FDM 11-50-1 Work Zone Policy Statement — May 15, 2019

See the Traffic Engineering, Operations and Safety (TEOpS) Manual Chapter 6 Section 1 for the Work Zone Policy Statement.

FDM 11-50-5 Transportation Management Plan Process — November 15, 2022

5.1 Introduction

The Federal Highway Administration (FHWA) published a final rule on Work Zone Safety and Mobility in the Federal Register on September 9, 2004. The rule took effect on October 12, 2007 and affects all states and local governments that receive Federal-Aid Highway funding. The purpose of the update is to address changing times of more traffic, more congestion, greater safety issues and more work zones on our highways. These challenges require a systematic and structured approach to ensure traffic management consistency statewide. The work zone policy statement in the TEOpS 6-1, addresses the Department's goals and objectives as well as discussing where responsibilities lie when implementing the work zone rule.

5.1.1 Key Features of the Work Zone Rule

- The rule takes a policy-based approach to institutionalize work zone processes and procedures.
- Emphasizes safety and mobility impacts of work zones.

5.1.2 How the Work Zone Rule Works

- It advocates for work zone considerations to be initiated as early as possible in the project delivery process.
- It underscores the adoption of policy and procedures that support systematic consideration and management (consistency) of work zone impacts.
- It encourages states and local governments to develop and implement strategies to manage impacts.
- It requires monitoring and assessing work zone performance.
- It encourages the use of work zone safety and mobility data to improve policy, processes and procedures.

5.2 What is a TMP?

A transportation management plan (TMP) is a set of coordinated transportation management strategies and describes how they will be used to manage work zone impacts of a road project. Transportation management strategies for a work zone include temporary traffic control measures and devices, public information and outreach, and operational strategies such as transportation operations and incident management strategies. The scope, content, and level of detail of a TMP may vary based on anticipated work zone impacts of the project. A transportation management plan is required on all projects.

DOT needs to minimize traffic impacts by balancing costs and attempt to limit stages for maximum value. Occasionally, short closures can eliminate multiple stages and make the job more efficient. The public may be receptive to short closures if it reduces the total construction timeline.

5.2.1 Purpose

The Wisconsin Department of Transportation (WisDOT) is committed to promoting safety for the traveling public and workers, minimizing congestion and adverse traffic impacts, and providing for improved public satisfaction during construction, maintenance, utility, and all other activities performed on or near the WisDOT highway network. Compliance with this policy will reduce work zone crashes, travel time and provide benefits to all stakeholders. All regional offices and statewide bureaus are responsible for implementing the portions of this policy that affect their operations. For further details on the WisDOT policy, refer to TEOpS 6-1.

Safely maintaining mobility during a project must be planned and executed. The department will use the transportation management plan process to balance the needs of the public and the project. Designers must consider project space, duration, and cost and balance that with the public's safety and mobility.

Using full closures and detours can provide the most safe and efficient workspace but also creates mobility restrictions that can have a significant impact to the traveling public and increase road user costs. Keeping the road open and maintaining complete access can create many short stages that potentially decreases project efficiency extending the project duration and increasing costs. Getting public input on potential mobility restrictions by the project team can inform decisions on which TMP strategies to use.

This document establishes guidelines for developing TMPs for all highway construction, maintenance, utility, and construction activities performed by WisDOT, municipalities and other agencies.

Managing traffic is a continuous process that requires monitoring and updating the TMP as traffic flow or construction scheduling changes. Review the TMP at project completion to determine its effectiveness and incorporate lessons learned in future projects.

An effective TMP generally addresses project and site-specific issues with traffic impact analyses performed in accordance with WisDOT's Facilities Development Manual (FDM), Traffic Engineering Operations and Safety Manual (TEOpS), Wisconsin Manual on Uniform Traffic Control Devices (WisMUTCD) and other supplemental policies or directives. Incorporate lessons learned from previous construction projects to improve the safety ad mobility of the work zone, see "Work Zone Mitigation Lessons Learned" (2022 Mitigation Lessons Learned).

Notify stakeholders about potential impacts early in the project initiation process to seek input and buy-in for the project. Larger projects may require the formation of a TMP Team to facilitate coordination and smooth project delivery. If a TMP Team is required, as determined by the regional project scoping team, it's advisable to have multi-faceted and multi-disciplinary members who share a common understanding of the project goals and objectives. Occasionally, a multi-jurisdictional team may be needed for projects whose scope extends to other regions or state(s).

5.2.2 Scope of these Guidelines

The intent of this guideline is to assist regional planners, traffic engineers and designers in developing TMPs for work zones. Many of the strategies developed and discussed facilitate planning, managing, operating, and evaluating work zone safety and mobility. The guideline defines a coherent framework for integrating TMPs and traffic operation policies into the project development process and encourages consideration of TMPs at an early stage in project development. Incorporating a TMP early into the project delivery process has three advantages:

- Some TMP elements require lead times and should be identified early so funds can be allocated and work planned for each element,
- Identifying TMP components early in project delivery facilitates overall project budgeting and approval processes,
- It ensures that impacts to highway users, businesses, workers and communities are minimized.

This guideline will help WisDOT develop and implement TMPs effectively and consistently statewide to enhance safety and mobility while minimizing delays caused by construction work zones.

5.3 Project Development Process

It is important to identify traffic management issues earlier in project development. Traffic management is not a snapshot of the project at a particular point in time during project development, but rather a continuous activity that is revisited, refined and updated to reflect changes in project scope. FDM 3-1 Attachment 1.1 illustrates the current Facilities Development Process. Traffic management must be considered until construction is complete.

Complete the following steps for each project:

1. Work Zone Impact Assessment before Life Cycle 11
2. 60% TMP during Life Cycle 12
3. 90% TMP before Life Cycle 20

5.4 Work Zone Impact Assessment

The Work Zone Impact Assessment is conducted during the project scoping and is completed before Life Cycle 11. The objective of the Work Zone Impact Assessment is to define the TMP type, recommend mitigation strategies based on estimated delay through a cost-benefit analysis, and determine potential alternative contracting strategies. These items should all be done to properly scope and determine the estimated cost for the projects temporary traffic control.

The degree of work zone impact assessment depends on project complexity. Each project is different and will have different impacts. It is advisable to perform an impact assessment because the level of traffic safety and mobility is directly affected by the appropriateness of the TMP.

Work zone impacts are not limited to the actual project limits. Impacts can be far reaching and have adverse effects on businesses, communities, schools, other roadways, highway corridors, other highway projects, and even on other regions if the project is located at critical segments on the network.

5.4.1 Work Zone Impact Assessment Team

Regional scoping teams are responsible for developing the Work Zone Impact Assessment in conjunction with regional traffic operations and project development. The design and construction project development staff must be included to provide the appropriate knowledge of how a project could be constructed. For larger projects, it will become necessary to bring in additional resources who have experience and expertise to ensure successful TMP development and project success. The team may include representatives from:

- Real Estate
- Technical Services
- Regional Communications
- Bureau of Traffic Operations
- Division of State Patrol
- Bureau of Project Development
- Bureau of Technical Services
- Bureau of Structures
- Office of Public Affairs
- Local Government (county or city)
- FHWA
- Others deemed necessary.

5.4.2 Work Zone Impact Assessment Contents

The Work Zone Impact Assessment should contain the following:

- Project Description
- Description of Work Zone Traffic Control Alternatives
- Work Zone Safety Considerations
- Work Zone Operational Considerations
- Other Considerations
- Work Zone Cost Considerations
- Feasibility of Work Zone Alternatives
- Recommendations

The following will describe the details for each section listed above. Some of the information developed for the Work Zone Impact Assessment will be used in the TMP.

For projects that have limited impacts, and only a single clear alternative is available, an abbreviated Work Zone Impact Assessment is an option. The abbreviated WZIA would include a Project Description, a Description of the Work Zone Traffic Control Alternatives, a discussion of why only one alternative is reasonable, and what type of TMP is recommended for the project. In most cases projects that use an abbreviated WZIA will be Type 1 TMP's. These types of projects include, standalone marking or signing projects, and pavement rehabilitation projects with no impacts. The abbreviated Work Zone Impact Assessment should be a concise document that is generally only one page long.

For local program projects, a Work Zone Impact Assessment will not be required as part of the TMP.

5.4.2.1 Project Description

Provide a brief description of the project background and a summary of the existing conditions of the project area. Include the existing capacity of the impacted roadway.

5.4.2.2 Description of Work Zone Traffic Control Alternatives

List all alternatives taken into consideration (no matter how briefly) and provide a brief description of each of the analyzed alternatives.

5.4.2.3 Work Zone Safety Considerations
In most cases, crashes increase on a corridor that has a work zone present and the purpose of this section is to determine the potential safety impacts resulting from the work zone. The safety impacts can be to the road users as well as the workers. This section could include a diagram of all the crashes within the project limits as well as any areas that may be impacted by the project, from queuing, detours, or alternate routes. For each alternative, document the safety impacts, if any, the work zone may cause.

5.4.2.4 Work Zone Operations Considerations
At a minimum, this section should provide a qualitative discussion on the work zone operational and capacity concerns. Field surveys or photographs taken during the peak periods are some ways to demonstrate capacity concerns if the data needed for detailed operational analysis is not available. Average annual daily traffic volumes (AADT), which are available through the coverage count program (https://wisconsindot.gov/Pages/projects/data-plan/traf-counts/default.aspx), can also provide insight into potential capacity concerns. Consideration should be given to all modes of transportation (passenger vehicles, bicycles, pedestrians, freight, etc.) when assessing the operational and capacity concerns.

Ideally, the Work Zone Impact Assessment should provide a summary of the quantitative capacity analysis conducted using the methodologies from the most recent version of the Highway Capacity Manual (HCM).

For mega and major projects, the region shall conduct a peer review of the traffic analyses for Work Zone Impact Assessment in accordance with the procedures outlined in TEOpS 16-25. In most cases, the peer review will consist of a region-level review of the analysis.

Always include the worst-case alternative, with travel delays exceeding the 15-minute delay threshold. Include all traffic staging alternative analyzed and document the travel delays for each alternative (i.e. full closure, lane closures, off peak lane closures, etc.) The travel delay will be used for justification of the chosen alternative.

5.4.2.5 Other Considerations
Determine if alternative contracting methods will have an impact on the work zone. This would include cost-plus-time bidding, design/build contracting, or incentives/disincentives. For more information on Alternative Contracting methods see FDM 11-2-1. These items could have an impact on the project schedule and cost. When considering alternative contracting methods, road user costs may need to be determined.

5.4.2.6 Work Zone Cost Considerations
Determine the estimated cost of each major alternative. Costs should be included for the following: temporary widening, improvement to detour/alternate routes, temporary structures, temporary concrete barrier, crossover construction, temporary traffic signals and any smart work zone device deployment.

5.4.2.7 Feasibility of Work Zone Alternatives
Highlight the advantages and disadvantages of each alternative. Advantages and disadvantages could include but are not limited to the following: constructability, project duration, availability/distance of detour routes. Clearly identify and justify whether each alternative is feasible or not.

If the region requires assistance in determining if a traffic control alternative requires further evaluation in the Work Zone Impact Assessment, consult with BTO.

5.4.2.8 Recommendations
Summarize the findings of the analysis, document the process followed to evaluate the alternatives, provide and recommend the viable alternative to carry forward to the 60% TMP. Determine the type of TMP and justification of the chosen type.

5.4.3 TMP Type Description

All highway construction, roadway maintenance, utility and construction activities performed by WisDOT, municipalities and local governments have been grouped into three categories characterized by the degree of traffic impacts on mobility, safety, and cost. The categories are based on the severity of impacts. At the lower end are type 1 projects that have little or no traffic impacts. At the high-impact end are project types requiring detailed stand-alone TMP documentation. Below are the descriptions that identify the three TMP project types and differentiates the impacts the projects may have on road users, local communities and businesses. Also included are the required TMP components (see FDM 11-50-5.5.2 for details on TMP components) and elements for each project type.

Type 1

Projects requiring this TMP type have little or no impacts to the traveling public. The duration of work may be short to moderate and occur during off-peak hours. Work zones may involve mobile operations or short duration lane closures for less than one hour. Hazards do not require shielding or positive protection. Pedestrian facilities are not impacted.

Local Program TMPs for rural bridges, roadways, and non-traditional projects that have limited transportation impacts, such as low volume roads with 400 AADT or less, can be considered Type 1. Some of these projects will be full closures with or without detours or completed utilizing flagging operations. For these TMPs, approval is completed only at 60%. In the WisTMP System, these projects will have the ability to select Local Program Types in Section 1, which will auto populate certain sections of the TMP.

Required TMP components:

- WisTMP form
- Traffic Control Plan (TCP), as appropriate
- Public Information & Outreach, as appropriate

Type 2

Most projects will be Type 2. Type 2 projects may have high public interest locally and potentially regionally because they affect more road users for a longer period during construction. Detours may be lengthy or require improvements to surface, geometry, or traffic controls. In urban areas, reconstruction may potentially disrupt business access and pedestrian/bicycle movement. Examples of projects that require this type of TMP include: resurfacing, reconstruction, pavement replacement or reconditioning, urban or intersection reconstruction projects with unusual access needs or high traffic delays, bridge replacement, or rehabilitation, etc.

Required TMP components:

- WisTMP form
- Traffic Control Plan (TCP)
- Public Information & Outreach
- Incident Management Plan (IMP) for projects on freeways/expressways

Type 3

Type 3 projects are long-duration, extensive (mega) projects with traffic and mobility impacts that may extend beyond metropolitan, regional, and state lines. Public interest is very high in these projects because traffic impacts affect many road users, communities, interest groups, and businesses within the corridor and the transportation network. These are long lasting projects that require detailed staging. They typically involve multiple contracts and have significant impacts on regional and inter-regional traffic flow. Examples of projects requiring this type of TMP include: Zoo Interchange, IH 41 corridor, IH 94 N/S corridor and IH 39 Wausau corridor.

Required TMP components:

- WisTMP form
- Traffic Control Plan (TCP)
- Public Information & Outreach Plan (PIOP)
- Incident Management Plan (IMP)

The FDM provides guidance and tools to help project managers and traffic engineers through the process of evaluating the extent of traffic impacts of a given project.

5.5 TMP Development

Once the project moves into the Life Cycle 11 and project teams are created by regional project development, work shall begin on the TMP based on the results of the Work Zone Impact Assessment. For TMP development, WisDOT has partnered with the UW TOPS lab to create a system for developing, routing, approving, and storing TMPs. The WisTMP system was built with features that have automated many parts of the approval process. The Project Manager is ultimately responsible for the TMP. The WisTMP system (https://transportal.cee.wisc.edu/tmp/) allows any user to view a TMP that has been created. All projects must use the WisTMP system for TMP development. When entering information into the WisTMP system, the form will adjust if additional information is needed.

5.5.1 TMP Approval

All TMP approval is performed in the WisTMP system and controlled by the Project Manager. TMPs are reviewed and approved at two stages: 60% and 90%. Most TMPs stay within the region for approval at both levels. TMPs that have Federal Oversight checked will be routed to FHWA and to the Bureau of Traffic Operations (BTO). BTO will also review and approve all Type 3 projects and any project that includes:

- Innovative contracting (lane rental, enhanced liquidated damages, etc.)
- Temporary speed declarations on all Interstates and facilities with a normal posted speed of 65 mph or greater.
- Nonstandard mitigation strategies (i.e. ruggedized ambulance, fire station, drones)
- Law enforcement mitigation.

Once the TMP attains approvals, it is automatically routed to the Region Project Development Chief. Once signed, the TMP is Approved.

5.5.2 TMP Components

Each TMP has ten sections as follows:

- Section 1 Project Information
- Section 2 Project Description
- Section 3 Existing Conditions
- Section 4 Work Zone Strategies
- Section 5 Work Zone Impacts
- Section 6 Traffic Analysis
- Section 7 Public Information Strategies
- Section 8 Incident Management Strategies
- Section 9 Staging Plans
- Section 10 Additional Information.

Complete each section in order and as sections are filled out, additional information may be required.

Section 1 Project Information

This is basic information about the project. The location information is also included in this section and must be completed.

Section 2 Project Description

The Project Description should only be a brief overview of what the project is going to accomplish. Attach the Work Zone Impact Assessment to this section of the TMP.

Section 3 Existing Conditions

The Existing Conditions section asks project teams about the project area. The first set of questions are simple yes/no questions to determine the users impacted by the project. The answers to these questions will determine what needs to be filled out later in the form. The second part asks for existing traffic conditions such as: posted speed limit, normal travel time, current capacity, truck percentage and the presence of queuing. The Traffic Forecast Report, any Automated Traffic Recorder (ATR) station data or traffic volume data should be attached to the TMP in this section.

Section 4 Work Zone Strategies

The Work Zone Strategies section allows preparers to list of all strategies that will be used on the project. The planning estimate cost of those strategies should be added as they are being chosen. The strategies are listed in Attachment 5.2. When some of these strategies are selected, additional information in the TMP will need to be filled out. An example is when Lane Closures are selected, Section 6 of the TMP will inquire about the closure schedule and how it was developed.

Section 5 Work Zone Impacts

The Work Zone Impact section will have varying amounts of information to fill out based on what has been answered earlier in the TMP. Impacts to other routes, regions, or states will always need to be answered. Determine the holidays and major special events that are anticipated to occur during construction and identify the ways these events will be handled. Attach any correspondence from the impacted groups that discuss how the issues will be mitigated.

Section 6 Traffic Analysis

The Traffic Analysis section is the only location that traffic analysis will be shown in the TMP. Work Zone capacity, delay, queuing, lane closure hours, and road user costs may all be entered in this section.

Each project will be required to fill in a table about the anticipated traffic conditions. The table will include what the anticipated delay and queuing will be for the project based on strategies selected for the preferred alternative. The table is based off the locations entered in Section 1c. The work zone capacity, delay, queue, and the cause of the delay will be input into the table. Preparers are also asked how the work zone capacity was calculated, including an explanation of the method used. Attach any calculations in the section.

Preparers will be asked if the lane and ramp closures will have time restrictions. If yes, a table will be enabled for input. It is anticipated that projects will have some delay, up to 15 minutes or greater if there is an exception. If the project is reporting zero delay, preparers must explain the delay incurred if the lane closure hours identified are not followed.

If a detour is selected in Section 4, a table will be enabled for entering detour route information. The normal travel time, detour travel time, and detour distance for all routes are to be input. The detour plan sheets can then be attached in this section.

If changes are being made to an intersection or temporary signals are being used, preparers will be asked to describe what those changes will be.

For projects that select any of the innovative contracting strategies, preparers will be asked to show how the road user costs were determined for the project. Upload the worksheets used to develop the road user costs in this section of the TMP.

Section 7 Public Information Strategies

The Public Information Strategies section allows preparers to select strategies that will be used immediately before and during construction to address traffic concerns with the public. When the strategy is selected, preparers will fill out information on the intended audience and any additional comments. At a minimum, all projects should attach the Public Information and Outreach Plan.

Section 8 Incident Management Strategies

The Incident Management Strategies section allows prepares to list strategies applicable to the project. Details on the strategies may be found in Attachment 5.4. Document the costs associated with a strategy. Attach an Agency Emergency Contact Table (FDM 11-50-10 Table 10.2) to the TMP that is as complete as possible. For larger projects, the following may also be added in the attachments section:

-Emergency Alternate Route Maps/Operations Guide
-Communications Flow Chart
-Available Barricade/Ramp Gate Locations for Ramp Closures
-Emergency Access, Pullout and Traveler Information Equipment Locations Map

Section 9 Staging Plans

The Staging Plan section is where the preparer should upload the staging plans. Include a brief overview of the staging and highlight any unique reasons for project staging. If pedestrian presence has been selected on the project, then Section 9 will request plans for accommodating pedestrians during construction. For more information on developing plans for pedestrians, see FDM 11-50-31.

When developing the TMP, consider the impact to OSOW vehicles and their ability to travel through the project. Determine what the minimum height and width restriction will be in the project based on the chosen mitigation strategies. Document the measures taken to mitigate impacts to freight in the TMP. The Vehicle Size Restriction table is included in the TMP to document the minimum width and shy distances for each location in the project. For more information on freight in work zones, see FDM 11-50-21.7.

Section 10 Additional Information

The Additional Information section only needs to be filled out when a nonstandard mitigation strategy is used. If a nonstandard mitigation strategy is selected, Section 10 will request that Attachment 5.5 be completed and attached to the TMP.

5.5.3 60% TMP

The 60% TMP must be approved before the Design Study Report is completed. When developing the 60% TMP, much of the information developed for the Work Zone Impact Assessment can be used. Thoroughly complete Sections: 1, 2, 3, 4, 5, 6, and potentially 10 before submitting the TMP for 60% approval. If the use of law enforcement mitigation is recognized before 60%, include its selection in Section 8. Sections 7 and 9 may still be conceptual at the 60% point, but include discussion points for the design moving forward.

5.5.4 90% TMP

The 90% TMP must be approved before the PS&E is completed. The 90% TMP will pick up where the 60% TMP left off. Any information that was left incomplete or conceptual at 60% will be fully developed at 90%. Any new requests for nonstandard traffic mitigation must also be added to the TMP. The 90% TMP Approval will document BTO's approval for all contents including Temporary Speed Declarations, and mitigation strategies included except for Law Enforcement Mitigation, which requires additional approval; see FDM 11-50-5.7.1.

5.6 TMP Strategies Matrix

5.6.1 TMP Strategies Matrix Overview

In Sections 4, 7, and 8 of the TMP, preparers will be asked to select different strategies. Work zone impact management strategies are used to:

1. Minimize traffic delays
2. Improve mobility
3. Improve safety for both motorist and worker
4. Reduce work duration
5. Maintain access to businesses, residents and other stakeholders

These strategies are not all inclusive and may not always be appropriate for all projects. An extensive list of TMP strategies is found in the TMP Management Plan Strategy Matrices found in Attachments 5.2 to 5.4. The strategies are broken down into the following types of strategies:

- Work Zone Mitigation Strategies (Constructability, Contracting, Innovative, Temporary Traffic Control, Detours, Restrictions, Coordination)
- Public Information and Motorist Mitigation Strategies
- Incident Management Mitigation Strategies

Strategies not identified in Attachments 5.2 to 5.4 are considered nonstandard strategies. To use a non-standard mitigation strategy, complete the "Request for nonstandard mitigation strategies approval" form found in Attachment 5.5 and submit to the BTO Work Zone Operations Engineer for approval through WisTMP.

The following are examples of services that are *not* eligible for funding:

1. Procurement of equipment such as speed display boards, total stations, uniforms, traffic control devices. (Consider exception if equipment can be reimbursed at a daily/weekly/monthly rate, or if equipment is consumable, i.e., typically has no useful life remaining after the project.)
2. County or local agency staff time involving project planning, providing data, meetings, or training, unless related directly to project incident management such as for dry run exercises. (Consider exception if a mitigation contract has been executed with the agency based on complexity of project, i.e. if there are multiple ramp/road closures involving frequent modifications to emergency access.)

5.6.2 Project Exception

The criteria used to determine the impact of a proposed work zone will be the 15 minutes of delay on freeways and expressways (FDM 11-50-30). When the delay exceeds 15 minutes above normal recurring traffic delays, request a project exception. The degree of detail in the exception request will vary with project complexity and expected impacts. The exception request should include a short discussion on the alternative mitigation strategies that were considered and those that are recommended to minimize delay while enhancing safety and mobility. For non-freeway projects, exemptions are not required.

5.7 Implement TMP

The TMP is implemented in the plans and specifications. If the Project Manager changes between design and construction, the new Project Manager must become familiar with the TMP. Before the project begins, it is advisable to identify key personnel and their responsibilities and provide contact information. The project manager/engineer and the contractor may discuss and agree (preferably at the project preconstruction meeting) on how emergency operations will be carried out. Further guidance is provided in FDM 11-50-10.4. This information should be added to the TMP. If the project stipulates that a daily log of traffic control operation be kept, document this requirement in the implementation plan and share information with parties before beginning construction activities.

Identify line of authority for project manager and contractor personnel responsible for traffic control. Also identify personnel assigned the TMP monitoring responsibility.

5.8 Monitor TMP

Project teams should monitor the traffic on the project and make changes if necessary. TMP changes that should be documented are described further in FDM 11-50-5.10. Some elements of TMP strategies such as media releases, notifications to target groups, brochures, flyers, newsletters, etc., may need early distribution. Additionally, motorist notification, installation of fixed message signs, signing of detour routes, placing changeable message signs and work zone ITS require lead time.

During construction, the region should assign an individual(s) to collect data on the TMP. The data collected may be used to prepare a report on the successes and failures of the TMP. The data collected may include:

1. Verification of work zone setup
2. Changes that were made during construction
3. Changes that were made to the original TMP (include successes or failures)
4. Public/motorist reaction
5. Identification of peak hours
6. Average daily delays and queues experienced
7. Frequency of complaints and the nature of the complaints
8. Crash occurrence (type and frequency)
9. Surveys/feedback
10. A track of implementation cost
11. Person(s) responsible for the implementation of TMP.

For Type 3 TMPs, a monthly report summarizing the above information should be developed.

5.9 Documentation of Changes to TMP

TMP documentation has an added advantage of enhancing communication among stakeholders by enabling sharing of information from project scoping through construction. It is therefore essential that TMP revisions be documented if there is significant change to the impacts on the traveling public or if the TMP revisions cause a contract change order.

Examples that may require revisions to the TMP documentation include:

- Extended duration of temporary full roadway closures into weekday or weekend peak traffic hours (example - taking an unanticipated weekend full freeway closure to erect bridge girders or to trench a culvert across the freeway).
- Additional road closure, or additional ramp closure that adds more than 15 minutes of delay above typical travel time.
- Additional closures that affect OSOW freight movement.
- Changes in scope or intent of work, including work limits, work hours and time of year.
- Construction stage changes that affect roadway geometry, lateral clearance, design speed, vertical

clearance, lane width and roadway closures.

- Extra Law enforcement contracts that were not originally anticipated.
- Both positive and negative lessons learned that impact safety, traffic flow and project delivery time.
- Revised detour routes that are an increase in distance and travel time for motorists compared to the original approved detour.

Project engineers are encouraged to engage and confirm with the region traffic engineer and BTO to determine whether the above listed traffic impact changes warrant an official documented change to the TMP.

Examples of changes that may not need revised TMP documentation may include:

- Planned long-term closures that are extended for short durations compared to their original planned closure schedule.
- Lane closure time period that does not cause additional travel delay.

Document the addendum to the TMP and complete the following:

1. Amend the TMP in the WisTMP System and revise the necessary sections. Attach any correspondence related to the change to the TMP.
2. E-mail to Regional PDS and Traffic (who signed the original TMP) and Statewide Bureaus (BPD/BTO), and FHWA if Federal Oversight project, describing the changes.

5.10 Post Construction Project Evaluation

Following good planning principles, the strategies should be linked to measures of performance to determine how effective the applied strategy was in promoting safety and mobility of a work zone. Use the data collected while monitoring the TMP during construction to assess the quality, performance, and effectiveness of the TMP in achieving project objectives.

Performance measures are typically applied to fulfill four functions:

- To continuously improve services (i.e., to understand how the strategy is performing and whether modification of its application is necessary to improve performance).
- To strengthen accountability of either the Department's or the Contractor's personnel to ensure the strategy is achieving the desired effect.
- To communicate the results of strategies to the public, stakeholders, and upper management.
- To provide better information for effective decision-making, and resource allocation in the future.

Performance measures for work zones differ from one project to the next. For example, car-pooling usage would be used to measure the effectiveness of a TMP mitigation strategy such as ride share incentives. Additionally, a work zone may include new strategies, such as new technology (ITS) or innovative contracting strategies. In these instances, a unique performance measure may be developed to evaluate the effectiveness of the new strategy.

The post construction report should provide brief discussion on the following areas:

- Overall statement reflecting the usefulness of the TMP
- Changes that were made to correct oversights in the TMP
- Changes that were made to the original TMP and how successful those changes were
- Public reaction to the TMP (using surveys)
- Average delay time, queue, etc., during construction
- How frequent complaints were made about the project, the nature of the complaints and how they were resolved
- Type of crashes/incidents that occurred during construction, and how they were resolved
- Recommendations or suggestions for future projects
- Highlight the areas of the TMP that were successfully implemented

Once the project is complete, the Project Manager shall mark the project as complete in the WisTMP system and attach the post construction report.

5.99 References

1. WisDOT Work Zone Policy Statement, TEOpS 6-1
2. Transportation Management Plan Guidelines, State of California, Department of Transportation

3. Traffic Management in Work Zones Interstate and Other Freeways, State of Ohio, Department of Transportation
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5. Traffic Control Plan/Design, State of Indiana, Department of Transportation
6. Traffic Management Plan, Forest Road, New Mexico Tech.
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9. Mosman Municipal Council, Guide for construction Traffic Management plan
10. Implementing the Rule on Work Zone Safety and Mobility, FHWA
11. Work Zone Public Information and Outreach Strategies, FHWA
12. Developing and Implementing Transportation Management Plans in Work Zones, FHWA
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15. Federal Highway Administration. September 2005. Work Zone Safety and Mobility Final Rule Implementation Guide. Prepared by Cambridge Systematics, Inc., Washington, D.C. https://ops.fhwa.dot.gov/wz/rule_guide/rule_guide.pdf
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25. Federal Highway Administration, Accommodating Pedestrians in Work Zones. Available at http://safety.fhwa.dot.gov/wz/planning/fhwasa03011/fhwasa03011.pdf

LIST OF ATTACHMENTS

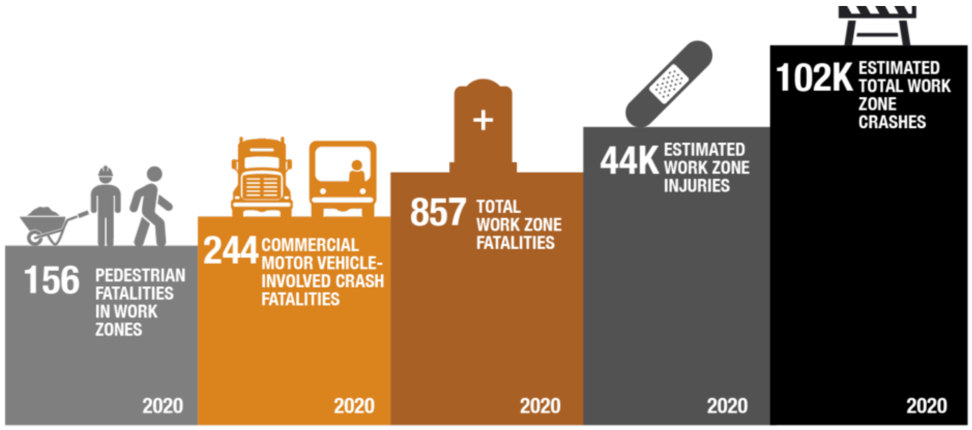
Attachment 5.1	Transportation Management Plan Development Process
Attachment 5.2	Standard Work Zone Strategy Matrix
Attachment 5.3	Standard Public Information and Motorist Mitigation Strategy Matrix
Attachment 5.4	Standard Incident Management Strategy Matrix
Attachment 5.5	Non-Standard Mitigation Approval Form

FDM 11-50-7 Mitigation Contracts

November 15, 2024

7.1 Law Enforcement Mitigation Contracts

Each year hundreds of lives are lost, and thousands injured in work zones nationally, as shown in the chart below. There are thousands of crashes in Wisconsin work zones every construction season with drivers and passengers, not workers, making up a majority of those. In Wisconsin, there are on average 12 fatalities a year in work zones. Work zones have the potential to increase crashes due to changing traffic patterns, lane closures or narrowed lanes, just to name a few. It is critical that work zones are designed for all road users, including pedestrians/bicyclists and commercial motor vehicles which is stated as part of the Transportation Management Plan (TMP). Included in the TMP are incident management strategies to mitigate impacts during construction, which includes law enforcement and the freeway service team.



https://workzonesafety.org/wp-content/uploads/2022/03/Summary-2020-with-title-1024x538.png

The purpose of law enforcement mitigation is to provide a presence in the work zone to increase the safety for the traveling public as well as the workers. A visible law enforcement presence decreases speeds and increases driver attentiveness. In general, the need for law enforcement is greatest on projects with high traffic speeds and volumes, and where the work zone is expected to result in substantial disruption to or changes in normal traffic flow patterns.

The primary goals of law enforcement in work zones are:

1. Speed limit enforcement
2. Targeted presence
3. Incident clearance

Enforcing the speed limit requires the speed limit to be appropriately set following the guidelines in TEOpS 13-5-6 . Drivers base their speed on their perception of the driving environment. If the posted speed limit does not correspond to existing conditions, drivers will disregard the speed limit. The speed limit signs need to be properly covered and uncovered so the posted speed limit signs are consistent throughout the work zone. If speed limit signs differ in a work zone, it becomes challenging for law enforcement to enforce the speed limit. Lastly, it can be very challenging for law enforcement to enforce the speed limit if there are not shoulders to safely pull a vehicle over so that should also be considered when adding law enforcement to a project.

Targeted presence in work zones is effective in creating a safe work zone for the motorists and workers. Given the limited resources of law enforcement in work zones, data should be collected and analyzed to identify locations and time periods when law enforcement will be most effective. Review current and historical crash data to identify “hot spot” locations prior to and during construction. Crash data can assist law enforcement in where to target their presence to prevent crashes from happening or respond in the event of an incident.

Another goal of mitigation is to clear incidents that have the potential to cause delay in the work zone or secondary crashes from slowed vehicles. The best way to clear incidents quickly from the work zone is to use the Freeway Service Team (FST) followed by assistance from law enforcement. FST uses a flatbed tow truck which provides tow relocation, conducts minor repairs like flat tires and provides small amounts of fuel. FST service is a mitigation technique designed to lessen the travel delay associated with crashes or mechanical breakdowns within a work zone. These are roving patrols which not only come upon disabled vehicles but are also dispatched by law enforcement to clear incidents. The intent of service patrols is to quickly clear disabled vehicles to maintain roadway capacity and reduce the incidence of secondary crashes.

Refer to TEOpS 6-3-6 "Freeway Service Team Policy and Procedure" for further information.

Law Enforcement Mitigation Process

There are many different steps to identify the need for and properly document law enforcement mitigation contracts for construction projects as detailed below. To ensure consistency in both the region and statewide, there should be one regional mitigation contact to help develop and review any contracts the region requests.

Development of Estimate

When the project is in scoping, a high-level traffic staging plan may be developed, which considers if the project will have lane closures, full closure with a detour, flagging operation, etc. The regional mitigation contact should coordinate and assist with development of a high-level estimate based on the scoping plan to provide a cost for mitigation based on the mitigation cost estimation spreadsheet. This estimate should be updated as the traffic staging plan evolves to provide better information in the Financial Integrated Improvement Programming System (FIIPS) for programming projects. If a traffic staging plan is not developed at scoping, complete a mitigation estimate as soon as a traffic staging plan is developed.

The mitigation cost estimation sheet includes law enforcement rates to calculate a total cost based on the number of hours the project expects as well as meals and mileage. The spreadsheet breaks out several different categories to fill in at the roadway level which include:

- Full Roadway Closures
- Rolling Closures
- Special Events
- Holidays
- Miscellaneous: dedicated law enforcement, commercial motor vehicle enforcement details, weekly meetings, and travel time.

Mitigation contracts are developed and approved for one year at a time, but the spreadsheet may be expanded to break out consecutive years to get a total cost over the course of several years to have as a placeholder in FIIPS. Contracts are only approved on a yearly basis so past mitigation expenditures can be reviewed to determine if subsequent changes are needed or if an amendment can be completed to extend the project end date if there are funds remaining.

Documentation in Transportation Management Plan

The TMP should identify a need for traffic mitigation based on the work zone traffic analysis and work zone staging. If dedicated enforcement is being considered outside of peak hours, outside of weekend recreational peak hours, holidays or special events, review and document crash data in Section 8 of the TMP. See detailed information in the Mitigation Selection Project section.

Update TMP at 60% and 90% Approval

As the TMP progresses and more details of the traffic staging are developed and finalized, revise the cost estimate as needed and update FIIPS based on the revised estimate, if changed, at both the 60% and 90% approval of the TMP.

Update Financial Integrated Improvement Programming System (FIIPS)

Anytime an estimate is updated, update the cost in FIIPS. To do this, work with your regional FIIPS coordinators to have it updated to reflect the mitigation cost estimation spreadsheet.

Law Enforcement Mitigation Contract Request

Refer to Attachment 7.1 for the Division of State Patrol law enforcement mitigation contract process map. Local agency contracts will be handled on a case-by-case basis but will follow the same processes (refer to Attachment 7.2). In January prior to the construction project starting, requests for law enforcement mitigation contracts are sent out to the regional mitigation contact. The regional mitigation contact will work with the projects that may need mitigation. They will review the project proposals, provide comments and identify projects that can be lumped together if there are closely spaced work zones. After review, the regional mitigation contact will send all the contracts to the BTO Statewide Work Zone Operations Engineer for review and comment. If there are comments from BTO, the contracts will be sent back to the region for more justification or clarification. If there are no comments, they are then approved by BTO. After BTO approval, BTO will schedule a meeting with the region and DSP to discuss any issues from law enforcement. If no issues, the contracts will be sent to Bureau of Project Development and the DSP Colonel for final signatures. After the contracts are signed, the contract will be sent to the regional mitigation contacts and DSP. The regional mitigation contact will send the signed contracts to the FIIPS coordinator to update the final contract amount and request authorization. Law enforcement mitigation cannot start until there is signed and executed contract.

Mitigation Project Selection

Law enforcement mitigation contracts may be used for freeway and expressway construction projects with significant safety and mobility impacts to the motorists but are not required. Identify the need for the Law Enforcement Mitigation Contracts in Section 8 – Incident Management Strategies of the TMP.

There are several factors to take into consideration when determining if a project warrants law enforcement mitigation which include:

- Roadway Volume
- Traffic Staging
    - Full roadway closures
    - Rolling closures
    - Bi-directional traffic
- Capacity Restrictions
    - Expected delay in addition to regular recurring delay
    - Expected queuing
- History of crashes in the project area including CMV crashes

Law enforcement mitigation during the peak hours, weekend hours for recreational traffic, holiday weekends and special events are considered standard in Wisconsin which is consistent with other states. There are several different types of standard law enforcement mitigation contracts which are identified below.

1. Projects with rolling closures require a law enforcement mitigation contract.
2. Projects with full roadway closures may be eligible for law enforcement assistance if the roadway has a complex geometry or higher traffic volume during off peak hours.
3. Projects with significant impacts during the peak hours may be eligible for dedicated law enforcement to assist with incident clearance.
4. Projects with a history of crashes in the project area may be eligible for a law enforcement mitigation contract to target high crash locations and enforce the speed limit. Consider CMV enforcement details when there are a higher number of CMV crashes.
5. Projects on recreational routes with impacts to capacity or lane width may be eligible for law enforcement assistance on weekends or holidays.
6. Projects with significant impacts during special events in the area may be eligible for law enforcement mitigation during special event time periods.

Any project requesting dedicated law enforcement outside of peak hours, weekend hours for recreational traffic, holidays or special events is considered a nonstandard mitigation strategy. If the strategy is determined to be a nonstandard mitigation strategy, then the “Request for nonstandard mitigation strategies approval” form shall be completed. See Attachment 5.5.

The non-standard strategy request will follow the following process:

1. Identify non-standard strategy in the TMP.
2. Complete the form, Attachment 7.3.
3. BTO will review the non-standard mitigation strategy and determine if additional approval is needed.
4. If additional approval is needed, BTO will coordinate a meeting with the following approvers and one

region/project representative to discuss the non-standard mitigation strategy:

   a. Bureau of Traffic Operations Director
   b. Bureau of Traffic Operations, Traffic Engineering and Safety Section Chief
   c. Two other Region Chiefs not involved in the project

5. At the meeting the group will determine if the strategy is approved or denied.
6. The region will have an opportunity to modify their non-standard strategy for further discussion.
7. BTO will attach a memo to the TMP and send an email to the attendees with information on approval or denial of the non-standard mitigation strategy for documentation.

As stated on the approval form, the following information should be provided at the time of the request:

- Type of strategy
- Cost of strategy
- Justification of strategy

The following is also required to be documented for review by the Statewide Work Zone Operations Engineer and nonstandard mitigation approvers to determine the need.

- Detailed Traffic Staging Plan
  - Inclusion of smart work zone system to help mitigate impacts
- Detailed Traffic Analysis
  - Documenting queuing and delay
- Crash Data
  - Previous 3 years crash data in the project area
  - Monthly summary
  - Time of day summary
  - Day of week summary
  - Crash severity (KABCO) summary
  - Manner of collision (head-on, rear-end, etc.) summary
  - Commercial motor vehicle summary
- After the project has started, the project shall complete monthly performance measure evaluations during construction to show benefits of dedicated law enforcement in the work zone which may include citations, traffic stops, incident clearance, hours worked, etc. The evaluation shall be sent to BTO monthly.

Non-freeway projects requesting law enforcement assistance will be on a project-by-project basis based on the specific work zone characteristics and roadway volume.

Law enforcement mitigation is required on any freeway or expressway project with rolling closures and only law enforcement can perform the rolling closures.

To request law enforcement mitigation services for a project, work with your regional mitigation contact.

Division of State Patrol

The Division of State Patrol (DSP) is the primary law enforcement provider for work zone traffic mitigation. DSP has the first right of refusal. If DSP cannot commit to providing the services deemed necessary in the proposed contract a local agency contract may be considered only after internal discussions with BTO, DSP and the regional mitigation contact are completed. Regions shall not reach out to any local agency without previous discussion of mitigation needs with BTO and DSP.

Depending on the needs of the project and mitigation requested, it may also be beneficial to have discussions with DSP about partnering with the county sheriff departments in the county the project resides in to help share mitigation needs. This has been done in the past and has worked well depending on what the need of the request is.

Local Agency Law Enforcement

If DSP cannot commit to providing services deemed necessary in the proposed contract and internal discussions have been held between DSP, BTO and the regional mitigation contact and agreed upon, the local agency may be contacted to develop a contract. Local agency contracts require approval by BTO as well as signatures from the local agency, DTSD Bureau of Project Development and the Governor. The process of getting signatures may be lengthy, a minimum of 4 weeks, so consider additional time for contract approval. Expect a minimum of 4 weeks for review and approval from the Bureau of Project Development and Governor.

Local agency cost estimates shall use the same spreadsheet required for DSP and shall be attached to the contract. Similar to DSP, only meals, mileage and time will be paid for by the department, which are included on the cost estimate spreadsheet. Meals and mileage are based on the total number of law enforcement hours requested.

Local agency law enforcement contracts should follow the same guidelines documented in previous sections.

Local agencies shall submit monthly invoices with a daily breakdown identifying each officer's hours worked, date worked, miles driven and total costs during the month of enforcement. The agency shall, within 30 business days after the end of the month, submit an invoice for the work performed.

The region shall submit a DT-25 Form, Recommendation to Governor for Contract and Bond Approval, to the Bureau of Traffic Operations Statewide Work Zone Engineer for review, at DOTBTOWorkzone@dot.wi.gov. A detailed cost estimate is required to be submitted or the contract will not be reviewed. After the Statewide Work Zone Operations Engineer reviews and approves the request, the project team can send the contract to the local agency for final signatures. Once the Statewide Work Zone Operations Engineer receives the signed contract, they will then send the DT-25 Form to the Bureau of Project Development (BPD) for final approval and signatures. Refer to Attachment 7.2 for the local agency contract process map. The following should be submitted with the DT-25 Form:

1. Estimate documenting costs
2. Signed Contract from Local Agency

After the DT-25 Form is approved and signed by the Governor, BPD will send the signed form to BTO, and BTO will then send it to the requestor. The region should then create a Purchase Order and send BTO a confirmation email with the purchase order number for monthly tracking purposes.

See FDM 19-10-20, Governors Approval Form (DT25).

7.2 Emergency Law Enforcement Mitigation with Division of State Patrol

Emergency law enforcement mitigation is to be used for unexpected/unplanned work zone mitigation. Any planned work zone mitigation should have a signed contract in place, regardless of the contract cost.

Requests for the use of emergency law enforcement mitigation requires approval by the Bureau of Traffic Operations, State Traffic Engineer. Typically, approvals are completed in less than a day. Work with your regional mitigation contact to request emergency law enforcement mitigation. The following information should be written up and submitted to the Statewide Work Zone Operations Engineer via email:

- Mitigation Need
- DSP Cost Estimate Spreadsheet

7.3 Freeway Service Team Mitigation Contracts

The Freeway Service Team (FST) provides expedited relocation of disabled and crashed vehicles by continuously patrolling designated segments of interstate and state highways during designated hours and specific work zones. The continuous patrol will facilitate a quick response time to traffic incidents such as breakdowns and traffic crashes, thus reducing the total time needed to clear the incident from the highway and restore normal traffic flow.

FST are frequently used as part of a project's work zone mitigation strategy and identified in the work zone TMP. Document the need for FST in Section 8 of the TMP. Refer to TEOpS 6-3-6 "Freeway Service Team Policy and Procedure" for further information.

7.4 Traffic Control or Capacity Improvement Mitigation Contracts

Projects may consider the need for traffic control or capacity improvements to minimize work zone delay on identified detour or alternate routes. Once the need for traffic control or capacity improvements are identified, work with your regional work zone engineer to determine the scope of the improvements necessary. Include a detailed scope of work and estimate for the desired improvement.

Improvements that are temporary, implying they will be removed after the project is completed, are considered standard strategies. Examples of standard mitigation strategies on detour and alternate routes are listed below:

- Revised Signal Timings
- Temporary Signals
- Temporary Pavement Markings
- Temporary Signing

If the strategy is a nonstandard mitigation strategy, then the “Request for nonstandard mitigation strategies approval” form shall be completed. See Attachment 5.5.

As stated on the approval form, the following information should be provided at the time of the request:

- Type of strategy
- Cost of strategy
- Justification of strategy

A follow-up analysis will also need to be completed 30 days after the strategy was implemented during construction to determine if it is effective. If it is not effective, the strategy should be removed from the project.

Local Agency DT-25 Contracts

The region shall submit a DT-25 Form, Recommendation to Governor for Contract and Bond Approval, to the Bureau of Traffic Operations Statewide Work Zone Engineer for review, at DOTBTOWorkzone@dot.wi.gov. A detailed cost estimate is required to be submitted or the contract will not be reviewed. After the Statewide Work Zone Operations Engineer reviews and approves the request, the project team can send the contract to the local agency for final signatures. Once the Statewide Work Zone Operations Engineer receives the signed contract, they will then send the DT-25 Form to the Bureau of Project Development (BPD) for final approval and signatures. Refer to Attachment 7.2 for the local agency contract process map. The following should be submitted with the DT-25 Form:

1. Estimate documenting costs
2. Signed Contract from Local Agency

After the DT-25 Form is approved and signed by the Governor, BPD will send the signed form to BTO, and BTO will then send it to the requestor.

See FDM 19-10-20, Governors Approval Form (DT25).

7.5 Multi-Modal Improvement Mitigation Contracts

Projects may consider the need for multi-modal improvements to minimize work zone delay. Once the need for multi-modal improvements are identified, work with your regional work zone engineer to determine the scope of the improvements necessary. Include a detailed scope of work and estimate for the desired improvement.

Improvements that are temporary, implying they will be removed after the project is completed are considered standard strategies. Examples of standard mitigation strategies on detour and alternate routes are listed below:

- Temporary Pedestrian/Bicycle Access Improvements
- Temporary Bus Turnouts

If the strategy is a nonstandard mitigation strategy, then the “Request for nonstandard mitigation strategies approval” form shall be completed. See Attachment 5.5.

As stated on the approval form, the following information should be provided at the time of the request:

- Type of strategy
- Cost of strategy
- Justification of strategy

A follow-up analysis will also need to be completed 30 days after the strategy was implemented during construction to determine if it is effective. If it is not effective, the strategy should be removed from the project.

Local Agency DT-25 Contracts

The region shall submit a DT-25 Form, Recommendation to Governor for Contract and Bond Approval, to the Bureau of Traffic Operations Statewide Work Zone Engineer for review, at DOTBTOWorkzone@dot.wi.gov. A detailed cost estimate is required to be submitted or the contract will not be reviewed. After the Statewide Work

Zone Operations Engineer reviews and approves the request, the project team can send the contract to the local agency for final signatures. Once the Statewide Work Zone Operations Engineer receives the signed contract, they will then send the DT-25 Form to the Bureau of Project Development (BPD) for final approval and signatures. Refer to Attachment 7.2 for the local agency contract process map. The following should be submitted with the DT-25 Form:

1. Estimate documenting costs
2. Signed Contract from Local Agency

After the DT-25 Form is approved and signed by the Governor, BPD will send the signed form to BTO, and BTO will then send it to the requestor.

See FDM 19-10-20, Governors Approval Form (DT25).

LIST OF ATTACHMENTS

Attachment 7.1	Division of State Patrol Work Zone Law Enforcement Mitigation Contracts Process Map
Attachment 7.2	Local Agency Contracts Process Map

FDM 11-50-10 Transportation Management Plan Attachments — *August 15, 2019*

10.1 Transportation Management Plan Attachments

A Transportation Management Plan (TMP) includes public and motorist information, demand management/transportation operation, incident management, alternative routes, construction strategies and other innovative/alternative contracting strategies. Type 1 projects may have not have any TMP Attachments, while a Type 3 project will require all components to be discussed and included in the TMP.

Refer to FDM 11-50-15 for further discussion on work zone traffic control plan process.

10.2 Public Information & Outreach Plan (PIOP)

WisDOT has a major role in ensuring the public is informed about traffic impacts related to construction activities. Accurate and timely reporting of project information to the public is a valuable element of the overall TMP strategy. A public information and outreach plan (PIOP) lays out clear and concise strategies and procedures to reach out to the traveling public and other stakeholders with information about existing traffic operations and planned changes due to proposed project activities. The PIOP must be updated throughout the project life cycle to address issues as they arise.

Regional offices perform public information and outreach activities and implement the overall PIOP in coordination with the Office of Public Affairs (OPA). PIOP is used to ensure that:

- Stakeholders are informed about the project and its impacts.
- OPA is aware of all PIOP issues.
- Communities, businesses, and schools directly impacted by the project are informed about the project’s impacts through participation.
- Road users are informed in a timely manner of possible negative impacts and where possible information on alternate routes are given.
- Emergency response agencies (e.g., law enforcement, ambulance service providers, hospitals, city and county officials) are informed of changes that might affect their operations.

10.2.1 PIOP Requirements

Each project presents varying degrees of challenges. Freeways/expressways, high-volume urban locations with commercial access requirements, and pedestrian/bicycle traffic present the most challenges and require the most extensive PIOP. Minor rural projects on low volume roads will not require as much detail. A PIOP may consist of any of the following basic items: (see Attachment 10.1)

- Media news release
- Public meetings or speaker forums
- Stakeholder and emergency response agencies meetings
- Notices to the traveling public (radio, TV, print media, social media, etc.)
- Brochures and mailers, videos, slides, presentations, etc.
- Paid advertising

- Special notification to targeted groups
- Telephone hotline
- Public information center
- Traveler information
- Portable changeable message signs (PCMS)
- Dynamic message signs (DMS)
- Ground mounted signs
- Portable work zone traveler information systems (ITS)
- Other affected group information
- Other methods including the Internet and social media

10.3 Work Zone Incident Management Plan (IMP)

A Work Zone Incident Management Plan (IMP) is a set of strategies used to help the contractor and the Department respond appropriately to incidents during construction within a reasonable timeframe in order to maintain safe traffic flow through the work zone. These strategies include monitoring traffic conditions within the work zone and adjusting traffic operations based on changing conditions. IMPs address unplanned events or incidents for TMP Type 2 project on freeways/expressways and are included in all TMP Type 3 projects to ensure effective management of responses within the work zone. Formal IMP documents are not required for TMP Type 2 projects on conventional highways, but if the project has detours or other temporary access restrictions on priority routes, coordinate with emergency service providers regarding incident and access planning. Modify and update the IMP to address field issues as they occur. The IMP is part of the TMP and is submitted or uploaded to the online WisTMP system. The IMP should be discussed early on during the TMP development. Identify the potential stakeholders/responders at the time of the 60% TMP Approval and Design Study Report (DSR) submittal to Bureau of Project Development (BPD). Upload a draft IMP to the WisTMP system for the 90% TMP Approval. Once the contractors have been identified finalize the IMP and upload it to the WisTMP system.

Key points to remember when using the IMP:

- IMPs serve as a plan and not a procedure.
- IMPs are applicable to any traffic incident or backup that occurs on any highway.
- IMPs are flexible and can be adapted based on the type of incident since no two projects are the same, apply experience and judgment in each situation.

IMP reference resources:

- Wisconsin Emergency Traffic Control and Scene Management Guidelines
- Emergency Traffic Control and Scene Management Field Operations Guidelines
- Regional Incident Management Coordinator Field Operations Guidelines
- Crisis Communication Management Plan
- Emergency Traffic Operations Plan
- Incident Command Flowchart

It is the intent of WisDOT to minimize impacts and delays to motorists and to promote safety in work zones. Planning for traffic incidents that occur within work zones is a critical component of reducing delay and increasing the safety, mobility, and reliability of the highway system. The level of complexity of the IMP depends upon the duration, complexity, and impacts of the project in the corridor/network. Long-term, complex reconstruction projects necessitate a comprehensive effort with procedures and processes to support the project. Short-term projects on lower-volume roads may simply require a meeting, ongoing coordination with the appropriate local or regional emergency response agencies.

Below are questions listed to help identify the appropriate elements within the IMP:

- How will this project impact emergency response in this corridor?
- Are there access issues for responding to incidents within the work zone?
- If an incident closes the highway in one or both directions, how will traffic be rerouted?
- Are there strategies to minimize project impacts on response agencies?
- Are there strategies to minimize incident impacts on the public?
- Are there procedures that would enhance incident clearance and safety?
- How will project personnel coordinate and assist emergency responders?

If additional strategies are needed to ensure stakeholders' needs are met during construction, the strategies should be identified, documented, and implemented. They may include:

- Contact list for construction and utility personnel (Emergency Contact Sheet)
- Procedures for communicating during an incident (Communication Flow Chart)
- Procedures for updating response agencies on traffic control changes
- Emergency access requirements
- Variable message signs or other traveler information strategies
- Emergency routes to be used in the event of a long-term incident

On projects with multiple stages, develop a plan for each stage of the project. Document and distribute the procedures and recommended strategies to all response agencies and construction personnel. Plan and budget strategies that require implementation (e.g., signing, ITS devices, and Freeway Service Team) as part of the project and are implemented at the start of the project. Training and follow-up sessions will be necessary to ensure that all agencies and construction personnel are familiar with the procedures in the plan. Review, revise, and update the procedures as necessary throughout the life of the project.

Identify on any project the minimum requirement, whether a traffic migration strategy already exists, and determine the role of the contractor in the implementation. Project staff or the contractor should also contact appropriate response agencies in the corridor to discuss their concerns with the proposed work zone and agree to procedures and strategies that will support the IMP. This communication and coordination is essential for any work zone. On more complex projects, coordination will become more formalized and require the involvement of more stakeholders. It will necessitate a greater commitment of time and resources on the part of the contractor.

10.3.1 Developing an Incident Management Plan (IMP)

Develop the IMP once the TMP type is determined. The level of IMP required is based on TMP type depending on if the project is on a freeway/expressway and the duration or the project (i.e., not needed for maintenance-type work).

The following process illustrates the common steps in developing an IMP:

1. Determine if there is a work zone incident management plan in place for the corridor
2. Identify response agencies
3. Meet with agencies to identify: existing protocols, concerns/issues, goals and objectives
4. Determine appropriate level of detail including availability of access points
5. Evaluate strategies
6. Recommend actions
7. Provide documentation to all response agencies via the IMP

If the construction project has multiple stages, the IMP should account for changes in project limits, ITS device locations, and contact information. Each construction project presents unique problems for emergency responders and the management of incidents that occur in the work zone.

10.3.1.1 Identify Stakeholders

To ensure work zones are safe and minimize the impact and delay to the traveling public, the plan should be developed in a collaborative effort with the emergency response and the public safety community and incorporated in the IMP. Planning for incidents that occur within work zones is a critical component for reducing delay and increasing the safety and reliability of the transportation system. Identify special events that may occur during construction and could affect work times. Acquire special event coordinator contact information.

10.3.1.2 Components

Each IMP provides a quick, in-the-field reference for response personnel. A standard format IMP ensures fast, effective, and consistent responses to incidents. Use the format listed below as the standard table of contents when developing each IMP for each TMP Type, note that the lists are not necessarily comprehensive. The recommendations of each section are described more in depth below.

TMP Type 2 Projects

- Project Summary
- Project Location Map
- Emergency Contact Information with TMC number

- Communication Flow Chart
- Inserts from the Emergency Alternate Routes Operations Guide (if available) or other Alternate Route Maps
- Available Barricade/Ramp Gate Locations for Ramp Closures if not already identified

TMP Type 3 Projects

- Project Summary
- Project Location Map
- Roles and Responsibilities
- Emergency Contact Information
- Support Services for Work Zone Mitigation (if available)
- Communication Flow Chart
- Inserts from the Emergency Alternate Routes Operations Guide (if available) or other Alternate Route Maps
- Available Barricade/Ramp Gate Locations for Ramp Closures if not already identified
- Activation of Traveler Information Systems
- Emergency Access, Pullout and Traveler Information Equipment Locations Map
- Appendices
    a. Emergency Alternate Route Maps (develop or insert if already available)
    b. Emergency Access, Pullout and Traveler Information Equipment Location Map
    c. Project Location Map

10.3.1.2.1 Project Summary

Provide a project description in the IMP. It may simply be the description used in the TMP document. Describe the location and type of project, the number of construction stages including closure locations and anticipated dates and special events that may affect the work zone. Also include a brief description of traffic volumes and any extraordinary circumstances that need to be accounted for.

10.3.1.2.2 Roles and Responsibilities

This section of the plan outlines the potential role of those agencies that could be involved in the response to an incident on the freeway/expressway. In addition, the day-to-day operational or project-related roles of each agency are summarized. An example incident agency role **and** responsibility table is included as Table 10.1.

***Table 10.1** Example Incident Agency Role and Responsibility*

Agency	Day-to-Day Operational or Project-Related Roles	Potential Role in Freeway Incident
WisDOT – Traffic Management Center (TMC)	Coordinate and communicate lane and ramp closures for maintenance and construction projects Monitor traffic camera information Operate state-maintained PCMS	Manage Incidents from TMC - Watch for traffic problem areas on the freeway - Locate/verify incidents - Provide traveler information - Provide information to IH-41 Team Communication Officer
County Sheriff's Department	Responsible for patrolling the freeway Primary agency for traffic enforcement and incident response	Generally, first responder on scene Establish incident command at incident scenes Contact additional responders as necessary Provide traffic control Investigate crash scene
Wisconsin State Patrol	Responsible for patrolling the freeway Primary agency for traffic enforcement and incident response Monitor traffic camera information	Generally, first responder on scene Contact additional responders as necessary Provide traffic control Investigate crash scene Provide Recon Team and CMV Specialists (MCSAP) Fond du Lac Post Communication Center - Watch for traffic problem areas on the freeway - Locate/verify incidents - Provide traveler information - Provide information to IH-41 Team
County Highway Department	Primary agency responsible for freeway maintenance	Provide traffic control assistance during incidents Assist with incident clean-up
County Department of Emergency Management	No day-to-day operational responsibilities for the freeway system	Help coordinate large scale incidents (e.g., HAZMAT) Provide incident responders with additional resources if needed
Local Transit	Operate local bus routes on city streets	Reroute buses around incident or congestion as necessary

10.3.1.2.3 Emergency Contact Information

The following list identifies contact information for emergency response agencies that will be responsible for responding to or designating response for incidents involving their agency. Complete the contact information sheet at the preconstruction meeting by the project team. Table 10.2 is an example agency emergency contract table. The contact list is organized as follows:

- Project Team & State Government

- Project Contracts
- Other Agencies
- County Agencies
- City or Village Agencies

***Table 10.2** Example Agency Emergency Contact Table*

AGENCY	CONTACT	OFFICE	CELL/OTHER
TRAFFIC MANAGEMENT CENTER (TMC)			
TMC	Main Number	800-375-7302*	414-227-2166 (Office)
Responders			
Wis. State Patrol Emergency			
State Patrol Dispatch			
State Patrol Officers			
_____ County Sheriff			
_____ County Sheriff			
_____ Police Dept.			
_____ Police Dept.			
_____ Fire Dept.			
_____ EMS			
DOT REGION MANAGEMENT			
Regional Duty Officer			
RIMC			
DOT Supervisor – PDS			
DOT Manager – PDS			
Regional Director			
Maintenance Supervisor			
Traffic Supervisor			
COUNTY PERSONNEL			
On call Maintenance			
_____ County Commissioner			
PROJECT STAFF			
Project Field Office			
Project Engineer			
Project Manager			
Region Communication Manager			
PRIME CONTRACTOR			
Specialized Equipment Contractor			
TRAFFIC CONTROL – GENERAL			
General _____			
Message Boards _____			
OTHER TRAFFIC/EMERGENCY CONTACTS			
DOT Public Information Officer			
Freeway Service Team			
Special Events Coordinators			
Additional Resources			
Specialized Equipment available			
TIM Trailer at ____ location			
Jersey Barrier at _____ location			

10.3.1.2.4 Support Services for Work Zone Mitigation

TMP Types 2 or 3 often employ mitigation contracts for services such as law enforcement, freeway service teams, emergency response services, traffic control or capacity improvements on alternate routes, and multi-modal improvements. Reference the FDM 11-50-5.7 for more details on the process to follow in determining need and scope for mitigation contracts.

10.3.1.2.5 Communications Flow Diagrams

Interagency communication flows ensure that information is shared in a consistent and accurate manner when an incident occurs. It is imperative that all responding agencies have a clear understanding of this document. The following communication flow diagrams were created to illustrate the communication flows that exist between agencies during the reconstruction project. All communication flows are assumed to be two-way.

The communication flow diagrams do not represent a hierarchy for responding agencies. Rather, the communication flow diagrams are meant to illustrate the initial flow of communication between agencies. An example communications flow diagram is provided as Attachment 10.3.

10.3.1.2.6 Emergency Alternative Routes

If the corridor does not already have emergency alternate routes established, identify project-specific alternate routes with each work zone on the highway system. Consistency in selecting alternate routes is an important aspect of the program. Use the following criteria help to evaluate potential alternate routes:

- Use state highways whenever possible
- Consider long truck routes when available
- Avoid alternate routes with weight restrictions
- Avoid height restrictions imposed by bridge clearances, power lines, etc.
- Avoid routes that require traffic to make 90-degree turns
- Avoid at-grade railroad crossings, especially those with a high number of trains
- Avoid four-way stops
- Select routes that carry traffic in the same general direction as the interstate
- Minimize length of alternate routes
- Consider routes with coordinated signal timing plans or avoid routes with multiple uncoordinated signals
- Avoid traversing residential areas and school zones
- Consider all route options and closure requirements at interchanges, especially system interchanges

Based on these criteria, identify a preliminary list of emergency alternate routes for freeway segments within a given study area. Evaluate potential routes to ensure that the roadway can handle freeway-type traffic volumes. Conduct a field review of potential emergency alternate routes to confirm route selection. For further guidance in determining appropriate alternate routes, contact the TMC.

Provide brief explanation of emergency alternate routes.

> *Example: The preferred alternate routes for I-94 are the existing frontage roads. These provide quick access by traffic and limit the amount of adverse travel. If traffic back-ups extend beyond the listed access points, longer alternate routes can be implemented.*

Explain alternate routes in detail below and provide alternate route maps (as shown in Attachment 10.4).

> *Example: For SB: Traffic can be diverted west on WIS-100 (Ryan Rd) to WIS-36, southwest on WIS-36 to US-45, south on US-45 to WIS-20 and then east on WIS-20 back to I-94. For NB: Traffic can be diverted west on WIS-20 to US-45, north on US-45 to WIS-36 to WIS-100 (Ryan Rd) and then east on WIS-100 back to I-94.*

If traffic backups extend beyond the access points of the barricade locations listed, longer alternate routes can be implemented. Provide information on who needs to be contacted for each alternate route option.

> *Example: Contact TMC, State Patrol, Racine County, Village of Caledonia when alternate routes are implemented. See Contact list.*

See Attachment 10.4 for Emergency Alternate Route Map for an example.

10.3.1.2.7 Available Barricade/Ramp Gate Locations for Ramp Closures

If not already identified in the Regional Emergency Alternate Routes Operations Guides, a list of the available locations of barricades/ramp gates shall be included on the Emergency Access, Pullout and Traveler Information Equipment Location Map as shown in Attachment 10.5. During an incident, the Incident Commander organizes the ramp closures.

***Table 10.3* Available Barricade Location Example Table**

Highway Ramp & Direction	Number of Barricades	Distance from Work Zone
Ex. Hwy KR to I-94 East (SB) ramp	*1 ramp gate*	*1 mile*

10.3.1.2.8 Activation of Traveler Information Systems

Contact TMC at 800-375-7302 for activation of traveler information systems such as 511 updates, Dynamic Messaging Signs (DMS), Portable Changeable Messaging Signs (PCMS) and Traffic Incident Alerts (TIAs). Also, for DMS special signage and considerations, contact the Control Room Engineer.

Regularly review and revise the IMP to monitor current practices, identify, and resolve issues to minimize frequency of incidents and severity. Assign an individual(s) on complex projects with the responsibilities of ensuring the IMP is up to date.

LIST OF ATTACHMENTS

Attachment 10.1 Public Information and Outreach Plan Checklist

Attachment 10.2 Transportation Operations Plan Checklist

Attachment 10.3 Example Communications Flow Diagram

Attachment 10.4 Example Emergency Alternative Route Maps

FDM 11-50-15 Work Zone Traffic Control Plan Process — *November 15, 2024*

This procedure explains the process used to develop a work zone traffic control (WZTC) plan. The text below explains some of the more significant actions in this process.

15.1 Project Scope

This refers to the Project Scoping Process described in FDM 3-1-10. Traffic engineers from the region Planning & Operations Section need to be included in this initial scoping process.

15.2 Traffic Control Scope

The Project Manager will collect all input received during scoping and begin developing the traffic control scope.

15.3 Construction Under Traffic

Early in the process the feasibility of constructing the project under traffic must be addressed. The designer must consider issues such as length of construction with a detour and without, and the preferences of local officials and the public.

15.4 Detour Determination

The region Project Development Section and the region Planning and Operations Section traffic staff will determine if the project will have a detour and where it will be. This will be done with input from local officials and other Department staff as appropriate. Designers must also determine who will sign the detour (a contractor or state forces) and what improvements, if any, the detour route needs to accommodate the increased traffic.

15.5 Develop Staging Plan

Based on scoping decisions, designers develop a staging plan on how traffic will be handled throughout the life of the project. The staging of the construction work and the traffic handling are often dependent on each other. Therefore, planning for construction operations and planning for traffic handling need to be considered together.

15.6 Standard Detail Drawings

If the traffic control can be handled entirely by Standard Detail Drawings (SDDs), then designers will submit a list of those drawings to the region traffic engineer for review and concurrence. This list shall then be considered to be the final traffic control plan. For many projects, a useful addition to the plan is a project overview sheet with a line drawing showing locations to use details of the SDD's. Such a drawing is useful to illustrate how the SDD's relate to each other and to ensure that no necessary traffic control details are overlooked. It also helps the contractor and project manager to determine exactly what will be needed on the project. If the SDD's do not adequately deal with the traffic control requirements, then a preliminary traffic control plan & details will be prepared.

15.7 Prepare Preliminary Traffic Control Plan & Details

The preliminary plan should detail the exact traffic patterns, types of devices to be used, taper lengths, spacing, etc. However, since these are preliminary sheets, it is not necessary to show each individual traffic control device. Designers must also identify which SDDs will be needed in the plan. Special provisions are usually not necessary at this point.

15.8 Preliminary Plan & Details Review

The designer meets with region personnel (and central office staff and others if necessary) to review the preliminary drawings before proceeding on the final Traffic Control Plan. This review will aid the traffic control plan designer.

15.9 Finished Traffic Control Plan & Review Meeting

It is recommended that this step become a new milestone in the project development process. The meeting can be an actual face to face meeting, a teleconference, or some combination. The designer's Work Zone Traffic Control (WZTC) checklist (see FDM 11-50-20) should be completed by this time and brought to the plan review meeting. The plan and special provisions at this stage shall be complete with all the detail and information necessary for PS&E except that quantities are not necessary at this time. Designers should document the results of this meeting, including meeting participants, and place a copy in the region files. The date of this meeting shall also be documented in the PS&E plan letter.

15.10 Contractor Involvement

In rare instances, the Wisconsin Transportation Builders Association (WTBA) may be used as a resource on traffic control issues. Contractor involvement in the WZTC process shall be limited to such topics as, general constructability, production rates, and timing constraints. Contractor involvement should be coordinated with the WTBA.

15.11 Bureau of Traffic Operations (BTO) Involvement

The decision to involve BTO on a project shall be determined by the region Planning & Operations Section. The region Planning & Operations Section will act as the liaison.

Projects that may require BTO input into a traffic control plan include, but are not limited to, plans that contain traffic control staging, complex urban or rural projects, projects that involve at-grade railroad crossings, politically sensitive projects, and highly unique situations that require a statewide perspective. BTO shall be involved in the review and approval of temporary speed zone declarations when reducing the speed limit from 65 and 70 mph.

FDM 11-50-20 Design of Work Zones *August 15, 2019*

20.1 General Requirements

This procedure is intended to assure the maximum safety of motorists, pedestrians, and construction workers on all WisDOT construction projects.

The guidance for the design of work zone traffic control is found in WisMUTCD Part 6. Part 6 contains national requirements for all roads, with the consideration that a state trunk highway has characteristics and traffic volumes greater than the minimum type of roadway which Part 6 addresses. For this reason, statewide policy has been developed concerning long term work zone traffic control on the state trunk highway system. When WisDOT administers projects on the local system, the devices used must meet WisDOT specifications and the minimum requirements of Part 6; however, the layout for the work zone traffic control itself should meet the maintaining authority's policy which may differ from WisDOT policy.

FDM 11-50-21 Design Details of Traffic Control Plans *May 15, 2025*

21.1 Signing

On STH projects, all warning signs which represent a changed condition are to be orange and black except the No Passing Zone Pennant (W14-3), Object Marker (W5-52) and RR X-ing Ahead (W10-1). This is generally noted by changing the code to WO instead of W and including the general note "WO signs are the same as W signs except the background is orange". If there are existing yellow and black warning signs in place, they do not need to be changed to orange as long as the condition being warned of still exists. Any signs which are no longer applicable due to the traffic control should be covered or removed. All diamond shaped signs are 48" x 48" unless space constraints such as a narrow median or terrace do not allow this size sign to be used.

21.1.1 Modification of Type I and Type II Signs

At times, an existing message on a freeway guide signs or other permanent signs need to be altered or the sign covered if it is no longer appropriate. Indicate conflicting permanent signs to be covered on the traffic control sheets, and clearly show the sign or the part of the sign to be covered. List signs required to be covered in the quantities with the appropriate sign covering details. Under some circumstances, there may be multiple cycles of covering and uncovering throughout the course of construction staging. The sign covering will be measured separately for each cover/uncover cycle. In addition, list the number of cycles in the quantities and, if necessary, indicate the stage the sign will be covered and uncovered. For route assemblies, measure one sign covering per location.

Do not write special provisions that make covering type II signs incidental. Table 21.1 is an example table format that can be used for covering signs for traffic control in the miscellaneous quantities sheets.

***Table 21.1* Covering Signs for Traffic Control Example Table**

Stage	643.0910 Traffic Control Covering Signs Type I			643.0920 Traffic Control Covering Signs Type II		
	Each	Number of Cycles	Number of Signs	Each	Number of Cycles	Number of Signs
Stage 1	*a * b*	*a*	*b*	*x * y*	*x*	*y*
Stage 2	*a * b*	*a*	*b*	*x * y*	*x*	*y*
Stage 3	*a * b*	*a*	*b*	*x * y*	*x*	*y*
Stage 4	*a * b*	*a*	*b*	*x * y*	*x*	*y*
TOTAL						

21.1.2 Custom Sign Details

When a new sign with a special message is needed, a detail for that sign needs to be developed and included in the plan. Examples of these types of messages include:

- USE ALTERNATE ROUTE
- 40 TON WEIGHT LIMIT
- HWY XX BRIDGE
- UNDER CONSTRUCTION
- BEGINNING "DATE"
- USE ALTERNATE ROUTES
- 10 FEET MAX WIDTH
- 6 MILES AHEAD
- HWY XX CONSTRUCTION

On some projects, it may be advisable to sign an alternate route or construction bypass. For questions send an email to DOTBTOSignDetails@dot.wi.gov.

21.1.3 PCMS and DMS

PCMS and DMS may also be used to help supplement the standard signing found on the SDDs. Determine if there are any DMS boards upstream of the project, if so they may be incorporated into the temporary traffic control signing plan. Work with the TMC staff to incorporate the DMS into the plan. TEOpS 6-2-55 states how to use PCMS on projects. For DMS, TEOpS 17-1-1 states when DMS may be used.

21.1.4 No Hand-Held Phones in Work Zone

A no hand-held phone in work zone sign may be used in the advanced warning area of the work zone as well as on-ramps within the work zone for projects on freeways and expressways that have a law enforcement mitigation contract. The G Series construction information sign, G20-68, may be used and can be found at the following link:

https://wisconsindot.gov/Pages/doing-bus/local-gov/traffic-ops/manuals-and-standards/signplate/gseries.aspx

Work with your regional work zone engineer to determine if the project has an associated mitigation contract before adding the G20-68 sign to the traffic control plan.

21.2 Pavement Marking

The use of temporary raised markers type I to supplement the temporary line is very helpful, especially in areas where the alignment is changed from the existing condition and crosses different colors of pavements. Temporary raised markers provide unique wet night reflectivity throughout the project life; however, they are not resistant to snowplows, so the season of the project must be carefully considered to be sure the markers will stay in place. The feasibility of using temporary raised markers depends on the need for additional guidance based on the geometric difficulty of navigating the work zone during different stages.

Paint or epoxy's greatest use is on binder or lower courses, other surfaces which will be covered or removed, or when the temporary marking location coincides with the location of the future permanent marking. On relatively new asphaltic surfaces, removable black mask-out tape may be used to cover the existing markings.

Removable tape has the capability of adhering to the pavement throughout the construction season and can be easily removed intact or in large pieces, without grinding, blasting, or solvents. Its greatest use is on surface courses where revisions in traffic flow are necessary and where removal must be easily and quickly accomplished.

21.3 Channelizing Devices

Channelizing devices are used to guide drivers through work zones and prevent them from entering restricted areas. Channelizing devices include:

- drums
- tubular markers
- barricades
- cones, and
- other devices.

For information on channelizing devices for pedestrians see FDM 11-50-31. Each device has a target value which is how formidable it appears to drivers. The higher the target value the more likely the driver will respect the device. Drums are the Department’s preferred channelizing device in work zones.

21.3.1 Drums

Drums have a high target value and provide a consistent dimension regardless of orientation to traffic. Use drums as the primary channelizing device for lane closures, lane shifts, shoulder closures, and ramp closures. For placement of lights on drums see FDM 11-50-20.6.

21.3.2 Flexible Tubular Markers

Use flexible tubular markers to divide opposing traffic lanes. For spacing information see SDD 15d6. Tubular markers may also be used where space restrictions do not allow for the use of other more visible devices or where specific conditions such as high wind may require a device that can be secured in place.

21.3.3 Barricades

Use Type III barricades to prevent drivers from entering restricted areas by placing them in the closed traffic lane, closed shoulders, across closed roadways, or at closed ramps. In areas where the roadway is closed to through traffic, barricades are staggered to allow access to businesses and residents. Type II barricades are useful in low speed situations and for pedestrian guidance. Type II and III barricades may also have signs placed on them.

21.3.4 Traffic Control Cones

42-inch traffic control cones may be used to delineate and channelize traffic through the tangent section or activity area of lane closures and to mark specific hazards. Also, the 42-inch traffic cones may be used during flagging operations on two-lane two-way roadways.

42-inch Traffic Control Cones are allowed as channelizing devices and may be used in the following situations:

- On an urban project where there is space or sight restrictions.
- Any duration of work where the use of a plastic drum would restrict proposed lane widths to less than 11 feet including shy distance.

42-inch traffic control cones are not allowed in the following situations:

- Lane tapers

- Shoulder closures
- To delineate temporary traffic signal trailers, message boards or arrow boards
- To delineate roadside materials or equipment.

Contractor requests to replace plastic drums with 42-inch channelizing devices should not be allowed unless changes in proposed construction will restrict the lane widths as described above.

21.3.5 Vertical Panels

Consider using vertical panels when a project stage will remain in place for multiple years or where mounting other traffic control devices is impractical. In both cases, contact the Regional Work Zone Engineer for further guidance.

21.3.6 Lights on Devices

Four types of lights exist that may be used in a work zone. They are classified A-D and more detailed information may be found in WisMUTCD Part 6. The most common types of lights used in Wisconsin are Type “A”, which are typically used on barricades and Type “C”, which are used on drums.

It is the policy of the Department of Transportation that Type "C" steady-burn lights should be used as a supplement to traffic control drums only where drums are used as channelization devices and the condition of the usage requires that motorists must deviate from their expected travel path when approaching or within a work zone:

1. In transition tapers at lane-drops, lights should be used on each drum from the beginning to the end of the lane-drop taper. In the case of lane-drops where the traffic will subsequently cross through a median crossover into a two-lane two-way traffic condition, lights should be placed on each drum in the initial transition, the tangent buffer area and the drums used to direct traffic from the single lane into the crossover. Where the length of the tangent buffer area exceeds three times the taper length, lights should not be used in the tangent buffer area.

2. At temporary exit ramps, lights should be placed on each drum in the gore area of the temporary exit ramp as follows: If drums are used adjacent to the mainline, on the first 5 drums, and when drums are used along the left side of the temporary ramp, to the point where traffic rejoins the permanent ramp. A minimum of 5 drums to a maximum of 10 drums will normally be used for the latter condition.

3. Short areas of control within a work zone such as a shift of traffic onto part or all of the shoulder around bridge work or other isolated work areas. Lights should be placed on the drums used to taper or transition the traffic into the temporary path.

4. Other areas which the designer or field engineer feels necessitate the use of lights on drums to provide a higher degree of control to attain an appropriate condition for motorist safety. Urban or suburban areas where adjacent development creates a high level of ambient lighting which may reduce the effectiveness of drums with sheeting only is an example.

5. Lights should not be used on drums that are used for delineation of a lane and are placed parallel to the lane, except as provided in preceding paragraphs.

6. Steady burn lights, where used, shall be one-way (unidirectional) with the light source showing only toward adjacent approaching traffic, unless there is a clear application in which two-way lights would logically benefit traffic control and safety.

21.3.7 Concrete Barrier Temporary Precast (CBTP)

Temporary concrete barrier may act as a channelizing device, see the requirements in FDM 11-50-35 for use.

21.3.8 Temporary Lane Separators

Consider using temporary lane separators when a location needs greater attention, such as a gore. Flexible tubular markers or vertical panels may be used in conjunction with temporary lane separators. Contact the Regional Work Zone Engineer for further guidance when considering this device.

21.4 Temporary Tape Rumble Strips (TTRS)

Temporary Tape Rumble Strips (TTRS) are traffic control devices used to alert motorists of changing roadway conditions by causing vibratory and audible alerts to vehicles when driving over them. TTRS are orange in color,

¼ inch thick by 4 inches wide, consist of a polymer with pre-applied adhesive and are adhered to the pavement. Consider installing temporary tape rumble strips (TTRS) upstream of the work zone to increase the safety of the work zone when lane closures, lane shifts or crossovers change the conditions of the roadway which would require additional driver attention or when a new temporary stop condition has been introduced through a stop sign or temporary traffic signal.

Figure 21.4 Temporary Rumble Strips

A 2021 study showed when TTRS were installed upstream of a work zone with a lane closure, speeds decreased by up to 2 mph more than when TTRS were not installed. The Missouri Department of Transportation also completed a study and found that the before and after traversing the rumble strips segment shows rumble strips decreased the speed violation by 68.0 percent. (https://spexternal.modot.mo.gov/sites/cm/CORDT/cmr22-004.pdf)

21.4.1 Temporary Tape Rumble Strips for Lane Closures, Lane Shifts and Crossovers

Consider the following factors when installing TTRS on a project that has lane closures, lane shifts or crossovers:

1. Duration
    a. If the project has long-term lane closures, lane shifts or crossovers lasting 14 days or more, TTRS may be installed.
    b. If the project has daily/nightly lane closures, TTRS should not be placed.
2. Noise Consideration
    a. Projects near residential properties or businesses should not install TTRS as the TTRS create noise and could become problematic for residents/businesses nearby.
3. Placement
    a. TTRS should not be placed at the end of the season due to winter snow plowing and maintenance.
    b. TTRS should be removed before the first snow to ensure plows do not remove them with the blades and leave pieces flapping or off in the ditch.
4. Speed
    a. TTRS may be used on facilities with a posted speed of 45 mph or greater.
5. Smart Work Zones
    a. TTRS may be used in conjunction with any smart work zone system. (Ex. Basic Queue Warning System, Portable Real-Time Queue Warning System, Dynamic Late Merge System)

Refer to STSP and SDD 15D12 and SDD 15D41 for more information.

21.4.2 Temporary Tape Rumble Strips for New Stop or Signal Condition

When temporary stop signs or signals are installed at one-lane two-way work zones, TTRS may be added to provide additional warning to drivers. When a new stop or signal control is added to an intersection, TTRS may also be added on the approaches that have changed from uncontrolled to stop or signal controlled for a period up to three months. Consider the following factors for installing TTRS for a new stop or signal condition:

1. Speed of facility
    a. Facilities with speeds 45 mph and greater have longer stopping sight distances may consider TTRS.
2. Crash history

a. If a location has a known history of crashes, consider adding TTRS. Any intersection safety improvement projects should include TTRS.

3. Traffic Volume

a. Consider peak hours when determining to use TTRS. Low AADT roadways may consider TTRS if there are peak hours when traffic volumes create intersection conflicts. Also consider the type of traffic the area experiences. Local or commuter traffic that is conditioned to the area will need more warning of the new stop or signal condition then drivers unfamiliar with the area.

4. Location

a. Residential areas may be impacted by the noise from the rumble strips. Public information should be provided to residents along the roadway with the TTRS to the benefits of the TTRS and why they are installed.

5. Weather

a. The TTRS will need to be removed prior to the winter months as snowplows will damage them.

21.5 Work Area Ingress and Egress

Ingress to and egress from work areas presents significant challenges. Hazards are compounded when the roadway carries high traffic volumes, high heavy vehicle percentage or operates at high traffic speeds. Safety challenges include:

- Motorists following construction vehicles into the work area;
- Deceleration of construction vehicles as they enter the work area and acceleration as they exit and enter open traffic lanes; and
- Proximity of workers on foot to ingress and egress locations.

In order for roadway construction projects to maintain safe operations, there must be procedures to allow for safe and efficient passage of work vehicles into and out of the work area and for motorists to travel through the work zone. Effectively addressing safe ingress and egress at the project level requires planning during the project development phase and implementing traffic control plans throughout the entire project. Therefore, designing work area ingress and egress is a critical aspect of the design process and should be considered when developing the TMP during planning and design phase of project development.

Consideration must be given to addressing how the contractor will safely move personnel, materials, and equipment into and out of the work area with minimum disruption. Proper work area ingress and egress improves safety for both the workers inside the work area and the traffic which may be traveling adjacent to the work area. Proper work area ingress and egress plans will:

- Allow for completion of intended work in the stage
- Minimize the impacts of slow construction vehicles on through traffic
- Reduce the number of vehicles following construction vehicles into the work zone
- Provide access control for driveways, intersections, and interchanges
- Improve communication with emergency responders; and
- Separate workers on foot from construction vehicles accessing the work zone.

Providing safe work area ingress and egress is mandated by the FHWA’s Final Rule on Temporary Traffic Control Devices (23 CFR 630 Subpart K § 630.1108 e). Proper work area ingress and egress is unique to every project and each project will have different requirements.

The design of ingress and egress points on a project with positive protection such temporary concrete barrier has safety and operational impacts to the work zone. Openings in this type of construction may potentially expose blunt ends to traffic.

21.5.1 Work Area Ingress and Egress Maps

The location of the work area ingress and egress points should be considered early in project development when developing the staging plan. Consider the following characteristics when identifying work area ingress and egress locations:

- Traffic characteristics (volume, speed, lane distribution, etc.)
- Lane and shoulder width
- Presence of concrete barrier, guardrail, crash cushions
- Pavement condition (joints), location of storm sewer structures (inlets, manholes)

- Adequate space for signs (type I, type II, fixed message)
- Stopping sight distances
- Location of horizontal or vertical curves
- Lighting
- Roadway geometry between travel lane and work zone
- Type of work to be performed in the area (for example, excavation for storm sewer or above- grade obstructions such as piling or bases for bridges, signs or lights)
- Weaving patterns between access points, intersections or interchanges (for example, access locations cannot be placed within 1,500 feet of interchanges)
- Emergency responders accessing the work zone
- Number of ingress/egress points to improve communication with emergency responders and delivery personnel
- Size, frequency and timeframe of deliveries
- Road restrictions for truck sizes
    - OSOW restrictions on Interstates or State Highways
    - County or City restrictions on local roads

21.5.2 Traffic Control Construction Details for Work Area Ingress and Egress

Provide a traffic control construction detail for work area ingress and egress on high profile public interest, especially on high speed, high volume projects. These construction details should be unique to each project but consider the following characteristics as well:

- Advanced warning signing and spacing
    - Fixed message and traffic control signs for trucks entering or exiting
    - Ingress and egress identification signing for emergency responders
- Channelizing device layout and spacing
- Temporary pavement marking layout
    - Identify locations for temporary raised pavement markers (RPMs)
- Concrete barrier layout
    - Exposed ends must be protected with approved end treatments
    - Identify locations for glare screens
- Acceleration and deceleration lane length and width
- The grade for the acceleration and deceleration lanes
- Taper rates or lengths
- Nighttime operations may require additional lighting
- Provide a procedure for when the ingress or egress is not in use:
    - Barricades with “Lane Closed/Road Closed/Bridge Out” signs
    - Channelizing devices
    - Covering inappropriate signs or installing fixed message signs over existing signs
- If necessary, develop a procedure for flagging or stopping traffic to allow ingress and egress.
- Tracking pads
- Parking/stopping locations or loading/unloading areas.

Consider the adequacy of tapers to allow construction vehicles to slow down before entering the work area, or conversely to merge at an appropriate speed upon exiting the work area. Improper design of work area ingress and egress points can cause traffic speeds to drop as merging construction vehicles impact the flow of through traffic. The slower speed may lead to rear end or run off the road crashes in the queue that form well away from the ingress and egress points.

21.5.3 Other Design Considerations - Work Area Ingress and Egress

In addition to the development of work area ingress and egress maps and construction details, there are many other work area ingress and egress elements which must be considered during the design phase. The elements to be considered can be categorized as design tasks, traffic control enhancements, traffic operations impacts, and construction operations effects. The elements listed below vary from project to project and are not all inclusive of potential construction ingress or egress operations.

Design Tasks:

- Development of work area ingress and egress plan for each individual construction stage
- Design of temporary haul roads
- Temporary fence or gates required during active and inactive operations
- Display the work zone clear zone requirements on the construction staging typical sections

Traffic Control:

- Proper guide sign placement for entrance and exit ramps
- Use of traffic control drums, type III barricades, flexible tubular markers, temporary raised pavement markers (RPMs),
- Use of temporary precast concrete barrier, end treatments or guardrail
- Utilization of PCMS or DMS during active access operations
- Locating speed limit reduction signs and speed trailers in advance of ingress locations

Traffic Operations:

- Signalization needs including temporary signals, vehicle detection, or signal phasing
- Ramp meter operation for ingress and egress near entrance ramps
- Physical turn restrictions for trucks at intersections or other ingress and egress locations
- Staged overhead clearances with utility wires, signal arms, sign bridges and bridges
- Pavement marking modifications
- Construction traffic speed differential with the posted speed upon re-entering travel lane
- CCTV camera utilization
- Work area ingress and egress restrictions during adverse road conditions

Construction Operations:

- Safe contractor parking locations outside clear zone, acceleration or deceleration lanes, and local roads
- Deceleration and acceleration lane shall be clear of debris and dirt that can be tracked onto the roadway through roadway sweeping and tracking pad installation
- Deceleration and acceleration lanes should be properly delineated from live traffic lanes and should be accessible at all times when in use
- Consider specialized construction operations such as bridge demolition, deck pours, crane mobilizations, beam setting, lighting, etc.
- Provide maps for truck drivers for clear work area ingress and egress, and establish good communication with truck drivers
- Staging of heavy equipment inside the work area
- Anchoring temporary concrete barrier if needed to protect a hazard or work area

21.6 Pavement Drop-off Protection

A drop-off is considered a change in elevation parallel to an adjacent travel lane 2 inches and greater with a slope steeper than 3H:1V. Drop-offs need to be properly protected to ensure vehicles and pedestrians can safely traverse the work zone. Common locations of drop-offs are between adjacent lanes of traffic, at pavement edges, on bridge decks, or between a work area and the sidewalk. Adjacent lane drop-offs are particularly dangerous for motorcycles. Prior to reopening travel lanes ensure an uneven lane condition does not exist, if it does add appropriate signing to the plans. To fulfill this goal, certain traffic control devices can be utilized. Use SDD 15d39 when drop-offs are anticipated.

If drop-offs greater than 4 inches are anticipated to exist for more than 48 hours and is within 8 feet of the edge of the traveled way, use temporary barrier or eliminate the drop-off using a 3H:1V slope of compacted aggregate material. See FDM 11-50-35 for more information on temporary concrete barrier.

For activities such as base patching, consider developing special provisions that limit the work area for a contractor.

If the project team determines that more clear zone is necessary, use special provisions to change the standard specifications.

Use special provisions to limit the depth of drop-offs. Contact your Regional Work Zone Engineer when developing limits for drop-offs.

21.7 Freight Consideration

Construction staging can adversely affect larger vehicles' ability to maneuver into and within the project limits.

For projects located on the OSOW Truck Route, verify that all OSOW-MT and OSOW-ST vehicles which can safely navigate in the preconstruction condition, can navigate safely during all stages of construction (see FDM 11-25-2.1.1 and FDM 11-25 Table 2.2). If unable to accommodate all required vehicles throughout construction, document these vehicles and propose mitigation techniques.

21.7.1 Multi-Trip Vehicle Dimension Consideration

Multiple-trip permit OSOW vehicles (OSOW-MT) exceed the legal semi-truck criteria to use the highway system. The permits are not load specific or route specific and are not required to check 511 prior to commencing a trip. Multiple Trip permits authorized by Wisconsin state statutes 348.27(2) and (7) may travel on any road or over any bridge (including culverts), unless the roadway or structure has been restricted in a manner consistent with various laws authorizing local or State personnel to restrict, e.g., weight posting. The envelope for these multiple trip permits are: 16 ft high; 15 ft wide; 150 ft long and 170k gross vehicle weight (gvw).

Lane and height restrictions that would restrict the movement of these OSOW-MT vehicles shall be identified and signed using appropriate signage. Special consideration shall be given to tight radius loop and interchange ramps to accommodate the longer vehicles.

21.7.2 Wind Tower Corridor Considerations

Wind towers sections are currently built and shipped out of Manitowoc, Wisconsin. The typical maximum load dimensions for these loads are 15 ft-8 in High, 205 ft Long, and 15 ft-1 in Wide. The dimensions of these loads have required extensive coordination and research to identify and maintain available corridors. See the OSOW maps for routes designated as Wind Tower corridors.

On projects located on these corridors, a minimum 16 ft travel lane shall be maintained in each direction. Due to the length of these vehicles, route the "Wind Tower Base" vehicle through the work zone using Autoturn to confirm off tracking will not impact the work zone.

If unable to maintain a 16 ft clear width, coordinate with adjacent regions and the BHM Freight Section to ensure viable routes exist.

21.7.3 High Clearance Routes

The Department has adopted statewide high clearance routes to maintain clearance for oversize loads up to 20 ft in height. On these routes, all temporary signals, signage etc. should be positioned to not impede loads up to 20 ft in height.

21.8 Traffic Control Quantities

When developing the traffic control quantities, include Traffic Control 643.5000. This item covers the installation, repositioning, and removal of the traffic control devices. However, Traffic Control 643.5000, does not include providing the devices and each project will need to include the individual bid items for each device that are used on the project. For sign covering see FDM 11-50-20.7.2.

21.9 Design of Traffic Control Plans

A checklist for use in the design of traffic control plans is included in Attachment 21.2.

21.10 Speed Control During Construction

Some motorists respond to a reduced speed, while others do not see a need to slow down. This may cause a differential in speed among drivers which is at times more dangerous than consistent higher speeds. Studies have indicated motorists will drive the speed they feel comfortable driving..

In 1994, Wisconsin legislature passed a law doubling the fines in work zones for certain moving violations. Speeding in a work zone is one of the violations for which the fine is doubled. For this law to be effective, reduced speed limits must be warranted, consistently set, and clearly posted in the work zone. On projects which have tourist traffic, congested conditions, major traffic volumes or other factors which make speed or other moving violations a major concern, the sign "Fines Double in Work Zones" (W21-61 or W21-62) may be placed on either end of the project.

Refer to the temporary traffic control zones speed reduction policy in TEOpS 13-5-16 for further details.

21.10.1.1 Speed Feedback Trailers

Speed feedback trailers may be deployed to increase motorist compliance with the posted speed limit. It is best practice to reposition the speed feedback trailer throughout the work zone as the work area moves. Leaving the speed feedback trailer in the same spot for longer than 3 weeks has the potential to lead to driver disregard, so it is recommended to reposition the speed feedback trailer periodically for the duration of the project.

According to a Michigan State Report, *Improving the Effectiveness of Speed Feedback Trailers in Freeway Work Zones* (Improving the Effectiveness of Speed Feedback Trailers), speed feedback trailers are most frequently used for lane closures, followed by traffic shifts. "Although speed feedback trailers were generally effective at reducing work zone speeds regardless of the deployment characteristics, they tended to be more effective when positioned closer to the work area, including ingress/egress locations. Thus, if only a single speed feedback trailer is to be used, which is commonly the case for work zones of a shorter distance, it should be positioned near the work area, approximately 200 ft upstream of the start of the active work."

Figure 21.10.1.1 Speed Feedback Trailer

21.10.1.2 Combination Work Zone Digital Speed Limit – Speed Feedback Sign Trailer (Speed Wizard)

The speed wizard is very similar to the speed feedback trailer but includes a digital speed limit sign along with the speed feedback sign on one trailer, see Figure 21.10.1.2 below. The speed wizard collects speed data and can be connected to the Work Zone Data Exchange specification to share real-time information to motorists about what the speed limit is. It is recommended a speed wizard be used if there is traffic mitigation on the project which would then provide law enforcement with information on what speeds are in the work zone and where to target their speed enforcement.

Figure 21.10.1.2 Speed Wizard

21.11 Detours

The Department will normally provide detours for traffic routing when the contract closes a state trunk highway to through traffic during construction. These are usually intended for use for short duration. See FDM 4-15-1 for a discussion of detour use.

When the detour causes abnormal inconvenience to the public which results in excessively high vehicle operating costs, the addition to the contract of interim liquidated damages should be considered.

These interim liquidated damages are separate from, and are assessed in addition to, the liquidated damages as contained in the Standard Specifications. The intent of their use is to motivate the contractor to complete a portion of the construction timely, as stated in the contract, to allow discontinuation of the detour and to reopen the specified section of highway to through traffic.

Interim liquidated damages are considered fixed and agreed damages due the state from the contractor for the inconvenience caused to the public by the continued closure of the section of highway beyond that time specified in the contract.

The use of interim liquidated damages may be appropriate on all projects where there is a need, regardless of the source of funding. Justification for such use shall be included in the Design Study Report.

The method for calculating the amount of interim liquidated damages to be applied to a project is contained in FDM 11-2-1.7 and additional information is contained in FDM 11-50-32.

21.11.1 Detours – Construction Under Traffic

The method of constructing a project, including handling the traffic (whether it be local, through, or emergency traffic), needs to be resolved early in the project development process. If the job is to be built under traffic, traffic safety and construction methods must be considered in specific detail in the planning, design, and construction of the project. If a detour is planned, some degree of construction on the detour route may be necessary in order to accommodate the detoured traffic, and this construction must be completed before traffic is detoured.

Road user costs should be considered when determining the merits of a detour. Incentive/disincentive contract provisions should be considered when road user costs for a detour are very high. The shortest detour that will provide adequate service at a reasonable cost should be selected. Selection of a long detour route over state trunk highways which may encourage heavy use and damage to local roads, should be avoided. The state can maintain only the marked detour route.

Early coordination with affected people and local units of government is necessary. Consideration must be given to not only thru traffic but also to farming operations, businesses, tourists, school transportation, civic events, police, fire and ambulance service. Detours should be discussed at public information meetings.

Even though the state has the right to detour a state trunk highway over any public road, agreement with local officials should be attained.

If a detour may encourage use of local roads which are not the marked detour, local officials should be notified of this possibility and informed that the state cannot repair damage to local roads that are not the marked detour.

Evaluation of the detours (as well as potential haul roads) by the region staff and local officials is required before traffic is detoured. Special consideration must be given to roadway geometrics, pavement condition, bridge ratings, and all safety items. Agreement should be reached on what repairs are needed before the road can be used for the detour. A video tape of the route serves as a very good log of pre-detour conditions.

Detours that may affect another region should be coordinated with that region office.

Selection of detours for connecting highway construction should be closely coordinated with local officials since they are responsible for maintenance of detours over their local streets.

21.11.2 Local Detours

For projects impacting local roads, the signing of detours is normally performed by the responsible local authority. If considering including a detour route for the local road, Section 84.20 of the Wisconsin Statutes states that damage to any county trunk or town highway or city or village street caused by reason of its use as a detour designated by the department shall be repaired by the department. The Department will not designate detour routes for local routes, the responsible local authority will designate the route. Have the local authority designating a detour complete attachment 21.1 and attach the completed document to the TMP in Section 6. For local route detour plans utilize only the M4-9 and M4-59 series of signs for Town or Local roads as shown on SDD 15c02. Cost shares associated with signing the detour route should be determined in the cost sharing agreement. During public involvement note that the detour route is chosen by the local authority.

Example: Replacement of bridge over interstate

A state bridge that carries a local roadway over the interstate is reconstructed requiring closure. The local authority request that a detour is added to the plan. The design team asks the local authority to complete attachment 21.1 designating the detour route. Once completed the document is attached to the TMP in section 6. If the local authority refuses to complete attachment 21.1 a detour route will not be signed for the project.

21.12 Emergency Response to Project Issues

Certain projects may benefit from the addition of special provisions that require the contractor to respond to the project outside of normal work hours. The type of situations that may require this timely response would be to repair displaced temporary concrete barrier, end treatments, or the roadway surface. Projects on rural interstate segments away from population centers could consider adding this type of special provision to the project. In order to justify adding such a special provision to the contract, the road user costs generated by delays from the contractor not responding to the site to reopen the roadway must be calculated. A liquidated damage will then be developed for the purpose of charging the contractor for failing to respond to the project in the allotted time. In order to reduce the amount of risk to the contractor a reasonable amount of time to respond to the project should be used prior to charging liquidated damages.

Steps for determining need of special provision

1. Justify the need
   a. Estimate the amount of time to travel to the project from population centers
   b. Determine road user costs from inability to open roadway
   c. Add the strategy to the TMP and document the justification
2. Develop the special provision
   a. Use the average amount time from the population centers as a means for giving the contractor time to respond
   b. If the project already has lane rental assessments those values could be used in determining the liquidated damage special provisions. If they are not already part of the project, the liquidated damage costs should be developed as normal.
3. Add the special provisions to the contract.

21.13 Connected Devices for Real-Time Work Zone Reporting

Connected devices in work zones provide real-time information to WisDOT, motorists and other third parties to make work zones safer for the traveling public and workers.

Per FHWA, "Improving access to work zone data is one of the top needs identified through the USDOT's Data for Automated Vehicle Integration (DAVI) initiative. Up-to-date information about dynamic conditions occurring on roads – such as construction events – can help ADS and humans navigate safely and efficiently."

Connected devices combine hardware that is mounted on traffic control devices and software to communicate work zone information in real-time through the Work Zone Data Exchange (WZDx) Specification. For more information on the Work Zone Data Exchange, see the FHWA Website: https://ops.fhwa.dot.gov/wz/wzdx/index.htm. WisDOT used planned data from the Wisconsin Lane Closure System (WisLCS) to publish a WZDx feed through the Advanced Traffic Management System (ATMS). Connected devices used in work zones are associated in the ATMS with a planned event from WisLCS and then updated in the WZDx feed to a verified/real-time event.

Currently, WisDOT uses the following connected devices:

1. Connected Arrow Board
2. Connected Work Zone Start and End Location Markers

21.13.1 Connected Arrow Board

A connected arrow board will look just like a regular arrow board, but there will be a modem attached to provide real-time information. A connected arrow board can be manufactured with the components or a retrofit kit can be added to a regular arrow board to make it connected. The following are benefits to deploying connected arrow boards:

1. Real-time lane closure information, shared with 511WI and Waze
2. Historical lane closure information
3. Alert drivers of a lane closure ahead and which way to merge

For real-time information to be shared, projects are required to have a connected arrow board and work zone start and end location markers. Additional information can be found in the Standard Detail Drawings.

21.13.2 Connected Work Zone Start and End Location Markers

Connected work zone start and end location markers are used to mark the start of the work zone and the end of the work zone. The start marker is placed at the "Road Work 1 Mile" sign or the "Road Work Ahead" sign and the end marker is always placed at the "End Road Work" sign. The benefit of using work zone location markers is drivers will know where the work zone starts and ends. WisLCS uses approximate locations, while the work zone location markers will update the geometry to the exact location to where the devices are placed in the field. Additional information can be found in the Standard Detail Drawings.

21.99 References

1. Wisconsin Manual on Uniform Traffic Control Devices (WisMUTCD)
2. FHWA's "Guidelines on Work Zone Access and Egress" AASHTO Roadside Design Guide
3. ATSSA Guidance for Use of Temporary Rumble Strips in Work Zones, 2013

LIST OF ATTACHMENTS

Attachment 21.1	Sample Local Road Detour Designation
Attachment 21.2	Work Zone Traffic Control Plan Review Checklist

FDM 11-50-22 Traffic Control Plans for Divided Highways — August 17, 2020

22.1 Traffic on Divided Roadways

When planning construction projects on divided highways, all feasible alternatives that would maintain one-way operation on each roadway should be considered. These include the following options:

- Construction under traffic
- Placing traffic on existing or renovated shoulders
- Constructing temporary bypasses
- Detouring traffic to other routes

If one of these alternatives is determined to be feasible, the cost should be compared to the alternative of providing a means of separating two-way traffic on one roadway of the divided roadway. Maintaining one-way traffic on each roadway is the preferred method of control unless the construction operations do not allow it.

Two-lane, two-way operation (TLTWO), otherwise known as bi-directional traffic, on one roadway of a normally divided highway shall be used only after careful consideration of other available methods of traffic control. Where the TLTWO is used, the traffic control plan shall include provisions for the separation of opposing traffic.

When the TLTWO is used on one roadway of a normally divided highway, it is not sufficient to separate traffic with only centerline striping, raised pavement markers and complimentary signing. Typically, the separation of opposing traffic in this situation includes the use of either tubular markers, drums or concrete barriers in addition to other items mentioned above.

In the transitions at the ends of the TLTWO, the typical traffic control plan will include a variety of the commonly available types of traffic control devices depending on the situation. Concrete barriers should be considered for use in high speed and relatively high traffic volume situations.

22.2 Lane Shifts

Lane shifts are a good way of maintaining lanes of traffic. In some locations, lane shifts can be deployed with only removing and replacing the pavement markings. In other locations, temporary widening or replacing the shoulders may be necessary to accommodate a lane shift. Document the cost of the temporary surface in the TMP. SDD 15d41 provides details for lane shifts on divided highways.

22.3 Lane Closures

Lane closures are frequently used to complete work on the roadway. When considering lane closures, traffic analysis must be completed. For more information on the traffic analysis see FDM 11-50-30. The traffic analysis will determine when and for how long lane closures are acceptable.

When lane closures will be used on a project, use the standard detail drawings. SDD 15d12-a is for a single lane closure with a speed reduction. For more information on the process of speed reductions, see FDM 11-50-21.10. When a speed reduction is used, the traffic control should follow SDD 15d12-b. For projects that expect delay and will be deploying a dynamic late merge system, SDD 15d12-c should be used.

Look to make sure the lane closure SDDs will be sufficient. Do not locate lane closure tapers on horizontal and vertical curves.

Lane closures that use the dynamic late merge system or have potential issues with speed, a lane shift may be added. In the case of the dynamic late merge system, the lane shift would be used to keep the DLMS one side of the roadway for the duration of the project. For speed, the lane shift after the lane closure will help slow drivers down.

In cases when more than one lane will be closed use SDD 15d14. This would only be used for closures less than 24 hours as most roadways would have too much volume for the remaining single lane to handle.

22.4 Lane Width

When space constraints become an issue, lane widths may be narrowed. Lanes widths may be reduced to 11 feet. Make sure to consider freight movements within the narrow lanes. When this is considered, also look at the shy distance from roadside hazards.

22.5 Entrance and Exit Ramps within Lane Closures

The entrance and exit ramp design guidance in this section pertains to locations that are affected by lane closures as shown in SDD 15d15. Interchanges affect how the work zone operates especially when volumes are higher on the mainline or the ramp. Limitations do exist on the standard detail drawings and each location must be examined to determine the best option, which may require the development of specific details for each project. Work with your regional traffic section when determining the best treatment for a specific interchange.

22.5.1 Design Elements

Evaluate the following design elements when lane closures will impact interchanges:

1. Determine where the interchanges are located.
2. For each location determine:
    a. Location of work
    b. Closed lane
    c. Volumes
    d. Truck percentage
    e. Existing geometry
3. When work occurs within a right lane closure provide a parallel ramp entrance and exit ramp as shown in SDD 15d15-a and SDD 15d15-e.
4. If the work is near the end of the ramp, determine if the ramp can be closed.
    a. Consider if the location is used regularly for emergency vehicles as an access point to the mainline or for hospitals in the area.
    b. Determine a detour for traffic that has lost access to and from the mainline facility.
    c. If the ramp must remain open and a physical barrier is present that prevents the creation of a parallel entrance ramp, provide enough acceleration length as possible. SDD 15d15-c may be used in this case.
5. When work occurs within a left lane closure examine the existing geometry to determine if additional traffic control is needed.
    a. If the location has a parallel entrance ramp design or an auxiliary lane is present and will remain in operation, the existing traffic control may be adequate.
    b. For locations that do not have a parallel entrance ramp or auxiliary lane, determine if the combined volume of the mainline and ramp is approaching the capacity of the single open lane. If the closure will be in place long term and is cost effective use SDD 15d15-b to create a parallel entrance ramp with temporary pavement.
    c. Interchanges that include loops and ascending ramps may create issues for merging traffic to find gaps. Consider using a lower capacity threshold for the mainline traffic that allows gaps for the merging traffic. Work with your regional traffic section to determine the lower threshold. If that capacity is exceeded than the use of SDD 15d15-b would be warranted.
    d. If the closure is in place intermediate duration or less use SDD 15d15-d.
    e. For exit ramps, the existing geometry and traffic control may be adequate.
6. When a left lane closure occurs on a facility that has three lanes or more, additional traffic control will not be needed, unless more than one lane is closed. If mainline traffic is reduced to a single lane then see #4 of this section.

7. When mainline traffic has been shifted to either the median or outside shoulder, the ramp alignment will potentially need to be shifted to maintain proper merging geometrics. This may require temporary grading and asphalt paving.

Locations that have high truck volumes, consider extending the temporary parallel entrance ramps for a longer acceleration lane.

For exit ramps, consider the potential of traffic backing onto the mainline during construction.

22.6 Crossover Design (Construction)

The crossover design guidance in this section pertains to a construction crossover as shown in Figure 20.1, Figure 20.2, Figure 20.3 and SDD 15d11 (not a maintenance crossover), which is shown in SDD 11a11. There are two types of construction crossovers shown in SDD 15d11 – temporary crossovers and crossovers to remain in place.

The typical temporary crossover roadway has a 4:1 side slope. This type of crossover is intended for use in a construction season or contract. Occasionally, there is more than one contract that will require the use of a crossover constructed in a previous contract. However, at the end of the contract(s) using the crossover, the crossover is removed and the median restored.

The typical crossover roadway to remain in place has a 10:1 or flatter side slope for high-speed facilities. This type of crossover is intended to remain in place after the construction contract(s) is completed. Occasionally, there is more than one contract that will require the use of a crossover constructed in a previous contract(s). However, at the end of the contract(s) the crossover will remain in place for future use. During rare situations where a permanent crossover is used on a lower speed facility, follow the slope guidance in FDM 11-45-30.

Construction traffic control is the same for temporary crossovers and crossovers to remain in place. Crossovers that remain in place require traffic control after construction that makes clear to drivers that the crossover is not open and that using the crossover is not allowed.

Identify the station location and construction crossover type for each installation in the plan.

22.6.1 Location of Crossover

When locating the crossover, be sure the superelevation can fit in with the existing pavement. Locate it far enough away from intersections and interchanges to allow traffic to normalize prior to potential conflicting traffic from an intersection or ramp. Typically, a lane closure is prior to a crossover so enough space must be provided to allow the lane closure to occur outside the interchange or intersection area. Physical constraints such as bridges, marshy median areas, bridge piers, etc., also influence the locations of the crossover. The location of the crossover should be such that the height of both roadways is approximately the same. Terrain must be suitable for a crossover: adequate decision sight distance, median width, and minimal difference in elevation of the opposing lanes, preferably in a tangent section of the roadway.

22.6.2 Crossovers to Remain in Place

Cost savings may be realized if some crossovers on freeway projects are left in place after the project is completed. Because these crossovers are designed to carry Interstate traffic, they are constructed with a high-type pavement that adds to the cost. If crossovers are left in place, this cost may be partially recovered as a cost savings to future construction. Crossovers also leave options open for emergency construction and remain available for future transportation operations plans, including incident management.

Crossovers left in place must be closed with positive separation when not in use, unless the opening is designed to be left open and an exception is obtained from FHWA. The following are some examples where it may be advisable to leave temporary crossovers in place:

- Major River Crossings. At these locations, there is usually one preferred location where a crossover can be placed, and any future work would require the rebuilding of the same configuration.
- Locations with Physical Constraints. In some instances, certain factors (e.g., sight distance problems, closely spaced structures, nearby interchanges, elevation differences between lanes) limit where a crossover can be built. Even though projects may be at different locations, the location of a crossover may be set by these limitations.
- Future Projects in Same Area. If structure work is scheduled for one year and roadway work anticipated in the next five years, the same crossover may be used for both projects. Another example would be a series of structures that are rehabilitated over several years.
- In the area of a long bridge, if the long bridge is damaged, the crossover could be used for emergency rerouting of traffic.
- Use for future work if a project is programmed in the near future (2-4 years) and the crossover is in an

appropriate location.

When encountering situations as outlined above, the designer should:

- give consideration to leaving the temporary crossovers in place after the project is completed, include provisions in the contract to close the crossover during the time it is not in use
- discuss these provisions at the regular coordination meeting
- obtain FHWA and BTO/BPD concurrence

22.6.2.1 Criteria for Crossovers to Remain in Place

There are times when it is useful to leave a temporary median crossover in place after the construction is complete. Although it is not WisDOT policy to leave all median crossovers in place, there is merit in looking at crossovers on a case by case basis to determine if removal is appropriate. Concerns about leaving a crossover in place include:

- Drainage such as culvert sizing, culvert apron endwall (10:1 slope or flatter) according to FDM 11-45-30, and consideration of vane drains
- Snow melt running onto the travel lanes
- Illegal U-turn usage
- Future maintenance, including the periodic field review of the flexible tubular marker condition
- Life of the surface without traffic on it
- Appropriate location for future use. It may not be appropriate to install a permanent crossover where flood maps indicate a potential flood area
- Side slopes/end slopes shall be 10:1 or flatter when a crossover is left in-place after construction

Typically, there are issues using temporary barrier in permanent crossovers (adequate length of need, adequate length of barrier system for properly function, end treatments, etc.). It is not recommended that temporary barrier be used in permanent crossovers without discussion with BPD.

When leaving a crossover in place the following design parameters must be considered:

- Safety
- Alignment, desirable degree of curve, width
- Cross slope for drainage to median
- Median drainage, pipe size, design frequency
- Pavement thickness and type to support traffic and resist weathering during non-use
- Delineation when not in use (See SDD 15d11 – Traffic Control, Single Lane Crossover for an example) and provide appropriate signing to disallow U-turns

22.6.3 Design Elements

Evaluate these design elements for the installation of a construction crossover. Many of the items listed below are shown on Figure 20.1, Figure 20.2 and Figure 20.3. Traffic control for a single lane crossover is on SDD 15d11.

1. Determine appropriate location(s) for the crossover early in the design process to allow subsurface investigation to take place at the same time as the roadway subsurface investigation.
    a. Conduct subsurface exploration/investigation in the crossover area, which may include power or hand borings.
        i. Many times, the median becomes a location where waste material or other debris may be deposited. There is no way of knowing the depth and extent of possible poor soils without an investigation.
2. Provide a construction drawing in the plan showing the various design elements.
3. Fore slope design.
    a. Temporary crossover – provide a 4H:1V fore slope or flatter.
    b. Crossover that remain in place – provide a 10H:1V fore slope or flatter.
4. Show the curve radii at each end of each crossover roadway. If the pre-construction posted speed is 65 or 70 mph on the roadway, design the radius of curve based on the posted speed, but it should not be less than 4000 feet.
5. Provide a sag curve in the crossover between the mainline roadways. This may become more

challenging when the mainline roadways are at different elevations and the median width is narrow. Drainage must flow away from each mainline roadway to prevent water/ice from forming on the mainline.

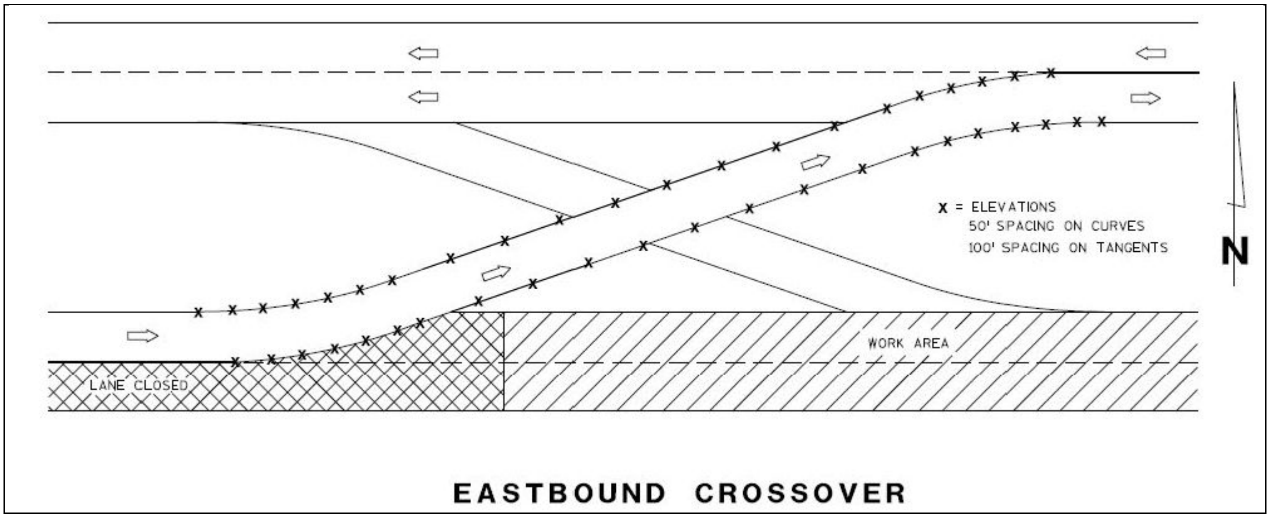
6. Show profile elevations in each direction and on each side of the proposed roadway, typically where the pavement marking edge line would be installed. Provide an elevation at least every 50 feet along curved sections, and every 100 feet along tangent sections.
7. When the profiles indicate that water ponding may occur it is recommended to consider a slotted drain installation. Contact BPD Design Standards and Oversight Section, Drainage Unit for assistance in the design and installation of slotted drains. The crossover is a rather large impermeable area and is generally difficult to get the surface water removed from the pavement quickly and surface drains must be considered.

   Pay attention to drainage in areas of cross slope rotation. One-lane crossovers typically have reverse curve alignments where the cross slope rotates from 2-percent left to 2-percent right. With a 2-percent cross slope, it is not necessary for this transition to be in the curve. It may be in the tangent at a location that is more favorable for drainage.
8. Pavement Structure. A pavement design is not required for crossovers, but the pavement structure should provide a practical, maintenance-free pavement for its intended surface life considering the soil conditions and estimated ESALs. A pavement crossover configuration is typically in the form of an X for a median width of 50 feet or wider (see Figure 20.1). A pavement crossover configuration may be in the form of a rectangle (large block) when the median width is less than 50 feet (see Figure 20.3).

   Experience has shown that a five-inch or six-inch thick HMA pavement over 12 inches of base aggregate dense has performed well on interstates and other high-volume roadways throughout the state. Four or five inches of HMA over 10 or 12 inches of base aggregate dense is typically used for all other roads.
   a. Temporary crossover – HMA pavement is recommended and will accommodate efficient removal. Use Asphaltic Surface Temporary bid item. Experience has shown that an HMA mix with 19 mm, 25 mm, or 37.5 mm aggregate is preferable since it can be placed in a single layer up to six inches thick (see Standard Spec 460.3.2).
   b. Crossovers to remain in place – may be HMA or concrete pavement.
      i. If using HMA for crossovers to remain in place, use the HMA Pavement bid items. The pavement can be placed in one or multiple layers.
      ii. If using jointed plain concrete pavement, then local aggregates may be used in the concrete mix even if the adjacent pavement will be constructed with high performance concrete.
9. Traffic control for on-ramps and off-ramps. Refer to SDD 15d7 for exit ramp traffic control where the exit crosses the median. Refer to SDD 15d8 for entrance ramp traffic control where the entrance crosses the median.

WisMUTCD Part 6 states, “the basic safety principles governing the design of permanent roadway and roadsides should also govern the design of temporary traffic control zones.” The goal should be to route traffic through such areas using geometrics and traffic control devices comparable to those for normal highway situations.

***Figure 22.1* Eastbound Crossover**



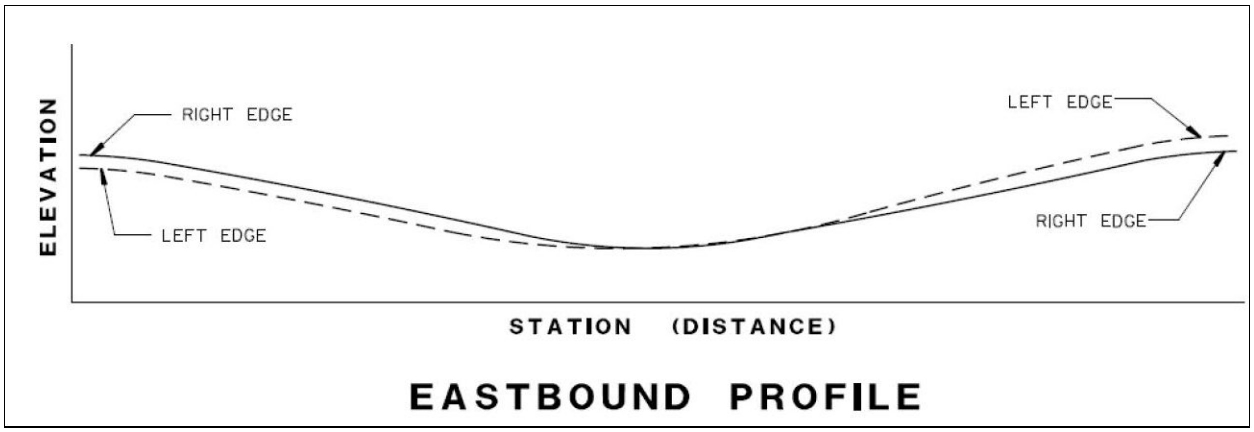
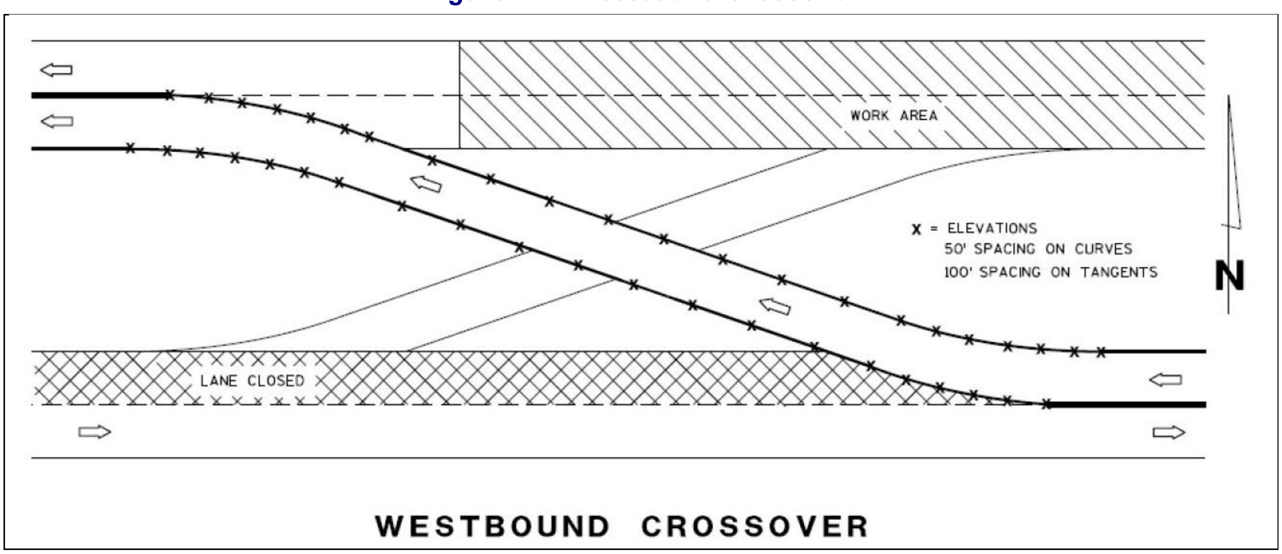


***Figure 22.2* Westbound Crossover**



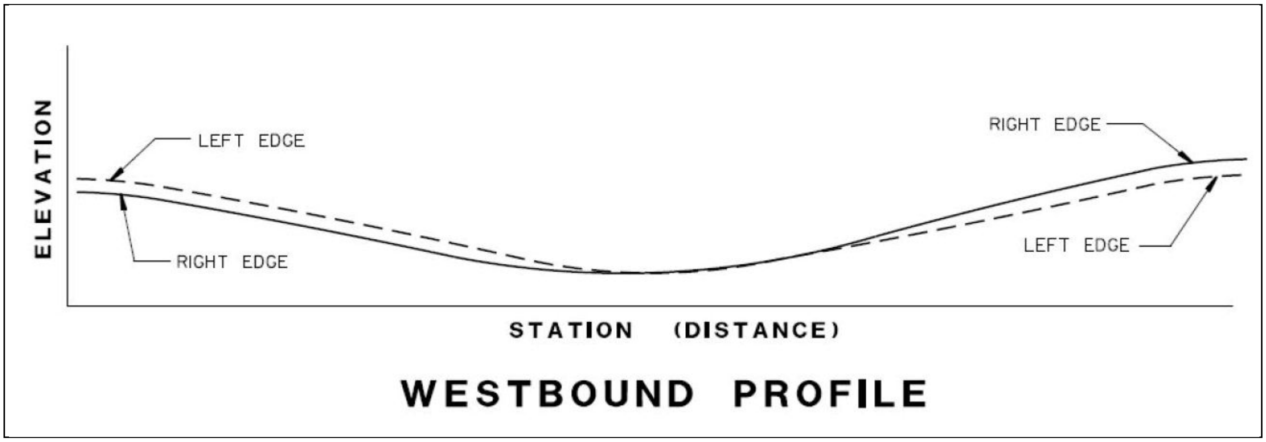
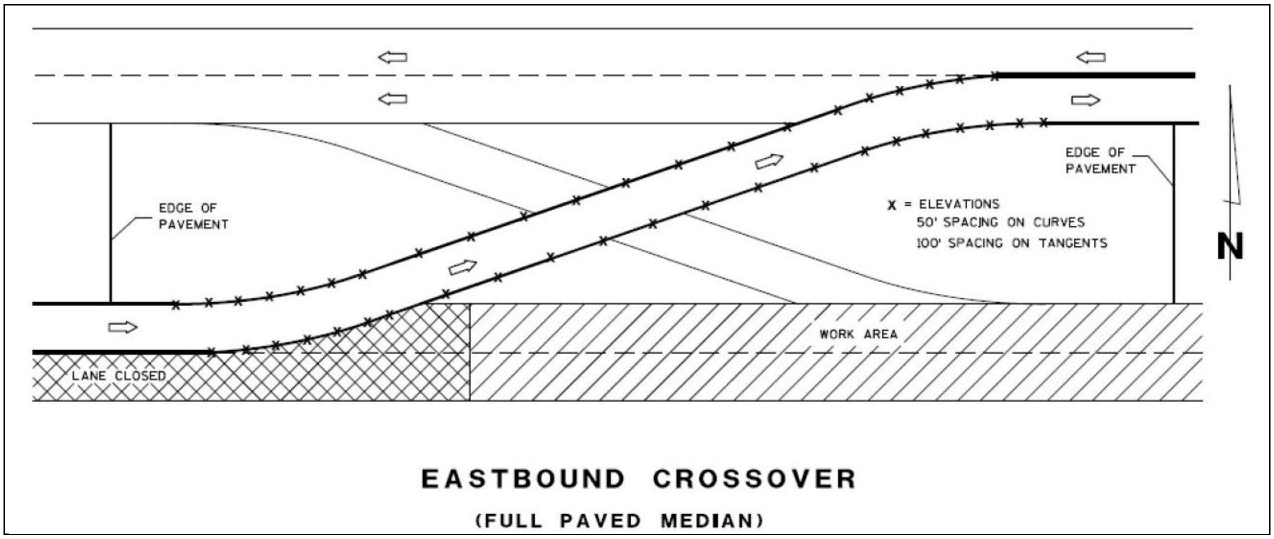


***Figure 22.3** Eastbound Crossover (Block Paving Style)*



22.99 References

1. [Wisconsin Manual on Uniform Traffic Control Devices (WisMUTCD)]
2. Southwest Improvement Guide 7-25-50

FDM 11-50-23 Traffic Control Plans for Undivided Highways *November 15, 2023*

23.1 Traffic on Undivided Highways

When planning constriction projects on undivided highways, all feasible alternatives that would maintain traffic operations should be considered. Evaluate the following design elements to determine which strategy will be the most feasible:

1. Determine the traffic volumes
2. Determine the construction activities that will be taking place
3. Determine the roadway geometry

23.2 Lane Shifts

When the roadway geometry allows, traffic may be maintained by utilizing a lane shift. This will typically occur in locations that have parking lanes that may be used. Traffic may also be shifted onto a shoulder that is paved. Traffic shifts may require construction staging to complete the work.

23.3 Lane Closures

Lane closures may be utilized on roadways that have multiple lanes in each direction. In an area with signals, the signal timing must be considered when closing a lane. Lane closures may also be used in conjunction with lane shifts and would function like a crossover on a divided highway by putting all traffic to a single side of the roadway. Construction staging is typically used when closing lanes.

23.4 Flagging

When considering different strategies, flagging may be considered on many roadways. Flagging is typically performed when work on the roadway can be completed within a day and an appropriate driving surface is available when the work is complete. Flagging is also used when an alternative route is impractical. Most roadways that have the best ability to accommodate flagging typically have an AADT of 5,000 vehicles per day (vpd) or less. Hourly volumes should then be checked to determine if they are below 600 vehicles per hour (vph). If volumes exceed 600 vph, add hourly restrictions to when flagging may occur. Check the area where the project occurs to determine if there are any traffic generators such as schools or factories that will cause significant queuing during a flagging operation. If the roadway is hilly, check to make sure truck percentages are low, as large trucks will have a difficult time accelerating up hills and this could have an impact on clearing the queue traffic.

Depending on the type of work flagging operations will move over the course of a day.

Temporary Portable Rumble Strips are required on flagging operations.

Temporary Portable Rumble Strips (TPRS) are traffic control devices used to alert motorists of changing roadway conditions. TPRS consist of textured rubber strips placed perpendicular to the direction of travel and weigh approximately 110 pounds. TPRS are not fastened or adhered to the pavement and are able to be placed with two workers. A 2016 speed study performed on a rural two-lane flagging operation during off-peak hours using TPRS in Wisconsin resulted in a daily average 85^{th} percentile speed reduction of 5 MPH, a daily average reduction of speed violators by 45%, and a daily average of motorists braking of 33%.

Advantages of TPRS:

- Increase driver awareness through audible and vibratory alert of upcoming conditions
- Increase compliance to standard traffic control devices
- Increase braking and reduced speeds
- Ease of installation and removal
- Reusable

Disadvantages of TPRS:

- May cause erratic or avoidance maneuvers by drivers
- May cause rough ride or hazard for motorcycles
- May move due to inadequate installation
- Nearby residents may complain due to noise

Refer to SDD 15c12 for layout details.

Pilot cars may be used on any flagging operation. Pilot cars are used to lead traffic from one end of the project to the other end and are the best method of controlling the speed that is traveled through the work zone. Pilot cars are typically used on projects that will have long distances between flaggers.

The distance of a flagging operation is determined by the work activity occurring. During pavement surface work flagging operations may extend a few miles. Culvert or landscape work the flagging operation may only be a few hundred feet. As the distance between flaggers increases the more likely additional flaggers will be needed at intersections within the work zone.

Nighttime flagging may be used when an alternative route does not exist and nighttime volumes are low. This allows some flagging operations on routes that are significantly higher than 5,000 AADT. Nighttime flagging is typically done only when necessary. Flaggers need to be illuminated so they can be seen by drivers. PCMS (portable changeable message sign) may also be added for additional advanced warning. Consult your Regional Work Zone Engineer when considering nighttime flagging.

All costs for the flagging are incidental to the contract as per Standard Spec 104.6. Additional bid items are not required if flagging is the only traffic control strategy used.

23.5 Temporary Signals

Temporary signals can be used to replace permanent signals during construction. Their use should be considered with the guidance of the Regional Signal Engineers. Temporary signals are another option in maintaining traffic in an area with a two-way one-lane configuration, such as during bridge or culvert work. See TEOpS 6-6-20 for more information.

23.6 Full Closures and Detours

When construction activities prevent traffic from using the route, a detour is typically set up. These types of activities are typically sewer, utility, or bridge work that will cause the road to be impassable. See FDM 11-50-21.11 for more information.

FDM 11-50-25 Smart Work Zones

May 15, 2025

25.1 Smart Work Zones

Use the smart work zone guidance to identify possible strategies that minimize work zone delay and improve work zone safety. Smart work zones consist of a variety of different devices and technologies that provide motorists with reliable real-time information about upcoming traffic conditions in the work zone.

Work with your Regional Work Zone Engineer or BTO Work Zone Engineer in determining the appropriate applications of smart work zone strategies.

25.2 Dynamic Late Merge System (DLMS)

A dynamic late merge system (Zipper Merge) may be used when there is heavy congestion and traffic is either slow or stopped due to a single lane closure as part of the work zone. When there is congestion, motorists use all lanes of traffic until reaching the defined merge area and then alternate merging into the open lane. When traffic is free flow or has light congestion, motorists move out of the closed lane as early as possible, which is often referred to as an early merge.

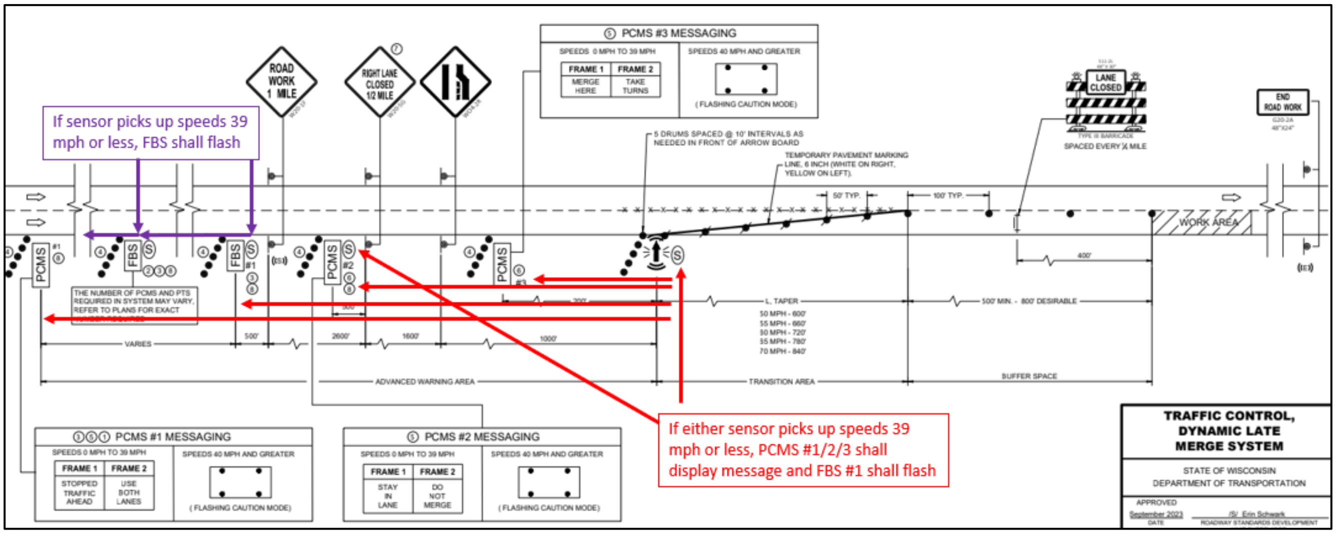
The DLMS is used to improve the flow of traffic on congested freeways to help reduce queue lengths and encourages drivers to stay in the closed lane until the merge point or taper through portable changeable message signs (PCMS). Deploying a DLMS can reduce the overall queue length by as much as 40% (from Minnesota Department of Transportation). Additional benefits of the system include:

- Increase in overall throughput
- Uniformly distributed speeds per lane
- Lane utilization
- Reduction in the maximum queue length
- Reduction of aggressive driving
- Reduction of crashes
- Alerts drivers of upcoming traffic conditions

A DLMS is typically made up of a series of PCMS used to display messages to motorists upstream of the work zone, portable traffic sensors (PTS) to detect real-time traffic speeds, arrow boards, flashing beacon signs (FBS), and an automated traffic system which stores the data and turns the system on and off based on a set of algorithms.

The system is real-time and only activates when there is congestion and speeds drop below 40 mph. When speeds drop below 40 mph, the system activates a series of PCMS with messaging encouraging the motorists to stay in their lane, take turns and merge at a designated area/location, thus achieving improved traffic flow and reduced queue. Once the congestion dissipates and speeds are back to free flow which is generally above 50 mph, the PCMS are deactivated and motorists follow the early merge process.

***Figure 25.1** DLMS Operation*



Consider a DLMS if the project has a single lane closure on a freeway, expressway, or multi-lane route with the potential to experience moderate to heavy congestion.

For a DLMS to be successful, public outreach is required to ensure the motorists know how to drive through the system. Several public outreach documents have been developed and may be used. Work with the Regional Communications Manager (RCM) and the BTO to determine the most effective public outreach.

Table 25.1 can be used as a reference for miscellaneous quantities in the plan in conjunction with Standard Special Provision 643-040, Dynamic Late Merge System and SDD 15D12-c, Dynamic Late Merge System (SDD 15D12-c). The example in the table below displays each location the system will be used, specific stages, number of FBS, number of PCMS and number of PTS required, as well as the total days for each location.

For example, Location IH 94 EB is anticipating a queue of 6 miles, which would require a total of 6 FBS and Location IH 94 WB is anticipating a queue of 4 miles, which would require a total of 4 FBS. The FBS are typically spaced every mile, starting 500 feet upstream from the W20-1F Road Work Ahead Sign until 1 mile downstream of PCMS #1. If there are more than two lanes or greater than 20% trucks, FBS should be placed on both sides of the roadway and an additional PCMS should be placed on the left shoulder across from PCSM #1.

Table 25.1 DLMS Miscellaneous Quantities Reference

643.1100.S DYNAMIC LATE MERGE SYSTEM					
Location	Stage	FLASHING BEACON SIGNS (FBS)	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)	PORTABLE TRAFFIC SENSORS (PTS)	DYNAMIC LATE MERGE SYSTEM (DAY)
IH 94 EB	1	6	2	7	95
IH 94 WB	1	4	2	5	95
IH 94 EB	2	6	2	7	100
IH 94 WB	2	4	2	5	100

* These items are part of the DLMS and are paid for one complete system per roadway

Ex. IH 94 has two lanes in each direction

643.1100.S DYNAMIC LATE MERGE SYSTEM					
Location	Stage	FLASHING BEACON SIGNS (FBS)	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)	PORTABLE TRAFFIC SENSORS (PTS)	DYNAMIC LATE MERGE SYSTEM (DAY)
IH 94 EB	1	12	4	7	95
IH 94 WB	1	8	4	5	95
IH 94 EB	2	12	4	7	100
IH 94 WB	2	8	4	5	100

* These items are part of the DLMS and are paid for one complete system per roadway

Ex. IH 94 has three lanes in each direction, therefore requiring devices on both sides of the roadway

25.3 Portable Automated Real-Time Traffic Queue Warning System (QWS)

A Queue Warning System (QWS) is used when extensive queueing is expected upstream of a work zone. The QWS alerts motorists of upcoming traffic conditions (e.g., slowing traffic, stopped traffic) by displaying warning messages on PCMS.

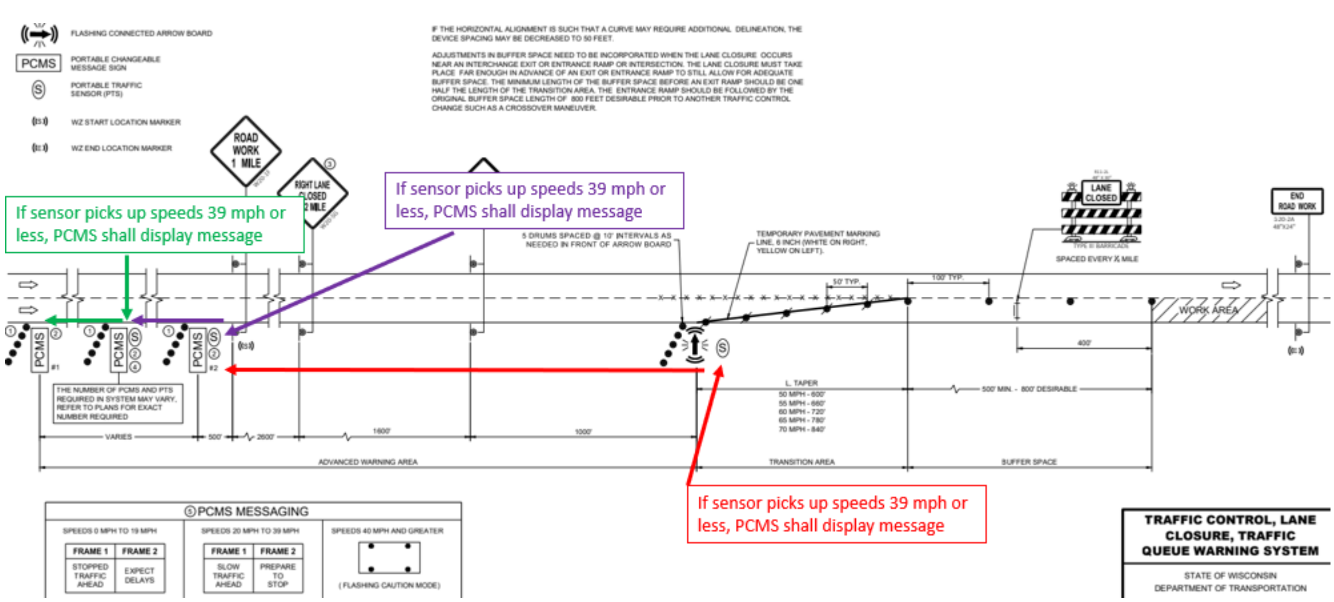
A QWS has the potential to reduce end of queue crashes by up to 45% (from Texas Department of Transportation). Other benefits include:

- Alerting motorists of upcoming slow or stopped traffic conditions
- Diversion onto alternate routes

A QWS is typically made up of a series of PCMS used to display messages to motorists upstream of the work zone beyond the maximum queue, traffic sensors to detect real-time traffic speeds and an automated traffic system which stores the data and turns the system on and off based on a set of algorithms. The PCMS are typically spaced every one mile upstream of the work zone to one mile beyond the maximum queue.

The system is real-time and only activates when traffic speeds drop below 40 mph, at all other times the system is inactive. When a portable traffic sensor detects speeds below 40 mph, the system activates the next upstream PCMS and displays a message to alert motorists of stopped or slow traffic ahead and to be prepared to stop. Once the queue dissipates and speeds are back to free flow (above 50 mph), the PCMS are deactivated.

***Figure 25.2** QWS Operation*



If the project has no adjacent projects within 15 miles, consider a QWS if at least one of more of the following criteria are met:

- Queuing
- Queue lengths expected to vary day to day and hour by hour

- Queues located near horizontal or vertical curves
- History of crashes in the project and queue area

In urban areas with primary commuter traffic and predictable queues, static signs with individual flashers may be used in place of PCMS. The static signs would say “Be Prepared to Stop When Flashing’.

Table 25.2 can be used as a reference for miscellaneous quantities in the plan in conjunction with Standard Special Provision 643-045, Portable Automated Real-Time Traffic Queue Warning System. The example in the table below displays each location the system will be used, specific stages, number of PCMS and number of PTS required, as well as the total days for each location.

For example, Location IH 94 EB is anticipating a queue of five miles, which would require a total of five PCMS and Location IH 94 WB is anticipating a queue of four miles, which would require a total of four PCMS. The PCMS are typically spaced every one mile, starting one mile upstream from the taper until one mile upstream of the end of anticipated queue. If more than two lanes or greater than 20% trucks, place PCMS on both sides of the roadway.

***Table 25.2* QWS Miscellaneous Quantities Reference**

643.1200.S PORTABLE AUTOMATED REAL-TIME TRAFFIC QUEUE WARNING SYSTEM				
Location	Stage	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)	PORTABLE TRAFFIC SENSORS (PTS)	QUEUE WARNING SYSTEM (DAY)
IH 94 EB	1	5	5	100
IH 94 WB	1	4	4	100
IH 94 EB	2	5	5	70
IH 94 WB	2	4	4	70
* These items are part of the QWS and are paid for one complete system per roadway				

Ex. IH 94 has two lanes in each direction

643.1200.S PORTABLE AUTOMATED REAL-TIME TRAFFIC QUEUE WARNING SYSTEM				
Location	Stage	PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)	PORTABLE TRAFFIC SENSORS (PTS)	QUEUE WARNING SYSTEM (DAY)
IH 94 EB	1	10	5	100
IH 94 WB	1	8	4	100
IH 94 EB	2	10	5	70
IH 94 WB	2	8	4	70
* These items are part of the QWS and are paid for one complete system per roadway				

Ex. IH 94 has three lanes in each direction, therefore requiring devices on both sides of the roadway

25.4 Basic Traffic Queue Warning System (BQWS)

A basic traffic queue warning system operates the same as a QWS but consists of static traffic signs with flashing beacon signs (FBS), instead of PCMS, alerting motorists of stopped or slow traffic ahead.

If the Average Annual Daily Traffic (AADT) is between 20,000 vehicles per day (vpd) and 25,000 vpd, projects should consider installing a BQWS on interstate/expressway lane closure projects that are expected to last longer than 4 weeks and do not anticipate regular queuing.

If the AADT is greater than 25,000 vpd, projects shall install a BQWS on interstate/expressway lane closure projects that are expected to last longer than 4 weeks and do not anticipate regular queuing.

See FDM 11-50-25.2 and FDM 11-50-25.3 for interstate/expressway projects expecting regular queueing for installation of a DLMS or QWS.

Consider adding a BQWS on projects in areas with regular recurring incidents or complex work zone set-ups, which could include bi-directional traffic or split lane configurations.

The BQWS will consist of three FBS for a two-lane configuration and six FBS for three lanes or greater configuration (both sides of the roadway). If truck percentages are greater than 20%, consider installing FBS on both sides of the roadway. Each FBS should be spaced approximately one mile from each other, as field conditions allow.

The system is real-time and only activates when traffic speeds drop below 40 mph, at all other times the system is inactive. When a portable traffic sensor detects speeds below 40 mph, the system activates the next upstream FBS and alerts motorists of stopped or slow traffic ahead. Once the queue dissipates and speeds are back to free flow (above 50 mph), the FBS are deactivated.

Figure 25.3 BQWS Operation

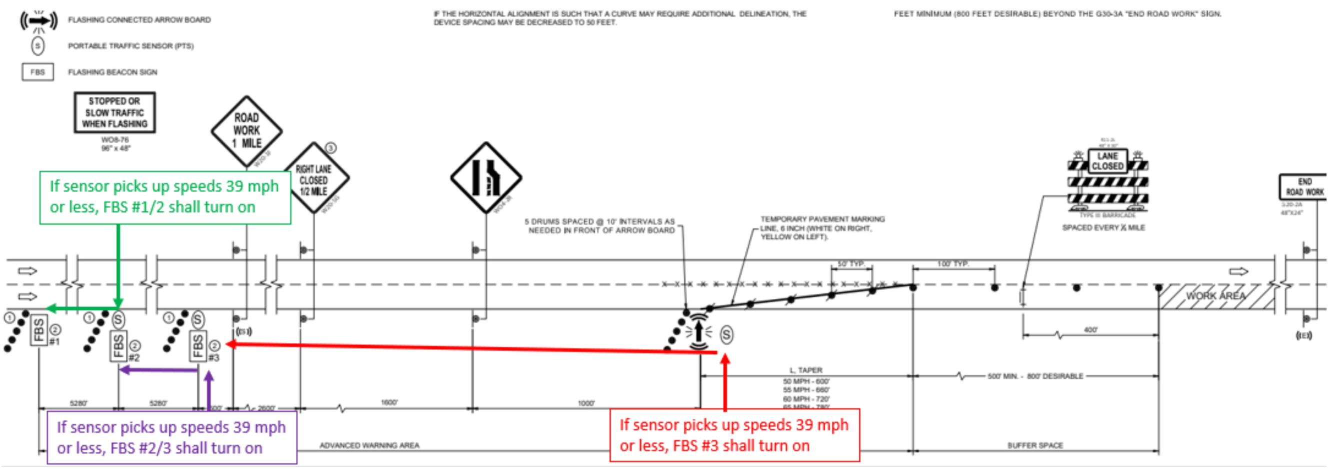


Table 25.3 can be used as a reference for miscellaneous quantities in the plan in conjunction with Standard Special Provision 643-046, Basic Traffic Queue Warning System and SDD 15D12-d, Traffic Control, Lane Closure, Basic Traffic Queue Warning System (SDD 15D12-d). The examples in the tables below displays the stage and direction the BQWS will be used as well as the number of FBS and number of PTS required for the set up and number of days the system will be used.

Table 25.3 BQWS Miscellaneous Quantities Reference

643.1205.S
BASIC TRAFFIC QUEUE WARNING SYSTEM

Location	Stage	FLASHING BEACON SIGNS (FBS)	PORTABLE TRAFFIC SENSORS (PTS)	BASIC QUEUE WARNING SYSTEM (DAY)
IH 41 NB	3	6	3	150
IH 41 SB	3	6	3	150

* These items are part of the QWS and are paid for one complete system per roadway

Ex: IH 41 has 3 lanes in each direction, therefore requiring FBS on both sides of the roadway.

643.1205.S BASIC TRAFFIC QUEUE WARNING SYSTEM				
Location	Stage	FLASHING BEACON SIGNS (FBS)	PORTABLE TRAFFIC SENSORS (PTS)	BASIC QUEUE WARNING SYSTEM (DAY)
IH 94 EB	3	3	3	150
IH 94 WB	3	3	3	150
* These items are part of the QWS and are paid for one complete system per roadway				

Ex: IH 94 has 2 lanes in each direction, therefore requiring FBS on only one side of the roadway.

643.1205.S BASIC TRAFFIC QUEUE WARNING SYSTEM				
Location	Stage	FLASHING BEACON SIGNS (FBS)	PORTABLE TRAFFIC SENSORS (PTS)	BASIC QUEUE WARNING SYSTEM (DAY)
IH 39/90 NB	1	6	3	100
IH 39/90 SB	1	6	3	100
* These items are part of the QWS and are paid for one complete system per roadway				

Ex: IH 39/90 has 2 lanes in each direction with more than 20% trucks, therefore consideration should be given to provide FBS on both sides of the roadway.

25.5 Digital Speed Reduction System (DSRS)

A digital speed reduction system should be used on projects that have changing speed limits based on the presence of workers. The DSRS has the flexibility to display different speed limits based on specific times when the temporary speed declaration warrants the speed limit to be changed. An example would be a project with lane closures only at night, and no work occurring during the day and the temporary speed declaration is written to reduce the speed only at night when workers are present with a lane closure. At all other times, the permanent speed limit should be posted. When the speed limit is reduced, the DSRS flashing beacon signs would flash, indicating a slower speed limit. When the permanent speed limit is posted, the flashing beacons will not flash. See Figure 25.4 for DSRS:

Figure 25.4 Digital Speed Reduction System

The DSRS has the potential to reduce the number of times workers are exposed to live traffic covering and uncovering the temporary posted speed limit.

Consider the following criteria when determining if a DSRS is warranted for a project:

- Nighttime or daytime lane closures requiring a temporary speed reduction only when workers are present;
- Long-term lane closures requiring a temporary speed reduction only when workers are present

Table 25.4 can be used as a reference for miscellaneous quantities in the plan in conjunction with a special provision and SDD 15D12-g, Traffic Control, Lane Closure, Digital Speed Reduction System (SDD 15d12). The example in the table below displays the stage and direction the DSRS will be used as well as the number of Digital Speed Limit Trailers (DSLT) required for the set up and number of days the system will be used.

Table 25.4 DSRS Miscellaneous Quantities Reference

643.0370.S
DIGITAL SPEED REDUCTION SYSTEM

Location	Stage	DIGITAL SPEED LIMIT TRAILERS (DSLT)	DIGITAL SPEED REDUCTION SYSTEM (DSRS)
IH 94 EB	1	7	35
IH 94 WB	1	4	35
IH 94 EB	2	7	60
IH 94 WB	2	5	60

25.6 Construction Truck Entering and Exiting System

A construction truck entering and existing system is used to automatically detect when construction vehicles are planning to enter or exit the work zone and provide advanced notification to motorists. The purpose of this system is to alert motorists there may be construction vehicles slowing down to enter the work zone or merging at slower speeds when exiting the work zone.

The truck entering/exiting system has the following possible benefits to improve mobility and safety:

- Alerting motorists of slow construction vehicles entering/exiting the work zone
- Reducing frequency of motorists following construction vehicles into the work zone
- Reducing rear-end crashes caused by abrupt slow downs

The system is real-time and only activates when a construction vehicle is entering or exiting a work zone. When a traffic sensor detects a construction vehicle, either entering or exiting, a PCMS message is displayed upstream to alert motorists of a truck slowing down or entering the flow of traffic.

The following criteria should be considered when determining if a truck entering/exiting system should be installed:

- A construction vehicle uses a live traffic lane to either decelerate or accelerate because a deceleration or acceleration lane can't be provided
- Construction stage will be in place for an extended period
- Construction stage changes are minimal and infrequent

A truck entering/exiting system typically includes traffic sensors or video detection, PCMS and an automated traffic system to activate the messaging. A static sign option may be used as well for trucks entering traffic which would include static signs with individual beacons that would flash when a truck was entering or exiting.

25.99 References

1. Wisconsin Manual on Uniform Traffic Control Devices (WisMUTCD)
2. FHWA's "Guidelines on Work Zone Access and Egress" AASHTO Roadside Design Guide
3. Minnesota Intelligent Work Zone System Selection Toolbox, "Minnesota IWZ Toolbox"
4. Texas Department of Transportation, "Innovative End-of-Queue Warning System Reduces Crashes Up to 45%"

FDM 11-50-30 Statewide Freeway and Expressway Lane Closure and Delay Guidelines

August 16, 2022

30.1 Introduction

Maintaining safe flow of traffic through a work zone during construction should be carefully planned and executed to improve work zone safety and minimize inconvenience and protect motoring public. Providing detours is sometimes a preferred alternative, but for many reasons, it is frequently impractical for freeway and expressway traffic, and traffic flow is maintained through the work zone. Traffic lanes may be closed, shifted, or encroached upon to provide room for construction or maintenance activities. When this happens, the remaining lanes available should be evaluated for expected work zone capacity and how they will perform under the demand volume on the roadway during the closure. See FDM 11-50-5 and FDM 11-50-10 for further details.

This section includes guidelines for planning typical lane closures and methodologies for considering regularly occurring high volume periods with special considerations for holidays and planned special events. These guidelines also include suggested procedures and methodologies to estimate the capacity of a roadway segment, determine traffic demand, and estimate queues and delays using traffic volume data. Once these factors are determined, necessary mitigation strategies can be developed to alleviate or eliminate user delay during a lane closure. Guidelines for emergency maintenance and construction operations and night freeway work operations are discussed and strategies are referenced for further investigation. The following process will be described in detail throughout the document.

1. Determine route-specific maximum delay guideline and recommended lane closure times
2. Estimate capacity under proposed lane closure (using Table 30.2 and other factors)
3. Estimate hourly demand profile (traffic volumes)
4. Estimate queues and delays using appropriate tools
5. Identify appropriate mitigation strategies
6. Plan and prepare for special conditions

30.2 Lane Closure System (LCS)

The Lane Closure System (LCS) is a web-based system for the request and approval of lane closures on all state trunk networks (STN). The LCS was developed for streamlining and enhancing the ability to track lane and shoulder closures on the STN. The system enhances communication between the Department and freight operators by providing advance notification on roadways with width restrictions to facilitate route planning. The benefits of LCS include:

- Enhanced coordination of activities to reduce back-ups and potential conflicts (i.e., multiple activities can utilize the same closure; avoid lane closures during a special event; avoid right lane closure near a left lane closure on the same roadway)
- Eliminating duplications and inefficiencies by streamlining information into one system
- Providing historical data that can be used to make informed decisions

All lane and shoulder closures and restrictions require approval by the Regional Traffic Engineer or Regional Traffic Supervisor. Include the LCS Standardized Special Provisions (STSP) in the specials. Lane closure entry and training are located on the internet at the Wisconsin Traffic Operations and Safety Laboratory (UW-TOPS Lab) WisTransPortal System.

30.3 Special Events and Holiday Work Restrictions

Special events that generate traffic in addition to normal traffic volumes should be considered in developing the transportation management and lane closure plans. A special event is defined as an event that generates a certain minimum attendance threshold according to the location of the event. Refer to TEOpS 17-2 for more information.

The contractor shall not close a lane(s) in the direction on approaches to the event unless the lane closure is part of an acceptable long-term traffic control staging for the project. Work with your Regional Traffic Engineer to identify the hours before and after an event. An illustrative list of specific events that may apply is provided for the Regions in Table 30.1.

***Table 30.1** Statewide Special Events that May Prohibit Lane Closures*

All Regions	Region Specific
Major holidays	Local Festivals
Major recreational destinations	Summer Fest
Major shopping malls	State Fair
Farm progress days	Brewer games
Major auctions	EAA fly-in
Concerts	Packer football home games
Tournaments	Badger football home games
Opening fishing	
Deer hunting season	
County fairs	

- Freeway and expressway lane closures are not allowed on the following holidays, other than accepted long-term traffic control staged projects:
  - Easter
  - Memorial Day
  - Independence Day
  - Labor Day
  - Thanksgiving
  - Christmas
  - New Year's Day
- Freeway and expressway lane closures are not permitted after noon on the day preceding a holiday. For holiday weekends, freeway lane closures are not permitted after noon on the day preceding the holiday weekend until 6:00 AM (or after the peak hour traffic volumes occur) the day after the holiday weekend. See FDM 19-15-40.1 for more details.
- Permitted freeway and expressway lane closure times may vary when high attendance is expected for special events. The actual permitted periods of lane closures at locations influenced by increased traffic due to special events will depend on the assessment of roadway capacity available compared to expected demand volumes including additional traffic generated by the special event.
- Freeway and expressway shoulder closures shall follow the same restriction times as lane closures during special events.

30.4 Peak Hour Restrictions

Peak hours are defined as the hours of the day that observe the largest utilization of capacity, which may cause user delay. Peak hour times vary depending on the location of the roadway and the types of users traveling on the roadway. In developed, urbanized locations, there is typically a morning and evening peak period during the weekdays. Consult the Regional Traffic Engineer for potential peak hour restrictions for the particular roadway segment being analyzed. No lane closures shall be permitted for short-term or short duration maintenance, utility, or surveying during normal peak periods unless peak hour volumes are below 1,600 passenger cars per hour per lane (pcphpl) and accepted by the Regional Traffic Engineer.

30.5 Freeway Work Zone Capacity

Accurately estimating freeway work zone queuing, delay, and road user costs is an important step in safely and efficiently planning lane closures for freeway work zones. To standardize how freeway work zone capacity analysis is performed, a work zone traffic analysis tool was developed for calculating work zone capacity and estimating queue, delay, and road user costs.

The maximum number of vehicles that can travel on a freeway at a given time is considered its capacity. In Chapter 12 (Exhibit 12-4) of the HCM 7th Edition, base capacities of freeway segments are flow speed of 70 mph, the base capacity is 2,400 passenger cars per hour per lane. In work zones, the capacity of freeway lanes can be greatly reduced due to the characteristics of the work zone site.

Delay is the amount of travel delay incurred by vehicles traversing a work zone. Estimating the potential delay resulting from a freeway work zone closure helps identify the impact to the road users and adjacent roadway networks. Motorists who do not find the delay acceptable may divert from their original route and travel on adjacent roadways.

Queues occur when traffic is stopped or slowed. In freeway work zones, queues are typically the result of either an incident or the volume of a freeway exceeding its capacity. In planning work zone closures, it is important to accurately estimate the length of queue from a potential work zone closure in which the freeway volumes are expected to exceed the capacity of the work zone.

Time spent traveling in a vehicle is a resource with economic value[1]. Therefore, when road users incur travel delay, there is an economic cost associated with delaying the road users. In freeway work zones, when the volume of a roadway exceeds the capacity, a queue of vehicles will form thereby delaying motorists.

30.5.1 Freeway Work Zone Traffic Analysis

The equation below should be used to determine freeway work zone capacity:

$$Average\ QDR_{PCE} = 1{,}866 - 40f_{LCSI} - 132f_{barrier} - 101f_{TOD} - 205f_{area} - 207f_{CI} - 47f_{regional}$$

where,

Average QDR$_{PCE}$ = average queue discharge flow rate (pcphpl),

f_{LCSI} = lane closure severity index; $\frac{1}{\#\ of\ open\ lanes * open\ ratio}$, where open ratio is the ratio of open lanes during construction to the total number of lanes,

$f_{barrier}$ = barrier type; concrete = 0, cone/barricade/drum = 1,

f_{TOD} = time of day; day = 0, night = 1, and

f_{area} = area type; urban =0, rural = 1

f_{CI} = construction intensity; low = 0, high = 1, and

$f_{regional}$ = regional area; south = 0, north = 1.

The work zone traffic analysis tool should be used for all freeway construction projects to determine queueing, delay and road user costs based on the work zone capacity and should be documented in the TMP.

Contact your Regional Traffic Engineer or the BTO Work Zone Engineers for additional information with the tool or calculating work zone capacity.

FDM 11-50-31 Temporary Pedestrian Accommodations — May 15, 2025

31.1 Introduction

The Wisconsin Manual on Uniform Traffic Control Devices (WisMUTCD), Section 6A.01 states -"*The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, or on private roads open to public travel, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC (Temporary Traffic Control) zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.*"

Per WisMUTCD Section 6C.02, if the TTC zone affects the movement of pedestrians, adequate pedestrian access and walkways shall be provided.

In addition, per WisMUTCD Section 6C.03, when existing pedestrian facilities are disrupted, closed, or relocated in a TTC zone, the temporary facilities shall be detectable and include accessibility features consistent with the features present in the existing facility.

Pedestrian and bicycle facilities are critical transportation routes for communities. They allow people to travel

[1] US Federal Highway Administration. (2011) Work Zone Road User Costs: Concepts and Applications. Final Report. FHWA-HOP-12-005. Washington, DC.

from one place to another, stimulate business districts by encouraging shopping, keep communities safe by providing more activity on the street, and enhance community health and well-being.

The range of pedestrians in a work zone can vary widely and includes the young, the elderly, and people with disabilities such as audio, visual, or mobility impairments. All pedestrians need protection from potential injury and must be provided a smooth, firm, stable, slip-resistant, and continuous hard surface with a clearly delineated travel path (without abrupt changes in grade or terrain). Pedestrian facilities parallel or crossing the work zone must provide these characteristics.

This guideline supplements FDM 11-46-1 “Bicycle and Pedestrian Elements Affecting Complete Streets” and is intended to minimize conflict between competing construction activities that produce unsafe or inconvenient conditions for pedestrians and bicyclists in work zones.

31.2 Project Scoping/Planning

Prior to work on any state route, project teams, utilities, permitted work, and maintenance staff need to determine if the work will impact pedestrian traffic. Collect general information on the project. The surrounding land uses will also be an indicator for pedestrian and bicycle travel. Identify stakeholders (e.g. walking, jogging, and cycling groups, transit agencies, etc.), who may be affected and need to be notified about the status of the project. Determine the following during the scoping and planning phase of the project:

- Construction workspace needs
- Location of impacted pedestrian facilities
- Alternative routes or lack of alternative routes
- Need for Temporary Limited Easements
- Bus stops
- Vehicle and pedestrian traffic generators (malls, gas stations, schools, etc.)

Include other groups such as water and utility companies that may have a project scheduled concurrently to discuss how advance utility work may impact pedestrian travel. Provide pedestrian accommodations during utility relocations and begin discussions during the permitting process.

Based on the conditions determined above, identify how the pedestrian access will be maintained from the figure.

Figure 31.1 Duration and Construction Impact

Duration

Construction Impact to Pedestrian Travel

WMUTCD→	Mobile	Short Duration	Short-term	Intermediate	Long-term
	Always moving	Up to 1 hour	More than 1 hour within a single daylight period	Up to 3 days	More than 3 days
No impacts Pedestrian Paths either do not exist on a project or work from a project does not impact pedestrian travel	Nothing required for pedestrians	Nothing required for pedestrians	Nothing required for pedestrians	Nothing required for pedestrians - Confirm during construction	Nothing required for pedestrians - Confirm during construction
Encroachment Restricting the pedstrian path to less than the normal existing width but leaving at least 4 feet of width	Move object/work encroaching, pedestrian flagging	Move object/work encroaching, pedestrian flagging	Pedestrian Flagging Detour	Pedestrian Flagging Detour	Pedestrian Flagging Detour Temp. Facility
Blockage The existing pedestrian path is intact but is not passable because of the following: existing path has less than 4 feet of width or work on the pathway or to something off of the pathway. Material or equipment is easily moved.	Move object/work encroaching, pedestrian flagging	Pedestrian Flagging Detour	Pedestrian Flagging Detour Temp. Facility	Pedestrian Flagging Detour Temp. Facility	Pedestrian Flagging Detour Temp. Facility
Reconstruction The existing path has been removed and is being reconstructed. The facility is not passable.	N/A - Unlikely a pathway is able to be reconstructed in this timeframe		May not be feasible Detour Temp. Facility	Detour Temp. Facility	Detour Temp. Facility

When the work and duration indicate the need for temporary pedestrian facilities, look further at what may be needed. Pay special attention to locations that may require a Temporary Limited Easement for items such as, temporary pedestrian walkways. In some cases, the only location to route pedestrians may be the roadway, make sure to consider the implications of a lane closure. Use the Work Zone Impact Assessment to document the impacts to pedestrians.

31.3 Transportation Management Plan/PS&E

Identify existing pedestrian facilities, and pedestrian generators, including shopping centers, schools, playgrounds, parks, housing, hospitals, churches, and concurrent work beyond the project limits that may influence the staging of construction. It is preferred to separate pedestrian movement from both work zone activity and adjacent traffic.

When pedestrians are identified in the TMP as being impacted, describe the impact to the pedestrians and how access will be maintained. For the 60% TMP submittal a conceptual plan should include the following:

- Locations of pedestrian routes
- Locations of curb ramps impacted
- Residential and Business access
- Transit stops
- Existing pedestrian signals and push buttons

The purpose of this will be to show where the needs of pedestrians are for the project. Use this document to develop the plans for the 90% submittal. For the 90% submittal, projects need to develop plans that include the temporary pedestrian facilities. The temporary pedestrian facilities should be shown on the traffic control plans, in order to prevent conflicts from being overlooked between plan sets. For multistage projects review if the temporary pedestrian facilities require changes between stages and include the temporary pedestrian facilities on each stage. For all plans include the follow notes:

- For all temporary curb ramps include the elevation of existing curb and pavement surface, determine slope and required length of ramp.
- For temporary surface list the type of surface being placed.
- Show where the temporary pedestrian barricades will be placed.

- Show any lateral work that may disruptions to the temporary pedestrian facilities

If using nonstandard items in the design, include special provisions in the contract documents. The usefulness of standard detail drawings is limited and need to be supplemented in the plans set.

31.4 Design Considerations

There are three primary considerations in designing for pedestrian safety in work zones on highways and streets:

1. Provide a safe, convenient travel path for pedestrians that replicates as nearly as possible the characteristics of the existing sidewalks. If necessary, provide an alternate accessible pedestrian route.
2. Avoid creating pedestrian paths that lead pedestrians into direct conflict with work vehicles, equipment or construction operations.
3. Avoid creating pedestrian paths that lead pedestrians into direct conflict with mainline traffic moving through or around the work zone.

The TMP process needs to evaluate traffic patterns: vehicles, pedestrians, and bicyclists travelling parallel to the work zone and crossing the work zone.

When determining pedestrian needs in the proposed work zone, consider information obtained during the public input process and through field visits to understand travel patterns and access to facilities in the work zone.

Where pedestrian's facilities are disrupted or closed, provide temporary pedestrian facilities. See FDM 11-46-5 for pedestrian circulation path and pedestrian access route accessibility criteria, and FDM 11-46-10 for curb ramp design standards. Providing access for our transportation system is a core function of the department and costs do not dictate whether we provide temporary pedestrian facilities or not. Only use costs in determining the most appropriate temporary pedestrian facility to provide. Design temporary pedestrian facilities to meet accessibility criteria to the maximum extent feasible.

31.4.1 Existing Pedestrian Facilities and Pedestrian Detours

The existing pedestrian facilities should be maintained as long as possible on a project. This is usually the most cost-effective way of providing access. Existing pedestrian facilities need to be free of construction materials, debris, and vehicle at all times. The existing facility is the basis for the temporary pedestrian facility, with locations of work spaced intermittently throughout.

Included in the existing facilities are pedestrian detours. Detours send pedestrians to the opposite side of the roadway or around the block, away from the work. Make improvements to the pedestrian detour route only when the features on the closed facility are more accessible. When laying out a Pedestrian Detour use Temporary Pedestrian Barricades to fully block the closed facility. Use signing as shown on SDD 15d30 to guide pedestrians.

31.4.2 Temporary Facilities

At the core of maintaining pedestrian accommodations, temporary pedestrian facilities need to be designed in a way to meet the requirements of Public Right-of-Way Accessibility Guidelines (PROWAG) and MASH. The following items will describe techniques used to maintain pedestrian access and maybe used individually or in concert with each other.

31.4.3 Temporary Surface

Temporary surfaces provide a smooth, firm, stable, slip-resistant and continuous hard surface throughout the entire length of the temporary walkway.

Construct temporary sidewalks across unimproved streets and drives designed in accordance with PROWAG.

Construct and maintain temporary sidewalks so there are no abrupt changes in grade or terrain that could cause a tripping hazard or could be a barrier for wheelchair use. Maintain temporary sidewalks to ensure that joints in the sidewalk have a vertical difference in elevation of no more than 1/4 inch (PROWAG R302.6.2) and that the horizontal joints have gaps no greater than 1/2 inch (PROWAG R302.6.3). Vertical differences between 1/4 inch and 1/2 inch shall be beveled with a slope no steeper than 45 degrees (PROWAG R302.6.3). Vertical differences between 1/2 inch and 6 inches shall have a maximum 8.3% slope (PROWAG R302.6.3)

The running slope of the temporary sidewalk shall not exceed 5% unless the adjacent roadway exceeds 5% and then the running slope of the sidewalk shall match the running slope of the adjacent roadway (PROWAG 302.4). The cross slope of temporary sidewalks shall be 2.1% maximum (PROWAG R302.5.1).

The grade of the temporary sidewalk should parallel the grade of the existing sidewalk or roadway and the cross slope be 2.1 percent maximum. Any change of vertical difference level, which exceeds 1/4inch height, must be beveled at 45 degrees. For closed trenches, temporary paving surfaces, walking surfaces, steel plates, etc., provide a smooth finished, firm, slip-resistant walking surface made even with surrounding sidewalks.

Pavement joints in the sidewalk are to be closed and flush to prevent tripping and to reduce the possibility of canes or small wheels getting trapped in gaps or spaces. If drainage openings are located within the pedestrian route, the grating should run perpendicular to the sidewalk and must be narrow enough that a sphere greater than 1/2-inch in diameter will not pass through it (PROWAG R302.6.3).

Examples of temporary pedestrian surface are matting, asphalt, and slip-resistant plates. Use matting or plates in most situations. Temporary asphalt should only be used when surface will be in place for longer than a week. Matting can be found on the Department's approved products list.

The type of pedestrian surface will depend on the duration and application of the need. For surface that is needed for 7 days or less, matting, slip-resistant steel plates, and specifically designed devices should be considered. These devices have a tendency to move and would need to be maintained over the course of the project. Matting is the most commonly used short duration temporary surface. Slip-resistant steel plates are typically used when there is the need to protect from a hole or drop-off within the pedestrian walkway. For surfaces in place more than 7 days, temporary asphalt should be considered. In situations where repeated work is taking place in the same location, it would be more efficient to use a surface other than temporary asphalt.

The minimum width of a pedestrian walkway is 4 feet. For continuous walkways, provide a 5-foot-wide passing space every 200 feet. This can be seen on SDD 15d30.

31.4.4 Temporary Curb Ramps

Provide temporary curb ramps to enable pedestrians to negotiate curbs safely when they are diverted to temporary routes in the roadway (Figure 31.2). Temporary curb ramps are to be the full width of the temporary route, with a 5 ft recommended width and a minimum width of 4 ft.

All curb ramps are to be firm, stable, and have a non-slip surface. Design curb ramps to have free draining surfaces with a maximum cross slope of 2.1 percent (PROWAG R302.5.1). The cross slope for midblock crosswalks can match the longitudinal slope of the roadway up to a maximum of 5 percent (PROWAG R302.5.2.2).

When a curb ramp is installed perpendicular to the curb, check to see the remaining roadway width to see if two-way traffic can be maintained. If the perpendicular curb ramp creates issues, consider using a parallel curb ramp.

When a curb ramp is installed parallel to the curb, provide a minimum 4-ft by 4-ft landing (PROWAG R304.2.5) at curb level to allow pedestrians to turn 90 degrees before descending the ramp. Provide a minimum 4-ft by 4-ft clear area at the bottom of the temporary curb ramp (PROWAG R304.2.4). Indicate the type of curb ramp that is to be installed in the plans.

Temporary curb ramps are to be concrete, asphalt, or commercially available prefabricated ramps and provide a safe path of travel for mobility-impaired pedestrians at all locations where ramps have been temporarily removed or required to route pedestrians.

For projects with winter layover, construct curb ramps out of concrete with cast iron detectable warning fields.

Design temporary curb ramps to:

- Be constructed such that installation and removal will not damage existing pavement, curb or curb and gutter

- Have a running-slope less than or equal to 8.3 percent. When the curb ramp run length must exceed 15 feet to achieve an 8.3% running slope the curb ramp length can be limited to 15 feet and the running slope may exceed 8.3% (PROWAG R304.3.1).

- Meet existing surfaces without gaps, while accounting for drainage of the roadway

- Have a transition between ramps and the street surface that is smooth such that no lip exists at the base of the ramp

- Include edge protection where there is a drop-off greater than 3 inches

Example calculation

Given:

Max Slope (S) = 8.3%

Max Cross slope (“C”) = 2%

Curb height (H) = 6”

Then, Run (R) = H/(S- C)”

R= 6”/(8.3% - 2%) = 7ft 11 in

(dimension S, C, and H are project specific)

31.4.5 Temporary Detectable Warning Fields

When a pedestrian route intersects with vehicular traffic, place temporary detectable warning fields across the full width of an opening or ramp at least 2 feet in depth.

31.4.6 Temporary Bus Pads

When necessary, provide a drawing of this plan, and if the plan layout deviates from the layout of the Temporary Bus Stop Pad shown in SDD 15d30 sheet “b”, provide the details necessary to properly construct it. If the construction zone is extensive and will impact multiple stops, it may be necessary to arrange for a shuttle or establish a temporary route that transports pedestrians safely around the work area. When feasible, same side stop relocation is preferred for temporary bus stops. Work with the local transit agency when developing plans with temporar**y bus pads for specific needs.**

31.4.7 Pedestrian Separation in the Work Zone

When pedestrians are required to navigate the work zone, consideration needs to be given to potential hazards. Excavations, drop-offs, manholes, etc., that exist near the pedestrian facility require delineation, covering or shielding. Consider pedestrian barricades or other protective barriers to prevent pedestrian access into a work zone (tape, rope, barrels or plastic chain are not adequate). Temporary work on sidewalks (e.g., utility openings, vaults, and sidewalk reconstruction) also needs to be barricaded. Verify that adequate sight lines are provided between pedestrian and drivers at intersections, midblock crosswalks and other potential conflict points. Potential pedestrian/vehicle sight obstructions include safety fences, boundary fences, bridge abutments, buildings, street furniture, queued vehicles, work vehicles, work equipment, and other local features. Refer to FDM 11-10-5.1 for additional sight distance information.

When the roadway is open to all traffic use the following table to determine the appropriate separation of pedestrians with traffic.

Figure 31.2 Type of Barrier Required Between Vehicle Traffic and Pedestrians

Speed (mph) \ **Duration (Days)**	<1	Up to 3	Up to 14	14<
45 and greater	None*	Temporary Pedestrian Barricade	Temporary Concrete Barrier	Temporary Concrete Barrier
40 to 30	None*	Temporary Pedestrian Barricade	Temporary Pedestrian Barricade	Temporary Concrete Barrier
25 and less	None*	Temporary Pedestrian Barricade	Temporary Pedestrian Barricade	Temporary Pedestrian Barricade

*If the work is moving and pedestrian shepherding is being used. If a detour route has been established the normal route should be blocked with temporary pedestrian barricades on each end of the closure.

This table is a starting point when determining how to separate vehicles and pedestrians. Each project location will also need to be reviewed to determine the appropriate way to separate pedestrians and vehicles.

31.4.7.1 Temporary Pedestrian Barricades

Use temporary pedestrian barricades to separate pedestrians from the work area, drop-offs, or traffic. Most temporary pedestrian barricades come in 6-foot sections and have a base that keeps them up right. Bases can require up to 2-feet of space on the side not facing the pedestrians. When laying out temporary pedestrian barricades, provide up to 2-feet of space for the bases that will not be interrupted by construction activities. Close joints between temporary pedestrian barricades to prevent canes or small wheels from being trapped, to reduce the risk of tripping, and to facilitate safe hand trailing. Furthermore, when used as a sidewalk closure mechanism, temporary pedestrian barricades must run the entire width of the sidewalk without gaps.

Temporary pedestrian barricades are only channelizing devices and are not positive protection devices. Using them to separate pedestrians and vehicle traffic should be limited as the table in the previous section shows.

On roads closed to through traffic, traffic operations are usually impacted, and speeds are reduced. Temporary Pedestrian Barricades are able to be used in lieu of temporary concrete barrier to separate pedestrians and vehicles.

Temporary pedestrian barricades must have or provide continuous detectable edging (PROWAG R303.6). Detectable edging at the top of the barricade must be no lower than 32 inches above the walking surface and must be free of sharp and abrasive surfaces. Detectable edging at the bottom of the barricade shall be a maximum of 2 inches above the walking surface and is used for detection by people with low vision that use a cane.

31.4.7.2 Temporary Concrete Barrier

Temporary concrete barrier may be needed due to increased risk for vehicle intrusion into temporary pedestrian facilities on high-speed roadways as the above table shows. Other reasons to use temporary concrete barrier are when roadways approach 30,000 AADT or area drivers display aggressive driving behavior.

When using temporary concrete barrier consult FDM 11-50-35 and SDD 14b7. In most cases the temporary concrete barrier will need to be anchored to limit the amount of deflection during a crash. As stated in FDM 11-50-35.4.1 temporary concrete barrier on roadways 45 mph and greater needs to have 4 feet of space for deflection, this would need to be in addition to the minimum 4 feet of width needed for a pedestrian walkway for a total of 8 feet wide in an unanchored condition. Add temporary pedestrian barricade in the walkway to prevent pedestrians from walking in the deflection area.

When developing plans, do not place the concrete barrier directly against a curb face as it will not perform properly. Also take into account potential drainage issues when using the temporary concrete barrier.

31.4.8 Temporary Pedestrian Facility Placement

When space exists, consideration should be put into placing temporary facilities on adjacent property while the permanent facility is under construction. In order to do this a Temporary Limited Easement would be needed. More information can be found in FDM 12-1-15.5. Placement of temporary pedestrian facilities on the private property is preferred over placing it on the roadway next to vehicular traffic as it avoids creating a pedestrian and vehicle conflict. It is up to the project team to determine if the cost of placing the temporary facility and restoring the underlaying landscaping is worth the benefit. Also consider the need for temporary pedestrian barricade along the easement.

31.4.9 Pedestrian Accommodations at Signals

When signals are within the work zone of a project, measures taken depend on the existing signal.

- If work restricts access to the existing call buttons, a flagger can be posted at the signal to active the call button. This may be used for work that is in place for a day or less. The call button would be accessible when the work is not taking place
- If work restricts access to the existing call buttons, consider adding temporary pedestals along with the other temporary pedestrian facilities to maintain accessibility to the call buttons. Show the addition of the temporary call buttons on the plan.
- If traffic operations allow, the existing call buttons can be disabled and the signal placed in “Pedestrian Recall” to allow pedestrians to cross on an exclusive phase.

If work restricts crossing movements cover/disable the pedestrian head and disable the call button. Use temporary pedestrian barricades to block the crossing movement on both side of the crosswalk.

When temporary signals are within a project and pedestrian access needs to be maintained, consider providing pedestrian heads and call buttons for pedestrians. If an alternative pedestrian walkway is provided and requires pedestrians to cross multi-lane intersections, the pedestrian walk phase may need a timing adjustment.

31.4.10 Lighting Temporary Pedestrian Accommodations

Consider the lighting that will be present during each stage of construction. Stage the project so that lighting will be maintained as long as possible to avoid the need for temporary lighting. If the permanent lighting is removed during construction, work with the local agencies in determining the need for temporary lighting. Some examples that may warrant temporary lighting include:

- Business districts
- Midblock crossings
- Intersections

Use lights with similar properties to the devices removed for temporary application. Consider using hanging lights at intersections and midblock crossings. Type C steady burn lights attached to the temporary pedestrian channelizing devices may provide enough lighting for a tangent section. Work on a cost sharing plan with the local agencies for the temporary lighting.

31.4.11 Overhead Protection

The use of overhead protection for temporary pedestrian facilities should be used as an option of last resort. It is preferable to detour pedestrians away from any overhead work. Comply with the 2015 International Building Code Covered Walkways 3306.7 requirement for overhead protection used for pedestrian accommodations. When using overhead protection include lighting as well. Temporary concrete barrier should be used to provide positive protection for the overhead protection structure.

31.4.12 Signing for Pedestrian Facilities

Place signs along the pedestrian route to guide them along a work zone or detour as shown on the SDD 15d30. Use signs that are specifically sized for pedestrian routes. The use of signs meant for vehicle traffic does have the effect of warning pedestrians blocks in advance of any hazards and could cause undesired diversions. Sidewalk Closed or signs with a similar message should only be used when there have been zero mitigating measures taken.

When the pedestrian access route is closed, temporary audible message devices that identify the alternate pedestrian access route are required (PROWAG R303.2). Additional guidance will be provided in the future in this section and the Standard Specifications to indicate what devices will be allowed and how they will be applied.

31.4.13 Physical Restrictions

Where it is impractical to provide a safe, effective temporary pedestrian facility due to space limitations or other physical constraints, alternative measures should be considered for accommodating pedestrians, including strategies such as:

- Detour routes using adjacent existing facilities that minimize out-of-direction travel.
- Partnerships with local transit providers (e.g. MCTS, Madison Metro, Valley Transit) to provide discounted or complimentary passes.
- Shuttle services provided by private transportation vendors.

In special circumstances where a temporary pedestrian accessible route is unavailable and the use of adjacent facility would result in a significant out-of-direction travel, providing a pedestrian transport vehicle should be considered.

31.4.14 Alternative Mobility Methods

If detour routes and other methods to accommodate pedestrians are infeasible, the following measures can also be considered:

- On-site shuttle services – for known high pedestrian volumes
- On-call shuttle services – for low pedestrian volumes
- A taxi fare voucher systems – for all pedestrian volume situations

Designate an area for pedestrians to wait for the transport vehicle. The pedestrian transport vehicle shall have the capacity of safely loading, unloading, and transporting through the work zone at least two ADA passengers in powered chair and a maximum of 10 able-bodied pedestrians. When using a shuttle service select a non-standard mitigation item in the TMP in Section 4 and describe the use of the shuttle.

31.4.15 Pedestrian Flagging

For work that allows pedestrians to still use the existing facility, flaggers can be used to hold pedestrians at the ends of the work area. When a pedestrian does arrive, work is stopped and the facility is cleared for the pedestrians to pass. This can be used for work that is short-term.

For work that lasts up to an hour, Temporary Pedestrian Barricades can be used along with a sign stating pedestrians to wait, to block the facility in lieu of a flagger. When a pedestrian arrives, the work is stopped and the facility is cleared for the pedestrian to pass by opening the Temporary Pedestrian Barricade. This would be done by an individual doing the work.

31.4.16 Business Access

In locations with pedestrian traffic in front of businesses and store fronts, it is acceptable to use more expensive materials to expedite construction of the pedestrian facility. Work with the businesses to determine the most appropriate method of maintaining accessibility. This may include using alternate entrances, coordinated business closing, or creating a dedicated temporary pedestrian facility during the project.

31.4.17 Temporary Audible Message Devices

Temporary audible message devices are motion actuated devices that play a recorded message. The temporary audible message device gives individuals with visual impairments the ability to receive a message that signs display. Use temporary audible message devices in locations where a sign is providing a message that is intended for pedestrians and no other feature relays that message. For example, a pedestrian detour sign that is used to guide pedestrians along the detour should be accompanied by a temporary audible message device. In locations where temporary pedestrian barricades are used to guide pedestrians, temporary audible message device would not generally be needed. Use a temporary audible message device if a pedestrian is required to make a decision.

Messages recorded on the temporary audible message devices should describe the intended message of the sign. This message should include the following:

- Brief announcement to get pedestrian’s attention
- Current location of the pedestrian
- What is occurring
- Location of impact
- Advisory action

An example message:

Attention southbound Oneida St. pedestrians

You are at the southwest corner of Oneida and Front St.

The northwest corner of Oneida and Milwaukee St. is closed.

Cross Oneida St. for access south of Milwaukee St.

31.4.18 Technical Infeasibility

There are situations where fully closing a pedestrian facility and not providing alternate access is the only option. However, every effort must be made to maintain accessibility. Cost cannot be used as a reason for infeasibility. An exception may only be considered after all other options are rendered unable to be used. When an exception is used complete the Technical Infeasibility Form (FDM 11-46-10 Attachment 10.3) and attach it to Section 9 of the TMP. The memo must show that the project team made a good faith effort in attempting to provide temporary facilities that maintained accessibility and mobility. The public needs to be involved and informed when a decision is made not to provide a temporary pedestrian facility. During construction coordination with impacted stakeholders will also be required. At this time the following situations may warrant the complete closure of pedestrian facilities:

- Bridge replacements in locations where a readily available detour does not exist, and a transit/ride share program does not exist. Documentation that attempts were made to provide a shuttle or transit option must be attached to the TMP.
- Curb ramps with no connections. These curb ramps are at intersections and do not have connection to any pedestrian generators. The ramps themselves may not connect to any sidewalk. The ramps are generally in remote locations where development may have been anticipated but has not taken place. Confirm that these ramps are not used through a site visit to look for foot paths, traffic generators such as schools, and talk to the local population.

In all cases, the disruption of the pedestrian facility must be made as short as possible.

31.99 References

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17. Guideline on the use of Positive Protection in Temporary Traffic Control Zones, American Traffic Safety Services Association (ATSSA)
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FDM 11-50-32 Road User Costs *August 15, 2024*

32.1 Introduction

Road User Costs in the work zone are added vehicle operating costs and delay costs to highway users resulting from construction, maintenance, or rehabilitation activity. They are a function of the timing, duration, frequency, scope, and characteristics of the work zone; the volume and operating characteristics of the traffic affected; and the dollar cost rates assigned to vehicle operations and delays.

Designers should consider road user costs when determining the most appropriate construction staging and final design. This should be done early in the design process while there is still flexibility in the design. The optimal design will mitigate or avoid disruptions before they can be created. In addition to considering road user costs for the present construction needs, the analysis procedure provides the tools to determine future road user costs based on future construction needs. By understanding the major factors influencing road user costs, the analyst can take steps to minimize the effect of planned future rehabilitation activities on highway users.

Road User Costs play an important role in computing:

- "Enhanced" Liquidated Damages (FDM 11-50-32.7)
- Interim Liquidated Damages (FDM 11-50-32.8)
- Incentives/Disincentives (FDM 11-50-32.9)
- Cost per unit of time specified in Cost-Plus-Time bidding (FDM 11-50-32.10)
- Lane rental fee assessments for the failure to open a lane (or shoulder) in Lane Rental specifications (FDM 11-50-32.6)

The contractor's failure to complete a contract or reopen a lane of traffic on time results in damages in terms of delay and cost to the motoring public and the Department. Typically, these damages will never be imposed because it is preferable to avoid high road user costs by adhering to the completion dates and allowable work hours provided in the contract.

Road user costs that are more than the amounts shown as Liquidated Damages in Standard Spec 108.11 shall be approved by the Supervisor of the Traffic Design Unit in BTO and, if the project is on the National Highway System or subject to FHWA review, by the FHWA.

Road user costs can be used in Benefit/Cost ratios, Life Cycle Cost Analyses, and selecting the most appropriate project delivery method (i.e., Incentive/Disincentive, Interim Liquidated Damages, A+B Bidding, Lane Rental, detour selection, etc.).

32.2 Road User Cost Computation

Road user costs can be estimated using a number of different techniques. These techniques are classified either as simulation models or by manual technique, (such as tables, graphs, or hand calculations). Various models and techniques are used by other state DOTs.

Contact your Region Traffic Engineer or BTO for the current information on computing road user costs.

32.3 Road User Cost Recovery Methods

Most of the improvement projects will continue to be designed and constructed using the traditional design-bid-build method, where cost determines the winning bid. Some alternative contracting techniques (flexible notice to proceed, lane rental that does not unduly delay traffic) might be useful in conjunction with many of the traditional projects. However, for a limited number of projects, due to their adverse impact on traffic, other alternative contracting methods may be appropriate. The alternative contracting methods discussed below are techniques to allow the department to stay in compliance with the Work Zone Policy Statement (FDM 11-50-1). As background on determining traffic impacts, see FDM 11-50-30 - Statewide Freeway and Expressway Lane Closure and Delay Guidelines.

The Moving Ahead for Progress in the 21st Century Act (MAP-21), was signed into law in July 2012. Among other items, MAP-21 provides an array of provisions designed to increase innovation and improve efficiency, effectiveness, and accountability in the planning, design, engineering, construction and financing of transportation projects. Building on FHWA's "Every Day Counts" initiative, MAP-21 changes will speed up the project delivery process, saving time and money for individuals and businesses, and yielding broad benefits nationwide. (See http://www.fhwa.dot.gov/map21/ for more information.) The alternative contracting methods discussed in this section are an integral part of MAP-21.

Current department practice, in the case of construction projects that exceed the contact time, liquidated damages are applied per standard spec 108.11. These liquidated damages are only expected to recoup the added administrative costs (staff time) due to the construction work extending beyond the time stated in the contract. The department already uses some other alternative contracting methods (sometimes allowing the free use of lanes during "off peak" hours - a basic form of lane rental - and sometimes using interim liquidated damages and incentive/disincentive provisions to assure timely completion of some or all of the work). Similarly, the new concept of enhanced liquidated damages (recovering road user costs at the conclusion of a project in addition to administrative costs) is another possibility for alternative contracting.

FHWA evaluated a number of methods for improving the efficiency of delivering transportation improvement projects under the Special Experimental Project 14 Program. Four formerly experimental techniques are now operational;

- cost-plus-time bidding
- lane rental
- design/build contracting
- and warranty clauses.

The department has a lot of experience with lane rentals and warranties and has used cost-plus-time bidding on a limited basis in the past. Variations of cost plus time bidding (cost plus lane rentals and accelerated bridge construction) are relatively new to the department.

Road User Costs:

Road user costs play an important role in computing the lane rental fee assessments for the failure to open a lane (or shoulder) in:

- Lane Rental specifications (FDM 11-50-32.6)
- Enhanced" Liquidated Damages (FDM 11-50-32.7)
- Interim Liquidated Damages (FDM 11-50-32.8)
- Incentives/Disincentives (FDM 11-50-32.9)
- cost per unit of time specified in Cost-Plus-Time bidding (FDM 11-50-32.10).

The monies specified are based on a portion of the calculated road user costs. Contact your Region Traffic Unit Supervisor or the Supervisor of the Traffic Design Unit in the Bureau of Traffic Operations for the current information on computing road user costs.

Other Work Zone Effects:

Other work zone effects that impact businesses and the community at-large are generally hard to quantify and therefore should be considered as non-monetary or qualitative factors in the decision-making process. Work zones can affect accessibility to local business premises, thus adversely impacting local commerce. Many business owners are concerned about the potential negative impacts on their businesses. Local communities have similar concerns, such as issues related to resident access, decrease in property and land values, noise, and air pollution. There is some variance in the process to calculate road user costs and the calculation generally results in a range of possible costs. If the businesses and the community at-large concerns are judged to be sufficiently severe, the monies specified may be placed at a slightly higher portion of the calculated road user cost range.

The potential use of alternative contracting methods should be considered in the early stages of project planning, as part of the scoping process (see FDM 3-1-10). This will allow any potential additional monies due the contractor for meeting or exceeding contract deadlines to be included in the project estimate. Unless noted otherwise, projects contemplated for alternative contracting methods should be free of third party conflicts and design uncertainties.

Sample special provisions for most of the alternative contracting methods discussed below are available in FDM 19-15-2.

There are other alternative contracting techniques that are presently considered experimental by the FHWA. To be approved for use of federal funds, the department or local public agency would have to submit a SEP-14 work plan through the local FHWA Division Office.

32.4 Process for Selecting an Alternative Contracting Method

The alternative contracting decision flowchart is shown in Attachment 32.1. The Overview (page 1) shows the process in general terms with more detail included in pages 2 through 8. The questions asked in the diamond boxes on the flowchart are addressed in discussions below.

Most of the techniques discussed below are based on assuming a normal design engineering process, then relying on either a normal or an accelerated construction process. In some rare cases, when the design time is extremely limited or construction of a project needs to be started quickly, a possible alternative contracting technique is "low bid" design/build. The "low bid" design/build concept could be constructed with normal or accelerated construction projection rates. See the discussion below in FDM 11-50-32.4.

Another type of alternative contracting is the use of Flexible Notice-to-Proceed specifications. It is useful when there are not any constraints on when the project needs to start and there is more than enough time available in the construction season than is needed for the project. The flexible notice-to-proceed concept is intended for a project that is expected to be constructed using normal construction production rates. See the discussion in FDM 11-50-32.5.

32.4.1 Alternative Contracting Methods for Projects Constructed with Normal Production Rates

The discussions below are not intended to apply to "low bid" design/build contracts, contracts with flexible notice-to-proceed special provisions, or lane rentals (long term or off-peak) when traffic is not delayed.

In order to consider the use of the alternative contracting methods discussed below, the proposed project must be relatively free of third party conflicts and design uncertainties, if not, normal contracting methods should be used (see page 4 of Attachment 32.1). The project must demonstrate a need to minimize traffic inconvenience. The project should also be able to be completed using normal construction production rates (FDM 19-10-30).

Utility conflicts, design uncertainties, or right-of-way issues which may impact the bid letting date or the project schedule complicate construction administration. The completion dates in the contract must accurately reflect the impacts of utility relocations, design uncertainties, and right-of-way constraints that may restrict construction operations. To consider alternative contracting methods, the project should not have significant conflicts or design uncertainties.

The project would in most cases be classified as a transportation management plan (TMP) Type 2 or Type 3 (see FDM 11-50-5) and should also meet at least some of the following criteria to demonstrate a need to minimize traffic inconvenience:

- Completion time constraint; this could include weather limitations or a potential interference with major public events
- Safety Considerations
  - School zone in or adjacent to project
  - Impairment of emergency vehicle response (hospital, police or fire)
  - Basic need for project is to alleviate accidents
  - Heavy pedestrian/bike usage; or
  - High worker exposure.
- Projects on OSOW routes (see FDM 11-25-1)
- Projects which have multiple activities occurring which do not necessarily have to be done sequentially.

Once the need to minimize traffic inconvenience is determined and third-party conflicts have been assessed, the following alternative contracting methods can be considered:

- FDM 11-50-32.6 Lane Rental (Long Term or Off-Peak), when traffic is delayed on remaining lane(s)
- FDM 11-50-32.7 Enhanced Liquidated Damages, with normal construction production rates
- FDM 11-50-32.8 Interim Liquidated Damages, with normal construction production rates.

32.4.2 Alternative Contracting Methods for Projects Constructed with Accelerated Production Rates

In order to be a candidate for the alternative contracting methods discussed below, the project must demonstrate a need to be constructed with accelerated production rates; it must be relatively free of third party conflicts; and the agency responsible must have necessary resources to accommodate an accelerated construction schedule.

As above, the project would in most cases be classified as a TMP Type 2 or Type 3 (see FDM 11-50-5). In addition to meeting some of the criteria discussed above under projects constructed with normal production rates (FDM 11-50-32.3.1) the project should also meet at least some of the following criteria to demonstrate a need for accelerated construction:

- Current level of service below “C”
- Major bridge or roadway out of service due to a natural calamity, such as earthquake or flood
- Projects where access to retail business will be restricted or inconvenienced because of reconstruction and as a result significant business loss can be expected to occur
- Motorists' delay time waiting in line is 15 minutes above normal recurring traffic delays between major city nodes and within each major city
- Road User Costs (RUC) related to detours or due to delays caused by congestion/capacity problems exceed 20% of the project construction cost, but are a minimum of $100,000
- The calculated RUC exceeds $40,000 per day. Traffic restrictions, lane closures, or detours result in high RUC. Some causes of high road user-costs are:
  - lengthy detours
  - high traffic volumes
  - major reconstruction or rehabilitation on an existing urban facility.
- Highly sensitive project (political issues, significant public interest and benefit, completion of a gap in a significant highway system)
- Traffic control phasing can be structured to maximize a contractor's ability to reduce the duration of construction and the department seeks contractors’ expertise to facilitate an earlier completion.

Similar to projects to be constructed with normal production rates, utility conflicts, design uncertainties, or right-of-way issues which may impact the bid letting date or interfere with the critical path schedule complicate contract administration on projects to be constructed with accelerated production rates. As above, the completion dates in the contract must accurately reflect the impacts of utility relocations, design uncertainties, and right-of-way constraints that may occur during the duration of the project.

Although the number of administrative staff-hours for a project using accelerated construction production rates is generally less or about the same as the same project bid conventionally, the responsible agency needs to be aware that the contractor will likely work longer hours. This will require an increase in staff-hours per day; overtime, weekend work, multi-shifts should be expected.

Once the need for accelerated construction is determined, the third-party conflicts and construction administration staffing issues have been assessed, the following alternative contracting methods can be considered:

- FDM 11-50-32.7 Enhanced Liquidated Damages, with accelerated construction production rates
- FDM 11-50-32.8 Interim Liquidated Damages, with accelerated construction production rates
- FDM 11-50-32.9 Incentives/Disincentives
- FDM 11-50-32.10 Cost Plus Time Bidding
  - A + B (and A + B1 + B2 + B3) bidding
  - A + Lane Rental (Long Term) bidding or A + Lane Rental (Off-Peak and Peak Hour) bidding
  - Accelerated Bridge Construction

Warranties (FDM 11-50-32.11) are an alternative contracting method which can be used to increase project quality by protecting the department’s investment.

32.5 "Low Bid" Design Build

The “Low Bid” Design-Build method is shown schematically in page 2 of Attachment 32.1.

The department has used a “low bid” design-build method one time on a bridge project (to rehabilitate the Wisconsin Avenue and Juneau Avenue bridges in the City of Milwaukee). Federal law provides that federally funded design-build projects may be procured using “any process permitted by applicable State and local law.” The department is normally awards construction contracts through a competitive bidding process but is not subject to any requirement to use a particular method to procure engineering services contracts. It is therefore possible to bundle design and construction services into a single contract awarded to the “lowest competent and responsible bidder.”

Although the design engineering process timeline is compressed with the “low bid” design/build concept, the construction work may or may not need to be accelerated to complete the entire project in the available time.

This contracting method should not solely be used to obligate funds nor to compensate for inadequate agency resources.

“Low Bid” Design/Build Advantages:

“Low bid” design/build allows the department to tap into the primary advantage of a design/build contract, allowing the construction to begin before the final design is complete, thus reducing the overall project time.

“Low Bid” Design/Build Disadvantages:

Use of this technique might limit the number of firms available to do both the design and construction work or might require firms to form partnerships to qualify for consideration.

“Low Bid” Design/Build Criteria for Selection:

The primary reason to consider a “low bid” design/build contract is a lack of time available to use the normal design process. Construction could be accomplished with normal or accelerated construction production rates.

32.6 Flexible Notice-to-Proceed

The Flexible Notice-To-Proceed method is shown schematically in page 3 of Attachment 32.1.

One type of alternative contracting is the use of Flexible Notice-to-Proceed specifications. It is useful when there are not any constraints on when the project needs to start and there is more than enough time available in the construction season than is needed for the project. However, once started, the project would be required to be completed in a certain amount of time or by a specified date. In those cases, it is possible to allow the contractor to pick the start date, within certain parameters such as the soonest and the latest it can start.

The contractor is expected to complete the work using normal construction production rates.

Flexible Notice-to-Proceed Advantages:

Using this concept allows a contractor to have more flexibility in scheduling the use of their equipment and manpower. Contractors seem to like this flexibility as it allows them to use their resources better. The result may be lower bid prices and perhaps reduced contract time.

Flexible Notice-to-Proceed Disadvantages:

It is somewhat more difficult to communicate the start date and end date with local communities, businesses, and utilities.

Flexible Notice-to-Proceed Criteria for Selection:

In order to use this concept, the project start date and end date must be able to be “floated”. If the estimated construction time for the project is appreciably less than the available construction window, this technique may be appropriate to use.

Refer to FDM 19-15-2 Attachment 15.1 for a listing of standardized special provisions available for use to specify flexible notice-to-proceed techniques.

32.7 Lane Rental

The Lane Rental methods are shown schematically in page 5 (for lane rental long term) and page 6 (for lane rental off peak) of Attachment 32.1.

Even though the possibility of closing the road to through traffic (and using a detour) is always available, in many cases the proposed construction can be accomplished by restricting the traffic to portions of the existing or reconstructed roadway. Common examples of these traffic restrictions are reducing a four-lane facility to two lanes of counter-directional traffic (while reconstructing the other two lanes) or reducing two lanes in one direction on a four-lane facility to a single lane (for construction activities on the closed lane). While these restrictions are defined as lane rentals, there is not always a lane rental fee assessment for using the lane for construction. Lane rental fee assessments are associated with a lane rental which unduly causes a “delay” (see definition below) in traffic.

Undue traffic delays as a result of lane rentals are defined in FDM 11-50-30: a “delay” occurs when the projected traffic volumes on the reduced lanes results in a traffic delay of more than 15-minutes. If the 15-minute threshold is not exceeded, it would not be considered a delay warranting special specifications. The designer should coordinate with the region Traffic Section and Bureau of Traffic Operations early in the project to identify impacts of lane closures and the hours such closures will be allowed.

The department defines two types of lane rentals - long term and off peak. Off peak lane rentals are defined as using a lane (or lanes) for a portion of a 24-hour period that has lower traffic volumes, then re-opening the lane (or lanes) when peak traffic volumes are present. Long term lane rentals are defined as using a lane (or lanes) for a defined number of consecutive 24-hour periods.

Off-Peak Lane Rentals:

In the simplest case, for a project that will temporarily reduce two lanes in one direction on a four-lane facility to a single lane, the existing traffic volume may be so low that the single remaining lane will handle the volume without delay at all times (peak and off-peak hours). This might occur for projects classified as TMP Type 2 or Type 3 (see FDM 11-50-5). Current WisDOT practice in this case is to allow lane (or shoulder) closures without charge. However, for higher traffic volumes, it may be that the peak hour traffic would be “delayed” while the off-peak would not. This might occur for projects classified as TMP Type 3 (see FDM 11-50-5). In this case, current WisDOT practice is to allow construction during off peak/nighttime hours without charge but restrict the use of the through traffic lanes during peak hours. For even higher traffic volumes, the off-peak traffic might be “delayed” and then the use of both the peak and off-peak use of a lane would be limited to the amounts shown in the special provisions.

When using off peak lane rentals, the designer shall make sure that the contractor will have a minimum of eight (8) hours of contract time per off-peak period, not including work zone setup and removal. If this is not considered, the letting may result in a no bidder scenario or extremely high unit prices.

As noted above, if traffic delays are expected, use of the lanes (during peak hour or off-peak) should be limited by specification. The specification should include a “failure to open” clause with associated costs if the lane is not re-opened when scheduled. Off peak and peak hour lane rentals could be daily, hourly or fractions of an hour. The lane rental fee assessments are dependent on the number and type of lanes closed and can vary for different hours of the day. For example: the rush hour periods (say 6:30 to 9:00 am and 3:00 to 6:00 pm) could have an hourly rental fee assessment of $2000 for closing one lane while a lane could be closed at off-peak times for an hourly rental fee assessment of $500. The fee assessments could begin to be charged when the lane is not open for a quarter hour. Assessments can be charged in AASHTOWare Project Construction using the administrative item Failing to Open Road to Traffic (see CMM 2-38). Lane rental fee assessments that are more than the amounts shown as Liquidated Damages in standard spec 108.11 shall be approved by the Supervisor of the Traffic Design Unit in the Bureau of Traffic Operations or delegate and, if the project is on the National Highway System or subject to FHWA oversight, by the FHWA.

Projects that include restrictions on the use of lanes during peak hours typically push the contractor into nighttime operations. The designer will need to coordinate with local officials to determine if there is any conflict with these operations and local noise or light ordinances. Though it would be the responsibility of the contractor to coordinate with the locals on these ordinances, the designer needs to make sure that the proposed construction staging and timeframes are achievable.

For a few projects that have a demonstrated need to minimize traffic inconvenience and a need for accelerated construction production rates, off-peak and peak hour lane rental may be used as a variation of the "Cost Plus Time Bidding" method. See the A + Lane Rental portion of FDM 11-50-32.10 for further information.

Long Term Lane Rentals:

On a project that will reduce two lanes in one direction on a four-lane facility to a single lane for a number of consecutive days, the traffic volumes may be so low that the remaining lane will handle the volumes without delay at all times. This might occur for projects classified as TMP Type 2 (see FDM 11-50-5). Current WisDOT practice in this case is to allow lane (or shoulder) closures without charge. However, for larger traffic volumes, it may be that the traffic on the remaining lane would be "delayed". This would usually occur for projects classified as TMP Type 3 (but maybe for TMP Type 2). In this case, current WisDOT practice is to limit by specification the maximum time of the long-term lane rental.

If traffic delays are expected, use of the lane should be limited by specification and include a "failure to open" clause with associated costs if the lane is not re-opened when scheduled. Lane rental fee assessments could be daily or fractions of a day. A long-term lane rental could have a lane rental fee assessment of $10,000 per day or more if the lane is not reopened. The lane rental fee assessments are based on a portion of the calculated road user costs (see FDM 11-50-32). The costs could begin to be charged when the lane is not open for a quarter day. Lane rental fee assessments can be charged in AASHTOWare Project Construction. Lane rental fee assessments that are more than the amounts shown as Liquidated Damages in standard spec 108.11 shall be approved by the Supervisor of the Traffic Design Unit in the Bureau of Traffic Operations and, if the project is on the National Highway System or subject to FHWA oversight, by the FHWA.

In some limited cases when the project has a demonstrated need to minimize traffic inconvenience and a need for accelerated construction production rates, long term lane rental may be used as a variation of the "Cost Plus Time Bidding" method. See the A + Lane Rental portion of FDM 11-50-32.10 for further information.

When provisions for lane rental fee assessments are added to the contract, it is a method of transferring a portion of the road user cost (RUC) to the contractor. The lane rental fee assessment is usually a portion of the estimated cost of delay or inconvenience to the road users during the rental period. The fee is assessed for the time that the contractor occupies or obstructs part of the roadway and is deducted from the progress payments. See FDM 11-50-32 for a discussion of road user costs. Road user costs that are more than the amounts shown as Liquidated Damages in standard spec 108.11 shall be approved by the Supervisor of the Traffic Design Unit in the Bureau of Traffic Operations or delegate and, if the project is on the National Highway System or subject to FHWA oversight, by the FHWA.

Lane Rental Advantages:

The intent of lane rental is to encourage contractors to schedule their work to keep traffic restrictions to a minimum, both in terms of duration and number of lane closures. The lane rental concept has merit for use on projects that significantly impact the traveling public. Projects on major urban commuter routes are prime candidates for this approach.

Lane Rental Disadvantages:

Lane rental can increase the cost of a project, as contractors may need to apply more resources to or work more quickly on lane rental jobs and require additional bond coverage.

Lane Rental Criteria for Selection:

Lane Rental is particularly applicable to projects where the contractor can adjust or design the traffic control plan to reduce lane closure durations or take lanes out of service during periods of the day or night when impacts to traffic are minimal.

Refer to FDM 19-15-2 Attachment 2.1 for a listing of standardized special provisions available for use to specify lane rentals.

32.8 Enhanced Liquidated Damages

If the contractor does not complete all contract work within the contract time, or within the extra time allowed under engineer-granted time extensions, the department will assess final liquidated damages. Final liquidated damages recover department costs to provide additional engineering and supervision to keep the project open longer. The department will deduct a specified sum from payments due the contractor for every calendar day on calendar day contracts and completion date contracts, or for every working day on working day contracts, that the work remains incomplete. See standard spec 108.11 of the standard specifications for daily liquidated damages that reflect only the cost of engineering and supervision.

On projects that meet some of the criteria in FDM 11-50-32.3.1, it may be appropriate to amend the definition of final liquidated damages (from standard spec 108.11) to recover not only the cost of engineering and supervision but also a portion of the calculated road user costs (see FDM 11-50-32). The department has chosen to call the amended definition enhanced liquidated damages. This concept would be useful for projects that need to be substantially complete before the road user impacts are gone.

Enhanced liquidated damages are used to motivate the contractor to complete the project early to discontinue the use of a detour and reopen the highway to through traffic. The designer must decide how much flexibility the department can give the contractor to complete the project and the level to which the contract time must be controlled. Generally, if the contractor has flexibility in determining the contract's timeframe, bid prices will be lower.

As noted in FDM 11-50-32.3.1, the use of enhanced liquidated damages is typically intended for projects expected to be constructed with normal construction production rates. It could, however, be used on projects expected to be constructed with accelerated construction production rates. Enhanced liquidated damages could be considered for projects classified as TMP Type 2 or Type 3 (see FDM 11-50-5).

Enhanced Liquidated Damages Advantages:

Using enhanced liquidated damages allows the department to recoup some of the road user costs. Also, the contractor may be more inclined to finish the project on time to avoid the higher assessments.

Enhanced Liquidated Damages Disadvantages:

It is possible that all the contractors bidding on a project may decide to bid some of the contract items slightly higher as a hedge against the higher enhanced liquidated damages.

Enhanced Liquidated Damages Criteria for Selection:

This technique is useful for projects that have a demonstrated need to minimize traffic inconveniences.

Refer to FDM 19-15-2 Attachment 15.1 for a listing of standardized special provisions available for use to specify enhanced liquidated damages.

32.9 Interim Liquidated Damages

As noted in FDM 11-50-32.3.1, the use of interim liquidated damages is intended for projects expected to be constructed with normal production rates. As discussed below, interim liquidated damages could sometimes be used on project expected to be constructed with accelerated production rates when no Incentive is included. Interim liquidated damages could be considered for projects classified as TMP Type 2 or Type 3 (see FDM 11-50-5) or any project with multiple stages or projects containing interim completion dates or interim stages.

Interim liquidated damages are not considered a penalty but are fixed and agreed-to damages that the contractor owes the state for not completing the work within the time specified in the contract. Not completing contract work within the specified time may result in:

- Public inconvenience due to detours and delays caused by increased traffic or lower highway speeds
- Excessively high vehicle operating costs if traffic is routed over a long detour
- Additional project costs due to maintaining the detour and using traffic control items for a longer period of time than anticipated
- Delay to remaining stages of the project.

Interim liquidated damages are used to motivate the contractor to complete a portion of the construction early in order to discontinue the use of a detour and reopen a section of highway to through traffic or ensure that the remainder of the project stays on track.

When using an interim liquidated damage provision in a contract, the preferred contract type is either a completion date or calendar day contract. Do not mix calendar day or completion date provisions with working day contracts.

The designer must decide how much flexibility the department can give the contractor to complete the project and the level to which the contract time must be controlled. Generally, if the contractor has flexibility in determining the contract's timeframe, bid prices will be lower. Interim deadlines specified in the contract must be realistic and not be subject to third-party delays that are beyond his control. Unrealistic timeframes increase risks and costs to both the department and contractors and add significant tension to contract administration.

When specifying interim liquidated damages, the designer may eliminate all excusable delays or restrict the number of weather delays, in addition to the conditions specified in section 108 of the standard specifications. Eliminating all excusable delays should be taken seriously, as it may not always be appropriate to do so. For example, do not eliminate all excusable delays if there is a strong likelihood of utility or other third-party delays that are beyond the control of the contractor. By increasing the number of adverse weather days allowed during the road closure period when interim liquidated damages are specified in a contract, the likelihood of granting the contractor a weather delay for the road closure period is reduced, since time extensions are granted when the number of adverse weather days actually occurring exceeds the number of adverse weather days listed in the contract. More guidance on how to complete a special provision for interim liquidated damages that restricts the number of weather delays is provided in the Technical Notes of the STSP Index spreadsheet located at:

https://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrces/tools/stsp.aspx

Interim liquidated damages are useful for projects that do not need to be substantially complete before the road user impacts are gone. Avoid using a deadline for interim liquidated damages that is the same as the deadline for completing all contract work. For example, suppose it is critical to open a roadway in front of a high school before the 2026 school year begins on September 3, 2026, and, because all major project work must be completed within the summer time period that school is not in session, the project has a short construction timeframe. Instead of specifying that interim liquidated damages will be assessed if all contract work is not completed by September 3, 2026, consider assessing interim liquidated damages if the roadway is not paved and open to through traffic on September 3, 2026, and then provide the contractor another week or two to complete work, such as landscaping, that can be completed with the highway open to traffic.

Interim Liquidated Damages by the Hour:

Interim liquidated damages assessed by the hour can be entered in AASHTOWare Project Construction™ using the administrative item Failing to Open Road to Traffic (see CMM 2-38). Very few projects need interim liquidated damages assessed by the hour.

Interim Liquidated Damages Advantages:

Using interim liquidated damages allows the department to recoup some of the road user costs. Also, the contractor may be more inclined to finish the project on time to avoid the higher assessments.

Interim Liquidated Damages Disadvantages:

Utility conflicts, design uncertainties, or right-of-way issues complicate contract administration on projects to be constructed with accelerated production rates. Special care must be used to assure that the completion dates in the contract accurately reflect the impacts of utility relocations, design uncertainties, and right-of-way constraints that may occur during the duration of the project.

Accelerated construction production rates generally require an increase in construction administration staff-hours per day; overtime, weekend work, multi-shifts should be expected.

32.9.1 Interim Liquidated Damages Criteria for Selection

The degree to which contract time is critical varies from project to project and may vary between different construction stages or roadway sections of the same contract. In most contracts, it isn't necessary to add interim liquidated damages; standard spec 108 will suffice. Use interim liquidated damages with care and only when necessary. The "damages" in interim liquidated damages are developed from considering road user costs of delay occurring in subsequent stages, and do not necessarily match standard spec 108.11.

32.9.2 Interim Liquidated Damages - Multiple Project Contract

Sometimes several small projects are combined into one contract, such as small bridge and approach projects, to obtain more competitive bids. In these contracts, it may be necessary to complete one or more of these projects at a specified date or within a specified time period within the overall contract time.

When this is necessary, use an interim liquidated damage provision for each project that has to be completed by a specified date or within a specified time period. If not completed within the time frame, assess the contractor interim liquidated damages.

This provision may be necessary to:

- Reduce public inconvenience
- Shorten the detour time
- Reduce disruption to traffic
- Reduce effects on businesses, tourism, etc.
- Reduce road user costs

Use the STSP template by selecting the most appropriate contract work type and modifying the interim completion language as needed. The STSP provisions to specify interim liquidated damages is provided as part of the STSP template located at:

https://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrces/tools/stsp.aspx

It is important to make a clear distinction between the intent of I/D provisions and interim liquidated damages. Although they have some common elements and similar mechanisms, the purpose or function of each provision is different.

Common features of both I/D and interim liquidated damages provisions are:

1. Both provide a specified contract date for the critical work to be completed to open the highway to traffic.
2. Both are used to recover some or all road user costs of detours and delays if the roadway is not opened on the specified date.
3. Both should be used with care and only when necessary.
4. Both can be used to keep subsequent stages on track.

Unique elements of Interim Liquidated Damages:

1. Is typically used when the work necessary to open highway can be completed with reasonably normal production rates.
2. Are used more frequently than I/D on projects where it is necessary to open a highway stage to traffic on a specific date, or within a prescribed time frame.
3. Could be used on projects with accelerated construction production rates when no Incentive is provided.

Unique elements of I/D Provisions:

1. This provision is used when the work necessary to open highway to traffic cannot be completed with normal production rates.
2. Provides significant financial motivation to complete critical work on a highly accelerated schedule.
3. Should be used very judiciously.

Refer to FDM 19-15-2 Attachment 15.1 for a listing of standardized special provisions available for use when using interim liquidated damages provisions.

32.10 Incentives / Disincentives

As noted in FDM 11-50-32.3.2, the use of incentives/disincentives is intended for projects expected to be constructed with accelerated production rates. Incentives/disincentives could be considered for projects classified as TMP Type 3 (see FDM 11-50-5).

Incentives/Disincentives Criteria for Selection:

See the criteria in FDM 11-50-32.3.2.

- The Incentive/Disincentive (I/D) provision is intended to motivate the contractor to complete the work faster than normal.
- The provision should be limited to projects where construction will severely disrupt highway traffic, significantly increase road users' costs.
- I/D provisions should be used judiciously and only on critical projects. Excessive use of the provision is detrimental to both WisDOT and contractors.
- When using the I/D provision in a contract, the preferred contract type is a completion date contract although a calendar day contract may be used.

- Federal funds can be used as part of the incentive provisions. FHWA policy recommends a cap of 5% of the total contract amount for the maximum incentive payment and no cap for the disincentive amount. In the past, WisDOT has not exceeded 2.5% on the contract amount for disincentives.

It is important to make a clear distinction between the intent of I/D provisions and interim liquidated damages. Although they have some common elements and similar mechanisms, the purpose or function of each provision is different.

Common features of both I/D and interim liquidated damages provisions are:

1. Both provide a specified contract date or time duration for the critical work to be completed to open the highway to traffic.
2. Both are used to recover some or all road user costs of detours and delays if the roadway is not opened on the specified date.
3. Both should be used with care and only when necessary.

Unique elements of Interim Liquidated Damages:

1. Is typically used when the work necessary to open highway can be completed with reasonably normal production rates.
2. Are used more frequently than I/D on projects where it is necessary to open a highway to traffic on a specific date.
3. Could be used on projects with accelerated construction production rates when no Incentive is provided.

Unique elements of I/D Provisions:

1. This provision is used when the work necessary to open highway to traffic cannot be completed with normal production rates.
2. Provides significant financial motivation to complete critical work on a highly accelerated schedule.
3. Should be used very judiciously.

Incentives/Disincentives Description

An incentive/disincentive (I/D) provision is part of a contract that compensates the contractor a certain amount of money for completing critical work on or ahead of schedule and assesses a deduction for work not completed on time. This provision is intended for critical projects where traffic inconvenience and delay is to be kept to a minimum and access is to be restored as soon as possible.

I/D provisions are applicable to projects that require accelerated construction production rates.

I/D provisions may be used to assure completion of interim stages or completion of the entire project to the point where road user impacts are gone but some other contract work remains. I/D provisions are also useful for projects that need to be substantially complete before the road user impacts are gone. Although labeled "Incentive/Disincentive for Interim Completion of Work", the current incentive/disincentive special provision has been used for completion of the project as well for completion of interim stages. To resolve this inconsistency, the designer is encouraged to use a new special provision called Incentive/Disincentive for Final Completion of Work when the work under the contract needs to be substantially complete by a certain time.

On many projects, it is better to list the bid items or portion of bid items that may remain incomplete in order for the contractor to receive the incentive. This list would generally be much shorter than a list of items that must be completed.

Incentives/Disincentives Advantages

Using interim incentives/disincentives allows the department to recoup some of the road user costs. Also, the contractor may be more inclined to finish the project on time to avoid the higher assessments.

Incentives/Disincentives Disadvantages

Utility conflicts, design uncertainties, or right-of-way issues complicate contract administration on projects to be constructed with accelerated production rates. Special care must be used to assure that the completion dates in the contract accurately reflect the impacts of utility relocations, design uncertainties, and right-of-way constraints that may occur during the duration of the project.

Accelerated construction production rates generally require an increase in construction administration staff-hours per day; overtime, weekend work, multi-shifts should be expected.

32.10.1 Project Types Appropriate for Incentives/Disincentives

On projects where delays will occur, the current peak hourly volumes must be used to determine the number of lanes required to handle the traffic.

The project must then be analyzed by region Traffic Section and Bureau of Traffic Operations staff to determine whether a shortening of the construction time can be accomplished on the project and whether the I/D provision will achieve the desired result.

Avoid selecting projects where contractor's production can be adversely affected due to the following conditions which are outside their control:

1. Utility conflicts/relocations
2. Hazardous materials coordination and clean up.
3. Major items of work with quantities that may vary considerably such as joint repairs and base patching in pavement rehabilitation work.

Project Development

The following information/steps will be helpful to designers at the project development stage:

1. It is important to define clearly the "work" which is subject to the I/D provision. See the sample Special Provision in FDM 19-15-2. The following is a list of items which should be considered:
    a. The number of driving lanes open to traffic. This may include some discussion of whether traffic flow must be completely unrestricted when reopened or if some defined minor temporary traffic restrictions may be allowed:
    b. Opening the bridge to unrestricted four lane traffic.
    c. The contractor will not be allowed to interrupt traffic once the bridge is re-opened except between 3:00 AM and 6:00 AM as approved by the engineer.
    d. Completion of shoulder work.
    e. Pavement markings completed. Specify whether permanent or temporary.
    f. Installation of bridge rail.
    g. Installation of beam guard.
    h. Completion of signing (all or just critical signing.)
2. To avoid claims during construction, the designer should make an extra effort to ensure compatibility of design, plans, specifications, and schedule. This may require conduction of more thorough design field reviews and collecting more field data rather than relying on as-built plans.
3. Consider pre-bid meetings to explain I/D provisions.
4. Make sure I/D dates are compatible with other contract dates, such as environmental dates, for migratory birds and fish spawning.
5. On staged projects with multiple contracts, coordinate I/D dates with other contract completion dates for compatibility.
6. When using I/D provisions on a single contract extending over more than one construction season, provide a clear explanation in the special provisions regarding the suspension of work time used as the basis for setting an I/D date in a future season. It is best to specify a firm suspension date.
7. Coordinate with locals on projects to determine their cost share for the I/D provision and to define the "work." Inform the locals of the implications of making the I/D provision too restrictive.
8. For projects that may experience a long delay between design completion and PS&E submittal, the I/D provisions should be reviewed for need and changed conditions prior to the letting.
9. Computations and justifications for I/D should be forwarded to the appropriate project design oversight engineer in the BPD, prior to the PS&E, who will ensure that the report is placed in the file for the project.
10. For steel bridge projects, be sure to account for lengthy fabrication time when determining the I/D date.

The I/D provision has a maximum dollar amount for the incentive payment but no maximum dollar amount for disincentive.

Local Participation

Generally, the department requests local participation in projects where local needs are served in addition to the needs of the through traveler. The goal of the cost sharing agreements is to reflect the reason for the project so those who benefit from the project also contribute to the cost of the project. Cost sharing of the I/D provision should have the same goal. Local governments should pay that portion of the I/D provision that corresponds to the benefit they will receive. Local participation in I/D provisions can vary widely. Some communities have paid 100% of the I/D provision on urban projects where early completion primarily benefited the local government. A municipality contributed 50% of the I/D provision on a rural interstate project because they felt it would benefit their tourism industry.

Whenever a local government asks for an I/D provision, the department should begin by requesting 100% local contribution and require a minimum of 50% local contribution. The department should only contribute to the I/D provision in this situation if there is a “significant benefit” to through travelers for early completion.

Refer to FDM 19-15-2 Attachment 15.1 for a listing of standardized special provisions available for use to specify incentives/disincentives.

32.11 Cost Plus Time Bidding

The Cost Plus Time Bidding methods are shown schematically in Attachment 32.1, page 7 (for A + Lane Rental bidding) and page 8 (for A + B bidding and Accelerated Bridge Construction).

Projects to be considered for cost plus time bidding should have a demonstrated need to minimize traffic inconvenience (see criteria in FDM 11-50-32.3.1) and a need for accelerated construction production rates (see criteria in FDM 11-50-32.3.2). The project should also be clear of third party conflicts and construction administration staffing issues assessed. Cost plus time bidding could be considered for projects classified as TMP Type 2 or Type 3 (see FDM 11-50-5).

Cost Plus Time Bidding Criteria for Selection

In some cases, additional emphasis on reducing traffic inconvenience is needed beyond including incentive/disincentive provisions in the contract. For critical projects that have very high road user delay impacts, the cost plus time bidding method can be an effective technique to significantly reduce these impacts. On projects that have used the cost plus time bidding method, contract times have been reduced, costs have been acceptable, and quality has been maintained.

It is appropriate to consider cost-plus-time bidding when the project has flexibility in the methods and means of construction. The following situations are appropriate to a project:

- Projects which allow alternate solutions where one solution may take significantly less time to construct, yet designers are hesitant to specify methods and means of construction or a proprietary solution.
- Projects in which innovative solutions from the contracting industry are sought (specialty work) which may be beyond the designer’s expertise.

If it is determined that accelerated construction production rates are needed but there is no apparent flexibility in the methods and means of construction, an incentive provision could be included to reward the contractor if the work is completed and the roadway reopened earlier than the time specified in the contract.

The cost plus time method generally includes three types of bidding.

1. The basic type is A + B bidding, where the contractor bids both items (A) and contract time (B).
2. The second type is A + Lane Rental, where the time component is the number of lane closures.
3. A third type is Accelerate Bridge Construction, where the maximum time specified in the contract is so restrictive that pre-fabricated bridge elements and systems, state-of-the-art equipment, material technologies, and innovative contracting methods would be needed.

All types of cost plus time bidding include a maximum time that could be bid and the cost (or costs) per unit (or units) of time bid that will be used to evaluate the bids.

32.11.1 A + B Bidding

The A+B bidding method, involves time, with an associated cost, in the low bid determination. Under the A+B bidding method, each bid submitted consists of two components:

- The "A" component is the traditional bid for the contract items and is the dollar amount for all work to be performed under the contract.

- The "B" component is a "bid" of the total number of calendar days required to complete the project, as estimated by the bidder (Calendar days are used to avoid any potential for controversy which may arise if work days were used). The bidding documents would specify the maximum number of days a contractor can bid.

The total bid for award consideration is based on a combination of the bid for the contract items and the associated cost of the time, according to the formula:

(A) + (B x Road User Cost / Day)

The above formula is only used to determine the lowest bid for award and is not used to determine payment to the contractor. A contract would be awarded for the bid amount for the bid items (A) with the time bid specified in the contract. See Attachment 32.2 for a Cost + Time bidding example.

As noted above, the "B" component is generally a "bid" of the total number of calendar days required to complete the project. The “B” component could also be the time to do interim stages of a contract. B1 could be the time to complete the first stage of a project, B2 the second stage, B3 the third stage, etc. It is normal to have the same road user cost for each of the interim stages although different road user costs could be used. The combination of the bid for the contract items and the associated cost of the time would normally then be:

(A)+ [(B1 + B2 + B3) x (Road User Cost / Day)]

Or, if there are different road user costs:

(A) + (B1 x RUC1 / Day) + (B2 x RUC2 / Day) + (B3 x RUC3 / Day)

The above formula is only used to determine the lowest bid for award and is not used to determine payment to the contractor. A contract would be awarded for the bid amount for the bid items (A) with the interims times bid specified in the contract. See Attachment 32.2 for a Cost + Time bidding example with interim stages.

The road user costs listed in the bidding proposal are some portion of the calculated road user costs. The listed costs are stated in dollars per day. The maximum number of days allowed to be bid is also written into the bidding proposal. Road user costs that are more than the amounts shown for Liquidated Damages in standard spec 108.11 shall be approved by the Supervisor of the Traffic Design Unit or delegate in the Bureau of Traffic Operations and, if the project is on the National Highway System or subject to FHWA oversight, by the FHWA.

When the A+B bidding method is used, a liquidated damages provision (that assesses road user costs) is usually incorporated into the contract to discourage the contractor from overrunning the time "bid" for the project. Consider A+B bidding without an incentive provision if:

- The project is not required to finish ahead of a specific completion date.
- RUC is not severe but other factors warrant expediting the project.

In addition, an incentive provision can be included to reward the contractor if the work is completed earlier than the time bid. If a project is especially time-critical and it is cost-beneficial to use them, incentive provisions will motivate contractors to further shorten the construction duration. Consider using A+B bidding with an incentive provision if:

- The RUC is high, and the monetary benefit to the highway user equals or exceeds the contractor’s costs to finish early and earn the maximum incentive.
- It is in the public interest to complete the project as soon as possible.

32.11.2 A + Lane Rental Bidding

As noted above (in FDM 11-50-32.6), if traffic delays are expected, temporary use of the lanes (during peak hour or off-peak) or a lane (during long term lane rental) would be limited by specification. Limited use should also include a “failure to open” clause with associated costs if the lane is not re-opened when scheduled. These limitations are applied assuming normal construction production rates.

However, if it is determined that accelerated construction production rates are needed and there is flexibility in how the lanes may be closed for construction, either type of lane rental could be used as part of the bid process similar to the “A + B” discussed above. Instead of the “time” portion being the total contract time, it could be the number of consecutive days (for long term lane rental) or the number of off-peak (or even peak hour) lane rentals multiplied by specified road user costs. See Attachment 32.3 for Cost + Lane Rental bidding examples.

(A) + (LR x Road User Cost / (Day or Hour))

Similar to A+B bidding, the contract would be signed for the sum of the quantities in the plan times the unit prices bid (the A portion of the bid) with the number of lane rental periods from the successful bid written into the contract.

Lane rental rates are stated in the bidding proposal in dollars per lane (or per shoulder) per time period. The maximum number of lane rentals allowed is written into the proposal.

Cost + Lane Rental bidding could be considered for projects classified as TMP Type 2 or Type 3 (see FDM 11-50-5).

Each of the two types of lane rental should include a “failure to open” clause with associated costs if the lane is not re-opened when scheduled (either at the end of the contract indicated period for long term lane rentals or at the start of the peak hour traffic period for off peak lane rentals) to discourage the contractor from overrunning the time "bid" for the lane rental. The associated costs are based on a portion of the calculated road user costs. The costs could begin to be charged when the roadway is not open for a quarter day (at the end of a long-term lane rental) or a quarter hour (for an off-peak lane rental). Costs can be charged by the day in AASHTOWare Project Construction Administration™ under an interim site time record. Costs by the hour (or portion thereof) can be entered using the administrative item Failing to Open Road to Traffic (see CMM 2-38).

If it is determined that accelerated construction production rates are needed but there is no apparent flexibility in how lanes may be closed for construction, an incentive provision could be included to reward the contractor if the work is completed and the lanes reopened earlier than the time specified in the contract. See the above discussion under A + B bidding for considerations of when or when not to use incentives.

32.11.3 Accelerated Bridge Construction Bidding

The normal (cast-in-place) reconstruction of some structures can create extreme hardship on the traveling public. A special type of cost plus time bidding which severely limits the time the bridge may be closed to traffic could be useful for those projects. If the bidding proposal provides an extremely tight timeframe, the result would be an accelerated bridge construction contract which would greatly minimize the contract time and impact on the public. Accelerated bridge construction emphasizes pre-fabricated bridge elements and systems, state-of-the-art equipment, material technologies, and innovative contracting methods, with a potential of using various construction materials. Sometimes precast bridge elements are moved using a self-propelled modular transporter (SPMT).

The accelerated bridge construction concept of providing an extremely short timeframe could also be used for projects (other than bridges) that would create extreme hardships. An example of this would be reconstruction of a high-volume intersection.

Cost Plus Time Bidding Advantages

The major benefit of the cost plus time bidding method is time savings, an important issue with the traveling public. The cost plus time bidding method is used to motivate the contractor to minimize the overall time on high priority and high usage projects.

It encourages potential contractors to analyze, develop and carefully plan operations that minimize contract time. Since the time bid by contractors is based on their capabilities to perform the work, the more efficient contractor can generally bid shorter times. This method allows the contractors to maximize efficiency in scheduling their work crews and equipment in order to meet the time bid. The method:

- Encourages contractors to work overtime, double shifts and at night to reduce construction time.
- Encourages contractors to develop or use existing innovative construction methods and procedures.
- Minimizes road user costs and inconvenience.
- Reduces the number of congestion related complaints from the road users and local communities.
- Reduces congestion related pollution and environmental impacts.

Cost Plus Time Bidding Disadvantages

Drain on Agency Human Resources

Since the project duration is shortened, cost plus time reduces the time that personnel are required on the project. However, the agency must be ready to work the construction schedule as determined by the contractor. Therefore, this method often extends the work schedules (hours/day and days/week).

Increased Construction Costs

The bid cost (A) on cost plus time contracts may be slightly higher than traditional contracts of similar scope and size. Also cost plus time projects with incentives tend to have a higher cost overrun than similar traditionally built projects. However, when the savings on road user costs is considered in the total cost of the project, the cost is almost always less than that of a traditional bid contract.

Unbalanced Bidding

Cost plus time bidding could lead to the contractor unbalancing the bid by increasing ‘A’ portion of the bid and take all the mobilization advances up front, use them, and return them at project's end as liquidated damages. Also, there is some documentation that many agencies tend to be lenient when assessing liquidated damages.

Refer to FDM 19-15-2 Attachment 15.1 for a listing of standardized special provisions available for use to specify cost-plus-time bidding.

32.12 Warranty Clauses

Warranties have been successfully used, in other countries and by some States on non-Federal projects, to protect investments from early failure. The 1991 Highway Act, referred to as ISTEA, permitted a State to exempt itself from FHWA oversight for Federal-aid projects located off the National Highway System. For projects under these conditions, warranty clauses may be used in accordance with State procedures.

On August 25, 1995, FHWA published an Interim Final Rule (IFR) for warranties for projects on the National Highway System. The IFR states that warranty provisions shall be for a specific construction product or feature. Routine maintenance items are not eligible. The IFR also prohibits warranties for items not within the control of contractors. The warranty Final Rule was published in the April 19, 1996 Federal Register and the interim final rule remains unchanged.

See FDM 19-15-3 for further discussion of warranties.

Warranty Clauses Advantages

Warranties are intended to increase the quality of a product by giving the contractor responsibility for replacement or repair of deficiencies. Warranties have been successfully used to protect investments from early failure and to improve overall construction quality.

Warranty Clauses Disadvantages

Warranty clauses have a couple of disadvantages:

- They become an additional expense for the contractor and the extra cost is passed along to the responsible agency.
- Adding a warranty to a project will complicate and delay the finals process.

Warranty Clauses Criteria for Selection

Warranty provisions shall be for a specific construction product or feature. A general warranty for the entire project is unacceptable since the contractor does not control the design process or make decisions during that phase.

Warranties may not cover items of maintenance not eligible for Federal participation. An example of this might be a warranty for guardrail construction where it would be inappropriate to warrant routine damage done to the guardrail by vehicle impacts.

Contractors are not to be required to warrant items over which they have no control.

Currently, the regulations do not restrict the duration of the warranty. However, practical experience has shown that 2 to 5-year warranties are common, and warranties beyond 5 years may not be as cost effective due to bonding or surety concerns. Warranty provisions have been used for bridge painting, traffic striping, and bridge expansion joints.

Prior approval by the FHWA Division Administrator of a warranty provision and its subsequent revisions are required for NHS projects. The clause must not require a contractor to warrant items over which they do not have control. Maintenance items ineligible for Federal-aid funding are not allowed to be warranted.

Use of warranty provisions for non-NHS projects will be governed by the individual State written procedures.

LIST OF ATTACHMENTS

Attachment 32.1	Alternative Contracting Decision Flowchart
Attachment 32.2	Cost Plus Bidding Examples
Attachment 32.3	Cost Plus Lane Rental Bidding Examples

FDM 11-50-35 Concrete Barrier Temporary Precast in Work Zone — August 17, 2020

35.1 Introduction

The following procedure establishes design guidelines for the use of Concrete Barrier Temporary Precast

(CBTP). CBTP is effective in providing positive separation between traffic and the work area. When used appropriately, CBTP has the potential to reduce the severity of crashes. However, the CBTP itself and the proximity of the end of the CBTP can also be a hazard to traffic. Whenever feasible, it is preferable to remove the hazard and avoid the need for CBTP. Typical reasons for use of CBTP are:

- To separate high-speed vehicular traffic from the work area, especially at locations that place workers at increased risk from motorized traffic
- To shield a hazard
- To protect vehicles from embankments or drop-offs
- To separate opposing directions of traffic

35.2 Factors to Consider

In this procedure, situations are listed that would typically justify CBTP. However, each project has a unique set of factors that should be considered. These factors include:

1. Speed and volume of traffic
2. Vertical and horizontal alignment of the roadway
3. Severity of the hazard, obstacle, or drop-off/slope adjacent to the roadway
4. Lateral clearance to the hazard, obstacle, or drop-off/slope
5. Duration of exposure to the hazard
6. Nature of the work zone (e.g., whether it is a stationary work zone, at a spot location, or a moving work zone)
7. Hazard that would be presented by the barrier itself and by the barrier installation and removal activity

For example, greater lateral clearance to a hazard results in a lesser need to shield the hazard with CBTP. Where a range of distances for the lateral clearance is listed in this procedure, consider factors such as traffic speed/volume and duration of exposure to determine appropriate lateral clearance for a project, and whether CBTP should be used.

35.3 Guidelines for CBTP Use

If the work area closure is anticipated to last more than 48 hours without a change to the traffic control layout or staging, CBTP is recommended for the following situations:

1. A bridge deck or culvert replacement/rehabilitation where any of the following conditions is anticipated to exist for more than 48 hours:
    - Full-depth holes in the deck
    - Railing removed
    - Confined/restricted work area
2. Dropping/removing a bridge deck over roadway if the work activity is more than 48 hours
3. A bridge painting project over the roadway
4. To separate counter directional traffic where two or more lanes in each direction are provided during the work and posted speed limit >= 45 mph
5. At freeway/expressway crossover entrances to prevent vehicles from entering opposing traffic lanes (as shown on SDD 15d5). CBTP should also be considered at crossover exits that will be in place for more than one week, as shown on SDD 15d10 where AADT is >=20,000.

Depending on the significance of the factors listed at the beginning of this procedure, other common situations which may justify CBTP, include:

1. Spot (or isolated) locations where the work area closure will last for more than 48 hours without a change to the traffic control layout or staging, and either of the following conditions is anticipated:
    - Exposed hazard that is at the same spot for more than three consecutive days and nights and is closer to an open traffic lane than:
        a. Posted speed limits above 55 mph: 15 ft lower minimum, 20 ft typical
        b. Posted speed limits from 45 mph to 55 mph inclusive: 10 ft lower minimum, 15 ft typical

c. Posted speed limits of 45 mph or less: 8 ft lower minimum, 10 ft typical

-Examples include footings, abutments, and construction activities such as false work.

The distance between the edge of the open traffic lane and the work is less than 6 feet (4 feet if non-freeway/expressway) and the work is anticipated to continue for more than 48 hours at the same spot location.

If the work area closure and hazard will last for extended length of time (e.g., more than 2 months), lateral clearance should be greater than noted above, or CBTP should be considered.

Whenever feasible, it is preferable to remove the hazard and avoid the need for CBTP. Where the hazard cannot be removed, an option in lieu of CBTP to shield some hazards is to use attenuators, or crash cushions as described in FDM 11-45.

2. Where a drop-off exists as defined in FDM 11-50-21.6.
3. Other situations where a combination of severity of hazard, high traffic volume, geometric concerns, or more than 48 hours of exposure exist.

35.4 CBTP Deflection Distance/Anchoring Requirement

Although CBTP is designed to prevent an errant vehicle from entering a construction work zone, research tests have shown lateral deflection of the barrier after a vehicular hit.

35.4.1 CBTP Deflection Distance

The values shown below are recommended buffer space behind a freestanding concrete barrier installation. Refer to SDD 14b7 for additional guidance.

When shielding hazards above ground:

Posted Speed	Deflection Distance
40 mph or less	2 ft
45 mph or greater	4 ft

When shielding drop-offs:

Posted Speed	Deflection Distance
40 mph or less	2 ft
45 mph or greater - Vertical Drop-off 6” or less and no traffic below - Vertical drop-offs greater than 6”	 2 ft 4 ft

When used as a temporary median barrier separating opposing traffic lanes:

Posted Speed	Deflection/Shy Distance
40 mph or less	0 ft minimum but 2 ft preferred
45 mph or greater	1 ft minimum but 2 ft preferred

35.4.2 CBTP Anchoring Requirement

The barrier shall be anchored if the distance to a 2-foot or greater drop-off is steeper than 3H:1V, and:

1. The posted speed is 45 mph or greater and the drop-off is less than 4 feet from the side of the barrier closest to the drop-off
2. The posted speed is 40 mph or less and the drop-off is less than 2 feet from the side of the barrier closest to the drop-off

For example, the edge of a bridge deck or a drop-off at the edge of pavement.

Where lateral displacement of the barrier cannot be tolerated, anchor the barrier to the underlying pavement surface according to the details in SDD 14b7.

35.5 Intersection Sight Distance

When specifying the need for CBTP, it is recommended that the designer check all side road approaches to ensure the CBTP does not restrict intersection sight distance. This is especially critical when the roadway segment has horizontal and vertical curves that may further affect sight distance. Provide appropriate turning radii in urban areas to accommodate school buses and other large vehicles. Install portable crash cushions so the end of the cushion is located at least 50 ft from the intersecting side road. The intersection may need grading to minimize drop-offs.

35.6 CBTP End Treatments

35.6.1 Clear Zone

For determining the need for end treatment for temporary precast concrete barrier in work zones, the following clear zones are appropriate. Where a range of values for clear zone is noted, consider traffic volume, speed, and duration of exposure to determine appropriate clear zone for the project. For stage switches and short-term work operations of no more than 24 hours duration, lesser clear zone than the minimum noted may be allowed. For end treatment barrier installations in place for extended length of time (e.g., more than 2 months), a greater clear zone should be considered.

- Posted speed limits above 55 mph: 15 ft lower minimum, 20 ft typical
- Posted speed limits from 45 mph to 55 mph inclusive: 10 ft lower minimum, 15 ft typical
- Posted speed limits of 45 mph or less: 8 ft lower minimum, 10 ft typical
- Bridge projects with temporary traffic signals, one open lane shared by both directions: 12 ft from the open traffic lane

35.6.2 Barrier Flare

The typical treatment for the exposed end of CBTP is to flare the barrier away from open traffic lanes to the edge of the clear zone as defined above. Cost effective flare rates range from 4:1 (low speed roadways) to 8:1 (high speed roadways). Longer flare rates increase the number of impacts while shorter flare rates increase the severity of crashes. For additional guidance, refer to the [Roadside Design Guide]. The recommended flare rates are shown below.

- 8:1 for operating speed of 45 mph or more
- 6:1 for operating speed of 40 mph or less

Often it is not possible to flare the barrier to the edge of clear zone due to space limitations or need for construction vehicles and equipment to access the work area. If the barrier is not flared to the edge of clear zone and speeds are 35 mph or greater, temporary grading may be required for uneven ditch sections or barrier end treatment from the Wisconsin Approved Products List (APL). The Roadside Design Guide contains recommended barrier end placement examples in non-level shoulders and medians.

35.6.3 Construction Work Operations and Traffic Stage Switches Near Flared Barrier

Even if the barrier is flared away from traffic, the barrier may have to be straightened and the barrier end moved closer to traffic to complete some work operations and traffic stage switches. If the barrier end would be located within the clear zone for longer than 24 hours and speeds are 35 mph or greater, one of the following treatments should be done:

1. Provide a portable crash cushion
2. Taper traffic to the shoulder or adjacent lane to provide more lateral clearance to the barrier end
3. Remove the barrier and stockpile it off the work site

35.6.4 Crash Cushion or Sand Barrels.

As indicated earlier in this procedure, if it is not possible to flare the barrier to the edge of the clear zone and speeds are 35 mph or greater, then an approved portable crash cushion or sand barrels should be provided as the barrier end treatment. Install a crash cushion or sand barrels from the Wisconsin APL on the exposed end of the barrier if within the clear zone. These end treatments are designed to absorb energy of an impacting vehicle by reducing the impact force to acceptable levels. A crash cushion or sand barrels are required on the upstream end for divided or one-way facilities, and on both ends for all two-way facilities, including temporary two-way facilities, such as in freeway counter-directional operations. The types of crash cushions currently used are listed in the WisDOT Approved Products List.

Sand Barrels consist of a group of free-standing barrels and are discussed in FDM 11-45. When selecting the crash cushion or sand barrels, consider the frequency of nuisance hits.

FDM 11-50-45 Pavement Marking — *August 15, 2025*

45.1 General

Guidance on pavement marking selection for various pavement types TEOpS Chapter 3.

45.2 Pavement Marking Selection

The selection of material is based on the expected life of the pavement, type of roadway, and type of line. The initial cost for durable markings is relatively expensive, but their use on new pavements is justified because of their durability and the likelihood that the pavement surface will not require short-term maintenance. This reduces the exposure of a marking crew to traffic and minimizes disruptions to the traveling public.

Use TEOpS 3-10-1 for selection of pavement marking. Additional information to take into consideration:

- Allow an additional 2 days or more if grooved into asphalt
- Allow the groove to dry before placing the marking
- If temporary markings are placed on the final surface:
    - removable tape may be used unless plowing operations may occur.
    - existing markings in the exact location where a groove will be placed shall be removed in the grooving operation and not in the Removing Pavement Marking items.

Same day pavement markings are only for necessary longline markings, on the upper surface layer placed on highways that are open to traffic and that have surfaces capable of retaining markings. When the existing markings are no longer functional, these markings are placed, or in the instance of when the upper surface layer is placed. If markings are installed before the centerline rumble strips, use temporary paint pavement markings. Once rumble strips are installed, use permanent pavement marking. Use temporary pavement markings for intermediate lifts.

Marking durability is jeopardized by cold pavement temperatures below 50 degrees Fahrenheit for tape and waterborne and 35 degrees Fahrenheit for epoxy. For this reason, permanent markings **shall not** be placed outside manufactures specifications and the Cold Weather Marking bid item should be used if projects are expected to be completed after October 1 (refer to Standard Spec 646.3.1.4). Do not place Black Epoxy under the cold weather marking item, place it in the spring under the standard Grooved Black Epoxy bid item.

Also refer to FDM 11-40-1.6.

45.3 Pavement Marking Removal

If permanent tape is on the existing surface where a lane shift or diamond grinding operations will occur use the Marking Removal Line Grooved Permanent Tape bid items. This bid item is not needed when the pavement surface is being completely removed. This item is not method specific.

Use the Marking Removal Line Water Blasting when the project wants to specify that water blasting be used to remove liquid or surface applied markings to protect the final surface from scarring.

Use the Marking Removal Line for liquid markings which any method can be used for removal on items.

Temporary Marking removal is incidental to the Temporary Marking Bid Items.

FDM 11-50-50 Signals *August 15, 2019*

50.1 General

Control devices in this category include traffic and pedestrian control signals, beacons, lane use control signals, lift bridge and swing bridge signals and gates, emergency traffic control signals, and railroad crossing signals and gates, all of which are either pre-timed or traffic actuated.

50.2 Traffic Signal Investigation

As part of the scoping process for a highway improvement project, the designer must consider whether traffic signals are anticipated within the project design life. If signals are currently located within the project area, it is very likely that signal operations/controls will require modification and updating.

Table 50.1 and Table 50.2 are NOT signal warrants but are a guide for determining if special intersection treatments or signals may be needed within the design life of the project. If the current or projected volumes come close to or exceed the suggested minimum threshold AADT volumes on both the major and the minor street listed in Table 50.1 or Table 50.2, notify the region traffic personnel that special intersection treatment or safety improvements may be needed. Case 1 is related to the volume of intersecting traffic through-put of an intersection. Case 2 is related to the lack of gaps, or continuous traffic, on the major street that may cause excessive delay on the minor street.

Table 50.1 should be used when the 85th percentile or posted speed exceeds 40 mph, or when the intersection lies in an area having a population of less than 10,000. Table 50.2 should be used in conjunction with facilities not covered by Table 50.1. When the traffic volumes are approached or exceeded in the following tables, the traffic section will evaluate possible solutions such as: the need for a four-way stop, improved signing, geometric changes, traffic signals, roundabouts or other improvements.

Table 50.1 Minimum Threshold Traffic Volumes for Case 1 & 2 (typically rural) 1

Lanes per Approach		Case 1		Case 2	
Major St.	Minor St.	Major St. (2-way ADT)	Minor St. (2-way ADT)	Major St. (2-way ADT)	Minor St. (2-way ADT)
1	1	5,600	3,400	8,400	1,700
2	1	6,700	3,400	10,100	1,700

[1] ITE, Manual of Traffic Signal Design, 1982, p18

Table 50.2 Minimum Threshold Traffic Volumes for Case 1 & 2 (typically urban) 1

Lanes per Approach		Case 1		Case 2	
Major St.	Minor St.	Major St. (2-way ADT)	Minor St. (2-way ADT)	Major St. (2-way ADT)	Minor St. (2-way ADT)
1	1	8,000	4,800	12,000	2,400
2	1	9,600	4,800	14,400	2,400

[1] ITE, Manual of Traffic Signal Design, 1982, p18

Region traffic personnel will evaluate the intersection for meeting various traffic signal warrants. The designer may have to provide information to the traffic personnel on the proposed design such as: adjacent parking, bus pullout bays, approach grades, lane widths, number of lanes, speed, percent trucks, design hour volumes, turning movement volumes and intersection layout showing access and sight distance. Part IV, Section C of the Manual on Uniform Traffic Control Devices (MUTCD) shows a complete list of the traffic signal warrants.

Traffic control signals should not be installed unless one or more of the traffic signal warrants are met. The satisfaction of a warrant or warrants is not in itself justification for a signal. If signals are to be installed on portions of the State Trunk System or on connecting highways, a region traffic engineer must submit a recommendation on the matter (form DT1199) and Signal Investigation Report for approval by the State Traffic Engineer before the signals may be incorporated into the project.

50.3 Design Criteria

The design of traffic signal systems shall conform to the WisDOT's Traffic Signal Design Manual (TSDM).

FDM 11-50-55 Signing

February 15, 2022

55.1 General

Signs are essential when special regulations apply at specific places or at specific times only, or when hazards are not self-evident. They also provide information concerning highway routes, directions, destinations, and points of interest. Signs are classified in accordance with their basic function as either regulatory, warning, or guide signs. For a detailed description of the various types, refer to the WisMUTCD.

When permanent signing is included under a contract with other construction operations such as grading, base, paving, etc., the permanent signing shall be shown on signing plan detail sheets separate from the plan and profile sheets.

If permanent signing is LET as a separate contract, the permanent signing layout detail sheets will become the plan sheets.

Permanent signing layout details shall show the location of sign bridges, sign bridge numbers, new signs, moving signs, removal of existing signs, revision of existing signs, signs being furnished or moved by others, delineators and other pertinent signing information.

Designers should contact the region signing staff on Type II signpost preferences. Do not use 4” x 4” wood posts on new permanent sign installations.

If the project contains specific information signs (SIS - the blue informational signs for gas/food/lodging, etc.) that will be affected by the project, then the designer shall include special provision 638-010 (Blue Specific Service Signs).

Any tourist oriented directional signs (TODS) or white arrow boards present within the project limits can be removed and reinstalled by the contractor. The contractor is responsible for any damage to the signs during this time.

In general, all new Type I signs have Type SH (super high intensity prismatic) sheeting, except yellow Type I signs and plaques, which are Type F (fluorescent high intensity prismatic) sheeting. For all new Type II and Type F sheeting shall be used for all orange work zone signs, all yellow W series signs, and all fluorescent yellow-green S series signs. Type H (prismatic high intensity) sheeting shall be used for all other Type II.

Careful attention needs to be given to signs at intersections on OSOW vehicle routes. Periodically signs and posts may have to be temporarily removed to accommodate vehicles passing through the intersection and turns properly. The designer should refer the OSOW freight network maps in FDM 11-25-1.4 and contact the Region freight coordinator to confirm if the project is located on an OSOW vehicle route. Confirm the proposed post type on these routes with Region Traffic Operations.

If conflicts may occur with signs at intersections on OSOW route, tubular steel signposts assemblies should be considered for signs that could be impacted by an OSOW vehicle. If removable signs are needed, install tubular steel sign post assemblies in accordance with Standard Spec 634.3.2 and standard sign plate A4-9. Place notes on the permanent signing plan to notify contractors of the required height of the top of the anchor system.

Each standard sign should be displayed only for the specific purposes as prescribed in the WMTCD. Before any new or reconstructed highway, temporary route or detour is opened to traffic all necessary signing should be in place. Signs required by road conditions or restrictions should be removed when those conditions are no longer present, or the restrictions are removed. Uniformity of application is as important as standardization with respect to design and placement. Identical conditions should always be marked with the same type of sign irrespective of where those particular conditions occur.

55.2 Reflective Sheeting and Replacement Guidelines for Highway Signs

In general, all new Type I signs have Type SH (super high intensity prismatic) sheeting, except yellow Type I signs and plaques, which are Type F (fluorescent high intensity prismatic) sheeting. For all new Type II and Type F sheeting shall be used for all orange work zone signs, all yellow W series signs, and all fluorescent yellow-green S series signs. Type H (prismatic high intensity) sheeting shall be used for all other Type II.

Type I signs

1. Per Department policy, type I guide signs should be replaced in qualifying improvement projects. Exceptions to this policy include:
    - It is not required to replace Type 1 signs on non-pavement-preservation preventive maintenance projects (see FDM 3-5-5), and
    - It is not required to replace Type 1 signs on Group 3 pavement-preservation preventative maintenance projects (see FDM 3-5-5 – work consists of milling, rut filling, seal coating, micro-surfacing and crack filling projects) because:
        - When Group 3 pavement strategies are applied early in the pavement life cycle, most signing should still be in good condition.
        - The work can easily exceed 10% of the project, i.e., it would not meet the requirements for incidental construction.
    - Exceptions to replacement of overhead mounted Type 1 guide signs can also be made if there is another improvement project programmed or scheduled on the same roadway segment within the next five years. Any signs not conforming to WisDOT and MUTCD policies shall be replaced in the improvement project. *Any exceptions to replacement of Type I signs shall be coordinated with the Region Traffic Engineering Supervisor.*
2. Galvanized steel I-beams should only be replaced if Type I signs are not at the proper offset (30-foot typical / 17.5-foot lower minimum offset from edge line to edge of sign) or if the new Type I sign is larger. All corten steel I-beams and bases shall be replaced.
3. Steel I-beams and bases that are re-used should have the base bolts replaced by utilizing bid item 635.0300 (Sign Supports Replacing Base Connection Bolts).
4. The Drilling Shafts bid item (531.2000 - 2999) is necessary when installing Type I sign bases as the excavating and backfilling is paid for separately from the Concrete Masonry Ancillary Structures Type NS item. The appropriate Drilling Shafts diameter and lengths can be found on the A3-1 sign plate.
5. Below are the guidelines for calculating miscellaneous quantities for steel I-Beams, concrete masonry and reinforcing steel for Type I sign supports.

Quantities for Sign Supports Structural Steel HS (Bid Item 635.0200):

1. Determine Length of I-beams For Ground Mounted Signs.
2. Determine Size of I-beams (W6X15, W8X18, W8X21, W10X22 or W12X26). Utilize A3-2 and A3-3 sign plates to determine I-beam size which is based on horizontal and vertical dimensions of the Type I sign and the maximum height from the ground line to the bottom of the principal sign panel.
3. Determine weight of I-beams from A3-1 plate.
    a. W6x15 is 15.0 lbs per foot.
    b. W8x18 is 18.0 lbs per foot.
    c. W8x21 is 21.0 lbs per foot.
    d. W10x22 is 22.0 lbs per foot.
    e. W12x26 is 26.0 lbs per foot.
4. Add “V” value from the A3-1 plate to each I beam weight calculated in step 3. The “V” value is the weight for the stub, base plates, stiffeners, perforated fuse plates, bolts, nuts, and washers.
    a. W6x15 post V value is 73.0 lbs.
    b. W8x18 post V value is 83.0 lbs.
    c. W8x21 post V value is 124.0 lbs.
    d. W10x22 post V value is 134.0 lbs.
    e. W12x26 post V value is 152.0 lbs.

Quantities for Concrete Masonry Ancillary Structures Type NS (Bid Item 531.1100):

1. W6x15 base is 0.8 CY for each base.
2. W8x18 base is 0.9 CY for each base.
3. W8x21 base is 1.0 CY for each base.
4. W10x22 base is 1.0 CY for each base.
5. W12x26 base is 1.2 CY for each base.

Quantities for Steel Reinforcement HS Ancillary Structures Type NS (Bid Item 531.1140):

1. W6x15 base is 71 lbs for each base.
2. W8x18 base is 102 lbs for each base.
3. W8x21 base is 110 lbs for each base.
4. W10x22 base is 151 lbs for each base.
5. W12x26 base is 180 lbs for each base.

<u>Type II signs</u>

1. In general, per Department policy, the replacement of Type II signs will be handled through maintenance as part of a 12-year corridor replacement schedule. However, there are situations that will require Type II signs to be placed in improvement projects that include:
    - Project is on a new alignment.
    - Projects that are installing new signs, signs that are not currently at the needed locations, e.g. changing intersection control or adding chevrons.
    - Updating or adding signs that were not there before, e.g. population, street name signs, overhead signs.
    - Placing no passing zone signs after the roadway has been re-spotted.
2. Projects that require removal, stockpiling and re-installation of Type II signs and posts will use the bid items of Moving Signs Type II and Moving Small Sign Supports.

3. Designers should include an undistributed quantity of posts (10% of existing) to account for the replacement of any posts that are rotted, warped, too short or get damaged during the removal/re-installation.

4. The designer should consult with the Region Signing Engineer or Region Sign Program Supervisor to confirm the use of improvement projects for the installation of Type II signs.

Pictorial drawings of signs and sign fabrication details are available from the BTO Traffic Design Unit at: DOTBTOSignDetails@dot.wi.gov, and will be prepared upon request. A minimum of three weeks lead-time is required by central office for the preparation of sign details. The TEOpS gives guidance for optimum sizes of signs for roadways and sizes of stop signs that should be used at roadway intersections.

FDM 11-50-60 Lighting — August 15, 2025

60.1 General

Installing roadway lighting has been shown to improve safety for most roadway and intersection types, however, these installations include significant costs to install, operate, and maintain. WisDOT takes a conservative approach to the use of roadway lighting, primarily because of the significant costs, coupled with the long-term maintenance and energy expenditures involved. There are several cases where WisDOT has determined that the safety benefits of installing roadway lighting outweigh the costs, and therefore roadway lighting is always installed. These cases are as follows:

- Signalized Intersections
- Signalized Interchanges
  - Single Point Interchanges (SPI)
  - Diverging Diamond Interchanges (DDI)
- Roundabouts
- Restricted Crossing U-Turn (RCUT)
- Milwaukee-Area Freeways
- Metered Ramps
- Tunnels
- Rest Areas
- Park & Rides
- Crash Investigation Sites (CIS)
- Safety and Weight Enforcement Facilities (SWEF)
- Waysides

Other than the facilities listed above, roadway lighting is typically not installed by WisDOT unless the safety benefits of installing roadway lighting outweigh the costs. Other facilities that may warrant the installation of roadway lighting, depending on conditions, include high-volume urban freeway segments outside of the Milwaukee area, system interchange ramps, collector-distributor roadways, tall bridge crossings, and non-standard intersections. The TEOpS Manual Chapter 11-1 describes WisDOT's policy and the approval process for the roadway lighting of WisDOT owned systems on State Trunk highway, US highway, and the Interstate highway systems.

Local units that request approval from WisDOT to install and operate roadway lighting for locations on the State Trunk and US highway systems can be accommodated per the approval and permitting process described in the TEOpS Manual Chapter 11-2. The roadway lighting can be included as part of the construction contract if the local unit agrees to pay the local cost share for installation and all future maintenance and energy costs involved.

WisDOT has made provisions for installing aesthetic lighting on several major bridges in larger metropolitan areas across the state by allowing the installation of necessary conduit, wiring, luminaires, etc. The approval and permitting process for installing aesthetic bridge lighting is described in the TEOpS Manual Chapter 11-2. Aesthetic bridge lighting is considered purely "Decorative" in nature and should not be confused with "Roadway Lighting".