, demand management, corridor/network management, safety management and enforcement, and work zone traffic management. The scope of the TO component should be determined by the project characteristics and the identified transportation operations and safety strategies.

Public Information Component

The PI component of the TMP includes communications strategies that seek to inform affected road users, the general public, area residences and businesses, and appropriate public entities about the project, the expected work zone impacts, and the changing conditions on the project. This may include traveler information strategies. The scope of the PI component should be determined by the project characteristics and the identified public information and outreach strategies. Public information should be provided through methods best suited for the project and may include, but not be limited to, information on the project characteristics, expected impacts, closure details, and commuter alternatives.

Development and Implementation of the TMP

- VDOT should develop and implement the TMP in sustained consultation with stakeholders (e.g., other transportation agencies, railroad agencies/operators, transit providers, freight movers, utility suppliers, police, fire, emergency medical services, schools, business communities, and regional transportation management centers).

- The Plans, Specifications, and Estimates (PS&Es) include either a TMP or provisions for contractors to develop a TMP at the most appropriate project phase as applicable to the concurrent engineering process for the project. A contractor-developed TMP is subject to VDOT approval and shall not be implemented before it is approved.

- The PS&Es include appropriate pay item provisions for implementing the TMP, either through method-based or performance-based specifications.

  — For method-based specifications, individual pay items, lump sum payment, or a combination thereof may be used.

  — For performance-based specifications, applicable performance criteria and standards may be used (e.g., safety performance criteria such as number of crashes within the work zone; mobility performance criteria such as travel time through the work zone, delay, queue

length, and traffic volume; incident response and clearance criteria; and work duration criteria).

- VDOT and the contractor shall each designate a trained person, as specified in the Final Rule, 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.[2]

OVERVIEW OF TMP DEVELOPMENT

This section summarizes how and when a TMP should be considered and developed. It lists possible conditions that could trigger specific TMP strategies and addresses how they should be considered in the context of project planning through TMP implementation and assessment. It provides some guidance on policies and processes that should be developed for TMPs and also discusses examples currently in use by various state DOTs.

Essentially, the bulk of TMP development occurs during the design phase of a project. This is how most agencies currently develop their TTC plans and TMPs, and ideally, the design phase is where the majority of TMP development effort should be concentrated. However, during systems planning and early project development (i.e., preliminary engineering), VDOT should consider the potential work zone impacts of its projects and identify potential work zone transportation management strategies and their costs. This is especially applicable to projects likely to have significant work zone impacts. So, this section provides a general procedure for assessing TMP needs that applies to the planning, preliminary engineering, and design phases—the only difference being in the level of detail and rigor involved in the assessment. The level of detail of the assessment will progressively increase from planning through preliminary engineering through design, as and when more project specific information becomes available. The TMP development process is intended to work in an iterative manner that helps flush out the work zone impacts of a project, given a certain combination of construction staging and impacts management strategies.

Conducting a TMP assessment during systems planning will help ensure that the TMP development/implementation costs are included in the project budget and encourage proper coordination and scheduling of projects along a corridor or in a region. The level of detail of the TMP assessment during systems planning is largely dependent upon the type of planning activity, the expected impacts of the project, and the availability of data. At a minimum, the assessment during systems planning should entail a qualitative exercise to list the potential impacts of a project, along with a list of potential management strategies, and the expected costs of the management strategies. Once this information is included in transportation plans and programs, the appropriate funding may be allocated for work zone impacts management, and the thinking and rationale that went into identification of the management strategies can be carried over to the subsequent phases of the project. The same is true for the preliminary engineering phase of a project, where the project design team should work with other technical experts, including construction, traffic engineering, and public outreach/relations personnel to identify jointly the work zone impacts issues that need to be accounted for.

Early consideration of work zone impacts and identification of transportation management strategies using a multidisciplinary approach are being increasingly recognized by DOTs as a critical path element. To develop sound mitigation strategies, traffic engineers should stage the construction site together with the project designers. The key to a successful TMP is development as early as possible in the project's life-cycle and the use of a multidisciplinary approach. Construction phasing and staging greatly affect the safety and mobility of work zone users. Therefore, it is important that designers/construction engineers who develop the construction phasing and staging plans consult and appropriately involve safety experts, traffic engineers, and other technical specialists in their processes. Often times, engineers develop the construction staging plans and then an appropriate TTC plan for the project. However, it would be more beneficial if the construction staging, a constructability review, and TTC plans were developed hand-in-hand.

Taking this one step further, engineers often develop construction staging plans and appropriate TTC plans that best suit the construction staging. However, very little or no thought is given to the sustained operations and management of the work zone and the work zone impact area. Transportation operations and management issues are often included in PS&Es as an afterthought, resulting in project delays and increased costs. However, if TO and PI issues are considered at the same time as construction staging and TTC issues, it may result in the development of a well-thought-out TMP that has synergy across its different components. Further, the availability of advanced knowledge of available TO and PI options for the project may result in the selection of a better (e.g., more efficient or cost-effective) construction staging and TTC plan.

For example, on a particular corridor it may be the case that a shoulder closure is required to construct a project; however, it may also be the case that the corridor has a high crash experience. The lack of knowledge about available TO options may preclude the shoulder closure option; however, if a traffic operations specialist had been involved in the early planning stages of the project, he or she could have mentioned that an incident management plan with a tow-truck-based incident response program could allow the shoulder to be closed for construction. Therefore, the essence of the TMP development process lies in developing and evaluating the best alternative combination of construction staging, project design option, TTC plan, TO strategies, and PI strategies hand-in-hand with each other.

TMP Development and Implementation Work Flow

TMP Development During Design and/or Planning/Preliminary Engineering

The project design team begins by compiling available project materials such as the project definition (project scope, roadway/traffic characteristics, other factors such as public outreach/community information, etc.), construction staging approaches/plans, preliminary work zone management strategies, and preliminary cost estimates for strategy implementation. Information for other projects in the corridor should also be compiled to assess the combined/cumulative impact of the projects. The planning or design team should work together with traffic engineering/operations personnel and other relevant technical specialists in moving

forward with the project design, since such collaboration would result in well-synthesized construction and mitigation plans. As more information and data become available, management strategies and their costs should be reassessed and refined. The following points aid in developing TMPs:

1. The type of TMP needed for the project is based on whether a project is determined to be significant. The work zone policies, project characteristics, anticipated work zone impacts, and potential mitigation strategies should be considered in assessing whether a project is significant. Some agencies already have policies governing TMP criteria and requirements, but many rely on engineering judgment for the decision. Depending on the "significance" of the project, three levels of TMP may be developed: basic, minor, or major (each is defined in more detail here).

   Some of the key project characteristics that agencies may consider for triggering the need for a minor or major TMP include:

   - new construction, major reconstruction, major rehabilitation, or bridge/pavement replacement
   - located on a congested roadway
   - significant capacity reductions (lane, ramp, or facility closures)
   - significant impacts on mobility through and within the project area
   - significant impacts on safety through and within the project/work zone impact area
   - significant impacts on local businesses and community
   - significant impacts from special events or seasonal variations (e.g., weather related, tourist traffic, sporting events)
   - when significant detour and alternative routing will be necessary
   - when no feasible alternative routes are available.

   VDOT should develop guidelines/policies for determining when a project is significant. According to Caltrans' policy guidance: "Significant traffic impact is 30 minutes above normal recurring traffic delay on the existing facility or the delay threshold set by the District Traffic Manager (DTM), whichever is less."[3]

2. Basic TMPs are typically applied on construction or maintenance projects with minimal disruption to the traveling public or on projects with a moving work zone. These projects typically only involve the development of a TTC plan, often known as a Traffic Control Plan (TCP). However, it is recommended that transportation operations and public information strategies be considered, as appropriate. TTCs shall be consistent with provisions of the MUTCD and AASHTO's Roadside Design Guide. Such typical TTCs are often one- or two-page forms that provide information on the location and schedule of the construction or maintenance project, with a TCP. The majority of construction and maintenance activities performed by agencies fall into this category.

3. Minor TMPs provide more detailed mitigation strategies for construction or maintenance projects that directly impact a moderate to high number of travelers and have low to moderate public interest, such as multiple lane closures in urban areas or central business

districts (CBDs). In addition to a TTC, minor TMPs also include PI, TO, and cost estimates that include approaches to keeping traffic flowing with minimal additional delays to motorists.

4. Major TMPs may affect less than 5 percent of all construction or maintenance projects performed by agencies. Projects that require major TMPs are typically those with very high regional impacts and a high level of public interest, such as total closure of a vital corridor in an urban area or CBD. Major TMPs should include components such as TTC, PI, TO, and cost estimates, as well as coordination strategies between stakeholders, a secondary mitigation strategy, and detailed analysis on detours and impacts of the mitigation strategies. It is recommended that a TMP team be developed for major TMP efforts to see the project through from design to final assessment. VDOT can either use in-house resources or seek the services of transportation consultants for the development of major TMPs.
   The TMP team should vary depending on the project characteristics. It may include representatives from VDOT's planning, design, construction, operations, maintenance, public affairs, public transportation, and local roads groups; local government (county, city, regional); FHWA; public transportation providers; regional smart traffic centers (STCs); the Virginia State Police (VSP) and local enforcement agencies; utility providers; emergency services; local businesses; community groups; and/or others.

5. The first step in the development of a minor or major TMP is to identify the stakeholders that should be involved. The stakeholders should be multidisciplinary and will vary depending on the location and nature of the project. VDOT stakeholders may include staff from design, pavement, bridge, traffic/operation, safety, planning, construction, and maintenance as well as technical specialists. Other stakeholders may include other local traffic agencies, regional STCs, railroad agencies/operators, freight companies, utility providers, police/highway/state patrol, emergency services, safety service patrols, businesses, schools, and/or community groups, and transit providers.

6. Mitigation strategies should be identified based on the project constraints, costs, construction staging plan, and type of work zone. The role of the stakeholders is to provide input for the document. Some state DOTs have strict lane closure strategies or permissible lane closure times that must be followed; others may use analysis tools to predict delays, queues, and impacts of detours on the city arterials of various strategies. Cost is often a constraint for the development of a TMP, particularly for major TMPs. So although many state DOTs would like to use simulation tools for better work zone analysis, many just use basic analysis tools such as QUEWZ and QuickZone. The TMP shall include appropriate pay item provisions for implementation.

7. At this stage, the TMP is a "dynamic document" that must be maintained and revised with changes made by the design team when necessary.

8. The PS&Es should include a TMP or the provisions for contractors to develop a TMP. TMPs should be subject to VDOT approval, with input from the stakeholders, as appropriate. Once approved, the TMP and the staging plans are finalized.

TMP Implementation and Monitoring During Construction

9. If a TMP has not yet been developed and approved, VDOT, or the design consultant, shall go through the process of determining whether the project is significant and develop the TMP accordingly based on the proposed construction staging. If a TMP has previously been developed, the contractor and/or design team may re-evaluate and/or revise the TMP because of alternative construction staging plans or other recommended management strategies. TMPs developed or revised during contracting or construction shall be approved by VDOT (or other appropriate owner agency) prior to implementation.

10. The TMP is implemented. In some cases, components of the TMP may need to be implemented prior to construction (e.g., public relations campaign, improvements to detour routes).

11. During construction, implementation of the TMP and the performance of the work zone should be monitored to verify whether or not the predicted impacts closely resemble the conditions in the field. Example performance measures are volume, travel time, queue length, delay, number of incidents, incident response and clearance times, contractor incidents, community complaints, user costs, and cumulative impacts from adjacent construction activities. Performance requirements should be based on VDOT policies, standards, and procedures and should be included in the project contracting documents.

12. If performance requirements are not met, VDOT and/or a consultant should revisit the TMP and consider alternate management strategies and/or staging approaches that meet the approval of VDOT. The contingency plan component should specify activities that should be undertaken to minimize traffic impacts when unexpected events occur in the work zone (e.g., accidents, unforeseen traffic demand, inclement weather).

Post-Construction Performance Evaluation

13. Following the completion of construction, a report should be prepared that contains an evaluation of the TMP. The post-project evaluation should contain successes and failures, changes made to the TMP and the results of those changes, public input, actual versus predicted measures, cost for implementation of the strategies, and suggested improvements. The findings should then be used to help in the development and implementation of future TMPs and in the refinement of these guidelines.

TMP COMPONENTS

This section contains an overview of the components that should be considered for inclusion in TMPs. The level of detail depends on the type of TMP required; agency policies, procedures, and guidelines; and the potential work zone impacts of the project. The components provided here are intended for major or minor TMPs; most state DOTs have TTC policies and procedures in place for blanket TMPs in the form of TCPs or Maintenance of Traffic (MOT) plans. The components discussed include elements of the TMP document itself, as well as those

for implementing the plan and post-implementation activities. The order, terminology, and inclusion of the components may vary by agency and/or type of project. This list is intended to serve as overall guidance that sets forth some basic principles and issues to consider in developing TMPs. Each contains a definition of the component and identifies some of the key items and issues to consider.

The following is a list of the TMP components that should be considered. Each component is described in more detail in the sections that follow.

1. Front Matter
2. Executive Summary
3. TMP Roles and Responsibilities
4. Project Description
5. Existing and Future Conditions
6. Work Zone Impacts Assessment
7. Work Zone Impacts Management Strategies
8. TMP Monitoring Requirements
9. Contingency Plans
10. TMP Implementation Costs
11. Conclusions and Recommendations
12. Appendices

1. Front Matter

This section should contain all the necessary reading guides for the TMP, such as cover page and table of contents. Components may include:

- cover page
- licensed engineer stamp page (if required)
- table of contents
- list of figures
- list of tables
- list of abbreviations and symbols
- terminology.

2. Executive Summary

The executive summary should contain a brief overview and summary of the project, general approach, selected construction staging approach(es), anticipated work zone impacts of the project, the chosen TMP strategies, cost estimate for the TMP, links to locations of specific TMP components, and conclusions/recommendations for the project.

3. TMP Roles and Responsibilities

The roles and responsibilities for the development, implementation, monitoring, and evaluation of the TMP should be documented. These may include, but are not limited to:

- TMP manager
- stakeholders/review committee
- approval contact(s)
- TMP implementation task leaders (e.g., public information liaison, incident management coordinator)
- TMP monitors
- emergency contacts.

4. Project Description

This component of the TMP presents the scope and definition of the project. It may include:

- project background
- project type
- project area/corridor
- project goals and constraints
- proposed construction staging
- general schedule and timeline
- related projects.

5. Existing and Future Conditions

This TMP component provides information on existing and anticipated future conditions in the study area including traffic, safety, and business and community access. It should include:

- data collection and modeling approach
- existing roadway characteristics(history, roadway classification, number of lanes, geometrics, urban/suburban/rural)
- existing and historical traffic data(volumes, speed, capacity, volume/capacity, percent trucks, queue length, peak traffic hours)
- existing traffic operations including signal timing, delay, and traffic control types
- crash data
- incident data
- local community and business concerns/issues
- traffic growth rates (for future construction dates)
- traffic predictions during construction (volume, delay, queue).

6. Work Zone Impacts Assessment Report

Depending upon the type of TMP, this component may include a qualitative and/or quantitative analysis of work zone impacts, impacts assessment of alternative strategies (in conjunction with each other), and the impacts of the chosen management strategies. These may include:

- qualitative summary of anticipated work zone impacts
- impacts assessment of alternative project design and management strategies (in conjunction with each other)
- construction approach/staging strategies
- work zone impacts management strategies
- traffic analysis results (if applicable)
  —traffic analysis strategies
  —analysis tool selection methodology and justification
  —analysis results
- constructability issues
- selected alternative.

7. Work Zone Impacts Management Strategies

The objectives of work zone impact management strategies are to minimize traffic delays, maintain or improve motorist and worker safety, and maintain access for businesses and residents. For the TMP, work zone impact management strategies should be identified for both the mainline and detour routes for the construction staging approach(es). Where appropriate, the management strategies should be documented on plan sheets. A list of work zone strategies, discussed in more detail in the Appendix, follows:

Temporary Traffic Control Strategies

- Full roadway closure
- Other roadway closure strategies (off-peak, night, intermittent)
- Reduce lane width (constriction).
- Lane closure
- Reduced shoulder width.
- Shoulder closure.
- Lane shift to shoulder/median
- One-lane, two-way operation.
- Two-way traffic operation on one side divided facility (crossover)
- Reversible lanes
- Ramp closures/relocation
- Freeway-to-freeway ramp closures
- Temporary structures/lanes/shoulders (temporary diversion or runaround)
- Work hour restrictions (peak hours, holidays, special events)
  —night work

  - —weekend work
- Traffic screens
- Signage
  - —construction signs
  - —detour signs
  - —traffic control officers
  - —flaggers
  - —flashing arrow signs
- Off-site detours
  - —capacity/geometric improvements
  - —signal timing/coordination
  - —signing and pavement marking enhancements
  - —parking restrictions
  - —changeable/dynamic/variable message signs (CMS/DMS/VMS).
  - —pedestrian/bicycle access improvements
  - —business access improvements
- Construction phasing/staging
- Construction management techniques
  - —innovative construction techniques (precast members, rapid cure materials)
  - —design build
  - —A+B bidding
  - —no excuse bonus clauses
  - —incentive/disincentive clauses
  - —milestones
  - —lane rental
  - —disincentives for lane closures
- Other strategies
  - —severe weather conditions
  - —bicycle/pedestrian traffic controls.

Transportation Operations Strategies

- Work Zone Safety and Traffic Control Features
  - —Changeable/dynamic/variable message signs (CMS/DMS/VMS)
  - —Radar speed monitoring/display units
  - —Temporary traffic signals
  - —Temporary traffic barrier
  - —Movable traffic barrier systems
  - —Crash-cushion (fixed and mobile)
  - —Temporary rumble strips
  - —Intrusion alarms
  - —Warning lights
  - —Construction safety inspectors
  - —Project task force/committee
  - —Team meetings
- Incident Management/Enforcement
  - —Tow

- —Safety service patrols
- —Surveillance (CCTV, loop detectors, lasers, probe vehicles)
- —Changeable/dynamic/variable message signs (CMS/DMS/VMS)
- —Highway advisory radio (HAR) (fixed and mobile)
- —CB Wizard Warning devices
- —Smart Work Zone Technologies
- —Call boxes
- —Smart Traffic Center (STC)
- —Distance/milepost markers
- —Accident staging/investigation areas
- —HAZMAT trailers
- —Fender bender/ move it signing
- —Total station units
- —Local detour routes
- —Contract support
- —Dedicated (paid) police enforcement
- —Cooperative police enforcement
- —Helicopter
- —Enforcing penalties
- —Incident/emergency management coordinator
- —Incident/emergency response plan
- —Media briefings

- Corridor/Network Management
  - —Advance/delay planned projects
  - —Signal timing/coordination improvements
  - —Temporary signals
  - —Street/intersection improvements
  - —Turn restrictions
  - —Parking restrictions
  - —Separate truck lanes
  - —Truck/heavy vehicle restrictions
  - —Ramp metering
  - —Temporarily suspend ramp metering
  - —Ramp closures
  - —Bus turnouts
  - — Reversible lanes
  - —Dynamic lane closure system
  - —Railroad crossings controls
  - —Speed limit reduction/variable speed limits
  - —Coordination with adjacent construction site(s)
- Demand Management
  - —Transit service improvements
  - —Reduced fares
  - —Transit incentives
  - —Ridesharing/carpooling incentives
  - —Park and ride promotion

  - —Shuttle services
  - —Pedestrian/bicycle access improvements
  - —HOV lanes
  - —Ramp metering
  - —Parking supply management
  - —Toll/congestion pricing
  - —Variable work hours
  - —Teleworking/telecommuting
- Work Zone Safety and Mobility Reviews and Audits
  - —TMP monitor/inspection team
  - —Windshield surveys.

Public Information (PI) Strategies

The inclusion of a public information and/or relations campaign can be very effective in keeping the public informed of the project and its potential work zone impacts. The public (particularly the impacted communities and businesses) should be included in the TMP process early and should be informed in a timely manner of potential impacts and issues. Coordination with VDOT's Office of Public Affairs will be necessary, particularly for significant projects.

- Public Awareness
  - —Brochures and mailers
  - —Rideshare promotions
  - —Press releases/alerts
  - —Paid advertisements (newspaper, radio, billboards)
  - —Public information center
  - —Public meetings/hearings
  - —Community task forces
  - —Telephone hotline
  - —Visual information (videos, slides, presentations) for meetings or for web-based dissemination
  - —Planned lane closure website
  - —Project website
  - —Email distributions
  - —Coordination with local/cable TV newsrooms, schools and school districts, local major employers/businesses, and local emergency services (fire, police, and ambulance)
- Motorist Information Strategies
  - —Portable and permanent changeable/dynamic/variable message signs (CMS/DMS/VMS)
  - —Ground mounted signs
  - —Commercial traffic radio
  - —Highway advisory radio (HAR) (fixed and mobile)
  - —Highway information network (web-based)
  - —Radar speed message sign
  - —Traveler information systems (wireless, handhelds), e.g., 511
  - —Freight-travel based information.

8. TMP Monitoring

Monitoring Requirements

Monitoring requirements for the TMP implementation should be included in the TMP. These should include or refer to any agency policies, standards, requirements, and procedures for TMP implementation and monitoring. The evaluation should consider both the performance of individual TMP strategies and overall performance of the work zone and work zone impact area. The evaluation report of the TMP should include successes and failures. This may include, but is not limited to:

- verification of work zone setup
- identification and process for monitoring TMP performance (e.g., volume counts, queue length, accidents, complaints, surveys)
- tracking TMP implementation costs and comparing them to the budgeted costs
- approach for and performance of corrective actions when TMP performance requirements are not met (see "Contingency Plans" in the next section)
- when alternative TMPs or changes to the TMP are submitted and the approval process
- identification of the person responsible for each component of the TMP monitoring.

Evaluation Report of the TMP

The TMP should include a reference to the development of an evaluation report upon completion of construction to document lessons learned and provide recommendations on how to improve the TMP process and/or modify guidelines. The report should include the following:

- an overall statement reflecting the usefulness of the TMP
- changes necessary to correct oversights in the TMP
- changes made to the original plan and their level of success
- public reaction to the TMP
- the maximum and average delay time encountered (e.g., average queues, slowdowns) during peak and off-peak periods, and delay history over the duration of the project
- identification of the peak traffic periods
- frequency of legitimate complaints and the nature of the complaints
- types and numbers of crashes that occurred during construction
- types and numbers of safety service patrols incidents
- level of success and performance log for each strategy of the TMP implemented
- suggested improvements or changes for similar future projects

9. Contingency Plans

The contingency plan should include a decision tree, trigger points, standby equipment or personnel, and the contractor's contingency plan. The components should specify activities that

should be undertaken to minimize traffic impacts when unexpected events occur in the work zone (e.g., accidents, unforeseen traffic demand, inclement weather). This plan, developed by VDOT or a consultant, should address specific actions to restore or minimize the effects of unexpected congestion or delays that exceed the original estimates or acceptable levels. Contingency plans are required for all planned work (basic through to major TMPs) and should include, but not be limited to, the following:

- information that clearly defines trigger points that require lane closure termination (i.e., inclement weather, length of traffic queue exceeds threshold)
- a decision tree with clearly defined lines of communication and authority
- specific duties of all participants during lane closure operations, such as coordination with VSP or local police
- names, telephone numbers and pager numbers for the district traffic engineer or a designee, the resident administrator, the maintenance superintendent, the permit inspector, the on-site traffic advisor, the VSP division or area commander, appropriate local agency representatives, and other applicable personnel
- coordination strategy (and special agreements if applicable) between the district traffic engineer, resident administrator, on-site traffic advisor, maintenance staff, VSP, and local agencies
- contractor's contingency plan that addresses activities under the contractor's control within the work zone
- standby equipment, VDOT personnel, and availability of local agency personnel for callout (normally requires a cooperative agreement)
- development of contingencies based on maintaining minimum level of service.

10. TMP Implementation Costs

Estimating the work zone management strategy implementation costs in the TMP, or earlier, and including them in the overall project cost are critical as obtaining additional funding at a later time may be difficult. This action potentially avoids under-allocation of funds. Where feasible, the cost estimates for the various management strategies should be itemized and documented in the TMP, with cost responsibilities, opportunities for sharing or coordinating with other projects, and funding sources specified. TMP components can be funded as part of the construction contract and/or in separate agreements.

11. Conclusions and Recommendations

This section highlights some of the key findings for the selected alternative and discusses feasibility, anticipated traffic, or safety concerns (e.g., specific roadways with long estimated queues, accessibility issues, ability of the detour routes to handle diverted traffic) and any special provisions or issues.

12. Appendices (As Appropriate)

Appendices may be included in the TMP to include information that may be relevant or of interest to the implementer of the TMP, TMP manager, VDOT, or other stakeholders. This could include, but should not be limited to, observed, historical, and/or estimated traffic volumes, speeds, travel times, level of service, delay, and accidents; maps; staging/phasing plans; lane closure charts; and detailed analysis methodology, assumptions, parameters used; etc.

REFERENCES

1. Federal Highway Administration. March 8, 2005. *Work Zone Safety and Mobility Final Rule Implementation Guide* (Draft). Prepared by Cambridge Systematics, Inc., Washington, D.C.

2. Federal Highway Administration. 2004. Final Rule on Work Zone Safety and Mobility on September 9, 2004. *Federal Register* (69 FR 54562). Washington, D.C. Available at www.ops.fhwa.dot.gov/wz/resources/final_rule.htm.

3. California Department of Transportation, Office of System Management Operations, Traffic Operations Program. 2004. *Transportation Management Plan and Major Lane Closure Guidelines*. Sacramento.

APPENDIX TO GUIDELINES: LIST OF WORK ZONE STRATEGIES

TEMPORARY TRAFFIC CONTROL (TTC) STRATEGIES

Full roadway closure. This strategy involves the complete closure of the roadway during the construction. It necessitates being able to detour traffic adequately onto existing routes. The advantage of this strategy is that it provides for faster construction by allowing the contractor full access to the work area and eliminates exposure of motorists to work zones and workers to traffic. It increases construction efficiencies, eliminates traffic control devices, and reduces overall project duration.

Full closure strategies (off-peak, night, intermittent). These strategies involve complete closure of the roadway for various time periods. Off-peak and night closures require detour routes and other strategies to manage the work zone traffic. For intermittent closures, traffic is stopped for short period(s) (one or both directions). Intermittent closures should be used only on roadways with low volumes or during periods of lower volumes (mid-day, night, weekends, etc.).

Reduce lane width (constriction). This involves reducing the width of one or more lanes to maintain the existing number of lanes on the facility. The width reduction may be less if the shoulder is available for use (width and structural adequacy). However, reduced lane widths reduce the facility's capacity and usually require lane marking changes.

Reduced lane width (constriction). This involves reducing the width of one or more lanes to maintain the existing number of lanes on the facility. The width reduction may be less if the shoulder is available for use (width and structural adequacy). However, reduced lane widths reduce the facility's capacity and may require lane marking changes.

Lane closure. This type of work zone closes one or more existing traffic lanes. This strategy should be analyzed to determine if significant impacts would result from the loss of capacity.

Reduced shoulder width. This involves reducing the width of the inside and/or outside shoulder for construction purposes.

Shoulder closure. Shoulder closure prevents vehicles from using a shoulder or any portion of the shoulder for its intended legal use. This strategy should be avoided in areas with high incident rates. It may also require provisions for towing disabled vehicles and construction of shoulder pull-outs.

Lane shift to shoulder/median. This strategy involves traffic being diverted onto the shoulder, or a portion of the shoulder, for use as a traffic lane. If the construction period is of long duration, a pavement engineer should determine if the pavement is adequate to support the traffic (consider the percentage of heavy vehicles for this corridor).

One-lane, two-way operation. One lane, two-way traffic control involves using one lane for both directions of traffic. It is usually implemented for short-term projects on bridges or in rural areas over a short distance. This may include the use of flaggers or temporary/portable traffic signals to control traffic and minimize delay and safety concerns.

Two-way traffic operations on one side of divided facility (crossover). Also known as reconstruction by halves, this involves the reconstruction of all lanes in one direction while the opposing lanes share the roadway with traffic in the opposite direction. Shoulders and/or lane constrictions may be used to maintain the number of lanes in each direction. This strategy provides an effective work area, and workers are generally separated from the traffic stream; however, there is the need for crossovers and positive separation. This strategy should be considered when it can reduce the construction period, safety concerns can be addressed, and there is adequate geometry to allow for crossovers. Standards should be developed and used for this strategy (e.g., crossover lengths, pavement, speeds, and positive separation devices).

Reversible lanes. This strategy involves sharing lane(s) of travel to accommodate peak period traffic flow. It is also known as variable lanes or contra-flow lanes. The direction of travel varies by time of day, or maybe day of week. Some sort of barrier (e.g., movable barrier system) should be used to maintain safety and direct traffic flow. However, the cost of this type of barrier system often limits the use of this strategy.

Ramp closures/relocation. Ramp closure involves closing one or more ramps in or around the work zone (for specific time periods, days of week, or all day). It may be necessary for construction purposes or to improve traffic flow on the mainline. Ramp relocation may be used to maintain accessibility to the freeway and/or local businesses or community. Consideration should be given to additional signage and public information campaigns to forewarn motorists, the potential impact to business and community access, and detour route and information. For safety reasons, adjacent ramps should not be closed at the same time unless absolutely necessary.

Freeway-to-freeway ramp closures. This strategy involves closing one or more freeway-to-freeway interchange connectors over a period of time. It may be necessary to close interchange connectors depending on the design characteristics and right-of-way availability. This type of closure will significantly impact the capacity of the facility, particularly on roadways with high volumes and/or congestion. Construction duration for this strategy can be reduced in conjunction with a design-build contracting approach. Provisions must be made for detouring traffic.

Temporary structures/lanes/shoulders (temporary diversion or runaround). This work zone type involves the use of a temporary roadway for diverting traffic so the structure, roadway, or shoulders can be closed for the project. This type of work zone typically involves significant work preparing the temporary roadway prior to actual construction of the roadway and may involve additional right-of-way or easements. It is recommended that the temporary facility be designed such that capacity and safety impacts are the same as or better than the existing facility.

Construction phasing/staging. The impacts of a work zone on traffic may be limited by staging a project in phases, thus completing portions of a construction project one part at a time.

Work hour restrictions (peak hours, holidays, special events). This involves restricting work hours such that work does not occur during periods of peak travel demand and congestion. Work zone staging and phasing will need to be considered to accommodate periods where a longer construction duration is necessary.

> **Night work.** Work is performed at night (end of evening peak period to beginning or morning peak period) to minimize the work zone impacts on motorists. Night work may occur during specific phases of the project or for the entire project duration. Night work has increased because of the need to maintain roads operating at or near capacity during the day. Safety issues may be of concern for night work as motorists' driving skills are typically impaired (e.g., lighting distractions, reduced perception, excessive travel speeds through the work zone). In addition, it is more difficult for contractors to get resources and labor for night work.
>
> **Weekend work.** Construction work (all or phases) is restricted to weekends, i.e., the period from the end of the Friday afternoon peak period to the beginning of the Monday morning peak period.

Traffic screens. Also known as glare or gawk screens, traffic screens consist of vertical panels that are attached on top of concrete barriers to minimize glare from opposing traffic and prevent motorists from viewing the construction activity. This is intended to be used to minimize rubbernecking delays and increase the safety of motorists and highway construction workers.

Signage. Signage should accurately describe the situation in and around the work zone. The content of the signs should reflect what action should be taken by motorists and provide relevant and current information. Advance warning signs need to be spaced accurately to allow for motorists' action.

> **Construction signs**. Advance signing should be used to notify the motoring public of the work zone and/or offer options for alternative routes. Signs should include dates and/or locations of construction and/or closures.
>
> **Detour signs**. Detour signs should clearly direct motorists onto detour routes, through the detour, and back to the route from which they were detoured. Advance notice is required so that the motorists have time to choose an alternate route.
>
> **Traffic control officers**. This involves the use of traffic control officers to direct traffic. It is most often used at heavily congested intersections or during special events, typically for a short duration.
>
> **Flaggers**. Flaggers are persons who control traffic and assign right of way at approaches to work zones. They slow traffic to ensure the safety of the construction workers and motorists. Flaggers should be used only after all other suitable methods of traffic control are considered and should be limited to rural, low-volume roadways. Flaggers should be clearly visible to approaching traffic and located far enough upstream so that motorists will have time to respond.

Flashing arrow signs. These signs consist of a message board with a flashing arrow and are intended to aid motorists in navigating and merging through and around the work zone. They are particularly effective in alerting motorists of lane closures and/or the need to change lanes. They are intended to supplement conventional traffic control devices.

Off-site detours. This strategy involves re-routing traffic to other roadways and should be considered with total closure of the roadway or where capacity is significantly reduced (one or both directions). Attempts should be made to synchronize the detour route with the beginning and end of construction. Facilities with large volumes should be detoured to other major routes (if feasible), whereas local route detours can generally be used for four-lane facilities. In either case, improvements may be necessary to accommodate the diverted traffic on the detour routes. Some of the factors that should be considered include available capacity, geometrics, detour route speeds, pedestrian concerns, rail crossings, and oversize/overweight/over height vehicle concerns. Some of the improvements that may be needed for detour routes include:

Capacity/geometric improvements. Improvements to the detour route may be necessary to accommodate the diverted traffic from the roadway impacted by the work zone. These may include improvements to the mainline and/or intersections, including roadway and/or shoulder widening, and additional through and/or turn lanes.

Signal timing/coordination. This involves retiming or coordinating (interconnecting) traffic signals to increase the capacity of the roadway and improve traffic flow.

Signing and striping enhancements. Signs and/or striping enhancements are provided to guide motorists through the detour route.

Parking restrictions. This strategy involves eliminating parking on the facility or instituting parking restrictions by time of day and/or day of week. The objectives can be either to use the parking area as an additional lane, increase capacity, or reduce traffic conflicts. Availability of parking for local businesses will need to be addressed, as well as the need to improve intersection geometrics to accommodate an additional lane.

Changeable/dynamic/variable message signs (CMS/DMS/VMS). CMS/DMS/VMS are message boards placed along roadways (typically freeways) that notify travelers of incidents, travel time information, construction/road closures, and other potential hazards in or around the work zone. Careful placement of the roadway equipment provides the information at points where drivers have recourse and can adjust their routes to account for the information. These message signs should be used when the condition of the work zone is changing and where a static sign is not sufficient to provide the information to motorists.

Pedestrian/bicycle access improvements. This strategy involves improvements for pedestrians and/or bicyclists where the work zone impacts their accessibility. They may include physical separation of pedestrians and vehicles, temporary or permanent sidewalks or bike lanes, protection from drop-off locations, temporary or permanent

lighting, and/or signal adjustments. Pedestrians/bicyclists should be directed to a safe location if walkways and paths cannot be provided. Special pedestrian/bicyclist considerations may be needed in locations where sidewalks traverse the work zone, where a school route traverses the work zone, where there is significant pedestrian/bicyclist activity, or where existing land use generates such activity (e.g., parks, schools, shopping).

Business access improvements. Some projects will have a direct impact on businesses, particularly accessibility. Accessibility improvements for businesses may include signage or information to direct motorists to the business(es) and/or relocation of access locations.

Construction management techniques.

Innovative construction techniques (e.g., precast members, rapid cure materials). These strategies involve the use of special materials such as quick curing concrete or precast items (e.g., culverts) to minimize the duration of the work zone or where traffic restrictions need to be minimized (e.g., roadways with high volumes).

Design-build. This strategy involves the use of one contractor to design and build the project. This decreases the project duration by allowing construction to begin prior to design completion. The results are reduced administrative costs; a single point of contact for design and construction issues; and flexibility for innovative designs, materials, and construction techniques.

A+B bidding. A+B bidding can be used to encourage contractors to minimize construction impacts by reducing the exposure time. This method is used to determine the winning bid, not actual payments to the contractor. Part A refers to the contractor's estimated cost of the work, and Part B refers to the total dollar amount based on a set user or agency cost per day times the number of days proposed by the contractor to complete the work.

No excuse bonus clauses. This strategy provides for a clause in the contract that awards the contractor a cash bonus for finishing the project or a significant item in the contract by a specified date. No excuses or outside impacts by weather, utilities, right of way, other contractors, unknown conditions, etc., are allowed that would change the set date. This strategy is particularly effective on projects that have utilities or right-of-way problems not cleared by the time work begins.

Incentive/disincentive clauses. This strategy involves the use of incentives and/or disincentives in the construction contract to minimize construction duration (e.g., additional funds may be paid to the contractor if the project is completed early or the contractor may be penalized if late). Incentive/disincentive provisions should be considered for projects that: have high traffic volumes; significantly impact traffic flow, businesses, and/or the community; replace a facility out of service (e.g., bridge or roadway damaged by a disaster); or have detours that are significant in length.

Milestones. This strategy sets milestones for different phases of a project to be complete to provide for earlier opening of a section of roadway or a bridge to traffic. Usually, incentive/disincentive or bonus clauses are added to give more emphasis to the milestone.

Lane rental. Lane rental involves a charge that is assessed to the contractor when a portion of the roadway is obstructed. The charge can vary according to time of day, day of week, number of lanes impacted, and duration. Contractors include in their bid an estimate to accommodate the number of hours they expect to keep a particular number of lane-miles closed. The contractor can make or lose money depending on how the actual number of lane miles involved compares to the bid.

Disincentives for lane closures. Under this strategy the contractor is penalized a specified amount for each quarter hour or other time period increment that he or she has not opened a lane or roadway to traffic during peak period rush hours. The penalty is usually very high and is generally based on road user costs. It is effective in ensuring that his or her work operations are complete prior to rush hour.

Other strategies.

Severe weather conditions. Severe weather information systems can be used to alert motorists of potential weather conditions to improve safety conditions through the work zone. However, because of increased difficulty in vehicle control and distraction and/or anxiety for road users during severe inclement weather, work on the project should be postponed, if possible, until the weather conditions improve. Planned work zone management strategies for the project should continue if inaction would be worse than allowing the work zone to be unattended.

Bicycle/pedestrian traffic controls. These may include physical separation of pedestrians and vehicles, temporary or permanent sidewalks or bike lanes, protection from drop-off locations, temporary or permanent lighting, and/or signal adjustments. Pedestrians/bicyclists should be directed to a safe location if walkways and paths cannot be provided. Special pedestrian/bicyclist considerations may be needed in locations where sidewalks traverse the work zone, where a school route traverses the work zone, where there is significant pedestrian/bicyclist activity, or where existing land use generates such activity (e.g., parks, schools, shopping).

TRANSPORTATION OPERATIONS (TO) STRATEGIES

Demand Management

Transit service improvements. Where appropriate, transit service improvements may include the modification of transit schedules and/or routes, increases in frequency, or the establishment of transit service in the corridor. This strategy should be considered only in areas where transit use is likely.

Reduced fares. Payments are made to a transit provider to subsidize fare costs to encourage increased ridership during the period of construction to reduce vehicles through the project.

Transit incentives. Transit incentives include employer transit subsidies and guaranteed ride home programs. These strategies work best when there are adequate transit routes and frequencies that serve major origins and destinations of motorists through the work zone.

Ridesharing/carpooling incentives. This strategy involves the use of rideshare/carpool incentives to reduce the number of vehicles going through a work zone. This could include preferential parking for carpools, the addition of mainline HOV lanes or bypass lanes on ramps, provision of vanpool vehicles, etc. These incentives should be used only in areas where a benefit such as reduced travel time or reduced user costs may be expected.

Park and ride promotion. This strategy involves the creation, expansion, and/or promotion (advertising) of park and ride lots to encourage ridesharing or transit use and reduce the number of vehicles traveling through the work zone.

Shuttle services. Shuttles and charter buses may be considered if a large number of users along the corridor are anticipated to use this service. Users would need to realize a benefit in travel time, parking costs, etc., in order for this strategy to be effective.

Pedestrian/bicycle access improvements. This strategy involves improvements for pedestrians and/or bicyclists where the work zone impacts their accessibility. These may include physical separation of pedestrians and vehicles, temporary or permanent sidewalks or bike lanes, protection from drop-off locations, temporary or permanent lighting, and/or signal adjustments. Pedestrians/bicyclists should be directed to a safe location if walkways and paths cannot be provided. Special pedestrian/bicyclist considerations may be needed in locations where sidewalks traverse the work zone, where a school route traverses the work zone, where there is significant pedestrian/bicyclist activity, or where existing land use generates such activity (e.g., parks, schools, shopping).

HOV lanes. High-occupancy vehicle (HOV) lanes, also known as carpool lanes, require two or more persons per vehicle for use (exceptions may include motorcycles and/or low-emission vehicles). HOV lanes can provide better efficiency for the roadway by moving more people per lane than does a general purpose lane. However, there needs to be a large amount of similar origins and destinations, and/or incentives (park-and-ride lots, preferential parking, time savings, ridesharing match program, etc.), for this strategy to work. HOV lanes could involve using a shoulder, using the median, or dedicating a travel lane for this purpose (likely to be controversial) and can be used during peak periods or for 24 hours/day.

Parking supply management. This strategy involves managing the parking supply typically through cost strategies to reduce the traffic demand. This strategy is difficult to implement unless parking at the origin/designation is controlled by VDOT and/or parking is limited.

Toll/congestion pricing. Tolls are fees paid by motorists to drive in a particular area. Congestion pricing, or value pricing, involves the use of higher tolls under congested conditions

and lower tolls at less congested times and is intended to reduce peak-period vehicle trips. This could be implemented in several ways: construct a new toll road to provide an alternative route or toll the roadway through the work zone to reduce the demand for the roadway; enforce during peak periods, weekdays only, or all day; collect tolls automatically or manually; or collect fixed or varied tolls (on a set schedule or based on changes in the level of congestion).

Variable work hours. This strategy involves encouraging motorists who typically travel through the work zone during periods of high demand to work variable hours (off-peak) to reduce the demand for travel during peak periods.

Telecommuting. Telecommuting involves employees working at home, or at a telecommuting center near their home, full time or part time. Motorists who normally travel through the work zone would be encouraged to telecommute during the duration of the project to reduce the demand.

Corridor Network Management

Advance/delay planned projects. This strategy advances or delays projects in the nearby network that are scheduled for construction during the same time that the project will be underway. Advancing the work so that it is complete prior to the beginning of project construction will provide more network capacity or better traffic operations. Delaying the work will prevent traffic impacts on both projects at the same time.

Signal timing/coordination improvements. This involves retiming traffic signals to increase the capacity of the roadway(s) and improve traffic flow.

Temporary signals. This involves the installation of temporary traffic signals to improve traffic flow through and near the work zone and/or address safety concerns.

Street/intersection improvements. Improvements on streets and intersections for the roadway and/or alternate routes may be necessary to handle the traffic through the work zone area. These may include improvements to the mainline and/or intersections such as roadway and/or shoulder widening and additional through and/or turn lanes.

Turn restrictions. This strategy restricts turning movements for driveways and/or intersections and can be implemented during peak periods or all day. Turn restrictions are typically used to increase roadway capacity and reduce potential safety issues.

Parking restrictions. This strategy eliminates parking on the facility or calls for parking restrictions by time of day and/or day of week. The objectives of restricting parking can be either to use the parking area as an additional lane, increase capacity, or reduce traffic conflicts. Availability of parking for the local businesses will need to be addressed, as will the need to improve intersection geometrics to accommodate an additional lane.

Separate truck lanes. This strategy involves the construction of new/separate truck lanes, use of one of the existing lanes for only trucks, or conversion of a shoulder or median for truck only

use. This should be considered only in areas with a high percentage of trucks, for projects of long duration, and where there is a capacity (e.g., reduced lane widths) and/or safety concern in the work zone with truck movements. Appropriate design and geometric concerns related to trucks would need to be addressed if these were implemented.

Truck/heavy vehicle restrictions. Trucks may be prohibited from using the facility completely by time of day or day of week. Implementing truck restrictions can increase the capacity of the roadway, particularly for facilities with a high percentage of trucks. Availability and sustainability of alternate routes for the trucks must be considered, as well as any state and/or local ordinances that govern truck traffic access.

Ramp metering. Ramp meters are traffic signals located on the freeway on-ramp or on freeway-to-freeway connectors that control the entry of vehicles onto the freeway to maintain safe and smooth freeway operations. Ramp metering can include pre-set timing, traffic-actuated (metering changes based on mainline traffic) metering, or centrally controlled metering and may be used during peak periods or all day. If ramp metering is considered, potential impacts due to ramp queues on local streets should be evaluated.

Temporarily suspend ramp metering. This strategy involves turning off existing ramp meters during specific time periods or for the duration of the project. This strategy may be considered where it is necessary to get traffic onto the freeway quickly (e.g., at the end of a detour route).

Bus turnouts. This involves the construction of bus stop areas that are recessed from the traveled roadway. This strategy should be considered on detour routes or on highway facilities with a high occurrence of bus traffic and stops. This strategy improves traffic flow and delays by minimizing the occurrence of buses blocking the roadway. Bus turnouts should be designed for clear rear vision for safe re-entry into traffic.

Reversible lanes. This strategy involves sharing lane(s) of travel to accommodate peak period traffic flow. It is also known as variable lanes or contra-flow lanes. The direction of travel varies by time of day, or maybe day of week. Some sort of barrier (e.g., movable barrier system) should be used to maintain safety and direct traffic flow. However, the cost of the barrier system often limits the use of this strategy.

Dynamic lane closure system. This system would involve advance warning signs for the lane closure, use of variable-length barriers making up a tapered lane closure system; and a control cabinet to operate the system (e.g., supervisory control PC, radio unit). The objective is to enhance mobility and the safety of highway workers.

Railroad crossings controls. If a rail crossing is located within the work zone and/or on the detour or diversion routes, improvements may need to be considered for safety purposes. These could include advanced warning signs, railroad crossing signs, pavement markings, flashing lights, and gate arms. The type of control would depend on the level of traffic and what rail crossing controls exist.

Speed limit reduction/variable speed limits. A reduced speed limit may be needed when the work zone may become a traffic hazard or to help protect construction workers. Speed limit changes may be implemented before traffic is detoured, through the work zone, or adjacent to unprotected construction workers. Unfortunately, adherence to speed limit reductions is often poor. To encourage adherence, additional enforcement and/or increased fines (with signage to reflect the increase) may be necessary.

Coordination with adjacent construction site(s). This involves combining or coordinating projects (scheduling) within a specific corridor to minimize the impacts to the motoring public and potentially result in cost savings to the state.

Work Zone Safety and Traffic Control Features

Changeable/dynamic/variable message signs (CMS/DMS/VMS). CMS/DMS/VMS are message boards placed along roadways (typically freeways) that notify travelers of incidents, travel time information, construction/road closures, and other potential hazards in or around the work zone. Careful placement of the roadway equipment provides the information at points where drivers have recourse and can adjust their routes to account for the information. These message signs should be used when the condition of the work zone is changing and a static sign is not sufficient to provide the information to motorists.

Radar speed monitoring/display units. This is a portable system that can be mounted on a sign or located on a portable trailer that uses radar to measure vehicle speed and that informs motorists of their speed. A sign with the speed limit for the roadway should be at or near the panel sign to inform motorists of the speed limit. The objective of this system is to enhance safety by reducing vehicle speeds and speed variations.

Temporary traffic signals. This involves the installation of temporary traffic signals to improve traffic flow through and near the work zone and/or address safety concerns.

Temporary traffic barrier. A temporary traffic barrier is some sort of a barrier system to separate traffic flow physically from construction workers during the duration of the project. It could range from a narrow bituminous island with delineator tubes to concrete barriers (moderate to long duration). The objective is to provide a physical separation for safety purposes.

Movable traffic barrier systems. This involves a mechanical system to move temporary barriers (e.g., portable concrete barriers) quickly within the work zone. Barrier systems are typically used for reversible lanes and for providing additional space for the contractor to work during off-peak hours.

Crash-cushion (fixed and mobile). Also known as an impact attenuator, a crash cushion is a fixed or mobile device placed at a specific location to prevent an errant vehicle from entering a work zone or crashing into a hazard by gradually decelerating the vehicle to stop or by directing the vehicle away from the hazard.

Temporary rumble strips. Rumble strips are temporary grooves or raised strips placed across a travel lane to alert motorists of the change in roadway conditions or a hazardous curve, slowing condition, or other hazard ahead.

Intrusion alarms. This strategy involves the use of a technology that detects vehicles entering the area between the motorists and the construction workers. When an intrusion is detected, workers in the area are warned via a loud siren.

Warning lights. Warning lights include flashing warning lights on barricades or signs to delineate a barrier or warn motorists of the work zone or other conditions ahead.

Construction safety inspectors. This strategy involves having one or more construction safety inspectors on-site.

Project task force/committee. A project task force/committee would be created to address the issue of safety within and near the work zone. The goal would be to identify and recommend actions to improve worker safety without sacrificing motorist safety and mobility.

Team meetings. This involves conducting project team meetings on a regular basis to discuss TMP strategies, implementation, and monitoring, particularly related to safety concerns.

Incident Management Enforcement

Tow. This strategy involves the use of on-site (or near site) tow trucks to reduce the time an incident (breakdown or accident) affects the work zone. This strategy should be considered in areas where a breakdown or accident will significantly impact traffic flow or safety. Parking areas and turnaround locations for the tow trucks should be provided.

Safety service patrols. These are specific motorist service patrols to assist motorists who are disabled in order to get them on their way to reopen the roadway or shoulder traffic.

Surveillance (CCTV, loop detectors, lasers, probe vehicles). This strategy involves the use of surveillance, also known as monitoring or detector stations, to detect, verify, and respond to incidents in the work zone.

Changeable/dynamic/variable message signs (CMS/DMS/VMS). CMS/DMS/VMS are message boards placed along roadways (typically freeways) that notify travelers of incidents, travel time information, construction/road closures, and other potential hazards in or around the work zone. Careful placement of the roadway equipment provides the information at points where drivers have recourse and can adjust their routes to account for the information. These message signs should be used when the condition of the work zone is changing and a static sign is not sufficient to provide the information to motorists.

Highway advisory radio (HAR) (fixed and mobile). Longer, more accurate messages than what are available using signage may be necessary for the work zone. HAR involves the

dissemination of traffic control information to motorists while en route over wide-area wireless communications directly to the vehicle's radio. Signage will need to be used to inform travelers of the number to obtain the information.

CB Wizard Warning System. The CB Wizard Warning Device is designed to send pre-recorded messages across two selected CB channels and is geared toward truck drivers. The CB Wizard Warning Device automatically kicks into a channel when there is a break in the action.

Smart work zone technologies. These are work zone devices and/or systems that use automatic sensors to measure traveler travel time or delay and display this information via PCMAs, HARs, the Internet, and other means in "real-time" conditions.

Call boxes. Temporary or permanent call boxes may be installed through the work zone to provide motorists with a means to contact incident response personnel. This expedites the process by which accidents and breakdowns can be removed.

Transportation management center (TMC). This strategy involves the use of and coordination with an existing TMC to aid in incident management. If the project is large and of long duration and a TMC does not exist, a TMC may be constructed and operated to help maintain traffic flow and manage incidents. Information, such as traffic data and incident information, can be communicated and shared.

Distance/milepost markers. Distance/milepost markers consist of a mounted sign located in the median or shoulder that lists location information (milepost, route, county, etc.). This strategy is effective in responding to incidents or breakdowns as motorists can quickly and correctly inform emergency or response personnel of their location. To be effective, these markers should be placed no further than 1/10 mile apart.

Accident staging/investigation areas. Areas located off the roadway where enforcement officials can complete their accident reports without blocking traffic.

Total station units. This involves the use of survey equipment for documenting/mapping major incidents to reduce the clearance time.

HAZMAT trailers. These provide for having readily available materials to clean up hazardous spills in the close proximity of the project. They speed up reopening the roadway to traffic.

Fender bender signing. This strategy places static signing at various locations along the road indicating to the public that in minor accidents they should move their vehicles out of the roadway and onto the shoulders until enforcement officials arrive so as not to obstruct traffic lanes.

Local detour routes. Identification and approval/authorization of local detour routes in the case of incidents is an important strategy to consider, particularly for high-volume and incident-prone facilities. This would involve identifying possible local detour routes throughout the work zone

and obtaining approval or authorization from the local agency for the use of the roadway(s) as a detour route(s) in the event of an incident.

Contract support. This strategy involves additional contract support than what is available by the contractor to support incident management. This could be with law enforcement, 911 dispatch, TMC support, towing and recovery providers, emergency medical services, or others.

Dedicated (paid) police enforcement. This strategy involves the use of paid police patrols in the work zone. Enforcement in the work zone can be used to deter speeding, provide for removal of vehicles involved in incidents or breakdowns, assist in traffic control, enforce other traffic laws, and prevent intrusions.

Cooperative police enforcement. Cooperative enforcement is similar to paid police enforcement except it is implemented through a cooperative agreement with the DOT.

Helicopter. This strategy involves the use of aerial surveillance to identify and verify incidents. This is rarely used unless it is available at no or a low cost (e.g., share expenses with a radio station traffic reporter).

Enforcing penalties. This strategy involves the use of enhanced fines for speeding or other violations in traffic work zones (e.g., fines may be increased to up to $500 in Virginia work zones). The intent is to deter speed violation and improve safety through the work zone.

Incident/emergency management coordinator. A person would be dedicated to overall incident and emergency management for the project. Some of the responsibilities might include developing incident and/or emergency response plans, overseeing implementation and monitoring of the work zone transportation management strategies, and managing incidents or emergencies. This strategy should be considered for large projects of long duration.

Incident/emergency response plan. This strategy involves the development of an incident response plan. This plan should include, but not be limited to, roles and responsibilities, response agencies, processes/procedures, actions to take for various incident types and levels, contact information, alternate routes, personnel and equipment information, and staging area locations.

Media briefings. This strategy involves working with the media to provide information for procedures to be used during an actual incident as well as proactive information to help inform the public.

Work Zone Safety and Mobility Reviews and Audits

TMP monitor/inspection team. This would require the establishment of a team (or person) to monitor and inspect implementation and monitoring of the work zone transportation management strategies.

Windshield surveys. This involves having a person drive (or walk) through the work zone and conduct an assessment of traffic flow and safety.

PUBLIC INFORMATION (PI) STRATEGIES

The inclusion of a public information and/or relations campaign can be very effective in keeping the public informed of the project and its potential work zone impacts. The public (particularly the impacted communities and businesses) should be included in the TMP process early and should be informed in a timely manner of potential work zone impacts and issues. Coordination with the agency's public affairs office will be necessary, particularly for significant projects.

Public Awareness

Brochures and mailers. Brochures and mailers are printed material containing project-related information such as advanced notice of the project's start date, schedules, pictures/graphics of the project, a description of the need for the project, alternative routes, etc. These may be passed out to motorists at key locations (e.g., large employers in the project area, rest stops, automobile associations, travel information centers) or mailed to affected businesses or communities.

Rideshare promotions. These include creating or marketing an existing rideshare program through signage, advertisements, brochures, and events. The purpose is to encourage ridesharing to reduce the number of vehicles traveling through the work zone.

Press releases/alerts. These involve the provision of project-related information to the news media, affected businesses, and other affected or interested parties. They can include print and/or electronic media and are almost always used to announce the start of a project and, for medium to large projects, to provide updates and report progress.

Paid advertisements (newspaper, radio, television). Paid advertisements announce the coming of a major project and can involve newspaper, radio, television, billboards, etc. Planning is necessary prior to construction of the project for scheduling and developing such advertisements. Paid advertisements can also be used for progress updates or to provide information regarding major changes to the work zone configuration and management.

Public information center. This is a facility that may be located near the project site that may contain scale model displays, maps, brochures, videos, etc., about the project.

Public meetings/hearings. This strategy involves using project or public relations staff to present project-related information to the public, community, and/or businesses.

Community task forces. This strategy involves the development of community task force(s), which includes various stakeholders from the community that may be impacted by the work zone (businesses, neighborhood groups, interested individuals, public officials, or other

representatives). The task force(s) could be developed as early as the planning stage of the project or during construction. The objective is for the group(s) to provide input and review/comment on the construction and management strategies and implementation to minimize the impacts of the project on the community. The contractor and agency would be responsible for meeting with the task force(s) to obtain their input and recommendations.

Telephone hotline. This traveler information system provides traffic or travel information for the work zone via telephone. It can include static broadcast information and/or real-time interactive request/response information.

Visual information (videos, slides, presentations) for meetings or for web-based dissemination. This involves the use of videos, slides, and presentations to supplement public meetings, public information center displays, or press releases.

Planned lane closure website. This strategy is typically not for one specific project but rather is usually implemented for an entire state, district, or geographic region. It includes a web page that provides planned lane closures of freeways for public information. It should include the routes involved as well as the start and end dates of the lane closure information, both in text and graphical form.

Project website. This traveler information system provides traffic or travel information for the work zone via the web/Internet. It can include static information and/or real-time interactive request/response information.

Coordination with local/cable TV newsrooms, schools and school districts, local major employers/businesses, and local emergency services (fire, police, and ambulance). This strategy involves coordinating with various community and business groups that are likely to be impacted by the work zone. Mechanisms (fax, e-mail, phone message, mailings) can be established to communicate project-related information including start dates, significant changes in the project, project schedule, and occurrences of incidents within the work zone.

Motorist Information Strategies

Portable and stationary changeable/dynamic/variable message signs (CMS/DMS/VMS). CMS/DMS/VMS are message boards placed along roadways (typically freeways) that notify travelers of incidents, travel time information, construction/road closures, and other potential hazards in or around the work zone. Careful placement of the portable roadway equipment provides the information at points where drivers have recourse and can adjust their routes to account for the information. These message signs should be used when the condition of the work zone is changing and a static sign is not sufficient to provide the information to motorists.

Ground-mounted signs. These are signs mounted in the ground with information to guide motorists through the work zone and warn of potential hazards.

Commercial traffic radio. The dissemination of project-related information via the radio.

Highway advisory radio (HAR) (fixed and mobile). Longer, more accurate messages than what are available using signage may be necessary for the work zone. HAR involves the dissemination of traffic control information to motorists while en route over wide-area wireless communications directly to the in-vehicle radios. Signage is needed to inform travelers of the telephone number and/or the radio channel where the information may be obtained.

Highway information network (web-based). A highway information network is a website where multiple stakeholder groups can place information related to the roadway. The website is shared among the various stakeholder groups, each with their own data storage areas (including control of functionality, security, data quality, etc.).

Radar speed message sign. A portable system mounted on a sign or located on a portable trailer that uses radar to measure vehicle speed and informs motorists of their speed. A sign with the speed limit for the roadway should be at or near the panel sign to inform motorists of the speed limit. The objective of this system is to enhance safety by reducing vehicle speeds and speed variations.

Traveler information systems (wireless, handhelds). For this strategy, motorists can be provided with information related to the work zone, static and/or real time, via wireless or handheld devises. These can be in the form of cell phones, pagers, in-vehicle systems, or e-mail notifications. Depending on the size, nature, and duration of the project, hand-held-type devices could be purchased or made available to motorists who regularly travel through the work zone to warn them of potential delays on a real-time basis.

Freight-travel based information. This strategy should be considered only when there is a moderate to high percentage of freight movement through the work zone area. This involves working with the freight community (trucking companies, truck drivers, etc.) to identify information they would like to be informed of in the work zone area (e.g., truck restrictions, occurrences of incidents, planned closures) and provides a mechanism for the information to be disseminated to freight stakeholders.