

Traffic Control Plan Development Course

February 2017



Office of
Traffic,
Safety
& Technology

(This page is intentionally left blank)

Contents

1. INTRODUCTION 1-1

1.1 Background 1-1

1.2 Goals of Course..... 1-1

1.3 Disclaimer 1-1

1.4 Acknowledgements..... 1-1

1.5 Contact Information..... 1-1

1.6 MnDOT OTST Website 1-2

1.7 Written Communications Policy..... 1-2

1.8 Glossary of Terms..... 1-3

2. TEMPORARY TRAFFIC CONTROL OVERVIEW 2-1

2.1 General..... 2-1

2.2 MN MUTCD Chapter 6B - Fundamental Principles..... 2-1

2.3 Legal Authority for Transportation..... 2-5

2.4 Federal Regulations 2-6

2.5 Engineering Standards 2-6

2.5.1 MN MUTCD Text Headings..... 2-6

2.5.2 Engineering Judgment and Documentation 2-7

2.6 Associated Manuals and Guideline 2-7

2.6.1 Work Zone Manuals and Guidelines Website 2-7

2.6.2 Federal Manual on Uniform Traffic Control Devices..... 2-9

2.6.3 Minnesota Manual on Uniform Traffic Control Devices 2-10

2.6.4 Temporary Traffic Control Zone Layouts Field Manual (MN MUTCD Chapter 6K) 2-11

2.6.5 Traffic Engineering Manual..... 2-13

2.6.6 Standard Specifications for Construction 2-14

2.6.7 Minnesota Intelligent Work Zone Toolbox..... 2-15

2.6.8 Work Zone Speed Limit Guidelines 2-16

2.6.9 2012 CMS Manual of Practice 2-17

2.6.10 Minnesota Standard Signs and Markings Manual..... 2-18

2.6.11 Standard Signs Summary 2-18

2.6.12 Additional Manuals and Guidelines 2-19

2.6.13 Minnesota Work Zone Safety and Mobility Policy Tech Memo 2-19

2.7 Temporary Traffic Control Planning and Implementation 2-40

2.7.1 TEM Handout..... 2-40

2.8 TMP Supplemental Information to the TEM 2-44

2.8.1 TMP Development Tips..... 2-44

2.8.2 Metro District TMP Resource 2-45

2.9 Temporary Traffic Control Strategies and Controlling Criteria 2-46

2.9.1 TEM Handout 2-46

2.10 TTC Strategies and Controlling Criteria Supplemental Information to the TEM..... 2-62

2.10.1 Oversize/Overweight Vehicles 2-62

2.10.2 Lane Width 2-62

2.10.3 Speed Limits in Work Zones 2-62

2.10.4 Positive Work Zone Protection..... 2-63

2.10.5	Work Zone Drop-Offs.....	2-64
2.10.6	Clear Zone Requirements	2-64
2.10.7	Innovative Contracting Methods.....	2-65
2.10.8	Business Impact Mitigation	2-88
2.11	Pedestrian Treatments.....	2-94
2.11.1	Background.....	2-94
2.11.2	Public Rights-of -Way Accessibility Guidance Tech Memo	2-94
2.11.3	Pedestrian Accessibility Considerations in Temporary Traffic Control Zones Check List.....	2-99
3.	TTC DEVICES	3-1
3.1	TTC Zone Devices.....	3-1
3.2	Traffic Signing	3-1
3.2.1	Guide Signs	3-1
3.2.2	Regulatory and Warning Signs	3-2
3.2.3	Supplemental Sign Plates.....	3-3
3.2.4	Temporary Sign Covering.....	3-3
3.2.5	Sign Panel Overlays	3-3
3.2.6	Additional Signing Information.....	3-4
3.2.7	Business Signing	3-4
3.3	Pavement Markings in Temporary Traffic Control Zones	3-14
3.3.1	TEM Handout	3-14
3.4	Pavement Marking Supplemental Information to the TEM	3-19
3.4.1	Definitions.....	3-19
3.4.2	Interim Pavement Marking Guidelines	3-19
3.4.3	Temporary Pavement Marking Guidelines.....	3-19
3.4.4	Final Pavement Markings	3-20
3.4.5	Temporary Raised Pavement Markers (TRPMs)	3-20
3.4.6	Pavement Marking Removal Scarring.....	3-20
3.5	Channelizing Devices	3-23
3.5.1	Surface Mounted (Centerline) Delineators.....	3-23
3.5.2	Channelizer Quick Reference Chart	3-24
3.6	Temporary Traffic Barriers.....	3-26
3.6.1	Crashworthiness.....	3-26
3.6.2	Anchoring	3-27
3.6.3	Portable Precast Concrete Barrier (PPCB)	3-27
3.6.4	Moveable Barrier	3-28
3.6.5	Portable Non-Concrete Barrier	3-28
3.6.6	Water-Filled Barrier.....	3-29
3.6.7	Barrier End Treatments.....	3-29
3.6.8	Truck/Trailer Mounted Attenuators	3-30
3.7	Portable Changeable Message Signs (PCMS).....	3-30
3.7.1	Definitions.....	3-31
3.7.2	Message Sign Panel.....	3-31
3.8	Portable Signal Systems	3-31
3.9	Automated Flagging Assist Device.....	3-32
3.10	Flashing Arrow Boards	3-32

3.11	Little Known Resources	3-32
3.12	Approved/Qualified Products (APL/QPL)	3-33
3.13	MN MUTCD Chapter 6F - Temporary Traffic Control Zone Devices	3-34
4.	WORK ZONE APPLICATIONS	4-1
4.1	Common Work Zone Projects	4-1
4.1.1	Work Zone Management Strategies Matrix	4-1
4.2	Control Strategies	4-1
4.2.1	Construction Phasing/Staging	4-1
4.2.2	Full Roadway Closures	4-1
4.2.3	Reduced Lane Widths to Maintain Number of Lanes (Constriction)	4-2
4.2.4	One-Lane, Two-Way Operation	4-2
4.2.5	Two-Way Traffic on One Side of Divided Facility (Crossover)	4-2
4.2.6	Reversible Lanes	4-2
4.2.7	Ramp Closures/Relocation	4-2
4.2.8	Freeway-To-Freeway Interchange Closures	4-2
4.2.9	Night Work	4-2
4.2.10	Weekend Work	4-3
4.2.11	Work Hour Restrictions for Peak Travel	4-3
4.2.12	Pedestrian/Bicycle Access Improvements	4-3
4.2.13	Business Access Improvements	4-3
4.2.14	Off-Site Detours/Use of Alternate Routes	4-3
4.3	Common Work Zone Layout	4-3
4.4	TTC Template Sheets for Stationary Work Zones	4-34
5.	WORK ZONE PLAN SETS	5-1
5.1	TTC Plan Development	5-1
5.1.1	General Information	5-1
5.1.2	Standard Plates	5-2
5.1.3	MnDOT Plan Assembly Steps	5-2
5.1.4	Metro District Traffic Control Plan Checklist	5-4
5.2	Process A vs Process B	5-60
5.3	Common TTC Plan Set Issues	5-60
5.3.1	Design Scene	5-61
5.4	Construction Plan Title Sheet	5-62
5.4.1	Plan Description and Location	5-62
5.4.2	Project Number(s)	5-63
5.4.3	Governing Specifications and Index of Sheets	5-63
5.4.4	Plan Preparation Certification Note	5-64
5.4.5	Project Numbers and Sheet Numbers	5-64
5.4.6	Signature Block	5-64
5.4.7	Index Map	5-65
5.4.8	Project Location	5-65
5.4.9	Plan Revisions Block	5-65
5.5	Traffic Control Plan Title Sheet	5-66
5.5.1	Notes and Guidelines	5-66
5.5.2	Traffic Control Plan Index	5-68

5.5.3	Traffic Control Devices and Symbols Legend.....	5-69
5.5.4	Traffic Control Key Legend.....	5-69
5.5.5	Title, Signature, Project Number and Sheet Number Block	5-70
5.6	Traffic Control Tabulation	5-70
5.6.1	Traffic Control Supervisor	5-71
5.7	Traffic Control Tabulation Charts Sheet.....	5-71
5.8	Special Sign Details	5-72
5.9	Narrative Sheet.....	5-73
5.10	Advanced Signing	5-74
5.11	Detour Sheets	5-75
5.12	TC Layout Sheets	5-76
5.12.1	Layout Sheet Tips	5-82
5.13	Typical Drawings.....	5-83
5.13.1	Interim Pavement Markings	5-84
5.13.2	Temporary Raised Rumble Strips	5-85
6.	SPECIFICATIONS AND SPECIAL PROVISIONS.....	6-1
6.1	MnDOT Standard Specification for Construction Book (Spec Book)	6-1
6.1.1	Format of the “Spec Book”	6-1
6.1.2	DIVISION III — Materials.....	6-6
6.2	MnDOT Contract Proposal	6-7
6.2.1	Contents	6-7
6.3	Special Provisions	6-7
6.3.1	Special Provision Boiler Plates.....	6-8
6.4	Addendum	6-39
6.5	Supplemental Agreements	6-39
6.6	Pay Items.....	6-39
7.	APPENDIX.....	7-1
7.1	Metro Website TMP Resources.....	7-1
7.1.1	TMP Process and Components.....	7-2
7.1.2	TMP Scoping Worksheet.....	7-6
7.1.3	TMP Worksheet	7-13
7.1.4	TMP Template	7-24
7.1.5	Red Flag Checklist.....	7-30
7.1.6	Work Zone Mobility Impact Assessment Worksheet.....	7-35
7.2	Design Scene Write-Ups and Sample News Letter	7-37
7.3	Sample Plan Sets.....	7-55

List of Exhibits

EXHIBIT 1-1	TTC TECHNICAL EXPERT CONTACTS	1-1
EXHIBIT 1-2	MNDOT OTST WEBSITE	1-2
EXHIBIT 2-1	MINNESOTA STATUTES WEBSITE.....	2-5
EXHIBIT 2-2	TEXT HEADING EXAMPLE FROM MN MUTCD	2-6
EXHIBIT 2-3	WORK ZONE MANUALS AND GUIDELINES WEBSITE	2-8
EXHIBIT 2-4	FEDERAL MUTCD	2-9
EXHIBIT 2-5	MINNESOTA MUTCD.....	2-10
EXHIBIT 2-6	EXAMPLE OF LANGUAGE UNIQUE TO MN MUTCD	2-11
EXHIBIT 2-7	TEMPORARY TRAFFIC CONTROL ZONE LAYOUTS FIELD MANUAL	2-12
EXHIBIT 2-8	MNDOT TRAFFIC ENGINEERING MANUAL (TEM)	2-13
EXHIBIT 2-9	STANDARD SPECIFICATIONS FOR CONSTRUCTION BOOK (SPEC BOOK).....	2-14
EXHIBIT 2-10	MINNESOTA IWZ TOOLBOX.....	2-15
EXHIBIT 2-11	WORK ZONE SPEED LIMIT GUIDELINES.....	2-16
EXHIBIT 2-12	2012 CMS MANUAL OF PRACTICE	2-17
EXHIBIT 2-13	MNDOT STANDARD SIGNS AND MARKINGS MANUAL.....	2-18
EXHIBIT 2-14	MNDOT STANDARD SIGNS SUMMARY	2-19
EXHIBIT 3-1	SAMPLE GUIDE SIGNS FOR TTC	3-2
EXHIBIT 3-2	SAMPLE REGULATORY AND WARNING SIGNS	3-2
EXHIBIT 3-3	PAVEMENT MARKING REMOVAL SCARRING.....	3-20
EXHIBIT 3-4	SPEC BOOK SECTION 2102 – PAVEMENT MARKING REMOVAL	3-21
EXHIBIT 3-5	SPECIAL PROVISIONS – PAVEMENT MARKING REMOVAL (NO LEAD)	3-22
EXHIBIT 3-6	CHANNELIZING DEVICES FOR TTC.....	3-23
EXHIBIT 3-7	SURFACE MOUNTED DELINEATORS FOR TTC	3-24
EXHIBIT 3-8	PORTABLE PRECAST CONCRETE BARRIERS FOR TTC.....	3-27
EXHIBIT 3-9	MOVEABLE BARRIER SYSTEM FOR TTC	3-28
EXHIBIT 3-10	PORTABLE NON-CONCRETE BARRIERS (STEEL)	3-28
EXHIBIT 3-11	WATER-FILLED BARRIER	3-29
EXHIBIT 3-12	TRUCK MOUNTED ATTENUATOR.....	3-30
EXHIBIT 3-13	PORTABLE CHANGEABLE MESSAGE SIGN	3-30
EXHIBIT 3-14	APPROVED/QUALIFIED PRODUCTS WEBSITE.....	3-33
EXHIBIT 4-1	TTC PLAN TEMPLATE SHEETS WEBSITE.....	4-34
EXHIBIT 4-2	SAMPLE TEMPLATE, RIGHT LANE CLOSE, MULTI-LANE UNDIVIDED (LONG TERM)	4-35
EXHIBIT 4-3	SAMPLE TEMPLATE, DYNAMIC LATE MERGE, LEFT LANE CLOSED	4-36
EXHIBIT 6-1	STANDARD SPECIFICATIONS FOR CONSTRUCTION BOOK (SPEC BOOK).....	6-1
EXHIBIT 6-2	SPEC BOOK 1504, COORDINATION OF CONTRACT DOCUMENTS.....	6-6
EXHIBIT 6-3	AASHTOWARE WEBSITE	6-40

This page is intentionally left blank.

1. INTRODUCTION

1.1 Background

This is a two-day Traffic Control Plan Development Course designed to enable the participants to obtain an understanding of the fundamental concepts and MnDOT standard practices related to the design of traffic control plans within the State of Minnesota.

1.2 Goals of Course

The main emphasis is to provide an overview of Temporary Traffic Control (TTC) plan development. At the end of this course, you will be able to:

- ✓ List the common publications and guidelines used in temporary traffic control (TTC)
- ✓ Identify devices and materials used in TTC
- ✓ Illustrate a typical layout required for a TTC situation
- ✓ Create a basic TTC plan set
- ✓ Locate and navigate through the various specifications and provisions

1.3 Disclaimer

This manual is disseminated under the sponsorship of the Minnesota Department of Transportation (MnDOT), Office of Traffic, Safety and Technology. MnDOT and Albeck & Associates assume no liability for its contents or use thereof.

MnDOT does not endorse products or manufacturers. Trademarks of manufacturer’s names appear herein only because they are considered essential to the object of this manual.

1.4 Acknowledgements

The development of this Traffic Control Plan Manual has been a result of the efforts of the MnDOT Office of Traffic, Safety & Technology (OTST) and Albeck Gerken, Inc. The contributions by Ken Johnson, Jeffrey Morey, Scott Meier, Adam Wellner, Ted Ulven and Ethan Peterson are gratefully acknowledged.

1.5 Contact Information

MnDOT’s technical experts are listed below with contact information.

Exhibit 1-1 TTC Technical Expert Contacts

Name	Email	Phone
Ken Johnson	ken.johnson@state.mn.us	651-234-7386
Jeffrey Morey	Jeffrey.morey@state.mn.us	651-234-7058

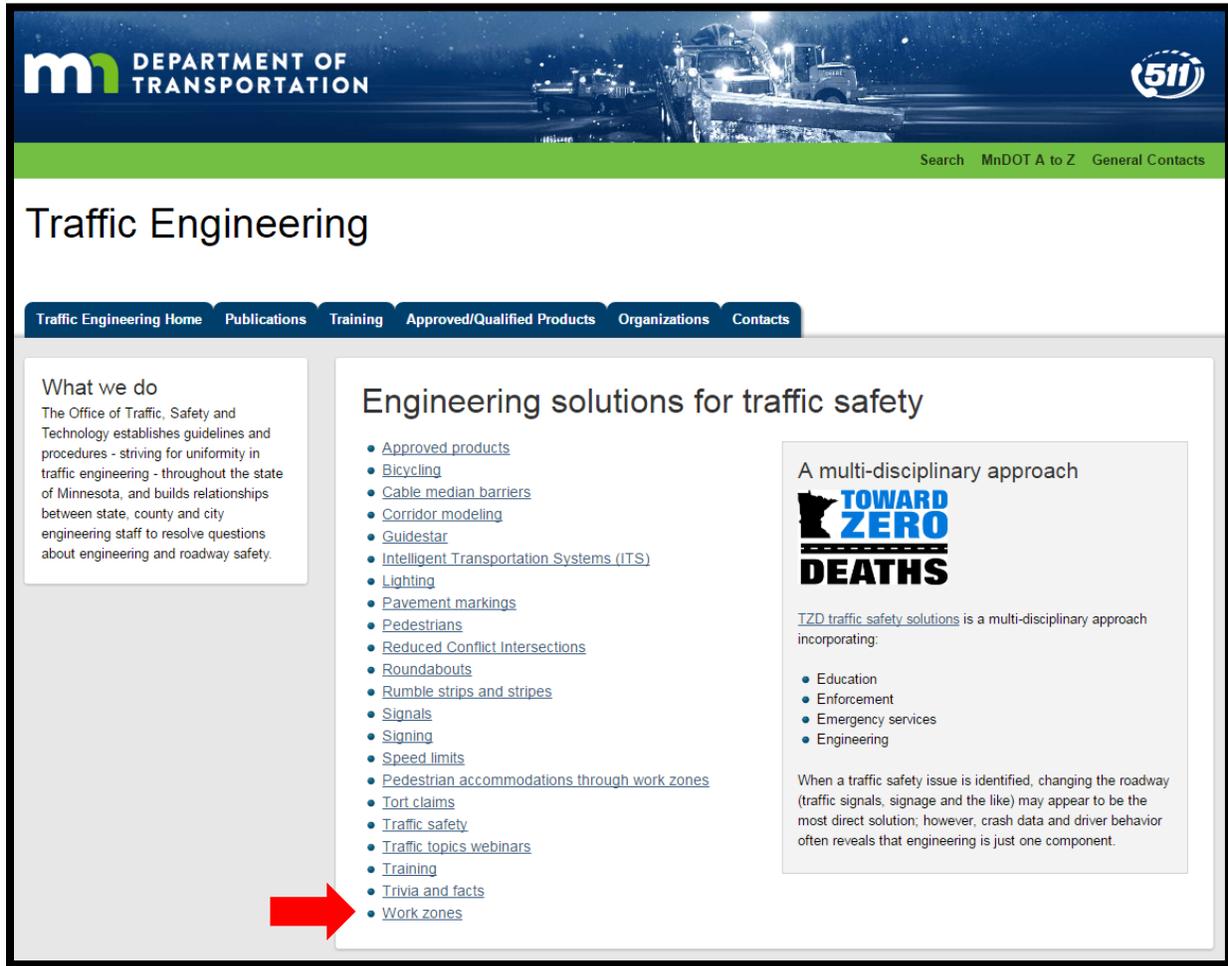
1.6 MnDOT OTST Website

The MnDOT Office of Traffic, Safety and Technology website (see **Exhibit 1-2**) includes a wide variety of traffic engineering information, including Work Zones. The website can be visited by going to:

www.dot.state.mn.us/trafficeng/index.html.

Click on the links to proceed to the appropriate Traffic Engineering Site. The Work Zones page is the bottom link shown with the red arrow in the exhibit.

Exhibit 1-2 MnDOT OTST Website



Details on the work zones website are listed in Section 2.6.1.

1.7 Written Communications Policy

To request this document in an alternative format, please contact the Affirmative Action Office at 651-366-4723 or 1-800-657-3774 (Greater Minnesota); 711 or 1-800-627-3529 (Minnesota Relay). You may also send an e-mail to ADArequest.dot@state.mn.us. (Please request at least one week in advance).

1.8 Glossary of Terms

The following words and terms, when used in this manual, have the following meanings, unless the context clearly indicates otherwise.

Term	Definition
Active work zone	The portion of a work zone where construction, maintenance or utility workers are on the roadway or on the shoulder of the highway, and workers are adjacent to an active travel lane. Workers are not considered adjacent to an open travel lane if they are protected by a traffic barrier and no ingress or egress to the work zone exists through an opening in the traffic barrier.
Activity Area	That part of a TTC zone activity area where the work actually takes place. It consists of the work space, traffic space and one or more buffer spaces.
ADT - Average daily traffic	The total volume of traffic during a number of whole days, more than 1 day and less than 1 year, divided by the number of days in that period.
Advance Warning Area	That part of a TTC zone used to inform the motorist what to expect ahead. This area may contain anywhere from a single sign or a rotating/strobe light on a vehicle to a series of signs and the use of a portable changeable message sign (PCMS). The location of the beginning of the TTC zone is dependent on it's visibility to motorists. Good visibility is achieved where the sight distance is sufficient to meet decision sight distance.
Advance Warning Sign Spacing	The distance between signs or between a sign and some other location or device in the Advance Warning Area. It is determined by the posted speed limit. This will ensure that the motorist has sufficient time to read the signs and react accordingly.
Advisory Speed	The recommended speed for all to safely negotiate a potentially hazardous condition, such as a curve within a crossover or a reduction in lane capacity which would lead to a delay causing a natural reduced speed condition. (see Section 2.6.8).
Approach Sight Distance	The distance which a motorist can visually identify a work space. The work space may be the flagger station, a lane closure, a slow moving or stopped vehicle, or any other situation which requires adjustments by the motorist.
Alternate Pedestrian Access Route (APR)	An alternate pedestrian route is used when an existing pedestrian access route is blocked by construction, alteration, maintenance, or other temporary conditions.
Attended Work Space	A work space is considered to be attended when the TTC devices are reviewed for knock-downs or other needed adjustments on an hourly basis.
Buffer Space	The space which provides a margin of safety for both the driver and the workers. It is important that the buffer space be free of equipment, workers, material and vehicles and can be used in conjunction with “Roll Ahead Distance”.

Term	Definition
Clear Zone	The total roadside border area, starting at the edge of the traveled way, that is available for an errant driver to stop or regain control of a vehicle. This area might consist of a shoulder, a recoverable slope, and/or a nonrecoverable, traversable slope with a clear run-out area at its toe.
Crashworthy	Is a characteristic of roadside devices that have been successfully crash tested in accordance with a national standard such as the National Cooperative Highway Research Program Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features" or "Manual for Assessing Safety Hardware (MASH)".
Decision Sight Distance	<p>the total distance traveled during the length of time required for a driver to:</p> <ul style="list-style-type: none"> ✓ detect an unexpected or otherwise difficult-to-perceive information source or hazard in a roadway environment that may be visually cluttered, ✓ recognize the hazard or its potential threat, ✓ select an appropriate speed and path, and ✓ initiate and complete the required maneuver safely and efficiently. <p>The decision sight distance is used to determine the minimum advance warning distance to the first temporary construction sign. When determining minimum sight distance to flaggers and mobile operations, these distances also apply. The required Decision Sight Distances (D) are included in the TTC Distance Charts.</p>
Delineator	A retroreflective device mounted on the road surface or at the side of the roadway in a series to indicate the alignment of the roadway, especially at night or in adverse weather.
Designated Bicycle Route	A system of bikeways designated by the jurisdiction having authority with appropriate directional and informational route signs, with or without specific bicycle route numbers.
Divided Road	A highway or two roadways where opposing traffic is separated by a median (ditch, barrier, curbing, etc.), and the median is generally wide enough to place TTC devices. Temporary traffic control for divided multi-lane roads may be also used for one-way roadways.
Downstream	A term that refers to a location that is encountered by traffic subsequent to an upstream location as it flows in an "upstream to downstream" direction. For example, "the downstream end of a lane line separating the turn lane from a through lane on the approach to an intersection" is the end of the lane line that is closest to the intersection.
Downstream Taper	The taper at the end of the activity area which guides traffic back into its original lane. When used, this taper is a minimum length of approximately 100 feet with a 20 foot spacing between channelizing devices.

Term	Definition
Duration	<p>The length of time any work operation occupies a specific location or causes a traffic obstruction without changing the location. This time is measured from the first disruption to traffic until the total clearing of the area. The following durations are defined in overlapping intervals since TTC layouts for longer durations may always be used for shorter durations, especially when roadway attributes such as traffic volume and speed, and the work space location may warrant higher levels of traffic control. ☐</p> <ul style="list-style-type: none"> ✓ Mobile - when an operation is continuously moving or stopped in one location for periods of 15 minutes or less. The traffic control devices are typically vehicle-mounted. The work area should change by at least the decision sight distance for it to be considered a change in location. ✓ Short Duration - when an operation stays in one location during daylight conditions from 15 minutes to one hour. Since it often takes longer to set up and remove traffic control that it would to perform the work - and workers may be more exposed in the set up and take down procedures, simplified control procedures (as compared to Short Term) may be warranted. ✓ Short Term - when an operation stays in one location during daylight conditions from 15 minutes to twelve hours, such that advance signing and channelizing devices are required. ✓ Intermediate Term/Night - when an operation stays in one location during daylight conditions from 15 minutes to no more than 3 days, or stays in one location during hours of darkness. Advance signing and larger channelizing devices (Type B) are required. ✓ Long Term - when an operation stays in one location for more than 3 days. A project specific Traffic Control Plan is typically required. For State Projects within the metro district a Transportation Management Plan Scoping Worksheet may be required. This can be found at http://www.dot.state.mn.us/metro/trafficeng/control_stripping.html.
Engineering Judgment	<p>The evaluation of available pertinent information, and the application of appropriate principles, provisions, and practices as contained in the MN MUTCD and other sources, for the purpose of deciding upon the applicability, design, operation, or installation of a traffic control device. Engineering judgment shall be exercised by an engineer, or by an individual working under the supervision of an engineer, through the application of procedures and criteria established by the engineer. Documentation of engineering judgment is not required. See Section 2.5.2.</p>

Term	Definition
Engineering Study	The comprehensive analysis and evaluation of available pertinent information, and the application of appropriate principles, provisions, and practices as contained in the MN MUTCD and other sources, for the purpose of deciding upon the applicability, design, operation, or installation of a traffic control device. An engineering study shall be performed by an engineer, or by an individual working under the supervision of an engineer, through the application of procedures and criteria established by the engineer. An engineering study shall be documented. See Section 2.5.2 .
Exposure Control Measures	Traffic management strategies to avoid work zone crashes involving workers and motorized traffic by eliminating or reducing traffic through the work zone, or diverting traffic away from the work space.
Expressway	A high speed, multilane, divided highway which is generally an arterial road with a posted speed greater than 55 mph. Most intersections are at-grade, although grade separated interchanges may exist.
Flare Rate	The flare rate is the rate at which the Temporary barrier approaches the traveled way.
Following Distance	The distance in a mobile operation between the shadow vehicle and the work vehicle. It is used to provide advance warning to traffic that some type of work is being done within the traffic lane. Traffic will have to change lanes, slow down and wait for a safe time to pass, or adjust their position within the lane to allow for a narrower traffic lane. The shadow vehicle shall be equipped with appropriate advance warning signing.
Freeway	A divided highway with full control of access.
High Speed Road	A roadway where the posted speed limit is 45 miles per hour or greater.
Interim Pavement Markings	Pavement Markings that are a thinner marking applied in order to maintain traffic until the next lift or permanent markings can be placed. See additional information in Section 3.4 .
Lane Closure	A closure of one or more lanes of the roadway to traffic. Generally, a minimum lane width of 10 feet is required for a traffic operation. Work operations that restrict adjacent lane width should consider various lane closure alternatives depending upon volume and speeds on the roadway.
Intelligent Work Zone (IWZ)	A system of devices that provides motorists, and/or workers, “real-time” information for improved mobility and safety through a work zone.
Late Merge	See “Zipper Merge”
Lane Width	For temporary traffic control purposes, a minimum lane width of 10 feet shall be provided. The lane width should be no less than 11 feet on multi-lane roads.

Term	Definition
Lateral Buffer Space	The space that separates the traffic space from the work space. It is typically the extra space provided between traffic and workers, excavations, pavement edge drop-offs, or an opposing lane of traffic. Traffic lanes may be closed to provide for lateral buffer space. See the longitudinal drop-off guidelines (pages 6k-xxi thru 6k-xxiii) of this MN MUTCD for more information.
Longitudinal Buffer Space	The distance between the transition area and the work space. If a driver does not see the advance warning or fails to negotiate the transition area, a buffer space provides room to stop before the work space.
Low Speed Road	A roadway where the posted speed limit is 40 miles per hour or less.
Merging Taper	The taper used on a multi-lane road to close a lane and combine its traffic from that of the adjacent lane. Its length is dependent on the posted speed of the roadway. Higher speeds require a longer distance for traffic to merge lanes.
MN MUTCD	The current edition of the Minnesota Manual on Uniform Traffic Control Devices, Part 6 addresses temporary traffic control.
Mobile Buffer Space	The distance in a mobile operation between the shadow vehicle and the work vehicle. This distance is dependent on whether the shadow vehicle is being used as an advance warning device or as a blocking/protection device for the work vehicle. Usually used in conjunction with “Roll Ahead Distance”.
Modes of Transportation	Motor vehicles (including buses and trucks), transit, bicycles or pedestrians.
Motorist	An operator of a motorized vehicle intended to be used on a roadway.
Multi-Lane Road	A roadway where two or more lanes of traffic travel in the same direction. A multi-lane roadway may be classified as either undivided or divided.
Normal Speed Limit	The statutory or posted speed limit that existed before temporary traffic control was established, for example, prior to the beginning of a work zone. It is used to determine the spacings of TTC devices and the lengths of various tapers on the TTC layouts.
Off Shoulder	A work space located primarily off of the shoulder, or which causes a little or no restrictions on the use of the shoulder. This work space should have little or no interference with traffic such that traffic speeds generally are not reduced.
Portable Changeable Message Sign (PCMS)	PCMS are variable message signs that can be moved to a location as required. In moving operations, portable signs may be mounted on a truck. See Section 2.6.9 .
Posted Speed Limit	The speed limit is speed shown on regulatory Speed Limit signs.
Positive Protection	Positive Protection is the use of devices that contain and/or redirect vehicles, reducing the risk of vehicle intrusion into the workspace.

Term	Definition
Protection Vehicle	The vehicle that is placed -upstream of the work space and equipment to block errant motorists from entering the work space.
Public Information Plan (PIP)	A plan that informs the public of the impacts on traffic and the general area during or prior to construction.
Road, Roadway	That portion of a highway improved, designed , or ordinarily used for vehicular travel and parking lanes, but exclusive of the sidewalk, berm, or shoulder even though such sidewalk, berm, or shoulder is used by persons riding bicycles or other human-powered vehicles.
Roll Ahead Distance	The recommended minimum distance between a protection vehicle and the work space.
Shadow Vehicle	The vehicle placed in advance of the work space in a mobile operation to provide advance warning to motorists. Because mobile operations generally have all advance warning signing mounted on vehicles, the spacing between vehicles should be the Following Distance (F) as included in the TTC Distance Charts.
Shifting Taper	The taper used to move traffic from the traffic lane onto a by-pass or shoulder. This traffic maneuver generally requires half the distance than a merging taper. See the TTC Distance Charts for the length of a shifting taper called L/2.
Shoulder Closure	A closure of the roadway shoulder for work operations. The shoulder then becomes unusable by traffic for vehicle maneuvers or break-downs. TTC layouts for work operations using or on a shoulder are dependent on the type of shoulder usage and duration.
Shoulder Taper	The taper used to close the shoulder off to traffic so that shoulder work can be done or equipment can be placed on the shoulder. Since this taper is used to guide errant traffic back to its normal lane path, it does not require a full merge distance. The taper length is reduced to one-third of a merging taper length.
Significant Projects	Is defined as one that, alone or in combination with other concurrent projects nearby, is anticipated to cause sustained work zone impacts that are greater than what is considered tolerable based on State policy and/or engineering judgment. See the MN work zone safety and mobility policy as described in Section 2.6.13 .
Temporary Pavement Markings	Pavement markings placed for staging of traffic on long term projects.
Temporary Pedestrian Access Route (TPAR)	A TPAR is a temporary pedestrian route that is fully accessible and meets the standards and guidelines.

Term	Definition
Temporary Traffic Control (TTC) Plan	A TTC plan describes TTC measures to be used for facilitating road users through a work zone or an incident area. TTC plans play a vital role in providing continuity of effective road user flow when a work zone, incident, or other event temporarily disrupts normal road user flow. Important auxiliary provisions that cannot conveniently be specified on project plans can easily be incorporated into Special Provisions within the TTC plan.
Temporary Traffic Control (TTC) Zone	An area of a highway where road user conditions are changed because of a work zone or incident by the use of temporary traffic control devices, flaggers, uniformed law enforcement officers, or other authorized personnel. See figures 6k-6 and 6k-7 of the MN MUTCD, component parts of a temporary traffic control zone.
Termination Area	That part of a TTC zone located beyond the work space which guides traffic back into its normal traffic path. A longitudinal buffer space may be used between the end of the work space and the beginning of the downstream taper.
TPAR Device	TPAR devices are pedestrian elements (such as temporary curb ramps, pedestrian channelizers, sidewalk barricades, etc) that meet the parameters defined in PROWAG.
Traffic Control Device	A sign, signal, marking, or other device used to regulate, warn, or guide traffic, placed on, over or adjacent to a street, highway, pedestrian facility, or shared-use path by authority of a public agency having jurisdiction.
Traffic Space	That part of the roadway open to traffic that is next to the activity area. Traffic routing is provided with channelizing devices of various sizes and shapes. For a description of the various types of channelizing devices and their general uses, see the temporary traffic control devices section (page 6k-xiii) of the MN MUTCD.
Transition Area	That part of the TTC zone that moves the traffic from its normal path or lane into the traffic space. This movement of traffic is done through the use of channelizing devices and directional signing placed in various types of tapers.
Transportation Management Area	An area designated by the Secretary of Transportation, having an urbanized area population of over 200,000, or upon special request from the Governor and the MPO designated for the area (see the Work Zone Safety and Mobility Policy in Section 2.6.13). There is only one in Minnesota (the Minneapolis/St. Paul area).
Transportation Management Plan (TMP)	Lays out a set of coordinated strategies and describes how these strategies will be used to manage the impacts of a project during construction. It may include the TCP, TOP and PIP (see the Work Zone Safety and Mobility Policy in Section 2.6.13).

Term	Definition
Transportation Operations Plan (TOP)	A plan that includes Demand Management Strategies, Corridor\Network Management Strategies, Work Zone Safety Management Strategies and Traffic\Incident Management and Enforcement Strategies. Traffic modeling may be required.
Turn Lane Closure	The closure of a right or left turn lane for work operations. Signing in the TTC zone shall provide adequate warning to the motorists and may provide an alternative turning maneuver. Layouts from the various roadway types should be reviewed for the best alternate depending upon roadway intersection design, traffic control (stop, yield, signals, etc.), speed limit and volume.
Two Way Taper	The taper used on two-lane, two-way road to change the road into a single lane of two-way traffic. It is primarily used for flagging operations.
Two-Lane, Two-Way Road	A roadway consisting of two single opposing lanes of undivided traffic.
Two-Way Left Turn Lane (TWLTL)	That part of the roadway that has a continuous two-way left turn lane located between the opposing lanes of traffic. This design variation may be found on either two-lane, two-way roads or multi-lane undivided roads.
Undivided Road	A roadway where opposing traffic lanes have no physical separation except pavement markings (where required).
Upstream	A term that refers to a location that is encountered by traffic prior to a downstream location as it flows in an "upstream to downstream" direction. For example, "the upstream end of a lane line separating the turn lane from a through lane on the approach to an intersection" is the end of the lane line that is farthest from the intersection.
Urban Street	A type of street normally characterized by relatively low speed, wide ranges in traffic volume, narrower roadway lanes, frequent intersections, significant pedestrian traffic, and more roadside obstacles.
Volume	The number of vehicles passing a given point on the roadway during a given timeframe. Commonly used volume rates in temporary traffic control are Average Daily Traffic (ADT) and vehicles per hour (vph).
Work Space	That part of the TTC zone closed to traffic and set aside for workers, equipment and materials. The space requirements for a specific TTC Zone will determine the type of TTC layout that is appropriate for the project. The layout will specify the appropriate sign locations, flagger stations and tapers depending on the type of work space.
Work Zone	A segment of highway or street where a road authority or its agent is constructing, reconstructing, or maintaining the physical structure of the roadway, its shoulders, or features adjacent to the roadway, including underground and overhead utilities and highway appurtenances, when workers are present. See full definition in Section 2.3.

Term	Definition
Work Zone Speed Limits	<p>A temporary regulatory speed limit in a temporary traffic control zone. This speed limit requires proper documentation to approve and install. See <i>work zone speed limit guidelines</i> at the following website for details:</p> <p>www.dot.state.mn.us/speed/pdf/WZSpeedLimitGuideline.pdf</p>
Zipper Merge (Late Merge)	<p>When a lane is closed in a construction zone, a zipper merge occurs when motorists use both lanes of traffic until reaching the defined merge area, and then alternate in "zipper" fashion into the open lane.</p> <ul style="list-style-type: none"> ✓ In an Active Zipper Merge, sensors and intelligence tell drivers when to use the Zipper Merge. ✓ In a Passive Zipper Merge, signs or PCMS notifying drivers to use Zipper Merge when backups occur.

This page is intentionally left blank.

2. TEMPORARY TRAFFIC CONTROL OVERVIEW

2.1 General

A Temporary Traffic Control (TTC) Zone (aka Work Zone) is an area of a roadway where road user conditions are changed because of a work space or incident by the use of TTC devices, flaggers, uniformed law enforcement officers or other authorized personnel. The type of operation planned, space requirements, time duration, and roadway characteristics for a specific TTC Zone will determine the appropriate procedures and preparation needed for the work zone.

Safety in the work zone is the primary consideration to be addressed in a TTC plan. A work zone may be as small as a single worker stopping alongside the roadway, to a mobile maintenance operation, to a flagger controlled lane closure, to a reduction of lanes on a multi-lane roadway and up to detoured traffic for a full roadway closure. The TTC plan must provide a safe work place and a safe route for the motorist and users of other transportation modes, such as pedestrians and bicyclists.

While Safety is of primary importance, mobility is also a consideration. Lack of mobility through a temporary traffic control zone can lead to frustration of drivers resulting in aggressive or otherwise unsafe driving behavior.

The topics in the manual address TTC over a longer period of time that requires a TTC plan.

Various laws, policies, standards, guidelines, and information are required to provide for this safety and mobility. The documents found through this chapter are a collection of Work Zone Design Tools which provide guidance to the project planner, temporary traffic control designer, contractors and field personnel.

The Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD) defines the term “temporary traffic control” as:



“Temporary Traffic Control Zone—an area of a highway where road user conditions are changed because of a work zone or incident by the use of temporary traffic control devices, flaggers, uniformed law enforcement officers, or other authorized personnel.”

Some refer to this term as “work zone traffic control,” which is the most common type of temporary traffic control.

2.2 MN MUTCD Chapter 6B - Fundamental Principles

The following is a handout from the MN MUTCD Chapter 6B on TTC Fundamental Principles. The MN MUTCD can be downloaded from the following web link:

www.dot.state.mn.us/trafficeng/publ/index.html

PART 6. TEMPORARY TRAFFIC CONTROL

Chapter 6B. Fundamental Principles

6B.1 Fundamental Principles of Temporary Traffic Control

SUPPORT:

Construction, maintenance, utility, and incident zones can all benefit from TTC to compensate for the unexpected or unusual situations faced by road users. When planning for TTC in these zones, it can be assumed that it is appropriate for road users to exercise extra caution. Even though road users are assumed to be using extra caution, special care is still needed in applying TTC techniques.

Special plans preparation and coordination with transit, other highway agencies, law enforcement and other emergency units, utilities, schools, and railroad companies might be needed to reduce unexpected and unusual road user operation situations.

During TTC activities, commercial vehicles might need to follow a different route from passenger vehicles because of bridge, weight, clearance, or geometric restrictions. Also, vehicles carrying hazardous materials might need to follow a different route from other vehicles. The Hazardous Materials and National Network signs are included in Sections 2B.62 and 2B.63, respectively.

Experience has shown that following the fundamental principles of Part 6 will assist road users and help protect workers in the vicinity of TTC zones. While these principles provide guidance for good TTC for the practitioner, they do not establish standards and warrants.

GUIDANCE:

Road user and worker safety and accessibility in TTC zones should be an integral and high-priority element of every project from planning through design and construction. Similarly, maintenance and utility work should be planned and conducted with the safety of drivers, bicyclists, pedestrians (including those with disabilities), and workers being considered at all times. If the TTC zone includes a grade crossing, early coordination with the railroad company or light-rail agency should take place.

SUPPORT:

Formulating specific plans for TTC at traffic incidents is difficult because of the variety of situations that can arise.

GUIDANCE:

The following are the seven fundamental principles of TTC:

1. General plans or guidelines should be developed to provide safety for motorists, bicyclists, pedestrians, workers, enforcement/emergency officials, and equipment, with the following factors being considered:
 - A. The basic safety principles governing the design of permanent roadways and roadsides should also govern the design of TTC zones. The goal should be to route road users through such zones using roadway geometrics, roadside features, and TTC devices as nearly as possible comparable to those for normal highway situations.
 - B. A TTC plan, in detail appropriate to the complexity of the work project or incident, should be prepared and understood by all responsible parties before the site is occupied. Any changes in the TTC plan should be approved by an official knowledgeable (for example, trained and/or certified) in proper TTC practices.
2. Road user movement should be inhibited as little as practical, based on the following considerations:
 - A. TTC at work and incident sites should be designed on the assumption that drivers will only reduce their speeds if they clearly perceive a need to do so (see Section 6C.1).
 - B. Frequent and abrupt changes in geometrics such as lane narrowing, dropped lanes, or main roadway transitions that require rapid maneuvers, should be avoided.
 - C. Work should be scheduled in a manner that minimizes the need for lane closures or alternate routes, while still getting the work completed quickly and the lanes or roadway open to traffic as soon as possible.
 - D. Attempts should be made to reduce the volume of traffic using the roadway or freeway to match the restricted capacity conditions. Road users should be encouraged to use alternative routes. For high-volume roadways and freeways, the closure of selected entrance ramps or other access points and the use of signed diversion routes should be evaluated.
 - E. Bicyclists and pedestrians should be provided with access and reasonably safe passage through the TTC zone.

HANDOUT

HANDOUT

- F. If work operations permit, lane closures on high-volume streets and highways should be scheduled during off-peak hours. Night work should be considered if the work can be accomplished with a series of short-term operations.
 - G. Early coordination with officials having jurisdiction over the affected cross streets and providing emergency services should occur if significant impacts to roadway operations are anticipated.
3. Motorists, bicyclists, and pedestrians should be guided in a clear and positive manner while approaching and traversing TTC zones and incident sites. The following principles should be applied:
- A. Adequate warning, delineation, and channelization should be provided to assist in guiding road users in advance of and through the TTC zone or incident site by using proper pavement marking, signing, or other devices that are effective under varying conditions. Providing information that is in usable formats by pedestrians with visual disabilities should also be considered.
 - B. TTC devices inconsistent with intended travel paths through TTC zones should be removed or covered. However, in intermediate-term stationary, short-term, and mobile operations, where visible permanent devices are inconsistent with intended travel paths, devices that highlight or emphasize the appropriate path should be used. Providing traffic control devices that are accessible to and usable by pedestrians with disabilities should be considered.
 - C. Flagging procedures, when used, must provide positive guidance to road users traversing the TTC zone.
4. To provide acceptable levels of operations, routine day and night inspections of TTC elements should be performed as follows:
- A. Individuals who are knowledgeable (for example, trained and/or certified) in the principles of proper TTC should be assigned responsibility for safety in TTC zones. The most important duty of these individuals should be to check that all TTC devices of the project are consistent with the TTC plan and are effective for motorists, bicyclists, pedestrians, and workers.
 - B. As the work progresses, temporary traffic controls and/or working conditions should be modified, if appropriate, in order to provide mobility and positive guidance to the road user and to promote worker safety. The individual responsible for TTC should have the authority to halt work until applicable or remedial safety measures are taken.
- C. TTC zones should be carefully monitored under varying conditions of road user volumes, light, and weather to check that applicable TTC devices are effective, clearly visible, clean, and in compliance with the TTC plan.
 - D. When warranted, an engineering study should be made (in cooperation with law enforcement officials) of reported crashes occurring within the TTC zone. Crash records in TTC zones should be monitored to identify the need for changes in the TTC zone.
5. Attention should be given to the maintenance of roadside safety during the life of the TTC zone by applying the following principles:
- A. To accommodate run-off-the-road incidents, disabled vehicles, or emergency situations, unencumbered roadside recovery areas or clear zones should be provided where practical.
 - B. Channelization of road users should be accomplished by the use of pavement markings, signing, and crashworthy channelizing devices.
 - C. Work equipment, workers' private vehicles, materials, and debris should be stored in such a manner to reduce the probability of being impacted by run-off-the-road vehicles.
6. Each person whose actions affect TTC zone safety, from the upper-level management through the field workers, should receive training appropriate to the job decisions each individual is required to make. Only those individuals who are trained in proper TTC practices and have a basic understanding of the principles (established by applicable standards and guidelines, including those of this Manual) should supervise the selection, placement, and maintenance of TTC devices used for TTC zones and for incident management.
7. Good public relations should be maintained by applying the following principles:
- A. The needs of all road users should be assessed such that appropriate advance notice is given and clearly defined alternative paths are provided.
 - B. The cooperation of the various news media should be sought in publicizing the existence of and reasons for TTC zones because news releases can assist in keeping the road users well informed.
 - C. The needs of abutting property owners, residents, and businesses should be assessed and appropriate accommodations made.
 - D. The needs of emergency service providers (police, fire, and medical) should be assessed and appropriate coordination and accommodations made.

HANDOUT

HANDOUT

- E. The needs of railroads and transit should be assessed and appropriate coordination and accommodations made.
- F. The needs of operators of commercial vehicles such as buses and large trucks should be assessed and appropriate accommodations made.

STANDARD:

Before any new detour or temporary route is opened to traffic, all necessary signs shall be in place.

All TTC devices shall be removed as soon as practical when they are no longer needed. When work is suspended for short periods of time, TTC devices that are no longer appropriate shall be removed or covered.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

2.3 Legal Authority for Transportation

Legal authority for transportation is found in the Minnesota Statutes, Chapters 160 to 174A. The Statutes can be found at <https://www.revisor.mn.gov/statutes/>.

Exhibit 2-1 Minnesota Statutes Website

The screenshot shows the website for the Office of the Revisor of Statutes. The main heading is "THE OFFICE OF THE REVISOR OF STATUTES". Below this, there is a search bar and a navigation menu with options like "House", "Senate", "Joint", "Schedules", "Legislators", "Committees", "Bills", "Law", "Multimedia", and "Publications". The main content area is titled "2016 Minnesota Statutes" and includes a search bar, a "Table of Chapters" section, and a "Resources" sidebar. The "Table of Chapters" section lists various chapters and their titles, such as "1 - 2A JURISDICTION, CIVIL DIVISIONS" and "16A - 16E ADMINISTRATION AND FINANCE".

Chapters	Title
1 - 2A	JURISDICTION, CIVIL DIVISIONS
3 - 3E	LEGISLATURE
4 - 9	CONSTITUTIONAL OFFICES AND DUTIES
10 - 12B	GOVERNMENT MISCELLANY
13 - 13C	DATA PRACTICES
13D	MEETINGS OF PUBLIC BODIES
14 - 15A	STATE AGENCIES
15B	CAPITOL AREA
15C - 16	FRAUDULENT STATE CLAIMS
16A - 16E	ADMINISTRATION AND FINANCE
17 - 43	AGRICULTURE
43A	STATE EMPLOYMENT
44	CITY MERIT SYSTEMS
44A - 45	COMMERCE

Chapter 169.011, **Definitions** includes the following:

Subd. 95. **Work zone.** "Work zone" means a segment of street or highway for which:

- (1) a road authority or its agent is constructing, reconstructing, or maintaining the physical structure of the roadway, which may include, but is not limited to, shoulders, features adjacent to the roadway, and utilities and highway appurtenances, whether underground or overhead; and
- (2) any of the following applies:
 - (i) official traffic-control devices that indicate the segment of street or highway under construction, reconstruction, or maintenance, are erected;
 - (ii) one or more lanes of traffic are closed;
 - (iii) a flagger under section 169.06, subdivision 4a, is present;
 - (iv) a construction zone speed limit under section 169.14, subdivision 4, is established; or
 - (v) a workers present speed limit under section 169.14, subdivision 5d, is in effect

2.4 Federal Regulations

Title 23 of the United States Code (U.S.C) outlines the role of highways in the United States Code (www.ecfr.gov/). Part 630 Subpart J covers Work Zone Safety and Mobility and Subpart K outlines Temporary Traffic Control Devices.

2.5 Engineering Standards

2.5.1 MN MUTCD Text Headings

When used in the sections of the MN MUTCD (see Section 2.6.3), the text headings shall be defined as follows:

STANDARD: A statement of required, mandatory, or specifically prohibitive practice regarding a traffic control device. The verb “shall” is typically used. Standards are sometimes modified by Options.

GUIDANCE: A statement of recommended, but not mandatory, practice in typical situations, with deviations allowed if engineering judgment or engineering study indicates the deviation to be appropriate. The verb “should” is typically used. Guidance statements are sometimes modified by Options.

OPTION: A statement of practice that is a permissive condition and carries no requirement or recommendation. Options may contain allowable modifications to a Standard or Guidance. The verb “may” is typically used.

SUPPORT: An informational statement that does not convey any degree of mandate, recommendation, authorization, prohibition, or enforceable condition. The verbs “shall”, “should”, and “may” are **not** used in Support statements.

Exhibit 2-2 is an example of the text headings used for Section 6H-4 from the MN MUTCD.

Exhibit 2-2 Text Heading Example from MN MUTCD

<p>STANDARD:</p> <p>TTC plans and devices shall be the responsibility of the authority of a public body or official having jurisdiction for guiding road users. There shall be adequate statutory authority for the implementation and enforcement of needed road user regulations, parking controls, speed zoning, and management of traffic incidents. Such statutes shall provide sufficient flexibility in the application of TTC to meet the needs of changing conditions in the TTC zone.</p> <p>SUPPORT:</p> <p>Temporary facilities, including pedestrian routes around work sites, are also covered by the accessibility requirements of the Americans with Disabilities Act of 1990 (ADA) (Public Law 101-336, 104 Stat. 327, July 26, 1990. 42 USC 12101-12213 (as amended)).</p>	<p>GUIDANCE:</p> <p>The TTC plan should start in the planning phase and continue through the design, construction, and restoration phases. The TTC plans and devices should follow the principles set forth in Part 6. The management of traffic incidents should follow the principles set forth in Chapter 6G.</p> <p>OPTION:</p> <p>TTC plans may deviate from the typical applications described in Chapter 6H to allow for conditions and requirements of a particular site or jurisdiction.</p>
--	---

2.5.2 Engineering Judgment and Documentation

In many instances, engineering judgment is required when standards cannot be fully met. For instance, in the definition of Guidance above, it states, “deviations allowed if **engineering judgment** or engineering study indicates the deviation”. The definition of engineering judgment from the MN MUTCD section 1A.13 states:

Engineering Judgment - the evaluation of available pertinent information, and the application of appropriate principles, provisions, and practices as contained in this Manual and other sources, for the purpose of deciding upon the applicability, design, operation, or installation of a traffic control device. Engineering judgment shall be exercised by an engineer, or by an individual working under the supervision of an engineer, through the application of procedures and criteria established by the engineer. Documentation of engineering judgment is not required.

While “documentation of engineering judgment is not required”, it is highly recommended. For liability purposes, it is important to document engineering judgment. Often, tort claims occur many months or years later. Documentation of decisions, including minutes of meetings, notes in a diary, notes on a plan, etc. become very important during depositions and trials.



Proper documentation of decision making during design and proper review and implementation during construction results in not only a better design and safer work zone, but clearly reduces risk and liability.

2.6 Associated Manuals and Guideline

There are a variety of manuals and guidelines related to TTC. In this section, some of the more common manuals are presented.

2.6.1 Work Zone Manuals and Guidelines Website

The Work Zone manuals and guidelines website (see **Exhibit 2-3**) includes a large variety of publications related to work zones. The website can be visited by going to:

www.dot.state.mn.us/trafficeng/workzone/wzmanual.html

Please be sure to visit the website to view the most up-to-date resources.

Exhibit 2-3 Work Zone Manuals and Guidelines Website

m DEPARTMENT OF
TRANSPORTATION

511

Search General Contacts MnDOT A to Z

Work Zone - Overview
Includes manuals, guidelines, checklists, specifications and tech memos

Traffic Engineering | Publications | Work Zone Training | Work Zone Committee | Contact Us

ADA in Work Zones

What is wanted, needed and/or required? MnDOT conducted a workshop and demonstration on ADA compliance in Maintenance and Construction work zones... [more...](#)

Work Zone Safety Resources

A work zone (also known as a Temporary Traffic Control (TTC) Zone) is an area of a roadway where road user conditions are changed because of a work space or incident by the use of TTC devices, flaggers, uniformed law enforcement officers or other authorized personnel.

The type of operation planned, space requirements, time duration, and roadway characteristics for a specific TTC Zone will determine the appropriate procedures and preparation needed for the work zone.

Safety in the work zone is the primary consideration to be addressed in a TTC plan. A work zone may be as small as a single worker stopping along side the roadway, to a mobile maintenance operation, to a flagger controlled lane closure, to a reduction of lanes on a multi-lane roadway and up to detoured traffic for a full roadway closure. The TTC plan must provide a safe work place, and a safe route for the pedestrian and the motorists.

Various laws, policies, standards, guidelines, and information are required to provide for this safety. The documents found through this page are a collection of Work Zone Design Tools which provide guidance to the project planner, temporary traffic control designer, contractors and field personnel. These tools are found in the Quick Links on the right-side menu of this web page. The tools include manuals, guidelines on current practices, reports on past studies, the latest technical memorandum related to Traffic Engineering topics, standards for various TTC devices, and the collection of special provisions boilerplate. The Template Sheets include typical plan sheets for various traffic configurations. The sheets help provide uniform statewide TTC designs.

Other Resources

- [Work zone safety campaign](#) - construction zone and safety information and safe driving tips
- [Work Zone Safety Awareness Program](#) - A free program involving work zone safety

Contact

- [Work Zone](#) questions and comments

Work Zone Design Tools

- [Overview](#)
- [Manuals and Guidelines](#)
- [TTC Reports](#)
- [Technical Memoranda](#)
- [TTC Device Standards](#)
- [ADA in Work Zones](#)
- [Special Provisions](#)
- [Sample TTC Plan \(PDF\)](#)
- [Sample TTC Plan \(DGN\)](#)
- [Template Sheets](#)

Traffic Engineering Sites

- [ADA \(TPAR\)](#)
- [Approved Products](#)
- [Corridor Modeling](#)
- [Lighting](#)
- [Intelligent Transportation Systems \(ITS\)](#)
- [Pavement Markings](#)
- [Pedestrians in Work Zones](#)
- [Signals](#)
- [Signage](#)
- [Speed Limits](#)
- [Tort Claims](#)
- [Training](#)
- [Traffic Safety](#)
- [Traffic Topics](#)
- [Trivia and Facts](#)
- [Work Zones](#)

Temporary Traffic Control Operation

The following sections describe some of the more common manuals and resources found within the above website. However, each item listed on the website could be relevant to your particular need.

2.6.2 Federal Manual on Uniform Traffic Control Devices

The Federal Highway Administration (FHWA) publishes the MUTCD, which contains all national design, application, and placement, standards, guidance, options, and support provisions for traffic control devices. At the time of publication of this manual, the 2009 Edition with Revision Numbers 1 and 2 incorporated, dated May 2012 is the current version. The national MUTCD website is located at:

<http://mutcd.fhwa.dot.gov/index.htm>.

The purpose of the MUTCD is to provide uniformity of these devices, which include signs, signals, and pavement markings, to promote highway safety and efficiency on the Nation's streets and highways.

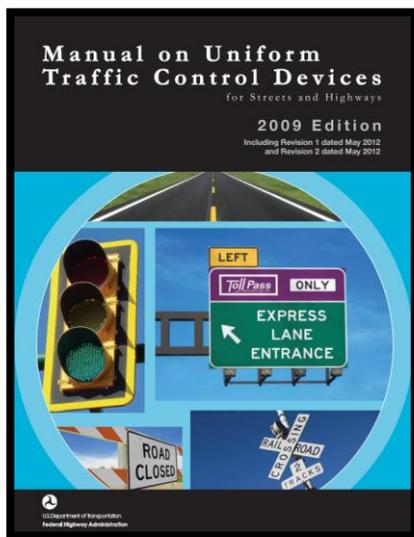
Title 23 of the Code of Federal Regulations requires all States to do one of three things within two years after a new national MUTCD edition is issued or any national MUTCD amendments are made:

1. adopt the new or revised national MUTCD as the standard for traffic control devices in the State;
2. adopt the national MUTCD with a State Supplement that is in substantial conformance with the new or revised national MUTCD; or
3. adopt a State MUTCD that is in substantial conformance with the new or revised national MUTCD.

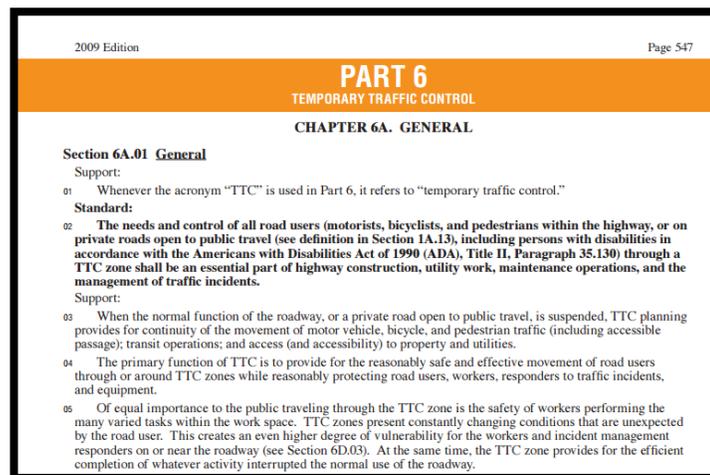


Minnesota develops and adopts a State MUTCD (3 above) that is in substantial conformance with the national MUTCD.

Exhibit 2-4 Federal MUTCD



Chapter 6 of the Federal MUTCD related to TTC

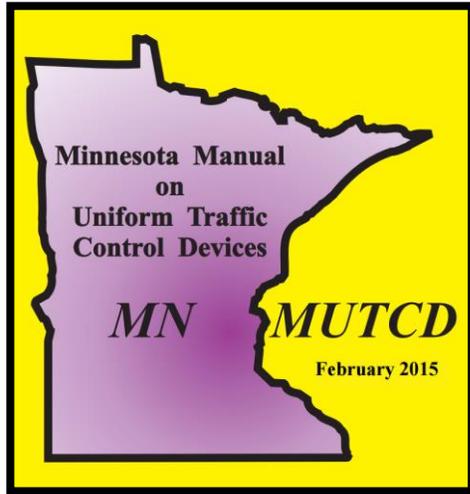


The Federal MUTCD is not just a “policy”. It is not a MnDOT document. It applies to all public roads in the United States. The MUTCD is part of Federal Law and the MN MUTCD is part of State Law. The Federal government issues the MUTCD and gives states a certain amount of time to adopt it, or lose federal funding. Some states adopt it “as is”, many states publish a supplement. Minnesota re-writes the document. Those that re-write can be more conservative, but not less. The MN MUTCD is the document to follow in Minnesota.

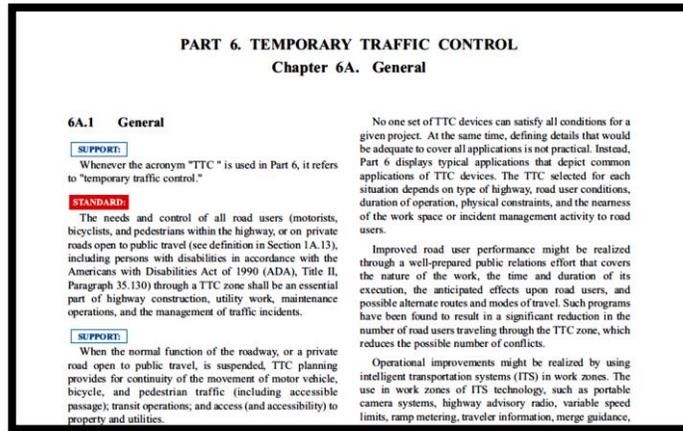
2.6.3 Minnesota Manual on Uniform Traffic Control Devices

As noted above, Minnesota develops and adopts a state MUTCD that is in substantial conformance with the Federal MUTCD. The Minnesota MUTCD (MN MUTCD) was recently updated in July 2012. Chapter 6 of the MN MUTCD is dedicated to temporary traffic control (TTC).

Exhibit 2-5 Minnesota MUTCD



Chapter 6 of the MN MUTCD related to Traffic Signs



The MN MUTCD contains Standards, Guidance, and Options for the signing of all types of highways, and private roads open to public travel. Detailed TTC requirements are located in the following section of Part 6 of the MN MUTCD:

- ✓ Chapter 6A. General
- ✓ Chapter 6B. Fundamental Principals
- ✓ Chapter 6C. Temporary Traffic Control Elements
- ✓ Chapter 6D. Pedestrian and Worker Safety
- ✓ Chapter 6E. Flagger Control
- ✓ Chapter 6F. Temporary Traffic Control Zone Devices
- ✓ Chapter 6G. Type of Temporary Traffic Control Zone Activities
- ✓ Chapter 6H. Speed Limits in Temporary Traffic Control Zones
- ✓ Chapter 6I. Control of Traffic Through Traffic Incident Management Areas
- ✓ Chapter 6J. Long Term Temporary Traffic Control Zone Layouts
- ✓ Chapter 6K. Temporary Traffic Control Zone Layouts (See Section 2.6.4)

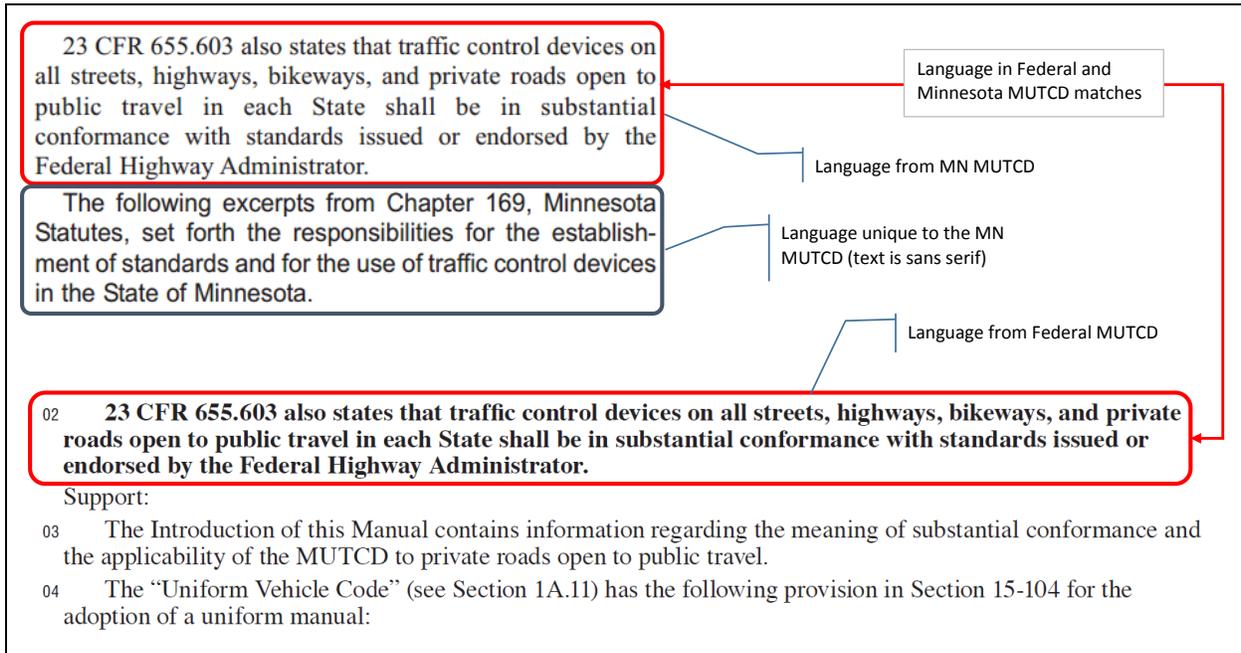


Chapter 6K is also known as the Field Manual and is available as a separate document.



Information in the MN MUTCD that was added or changed from the Federal MUTCD is shown in a sans serif font. See [Exhibit 2-6](#).

Exhibit 2-6 Example of Language Unique to MN MUTCD



2.6.4 Temporary Traffic Control Zone Layouts Field Manual (MN MUTCD Chapter 6K)

This Field Manual is a section of Part 6 of the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD). It has been reprinted as a separate document for use in field operations. This Field Manual contains the general Temporary Traffic Control (TTC) standards and the user should refer to the MN MUTCD - Part 6 for more details, and follow any TTC plans, specifications, and special provisions written for a specific project. When specific TTC plans for a specific operation are not available, any public or private agency whose work affects vehicular and pedestrian traffic should use this Field Manual to provide proper temporary traffic control (TTC).

2.6.5 Traffic Engineering Manual

The Traffic Engineering Manual (TEM) is issued and updated by the MnDOT Office of Traffic, Safety and Technology (OTST). The purpose of the TEM is to establish uniform guidelines and procedures, primarily for use by personnel at MnDOT. Counties, cities, and local units of government will also find this manual useful when striving for uniformity in traffic engineering throughout the state of Minnesota. It is the intent of this Manual to set forth accepted practices, procedures, and guidelines, chiefly for the sake of uniformity of application, but there is no legal requirement for their use.

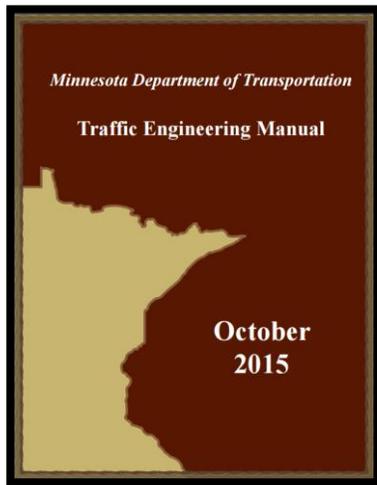
The TEM contains 13 chapters. Chapter 8 is related to Work Zone Traffic Controls (see **Exhibit 2-8**). The most current version of the TEM can be found at:

<http://www.dot.state.mn.us/trafficeng/publ/tem/index.html>



At the time of this publication print, MnDOT OTST was working on an update to the TEM. Be sure to check the above reference website for future updates to the manual. A new section on business signing is one of the future updates. The approved language on this topic is included as a handout in Section **3.2.7**.

Exhibit 2-8 MnDOT Traffic Engineering Manual (TEM)



Chapter 8 of the TEM related to Work Zone TC

August 2015	Traffic Engineering Manual	Chapter 8
8-1.00 INTRODUCTION		
8-1.01 Purpose		
This chapter is intended to show applications of basic principles of temporary traffic control and assist in developing temporary traffic control plans including Transportation Management Plans, plan sheets, specifications, special provisions, etc.		
8-1.02 Scope		
This chapter has been written to supplement, not to replace, the MN MUTCD . This chapter includes guidelines varying from planning traffic control to fit the needs of a particular activity to the reasons for keeping accurate records. The guidelines should be useful to any qualified individual involved with planning, designing, installing, maintaining, and inspecting temporary traffic control zones. Individuals are qualified by means of training in temporary traffic control practices, having a basic understanding of the principles of traffic control in work zones, or having experience in applying traffic control in work zones.		
Other road authorities are encouraged to review the MN MUTCD and establish guidelines to meet their needs.		

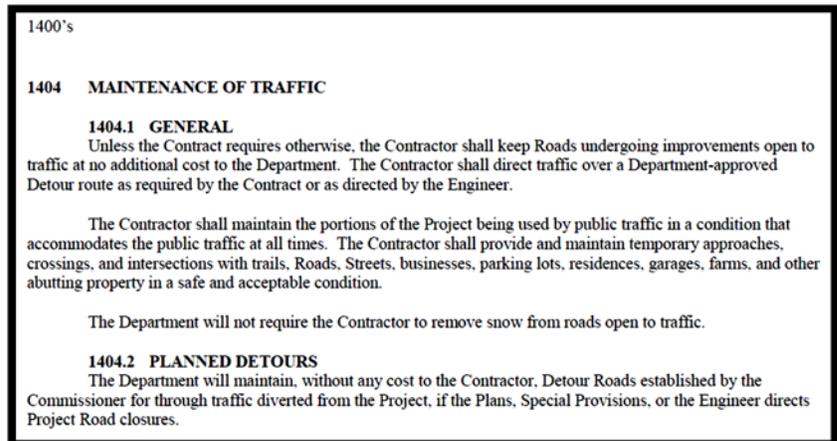
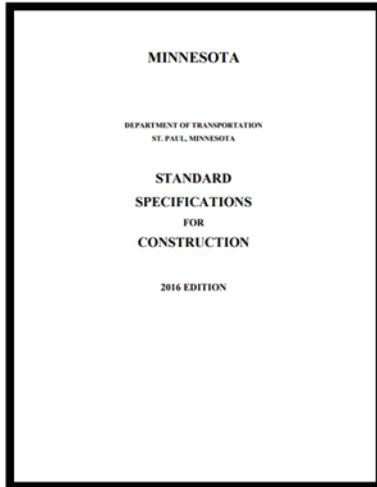
Chapter 8 of the TEM is broken into the following subsections:

- ✓ 8-1.00 Introduction
- ✓ 8-2.00 Glossary
- ✓ 8-3.00 Responsibility
- ✓ 8-4.00 Planning for Temporary Traffic Control
- ✓ 8-5.00 Temporary Traffic Control Devices
- ✓ 8-6.00 Temporary Traffic Control Plans
- ✓ 8-7.00 Establishing and Maintaining Detours
- ✓ 8-8.00 Installation and Inspection of TTC Devices
- ✓ 8-9.00 References

2.6.6 Standard Specifications for Construction

The “Spec Book” (**Exhibit 2-9**) contains standard specifications to be used and referred to in the design of plans and in the preparing of Special Provisions. Plan designers need to be aware of the specifications contained in the Spec Book that may apply to their individual project.

Exhibit 2-9 Standard Specifications for Construction Book (Spec Book)



The Spec Book is made of three divisions:

- ✓ Division I - General Requirements and Covenants
- ✓ Division II - Construction Details
- ✓ Division III - Materials

A few of the specifications of interest include the following (not all are listed, be sure to investigate all applicable sections):

- ✓ 1404 - Maintenance of Traffic
- ✓ 1504 – Coordination of Plans and Specifications
- ✓ 1710 – Traffic Control Devices
- ✓ 1807 – Failure to Complete the Work on Time
- ✓ 2102 – Pavement Marking Removal
- ✓ 2582 – Permanent Pavement Markings



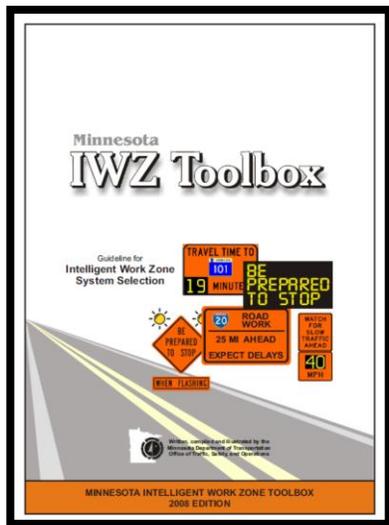
Note: The Standard Specification Book traditionally was updated on an approximately 5 year schedule. It is anticipated that future versions will be updated in 2018 and will be provided in electronic (online) format.

Refer to Chapter 6 for additional details.

2.6.7 Minnesota Intelligent Work Zone Toolbox

The IWZ Toolbox (**Exhibit 2-10**) has been prepared as a guideline for selecting an appropriate Intelligent Work Zone (IWZ) System for existing work zone traffic issues and to mitigate anticipated issues on scheduled projects. The IWZ System descriptions contained in this toolbox are intended as brainstorming material and should lead to practical solutions to a project's unique problems. The examples are purposely left void of many dimensions, except where particular distances are highly recommended, and engineering judgment is required to customize the system to a project.

Exhibit 2-10 Minnesota IWZ Toolbox



At the time of this publication print, MnDOT OTST was updating the IWZ Toolbox. Some of the sheets found in the toolbox are listed as “Under Development”.

The IWZ systems included in the document are:

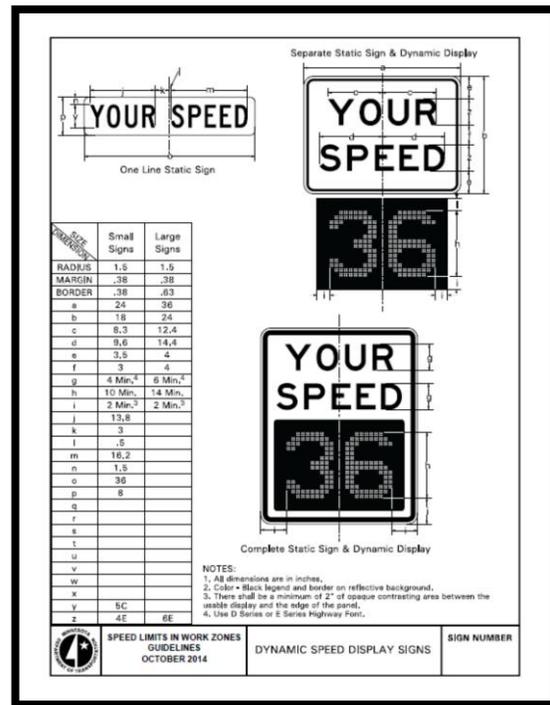
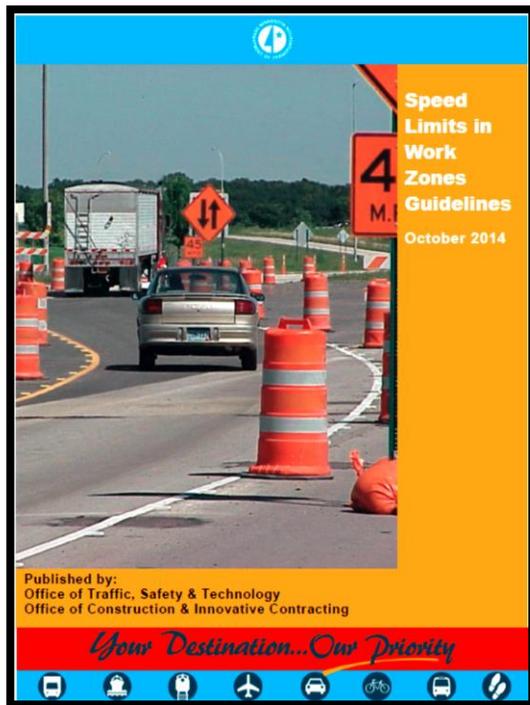
- ✓ Travel Time Information - Trip Time or Estimated Delay
- ✓ Speed Advisory Information
- ✓ Congestion Advisory
- ✓ Stopped Traffic Advisory
- ✓ Dynamic Merge - Late or Early
- ✓ Traffic Responsive Temporary Signals
- ✓ Temporary Ramp Metering
- ✓ Excessive Speed Warning - incl. Dynamic Speed Display Signs
- ✓ Over Dimension Warning
- ✓ Work Space / Haul Road Intrusion Warning
- ✓ Construction Vehicle Warnings - Merging, Crossing & Exiting
- ✓ Hazardous Condition Warnings - Road Surface or Visibility
- ✓ Changeable Work Zone Signage - incl. WZ Speed Limits
- ✓ Traffic Surveillance Camera

IWZ warrants can be found at, <http://enterprise.prog.org/>. Keep in mind that the warrants on this site are not an all-inclusive list of IWZ features that are available to the designer.

2.6.8 Work Zone Speed Limit Guidelines

The purpose of the Work Zone Speed Limits Guidelines (**Exhibit 2-11**) is to provide a uniform guideline for the proper application of speed limits in street and highway work zones. The booklet outlines the guidelines, proper layouts and procedures for implementing work zone speed limits primarily for use by MnDOT personnel. Although it is usually desirable to provide all traffic controls as shown in the layouts, situations arise where this becomes impractical. Engineering judgment may dictate modifications to the typical layouts. When modifications are made, factors such as traffic volume, speed, sight distance, type of work, etc. must be considered.

Exhibit 2-11 Work Zone Speed Limit Guidelines



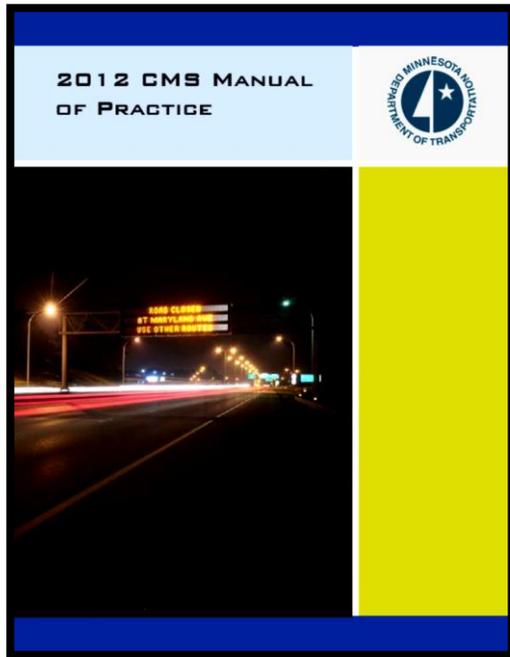
The topics include in the booklet include:

- ✓ Introduction
- ✓ The Law
- ✓ Documentation
- ✓ Advisory Speed Limits
- ✓ Workers Present Speed Limits
- ✓ 24/7 Construction Speed Limits
- ✓ Higher Fines for Inplace Speed Limits in Work Zones
- ✓ Speed Limits On Detours
- ✓ Dynamic Speed Display Signs
- ✓ Extraordinary Law Enforcement

2.6.9 2012 CMS Manual of Practice

The 2012 CMS Manual of Practice document (**Exhibit 2-12**) is in conformance with the Mn MUTCD and the guidelines set forth by FHWA. It is intended to be used as a guide for MnDOT internal stakeholders and external stakeholders, including other agencies and private contractors.

Exhibit 2-12 2012 CMS Manual of Practice



The items include in the manual are:

- ✓ Introduction
- ✓ Message Guidelines
- ✓ Permanent Changeable Message Signs
- ✓ Portable Changeable Message Signs (PCMS)



The 2012 CMS Manual includes information on the types of allowable and prohibited message and abbreviations that can be displayed on a CMS. Allowable and prohibited messages can also be found in the MN MUTCD

Web-based training on CMS is available from the following site:

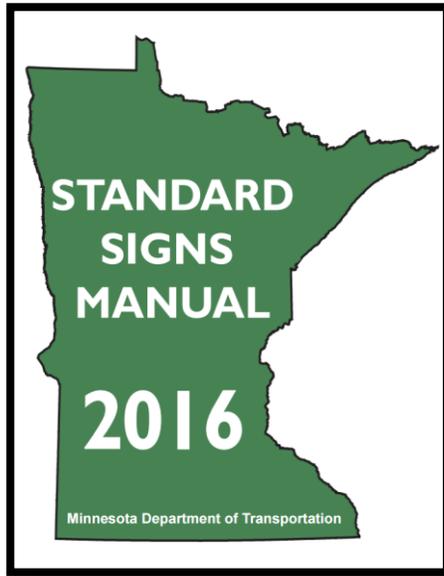
<http://www.dot.state.mn.us/trafficeng/education/changeable-message-signs/index.html>.

2.6.10 Minnesota Standard Signs and Markings Manual

The Standard Signs and Markings Manual contains a wide variety of standard signs that are used in the state (see [Exhibit 2-13](#)). It includes the common R, W, M, G, S, D, I, E and X series. Each Series is broken into groups. For instance, the R series is broken into 16 groups from Group 1 on Right of Way to Group 16 Miscellaneous. The manual also includes pavement markings.

The Standard Signs Manual includes detailed information on the layout of the sign.

Exhibit 2-13 MnDOT Standard Signs and Markings Manual



Sample Page from Standard Signs and Markings Manual (R1-1)

26.5 X 72	42 X 114	
a	37	60
b	35	54
c	7.5	12
d	9.5	15
e		
f		
g		
h		
i		
j		
k		
l		
m		
n		
o		
p		
q		
r		
s		
t		
u		
v		
w		
x		
y		
z		

Straight Pavement Marking Arrow

APPROVED	DATE OF REV.	 PMA-1
1/1/03		

NOTES: 1. All dimensions are in inches.
2. The 26.5 X 72 size shall be used for bike trails and bike lanes only.

2.6.11 Standard Signs Summary

As the name implies, the Standard Signs Summary is a summary of the standard signs used in the state (See [Exhibit 2-14](#)). It includes the sign number (nomenclature), a drawing of the sign, and the color of the sign and the sizes of the sign. Unlike the Standard Signs Manual, it does not contain the detailed layout details of the sign.

For the pavement markings, the following abbreviations are used in the manual:

- ✓ PMA = Pavement Markings Arrows
- ✓ PMC = Pavement Marking Characters
- ✓ PMS = Pavement Marking Symbol
- ✓ PMW = Pavement Marking Word



If any special signs are used, the designer needs to call out the structure that is to be used.

Exhibit 2-14 MnDOT Standard Signs Summary



Sample R Series from Standard Signs Summary

R Series							
No.	Drawing	Color	Use & Size	No.	Drawing	Color	Use & Size
R1-1		White on Red	B-P 18 x 18 B/RT 30 x 30 CR-SL 30 x 30 CR-ML, E 36 x 36 O 48 x 48	R1-X3		Black on White	24 x 18 30 x 24
R1-2		White on Red	B-P 18 x 18 x 18 B/RT 30 x 30 x 30 CR-SL 36 x 36 x 36 CR-ML, E 48 x 48 x 48 F 60 x 60 x 60	R2-1		Black on White	M 18 x 24 CR-SL 24 x 30 CR-ML, O 30 x 36 E 36 x 48 F 48 x 60
R1-2aP		Black on White	CR-SL 24 x 18 CR-ML 24 x 18 E 36 x 30 F 48 x 36	R2-3P		White on Black	CR-SL 24 x 24 CR-ML 24 x 24 E, O 36 x 36 F 48 x 48
R1-3P		White on	CR-SL 18 x 6				

2.6.12 Additional Manuals and Guidelines

The above sections (2.6.1 to 2.6.11) are a sampling of some of the more common (not necessarily most important) manuals and guidelines found on the Work Zone Manuals and Guidelines website. Be sure to fully investigate the website for details as it is continually being updated.

2.6.13 Minnesota Work Zone Safety and Mobility Policy Tech Memo

The following is a handout Technical Memorandum 12-03-T-02. The memo can be downloaded from the following web link:

www.dot.state.mn.us/trafficeng/workzone/wzmanual.html.

It is important that the holder of this manual checks the above link for updates.

The policy is addressed in three (3) levels as follows:

1. Project Level Procedures
2. District or Local Agency Level Process and Procedures
3. State Level Processes and Procedures

Of particular interest for this manual are the Project Level Procedures. These procedures are divided into:

- ✓ Work Zone Mobility Impact Assessment
- ✓ Transportation Management Plan (TMP)
- ✓ Plans, Specifications and Estimates (PS&Es)
- ✓ Project Temporary Traffic Control (TTC) Field Observations

It is important to provide the proper attention to these items in the early stages of the development process. Refer to the handout for full details.



MINNESOTA DEPARTMENT OF TRANSPORTATION
Engineering Services Division
Technical Memorandum No. 12-03-T-02
 February 6, 2012

To: Electronic Distribution Recipients

From: Jon M. Chiglo, P.E. 
 Division Director, Engineering Services

Subject: Minnesota Work Zone Safety and Mobility Policy

Expiration

This Technical Memorandum supersedes TM 07-16-T-05 and shall remain in force until February 6, 2017 unless superseded prior to that date or incorporated in the Traffic Engineering Manual.

Implementation

This policy shall be implemented immediately for all projects and operations in the planning and design phase. The provisions of these policies and procedures apply to Federal and non-Federal aid MnDOT projects and State-Aid projects with Federal aid in the State of Minnesota.

For projects that are in the later stages of development at/or about the compliance date, and if it is determined that the delivery of those projects would be significantly impacted as a result of this rule's provisions, MnDOT may request variances for those projects from the FHWA, on a project-by-project basis. They should also be implemented on maintenance and utility operations to the extent practical.

The provisions contained in this Technical Memorandum do not apply to **current** Construction Projects and Maintenance Operations.

Introduction

Use of the Work Zone Impact Assessment Decision Tree for projects on lower-volume streets and highways typically only requires the development of a temporary traffic control plan. Agencies are encouraged to apply the good practices, especially the decision tree included in the Minnesota Work Zone Safety and Mobility Policy, on all projects.

Purpose

The purpose of the attached "Minnesota Work Zone Safety and Mobility Policy" is to implement the requirements and guidelines contained in the Code of Federal Regulations, Title 23 Part 630, Subpart J, "Work Zone Safety and Mobility" for appropriate highway projects in Minnesota.

Guidelines

See attachment "Minnesota Work Zone Safety and Mobility Policy".

Questions

For information on the technical contents of this memorandum, please contact **Ken Johnson** at **(651) 234-7386**.

Any questions regarding publication of this Technical Memorandum should be referred to the Design Standards Unit, DesignStandards.DOT@state.mn.us. A link to all active and historical Technical Memoranda can be found at <http://techmemos.dot.state.mn.us/techmemo.aspx>.

To add, remove, or change your name on the Technical Memoranda mailing list, please visit the web page <http://techmemos.dot.state.mn.us/subscribe.aspx>

Attachments:

Minnesota Work Zone Safety and Mobility Policy
 Work Zone Impact Considerations Worksheet
 Work Zone Management Strategies

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Minnesota Work Zone Safety and Mobility Policy

February 6, 2012

INTRODUCTION

Work zones directly impact the safety and mobility of road users and highway workers. These safety and mobility impacts are exacerbated by an aging highway infrastructure and growing congestion in many locations. Everyone involved in project development and delivery including field operations must be committed to providing safety and mobility for all operations. Addressing these safety and mobility issues requires considerations that start early in project development and continue through project completion.

Purpose

The purpose of the policy contained in this document is to implement the requirements and guidelines contained in the Code of Federal Regulations, Title 23 Part 630, Subpart J, "Work Zone Safety and Mobility" for appropriate highway projects in Minnesota.

This document establishes requirements and provides guidance for systematically addressing the safety and mobility impacts of work zones, and developing strategies to help manage these impacts. The requirements and guidance are addressed at the following three (3) levels with associated procedures for each level and policies that should be developed ensure their uniformity and compliance statewide:

1. Project Level Procedures including:
 - a. Work Zone Mobility Impact Assessment
 - b. Transportation Management Plan (TMP)
 - c. Plans, Specifications and Estimates (PS&Es)
 - d. Project Temporary Traffic Control (TTC) Field Observations
2. District or Local Agency Level Process and Procedures
 - a. Establishment of a Work Zone Safety Coordinator
 - b. Operational Performance Information
 - c. Work Zone Crash Data Review
3. State Level Processes and Procedures
 - a. Statewide Work Zone Data
 - b. Statewide Field Reviews
 - c. Training
 - d. Process Feed-Back Discussions
 - e. Statewide Group Activities

Scope

The provisions of these policies and procedures apply to federal and non-federal aid MnDOT and State-Aid Projects with federal-aid in the State of Minnesota. They should also be implemented on maintenance and utility operations to the extent practical and feasible.

PROJECT LEVEL PROCESSES AND PROCEDURES

This section provides guidance and establishes procedures to manage the work zone impacts of individual projects.

For all construction and maintenance projects attention must be given to traffic mobility and safety from the early stages of development of the project, through the completion of the actual construction, including the preliminary layout studies, detailed design, and the drafting of the special provisions. It is considered essential that personnel of various technical expertise be involved in order to provide their specialty input so an appropriate transportation management plan can be developed.

During project planning and preliminary plan development, the Project Manager should review the scope of the project with traffic engineering, construction, design and maintenance personnel to establish traffic mobility and determine traffic control concepts for the proposed project. Project staging should be determined by the traffic carrying capacities of the roadway under construction, bypasses or detours. Consideration should be given for other construction/maintenance work in the proposed roadway corridor or general vicinity. Work zone mobility impact assessments should be done for all projects as detailed in the next section.

Work Zone Mobility Impact Assessment

The Work Zone Mobility Impact Assessment Decision Tree shown in Figure 1 should be used for all projects to identify the potential impact the project will have on mobility through the work zone and provide guidelines for developing the strategies to mitigate the impact. When the impacts are identified, the documentation and management of the mitigation strategies are combined into an appropriate level of Transportation Management Plan for the project.

To facilitate the use of this decision tree each district or local road authority should develop and implement a general traffic delay restriction policy for their jurisdiction. This policy should include restrictions by time-of-day, day-of-week, seasonal or special events, and may specify allowed durations or exceptions. A simple example of a district/road authority traffic delay restriction policy would be: "There shall be no lane closures on holiday weekends between 12 noon the day preceding the weekend until 5 am the day after the weekend".

The district or local road authority may have an established "Lane Closure Manual" which specifies times that a lane may be closed. These restrictions are typically based upon hourly traffic volume predictions. In areas where roads are not covered by such a manual, the following guidelines should be used to identify a potential mobility impact due to a lane closure:

- On 2-lane 2-way roadways, traffic should not be stopped (such as a flagging operation) for greater than 15 minutes.
- On multi-lane roadways, traffic volumes should not exceed 1800 vehicles per hour per open lane.

The Work Zone Mobility Impact Assessment Decision Tree (Figure 1) also considers any project which will impact mobility for more than three (3) days as requiring at least a Basic TMP as explained below.

Work Zone Mobility Impact Assessment - Decision Tree

Figure 1.

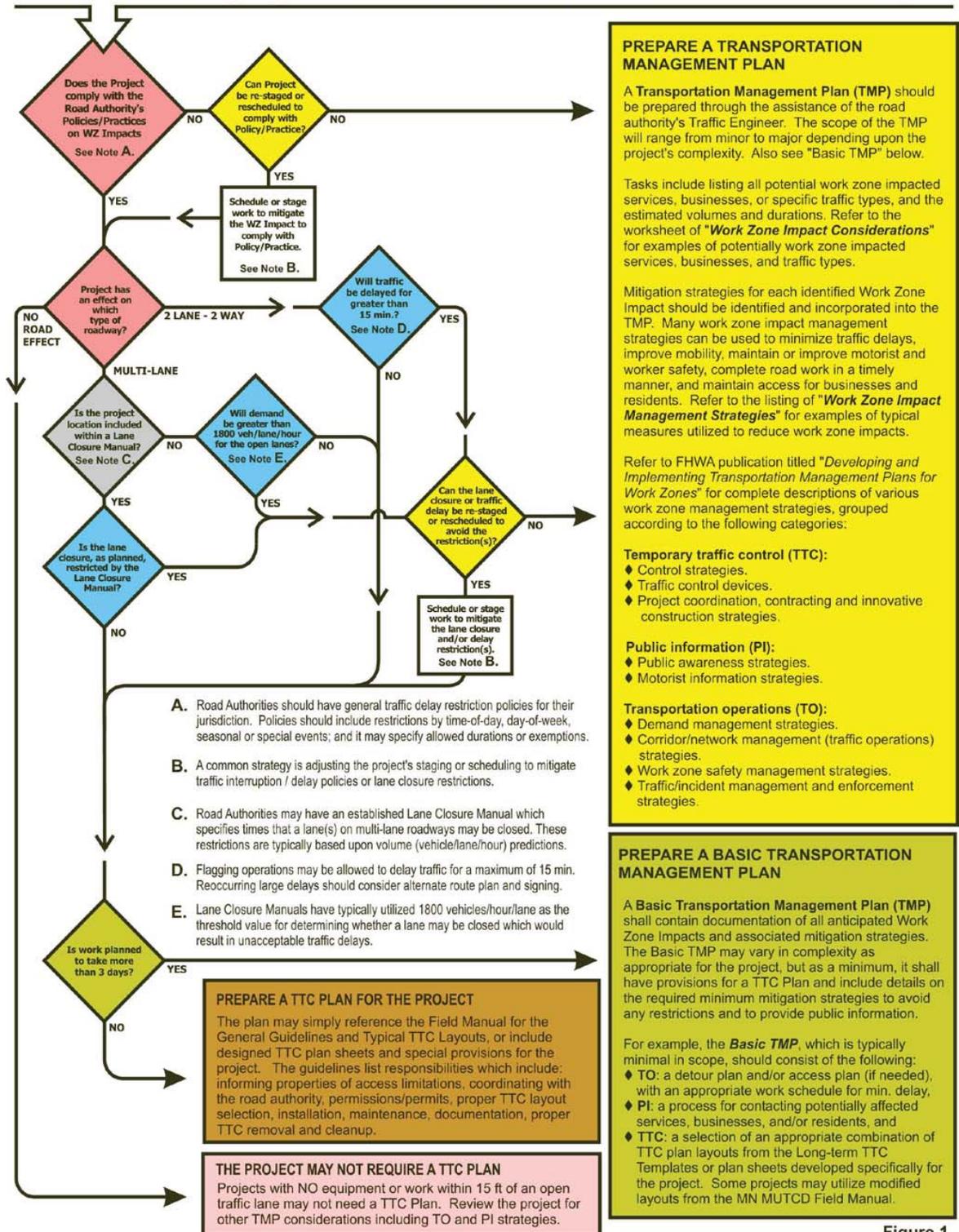


Figure 1.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Transportation Management Plan (TMP)

A Transportation Management Plan (TMP) should be prepared through the assistance of the road authority's Traffic Engineer. The TMP should be developed and implemented in sustained consultation with stakeholders (e.g., other transportation agencies, railroad agencies/operators, transit providers, freight movers, utility suppliers, police, fire, emergency medical services, schools, business communities, and regional transportation management centers).

Tasks include listing all potential work zone impacted services, businesses or specific traffic types and the estimated volumes and durations. Refer to the Attachment "A" titled "Work Zone Impact Considerations Worksheet" for examples of potential work zone impacted services, businesses and traffic types. The FHWA document #2: "**Work Zone Impacts Assessment: An Approach to Assess and Manage Work Zone Safety and Mobility Impacts of Road Projects**" provides guidance on developing procedures to assess and manage work zone impacts of road projects, as well as examples and practices of how agencies are currently assessing and managing work zone impacts. The FHWA also requires that work zone impacts and mitigating strategies be discussed in the project's environmental document.

ATTACHMENT A: <http://www.dot.state.mn.us/trafficeng/workzone/wzmobility/AttachmentA-considerations.pdf>

FHWA Doc #2: http://www.ops.fhwa.dot.gov/wz/resources/final_rule/wzi_guide/index.htm

Mitigation strategies for each identified work zone impact should be identified and incorporated into the TMP. Many work zone impact management strategies can be used to minimize traffic delays, improve mobility, maintain or improve motorist and worker safety, complete road work in a timely manner, and maintain access for businesses and residents. Attachment "B" titled "Work Zone Impact Management Strategies" contains a listing of examples of typical measures utilized to reduce work zone impacts. Refer to the FHWA document #3: "**Developing and Implementing Transportation Management Plans for Work Zones**" for information about developing and implementing Transportation Management Plans (TMP), including information on how and where a TMP fits into project-level processes and procedures, a list of components that can be considered for inclusion in a TMP, descriptions of work zone management strategies, and examples and practices of how agencies are currently using TMPs.

ATTACHMENT B: <http://www.dot.state.mn.us/trafficeng/workzone/wzmobility/AttachmentB-strategies.pdf>

FHWA Doc #3: http://www.ops.fhwa.dot.gov/wz/resources/publications/trans_mgmt_plans/index.htm

Components of the TMP

Various work zone management strategies are found within a TMP. The three primary management components are listed below:

Temporary Traffic Control (TTC)

- Control Strategies
- Traffic control devices
- Project coordination, contracting and innovative construction strategies

Transportation Operations (TO)

- Demand management strategies
- Corridor/network management (traffic operations) strategies
- Traffic/incident management and enforcement strategies

Public Information (PI)

- Public awareness strategies
- Motorist information strategies

Temporary Traffic Control (TTC) Plan:

The TTC plan is a component of the TMP which identifies the strategies for handling traffic through a specific highway or street, work zone or an incident area. The TTC plan plays a vital role in providing continuity of reasonably safe and efficient road user flow and highway worker safety when a work zone, incident, or other event temporarily disrupts normal road user flow. A TTC plan may range in scope from a simple reference to an appropriate layout in the MN MUTCD Field Manual (or the road authority's adopted TTC manual) up to a very detailed plan designed solely for a specific project with standard specifications. The degree of detail in the TTC plan will depend on the project complexity and traffic interference with construction or maintenance activity.

The TTC plan shall be consistent with the provisions under Part 6 of the MN MUTCD and with the work zone hardware recommendations in Chapter 9 of the **AASHTO Roadside Design Guide** titled: "Traffic Barriers, Traffic Control Devices, and Other Safety Features for Work Zones". In developing and implementing the TTC plan, pre-existing roadside safety hardware shall be maintained at an equivalent or better level than existed prior to project implementation. If there is no approved safety hardware to make extensions or additions to the existing safety hardware, experimental hardware may be used to accomplish roadside safety and project goals.

Traffic Operations (TO) Plan:

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

Public Information (PI) Plan:

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

Scope of the TMP

Depending upon the project's impact assessment, the scope of the TMP may range from very minimal requirements on many projects to a very formal and complex on large projects, which attempts to mitigate significant mobility and safety impacts utilizing the components listed above. Although many projects will not create significant impacts, they may still require a basic level of TMP consideration due to the project duration. Shorter duration projects may not require any formal TMP.

A Basic TMP, which is minimal in scope, shall have provisions for a TTC plan. The Basic TMP shall contain documentation of the basic work zone mobility impacts, such as excessive delays and project duration. The Basic TMP shall include details on the required minimum mitigation strategies to avoid or reduce any mobility restrictions and to provide public information.

As an example, the Basic TMP should consist of the following:

- TTC – a selection of an appropriate combination of TTC plan layouts from the long-term TTC templates or plan sheets developed specifically for the project. Some projects may utilize modified layouts from the MN MUTCD Field Manual.
-
- Traffic Operations – a detour plan and/or access plan as needed, with an appropriate work schedule to minimize delay
- Public Information – a process for contacting potentially affected services, businesses and/or residents

Projects having relatively insignificant work zone impacts, as detailed in the attached work zone mobility impact assessment decision tree, do not require a formal TMP beyond a TTC plan. This plan may simply reference the MN MUTCD Field Manual for the “TTC General Guidelines” and typical TTC layouts, or may include TTC plan sheets and special provisions designed for the project. The “TTC General Guidelines” list many responsibilities which include:

- informing adjacent property owners of access limitations
- coordinating with all the road authorities
- receiving permission or permits for the work
- selecting proper TTC layout
- installing, maintaining and documenting proper TTC devices
- removing TTC devices when they are no longer needed

Plans, Specifications, and Estimates (PS&Es)

The Plans, Specifications, and Estimates (PS&Es) shall include the appropriate provisions of the TMP (the TTC plan, TO and/or PI components) or provisions for contractors to develop a TMP at the most appropriate project phase as applicable to the chosen contracting methodology for the project. Generally the agency develops the TMP. A contractor developed TMP shall be subject to the approval of the Road Authority, and shall not be implemented before it is approved.

Detailed final design should involve the traffic engineering, construction and maintenance personnel and appropriate FHWA personnel as the final detail plans are being developed so the necessary details for traffic control and mobility are included in the construction plan and proposal. If the complexity of a project warrants, a traffic control layout may be prepared and be included in the P.S. & E. On some projects it may be appropriate to provide broad TTC plan parameters in the P.S. & E., then permit the successful bidder to develop a detailed TTC plan and use it if the road authority and/or FHWA find it acceptable. Development of detailed time and traffic provisions should involve design, traffic engineering, and construction personnel. The pay items to be included in the plans must be determined during design.

Pay Items

The PS&Es shall include appropriate pay item provisions for implementing the TMP. Designers are encouraged to use appropriate pay items to the fullest extent practical, either through end based or performance based specifications.

- (1) For end-based specifications individual pay items, lump sum payment, or a combination thereof may be used.
- (2) For performance based specifications, applicable performance criteria and standards may be used (e.g., safety performance criteria such as number of

crashes within the work zone; mobility performance criteria such as travel time through the work zone, delay, queue length, traffic volume; incident response and clearance criteria; work duration criteria).

Responsible persons

The road authority and the contractor shall each designate a trained person, at the project level, who has the responsibility and sufficient authority for implementing the TMP and other safety and mobility aspects of the project.

The responsible persons should insure, among other things, that the following activities are completed:

- Appropriate project personnel are familiar with the MN MUTCD, the contract plans and special provisions, the current Minnesota Standard Specifications for Highway Construction and its supplements.
- Personnel assigned to the project implement proper techniques of traffic safety and traffic operations prior to beginning construction and specifically how they relate to the TTC plan.
- Ensure that all affected agencies such as State Patrol, local police, fire departments, sheriff's office, hospital, ambulance services, local government, post office, school districts, etc., are informed of the scope of the project and how it may affect their individual needs and services. This public relations work is extremely critical in the case of a total detouring of traffic.
- Notify the major local news media (TV, radio stations, newspapers, etc.), local tourism associations, AAA, local legislators, etc. of the scope of the project prior to beginning operations. Cooperation with the contractor and any involved local government agencies is advised. All items of interest should be included. These include:
 - Type of work to be performed.
 - Hours the highway will be fully opened to traffic.
 - Hours of restricted usage.
 - Type and place delays can be expected.
 - Duration of the project.
 - Location of the detour, if applicable.
 - Anticipated completion date of project.
 - A name and phone number the public can contact for information or to make comments about the project.
- Regularly review field observations, available work zone crash data, and operational information and use the data and information to manage work zone impacts for the project, including revising the TTC plan, during construction.
- Insure that traffic operations are reviewed through the project limits, including the condition of all traffic control devices on a regular basis. The frequency of these reviews should vary with the complexity of the projects. On some projects, it may be necessary to change the TTC plan during construction, depending on the contractor's schedule, progress of utility work, etc.
- Ensure that current documentation is maintained as to when deficiencies were noted in the implementation of the TTC plan and how and when they were corrected.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Project TTC Field Observations

Field observations (generally regular drive through reviews) shall be made to assure that traveler information is accurate and up-to-date. This includes:

- Warning, Guide, and Information signing;
- Changeable Message Sign (portable and non-portable) messaging;
- Temporary Traffic Control devices; and
- Pavement Markings.

Revisions to the TTC plans shall be reviewed to determine if they comply with all standards in the MN MUTCD, Special Provisions and Specifications. For major revisions this review should include consultation with traffic engineering staff before the revision is implemented.

While adjustments to the temporary traffic controls are anticipated on all projects, a revision to the TTC Plan is less common. Revisions to the TTC plans shall be “properly” documented in the project file. Proper documentation may range from a daily diary entry to marked up TTC plan sheets.

DISTRICT OR LOCAL AGENCY LEVEL PROCESS AND PROCEDURES

Each District or Local Agency is encouraged to establish a Work Zone Safety Coordinator. This Coordinator should be responsible for:

- Making periodic reviews of maintenance and construction projects to determine the adequacy of the TTC plan and to assist project and maintenance personnel with compliance to the plan.
- Ensuring proper documentation is maintained when deficiencies are noted and the corrective action that was taken.
- Regularly obtain and keep a record of all known crashes within a work zone. This record should include all available information, such as: time of day, probable cause, location, pictures, sketches, weather conditions, interferences to traffic, etc. These records should be sent to project personnel.
- Making recommendations to design, construction, maintenance and management regarding temporary traffic controls.
- Working with design and field personnel on the development of TMP and TTC plans for maintenance and construction projects.

If the District or Local Agency does not establish a Work Zone Safety Coordinator the above responsibilities should be delegated to the appropriate personnel.

Operational Information

Operational information shall be used to determine if temporary traffic controls and traffic control schemes are meeting the safety and mobility goals for the project or field operation. This provision requires the use of available data and information to take action in a timely manner to correct potential safety or mobility issues in the field. This information may include:

- Incident Response Time. The time from notification to initial response and the time from notification to all lanes clear to determine if project level goals are being met.
- Delay Time. Total delay during construction or maintenance should be compared to the anticipated total delay estimated for the project. The anticipated total delay, due to construction activities and reduced capacity should be calculated for typical traffic patterns including peak periods.
- Traffic Measures. When Intelligent Work Zone (IWZ) systems are used, the traffic data collected should be compiled and analyzed to determine if project level goals are being met.

Work Zone Crash Data Reviews

Work zone crash data shall be analyzed on a District or Local Agency level. Analysis includes:

- Reviewing all fatal and life-changing crashes. Take into account crashes that occur within a project or on the roadways immediately entering a project.
- Determine if improvements in District or Local Agency temporary traffic control practices are indicated.
- Report deficiencies within current statewide standards or guidelines that should be considered for modification.

STATE LEVEL PROCESSES AND PROCEDURES

This section consists of processes and procedures to implement and sustain work zone safety and mobility policies. These processes and procedures, data and information resources, training, and periodic evaluation enable a systematic approach for addressing and managing the safety and mobility impacts of work zones.

Statewide Work Zone Data

Field observations, available work zone crash data, and operational information to manage work zone impacts for specific projects during implementation shall be used. This data shall be used to continually pursue improvement of work zone safety and mobility by analyzing work zone crash and operational data from multiple projects to improve these processes and procedures. Each road authority should maintain elements of the data and information resources that are necessary to support these activities.

Work Zone Crash Data:

Statewide analysis is accomplished by reviewing work zone crash records contained in the TIS (Transportation Information System) data base. Annual reporting of these crashes on all road systems shall be conducted by the Office of Traffic, Safety and Technology.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Statewide Field Reviews

The Office of Construction and Innovative Contracting (OCIC) and the Office of Maintenance (OM) will conduct regular field reviews of temporary traffic controls in each district. The purpose of these reviews is to:

- Determine adequacy of temporary traffic controls
- Identify areas that need improvement

Training

Personnel involved in the development, design, implementation, operation, inspection, and enforcement of work zone related transportation management and traffic control shall be trained, appropriate to the job decisions each individual is required to make. Periodic training updates that reflect changing industry practices and State processes and procedures shall be required.

Available training can be found at <http://www.dot.state.mn.us/const/wzs/training.html>

Process Feed-Back Discussions

To assess the effectiveness of work zone safety and mobility procedures annual process feed-back discussions will be conducted. This discussion may include the evaluation of work zone data at the State level, and/or results of OCIC/OM field reviews.

Appropriate personnel (stakeholders) who represent the project development stages and the different offices within the State, and the FHWA should participate in these discussions. Other non-State stakeholders may also be included as appropriate. The discussion team members are listed below.

The primary purpose of these discussions is to identify best practices that facilitate improvements in work zone processes, procedures and data and information resources that enhance efforts to address safety and mobility on projects. Through an annual report to the team sponsor, these discovered best practices can then be shared with other stakeholders. The team should also consider making presentations to other groups (SWZSC, TEO, Resident Engineers, Design Engineers, etc.) as appropriate to share this information.

A secondary purpose of these discussions is to discover issues that should be addressed on a statewide basis. Another source that identifies these issues are the reviews conducted by OCIC and OM during their normal field reviews. All of these observations and concerns discovered during these reviews and discussions will be used to make improvements in the statewide processes, procedures and training programs.

Discussion Team

The discussion team will consist of the following team sponsor, team leader and team members:

- Team Sponsor – MnDOT State Traffic Engineer – Sue Groth
- Team Leader – Work Zone, Pavement Marking, and New Products Engineer – Ken Johnson

Team Members:

- FHWA Safety Engineer – Will Stein
- OCIC Representative – Craig Mittelstadt
- OM Representative – Sue Lorentz
- OTST Representative – Ted Ulven

Primary stakeholders include:

- District Engineers
- District Construction
- District Maintenance
- District Planning
- District Design
- District Traffic Engineering
- Local Road Authorities
- Law Enforcement

Discussion Schedule

It is anticipated these two day visits will be conducted in 2-3 MnDOT Districts per year resulting in completing statewide visits every three years. Each District visit will consist of:

- Initial meeting with all Stakeholders
- Individual interviews with Stakeholders
- Identification of Observations
- Closing report to all Stakeholders
- Final written report to District/Road Authority

Statewide Group Activities

There are four statewide groups that are active in work zone traffic control and safety in Minnesota. They are:

- Statewide Work Zone Safety Committee
- Special Provisions Annual Update
- Traffic Engineering Organization Temporary Traffic Control Committee
- Resident Engineers Work Zone Safety Advisory Committee

They are included in this document to illustrate the level of commitment and ability of MnDOT to provide continual improvement in the area of work zone traffic control and safety. These groups are also involved with and responsible for implementing many of the recommendations of field observations and process reviews.

Statewide Work Zone Safety Committee

The MnDOT Statewide Work Zone Safety Committee (SWZSC) includes key MnDOT employees and stakeholders external to MnDOT and focuses on Work Zone Safety issues. Its purpose is to provide a forum for:

- Identifying Work Zone Safety problems, safety areas, and help set priorities;
- Acting as a sounding board;
- Brainstorming ideas; and
- Recommending direction to the Office of Construction and Innovative Contracting, Office of Maintenance, and Office of Traffic, Safety and Technology.

The mission of the SWZSC is to influence the actions of those involved with Work Zones through the information that is shared and through the innovations and best practices that are identified so that we achieve safety Work Zones and fewer fatal and life changing crashes.

Special Provisions Annual Update

MnDOT's Office of Construction and Innovative Contracting conducts an annual workshop to review and improve the Standard Special Provisions for time and traffic and traffic controls used for the development of construction projects. This workshop uses the results of observations detailed in these procedures to make improvements to these standard special provisions. Participants in this workshop include Central Office and District Construction and Traffic Engineering personnel and traffic control industry representatives.

Traffic Engineering Organization Temporary Traffic Control Committee

MnDOT's Traffic Engineering Organization (TEO) has formed a Temporary Traffic Control Committee that reviews and approves traffic engineering standards and guidelines related to temporary traffic controls. Members of this committee include representatives from all District Traffic Offices, Resident Engineers group representative, OCIC, OM, OTST, and Metro District Maintenance.

Resident Engineers Work Zone Safety Advisory Committee

MnDOT's Resident Engineers has formed a Work Zone Safety Advisory Committee that reviews and approves work zone safety and TTC special provisions and project related issues. Members of this committee include representatives from OCIC, OTST and the Resident Engineers group.

Related Standards, Guidelines and Procedures

There are many standards, guidelines and procedures that have been established to aid in providing safety and mobility in highway work zones. These include:

- Part 6 of the Minnesota Manual on Uniform Traffic Control Devices (MN MUTCD);
- The Standard Specifications for Construction;
- Time and Traffic sample special provisions;
- Work Zone Mobility Impact Assessment Decision Tree;
- Federal Highway Administration Guidance Documents:
 1. *"Implementing the Rule on Work Zone Safety and Mobility"*
http://www.ops.fhwa.dot.gov/wz/rule_guide/index.htm
 2. *"Work Zone Impacts Assessment: An Approach to Assess and Manage Work Zone Safety and Mobility Impacts of Road Projects"*
http://www.ops.fhwa.dot.gov/wz/resources/final_rule/wzi_guide/index.htm
 3. *"Developing and Implementing Transportation Management Plans for Work Zones"*
http://www.ops.fhwa.dot.gov/wz/resources/publications/trans_mgmt_plans/index.htm
 4. *"Work Zone Public Information and Outreach Strategies"* ([pdf](#))
http://ops.fhwa.dot.gov/wz/info_and_outreach/public_outreach_guide.pdf

WORK ZONE IMPACT CONSIDERATIONS WORKSHEET

Work Zone Impacts Considerations	Project Design Notes
Project Characteristics	
<ul style="list-style-type: none"> • Project type. • Project size, extent, duration, and complexity. • Roadway classification. • Area type (urban, suburban, rural). 	
Travel and Traffic Characteristics	
<ul style="list-style-type: none"> • Traffic demand and volumes. • Seasonal and temporal variations in demand (hourly, daily, or weekly). • Occurrence of special events. • Percentages of different vehicular volumes (autos – Single-Occupancy Vehicle, High-Occupancy Vehicle; trucks; or buses). • Type of travel (commuter or tourist), freight corridor, transit corridor. • Public and private facility access issues. • Potential impacts of weather. • Other such similar characteristics. 	
Corridor, Network, and Community Issues	
<ul style="list-style-type: none"> • Impacts of the project at both the corridor and network levels including parallel corridors, alternate routes, the transportation network, other modes of transportation, and impacts of other work zones in the vicinity of the project, either at the corridor level or the network level. • Impacts on nearby transportation infrastructure such as key intersections and interchanges, railroad crossings, public transit junctions, and other junctions in the transportation network. • Impacts on evacuation routes in the vicinity of critical transportation or other infrastructure. • Impacts on affected public properties, including parks, recreational facilities, fire stations, police stations, and hospitals. • Impacts of the project on affected private properties, including businesses and residences. 	

HANDOUT

HANDOUT

HANDOUT

HANDOUT

WORK ZONE IMPACT CONSIDERATIONS WORKSHEET

Design, Procurement and Construction Options	
<ul style="list-style-type: none"> • Temporal alternatives for work performance such as season, month, day of week (weekend versus weekday), and time of day (night time versus day, off-peak versus peak). • Alternative lane closure strategies such as full closure, partial closure, crossovers, multiple lane closure, single lane closure, and impact of alternative traffic management strategies on lane-closure decisions. • Alternative design solutions that address the durability and economy of maintenance of the roadway. • Alternative design solutions and strategies that impact decision-making on right-of-way (ROW) acquisition. • Alternative construction staging plans, and construction techniques and methodologies (e.g., accelerated construction techniques) that may have varying types and severity of work zone impacts. • Alternative contracting methodologies such as design-build, A+B bidding, and incentive/disincentive contracting. 	
Work Zone Design and Safety Issues	
<ul style="list-style-type: none"> • Cross-sectional issues such as lane widths, shoulder availability and widths, and number of lanes available for travel. • Longitudinal issues such as taper widths, taper lengths, and stopping sight distance. • Horizontal and vertical sight distance. • Project signing and advance warning. • Roadside devices and safety. • Work area separation, channelization, and protection (e.g., positive separation, barrels, cones, clear zone considerations, construction zone intrusion detection). • Work area and worker delineation (visibility, retroreflectivity, etc.). • Work site access and access points. • Visibility issues (e.g., night-time work, lighting, fog). • Curvature and gradient – vertical and horizontal. • Speed – posted speed limits, speed zoning, etc. • Work zone enforcement (e.g., use of uniformed police officers and/or patrol cars, active enforcement using radar guns and/or automated enforcement). 	

HANDOUT

HANDOUT

HANDOUT

HANDOUT

WORK ZONE IMPACT CONSIDERATIONS WORKSHEET

HANDOUT

HANDOUT

<p>T.T.C. Strategy Considerations</p> <ul style="list-style-type: none"> • Traffic safety and capacity requirements. • Alternate route scenarios. • Potential impacts on other corridors, nearby intersections/interchanges, and the larger transportation network. • Lane closure types and strategies (full-closure, lane-width restrictions, cross-overs, positive separation, etc.). • Work zone and work area configurations. • Traffic safety and control checklists for developing a TMP. 	
<p>T.O. Strategy Considerations</p> <ul style="list-style-type: none"> • Deployment of ITS technologies for work zone traffic monitoring and management. • Provision of real-time traveler information to the public, including web-based information. • Application of transportation systems management (TSM) and corridor management strategies, including mitigation treatments for alternate routes (e.g., traffic signal timing adjustment on affected corridors), and alternate modes (e.g., public transit subsidies, incentives, and special programs). • Coordination of transportation management with existing regional transportation management centers (TMCs). • Conduct of mobility and safety reviews and audits. • Speed enforcement and management in work zones using either police officers or automated techniques. • Traffic incident management plans for work zones. • Policies on work zone traffic management during emergencies (e.g., hurricane evacuations). 	
<p>P.I. Strategy Considerations</p> <ul style="list-style-type: none"> • Provision of project and work zone information prior to the commencement of the work in order to make the public aware of the expected work zone impacts and the State's actions to mitigate the impacts. • Recommendations to the public on commuter alternatives, such as information on alternate routes and/or modes. • Provision of information on changing conditions on the project during implementation (e.g., changes in lane closure scenarios, construction staging, construction times, or alternate routing). 	

HANDOUT

HANDOUT

WORK ZONE IMPACT CONSIDERATIONS WORKSHEET

- Obtaining public input for the development of appropriate work zone impacts management strategies during the planning and design phases of the project; refinement of work zone management strategies during project implementation; and feedback on performance of the work zone and the project following the completion of the project.
- Dissemination of information through brochures, pamphlets, and media sources including newspapers, television, radio channels, and web sites.
- Public meetings and hearings.
- Coordination and cooperation with affected public and private parties.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Work Zone Management Strategies		
I. Temporary Traffic Control (TTC)		
A. Control Strategies	B. Traffic Control Devices	C. Project Coordination, Contracting, and Innovative Construction Strategies
IA1. Construction phasing/staging IA2. Full roadway closures IA3. Lane shifts or closures <ul style="list-style-type: none"> • Reduced lane widths to maintain number of lanes (constriction) • Lane closures to provide worker safety • Reduced shoulder width to maintain number of lanes • Shoulder closures to provide worker safety • Lane shift to shoulder/median to maintain number of lanes IA4. One-lane, two-way operation IA5. Two-way traffic on one side of divided facility (crossover) IA6. Reversible lanes IA7. Ramp closures/relocation IA8. Freeway-to-freeway interchange closures IA9. Night work IA10. Weekend work IA11. Work hour restrictions for peak travel IA12. Pedestrian/bicycle access improvements IA13. Business access improvements IA14. Off-site detours/use of alternate routes	IB1. Temporary signs <ul style="list-style-type: none"> • Warning • Regulatory • Guide/ information IB2. Changeable message signs (CMS) IB3. Arrow panels IB4. Channelizing devices IB5. Temporary pavement markings IB6. Flaggers and uniformed traffic control officers IB7. Temporary traffic signals IB8. Lighting devices	IC1. Project coordination <ul style="list-style-type: none"> • Coordination with other projects • Utilities coordination • Right-of-way coordination • Coordination with other transportation infrastructure IC2. Contracting strategies <ul style="list-style-type: none"> • Design-build • A+B bidding • Incentive/disincentive clauses • Lane rental IC3. Innovative construction techniques (precast members, rapid cure materials)

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Work Zone Management Strategies	II. Public Information (PI)
A. Public Awareness Strategies	B. Motorist Information Strategies
IIA1. Brochures and mailers	IIB1. Traffic radio
IIA2. Press releases/media alerts	IIB2. Changeable message signs (CMS)
IIA3. Paid advertisements	IIB3. Temporary motorist information signs
IIA4. Public information center	IIB4. Dynamic speed message sign
IIA5. Telephone hotline	IIB5. Highway advisory radio (HAR)
IIA6. Planned lane closure web site	IIB6. Extinguishable signs
IIA7. Project web site	IIB7. Highway information network (web-based)
IIA8. Public meetings/hearings	IIB8. 511 traveler information systems (wireless, handhelds)
IIA9. Community task forces	IIB9. Freight travel information
IIA10. Coordination with media/schools/businesses/ emergency services	IIB10. Transportation management center (TMC)
IIA11. Work zone education and safety campaigns	
IIA12. Work zone safety highway signs	
IIA13. Rideshare promotions	
IIA14. Visual information (videos, slides, presentations) for meetings and web	

REFER TO FHWA DOCUMENT TITLED: “Developing and Implementing Transportation Management Plans for Work Zones” ([pdf](#)) Chapter 4 for an explanation of each of the strategies.

Attachment “B”

page 2 of 3

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Work Zone Management Strategies		III. Transportation Operations (TO)	
A. Demand Management Strategies	B. Corridor/Network Management Strategies	C. Work Zone Safety Management Strategies	D. Traffic/Incident Management and Enforcement Strategies
IIIA1. Transit service improvements	IIIB1. Signal timing/coordination improvements	IIIC1. Speed limit reduction/variable speed limits	IIID1. ITS for traffic monitoring/management
IIIA2. Transit incentives	IIIB2. Temporary traffic signals	IIIC2. Temporary traffic signals	IIID2. Transportation management center (TMC)
IIIA3. Shuttle services	IIIB3. Street/intersection improvements	IIIC3. Temporary traffic barrier	IIID3. Surveillance [Closed-Circuit Television (CCTV), loop detectors, lasers, probe vehicles]
IIIA4. Ridesharing/carpooling incentives	IIIB4. Bus turnouts	IIIC4. Movable traffic barrier systems	IIID4. Helicopter for aerial surveillance
IIIA5. Park-and-ride promotion	IIIB5. Turn restrictions	IIIC5. Crash-cushions	IIID5. Traffic screens
IIIA6. High-occupancy vehicle (HOV) lanes	IIIB6. Parking restrictions	IIIC6. Temporary rumble strips	IIID6. Call boxes
IIIA7. Toll/congestion pricing	IIIB7. Truck/heavy vehicle restrictions	IIIC7. Intrusion alarms	IIID7. Mile-post markers
IIIA8. Ramp metering	IIIB8. Separate truck lanes	IIIC8. Warning lights	IIID8. Tow/freeway service patrol
IIIA9. Parking supply management	IIIB9. Reversible lanes	IIIC9. Automated Flagger Assistance Devices (AFADs)	IIID9. Total station units
IIIA10. Variable work hours	IIIB10. Dynamic lane closure system	IIIC10. Project task force/committee	IIID10. Photogrammetry
IIIA11. Telecommuting	IIIB11. Ramp metering	IIIC11. Construction safety supervisors/inspectors	IIID11. Coordination with media
	IIIB12. Temporary suspension of ramp metering	IIIC12. Road safety audits	IIID12. Local detour routes
	IIIB13. Ramp closures	IIIC13. TMP monitor/inspection team	IIID13. Contract support for incident management
	IIIB14. Railroad crossings controls	IIIC14. Team meetings	IIID14. Incident/emergency management coordinator
	IIIB15. Coordination with adjacent construction site(s)	IIIC15. Project on-site safety training	IIID15. Incident/emergency response plan
		IIIC16. Safety awards/incentives	IIID16. Dedicated (paid) police enforcement
		IIIC17. Windshield surveys	IIID17. Cooperative police enforcement
			IIID18. Automated enforcement
			IIID19. Increased penalties for work zone violations

Attachment "B"

page 3 of 3

HANDOUT

HANDOUT

2.7 Temporary Traffic Control Planning and Implementation

2.7.1 TEM Handout

The following is a handout from TEM Chapter 8, Section 8-4.00. The TEM can be downloaded from the following web link:

www.dot.state.mn.us/trafficeng/publ/index.html

It is important that the holder of this manual checks the above link for updates.

The information covered in the TEM Section 8-4.00 include:

- ✓ Temporary Traffic Control Goals
- ✓ Transportation Management Plans (TMPs)

Additional information on Traffic Management Plans (TMPs) can be obtained from:

www.dot.state.mn.us/trafficeng/training/tmp.html

Supplemental information on TMPs are found in this manual in Section **2.8**.



The goals, scope and PMP are described in the TEM are an important component in temporary traffic control.

Minnesota Statutes Sections [169.06](#), Subd. 1-4 and [169.07](#) establish the legal authority for MnDOT and local units of government to: (1) place and maintain markings, (2) require obedience to official markings, (3) prohibit the display of unauthorized markings, and (4) prohibit interference with official markings. Markings shall be placed only by the authority of the public body having jurisdiction over the highway, road, or street for the purpose of regulating, warning, or guiding traffic. Pavement and curb markings, object markers, and delineators are all normally within highway, road, or street rights-of-way and, therefore, should never be installed except under public authority.

Construction contractors and public utility companies are permitted to erect temporary construction and maintenance signs and place temporary pavement markings at work sites to protect the public, equipment, and workers provided that such signs and markings conform to the standards of the [MN MUTCD](#) and the proper authority has been given by MnDOT.

[Minn. Stat. Sec. 169.14, Subd. 5d](#) allows the establishment of a Workers Present Speed Limit. Refer to the document "Speed Limits in Work Zones Guidelines" located on the [Speed Limits in Minnesota](#) website for additional information.

8-4.00 TEMPORARY TRAFFIC CONTROL PLANNING AND IMPLEMENTATION

8-4.01 Temporary Traffic Control Goals

During planning for temporary traffic control (TTC) zones, the greatest payoff in terms of safety and convenience at a cost commensurate with the hazards and problems involved should be the goal. A properly installed temporary traffic control zone will allow traffic to pass through or around a work zone safely. It requires time and effort for planning, installation, and maintenance.

Work zone traffic control planning is based upon analysis of the work activity as it relates to the provision of adequate safety and capacity. Questions to consider include: What is the likelihood of motorists failing to negotiate the work zone safely? What are the consequences of such action on workers, traveling public, and other road users (including pedestrians and bicyclists)?

Planning for traffic control through a construction work zone may be more involved than for maintenance or utility zones because of the differences in traffic disruption and duration of the work. The exposure of traffic to potential hazards is a function of the traffic volume and the length of time that the closure will be in effect. The goals common to all temporary traffic control zones are to:

- Protect the workers,
- Minimize crashes and crash severity, and
- Minimize inconvenience and conflicts as a result of the work.

Federal regulations also require that workers are as safe as practicable through the use of:

- Exposure control measures such as road and ramp closures, median crossovers, detours, and accelerated construction techniques,
- Positive protection devices such as barrier, truck/trailer mounted attenuators, and vehicle arresting systems,
- Other traffic control measures such as credible signing, portable changeable message signs, arrow boards, rumble strips, pilot cars, etc.

8-4.02 Transportation Management Plans (TMPs)

A Transportation Management Plan is a plan that lays out a set of coordinated strategies and describes how these strategies will be used to manage the impacts of a project during construction. It includes the:

1. Temporary Traffic Control Plan (TTCP),
2. Transportation Operations Plan (TOP), and
3. Public Information Plan (PIP), if needed.

The scope of the project will dictate the level of effort and detail of the TMP. The TMP can range from the citation of a specific layout from the [Field Manual](#) that is being followed, to a full report that includes a TTCP, TOP (including traffic modeling), and PIP.

The development of the TMP will take into consideration the safety and mobility of workers and all users of the transportation system (motorists, pedestrians, and bicyclists). The TMP process is detailed in [Technical Memorandum 12-03-T-02 Minnesota Work Zone Safety and Mobility \(WZSM\) Policy](#). This process includes a Work Zone Mobility Impact Assessment that will identify the appropriate level of TMP for the project. The level of TMP will then dictate the necessary documentation for the project. This could be as little as identifying the appropriate layout from the [Field Manual](#), to a full Temporary Traffic Control Plan, a Traffic Operations Plan (possibly including traffic modeling), and a separate Public Information Plan. These components of the TMP are listed in the Tech Memo, as well as overall guidance in the development of each of the components. Each district should develop templates and procedures to develop these components to meet their district needs and characteristics.

The following is additional guidance that may be used as the TMP is being followed through the project development process:

Responsibility

Involvement from each of the functional areas is needed to insure that adequate consideration is given to proper temporary traffic control for all operations. In order to assure that this commitment is met, it will require early involvement by all parties including project management, pre-design, design, traffic, maintenance, and construction. Typical guidelines have been developed for the various stages.

Scoping and Environmental Documentation

During the scoping/preliminary design development phase, the Project Manager should review the scope of the project with staff from Traffic, Construction, and Detail Design to determine traffic control concepts for the proposed construction. Construction staging should be determined by the traffic carrying capacities of the roadway under construction, bypasses, or detours. Consideration should be given for other construction work in the proposed highway corridor or general vicinity by other than MnDOT forces such as cities and counties.

Metro District has created a TMP Scoping Worksheet that allows the documentation of possible work zone mobility impacts. Districts are encouraged to develop their own version of this worksheet so that impacts to traffic are considered in the Scoping phase. The TMP Scoping Worksheet can be found at the [Metro District Traffic Engineering Work Zones and Pavement Marking](#) page.

The Federal Highway Administration (FHWA) also requires that traffic control considerations and effects be mentioned in the environmental documentation. Traffic operations analyses (such as modeling) may need to be performed to assess the mobility of the proposed temporary traffic control, depending on the level of TMP for the project. Commitments made to stakeholders that impact the mobility of road users should be entered into the TMP which is initiated in this phase.

Detail Design

The Detail Design staff should involve staff from Traffic, Construction, and appropriate FHWA personnel as the final detail plans are being developed so that the necessary details for traffic control are worked into the TMP. This may range in scope from a very detailed plan (or proposal) designed solely for a specific project, to a reference to a standard specification, a section of the MN MUTCD, or a standard agency manual. The TMP requirements shall be incorporated into the plans, specifications, and estimate (P.S. & E). If the complexity of a project warrants, a traffic control layout may be prepared by the District Traffic Engineer and be included in the P.S. & E.

On some projects it may be appropriate to provide broad TTC Plan parameters in the P.S. & E., and then permit the successful bidder to develop a detailed TTC Plan and use it if MnDOT and FHWA find it acceptable.

The Detail Design staff should involve staff from Traffic, Construction, and the District Work Zone Safety Coordinator personnel to develop detailed time and traffic provisions.

The pay items to be included in the plans must be determined by the district during design. Individual projects may have varying pay items depending on size, complexity, and location. Districts are encouraged to use appropriate pay items to the fullest practical extent.

Construction

During the construction stage, the resident/project engineer will generally be the MnDOT person responsible for implementing the TMP and reviewing the temporary traffic control. The resident/project engineer may delegate this authority. This should be done at or before the pre-construction conference.

The responsible person should have the following duties:

- Develop a familiarity with the [MN MUTCD](#), the contract plans and special provisions, the current [Minnesota Standard Specifications for Highway Construction](#) and its supplements.
- Coordinate MnDOT personnel assigned to the project relative to proper techniques of traffic safety and traffic operations prior to beginning construction and specifically how they relate to the TTC Plan. The District Traffic Engineer and others shall be available to assist in this task.
- Ensure that all affected agencies such as State Patrol, local Police, fire departments, sheriff's office, hospital, ambulance services, local government, post office, school districts, etc., are informed of the scope of the project and how it may affect their individual needs and services. The Public Information Plan (PIP) of the TMP is extremely critical in the case of a total detouring of traffic. The District Public Affairs Coordinator and/or the Office of Communications may be of help in this responsibility.
- As identified in the PIP, notify the major local news media (TV, radio stations, newspapers, etc.), local tourism associations, AAA, local legislators, etc. of the scope of the project prior to beginning operations. Cooperation with the Contractor and any involved local government agencies is advised. All items of interest should be included:
 - Type of work to be performed.
 - Hours the highway will be fully opened to traffic.
 - Hours of restricted usage.
 - Type and place delays can be expected.
 - Suggested alternate routes.
 - Duration of the project.
 - Location of the detour, if applicable.
 - Anticipated completion date of project.
 - A name and phone number the public can contact for information or to make comments about the project.

At appropriate times during the life of the project the responsible person should update the information mentioned above so that the public is kept current on the status of the project. The Public Affairs Coordinator may be of help in this responsibility.

- Update 511 at the start of construction, listing details on how traffic is affected.
- Monitor the Contractor's operations with regard to traffic and safety operations and enforce the requirements of the contract. On some projects, it may be necessary to change the TTC Plan during construction, depending on the contractor's schedule, progress of utility work, etc. If this is done, the TMP needs to be modified as well.
- Review traffic operations through the project limits, including the condition of all traffic control devices on a regular basis.

8-5.00 TEMPORARY TRAFFIC CONTROL STRATEGIES AND CONTROLLING CRITERIA

2.8 TMP Supplemental Information to the TEM

TMP development begins during systems planning and progresses through the design phase of a project. Existing project development processes can provide valuable information to guide TMP development.

Information on TMP development can be found in a variety of resources provided by the Federal Highway Administration (FHWA). MnDOT has included links to these materials on the following webpage:

www.dot.state.mn.us/trafficeng/training/tmp.html

2.8.1 TMP Development Tips

In January of 2011, the FHWA presented a Transportation Management Plan training (slides and materials included in the link shown above). Of note for this manual are tips on TMP development. These tips are drawn from the experiences of six States who have been very active in TMP development.

- ✓ **Start early.** TMP development should start as early in the project development process as possible so that TMP strategies can be accounted for in the budgeting/scoping process.
- ✓ **Coordinate early.** An effective TMP is one that has input from all of the key players in the project development process (e.g., operations, construction, planning, design, safety, maintenance, public affairs, technical specialists, FHWA, local transportation agencies, enforcement agencies, utility providers, emergency services, local businesses, community groups, etc.). Ensure all of these people are involved from the start of TMP development so that important strategies are not initially overlooked and projects are coordinated.
- ✓ **Use templates, guidance and other tools.** Templates, guidance, and other standardized agency resources help ensure that TMPs within an agency are consistent. These tools also simplify TMP development by helping those developing TMPs understand what is expected for agency TMPs.
- ✓ **Provide TMP Training for personnel involved in TMP development and implementation.** This helps ensure consistent TMPs, but also helps personnel understand why TMPs are important. It also can also help gain management buy-in for TMPs, as management support is needed for effective TMP efforts.
- ✓ **Assess, Monitor, and Update the TMP.** Include funding for monitoring traffic conditions during construction to track TMP effectiveness. This can be a challenge because it requires additional time beyond just developing the TMP. However, monitoring and updating the TMP as the project progresses or new potential impacts are discovered is important to ensuring the TMP remains effective at increasing work zone safety and mobility.
- ✓ **Document everything.** The TMP becomes a written history of the project. If design and development decisions are well documented, time, energy and money can be saved in the development of the project, as well as future projects. A brief standardized report at the completion of major projects that describes the TMP development and implementation process and outcomes can be very beneficial to future projects.
- ✓ **Understand diversion rates.** Accurate estimates of diversion rates can be very useful when developing the TMP. When people are aware of a construction project, some of them will divert to an alternate route. This reduction in demand may make a broader range of construction and MOT options feasible, possibly reducing project or TMP cost.

- ✓ **Facilitate use of alternate routes.** Begin looking into the feasibility of alternate routes early in the TMP process. If improvements are needed to alternate routes, schedule that work at least a year prior to the project so that the alternate routes can be ready for use once the project begins.
- ✓ **Use strategies that keep lanes open, especially during peak traffic times.** Some examples are imposing damages for late lane opening; contract incentives/disincentives; narrowing lane widths or occasionally using shoulders during peak periods to maintain the number of lanes; night work.
- ✓ **Consider using extended closures or full closures versus numerous night closures.** Extended and full closures can greatly reduce overall construction time and in many studies, it has been found that the public prefers one long-term closure to numerous smaller closures because the work can be completed sooner.

2.8.2 Metro District TMP Resource

The Metro district maintains a website with TMP resources at:

http://www.dot.state.mn.us/metro/trafficeng/control_striping.html

Items include:

- ✓ TMP Process and Components
- ✓ TMP Scoping Worksheet
- ✓ TMP Worksheet
- ✓ TMP Template
- ✓ Red Flag Checklist
- ✓ Work Zone Mobility Impact Assessment Worksheet

This information is included as a handout in the Appendix, Section **7.1**.



It is important to contact the district you are working in prior to starting a TMP. They may have forms and templates unique to them for use.

2.9 Temporary Traffic Control Strategies and Controlling Criteria

2.9.1 TEM Handout

The following is a handout from TEM Chapter 8, Section 8-5.00 regarding TTC Strategies and Controlling Criteria. The TEM can be downloaded from the following web link:

www.dot.state.mn.us/trafficeng/publ/index.html

It is important that the holder of this manual checks the above link for updates.

Items include:

- ✓ Lane Width (also see Section **2.10.2**)
- ✓ Crossovers and Bypasses (Diversion)
- ✓ Closures and Detours
- ✓ Delay Time
- ✓ Flagging Operations
- ✓ Speed Limits in Work Zones (also see Section **2.10.3**)
- ✓ Positive Protection
- ✓ Cable Median Barrier
- ✓ Lighting
- ✓ Drop-offs
- ✓ Zipper Merge
- ✓ Intelligent Work Zones
- ✓ Innovative Contracting Methods (also see Section **2.10.4**)
- ✓ Other Travel Mode Considerations (such as Pedestrians, also see Section **2.11**)
- ✓ Clear Zones
- ✓ Business Impact Mitigation
- ✓ Public Information

The pay items to be included in the plans must be determined by the district during design. Individual projects may have varying pay items depending on size, complexity, and location. Districts are encouraged to use appropriate pay items to the fullest practical extent.

Construction

During the construction stage, the resident/project engineer will generally be the MnDOT person responsible for implementing the TMP and reviewing the temporary traffic control. The resident/project engineer may delegate this authority. This should be done at or before the pre-construction conference.

The responsible person should have the following duties:

- Develop a familiarity with the [MN MUTCD](#), the contract plans and special provisions, the current [Minnesota Standard Specifications for Highway Construction](#) and its supplements.
- Coordinate MnDOT personnel assigned to the project relative to proper techniques of traffic safety and traffic operations prior to beginning construction and specifically how they relate to the TTC Plan. The District Traffic Engineer and others shall be available to assist in this task.
- Ensure that all affected agencies such as State Patrol, local Police, fire departments, sheriff's office, hospital, ambulance services, local government, post office, school districts, etc., are informed of the scope of the project and how it may affect their individual needs and services. The Public Information Plan (PIP) of the TMP is extremely critical in the case of a total detouring of traffic. The District Public Affairs Coordinator and/or the Office of Communications may be of help in this responsibility.
- As identified in the PIP, notify the major local news media (TV, radio stations, newspapers, etc.), local tourism associations, AAA, local legislators, etc. of the scope of the project prior to beginning operations. Cooperation with the Contractor and any involved local government agencies is advised. All items of interest should be included:
 - Type of work to be performed.
 - Hours the highway will be fully opened to traffic.
 - Hours of restricted usage.
 - Type and place delays can be expected.
 - Suggested alternate routes.
 - Duration of the project.
 - Location of the detour, if applicable.
 - Anticipated completion date of project.
 - A name and phone number the public can contact for information or to make comments about the project.

At appropriate times during the life of the project the responsible person should update the information mentioned above so that the public is kept current on the status of the project. The Public Affairs Coordinator may be of help in this responsibility.

- Update 511 at the start of construction, listing details on how traffic is affected.
- Monitor the Contractor's operations with regard to traffic and safety operations and enforce the requirements of the contract. On some projects, it may be necessary to change the TTC Plan during construction, depending on the contractor's schedule, progress of utility work, etc. If this is done, the TMP needs to be modified as well.
- Review traffic operations through the project limits, including the condition of all traffic control devices on a regular basis.

8-5.00 TEMPORARY TRAFFIC CONTROL STRATEGIES AND CONTROLLING CRITERIA

8-5.01 Lane Width

For temporary traffic control purposes, a minimum lane width of 10 feet shall be provided. The lane width should be no less than 11 feet on multi-lane roads. Reduced widths should be analyzed for the off-tracking of the design vehicle. AutoTurn within MicroStation, or other comparable methods, may be used for the analysis.

When shoulders are provided, the minimum width should be no less than one foot. When barrier is used, a lateral buffer of at least two feet should be provided.

8-5.02 Crossovers and Bypasses (Diversions)

A crossover is a construction staging technique used to shift traffic from one side of a divided roadway onto a portion of roadway not under construction, typically sharing the remaining roadway with opposing traffic. A specific type of crossover, known as a bypass (or diversion), moves traffic onto a temporary alignment constructed either in the median or adjacent to the original alignment. Crossovers are an effective method for completing construction of a roadway by replacing or repairing the roadway or a structure while maintaining traffic in both directions.

As mentioned in [Section 8-4.01 Temporary Traffic Control Goals](#), recent federal regulations highlight the importance of worker safety through a variety of methods, one of which is exposure control measures. Crossovers and bypasses are an effective means for providing long-term positive separation between workers and live traffic. Strong consideration should be given to this exposure control method.

Crossovers are typically used on freeways, but may be used on divided highways with limited at-grade accesses. Lane closures and traffic shifts are typically used on multi-lane divided expressways, but crossovers are an option for long-term stationary work.

Construction of a bypass typically consists of a temporary roadway alignment (possibly construction of a temporary structure as well). The limits of the bypass extend from the initial reverse curve leaving the existing roadway to the final reverse curve tying the alignment back into the existing roadway.

8-5.02.01 Design Speed for Crossovers and Bypasses

As stated in the [MN MUTCD](#) Part 6, design speed for the reverse curves used in a crossover or bypass should be no less than 10 miles per hour below the posted speed prior to work starting. If unusual site conditions require that a lower design speed be used, the signing should reflect an advisory speed determined by engineering judgment or study.

8-5.02.02 Roadway Lighting for Crossovers and Bypasses

On long term projects, the use of roadway lighting may be beneficial and should be considered especially when there are unusual site conditions that would require a lower design speed.

8-5.02.03 Crossed-Over - Two-Lane, Two-Way Traffic on One Side of Divided Facility

Once the traffic has been crossed over to the roadway not under construction, how to divide traffic must be considered. There are a few options available:

- Pavement Markings
The use of pavement markings alone should only be used on low speed facilities.
- Surface Mounted Delineators (see [MN MUTCD](#), Part 6F.65.1)
These are used to supplement pavement markings and should be used on higher speed facilities such as expressways or freeways.
- Temporary Barrier
Temporary barrier is a consideration where a physical barrier is desired between the traffic flows. Traffic volume, travel speed, geometrics, and duration are all factors to consider when evaluating the

use of barrier.

One design element to be aware of is to protect hazards from both directions of travel – the TTC design should incorporate protection measures (barrier, attenuation, etc.).

8-5.03 Closures and Detours

As mentioned in [Section 8-4.01 Temporary Traffic Control Goals](#), recent federal regulations highlight the importance of worker safety through a variety of methods, one of which is exposure control measures. Temporary road closures and detours are an effective method of exposure control. Strong consideration should be given to this exposure control method.

Temporary road closures are being used more commonly even on major freeways where parallel routes exist. These closures should generally take place during off peak travel times, such as nights and weekends.

8-5.03.01 Establishing and Maintaining Detours

A traffic detour can be a very effective traffic control measure. By closing the road to live traffic, positive protection for workers is maximized. Detours can also allow for improved finished products as contractors can work in a single work space without the need to construct the project in multiple smaller pieces. Possible considerations for establishing a detour follow:

- The physical work area cannot support live traffic and construction activities concurrently.
- When the accelerated completion of a project is desired, having uninterrupted use of the entire work site can facilitate a time-critical schedule.
- Construction constraints (e.g. vehicle weight or size restrictions) require specific vehicle classes to be precluded from the work zone.

Effective detour designs must consider, address, and incorporate the following:

- Detour routes must accommodate height, width, weight, length, off-tracking, and other physical characteristics of the design vehicle (the largest vehicle expected to use the detour). The designer of the temporary traffic control plan should coordinate with the [Office of Freight & Commercial Vehicle Operations Overdimension Permits](#).
- Appropriate and adequate detour signing for the entire route in both directions.
- For conditional or periodic detours, using multiple portable changeable message signs (PCMSs) can provide real-time advance warnings or notifications.
- Coordination with the [Regional Traffic Management Center \(RTMC\)](#) for considerations with [511 traveler information](#).
- Coordination with local road agencies for proposed detour route(s). This should look at proposed work that the local road agency is performing that may impact the detour route.
- Agreements with local road agencies regarding the payment for the road life used by the detour, and if MnDOT or the local road agencies will maintain the roadway during the life of the detour.

8-5.03.01.01 Governing Laws Regarding Temporary Roads and Detours

Applicable laws for establishing and maintaining detours are found in Minn. Stat. Sec. [160.12](#), [160.16, Subd. 2](#), [160.2715](#), [161.24, Subd. 3](#), and [161.25](#).

8-5.03.01.02 Detailed Detour Procedures

The following information provides a general overview of the process for establishing and maintaining detours. Details on establishing a detour or haul road can be found in the:

- MnDOT [Right of Way Manual](#), Sections 115.6 and 115.7, and

- MnDOT [Construction Tools - Haul Roads & Detours](#) website.

Details on detour agreement procedures can be found at:

- [Cost Participation and Maintenance Responsibilities with Local Units of Government Manual](#), Section III.B.2 Detour,
- [Technical Memorandum No. 13-19-MAT-01, Detour Restoration Road Life Analysis using the Equivalent Overlay Method](#), and
- [Technical Memorandum No. 10-09-TS-03, Revised Detour Restoration Road Life Formula for the Gas Tax Method](#).

8-5.03.01.03 Selection of a Detour Route and Detour Agreement Development

When a route is to be selected for a detour, the appropriate personnel should be consulted as soon as possible for review of the proposed route. The district should designate a person to coordinate this review. The review team may include the District Traffic Engineer, District State Aid Engineer, District Design Engineer, Project Engineer, Area Maintenance Engineer, as well as the local road authorities of the road(s) which will be affected. The information obtained in this review should include a detailed surface condition report, recommendations for reinforcement or modification of the proposed route, and recommendations for traffic control and signing on the proposed route.

Detour Agreement

A Detour Agreement is required to compensate the local road authority for the road life consumed by the detoured traffic. The district will write simple detour agreements. The Cooperative Agreements Unit of the [Office of Project Management & Technical Support](#) will author complex detour agreements. See MnDOT's [iHUB Project Management and Technical Support - Cooperative Agreements](#) website for Detour Agreement Boiler Plates.

Detour Traffic Control Devices

Once the detour route has been established and the Detour Agreement initiated, the Traffic Engineer and the Area Maintenance Engineer should work together to develop the signing layout and have the necessary signs prepared. The Project Engineer should consult with the Traffic and Area Maintenance Engineers to determine the advance notice needed before the detour is to go into effect. The advance notice should allow enough time to have all signing and other traffic control devices properly installed and reviewed before traffic is diverted onto the detour. Traffic control devices (particularly signing and pavement markings) along the detour should be brought to State Highway standards – this work is usually performed by the contractor of the construction project.

The detour will become a temporary trunk highway on the date the trunk highway markers are erected and will remain in effect until the markers are removed and the local road authority has been compensated per the terms of the Agreement.

Detour Documents

The detour documents (primarily the map of the detour) will be kept by the Project Engineer for the duration of the detour. A copy of the document is sent to the permit office at CO, Rm 153, Mailstop 420. The Project Engineer will notify the local road authority, by letter, when the detour signing is removed. Once the detour is released, the date of the release and the signature of the local road authority is affixed to the document. The District Engineer or designee will also sign the document. The documents are then submitted to the Legal Descriptions/Commissioner's Order Unit (Mailstop 632) of the [Office of Land Management](#) for a Commissioner's Order to be assigned and entered into the permanent record.

When a detour is found to be necessary after actual construction has begun and is requested by the contractor, the above procedure is followed except that generally the Project Engineer coordinates the route review. In addition, a Supplemental Agreement will have to be written documenting the change from the original contract.

8-5.03.01.04 511 Notification of a Detour

For construction projects, district staff (either Construction or Public Affairs) should notify 511 staff of the detour through the use of a faxed-in lane closure form. Currently each district has their own form. The [511 Traveler Information Protocol Website](#) contains more detailed information. More formal 511 notification methods will be forthcoming.

8-5.03.01.05 Maintenance of a Detour

Unless other arrangements are made in the construction contract, it will be assumed that the detour is to be maintained by state forces (see [MnDOT Maintenance Manual](#), Chapter 11, Section 4.02 Maintenance Work on Detours). However, if conditions make it advisable to have local authorities maintain their own roads, such arrangements are made in the Detour Agreement at the time the route negotiations are conducted. See the [MnDOT Maintenance Manual](#), Chapter 11, Section 4.0 Detour Agreement, for specific instructions on maintenance agreements.

8-5.03.01.06 Unofficial Detours

Unofficial detours are when a portion of traffic is not found to follow the official detour and local roads are being used – this can lead to degradation of the local roads. An unofficial detour agreement is written with a local unit of government, most often a township, to allow MnDOT to compensate them for increased maintenance costs, over and above the average expenditures associated with local or through-traffic using local roads rather than an official detour route that was established as part of a construction or reconstruction project. Increased costs of maintenance on the local roadway, not including improvement costs, are documented by the local road authority and submitted to the MnDOT district for payment consideration.

If the district concurs with the additional costs, an unofficial detour agreement is written to provide payment to the local road authority. If MnDOT and the local road authority cannot agree upon the amount of additional maintenance costs that should be paid, the “Gas Tax Method” ([Technical Memorandum No. 10-09-TS-03](#)) may be used for determining payment for a detour placed on paved roadways. An agreement or payment will not be written for less than \$500. Unofficial Detour Agreements are written by the district or the Cooperative Agreements Unit in the [Office of Project Management & Technical Support](#).

8-5.03.01.07 Haul Roads

Follow the guidance and procedures found on the [Construction Tools - Haul Roads and Detours](#) website.

8-5.03.01.08 Emergency Detours

Follow the guidance stated in the [MnDOT Maintenance Manual](#), Chapter 11, Section 5.0 Emergency Detours.

8-5.03.02 Road Closed, Open to Local Traffic

When the ROAD CLOSED, LOCAL TRAFFIC ONLY sign or the ROAD CLOSED TO THRU TRAFFIC sign is used, the portion of road beyond that sign is still open to the residents and businesses beyond. **The road needs to meet the overall standards and guidelines of safe travel.**

The ROAD CLOSED sign on barricades across the road width indicates a full closure point beyond which construction activities may proceed without interference from traffic. Traffic control devices may not be necessary in this area.

8-5.04 Delay Time

In general, traffic should not be delayed by more than 15 minutes. If it is expected (through traffic flow modeling or experience) that traffic will be delayed more than this, the TMP will need to consider additional public information efforts and demand management strategies (see [Technical Memorandum No. 12-03-T-02 dated February 6, 2012 - Minnesota Work Zone Safety and Mobility Policy](#)).

8-5.04.01 Detour Delay Time

In long term work zones, the overall travel time due to detours may exceed 15 minutes; however, additional public information efforts should be identified in the TMP and implemented. Unless the travel time is exceedingly high, demand management strategies are not necessary.

8-5.04.02 Maximum Flagger Hold Time

Flagging operations should limit the hold time to 15 minutes and should coordinate to reduce the delay.

8-5.05 Flagging Operations

Flagging procedures, when used, can provide positive guidance to the motorist traversing the work area. Part 6 of the [MN MUTCD](#) contains methods, procedures, and specifications for flagging. Refer to the Minnesota Flagging Handbook found on the [Work Zone Safety Tools](#) website for overall state standards and procedures.

MnDOT has additional clothing requirements for work on the State Highway system. Flaggers shall wear:

- ANSI Class 2 vest, shirt, or jacket
- ANSI Class 2 hat
- ANSI Class E long pants

All high visibility apparel must be worn in the manner for which it was designed. All apparel worn on the torso must be closed in the front to provide contiguous 360 degree visibility. If a worker's high visibility apparel becomes faded, worn, torn, dirty, or defaced, reducing the conspicuity of the apparel, the apparel shall be removed from service and replaced with new apparel.

8-5.05.01 Approach Lanes to Flagging Operation

Flagging operations are most effective when a single lane of traffic approaches the flagger. Due to this, multi-lane roads should include a lane reduction prior to the flagger station. At intersections with dedicated turn lanes, the flagger station should be located at the beginning of the furthest upstream taper location.

8-5.05.02 Flagger Station Lighting

As stated in the [MN MUTCD](#), Part 6E.8, flagger stations shall be illuminated at night. The average maintained illuminance should be a minimum of 5 foot candles (54 lux). Balloon lighting or floodlights may be used; however, if floodlighting is used, it shall not produce a disabling glare condition for approaching road users, flaggers, or other workers.

Vehicle headlights shall not be used to illuminate the flagger station.

8-5.05.03 Delay Times due to Flagging Operation

As stated in Section [8-5.04.02](#), flagging operations should limit the hold time to 15 minutes and flaggers should coordinate to limit the delay to the traveling public.

8-5.05.04 Flagging at Signalized Intersections

When flagging a signalized intersection, the signal must be turned off or turned to flashing mode. Only a licensed uniformed law enforcement officer may override a fully operational traffic control signal system.

8-5.05.05 Flagging on Freeways

Flaggers should not be used to control traffic on a freeway due to the potential of creating a speed differential which could result in a higher risk of rear-end crashes or vehicular evasive maneuvers that result in work area intrusions.

When a full closure is needed on a freeway for a very limited time (i.e. to set bridge beams), a flagging operation may be used at night when volumes are low; however, a law enforcement officer shall be used and the duration of the operation should be less than 15 minutes. See Layout 83 in the [Field Manual](#).

8-5.05.06 *Side Roads Within the Temporary Traffic Control Zone*

For lengthy flagging areas that contain side roads, a flagger and/or appropriate signing for each intersecting side road within the limits of the active work area should be considered. Also consider provisions to contact and notify individual private residences along the highway within the work area of the process for entering and exiting their property.

8-5.05.07 *Temporary Stop Signs Alternative to Flagging*

Temporary stop signs are an acceptable alternative to flagging on roads with less than 1500 ADT and clear sight between the stop areas. See Layout 6J-12 located in Part 6, of the [MN MUTCD](#).

8-5.05.08 *Pilot Car Operations*

Pilot Cars may be used in conjunction with flaggers to guide platoons of vehicles through lengthy two-way, one-lane work areas. Pilot cars may be considered when:

- Lane closures exceed ½ mile and sight distance between the flagger stations is obscured,
- Workers are immediately adjacent to the traveled lane,
- There are multiple isolated activities occurring throughout the work area.

When used, it may be worthwhile to notify residents along the corridor of the proper way to enter the highway while the pilot car is in operation. This should be considered as the public information plan of the TMP is being developed.

8-5.05.08.01 *Pilot Car Maximum Speeds*

Limiting the travel speed of the pilot car should be considered for the flagging operation, particularly when the pilot car is passing workers in the lane adjacent to traffic. If the travel speed of the pilot car is limited to 45 mph near workers, the project may not need to implement a Workers Present Speed Limit of 45 mph.

8-5.05.09 *Automated Flagger Assistance Devices (AFADs)*

The AFAD is an automated, trailer-mounted device used as an option for flagging within a two-way, one-lane work zone operation. These devices are controlled by either one or two flaggers, depending on the visibility of the queues controlled by each AFAD. An advantage of AFADs is that they remove the flaggers from the flagging stations. Two types of AFADs are available:

4) STOP/SLOW AFAD

This type uses a STOP/SLOW sign, similar to a flagger paddle, that alternately displays the STOP face and the SLOW face, depending on the direction of the flagging operation.

5) Red/Yellow Lens AFAD

This type displays either a steadily illuminated CIRCULAR RED lens or a flashing CIRCULAR YELLOW lens, depending on the direction of the flagging operation.

The general requirements for each can be found in Part 6E of the [MN MUTCD](#). MnDOT also requires that a gate arm be included for either option when used on the state highway system. Compared to portable signals, AFADs may allow more flexibility to react to varying queues as they are controlled by a flagger(s).

8-5.05.10 *Portable Signals*

Portable signals are an alternative to a standard flagging operation. A portable signal operation requires that district traffic staff set up the timing of the signals. Compared to AFADs, portable signals require fewer employees to staff the work zone as flaggers are not necessary. Portable signals are also useful for alternating

one way traffic operations in unattended work zones.

8-5.06 Speed Limits in Work Zones

There are several methods of signing available for speed control in work zones. These methods are:

- Advisory Speeds,
- Workers Present Speed Limits, and
- 24/7 Construction Speed Limits.

Under certain conditions, a Workers Present Speed Limit is required by Minnesota Statute. For additional information, details, and typical layouts, see “Speed Limits in Work Zones Guidelines” found on MnDOT’s [Speed Limits in Minnesota](#) website.

8-5.07 Positive Protection

As mentioned in Section 8-4.01 Temporary Traffic Control Goals, recent federal regulations highlight the importance of worker safety through a variety of methods, one of which is the use of positive protection devices. Strong consideration should be given to this exposure control method.

The FHWA defines “Positive Protection Devices” as devices that contain and/or redirect vehicles and meet the crashworthiness evaluation criteria contained in the [National Cooperative Highway Research Program \(NCHRP\) Report 350](#) or the [Manual for Assessing Safety Hardware \(MASH\)](#). The determination of when to use positive protection is based on engineering judgment. Numerous products and devices can be used to provide different degrees of positive protection, devices more commonly used in Minnesota are described in this section.

8-5.07.01 Temporary Barriers for Positive Protection

While portable concrete barrier has historically been the primary choice in Minnesota, other options are available. The options and considerations include:

- Portable Concrete Barrier
 - Usually used for long-duration activities where work space is limited and either worker/traffic exposures or road user/work area hazard exposures are present on a regular basis.
 - Adequate space is required for barrier deflection or the barrier needs to be pinned to the pavement surface.
 - Adequate space is needed for equipment to install/move/remove the barrier.
 - Barrier must be placed on rigid pavement surface (bituminous or concrete) to remain crashworthy.
 - Adequate contractor ingress/egress points will be needed either at barrier ends or mid-run.
 - All exposed ends must be treated with some manner of impact attenuation or protection.
- Steel Barrier
 - While not widely used, steel barrier options are on MnDOT’s [Approved/Qualified Products for Temporary Barrier List](#) (APL). It has several advantages over portable concrete barrier - including ease and reduced cost of transport, speed of installation, durability, portability once on-site, and weight per foot to minimize bridge dead-loading.
 - When anchored, steel barrier equals concrete barrier in providing a safe and effective positive protection device with minimal deflection; however, unanchored, steel barrier has significantly higher deflection.
 - On shorter term projects, steel barrier may be more cost-effective than portable concrete

barrier due to the reduced transportation costs and set up time.

- End treatment is still necessary.
- Water-Filled Barrier
 - Also not widely used, water-filled barrier options are on MnDOT's [APL](#). It also has some advantages over portable concrete barrier - including ease and reduced cost of transport, speed of installation, and portability once on-site.
 - Water-filled barrier has higher deflection than portable concrete barrier and steel barrier.
 - Some types of water-filled barrier can act as its own end treatment.
- Moveable Barrier
 - Moveable barrier has been used successfully on a few MnDOT projects and there is an option on MnDOT's [APL](#).
 - Moveable barrier is most effective for projects where lane configurations must change regularly (e.g. reversing peak traffic flows, lane reductions during non-peak hours, multiple longitudinal work areas (e.g. micro-silica deck pours, bridge deck joint replacements)) and other locations where barrier is warranted, but the shorter duration of the activity makes placement of standard concrete barrier challenging and risky.
 - Advance coordination, communication, and project planning is needed to include in a construction project.

8-5.07.02 Protection Vehicles and Truck/Trailer Mounted Attenuators (TMAs)

Protection vehicles may be used to provide positive protection in work areas where intrusions are a concern. Protection vehicles may be equipped with a TMA; however, any protection vehicles operating totally or partially within a traffic lane should be equipped with a TMA. Protection vehicles with TMAs are primarily used for mobile and short duration activities.

Long term work zones may also benefit from the use of protection vehicles, including situations such as:

- Isolated areas of work in a long work area where workers are in the lane adjacent to traffic,
- Road closure locations where intrusions are a concern.

8-5.08 Cable Median Barrier

Forthcoming

8-5.09 Lighting

Lighting of nighttime work zones should be considered carefully as it can enhance the overall safety of the temporary traffic control area; however, the negative impacts of glare on the driver needs to be minimized. The following are some objectives of nighttime work zone lighting:

- To provide the appropriate level of lighting that allows construction work to be completed safely and effectively,
- To reinforce both the intent of the traffic control plan as well as provide better guidance for drivers traveling through the work zone, and most importantly,
- To improve the overall safety of the workers and traveling public.

8-5.09.01 Roadway Lighting

Forthcoming

8-5.09.02 Work Area Lighting

Work area lighting can enhance the safety of workers and the traveling public. [NCHRP Report 498 Illumination Guidelines for Nighttime Highway Work](#) examined this in detail and developed some recommendations. This section contains guidelines from this report that may be used if work area lighting is being considered.

Three categories were recommended based on considerations such as minimum lighting levels recommended by the [Illuminating Engineering Society](#) (IES), federal and state lighting requirements and guidelines, research, and expert opinions. Researchers found these categories to adequately account for a majority of highway and bridge-related construction and maintenance activities. Examples of work zone tasks and their associated recommended illumination levels are summarized below.

Recommended Illumination Levels by Task

Examples of Tasks	Illumination Level	Average Minimum Maintained Illuminance
All work operations areas; <ul style="list-style-type: none"> • setup of lane or road closures, • lane closure tapers, and • flagging stations. 	Level I	54 lux (5 foot-candles*)
Areas on or around construction equipment; <ul style="list-style-type: none"> • asphalt paving, • milling, and • concrete placement/removal. 	Level II	108 lux (10 foot-candles)
Pavement or structural crack/pothole filling; <ul style="list-style-type: none"> • joint repair, • pavement patching/repairs, • installation of signal/electrical/mechanical equipment. 	Level III	215 lux (20 foot-candles)
A foot candle (fc) is defined as unit of illumination that is equal to one lumen per square foot, or 10.764 lux.		

Level I

Level I illuminance is important in areas where the work crew is in motion, moving from spot to spot. This level of illuminance is appropriate for tasks requiring low accuracy, involving slow-moving equipment, and where there are large objects to be seen.

Level II

Level II illuminance is recommended for areas on or around construction equipment to provide a safer environment for the workers operating the equipment, allowing them to perform tasks that require a moderate level of accuracy, as described above.

Level III

Level III illuminance is appropriate for those tasks that require a greater level of visual acuity or for tasks with a higher level of difficulty.

The following types of work zones and factors should be considered when selecting the types of lighting that are best suited for the work zone.

- Mobile work zones, such as a paving operation
 - If the work zone is mobile, the length of the work activity for one night may dictate either that the lighting plan be continuous for the length of the work zone or that a mobile system be used so that the lighting moves with the various work activities.

- Stationary work zones
Work duration would determine the type of lighting in this situation. A long-duration work zone could use roadway luminaires mounted on temporary poles, while shorter duration work zones could use trailer-mounted light towers or balloon lighting at fixed locations.
- Glare
Glare from the lighting systems should be minimized for both the workers and any adjacent motorist. Glare should be considered from each direction and on all approaching roadways and opposing lanes of traffic, even those separated by grass medians.
- Light Trespass
Trespass occurs when light spills onto private property. This could be a problem in a residential area and could require shielding as a preventative measure.

8-5.09.03 Vehicle Lighting for Temporary Traffic Control

Appropriate vehicle lighting is required to enhance the conspicuity of vehicles within temporary traffic control zones. This applies to both day and night time operations. All mobile equipment, operating within the limits of a TTC zone with potential exposure to passing traffic, shall be equipped with operable warning lights that meet the appropriate requirements of the SAE specifications listed below. This would include closed roads that are open to local traffic only. This also includes any vehicle that enters the traveled roadway at any time. MnDOT maintains an APL for [Vehicle Safety Lights](#) – all vehicle lighting packages must be from this APL.

- 360 Degree Rotating Lights - SAE Specification J845
- Flashing Lights - SAE Specification J595
- Flashing Strobe Lights - SAE Specification J1318

Lights shall be mounted so that at least one light is visible at all times from a height of 3.5 feet and from a 60-foot radius about the equipment. In order to meet the 360 degree at 60-foot radius requirement supplemental lighting may be used. All supplemental lights must be SAE Class 1 certified.

Per the MN MUTCD, vehicle warning lights shall be operating and visible when a vehicle decelerates to enter a construction work zone and again when a vehicle leaves the work zone and enters the traveled traffic lane.

8-5.10 Drop-offs

Drop-offs or abrupt edges are inevitable during some construction activities. Protecting or not protecting drop-offs with temporary concrete barrier within the clear zone depends on the depth of the drop, the proximity to live traffic, speeds, volumes, roadway geometry, and duration of the exposed hazard. The [Field Manual](#) contains longitudinal drop-off guidelines for drop-offs of less than 12 inches (See Figure 6K-3 Longitudinal Drop-off Guidelines).

For drop-offs of greater than 12 inches, see the [MN MUTCD](#), Part 6F.85 Temporary Traffic Barriers for guidance regarding the placement of temporary barrier, particularly Table 6F-5.

When temporary barrier is used, anchorage is required if the temporary barrier is close to the drop-off. [MnDOT Standard Plan 5-297.680](#) covers portable concrete barrier anchoring and requires anchoring when the portable concrete barrier is within two feet of the drop-off. If steel barrier is used to protect the drop-off, consult the manufacturer's specifications for anchoring requirements.

8-5.11 Zipper Merge

The Zipper Merge is a method of merging where drivers are encouraged to use both lanes up to a defined merge point and then take turns merging. This is typically used with a lane reduction in a congested work zone. Early merging is still being encouraged when drivers are traveling at highway speeds as that gives drivers a better opportunity to find a gap in the through lane prior to the lane reduction. Districts are encouraged to

incorporate the Zipper Merge TTC when volumes are expected to exceed 1500 vehicles per hour. There are two methods for implementing a Zipper Merge in a lane reduction:

1) Active Zipper Merge

An Active Zipper Merge uses Intelligent Work Zones elements (detection, algorithms, and communication) to actively direct drivers when to use both lanes and where to merge. This type of Zipper merge is shown in the [Minnesota IWZ Toolbox](#) document in the layout *Dynamic Lane Merge* and the templates *Active Zipper Merge (Right Lane Closure & Left Lane Closure)* found on [OTST's TTC – Template Sheets website](#).

2) Passive Zipper Merge

A Passive Zipper Merge uses signs and/or PCMSs to notify drivers that both lanes should be used when there are backups. This leaves the decision to the driver as to whether a backup exists or not. This type of Zipper Merge is shown on Layout 6K-46 for a Mobile Lane Closure and Layout 6K-54 for a Standard Lane Closure in the [Field Manual](#). There are also templates on [OTST's TTC – Template Sheets website](#) for Passive Zipper [Merge Right Lane Closure](#) and Passive Zipper [Merge Left Lane Closure](#).

The Active Zipper Merge has been found to lead to higher compliance among drivers than the Passive Zipper Merge, but both methods have been shown to be successful - particularly in longer term work zones.

8-5.12 Intelligent Work Zones

Intelligent Work Zones (IWZ) use standard system components (detection, analysis, and communication) to provide a real-time notification system to provide drivers, project personnel, and the agency with information about work zone conditions. OTST has published the [Minnesota IWZ Toolbox](#) as a guideline for selecting an appropriate IWZ System for existing work zone traffic issues and to mitigate anticipated issues on scheduled projects. The IWZ System descriptions contained in the toolbox are intended as brainstorming material and should lead to practical solutions to a project's unique expected conditions. The layouts and examples are purposely left void of many dimensions, except where particular distances are highly recommended, and engineering judgment is required to customize the system to a project.

8-5.13 Innovative Contracting Methods

Innovative contracting methods (such as Lane Rentals, ABC, Best-Value, etc) are initiatives to reduce construction time and delivery of projects, improve quality, and develop new processes to administer projects. These supplement traditional low-bid, design-bid-build contracting. See MnDOT's [Office of Construction and Innovative Contracting](#) website for guidelines and full descriptions of the innovative contracting methods.

8-5.14 Other Travel Mode Considerations

Temporary traffic control plans are generally focused on vehicular traffic; however, there are other modes of travel that must be considered and should be incorporated into the plan documents.

8-5.14.01 Pedestrians

Pedestrians need to be considered in the development of the TTC plan. The [MN MUTCD](#) states:

MN MUTCD Part 6D.1 – Pedestrian Considerations

Standard: If the TTC (temporary traffic control) zone affects the movement of pedestrians, adequate pedestrian access and walkways shall be provided. If the TTC zone affects an accessible and detectable pedestrian facility, the accessibility and detectability shall be maintained along the alternate pedestrian route.

MN MUTCD Part 6D.2 – Accessibility Considerations

Standard: 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 pedestrian facility.

Due to these Standard statements, the districts are highly encouraged to include a Pedestrian TTC Plan within the TMP documents (this could typically be in the overall TTC plan). If not within the project documents, contractors have difficulty implementing pedestrian routes within construction projects.

In general, the Pedestrian TTC Plan should clearly show pedestrian diversion routing and necessary traffic control devices with locations of sidewalk barricades, pedestrian channelizers, temporary curb ramps, temporary walkway surfaces, and communication devices (signing and audible/tactile devices, as needed). If a detour is provided, include signing for the detour.

Sidewalks or multi-use trails that are direct routes should be detoured as little as possible. As stated in the [MN MUTCD](#), Part 6, Chapter 6D, "Pedestrians should be provided with a convenient and accessible path that replicates as nearly as practical the most desirable characteristics of the existing sidewalk(s) or a footpath(s)." This includes keeping the re-routing as short as is practical. The routing order of preference should be:

1. Provide the Alternate Pedestrian Route (APR) on the same side of the street as the disrupted route utilizing bypasses.
2. Where it is not feasible to provide a same side APR, provide an APR on the other side of the street.
3. Where it is not feasible to provide an APR on the other side of the street, provide an APR detour with trailblazing signs.

Recreational trails may have longer detours as these are generally used for recreation, not direct access routes.

OTST has published template sheets for Alternate Pedestrian Routes (APR) bypasses/detours and Temporary Pedestrian Access Route (TPAR) devices. These may be modified and inserted into plans or used as a reference in developing a Pedestrian TTC plan.

8-5.14.02 *Bicyclists*

Bicyclists need to be considered in the development of the TTC plan. The [MN MUTCD](#) states:

MN MUTCD Part 6A.1 – General

Standard: The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, or on private roads open to public travel (see definition in Section 1A.13), including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

MN MUTCD Part 6G.5 – Work Affecting Pedestrian and Bicycle Facilities

It is not uncommon, particularly in urban areas, that road work and the associated TTC will affect existing pedestrian or bicycle facilities. It is essential that the needs of all road users, including pedestrians with disabilities, are considered in TTC zones.

Dedicated bike lanes should be addressed in the TTC plan. [Minn. Stat. Sec. 169.18, Subd. 7\(d\)](#) states:

Whenever a bicycle lane has been established on a roadway, any person operating a motor vehicle on such roadway shall not drive in the bicycle lane except to perform parking maneuvers in order to park where parking is permitted, to enter or leave the highway, or to prepare for a turn as provided in section 169.19, subdivision 1.

If a TTC setup directs vehicular traffic into the marked bike lane, the bike lane needs to be closed prior to this location and the bikes either need to be diverted/detoured or share the road warning signs need to be placed.

8-5.15 **Clear Zones**

The clear zone concept applied to work zones differs from clear zone concepts applied to permanent roadways.

Due to the nature of a work zone, the amount of horizontal clearance is often limited. Further, driver awareness is often heightened. As a result, lateral clear zone requirements are generally less. Work zone clear zones do not override the permanent clear zone - meaning existing roadside features should not be removed to meet work zone clear zone requirements; however, if work activities expose hazards which were not previously in the clear zone (such as in crossovers) then protections should be provided. Engineering judgment is regularly used to determine tolerable clear zone widths in work zones. Depending on site restrictions, it may only be feasible to provide an operational clearance - often as little as two feet.

Staging needs and opportunities for positive separation between workers and traffic should be considered. Actual clear zone distances should be maximized, where possible. When clear zone distances are critical within a given project or stage, distances should be identified within the project documents.

Clear zone determinations should take into account traffic speeds, volumes, roadway geometry, available right of way, and duration of work. Any specific clear zone widths needed for construction should be documented in the project file.

Stockpiled materials and inactive construction equipment and vehicles not behind barrier should be stored a minimum of 30 feet from the traveled way for all projects. The work zone clear zone concept applies to exposed hazards in the work zone - exposed barrier ends, stored equipment, drop-offs, fixed objects, etc. For practicality purposes, the work zone clear zone concept does not apply to construction vehicles and materials being used for active construction operations.

Clear zones also apply to Drop-off conditions, see Section [8-5.10 Drop-offs](#) for further information.

8-5.16 Business Impact Mitigation

Business impact mitigation is an important part of MnDOT's public involvement and project development processes, and is also addressed in [Minnesota Statute 160.165](#), Mitigating Transportation Project Impacts on Business. The purpose of business impacts mitigation is to:

- Involve businesses more in the project development process,
- Keep businesses informed regarding project issues,
- Help businesses understand a project and its potential impacts,
- Mitigate construction impacts to businesses as feasible (includes reducing and, if practical, preventing negative impacts to businesses).

Substantial business impacts is defined as "Impairment of road access, parking, or visibility for one month or longer, for one or more businesses". If the project is expected to cause substantial business impacts, specific actions need to be performed by the Project Manager and/or identified in the TMP. See [Business Impact Mitigation](#) from MnDOT's Highway Project Development Process for additional information and guidance.

The statute requires that one of the mitigation efforts that must be considered is signage. See "[Temporary Business Signing in Work Zones](#)" in Section 8-6.02.02 for guidance.

8-5.17 Public Information

The [Minnesota Work Zone Safety and Mobility Policy](#), Technical Memorandum No. 12-03-T-02, requires that public information be included in the TMP for projects of certain levels of impact. Some strategies are identified in this section.

8-5.17.01 Traveler Information - 511

511 is a public service of MnDOT to help drivers access information about road conditions, work zones, traffic incidents, commercial vehicle restrictions, and weather information via the phone, the web, or handheld

devices. Most TTC projects that are expected to impact traffic are included in 511. The use of 511 satisfies the public information requirements on many projects. TTC implementations that are anticipated to impact traffic are sent to 511 staff, which then enters the data into 511. 511 notifications are generally provided to the Regional Traffic Management Center (RTMC) during the construction project.

8-5.17.02 Advance Notice of Construction

This generally consists of MnDOT Public Affairs staff notifying the public of upcoming projects using a variety of means including pre-season construction kick-offs, project website updates, constant contact emails, print media, and press releases.

When used, Public Information methods should be identified in the TMP.

8-5.17.02.01 Temporary Signing Options

On method of advance notice uses some of the Construction Information (G20) series of signs found in the [MnDOT Standard Signs Summary](#). In particular, the following are often used:

- G20-X1 - Closure Notice
- G20-X2 - Work Zone Advance Notice
- G20-X15 - Ramp Closure Advance Notice

These are used to notify drivers that regularly use that road that construction will be starting. This may help drivers determine if alternate routes should be used once construction begins. These signs are typically installed five to seven days in advance of the actual start of construction.

8-5.17.03 Portable Changeable Message Sign (PCMS) Strategies

PCMSs may be used in addition to or instead of the advance notice signs listed above. See the [2012 CMS Manual of Practice](#) for the appropriate use of PCMS as well as approved messages.

8-6.00 TEMPORARY TRAFFIC CONTROL DEVICES

8-6.01 General Requirements of Temporary Traffic Control Devices

All TTC devices used on MnDOT street and highway construction or maintenance work shall conform to the specifications of the latest edition of the [MN MUTCD](#), the [MnDOT Standard Specifications for Construction](#), and all other appropriate MnDOT technical manuals.

8.6.01.01 Crashworthiness of TTC Devices

MnDOT requires that all TTC devices used (with the exception of Category 4) are crashworthy in accordance with the [National Cooperative Highway Research Program \(NCHRP\) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features"](#) or the [American Association of State Highway and Transportation Officials \(AASHTO\) "Manual for Assessing Safety Hardware \(MASH\)"](#).

Under the NCHRP Report 350 and MASH standards for crash testing, work zone devices have been classified into four categories, each having its own testing requirements:

- **Category 1** - Low-mass devices such as channelizing devices. Devices typically [self-certified](#) for crashworthiness.
- **Category 2** - Devices with higher mass that are frequently crash tested. Examples include permanent and portable sign supports, barricade supports, and small portable (balloon) lighting.
- **Category 3** - Much higher mass and requires correct installation and protection. Mandatory crash-testing. Examples include temporary barrier and TMAs.

2.10 TTC Strategies and Controlling Criteria Supplemental Information to the TEM

2.10.1 Oversize/Overweight Vehicles

When planning for temporary traffic control in a work zone, oversize/overweight (OSOW) vehicles need to be considered. Due to the temporary traffic conditions it may be difficult or impossible for OSOW vehicles to navigate through the work zone. In cases where OSOW vehicles will have problems, be sure to contact the permits department.



Information for the 511 system is often 3 days. OSOW permits are often granted 7 days ahead of time. Therefore, it is important to check to ensure an OSOW permit is not, or is being planned if this cannot be handled.

2.10.2 Lane Width

In some TTC areas, reduced lane widths are used to maintain the number of lanes. This involves reducing the width of one or more lanes in order to maintain the existing number of lanes on the facility while permitting work access to part of the facility. In cases where the lane width is considered, it is important to determine this through communication with all interested departments, including, but not limited to traffic, construction and design. For traffic control purposes, a minimum lane width of 10 feet shall be provided.

2.10.3 Speed Limits in Work Zones

MN Statutes 169.14, Subd. 5d went into effect August 1, 2014. This statute modified speed limits in work zones. It requires a reduction under certain conditions; allows a road agency to set without an engineering study and includes a modified fine.

The statute states “the speed limit on a road having an established speed limit of 50 miles per hour or greater is adjusted to 45 miles per hour in a work zone when (1) at least one lane or portion of a lane of traffic is closed in either direction, and (2) workers are present.” There are exceptions when:

- ✓ Positive barriers are placed between workers and the traveled portion of the highway;
- ✓ The work zone is in place for less than 24 hours;
- ✓ A different speed limit for the work zone is determined by the road authority following an engineering and traffic investigation and based on accepted engineering practice; or
- ✓ A different speed limit for the work zone is established by the road authority as defined in the following paragraph.
 - The commissioner, on trunk highways and temporary trunk highways, and local authorities, on streets and highways under their jurisdiction, may authorize the use of reduced maximum speed limits in work zones when workers are present, without an engineering and traffic investigation required. The work zone speed limit must not reduce the speed limit on the affected street or highway by more than:
 - 20 miles per hour on a street or highway having an established speed limit of 55 miles per hour or greater; and
 - 15 miles per hour on a street or highway having an established speed limit of 50 miles per hour or less.

- A work zone speed limit is effective on erection of appropriate regulatory speed limit signs. The signs must be removed or covered when they are not required. A speed in excess of the posted work zone speed limit is unlawful.

A person convicted of operating a motor vehicle in violation of a speed limit in a work zone, or any other provision of this section while in a work zone, shall be required to pay a fine of \$300.

The provision of “fines double” no longer applies to violations within work zones. The MN MUTCD will allow turning the existing posted speed limits into a work zone speed limit assembly. If the contractor requests not to, then don’t use Workers Present Speed Limit pay item.

The types of projects that may be affected by this new law include:

- ✓ Pavement rehabilitation (reclaim and overlay, mill and overlay, overlay, chip seals, micro surfaces)
- ✓ Pavement patching and crack sealing
- ✓ Reconstruction projects
- ✓ Multi-day culvert replacement (at one location)
- ✓ Bridge construction/repair
- ✓ Installation of an intersection traffic control device (e.g. traffic signal or roundabout)

Speed Limits in Work Zones Website

The speed limits in work zones website is, <http://www.dot.state.mn.us/speed/>. This contains the Speed Limits in work zone guidelines. This (PDF) booklet outlines the guidelines, proper layouts and procedures for implementing various speed limit types to be used in work zones. In addition, see work zone advisory and temporary speed limit sign standards linked on the website.

2.10.4 Positive Work Zone Protection

Title 23 CFR 630.1108(a) indicates that the need for longitudinal traffic barrier and other positive protection devices shall be based on an engineering study. The engineering study may be used to develop positive protection guidelines for the agency, or to determine the measures to be applied on an individual project. At a minimum, positive protection devices shall be considered in work zone situations that place workers at increased risk from motorized traffic, and where positive protection devices offer the highest potential for increased safety for workers and road users. In addition:

- ✓ Use positive protective measures to separate workers on highway construction projects from motorized traffic in work zones conducted under traffic in areas that offer workers no means of escape (such as tunnels and bridges).
- ✓ Use temporary longitudinal traffic barriers to protect workers on highway construction projects in long-duration stationary work zones when the project design speed is anticipated to be high & the nature of the work requires workers to be within 1 lane-width from the edge of a live travel lane.
- ✓ When positive protective devices are necessary, those devices are paid for on a unit-pay basis, unless doing so would create a conflict with innovative contracting approaches, such as design build or some performance-based contracts.

Section 630.1108 includes the following definition for Positive Protection Devices:

Positive Protection Devices means devices that contain and/or redirect vehicles and meet the crashworthiness evaluation criteria contained in National Cooperative Highway Research Program (NCHRP)

Report 350, Recommended Procedures for the Safety Performance Evaluation of Highway Features, 1993, Transportation Research Board, National Research Council. The Director of the Federal Register approves this incorporation by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. This document is available for inspection and copying at FHWA, 1200 New Jersey Avenue, SE., Washington, DC 20590, as provided in 49 CFR part 7. You may also inspect a copy at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call (202) 741 6030, or go to: http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.

2.10.5 Work Zone Drop-Offs

Additional channelizing devices should be placed in areas that may be considered hazardous to the public or workers. Temporary traffic barriers are used to channelize vehicles away from pavement drop-offs are covered in Section 6F.85 of the MN MUTCD. Refer to the handout in Section **3.13**.

These areas include but are not limited to:

- A. Full longitudinal channelizing, as stated in Section 6F.58 (Channelizing Devices), when traffic is adjacent to longitudinal drop-offs greater than 4 inches.
- B. Full longitudinal channelizing, as stated in Section 6F.58 (Channelizing Devices), and barriers, as stated in Section 6F.81 (Temporary Traffic Barriers), when traffic is adjacent to longitudinal drop-offs greater than 12 inches.
- C. Full longitudinal channelizing, as stated in Section 6F.58 (Channelizing Devices), when roadway geometry, dust, weather, or darkness restricts visibility of the open travel lane.

2.10.6 Clear Zone Requirements

Clear Zones (from the Road Design Manual)

“The roadside clear zone is the distance from the edge of the travel lane which should be free of any non-traversable hazard such as steep slopes or fixed objects. The clear zone distances are targeted towards allowing approximately 80 to 85 percent of all run-off-the-road vehicles to recover or come to a safe stop. The width of a clear zone along the horizontal alignment is dependent on roadside geometry, design speed, radius of horizontal curve, and the ADT. Higher speeds mean vehicles will travel farther before recovering. Horizontal curvature increases the likelihood of a vehicle leaving the highway and increases the distance it will travel off the highway, as will steeper fill slopes. In general, hazards within the clear zone which cannot be removed, relocated, or made breakaway will warrant guardrail.

The designer should not apply rigid adherence to the calculated clear zone distance. If a formidable hazard lies just beyond the clear zone, it should be removed or shielded if costs are reasonable. Conversely, the designer should not have the philosophy that the clear zone should be achieved at all costs. Limited right of way or unacceptable construction costs may lead to installation of a barrier or, perhaps, no protection at all if there are many hazards along the entire length of the roadway inside the calculated clear zone.

The designer should not use the clear zone distances as boundaries for introducing roadside hazards such as bridge piers, non-breakaway sign supports, or trees. These should be placed as far from the roadway as practical.”

2.10.7 Innovative Contracting Methods

Innovative Contracting incorporates new practices to supplement traditional low-bid, design-bid-build contracting. Innovative contracting can decrease project delivery time, reduce construction time, improve safety, incorporate innovation, and reduce costs.

The following is a handout, 2008 Innovative Contracting Guidelines. The manual can be downloaded from the following website:

www.dot.state.mn.us/const/tools/innovativecontract.html

INNOVATIVE CONTRACTING GUIDELINES

Office of Construction and Innovative Contracting

A+B Bidding

Lane Rentals



**Incentives/
Disincentives**



Constructability Reviews

Locked Incentive Dates

Design-Build

Warranties

Pay for Performance



CPM Schedules



www.dot.state.mn.us/const/tools/innovativecontract.html

Dec, 2008

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Introduction

This manual provides guidance to Mn/DOT, counties, cities and other agencies construction and design personnel in identifying projects that can utilize innovative contracting techniques. Mn/DOT's Innovative Contracting website provides additional tools such as specification templates, sample specifications, and case histories.
(www.dot.state.mn.us/const/tools/innovativecontract.html)

Innovative contracting starts early during the design phase. Design and construction staff need to work closely together during the development of preliminary (30%) and final plans.

Mn/DOT currently uses the following types of innovative contracting processes:

- A+B Bidding** A+B bidding reduces contract time on projects. Contractors bid the time to complete the project and a dollar amount for work items. The contract is awarded to the lowest combination of time and cost.

- Lane-Rental** Lane-rental reduces impacts to the traveling public by minimizing the time lanes are closed. Contractors are charged a fee for closing lanes and shoulders due to construction activities. The concept focuses on the time that the public is affected, NOT the overall contract time.

- Incentives/Disincentives** The contractor is paid for early completion of a project as provided for in the contract. If the contractor completes the project later than the time allowed, disincentive money is subtracted from payments due.

- Constructability Reviews** The industry provides valuable feedback into key areas that the Agency may not be able to quantify during the project development process. Feedback on preliminary plans has the potential to significantly reduce project costs and construction timelines.

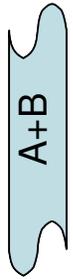
- Locked Incentive Date** A locked incentive date provides an incentive if the contractor completes the work done early. Contractors are not allowed any extensions in the completion date, regardless if extensions are owner caused or not.

- Design-Build** Design and construction phases overlap, allowing faster overall project delivery.

- Pay-for-Performance** Pay-for-performance specifications rely on final outcomes measured against performance criteria set forth in the contract. If the contractor fails to meet minimum performance criteria, payment is withheld and corrective action is required.

- Warranties** Warranties require contractors to guarantee all or portions of a construction project to be free of defects in materials and workmanship for a period of time. The contractor is required to correct deficiencies that occur during the warranty period.

- Critical Path Method (CPM Schedules).** Critical Path Method (CPM) schedules are excellent tools for both the contractor and Mn/DOT to monitor contract time during a construction project.



HANDOUT

HANDOUT

A+B Projects

Description

Cost-plus-time bidding, more commonly referred to as the A+B factors time plus cost to determine the low bid. Under the A+B method, each bid submitted consists of two components:

- 'A' - Traditional dollar amount for the contract items
- 'B' - Days bid to complete the work

The number of 'B' days is multiplied by the road user cost furnished by the owner and added to the 'A' component to obtain the total bid.

$$(A) + (B \times [\text{Road-User Cost} / \text{Day}]) = \text{Total Bid}$$

This formula only determines the lowest bid for award, not the payment to the contractor.

Benefits

- Improved coordination between prime and sub-contractors
- Reduced construction time minimizes impacts to users.
- Contractors are required to put together a well conceived schedule.

Drawbacks

- Contract changes are magnified; too many changes nullify the advantages of A+B.
- Acceleration techniques may require more resources for contract administration.
- More hours and over-time budget required from district staff.
- Negotiations for additional work are more intense since time being a bigger issue.

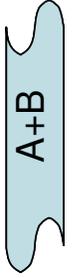
Project Selection

A+B bidding should focus on projects with significant impacts to motorists, businesses, emergency services, or other groups that will be directly impacted by the project.

Good Candidates	Poor Candidates
<ul style="list-style-type: none"> • Mill and Overlay • Un-bonded concrete overlays • Detour projects • New construction and reconstruction (grading and structures) • Bridge painting • Intersection upgrades • Bridge rehabilitation (if confident with quantities) 	<ul style="list-style-type: none"> • Traffic Management System (TMC) (Mn/DOT-provided items can cause delay) • Steel fabrication (minimal benefit to public) • Concrete rehabilitation (due to high probability of overruns) • Signal systems (Mn/DOT provided items can cause delay) • Landscaping (minimal disruption to traffic) • Signing Projects

HANDOUT

HANDOUT



HANDOUT

HANDOUT

IMPLEMENTING A+B PROJECTS

Follow these steps to implement A+B bidding:

Step 1: Is My Project a Good Candidate for A+B?

YES	NO	
<input type="checkbox"/>	<input type="checkbox"/>	RIGHT OF WAY
<input type="checkbox"/>	<input type="checkbox"/>	Will all right-of-way be secured prior to letting date?
<input type="checkbox"/>	<input type="checkbox"/>	If not, do the staging plans allow the contractor to sequence work around the conflicts and is a right-of-way time determination schedule in the special provisions?
<input type="checkbox"/>	<input type="checkbox"/>	PLANS
<input type="checkbox"/>	<input type="checkbox"/>	Is there high confidence in the design?
<input type="checkbox"/>	<input type="checkbox"/>	Has a thorough field review been conducted?
<input type="checkbox"/>	<input type="checkbox"/>	Has design coordinated with construction at various stages (e.g. 30%, 90%)?
<input type="checkbox"/>	<input type="checkbox"/>	Has a constructability and bid-ability review been conducted by design and construction?
<input type="checkbox"/>	<input type="checkbox"/>	UTILITIES
<input type="checkbox"/>	<input type="checkbox"/>	There is <i>little or no chance</i> that utilities will significantly delay the contractor.
<input type="checkbox"/>	<input type="checkbox"/>	Are utility conflicts clearly identified in the plan and special provisions?
<input type="checkbox"/>	<input type="checkbox"/>	THIRD-PARTY AGREEMENTS
<input type="checkbox"/>	<input type="checkbox"/>	Will all permits be secured by the letting date?
<input type="checkbox"/>	<input type="checkbox"/>	Will all municipal agreements be secured by the letting date?
<input type="checkbox"/>	<input type="checkbox"/>	PROGRAM IMPACTS
<input type="checkbox"/>	<input type="checkbox"/>	Have you considered the district wide impacts of using an accelerated schedule? Have you considered the potential cost and delivery to other projects?
<input type="checkbox"/>	<input type="checkbox"/>	SOIL CONDITIONS
<input type="checkbox"/>	<input type="checkbox"/>	There is <i>little</i> risk of contaminated or poor soils adding significant extra work.

HANDOUT

HANDOUT

Minnesota Department of Transportation
Innovative Contracting Guidelines

A+B

<input type="checkbox"/>	<input type="checkbox"/>	<p>TRAFFIC CONDITIONS Do construction traffic impacts relate to any of the following conditions?</p> <ul style="list-style-type: none"> • Lengthy detours • Significant delays to motorists • Significant impacts to businesses, schools, or emergency services
<input type="checkbox"/>	<input type="checkbox"/>	<p>STAFFING CONSIDERATIONS Do you have the staff available if the contractor has an aggressive schedule?</p>
<input type="checkbox"/>	<input type="checkbox"/>	Do you have the budget for any additional overtime?

If the answer is **YES** to most of the above questions, the project may be suitable for A+B. If you answered **NO** to some of the questions, your project may still be a good candidate for A+B, but give careful consideration to the items with a **NO** response.

Step 2: Determine How to Use A+B

A+B techniques can be applied to many aspects of a project. Determine how you can best use A+B on your project.

- Entire contract length
- Intermediate dates
 - o Detour duration
 - o Interchange closure period
 - o Lane closure timeframe
 - o Stages
- Multiple timeframes (A+B+C)
- Any other project aspect

Step 3: Determine Road User Costs

- Obtain Road-User Costs (RUC) from Mn/DOT's Office of Investment Management (OIM). The contact is Ed Idzorek (651) 205-4391.
- Project engineer/supervisor needs to weigh how the RUC may affect the bid to determine the appropriate balance between the 'A' and 'B' portions of the bid. Adjust the RUC if necessary.

Example: RUC calculated by OIM = \$75,000 per day

Bidder #1: \$1,000,000 at 50 Days (A+B = \$4,750,000)

Bidder #2: \$1,500,000 at 40 Days (A+B = \$4,500,000) – Awarded Contract

Question: Are you willing to spend an extra 50 percent to complete the project 10 days early? Adjusting the RUC may minimize this effect.

HANDOUT

HANDOUT

HANDOUT

HANDOUT



HANDOUT

HANDOUT

Step 4: Determine Contract Time

- Perform a constructability review on the plan set.
- Assess the time, manpower and equipment impacts to other projects in the area.
- Determine the Contract Type
 - Working Days (recommended for projects <100 working days)
 - Calendar Days (recommended on multi-year projects)
 - If using a CPM schedule, use Calendar Days.
- Determine the amount of contract time and any intermediate dates. Use this as the maximum amount of time Mn/DOT would allow.
- Consider adding a minimum number of days. This will likely be required if the RUC is not equal to the disincentive.

Note: If you calculate an overly aggressive schedule, you might not see a significant reduction in the days bid, or you may see an increase in the \$ portion.

Step 5: Determine Incentives and Disincentives

Incentives (Optional)

- Do I want to include an incentive? Check with management.
- Determine incentive amount
 - Often equal or less than RUC
 - Incentive should be capped by the days and/or dollar amount)
 - Total incentive < 5 percent of the engineers estimate

Disincentives

- Should be considered
- Should not be used in lieu of liquidated damages.
- Determine disincentive amount
 - No limit is recommended
 - Should ALWAYS equal RUC.

Step 6: Draft Special Provisions

- Use standard template on the Innovative Contracting Website:
<http://www.dot.state.mn.us/const/tools/innovativecontract.html>
- Inform the design squad so that contract time can be added as a bid item.
- Special Provisions 1806 & 1807 must be clear and concise.

Note: It is recommended that a liquidated damage (LD) be used on all projects. A disincentive may also be used in combination with a LD. Make sure your specs are clear and identify each separately.

HANDOUT

HANDOUT

Step 7: Construction Considerations

- Consider using a CPM Schedule to help administer contract time.
- Prepare staff for aggressive contractor schedules.
- Obtain frequent schedules updates if needed.
- Resolve issues proactively to reduce owner delayed time.
- Minor work orders, supplemental agreements and change orders need to be processed in a timely manner.
- Minor work orders, supplemental agreements and change orders need to be address contract time extensions/reductions.
- Work with the contractor to revise the schedule if plan additions occur
- Consider safety impacts to the roadway user, contractor personnel and Mn/DOT staff during construction. Consider impact to clear zones during construction, drop-off requirements, and lane-closure requirements.



HANDOUT

HANDOUT

HANDOUT

HANDOUT

Lane Rental

Description

Lane rentals encourage contractors to minimize road-user impacts. Contractors pay a rental fee for closing lanes and shoulders to do construction work. A rental fee is included in the contract.

Lane-rental fees are based on the estimated cost of delay or inconvenience to the road-user 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 monthly progress payments.

Lane Rental should **NOT** be used to reduce overall contract time but to focus on the time that roadways users are impacted by construction traffic.

Benefits

- Better coordination of prime and sub-contractors
- Minimized impact to traveling public
- Better public perception due to fewer un-utilized lane closures

Drawbacks

- Extra effort by staff to monitor lane rental
- Negotiating lane rental adjustments can be difficult with contract changes
- Potential added costs to the project

Safety Considerations

Safety needs to be addressed with every lane-rental project. Plans and specifications should identify cases when lane closures (clear-zones, drop-offs) will be required to reduce the chance that contractors will take safety risks to reduce lane-rental charges.

District 1 included a plan sheet on a recent project to specify when lane closures would be allowed. The plan sheet eliminated confusion or disagreements with the contractors and preserved safety on the project.

Assessing Lane Rentals (Incentives/Disincentives)

On a lane-rental project, the contractor bids a lump-sum amount for lane rental. Mn/DOT specifies lane rental rates and the contractor estimates the number of hours in each lane-rental category.

Lane-rental use is tracked by the project personnel as the project progresses. At the end of the project, contractors receive either an incentive or disincentive as determined below:

Incentive – An incentive is usually paid for the difference between the lump-sum bid amount and actual lane-rental use. The incentive encourages contractors to reduce traffic impacts during construction.

Disincentive - A disincentive will be charged if the contractor exceeds the lump-sum bid amount.

Project Selection

Lane rental should be used on projects with significant impacts to motorists. Here are general guidelines for using lane-rental.

Good Candidates

- Bituminous mill and overlay (short duration only)
 - Two-lane roadways with flagging operations
 - Intersection impacts
- Grading projects with intermittent **TEMPORARY** lane closures
 - Temporary widening with lane closures
 - Traffic switches
 - Striping (permanent or temporary)
 - Lane closures for delivery of goods and equipment
- Guardrail projects
- Signing projects
- Striping applications
- Bridge painting
- Crack sealing
- Signal systems
- Traffic management projects (ITS)

Poor Candidates

- Concrete rehabilitation (high probability of overruns)
- Detour projects (use A+B instead)
- Projects with long-term **PERMANENT** lane closures (use A+B instead)
- Bridge re-deck or overlays (Consider A+B)
- New construction projects (off alignment)
- Long-term projects that would be difficult for contractors to accurately bid the number of lane-rental hours.

HANDOUT

HANDOUT

Including Lane Rental

Use the following procedure to incorporate lane rental in your project.

Step 1: Is My Project Suitable for Lane Rental?

YES	NO	
<input type="checkbox"/>	<input type="checkbox"/>	<p>CONTRACTOR BIDDING</p> <p>Can the contractor accurately predict the duration of activities that will impact a lane?</p>
<input type="checkbox"/>	<input type="checkbox"/>	<p>THIRD-PARTY AGREEMENTS</p> <p>There are <i>little or no</i> utility or third-party impacts that can delay aspects of the project relative to lane-rental?</p>
<input type="checkbox"/>	<input type="checkbox"/>	<p>TRAFFIC CONSIDERATIONS</p> <p>Traffic restrictions or lane closures with no or limited alternate routes that result in a high user cost.</p> <p>or</p> <p>Opportunities exist to reduce closure times (e.g. staging or construction of temporary work that will impact traffic).</p> <p>or</p> <p>User fees are substantial enough to offset the potential cost increase.</p>
<input type="checkbox"/>	<input type="checkbox"/>	<p>SAFETY</p> <p>The plan and/or special provisions can accurately insure that the safety of the construction operations will not be jeopardized by using lane-rental.</p>
<input type="checkbox"/>	<input type="checkbox"/>	<p>DESIGN UNCERTAINTIES</p> <p>Confidence that plan additions and significant overruns that may impact lane closure times have been minimized</p>

If the answer is **YES** to most of the above questions, the project may be suitable for lane rental. If you answered **NO** to some of the questions, your project may still be a good candidate for lane rental, but give careful consideration to the items with a **NO** response.

Step 2: When and Where do I Use Lane Rental?

Determine locations for lane-rental

- Mainline
- Shoulders
- Ramps
- Turn lanes
- Signal systems impacted

Determine time-frames for lane-rental

- Peak hour (recommendation: do not allow lane rental during this time)
- Off-peak hour
- Weekends
- Nights

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Step 3: Determine Road User Costs

- Obtain Road-User Costs (RUC) from Mn/DOT's Office of Investment Management (OIM). The contact is Ed Idzorek (651) 234-7717.
- Hourly road-user costs should be applied to various times and locations.

Example: Mainline closure on an interstate highway

Peak hours	No Lane Closure Allowed*
7:00 to 9:00 PM	RUC = \$3,000/Hour
9:00 PM to 6:00 AM	RUC = \$1,000/Hour
Weekends	RUC = \$1,000/Hour
Shoulders	RUC = \$500/Hour

* Lane rentals may be allowed in peak hours where traffic levels are low.

Step 4: Estimate Contractor Bid Amount

- Estimate the hours that a typical contractor will bid. Provide this number to Mn/DOT's estimate unit for inclusion in the Engineer's Estimate.

Step 5: Draft Special Provisions

- Use standard templates on the Innovative Contracting Website:

<http://www.dot.state.mn.us/const/tools/innovativecontract.html>

Step 6: Construction Considerations

- Consider using a Critical Path Method (CPM) Schedule to help administer contract time.
- Prepare staff for monitoring the lane-rental schedule.
- Review the requirements with the contractor at the pre-construction meeting.
- Work with the contractor to revise the schedule if plan additions occur.
- Consider safety impacts to the roadway user, contractor personnel and Mn/DOT staff during construction. Consider impact to clear zones during construction, drop-off requirements, and lane closure requirements.

HANDOUT

HANDOUT

Incentive / Disincentive Projects

Description

Incentive/Disincentive is a process where the contractor is paid an incentive for completing a project earlier than the time specified in the contract. If the contractor completes the project later than the time allowed, disincentive money is subtracted from payments due.

Incentive/Disincentives can be used in a wide variety of projects. It is best applied when Mn/DOT is willing to pay the contractor to expedite the work to reduce the contract time. It is similar to the A+B in that it works well with urban reconstruction and bridge-related projects

Benefits

- Reduced construction time
- Potential for lower contract administration costs
- Improved public relations by information businesses/residents that you are committed to completing the project as quickly as possible.
- Better control of project acceleration compared to A+B

Drawbacks

- May require additional funding
- Contract changes can lead to disputes regarding incentive payments

Project Types

Good Candidates

- Projects with high road-user or business impacts
 - Urban reconstruction projects
 - Bridge replacement projects
 - Detour projects
 - Urban pavement rehabilitation projects (if confident with quantities)
 - Interstate (high volume) projects with major traffic impacts
- A+B projects
- Bridge rehabilitation projects
- Projects with commitments to open a roadway as quickly as possible.

Poor Candidates

- New construction projects with minimal impacts to road users
- Projects where right-of-way or utilities are not clearly identified
- Traffic Management System (TMC)
- Steel fabrication (minimal benefit to public)
- Landscaping (minimal disruption to traffic)

Types of Incentive / Disincentive Contracts

Linear – Contractor receives the same daily amount regardless of the number of days completed, early or late.

Non-Linear (Escalating) – The earlier a job is completed, the greater the daily amount paid to the contractor.

Escalating Example: For each day that all work under this contract is completed before August 1, 2006, the contractor will obtain an incentive in accordance with the following schedule:

1-5 Days	\$0 per calendar day
6-10 Days	\$5,000 per calendar day (Maximum of \$25,000)
Over 10 Days	\$10,000 per calendar day (Maximum of \$100,000)

Incentives will not be paid cumulatively. For example, if a contractor completes the work 13 days early, the maximum amount of incentive is \$100,000. The contractor will not receive an additional incentive of \$25,000 for completing the project within the 6-to 10-day incentive period.

Incentive / Disincentive Amounts

- Incentives should be based on items such as Road-User Costs (RUC). Contact Ed Idzorek at OIM (651) 234-7717 for a RUC.
- Incentives must be sufficient to encourage contractor interest, stimulate innovative ideas, and increase profitability of meeting tight schedules. Recent experience indicates that daily incentives between \$5,000 and \$10,000 with caps in excess of \$50,000 are substantial amounts for contractors.
- If incentives are not sufficient to cover the contractor's cost for the extra effort, there is little motivation for the contractor to accelerate production.
- Maximum incentive should not exceed 5 percent of the total contract amount.
- Incentive should be equal to or less than the disincentive rate.
- A maximum incentive should be specified.

Contract Administration Considerations

- Consider using a CPM schedule.
- Time extensions should not be given unless overruns occur on critical path.
- Prepare staff for an aggressive contract schedule.

Special Provisions

- Use standard templates on the Innovative Contracting Website:
<http://www.dot.state.mn.us/const/tools/innovativecontract.html>

Constructability Reviews

Description

Industry representatives can provide valuable information into many keys areas that Mn/DOT may not be able to quantify during the project development process. Feedback on preliminary plans has the potential to significantly reduce project costs and construction timelines.

Benefits

There are many benefits to using constructability reviews during the plan development process.

Lower Construction Costs

- Contractors can identify cost savings situations or alternative designs
- Contractors can help Mn/DOT identify areas of potential risk
- Mn/DOT can provide detailed background into the project that can not be relayed on a set of plans, thereby reducing risk.

Construction Schedule

- Contractors can provide valuable input into construction timelines/production rates.

Industry wants to do this!

- At this point, industry is open to meeting with Mn/DOT at no cost
- *"If value is added we should continue with similar programs in the future.....there is nothing our members like more than interacting with the customer where both parties benefit"* Dave Semerad, Minnesota AGC, commenting on TH 36 Constructability Review

Drawbacks

- Needs to be accomplished early in design process (approximately 50%)

Project Types

Good Candidates

- Complex or large projects with staging concerns
- Project with tight construction timelines
- Projects with new methods being proposed
- Projects when contractors can add innovation

Guidelines

- If you are considering utilizing a constructability review, contact the Project Development Engineer (Kevin Kosobud) at 218-828-5822.

Locked Incentive Date (LID)

A Locked Incentive Date provides an incentive if the contractor completes a phase of a project on or before a date specified within the contractor. With the LID spec, the contractors are not allowed any extensions in the date even if an owner caused delay occurs. Examples of owner caused delays are utility delays, plan overruns, and extra work.

Contractors have the option of either pursuing the incentive or not. If a contractor chooses not to pursue the incentive, the Contractor has the right to seek time extensions in accordance with Mn/DOT standard specifications. If the contractor chooses the incentive, he/she also agrees to waive all claims for work done to date on the project.

A Locked Incentive Date should only be used on unique projects. If you are considering using a LID provision, contact the Project Development Engineer (Kevin Kosobud) at 218-828-5822.

Locked Incentive Date

Benefits

- Reduced construction time
- Increased contractor concern for the project schedule
- Eliminates claims
- Better coordination between the owner, contractor, and subcontractors, the use of more innovative techniques and the development of more realistic bids

Drawbacks

- The dollar amount for the LID has to be substantial enough for contractors to pursue. The dollar amount will be substantially higher compared to a normal incentive contract. This can add costs to your project.
- Quality of work may suffer when a contractor rushes to meet a bonus date.
- No-excuse clauses can strain owner-contractor relations.
- Difficulty in negotiating owner-initiated change orders and supplemental agreements due to the fixed timeline

Minnesota Law

- Minnesota law prevents public works contracts which include language “that waives, releases, or extinguishes the rights of a contractor to seek recovery for costs or damages, or seek an equitable adjust, for delays, disruption, or acceleration in performing the contract is void and unenforceable if the delay, disruption, or acceleration is caused by acts of the contracting public entity...”

Design-Build

Description

Design-build differs from traditional methods by overlapping design and construction, allowing construction to begin after only a portion of the design has been completed. Typically, design-build contracts are awarded after Mn/DOT has completed the layout (30% design), the environmental process is complete (or nearly complete) and right-of-way is in the process of being secured.

Design-build also has a different approach to risk management and project responsibilities. The contractor often has more responsibility for Quality Control (QC) and Quality Assurance (QA) of the project; Mn/DOT provides verification.

Project Selection

Mn/DOT's design-build program is currently tailored to large construction projects, but can be modified for smaller projects.

For projects being considered for design-build, contact Mn/DOT's Design-build director as soon as possible. The district and the design-build director will need to coordinate efforts to define the scope of work and begin the design-build team selection process. The selection of the design-build team often requires an extensive Request for Qualifications (RFQ) and Request for Proposal (RFP).

Benefits

- Shortened completion time by overlapping design and construction
- Construction can begin before all design details are final
- Greater innovation in selecting design, materials and construction methods
- Reduced claims due to design errors
- Accelerated response time and dispute resolution through a team effort
- Single contact point for quality, cost and schedule from design through construction
- Shortened project delivery time which can reduce user costs
- Use of best-value project award selection criteria which evaluates both technical and financial elements

Drawbacks

- High learning curve because design-build changes stakeholders' roles
- Parties are familiar with traditional methods
- Bidding process more expensive for design-build teams
- Coordination is more challenging due to faster pace

Project Types

Good Candidates

- Projects that need to be "fast-tracked" for public safety or political reasons
- Projects that allow for innovation in the design and construction efforts
- Projects with funding "sun-set" dates where traditional bid-build delivery may not be able to achieve these dates
- Projects where in-house staffing cannot meet the project demands
- Emergency projects with tight time constraints

Want more Information?

Contact Mn/DOT Design-build director at 651-366-4210.

Pay-for-Performance

Pay for Performance is a process where the contractor is paid for work on a graduated scale based on the quality and longevity of the work over time. Pay-for-performance specifications rely on final outcomes that can be measured against performance criteria set forth in the contract. If the contractor fails to meet minimum performance criteria, payment is withheld and corrective action is required.

Unlike traditional specifications when Mn/DOT prescribes the methods and/or means of producing or constructing an item, if the contractor complies with specifications, but the final outcome is not acceptable, the contractor is not responsible for corrective action.

Benefits

- Eliminates blame when there is a problem with the quality of a specific work item
- Shifts the risk of providing a quality product to the contractor
- Provides higher quality products for a longer duration

Drawbacks

- Time is needed after project completion to ensure product performance
- Longer project close-out (completing finals)
- Product monitoring and inspection is time-consuming
- Contractor may be required to finance a portion of the work during the performance period.

Pay-for-Performance Example

- Pavement markings (Used on I-494 Design-Build) – Measured reflectivity over time

How to use a Pay-for-Performance Items

Contract the Project Development Engineer at (218) 828-5822. The Office of Construction and Innovative Contracting (OCIC) can provide guidance and possibly some example specifications.

Warranties

Description

Warranties require contractors to guarantee all or portions of a construction project to be free of defects in materials and workmanship for a period of time. The contractor is required to correct deficiencies that occur during the warranty period.

Benefits

- Quality and durability of selected work items guaranteed for a specific time
- Longer timeframe for acceptance means agency can ensure contractor is performing high-quality work
- Decreased inspection level on warranty projects allows states to allocate resources elsewhere

Drawbacks

- Owner must ensure that warranty guidelines are reasonable and enforceable
- Warranty may not be collectable if guidelines are too restrictive or place undue burden on contractor
- Requires additional staffing to monitor the warranty after construction

Project Types

Warranties can be used on a variety of different construction items. Listed below are a few items that are good candidates for warranties.

Warranty Candidates

- Bituminous
- Grading (settlement)
- Culvert (settlement)
- Route and seal
- Concrete pavement

Warranty Period

- The length of the warranty period can vary on each project and warranty item.
- The longer a warranty, the more difficult to enforce.
 - **Recommended warranty length is to 2-3 years.**
 - Maximum warranty length: 5 years.

Warranty Enforcement

Monitoring the warranty is the responsibility of the district and not Mn/DOT's specialty offices such as the bituminous or concrete office. Specialty offices may assist with assessing the products during the warranty period, but the ultimate responsibility is with the district.

Warranty Dates

- Establishing a clear date when the warranty begins is essential to enforcing the warranty.

Recommendation: Warranty start date (Final Construction Acceptance [FCA]) should start when construction is complete and the roadway is open to the public without restrictions.

- **Long Term (Multi-Stage Projects)**

Consider starting the warranty at the completion of various stages

Example. A 3-year construction project has 2-year bituminous warranty.

Contractor completes concrete paving on eastbound in Stage 1 and switches traffic over to the new pavement. Two years later, the contractor completes westbound during Stage 2 and opens the roadway to un-restricted traffic. The warranty should be broken into two segments:

**Eastbound – Warranty period should begin at the end of stage 1
Westbound – Warranty period should begin at the end of stage 2**

- Vague terms such as “substantial completion” or “all work is completed” should not be used in the contract. These are items that are open to interpretation and can significantly change the FCA date.

Warranty Criteria

Warranty threshold criteria must be established within the contract in order for the warranty to be enforceable. In addition, Mn/DOT may also want to indicate corrective actions required if the threshold limits are exceeded.

- Warranty criteria should be developed in conjunction with Mn/DOT’s specialty offices (e.g. Bituminous or Concrete Units).
- Warranty criteria should be compared to other past projects. Enforcing a warranty will be difficult if criteria changes from project to project.

Warranty Specifications

- Warranty specifications should be similar in format. Several examples are available on Mn/DOT’s Innovative Contracting Website.
- Contact the specialty office or OCIC’s director of innovative contracting to obtain the latest specifications if you are using an established warranty specification item.

Contract Administration Considerations

- Establish a firm and clear date when the warranty period begins
- Notify the contractor of the date that the warranty period begins.
- Notify the OCIC Contract Administration Engineer prior to award to insure that the warranty bond is submitted.
- Notify Mn/DOT maintenance of the warranty. This will preclude maintenance from doing work that will void the warranty.
- Identify a district person to monitor the work during the warranty period. Mn/DOT specialty offices will **not** monitor the work during the warranty period.
- Review work periodically during the warranty period. Document deficiencies.
- Notify OCIC Contract Administration Engineer if you need to invoke the warranty bond during construction.

Warranties

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

CPM Schedules

Description

Critical Path Method (CPM) schedules are excellent tools for both the contractor and Mn/DOT to monitor contract time during a construction project. Unlike a traditional bar chart schedule, CPM schedules use logic to link activities and define the critical path and project duration.

Benefits

- Improved tool to monitor contract time
- Tool to assist with quantifying and mitigating project impacts
- Contractors are required to put together a well thought-out schedule.
- Provides an opportunity for owner “buy-in”
- Identifies sufficient weather and duration contingency

Drawbacks

- Requires experienced personnel to oversee the contractor’s schedule.
- Requires experienced contractor personnel to develop a schedule
- Owner acceptance of the schedule may assume unnecessary liability
- Additional contract requirements to enforce

Project Selection

CPM should be used on complex projects or projects with critical timelines. Due to the level of experience required for both the contractor and Mn/DOT, CPM schedules are not recommended on lower cost, simpler projects, at this time.

If CPM is not used, the contract should never waive the schedule requirements of Mn/DOT 1803.1. The schedule should contain a level of detail as to communicate a well-thought-out plan that matches the complexity of the job.

Good Candidates

- New construction and reconstruction projects (>\$5,000,000).
- Time-sensitive projects when commitments have been made.
- Phase or staged construction.
- Multi-year projects
- Projects with significant claim potential.
- A+B(+C) projects.
- Early completion incentive projects.

Poor Candidates

- Projects that do not require continual work effort.
- Projects that do not significantly impact the public
 - Traffic Management System (TMC)
 - Mill-and-Overlay Projects
 - Signal systems
 - Landscaping

HANDOUT

HANDOUT

Draft Special Provisions

Contact Mn/DOT's Project Control Engineer (651) 366-4239 for the latest special provisions. The special provisions can be modified to meet your project type.

Contract Administration Considerations

- Consider hiring a consultant to help with administering CPMs. This is highly recommended on large, complex projects that will require significant staffing.
- Mn/DOT staff should be properly trained in administering a CPM schedule. If not administered properly, a CPM schedule could significantly hurt Mn/DOT during a claim.
- Be consistent with administering the CPM special provision.
- Work with the contractor to revise the schedule if plan additions occur

Updated changes to contact information can be found at:
<http://www.dot.state.mn.us/const/tools/iccontacts.html> .

2.10.8 Business Impact Mitigation

Business impact mitigation is an important part of MnDOT's public involvement and project development processes, and is also addressed in Minnesota Statute 160.165. The purpose of business impacts mitigation is to:

- ✓ Involve businesses more in the project development process
- ✓ Keep businesses informed regarding project issues
- ✓ Help businesses understand a project and its potential impacts
- ✓ Mitigate construction impacts to businesses as feasible
(Includes reducing and, if practical, preventing negative impacts to businesses)



Business impact mitigation should occur from the start of TMP development (see Section **2.8**) so that important strategies are not initially overlooked and projects are coordinated.

The following document handout is information on Business Impact Mitigation from the Highway Project Development Process (HPDP) website. This can be obtained from:

www.dot.state.mn.us/planning/hpdp/

Business Impact Mitigation

Contact

Vanessa Levingston
vanessa.levingston@state.mn.us
Public Involvement Consultant
Office of External Partnering, MS 670
395 John Ireland Boulevard
St. Paul, MN 55155
Phone: (651) 366-3177

Purpose

Business impact mitigation is an important part of Mn/DOT's public involvement and project development processes, and is also addressed in [Minnesota Statute 160.165](#). The purpose of business impacts mitigation is to:

- Involve businesses more in the project development process
- Keep businesses informed regarding project issues
- Help businesses understand a project and its potential impacts
- Mitigate construction impacts to businesses as feasible
(Includes reducing and, if practical, preventing negative impacts to businesses)

Threshold Criteria

Is the project anticipated to cause *substantial business impacts*?

Substantial business impacts: Impairment of road access, parking, or visibility for one month or longer, for one or more businesses. (A one month impact is the **minimum** period that triggers required mitigation, but give due consideration regardless of the impact period).

If yes (substantial business impacts are anticipated):

- Designate a project Business Liaison
(Someone accessible that affected businesses can contact directly)
- Use the [Business Impact Mitigation Checklist](#) to ensure and to document business impact mitigation.
- Follow the guidelines in the *Guidelines* section (below).

Business Impact Mitigation

HPDP / Subject Guidance

Minnesota Department of Transportation

Responsibilities of the Business Liaison include:

- Consult with affected businesses before and during construction.
- Investigate means of mitigating project impacts to businesses.
Mitigation considered must include signage.
(Work with District Traffic Engineer)
- Provide information to the businesses before and during construction.
This information includes:
 - Project overview, duration and timetables
 - Lane and road closures
 - Detours
 - Access impacts
 - Customer parking impacts
 - Visibility
 - Noise, dust, and vibration
 - Public participation opportunities
 - Business Liaison and Project Manager contact information

Guidelines

Use the [Business Impact Mitigation Checklist](#)

Temporary Business Signing in Work Zones

(New approved language for Traffic Engineering Manual, 8-5.02.030)

Identify Businesses

Early in Scoping, identify small businesses in the project area (not just within the project termini). List potentially-affected businesses and their contact information – both property owners and tenants. This information may be found during other project activities (EA/EIS), or from local government resources or business organizations (e.g., Chamber of Commerce, community planning councils, etc.).

Contact Business Owners

Provide information on the project in written format. (See guidelines/examples in [Appendix F](#) of the [Report on Mitigation of Transportation Construction Impacts](#)).

Provide contact information for the Business Liaison (e.g., business card, project brochure, etc.).

Business Impact Mitigation

HPDP / Subject Guidance

Minnesota Department of Transportation

Work with businesses to identify potential concerns, and determine preferred methods for future project communications

Identify Potential Impacts

Identify potential impacts to businesses. Determine the resources needed to identify and evaluate potential impacts. Does the project have unique characteristics? Do businesses in the area have any unique issues? Is there a need for specific expertise? Does the project scale warrant extra resources?

Contact Local Governments

Consult with city and county governments to identify potential impacts and discuss potential mitigation measures.

Contact MN Department of Employment and Economic Development (DEED)

Contact [DEED](#) for assistance in determining a list of business-development organizations that may offer resources to affected businesses.

Contact Business Assistance Organizations

Contact representative organizations (e.g., Chamber of Commerce, business associations, etc.).

Create a Project Information Packet

Create a project information packet suitable for businesses. Include the following:

- Project overview, duration and timetables
- Anticipated changes/impacts, such as:
 - Parking
 - Traffic
 - Access
 - Lane and road closures
 - Detours
 - Visibility
 - Noise, dust, vibration
- Public participation opportunities
- Business Liaison and Project Manager contact information

Tailor the information packet to the project and businesses. Include information on why the project is being done (e.g., to address safety, capacity, etc.), to help businesses see project benefits.

Business Impact Mitigation

HPDP / Subject Guidance

Minnesota Department of Transportation

See examples of business outreach materials in the appendix of the [Mitigation of Transportation Construction Impacts Report](#) (the appendix can be found at [Road Construction Impacts on Small Businesses](#)).

Mn/DOT Tools/Resources

[Business Impact Mitigation Checklist](#)

[Traffic Engineering Manual \(TEM\)](#)

Go to Ch 8, Section 8-5.02.03 – Business Signing in Work Zones

[Temporary Business Signing in Work Zones](#)

(New approved language for TEM 8-5.02.030)

[Public & Stakeholder Participation – Hear Every Voice](#)

Mn/DOT’s Business Impacts Resources

Website: [Road Construction Impacts on Small Businesses](#)

Report: [Report on Mitigation of Transportation Construction Impacts](#)

Sample Business Outreach Materials (from the above report):

[Business Assessment Form](#)

[Business Assessment Summary](#)

[Business Outreach Meetings Summary](#)

[Business Packet Content](#) (Examples)

This sample packet includes the following:

Open for Business: A Workbook for Businesses

(Used on the TH 36 reconstruction project)

Highway 10 Connect Detroit Lakes Project

(Developed by Mn/DOT District 4 to describe project benefits)

3rd Avenue in Alexandria, MN Open for Business brochure

(Developed by Mn/DOT District 4 to communicate project-related detours)

Business Impact Mitigation

HPDP / Subject Guidance

Minnesota Department of Transportation

Medians & Access Management brochure

(Developed by Anoka County Highway Department to educate stakeholders on the need for transportation improvements)

TH 65 Detour Map

(Developed by Anoka County for the TH 54/County Road Reconstruction Project to communicate project-related detours)

Legal Basis

[Minnesota Statute 160.165](#): Mitigating Transportation Construction Impacts on Business

Agencies Involved

[Minnesota Department of Employment and Economic Development \(DEED\)](#)

Assists in determining a list of business-development organizations that may offer support or resources to affected businesses.

2.11 Pedestrian Treatments

When pedestrian facilities are impacted due to maintenance or construction, pedestrian accommodations must be provided to the maximum extent feasible. These accommodations may be made detectable and must have accessibility features up to the level of the disturbed route. Signage and devices, as necessary, must be provided to direct pedestrians safely through the work zone. A Temporary Pedestrian Access Route (TPAR) is a temporary pedestrian route that is fully accessible and meets the standards and guidelines.



The project does not necessarily need to be tearing up the pedestrian route to require a pedestrian detours. There may be issues, such as sand-blasting, that would be unsafe for pedestrians.

In addition, ensure that any pedestrian detour does not reroute past construction activities that could be harmful to them.

2.11.1 Background

The need to create an inclusive environment for pedestrian facilities is required by the Americans with Disabilities Act of 1990 (particularly in Title II and Title III). In order to accomplish this, MnDOT has chosen to adopt the guidelines published under the [“Public Right-Of-Way Accessibility Guidelines \(PROWAG\)”](#) first published in November 2005. This was adopted through [Technical Memo 10-02-TR-01 “Public Rights of Way Accessibility Guidance”](#). This Tech Memo applies to MnDOT construction/maintenance projects and work that other agencies/permit holders perform on MnDOT right of way. In addition, the [Minnesota MUTCD Part 6D](#) requires that pedestrian accessibility be maintained whenever the facility is restricted or realigned due to a construction or maintenance project. It applies to all public roads (and all private roads open to the public) in Minnesota. [Read more about accessibility and MnDOT.](#)

2.11.2 Public Rights-of -Way Accessibility Guidance Tech Memo

The following is a handout Technical Memorandum 15--02-TR-01. The memo can be downloaded from the following web link:

<https://techmemos.dot.state.mn.us/>

It is important that the holder of this manual checks the above link for updates.



MINNESOTA DEPARTMENT OF TRANSPORTATION
Engineering Services Division
Technical Memorandum No. 15--02-TR-01
February 10, 2015

To: Electronic Distribution Recipients

From: Nancy T. Daubengerger, P.E. *NTD*
Division Director, Engineering Services

Subject: Adoption of Public Rights-of -Way Accessibility Guidance (PROWAG)

Expiration and Purpose

This Technical Memorandum extends the expiration date of Technical Memorandum 10-02-TR-01 to February 10, 2017 unless superseded prior this date.

Guidelines

See Attachment: TM 10-02-TR-01 Adoption of Public Rights-of -Way Accessibility Guidance (PROWAG).

Questions

Any questions regarding the technical provisions of this Technical Memorandum can be addressed to the following:

- **Kristie Billiar**, ADA Implementation Coordinator, at **651-366-3174**

Any questions regarding publication of this Technical Memorandum should be referred to the Design Standards Unit, DesignStandards.DOT@state.mn.us. A link to all active and historical Technical Memoranda can be found at <http://techmemos.dot.state.mn.us/techmemo.aspx>.

To add, remove, or change your name on the Technical Memoranda mailing list, please visit the web page <http://techmemos.dot.state.mn.us/subscribe.aspx>

Attachment:

TM 10-02-TR-01 Adoption of Public Rights-of -Way Accessibility Guidance (PROWAG).

-END-

HANDOUT

HANDOUT

HANDOUT

HANDOUT



MINNESOTA DEPARTMENT OF TRANSPORTATION
Engineering Services Division
Technical Memorandum No. 10-02-TR-01
February 11, 2010

To: Distribution 57, 612, 618, and 650
From:  Khani Sahebjam, P.E.
Deputy Commissioner / Chief Engineer
Subject: Public Rights-of -Way Accessibility Guidance

Expiration

This Technical Memorandum supersedes Technical Memorandum 08-13-TS-05, and shall continue in force until February 11, 2015 unless superseded or suspended.

Implementation

The guidance contained in this Technical Memorandum is effective immediately. This Technical Memorandum affect projects in the design in construction phase and all work in Mn/DOT rights-of-way, including work done under permit or by agreement by other agencies or private entities.

These guidelines must be incorporated into all new construction, reconstruction, and alteration projects.

Projects that may directly or indirectly affect a qualified Historic Facility or District must be reviewed by the Cultural Resources Unit to determine if the proposed alteration may threaten or destroy the historic significance of the property. (See additional guidance under Guidelines)

A public agency is only exempt from fully meeting the Americans with Disabilities Act (ADA) standard where physical terrain or site conditions restrict the construction or altering the facility to the required standard. In such circumstances, the Design Project Manager must provide accommodation to the maximum extent feasible, document the instance with a memo signed by a direct supervisor, and place the documentation in the project file for reference and added to Mn/DOT's Transition Plan.

Accessibility improvements are to be planned, designed, and constructed to proceed at the same time as project roadway improvements. An addendum or supplemental agreement may be necessary for projects currently under construction.

If a Mn/DOT District Engineer determines that incorporating a new or updated accessible feature (or features) into a construction project will cause significant letting delays, the District Engineer (or designee) will direct the Resident Construction Engineer to issue a supplementary agreement to remedy the installation of the feature.

Local Road authorities are encouraged to adopt these or similar guidelines.

Introduction

Pedestrian facilities on public rights-of-way are required to be accessible to persons with disabilities through the following federal statutes:

- Section 504 of the Rehabilitation Act of 1973 (Section 504) (29 U.S.C. 5794) and
- Title II of the Americans with Disabilities Act of 1990 (ADA) (42 U.S.C. 59 12131-12164)

Title II of the ADA governs all state and local governments and their agencies and facilities, regardless of the funding source. All pedestrian facilities within the public rights-of-way designed, constructed, and/or altered on behalf of or for the use of a public entity must be readily accessible to and usable by persons

-MORE-

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Technical Memorandum 10-02-TR-01
Public Rights-of-Way Accessibility Guidance
February 11, 2010
Page 2 of 3

with disabilities. Mn/DOT's Strategic Plan and the Statewide Transportation Plan recognize accessibility as an integral part of the State's transportation networks.

Purpose

This Technical Memorandum sets forth interim planning and design guidance for accessible pedestrian facilities through the implementation of the Access Board's *Draft Public Rights of Way Accessibility Guidelines (PROWAG) 2005*. This implementation of PROWAG does not include the provisions for multilane roundabouts which are being analyzed by a separate roundabout committee.

The full text of PROWAG can be found at: <http://www.access-board.gov/prowac/draft.pdf>. A separate mailing of PROWAG will not be made.

Guidelines

Scoping

Project Managers are required to identify all accessible pedestrian facility needs in the scoping phase of project development for all new construction, reconstruction, and alteration projects.

New construction and reconstruction

All pedestrian facilities in new construction and reconstruction roadway projects are required to meet the accessibility guidance in PROWAG. All newly constructed and reconstructed standalone pedestrian facilities {e.g. trails, sidewalks, and sidewalk segments} located in the public right-of-way are required to meet the design guidance in PROWAG.

Alteration Projects

All alteration projects must, at a minimum, address all curb ramps in the curb radius by providing ramps where they are required and do not currently exist and to bring existing curb ramps into compliance with detectable warnings, cross slope, running slope, and landings. Curb ramp improvements must comply to the maximum extent feasible without regard to cost.

In an alteration project the scope of the initiating project determines which additional accessible features are included in the project and the extent to which additional accessible features must be addressed. Where pre-existing site conditions would require expanding the project's scope to purchase of right-of-way, relocate utilities, provide drainage work, etc. there is no expectation that the scope of work be expanded to provide the accessible feature. Pre-existing conditions include, but are not limited to, underlying terrain, right-of-way availability, underground structures, adjacent developed facilities, drainage, or the presence of a notable natural or historic feature. When other pedestrian facilities are within the right-of-way but are not part of the scope of the alteration project it is not required that work be done on those features. Any accessible feature that is not built to PROWAG standard must be documented with a memo signed by a direct supervisor, and placed in the project file and added to Mn/DOT's Transition Plan.

When developing the scope for an alteration project, project managers are encouraged to look at the total function and accessibility of the pedestrian network, including transit facilities such as bus stops and shelters. Project Managers are encouraged to identify and correct any accessibility barriers within the project limits to the maximum extent feasible, not just curb ramps. Addressing multiple elements or spaces within a facility may provide a cost-effective opportunity to make the entire facility, or a significant portion of it, accessible. Jurisdictions should consult their Transition Plans to determine if related work has been identified as needed to achieve program accessibility in existing facilities at the same location.

Alteration projects include all types of resurfacing work. Only the work types identified in the preventative maintenance section that follows are excluded from providing ADA improvements.

-MORE-

Technical Memorandum 10-02-TR-01
Public Rights-of-Way Accessibility Guidance
February 11, 2010
Page 3 of 3

Preventative maintenance projects

Pedestrian facility upgrades and accessibility improvements are not required on preventative maintenance projects where the primary purpose of the project is to maintain the existing roadway without increasing the structural capacity of the system.

Preventative Maintenance:

- Asphalt crack sealing
- Bituminous pavement seal coat
- Chip sealing
- Isolated concrete dowel-bar retrofit
- Concrete repair: Isolated, partial and/or full-depth repairs to restore functionality of the slab; e.g., edge spalls, corner breaks
- Concrete joint sealing
- Concrete pavement surface planing / diamond grinding
- Slurry or micro-surfacing
- Bridge substructure preservation: concrete and steel
- Bridge superstructure activities: Painting, joint replacement, bearing rehabilitation/replacement and barrier/guardrail/railing restoration.

Preventative maintenance projects are typically applied to pavements in good condition with significant remaining service life. These activities include actions that are intended to retard future deterioration and maintain the functional condition of the roadway without increasing structural capacity. In general, these improvements do not appreciably affect the roadway or pedestrian access route surface. A pedestrian access route is defined as: a continuous and unobstructed walkway within a pedestrian circulation route specifically designed for ADA –accessible travel.

Historical Properties

All new construction, reconstruction, and alterations that may directly or indirectly affect a qualified Historic Facility or District must be reviewed by the Cultural Resources Unit to determine if the proposed alteration may threaten or destroy the historic significance of the property. The Cultural Resources Unit, OES, will make a determination of impact and recommend accessible feature location and design solutions that will preserve the historic significance of the property.

Accessibility during construction

When a pedestrian access route is disrupted, closed, or relocated during construction, maintenance work, or other temporary condition, the alternative pedestrian access route shall include pedestrian ramps to maintain accessibility. See the [Minnesota Manual on Uniform Traffic Control Devices](#) (MN MUTCD) for further guidance on the requirements for establishing an alternative pedestrian access route for temporary traffic control. See also the "Pedestrian Accessibility Considerations in Temporary Traffic Control Zones Check List" in the MN MUTCD.

Questions

For information on the technical contents of this memorandum, please contact **Kristie Billiar, ADA Implementation Coordinator, at (651) 366-3174**

Any questions regarding publication of this Technical Memorandum should be referred to the Design Standards unit, designstandards.dot@state.mn.us. A link to all active and historical Technical Memoranda can be found at <http://techmemos.dot.state.mn.us/techmemo.aspx>.

To add, remove, or change your name and/or address on the Technical Memoranda mailing list, write or call the Mn/DOT Central Office Mail Room G-18 Transportation Building, 395 John Ireland Blvd., St. Paul, MN 55155, phone number (651) 366-3051.

-END-

2.11.3 Pedestrian Accessibility Considerations in Temporary Traffic Control Zones Check List

The following is a handout Pedestrian Accessibility Considerations in Temporary Traffic Control Zones Check List. The Checklist can be downloaded from the following web link:

www.dot.state.mn.us/trafficeng/workzone/wzmanual.html

It is important that the holder of this manual checks the above link for updates.

Pedestrian Accessibility Considerations in Temporary Traffic Control Zones Check List

This project has been reviewed for the various temporary traffic control provisions for pedestrian accessibility considerations contained in MN MUTCD Part 6. These provisions have been applied by knowledgeable persons after appropriate evaluation and engineering judgment. Considerations as listed below have been reviewed and where applicable, deviations and/or exceptions from Part 6 are documented.

Engineer's Signature : _____ Date : _____

Project Number: _____ Project Location: _____

IS IT REASONABLE TO EXPECT THAT PEDESTRIANS WILL BE PRESENT WITHIN THE VICINITY OF THE PROPOSED TEMPORARY TRAFFIC CONTROL ZONE?

Consider features such as schools, parks, paths / trails, transit stops, commercial property, residential areas, assisted living centers, office complexes, or other pedestrian generators in the area. Special events during the time of construction must also be considered, such as community festivals or other unusual situations that generate temporary pedestrian traffic.

- YES** - complete the following checklist
 NO - document your conclusion

MN MUTCD 6D.01 Standard:

The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a temporary traffic control zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

MN MUTCD 6D.02 Standard:

When existing pedestrian facilities (routes) are disrupted, closed, or relocated in a temporary traffic control zone, the temporary facilities **shall be** detectable and include accessibility features consistent with the features present in the existing pedestrian facility.

Guidance:

To accommodate the needs of pedestrians, including those with disabilities, many considerations should be addressed when temporary pedestrian pathways in temporary traffic control zones are designed or modified. Use the following checklist to document your decisions. **Refer to the MN MUTCD Part 6 for additional standards, and guidance and/or clarification on pedestrian and ADA requirements in temporary traffic control zones.**

- A. Will a reasonably safe, convenient, and accessible path be provided that replicates as much as practical the desirable characteristics of the existing pedestrian facilities?
 YES **NO (partially) document your decision**
- B. Will access be provided to current or temporary transit stops?
 YES **NO (partially) document your decision**
- C. Will all pedestrian facilities near temporary traffic control zones be separated from the worksite by appropriate barriers that maintain the accessibility and detectability for pedestrians with disabilities?
 YES **NO (partially) document your decision**

Figure 6D-1 Pedestrian Accessibility Checklist

(Sheet 1 of 2)

- ***HANDOUT***
- D. Will blocked routes, alternate crossings, sign and signal information be communicated to pedestrians with visual disabilities?
- Devices should include audible information devices, accessible pedestrian signals, or barriers / channelizing devices that are detectable to the pedestrians traveling with the aid of a long cane or who have low vision.
 - Where pedestrian traffic is detoured to a temporary traffic control signal, engineering judgment should be used to determine if pedestrian signals or accessible pedestrian signals should be considered for crossings along an alternate route.
- YES NO (partially) document your decision
- E. Will sidewalk(s) be closed properly with advance notification to the maintaining agency?
- Advance notification of sidewalk closures **shall be** provided to the maintaining agency.
 - Where pedestrians with visual disabilities normally use a closed sidewalk, a barrier that is detectable by a person with a visual disability traveling with the aid of a long cane **shall be** placed across the full width of the closed sidewalk.
- YES NO (partially) document your decision
- F. Will channelization with continuous edging be used to delineate a pedestrian pathway throughout the length of the facility such that pedestrians using a long cane can follow it?
- These detectable edgings should adhere to the provisions of Section 6F.68.
- YES NO (partially) document your decision
- G. Will a smooth, continuous hard surface that will not cause tripping or restrict wheelchair use be provided throughout the entire length of the temporary pedestrian facility?
- YES NO (partially) document your decision
- H. Will the width of the existing pedestrian facility be provided for the temporary facility?
- Where it is not possible to maintain a minimum width of 1500 mm (60 in) throughout the entire length of the pedestrian pathway, a 1500x1500 mm (60 x 60 in) passing space should be provided at least every 60 m (200 ft), to allow individuals in wheelchairs to pass.
- YES NO (partially) document your decision
- I. Will traffic control devices and other construction materials and features NOT intrude into the usable width of the sidewalk, temporary pathway, or other pedestrian facility?
- Signs and other devices mounted lower than 2.1 m (7 ft) above the temporary pedestrian pathway should not project more than 100 mm (4 in) into accessible pedestrian facilities.
 - Barricade rail supports should not project into pedestrian circulation routes more than 100 mm (4 in) from the support between 675 mm (27 in) and 2000 mm (80 in) from the surface. Ballast **shall not** extend into the accessible passage width of 1500 mm (60 in). Refer to Section 6F.63 for more details.
- YES NO (partially) document your decision
- ***HANDOUT***

Figure 6D-1 Pedestrian Accessibility Checklist

(Sheet 2 of 2)

May, 2005

6D-6

(This page is intentionally left blank)

3. TTC DEVICES

3.1 TTC Zone Devices

All traffic control devices used on MnDOT street and highway construction or maintenance work shall conform to the specifications of the latest edition of the MN MUTCD, the MnDOT Standard Specifications for Construction; and all other appropriate MnDOT technical manuals.

All devices shall be placed where they will convey their messages most effectively so the driver will have adequate time to react. All traffic control devices must be kept clean to insure proper effectiveness and retroreflectivity. All devices shall conform to the quality standards of the MN MUTCD Field Manual.

This section will summarize some of the common devices used for temporary traffic control.



This chapter discusses some common devices used for temporary traffic control. The devices listed are not intended to be an all-inclusive list.

The devices discussed in this section include the following:

- ✓ Traffic Signing (Section 3.2)
- ✓ Pavement Markings in Temporary Traffic Control Zones (Section 3.3)
- ✓ Channelizing Devices (Section 3.5)
- ✓ Temporary Traffic Barriers (Section 3.6)
- ✓ Portable Changeable Message Signs (PCMS) (Section 3.7)
- ✓ Portable Signal Systems (Section 3.8)
- ✓ Automated Flashing Assist Device (Section 3.9)
- ✓ Flashing Arrow Boards (Section 3.10)
- ✓ Approved Products List (Section 3.12)

3.2 Traffic Signing

TTC zone signs convey both general and specific messages by means of words or symbols and have the same three categories as all road user signs: regulatory, warning, and guide. Additional details on signing in a TTC area can be found in the MN MUTCD Parts 6F.2 through 6F.59 (See the MN MUTCD Handout starting on page 3-34).

3.2.1 Guide Signs

The placement and revision of guide signs is important to providing traffic control through work zones. However, placement of these signs should not interfere with necessary regulatory and warning signs. One commonly used guide sign is the advance notice guide sign. It is used to provide notice of when and where construction or maintenance will occur. There are two types of advance notice guide signs:

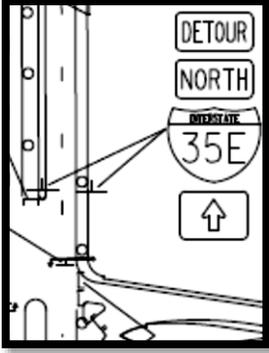
1. those signs that inform motorists of a date when construction and/or closures will begin, and
2. those signs that inform motorists of exact location(s) of construction that is underway.

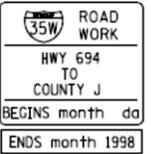
Beside addition of special guide signs to highway work zones it is important that in-place guide signs be covered or modified to reflect actual conditions. For example if a ramp is closed, all advance guide signs should be properly modified to inform the motorist of the closure. For short term closures this signing is impractical and warning signs may be used to provide this information.

Exhibit 3-1 Sample Guide Signs for TTC





"G" SERIES			
SIGN	SIGN NO.	COLOR	SIZE
	G20-2A	BLACK ON ORANGE	48" X 24"
	G20-X2	BLACK ON ORANGE	168" X 132"

3.2.2 Regulatory and Warning Signs

Refer to the MN MUTCD Parts 2 and 6 for standards on regulatory and warning signs in work zones. Portions of Part 6 are included as a handout in Section 3.13.

Exhibit 3-2 Sample Regulatory and Warning Signs





"R" SERIES			
SIGN	SIGN NO.	COLOR	SIZE
	R2-1	BLACK ON WHITE	48" x 60"

"W" SERIES			
SIGN	SIGN NO.	COLOR	SIZE
	W20-1	BLACK ON ORANGE	48" x 48"

3.2.3 Supplemental Sign Plates

Separate demountable plates were introduced to allow greater flexibility in some cases of work zone signing. However, demountable legend plates should meet all of the following standards:

1. Legend plates shall have proper legend.
2. The legends shall be of proper letter size and series in accordance with the sign they are being attached to.
3. They shall be properly fastened to the sign face and shall have plastic spacers behind them to provide a minimum clearance of 1/4 inch from the existing legend.
4. The plates shall be made from the same type of retroreflective material as the sign face.
5. The sign sheeting shall be oriented the same as the sign face material.

The following signs are allowed to utilize demountable legend plates as detailed in the Standard Signs Manual.

1. Lane Reduction Transition (Right or Left) Sign (W4-2)
2. MERGE w/Arrow Sign (W20-X3)
3. RIGHT/LEFT TWO LANES CLOSED Sign (W20-X13)
4. Vehicle Mounted Signs for Mobile Operations Sign (W21-X4)
5. RIGHT/LEFT LANE CLOSED Sign (W21-X5)

3.2.4 Temporary Sign Covering

When it is necessary to cover an in place sign, care must be taken to preserve the in place sign since some coverings may cause permanent damage to the sign face sheeting. Avoid the use of ropes, wire fasteners or strapping that may abrade the sign sheeting surface. Do not apply tape to the sign sheeting surface because sunlight will cause it to bond permanently. Pre-mask or application tape must be removed prior to exposure to sunlight. Do not use paper or plastic covers as heat and moisture entrapment can cause permanent damage to the reflective sheeting on the sign face.

Refer to the Sign Framing, Installation, and Covering Details at the following link:

<http://www.dot.state.mn.us/trafficeng/workzone/ttctemplates.html>.



The above referenced typical detail includes a designer note. This note is intended as information for the designer and it should be removed when using this sheet for a plan set.

3.2.5 Sign Panel Overlays

When it is necessary to cover an in place sign; care must be taken to preserve the in place sign. Coverings for overhead sign should be sheet aluminum and installed according to the sheeting manufacturer's instructions.



It is important to review all signing for the project. It is possible, or probably, that relevant signing exists outside of the project limits.

3.2.6 Additional Signing Information

For additional details on signing, refer to the MN MUTCD Part 6F handout starting on page **3-34**.

3.2.7 Business Signing

The following is a handout from the TEM Section 8-6.02. The TEM can be downloaded from the following web link:

www.dot.state.mn.us/trafficeng/publ/index.html

It is important that the holder of this manual checks the above link for updates.

8-6.01.04 Sheeting Requirements of TTC Devices

Some TTC devices (signs, channelizing devices, etc) include sheeting and there are requirements based on their use. The [Sign Sheeting Materials APL](#) includes the sheeting type requirements for each application/device.

8-6.01.05 Quality Standards of TTC Devices

The use of temporary traffic control zone devices subjects them to wear which does not occur with permanent devices. Although errant vehicles cause much of the damage to the devices, they also deteriorate in appearance from wear occurred during their storage, shipment, installation, relocation, and removal. Whenever a high number of these worn and damaged devices appear on the same project, the general appearance of the Temporary Traffic Control Zone deteriorates, reducing the level of safety provided to the workers, pedestrians, and traveling public.

Quality standards have been developed in an effort to offset the deterioration in the appearance of TTC devices. A determination of the condition of device quality should be made at several stages: while in storage, during preparation for delivery to the Temporary Traffic Control Zone, during initial set up, and periodically during the course of the work. Suppliers and contractors are encouraged to apply this standard prior to delivery of devices to the job site. Doing so will minimize agency involvement and reduce costs related to on-site replacement.

The Quality Standards section of the [Field Manual](#) includes Quality Classifications and Requirements for the majority of temporary traffic control devices, while considering the duration of the work zone. These standards are intended to address the day-to-day operations of traffic control within a Temporary Traffic Control Zone and are not meant to cover the needs of emergency situations.

8-6.02 Signs

The primary means by which the agency communicates with road users is through the use of signs. In order to be effective, there needs to be some distance between signs for the driver to be able to read, understand, and if necessary, react to the message communicated by the sign. Refer to the [MN MUTCD](#) Parts 2 and 6 for standards on signs.

8-6.02.01 Regulatory and Warning Signs

Regulatory signs communicate laws and warning signs communicate conditions of which the driver needs to be aware. These signs take precedence over guide signs when placed along a TTC route.

8-6.02.02 Guide Signs

The placement and revision of guide signs is important to providing traffic control through work zones. However, placement of these signs should not interfere with construction information signs or necessary regulatory and warning signs.

A. Construction Information Signs

One commonly used construction information sign is the advance notice guide sign. It is used to provide notice of when and where construction or maintenance will occur. There are two types of advance notice guide signs:

1. Signs that inform motorists of a date or a day when construction and/or closures will begin, and
2. Signs that inform motorists of exact location(s) of construction that is underway.

It is important that in-place guide signs be covered or modified to reflect actual conditions. For example if a ramp is closed, all advance guide signs should be properly modified to inform the motorist of the closure. For short term closures this signing is impractical and warning signs may be used to provide this information.

B. Temporary Business Signing in Work Zones

MnDOT construction projects have frequently caused disruption of traffic patterns in business areas and have sometimes caused difficulty and confusion for motorists attempting to reach specific businesses or groups of businesses. This has resulted in the development of temporary business signs for use in construction areas.

Temporary business signs are used to improve driver guidance, create safer operations, and reduce the impact on businesses created by construction activities and detours. When temporary business signs are deemed necessary, they should be included as part of the Traffic Control Plan (TCP) for the construction project.

Properly placed and designed temporary business signing may alleviate business impacts due to the construction project. Inadequately designed signs with illegible messages may become traffic safety hazards and reflect poorly on the project and the businesses. The guidelines described in the following sections for temporary business signing have been developed with a balance between the standards utilized for permanent signing and the need for temporary supplemental signing during construction to guide motorists to businesses that depend upon the normal traffic flow for customers. Allowing a sign for a specific business during a construction project will not be justification for permanent business signing as governed by other parts of the TEM and MN MUTCD.

Location and Installation of Temporary Business Signs

Temporary business signs, classified as supplemental guide signs, shall not interfere with permanent or construction signing. As commonly practiced, when space becomes restricted, the hierarchy for sign installation is regulatory, warning (permanent and construction), and guide signs, in that order, over supplemental guide signs. All temporary business signs should conform to the [MN MUTCD](#), this Manual, and Minnesota's standards for guide sign design to the extent practical and possible. All temporary business signing shall be removed when the impact to traffic ends, or at such time that permanent changes in the affected area are completed.

A system of temporary business signs should be designed such that multiple sign structures are not required in a single location. However, in situations where a second structure is required, the structures should be placed a minimum distance apart along the right-hand side of the roadway as shown in Table 8-1 below. Temporary business sign structures shall not be combined with other signs on one structure and shall be installed in accordance with current practices for temporary construction signs, including all crashworthy standards.

Posted Speed Limit	Minimum Distance Between Business Signs
< 45 mph	100 feet
45 - 55 mph	150 feet
> 55 mph	300 feet

Table 8-1 Temporary Business Sign Structure Spacing

Business signing should not be installed on freeways except as needed to replace existing signage for major traffic generators or regional shopping centers. Refer to [Chapter 6](#) of this Manual, Section 6-7.09 Supplemental Guide Signing Programs.

All temporary business signing that is proposed by MnDOT to guide traffic will be funded by MnDOT and installed by MnDOT or contract forces. Any additional temporary business signing proposed by the businesses and allowed by MnDOT shall be funded by the businesses. All temporary business signs shall comply with Minnesota Statutes, [Chapter 173, Signs and Billboards Along Highways](#). Any signs installed off state right-of-way shall conform to any local ordinances for advertising and/or business signing.

Temporary Business Signing Plan Guidelines

HANDOUT

The district should study all local businesses to estimate the extent of the work zone impact on each business and determine which should be classified as “traffic sensitive” or “regionally significant”. Traffic sensitive businesses may lose a large portion of their patrons to similar businesses with easier access. These businesses typically include fuel/convenience stores, restaurants/cafes/fast food, and lodging/camping. Other typical businesses may be those previously identified through Supplemental Guide Signing Programs. Regionally significant businesses are visited by non-local traffic, and the traveling public would be impacted if the access was reduced. These areas may include retail centers, transportation hubs, recreational centers, or geographical areas. A district may develop other uniform guidelines to determine whether a business is “traffic sensitive” and what types of “regionally significant” businesses may qualify in their regional part of the state.

Temporary business signing is an option for alleviating the project’s work zone impact on traffic sensitive or regionally significant business areas. MnDOT districts and partnering jurisdictions or organizations should work with businesses to suggest marketing plans to encourage continued customer patronage during construction. The marketing plans for individual businesses and/or business areas may include special advertisements via local media to inform customers of the appropriate directional information.

Types of Temporary Business Signs

Temporary business signing should be designed such that motorists are guided to the businesses through a series of easy decisions. Routes to the area businesses should be trailblazed in successive steps such that the signing may remain understandable and legible. The first type of business signing to be encountered should be generic in regards to the business names and provide the most practical signage that easily directs traffic to any type of business or group of businesses. These signs are Business Access signs or Business Service signs. To provide the motorist adequate information to make route decisions, Business Identification signs to specific business (or business area) locations or entrances may be required.

BUSINESS SIGN LETTER AND STRUCTURE SIZES:

Although many signage options are available for temporary business sign structures, there are maximum allowable sign structure sizes and minimum letter size requirements. The maximum height of the temporary business sign structure is determined by the U-Post Wind-load charts for typical Type ‘D’ sign sizes without using breakaway I-Beam construction. Refer to the following tables for typical sign structure sizes based upon recommended letter sizes and maximum number of messages allowed per structure.

The lettering sizes are chosen to provide legibility based upon traffic speed and typical distances to the signs. Although standard sign series fonts shall be used, the standard word and line spacing on the temporary business signs may be reduced to help fit longer business names onto the standard sign blanks. Refer to the following tables for recommended letter sizes. The alternate smaller letter sizes should only be used when a resulting narrower sign structure is required due to lateral space restrictions.

BUSINESS ACCESS SIGNS:

The BUSINESS ACCESS (G20-X6) sign should be provided as the primary trailblazing sign option. This sign is listed in the [MnDOT Standard Signs Manual](#) G-Series, in three standard sizes, making it readily available for short term detour and business access situations.

The G20-X6 sign may be supplemented with a plaque to provide guidance to a specific business center or portion of a business area through an understandable name/designation. A business area may be designated by a larger anchor business, geographic location, recognizable business area name, or a temporary project name or logo associated with local advertising.

Refer to Table 8-2 below for sizes.



Roadway Type	Posted Speed Limit	G20-X6	
		width	height
2 Lane - 2 Way	40 mph or less	36"	24"
	45 mph or greater	48"	36"
Multi-Lane	40 mph or less	48"	36"
	45 mph or greater	66"	48"

Table 8-2 Temporary Business Access Signs

BUSINESS SERVICE SIGNS:

A BUSINESS SERVICE (G20-X8) sign may be installed indicating the types of business services that are available, with a limit of six categories per sign. The major business service types include gas, food, lodging, camping, grocery, and shopping, but when space allows, other generic types may be included such as mall or hardware. If needed for clarification the sign may include a destination. The destination may be a city name, an area designation such as SOUTH SIDE, a street name, or shopping center name.

Refer to Table 8-3 below for typical font and letter heights for various roadway types.



Roadway Type	Posted Speed Limit	Recommended Font	Minimum Font	G20-X8	
				Typical Panel Width (1)	
				1 column	2 column
2 Lane - 2 Way	40 mph or less	5" C	4" C	42"	60"
	45 mph or less	5" C	5" C	42"	60"
Multi-Lane	40 mph or less	6" C	5" C	60"	72"
	45 mph or greater	8" C	6" C	84"	96"

Note (1): Widths may vary. See the examples which show various combinations of messages.

Table 8-3 Temporary Business Services Signs

HANDOUT

HANDOUT

HANDOUT

HANDOUT

BUSINESS IDENTIFICATION SIGNS:

Businesses may require temporary business identification signs. These are generally needed when the business' normal signing is not visible from the trailblazing route. These signs may be designed as either individual panels or as a single panel guide sign.

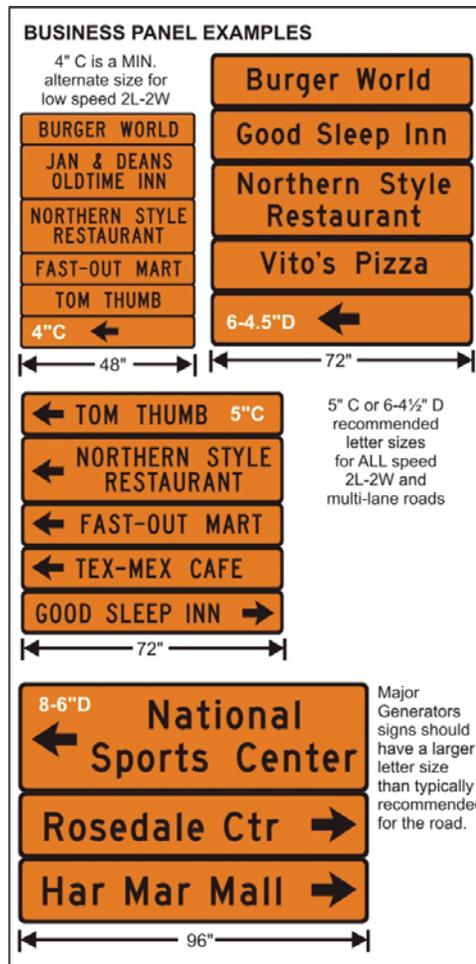
Examples of typical businesses that may be approved for identification are Major Traffic Generators such as shopping centers or recreational centers. Businesses, attractions, and other destinations currently signed through several of the "Requestor Pay" Supplemental Guide Signing Programs may be approved for signing.

Temporary Business Panel Signs:

Although the alternative font sizes and panel sizes are shown to provide flexibility when selecting a sign size, the following guidelines should be followed:

- Sign Assembly designs may inter-mix single line signs with double line signs while not exceeding the maximum assembly height.
- Business names should be listed in order of distance from sign. When arrows are used for each business, then the order should be through-left-right.
- Font sizes and series shall not be mixed on a sign assembly.

Refer to Table 8-4 on the following page for typical font and letter heights for various roadway types.



HANDOUT

HANDOUT

HANDOUT

HANDOUT

Font Series			2 Lane 2 Way		Multi-Lane	Major Generator (3)	
	Posted Speed Limit		≤ 40 mph	ALL	ALL	≤ 40 mph	ALL
C Series all caps	Minimum Letter Size		4"	5" (4)	5" (4)	6"	8"
	Single Line Panel Sizes (2)		48 x 9	72 x 12	72 x 12	72 x 12	96 x 15
	Double Line Panel Size (2)		48 x 15	72 x 18	72 x 18	72 x 21	96 x 27
	Characters per Line (5)	w/arrow (6)	12	14	14	11	11
		w/o arrow	15	18	18	15	15
D Series upper and lower case			2 Lane 2 Way		Multi-Lane	Major Generator (3)	
	Posted Speed Limit		≤ 40 mph	ALL	ALL	≤ 40 mph	ALL
	Minimum Letter Size		4 – 3"	6 – 4.5"	6 – 4.5"	6 – 4.5"	8 – 6"
	Single Line Panel Sizes (2)		48 x 9	72 x 15	72 x 15	72 x 15	96 x 18
	Double Line Panel Size (2)		48 x 15	72 x 21	72 x 21	72 x 21	96 x 30
	Characters per Line (5)	w/arrow (6)	11	11	11	11	11
		w/o arrow	15	15	15	15	15
Maximum number of Single Line Panels per Structure			6	6	5	4	4
Maximum number of Double Line Panels per Structure			4	6	4	3	2
Maximum Structure Assembly Height (1)			90"	84"	84"	84"	72"
NOTE 1	The maximum combined height of the panels is based upon the U-Post Wind-load Chart restrictions as published in the MnDOT Guide Sign Design Manual. However, for the 4" letter size, the max height has been restricted by number of panels rather than wind-load chart for legibility.						
NOTE 2	Three widths (48, 72, & 96") are standardized for typical post spacing. Panel widths and heights may be modified for usually low or high number of characters within a line of text.						
NOTE 3	Businesses qualifying as Major Traffic Generators and/or Regional Shopping Centers should be trail blazed with larger font sizes (reference TEM Chapter 6).						
NOTE 4	Reference the Minnesota Standard Signs Manual D9-X6 for the typical design details.						
NOTE 5	Approximation made using the recommended panel width with an average character width, with and without a standard directional arrow (left or right) included on the text line.						
NOTE 6	Refer to the Standard Signs Manual for proper arrow sizes depending upon orientation and placement.						

Table 8-4 Temporary Business Panel Signs

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Temporary Business Guide Signs:

A temporary business sign structure made up of individual panels may be replaced by a single panel guide sign. Although the maximum sign size remains the same as the combined panel signs, since the borders between business names may be removed, additional lines of text or a logo may be placed on the sign.

Design options may be utilized to optimize the legibility and clarity of the message. The options include but are not limited to:

- Use the business center name or refer to the anchor businesses' names.
- Use easily recognizable business center logos.
- Use a special project logo to identify business areas.
- Use horizontal lines or borders to separate names.
- Repositioning the arrow may provide for longer business names.

Refer to Table 8-5 on the following page for typical font and letter heights for various roadway types.



HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

	2 Lane – 2 Way		Multi-lane	Major Traffic Generator (3)	
	ALL Speeds	≤ 40 mph	ALL Speeds	ALL Speeds	≤ 40 mph
Minimum Font Size and Series (5)	6-4.5" D	4 – 3" D	6-4.5" D	8 – 6" D	6-4.5" D
Approx. No. of Characters per Line (1)	10	11	10	11	10
No. of Characters per Line w/o Arrow (2)	14	14	14	14	14
Maximum No. Lines of Text Allowed	6	6	5	4	4
Recommended Sign Panel Width (4)	72"	48"	72"	96"	72"
NOTE 1	Approximation made using the recommended panel width with an average character width, and a standard directional arrow (left or right) included on the text line.				
NOTE 2	Approximation made using the recommended panel width with an average character width, and the directional arrow is placed at the bottom of the sign replacing one of the lines of text.				
NOTE 3	Businesses qualifying as Major Traffic Generators and/or Regional Shopping Centers should be trail blazed with larger font sizes (reference TEM Chapter 6).				
NOTE 4	Three widths (48, 72, & 96") are standardized for typical post spacing. Larger signs may be designed if required.				
NOTE 5	Refer to the Standard Signs Manual for proper arrow sizes depending upon orientation and placement.				

Table 8-5 Temporary Business Guide Signs

8-6.02.03 Sign Mounting in TTC Zones

Refer to [MN MUTCD Part 6F](#) for standards on placement and mounting post-mounted and portable mounted signs. Whenever possible, all temporary signs should be post mounted using the currently accepted crashworthy supports as detailed in [Layout 20 of the TTC Plan Sheet templates](#).

Temporary signs that will remain in place for 30 days or less may be mounted on portable crashworthy support structures as defined in [MN MUTCD Part 6F](#). See [Minnesota Design Temporary Sign Supports passing NCHRP 350](#) for non-proprietary NCHRP Report 350 tested and approved temporary sign support structures.

Any portable signs placed on a sidewalk must:

- Allow a 48 inch clear walkway adjacent to the portable sign.
- Not be a tripping hazard. Any portable sign supports that extend into the walkway shall be no greater than ½ inch in height; if the support is greater than ¼ inch, then the support must be tapered between the ¼ inch and ½ inch dimensions. Alternatively, a detectable edge may be placed around the sign supports.
- Allow no portion of the sign to extend any greater than 4 inches into the clear walkway between the heights of 27 inches and 80 inches.
 - If there are sidewalk intrusion issues, consider post-mounting the temporary sign or use the [NCHRP 350 Compliant 5 Feet Portable Sign Stand for 48" x 48" Diamond portable sign](#).

Unless designed and crash tested with other ballasting systems, the ballast system for use on portable support mounted signs is sandbags. See [Section 8-6.05 Ballast](#) for more information.

8-6.02.04 Sign Overlays and Coverings

When it is necessary to cover an inplace sign, or place an overlay on existing or work zone sign, care must be taken to preserve the sheeting on the existing sign.

HANDOUT

HANDOUT

3.3 Pavement Markings in Temporary Traffic Control Zones

These guidelines apply to all MnDOT construction and maintenance activities. They will apply to any temporary traffic control zone of at least 350 feet in length on tangent sections and of 50 feet in length or longer on curves of 6 degrees or greater.

3.3.1 TEM Handout

The following is a handout from TEM Chapter 8, Section 8-6.03 regarding TTC Strategies and Controlling Criteria. The TEM can be downloaded from the following web link:

www.dot.state.mn.us/trafficeng/publ/index.html

It is important that the holder of this manual checks the above link for updates.

Items included in the handout are:

- ✓ Interim Pavement Marking Guidelines
- ✓ Temporary Pavement Markings Guidelines
- ✓ Temporary Raised Pavement Markers (TRPMs)
- ✓ Pavement Marking Removals
- ✓ Final Pavement Marking Guidelines

Partial Sign Overlay on TTC Sign

Separate demountable plates were introduced to allow greater flexibility in some cases of rigid work zone signing. Demountable legend plates should meet all of the following standards:

- Legend plates shall have proper legend.
- The legends shall be of proper letter size and series.
- The plates shall be properly fastened to the sign face and shall have plastic spacers behind them to provide a minimum clearance of 1/8 inch from the existing legend.
- The plates shall be made from the same type of retroreflective material as the sign face.
- The sign sheeting shall be oriented the same as the sign face material.

The following signs are allowed to utilize demountable legend plates as detailed in the MnDOT [Standard Signs Manual](#).

- Lane Reduction Transition (Right or Left) Sign (W4-2)
- MERGE w/Arrow Sign (W20-X3)
- RIGHT/LEFT TWO LANES CLOSED Sign (W20-X13)
- Vehicle Mounted Signs for Mobile Operations Sign (W21-X4)
- RIGHT/LEFT LANE CLOSED Sign (W21-X5)

Signing for moving operations also allows the use of demountable legend plates.

All work zone signs not listed above shall have the legend directly applied to the sign face as detailed in MnDOT specifications 3352.2.A.5.c Screen Processed Painted Legend and 3352.2.A.5.d Pigmented Plastic Film Legend. See MnDOT [Standard Specifications for Construction](#) for details.

The sign face and partial overlay shall maintain a uniform color and brilliance when viewed during both daytime and nighttime hours.

Temporary Sign Covering

When it is necessary to cover an in-place sign, care must be taken to preserve the in-place sign since some coverings may cause permanent damage to the sign face sheeting. Burlap, ropes, wire fasteners, or strapping should not be used as they may abrade the sign sheeting surface. Tape should not be applied to the sign sheeting surface because sunlight will cause it to bond permanently. Pre-mask or application tape must be removed prior to exposure to sunlight. Paper or plastic covers should not be used as heat and moisture entrapment can cause permanent damage to the reflective sheeting on the sign face.

Sign covers shall be rigid panel (such as sheet aluminum or plywood) and provide a minimum spacing of 1/8 inch (1 inch maximum) between the overlay panel and the sign. The spacers shall be a material that will not harm the sign sheeting face (such as plastic or rubber). For more detail on rigid sign covers for smaller signs, see [TTC Template Typical Temporary Sign Framing and Installation Details](#).

Sign Panel Overlays

When it is necessary to modify the legend of an in-place sign, care must be taken to preserve the sign. A legend revision, such as EXIT CLOSED, on an overhead sign should be sheet aluminum and installed with minimum 1/8 inch spacers. The spacers shall be a material that will not harm the sign sheeting face (such as plastic or rubber).

8-6.03 Pavement Markings in Temporary Traffic Control Zones

Through many work zones, traffic is moved from one lane to another. Traffic must be given clear direction as to which pathway to follow. Pavement markings such as center lines and edge lines provide direction for the

motorist. Pavement marking modifications are required in long term TTC Zones (which are in place for 3 days or more) that contain transitions or alignment change areas - see Layout 6J-1 in the [MN MUTCD](#). Edge lines through transition and alignment change areas shall be marked with temporary pavement markings with wet retroreflective/recoverable properties. See [Section 8-6.03.03 Temporary Pavement Markings Guidelines](#) for more details.

This section applies to all MnDOT construction and maintenance activities with TTC zones of at least 350 feet in length on tangent sections and of 50 feet in length or longer on curves of 6 degrees or greater. As stated in [Section 8-6.01.02 Approved Product List/Qualified Product List \(APL/QPL\)](#), pavement markings have a QPL (see [MnDOT Approved/Qualified Products List](#)) upon which only these pavement marking materials are allowed to be used on the State Highway system. This includes interim, temporary, and final pavement marking installations.

Following are the minimum requirements for pavement markings prior to opening a road to traffic (for exceptions, see [Section 8-6.03.02 Interim Pavement Marking Guidelines](#)):

- Multi-lane Undivided Roadways - all double yellow centerlines, lane lines, and broken line stripe pavement markings.
- Multi-lane Divided Roadways - all lane lines.
- Three and Five Lane Roadways with Two-Way Left Turn Lanes - all solid yellow lines with yellow, broken line stripe pavement markings and lane lines (for five lane sections).
- Two Lane Undivided Roadways - all centerlines.

8-6.03.01 Pavement Marking Definitions

See [Section 8-2.00 Glossary](#) for definitions of pavement markings used in TTC zones.

8-6.03.02 Interim Pavement Marking Guidelines

Interim pavement markings are any pavement markings that are not the final marking or are temporarily placed for staging purposes. Interim broken line stripe pavement markings shall use the same cycle length as final pavement markings (50 feet) and shall be a minimum of 2 feet in length. If the cycle length is not 50 feet and the section to be striped is greater than 350 feet in length but less than 1¼ miles in length, the interim marking shall match the cycle length at either end of the project. See [Interim Pavement Marking Template Sheets](#) and [MN MUTCD](#) Part 6, Figure 6F-8b.

Material specifications and tolerances for interim pavement markings will be the same as for final pavement markings, with the following exception. When final pavement markings are to be epoxy, and paint is used for interim solid lines, a 10-mil thick layer application of paint shall be used. In this case, beads should be applied at a rate of 6 lbs/gal. Removal of this thin layer of paint is not required prior to placing the epoxy.

Temporary raised pavement markers (TRPMs), when used as interim pavement markings, shall be installed in accordance with [Section 8-6.03.04 Temporary Raised Pavement Markers \(TRPMs\)](#) of this chapter.

In areas where paint or tape will not adhere to the surface (i.e. chip or sand seal operations), temporary raised pavement markers may be used to simulate a centerline as detailed in [Section 8-6.03.04 Temporary Raised Pavement Markers \(TRPMs\)](#) of this chapter.

The minimum required interim pavement markings shall be installed prior to opening the roadway to traffic and should not be left in place for more than 14 calendar days unless they meet the requirements of temporary or final markings. Minimum required interim pavement markings include:

- Multi-lane Undivided Roadways - all double yellow centerlines, interim lane lines, and interim broken line stripe pavement markings.
- Multi-lane Divided Roadways - all interim lane lines.
- Three and Five Lane Roadways with Two-Way Left Turn Lanes - all solid yellow lines with yellow interim broken line stripe pavement markings and interim lane lines (for five lane sections).

- Two Lane Undivided Roadways - all centerlines, turn lanes, bypass lanes, and outlines for any painted islands.

If the Average Daily Traffic (ADT) is less than 1500 and the Project Engineer determines that it is not possible or practical to install interim pavement markings on Two Lane Undivided Roadways before opening the road to traffic, Figure 6F-8a in Part 6 of the [MN MUTCD](#) may be followed, also shown in [Interim Pavement Marking Template Sheets](#). If the ADT is greater than 400, then this layout shall be limited to three days.

8-6.03.03 Temporary Pavement Markings Guidelines

Typically, the markings placed for staging purposes on long term projects are temporary, meaning they will eventually be covered by surfacing materials or removed completely. The material used for temporary pavement markings should be selected based upon whether the marking is placed on the final surface (such as a lane shift crossing the final surface) or not, as well as how long the marking needs to last. Temporary pavement markings are to be installed to the same specifications as final pavement markings. To increase pavement marking conspicuity in work zones, temporary pavement markings in tapers and transitions should be installed at a minimum of six inches in width. Removable preformed pavement marking tape, paint, or epoxy are typically used.

Temporary or final markings and all other pavement markings including edge lines, channelizing lines, lane reduction transitions, gore markings, and other longitudinal markings, and the various non-longitudinal markings (stop lines, railroad crossings, crosswalks, words, symbols, etc) should be installed within 14 calendar days.

The time limitations for installing temporary or final markings begin when construction operations first remove the in-place markings from the roadway. The time limitations restart any time temporary or final markings are restored.

Edge lines through transition and alignment change areas shall be marked with temporary pavement markings with [Wet Retroreflective/Recoverable \(WR\) Properties](#). Transition and alignment change areas include: lane closure tapers, lane shifts, sharp curves, shifts onto temporary roadways or detours, etc. The following WR pavement markings consist of a combination of one or more products to achieve the required properties.

- Temporary pavement marking tape lines supplemented with temporary raised pavement markings (TRPMs).
- Temporary WR pavement marking tape lines.
- Pavement marking paint or epoxy lines supplemented with TRPMs.
- Pavement marking paint or epoxy lines with WR elements

As with other pavement markings, there is an [APL for TRPMs](#) and a [QPL for WR Pavement Markings](#).

There is a high risk of damage or removal of WR products by snow plowing operations. Therefore, pavement markings which are applied for winter carry-over in transition and alignment change areas should be applied as wide markings and additional WR properties may be omitted.

8-6.03.04 Temporary Raised Pavement Markers (TRPMs)

TRPMs are normally used with construction zone markings. They are commonly referred to as “temporary markers” or “TRPMs”. TRPMs are glued to the roadway with a bitumen or epoxy adhesive. Most markers of this type consist of a plastic body with a reflective surface.

TRPMs are to be replaced when they become damaged or have been removed by traffic. These markers will be inspected on a routine basis and replaced as necessary. TRPMs shall not be used as an interim pavement marking between October 1 and May 1 because of snowplowing operations.

Another general type of temporary raised marker is the “peel and stick” type. These typically have a paper backing that is removed to expose a butyl/adhesive pad. The marker is then applied to the roadway and firmly pressed in place.

TRPMs may be used to simulate solid lines without the use of any other pavement marking material, or they may be used to supplement other types of pavement markings. See [Interim Pavement Marking Template Sheets](#) and Layout 6J-2 in Part 6 of the [MN MUTCD](#) for guidelines on how to use TRPMs to simulate and supplement pavement markings.

TRPMs are classified into four types as follows:

- TRPM Type 1 - These markers are acceptable for use on all roadways for short or long term projects. They may be used to supplement or simulate solid or broken lines.
- TRPM Type 2 - These markers are acceptable for use on projects with Average Daily Traffic (ADT) of less than 3000. They may be used to supplement or simulate solid or broken lines.
- TRPM Type 3 - These markers are acceptable for use on all roadways for short or long term projects. They may be used to supplement solid or broken lines. These markers are NOT acceptable to simulate solid or broken lines. If these markers do not conform to the color requirements herein they shall not be placed directly on the pavement marking line.
- TRPM Type 4 - These markers are acceptable for use on chip or sand sealing operations. These markers are designed to be placed prior to the sealing operation with a protective cover that is removed after the seal coat is applied.

As with other pavement markings, there is an [APL for TRPMs](#).

8-6.03.05 Pavement Marking Removals

The removal of pavement markings must be done with care, especially within a TTC zone where excessive scarring can mislead drivers. See [TEM](#) Chapter 7, Pavement Markings for more information.

8-6.03.06 Final Pavement Marking Guidelines

Standard final striping plan sheets shall be included in each Project Construction Plan. Refer to [TEM](#) Chapter 7, Pavement Markings for more information.

8-6.04 Channelizing Devices

Overall channelizing device standards and guidelines can be found in the [MN MUTCD](#), Part 6. Refer to this section for the categorization and different types of channelizing devices. More specific standards are found on Standard Plate 8000j, which shall be used in construction projects.

As with other devices, all channelizing devices need to be crashworthy. There are proprietary and non-proprietary crashworthy designs for barricades available. Documentation should be provided from the vendor/contractor to verify crashworthiness. See the [MnDOT Type III Crashworthy Barricade Designs](#) for designs of non-proprietary crashworthy Type III barricades.

8-6.05 Ballast

Ballast is important so that TTC devices have limited movement due to wind caused by weather or vehicles. It is also important that the entire system of the device and ballast is crashworthy.

Sandbags are the most common ballast for TTC devices. When sandbags are used, they should be constructed so they will not readily rot or allow the sand to leach when exposed to the highway environment. Also, the sandbag should be constructed of a material which will allow the bag to break and disperse its contents when struck by an errant vehicle. Sandbags should not be filled to the extent that they become too heavy to be readily moved when a traffic control device is relocated. The number and size of sandbags used as traffic control device ballast should be kept to the minimum needed to provide stability for the device. During freezing conditions, the sand for bags shall be mixed with a deicer to prevent the sand from freezing. Sandbags shall not be suspended from the traffic control device. For proprietary devices, check with the manufacturer for ballasting requirements.

3.4 Pavement Marking Supplemental Information to the TEM

3.4.1 Definitions

See the Glossary of Terms on page 1-3.



Pavement marking plan sheets are found in the Pavement Marking section of the plan set, not the traffic control section.

3.4.2 Interim Pavement Marking Guidelines

For the latest notes on what is required for interim pavement markings, refer to the notes on the “Interim Striping” pdf at: <http://www.dot.state.mn.us/trafficeng/pavement/typicaldetail/index.html>.

For interim pavement markings, what is required is, centerline, no passing zones, painted islands, lane lines (including turn lane lines) and edge lines after 14 days. Does not require cross hatching. Interim markings has to go where the final PM will go.



The easy way to determine quantities for Interim Pavement Markings on a divided road is to take the permanent striping quantities and subtract the left edge line.

3.4.3 Temporary Pavement Marking Guidelines

Refer to the TEM for full details.

Wet Retroreflective Properties

A temporary pavement marking that has wet retroreflective properties (commonly called Wet Retroreflective Pavement Markings) retains retroreflectivity, presence, and color when wet or submerged in water. The following wet retroreflective pavement markings consist of a combination of one or more products to achieve the required properties:

1. Solid temporary pavement marking tape lines supplemented with TRPMs (temporary raised pavement markings) or
2. Solid temporary wet retroreflective pavement marking tape lines or
3. Solid pavement marking paint or epoxy lines supplemented with TRPMs (temporary raised pavement markings) or
4. Solid wet retroreflective pavement marking paint or epoxy lines.

For approved Removable Tape, TRPM, and Wet Retroreflective Removable Tape products, see the Temporary Traffic Control Approved Product List on the Qualified Products web page listed below.

For approved Wet Retroreflective Marking Paint or Epoxy products, see the Pavement Markings Approved Product List on the Approved Products web page listed below.

There is a high risk of damage or removal of wet retroreflective products by snow plowing operations. Therefore pavements markings which are applied for winter carry-over in transition and alignment change areas should be applied as double width markings and additional wet retroreflective properties may be omitted.

3.4.4 Final Pavement Markings

Refer to the TEM Chapter 7 on Pavement Markings, for more information on final pavement markings.

3.4.5 Temporary Raised Pavement Markers (TRPMs)

TRPMs may be used to simulate solid lines without the use of any other pavement marking material, or they may be used to supplement other types of pavement markings. See the Standards for TRPMs as posted on the Approved Products web page for guidelines on how to use TRPMs to simulate and supplement pavement markings. The website is:

www.dot.state.mn.us/products/pavementmarkings/reflectiveelementsforpavementmarkings.html.

3.4.6 Pavement Marking Removal Scarring

Markings that are no longer applicable for roadway conditions or restrictions and that might cause confusion for the road user shall be removed or obliterated to be unidentifiable as a marking as soon as practical.

Overly aggressive removal techniques leave scars that can confuse drivers during night and wet conditions. Do not allow excessive scarring. Any excessive scarring should be repaired to avoid wet weather confusion.

Exhibit 3-3 Pavement Marking Removal Scarring



Typically, sandblasting, grinding, and high pressure water jet have been used to remove markings, but the results at times have been less than desirable. For larger projects, truck-mounted, hydraulically controlled, dual scarifying drums with a built-in vacuum system could be considered. A trailing sweeper/vacuum unit recovers the coarser paint/surface waste mixture.

Markings may be temporarily masked with black tape (not paint) until they can be removed or obliterated.

Lines and scars from line removal may look different at night or in an east/west roadway do to time of day and overcast conditions. Nighttime inspections are desirable to determine that the pavement markings are visible and understandable under day and night conditions.

Exhibit 3-4 Spec Book Section 2102 – Pavement Marking Removal

2102 PAVEMENT MARKING REMOVAL

2102.1 DESCRIPTION

This work consists of removing temporary and permanent pavement markings, except for removable preformed plastic pavement markings, that conflict with revised traffic patterns.

2102.2 MATERIALS — (BLANK)

2102.3 CONSTRUCTION REQUIREMENTS

Before making a change in traffic pattern, remove conflicting pavement markings as required by the contract and as directed by the Engineer without damaging the pavement structure or surface texture. If determined by the Engineer, repair damaged areas as directed by the Engineer at no additional cost to the Department.

Control or restrict operations to avoid exposing traffic to hazardous conditions in accordance with 1701, "Laws to be Observed," 1707, "Public Convenience and Safety," and 1717, "Air, Land, and Water Pollution." Remove expended materials or agents used in the pavement marking removal process from the pavement surface as the work progresses. Dispose of removed marking material in accordance with 1701, "Laws to be Observed," and 1717, "Air, Land, and Water Pollution."

Removed pavement marking material shall become the property of the Contractor.

2102.4 METHOD OF MEASUREMENT

The Engineer will measure *Pavement Marking Removal* by area or length of the original markings as removed.

The Engineer will measure removal areas on the basis of nominal widths and actual lengths as originally applied and still visible at the time of pavement marking removal. The Engineer will enclose irregularly shaped markings within rectangular boundaries of least dimension as determined by the Engineer.

The Engineer will measure removal length by the actual length of each 4 in [100 mm] wide pavement marking removed. The Engineer will measure longitudinal pavement marking removal quantities greater than 4 in [100 mm] wide based on a ratio of actual pavement marking width relative to 4 in [100 mm]. The Engineer will not include the gap between the broken lines in the removal length measurement.

The Department will include the cost of removing removable preformed pavement marking tape with the relevant contract unit prices in accordance with 2581, "Removable Preformed Pavement Marking Tape."

2102.5 BASIS OF PAYMENT

The contract unit price for *Pavement Marking Removal* includes the cost of obliterating the markings as required by the contract and for restoring the original pavement texture as directed by the Engineer.

Unless the contract requires otherwise, the Department will pay for the removal of markings of all types under a single contract item.

The Department will pay for pavement marking removal on the basis of the following schedule:

Item No.:	Item:	Unit:
2102.501	Pavement Marking Removal	square foot [square meter]
2102.502	Pavement Marking Removal	linear foot [linear meter]

It is suggested that on projects where pavement scarring and leaving deceptive markings is a potential concern, and/or you know the inspector will ask the Contractor to utilize water-blasting and/or sandblasting equipment that it should be spelled out ahead of time in the Special Provisions. This will help ensure the job is bid appropriately, while also giving the inspector the assurance that the Contractor has clear expectations.

The language below is what is currently provided in MnDOT’s Boiler Plate Special Provisions for those situations.

Exhibit 3-5 Special Provisions – Pavement Marking Removal (No Lead)

Use S-2 when there is any pavement marking removal on the job.

S-73.2 MnDOT 2102.3 is hereby deleted and replaced with the following:

Before making a change in traffic pattern, remove conflicting pavement markings as required by the contract and as directed by the Engineer without damaging the pavement structure or surface texture. If determined by the Engineer, repair damaged areas as directed by the Engineer at no additional cost to the Department.

Remove pavement markings on the basis of nominal widths and actual lengths as originally applied and still visible at the time of pavement marking removal. Remove irregularly shaped markings by enclosing them within rectangular boundaries of least dimension as determined by the Engineer.

Control or restrict operations to avoid exposing traffic to hazardous conditions in accordance with 1701, "Laws to be Observed," 1707, "Public Convenience and Safety," and 1717, "Air, Land, and Water Pollution." Remove expended materials or agents used in the pavement marking removal process from the pavement surface as the work progresses. Dispose of removed marking material in accordance with 1701, "Laws to be Observed," and 1717, "Air, Land, and Water Pollution."

Removed pavement marking material shall become the property of the Contractor.

Construction needs to choose which option shown below is to be used.

All pavement marking removal shall be done utilizing either waterblasting or sandblasting equipment. GRINDER-TYPE CUTTING HEADS SHALL NOT BE USED for pavement marking removal.



OR

All Pavement marking removal shall be done utilizing either grinding, water-blasting, or sandblasting equipment.

OR

All Pavement marking removal shall be done utilizing water-blasting equipment.

Another option includes using Temporary Raised Pavement Markers to simulate markings or temporary tape. Temporary tape is more expensive than liquid markings, but can be cost-effective. To illustrate this issue, MnDOT had a project with significant scarring on a concrete freeway from different traffic stages during construction. This required planning the entire concrete surface to remove the scars before installing final markings and fully opening the roadway to traffic.

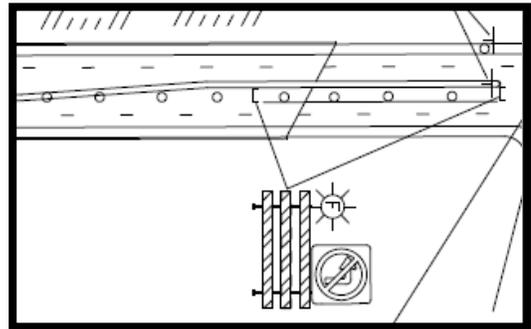
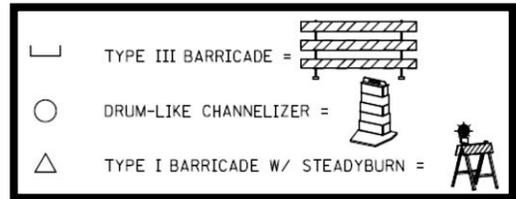
When using temporary tape, MnDOT requires the use of primer, regardless of product specifications. The following language is found in the Special Provisions for all temporary tape uses:

"The Contractor will be required to use primer prior to the installation of all tape regardless of weather or pavement conditions or Manufacturer's specifications. All other installation procedures and materials used shall follow the manufacturer's specifications. Application of the primer shall be incidental to the cost of installing the tape."

3.5 Channelizing Devices

Channelizing devices are classified into 3 types. Type A channelizing devices include cones, surface mounted delineators, tubular delineators, weighted channelizers, and opposing traffic lane dividers. Type B channelizers include drums, Type I & II barricades and direction indicator barricades. Type C channelizers include Type III barricades. Refer to the MN MUTCD Part 6 for proper spacing, applications, sizes, color, and retroreflective sheeting requirements. See the Approved Products web page listed below for examples of NCHRP Report 350 tested and approved Type III barricades.

Exhibit 3-6 Channelizing Devices for TTC



3.5.1 Surface Mounted (Centerline) Delineators

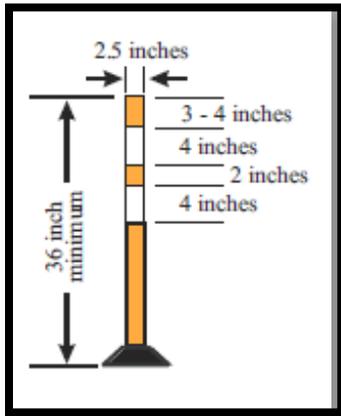
Surface mounted delineators are delineation devices that may be used as center lane dividers to separate opposing motor vehicle traffic on a two-lane, two-way operation.

Surface mounted delineators may also be used to provide other traffic delineation. Refer to the MN MUTCD Part 6F.65.1 and the APL at <http://www.dot.state.mn.us/products/temporarytrafficcontrol/index.html>.

In addition, there are separate pay items for “Tube Delineator” and “Replace Tube Delineator”. The “Replace” is used to for delineator hits, deterioration, etc.

TUBE DELINEATOR	EACH
REPLACE TUBE DELINEATOR	EACH

Exhibit 3-7 Surface Mounted Delineators for TTC



3.5.2 Channelizer Quick Reference Chart

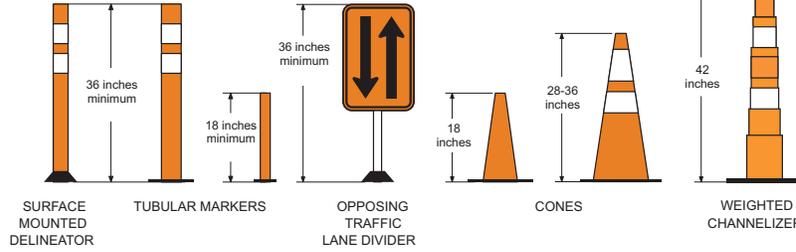
The following handout is a reference chart on channelizer devices from Park 6K of the MN MUTCD (Field Manual):

<http://www.dot.state.mn.us/trafficeng/workzone/wzmanual.html>

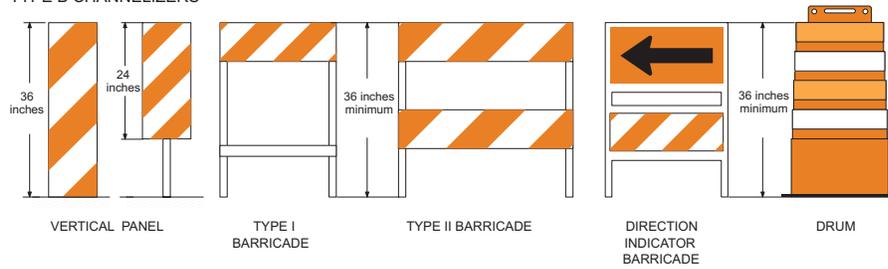
HANDOUT

HANDOUT

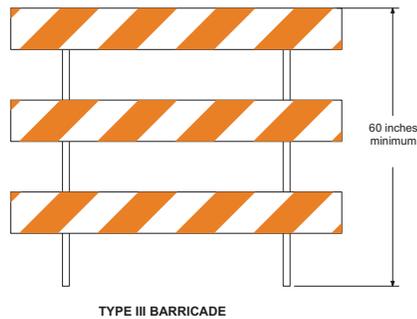
TYPE A CHANNELIZERS



TYPE B CHANNELIZERS



TYPE C CHANNELIZER



Channelizing Devices

Figure 6K-11

6K-xxix

January, 2014

HANDOUT

HANDOUT

3.6 Temporary Traffic Barriers

A number of temporary barriers are used for temporary traffic control. Approved temporary barriers are listed at, www.dot.state.mn.us/products/temporarytrafficcontrol/temporarybarriers.html. Proper temporary barrier system selection and design involves the consideration of a number of specific factors including:

- ✓ The NCHRP Report 350 test level needed to accommodate expected impact conditions (devices are classified into categories in the report based on characteristics such as the weight of the device).
- ✓ Duration and ease of installation, maintenance, and removal.
- ✓ Exposure and safety risks for workers and road users during installation, repair, and removal.
- ✓ Expected frequency and severity of impacts (based in part on crash data).
- ✓ Available space for barrier installation and lateral deflection (perpendicular to traffic flow).



The AASHTO Manual for Assessing Safety Hardware (MASH) is the new state of the practice for the crash testing of safety hardware devices for use on the National Highway System (NHS). It is phasing out NCHRP Report 350 and older versions of MASH.

Per the MN MUTCD Section 6F.85 (see section **1.1**), there are five primary functions of temporary traffic barriers:

- ✓ To keep motor vehicle traffic from entering work areas, such as excavations or material storage sites;
- ✓ To separate workers, bicyclists, and pedestrians from motor vehicle traffic;
- ✓ To separate opposing directions of motor vehicle traffic; and
- ✓ To separate motor vehicle traffic, bicyclists, and pedestrians from the work area such as false work for bridges and other exposed objects; and
- ✓ To protect drop-offs of greater than 12 inches on longer term projects when a suitable buffer lane cannot be provided.

3.6.1 Crashworthiness

Crashworthy is a characteristic of roadside devices that have been successfully crash tested in accordance with a national standard such as the National Cooperative Highway Research Program Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

All temporary traffic control devices, including Type A and Type B channelizing devices, Type III barricades, ballast systems and sign support structures, used on any roadway open to public travel shall be crashworthy when installed facing traffic or turned away from traffic. FHWA policy requires that all roadside appurtenances, including temporary traffic control devices, have been successfully crash tested in accordance with the National Cooperative Highway Research Program (NCHRP) Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features" or the American Association of State Highway and Transportation Officials (AASHTO) "Manual for Accessing Safety Hardware (MASH)."

Some key points regarding MASH are:

- ✓ All new testing will be done following MASH evaluation techniques.

- ✓ Hardware accepted under NCHRP Report 350 is appropriate for replacement and new installation. Retesting is not required.
- ✓ As of January 1, 2011, all new products must be tested using MASH crash test criteria for use on the National Highway System (NHS).

3.6.2 Anchoring

To control or eliminate lateral deflection close to pavement edge drop-offs and in other situations where deflection space is limited, barrier sections may be anchored to the pavement. On bridge decks, overpasses, retaining walls or any other large edge drop off where no deflection can be accommodated, anchoring of the barrier by bolting it is required. Placing an anchor behind a PCB is not allowed, as it does not provide significant rollover resistance and could result in the barrier overturning on impact.

Also note that the Bridge Department has a memo, “Interim Guidance for Installation of Temporary Barriers on Bridges and Approach Panels”. This can be found at, www.dot.state.mn.us/bridge/pdf/lrfdmanual/memo/Memo2011-03.pdf.



It is important to work with the Bridge Office to get a recommendation on anchoring on bridges.

3.6.3 Portable Precast Concrete Barrier (PPCB)

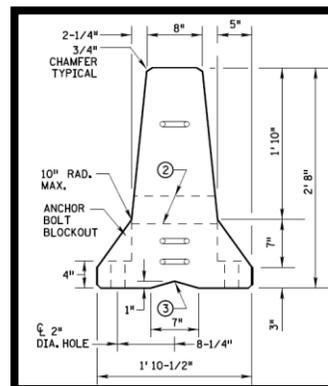
The majority of temporary barriers used in Minnesota are portable precast concrete barriers. See the MN MUTCD Part 6 for application information and spacing requirements (200' is the minimum distance allowed).

MnDOT has no Approved Products List for these devices. However, MnDOT has an approved specification found at,

<http://standardplates.dot.state.mn.us/StdPlate.aspx>,

Standard Plates 8337C1, 8337C2 and 8337C3. Other barrier designs will be allowed if certified by the FHWA as meeting or exceeding the NCHRP 350, TL-3. Different barrier designs shall not be connected together.

Exhibit 3-8 Portable Precast Concrete Barriers for TTC



3.6.4 Moveable Barrier

Exhibit 3-9 Moveable Barrier System for TTC



Source: Barrier Systems Inc.



Consider the placement of the moving machine in non-use operation.

3.6.5 Portable Non-Concrete Barrier

In Minnesota and throughout the US, the PPCB is the most widely used positive protection device in use today. The PPCB does have a low initial cost and are readily available; however, they also are quite heavy. This creates issues when required on a bridge project and during transport. Other barrier systems (such as steel) are available that are typically lighter. Generally these systems have a higher upfront cost but may be advantageous in some situations such as a bridge project. A listing of the approved portable non-concrete barriers are found on the APL, <http://www.dot.state.mn.us/products/temporarytrafficcontrol/temporarybarriers.html>.

Exhibit 3-10 Portable Non-Concrete Barriers (Steel)



3.6.6 Water-Filled Barrier

Water-filled barrier systems are also shown on the APL. The barriers shall be certified by the FHWA as meeting or exceeding the requirements of the NCHRP 350, TL-3. The installer shall install according to the manufacturer's installation instructions.

Exhibit 3-11 Water-Filled Barrier



Note that there are also longitudinal channelizing devices for pedestrians. Information can be found at,

<http://www.dot.state.mn.us/trafficeng/workzone/apr.html>.

3.6.7 Barrier End Treatments

All upstream leading ends that are present shall be appropriately flared or protected with properly installed and maintained crashworthy cushions. Crash cushions are systems that mitigate the effects of errant vehicles that strike obstacles, either by smoothly decelerating the vehicle to a stop when hit head-on, or by redirecting the errant vehicle. A typical barrier end treatment can be found at, <http://www.dot.state.mn.us/trafficeng/workzone/doc/PCBendtreatment.pdf>.



It is important to attenuate both ends of barriers on undivided roadways as the barrier can be impacted from both directions.

Barrier Flare

The barrier run may be flared to the limits of the clear zone. The existing shoulder slope or median slope may be too steep for this type of installation. If this is the case, temporary grading should be provided or a different end treatment should be used.

Stationary Crash Cushions

This section discusses stationary crash cushions used to protect the end(s) of temporary traffic barriers in highway work zones. The crash cushions shall be one of two types.

1. Non-Redirective (Gating)
2. Redirective (Non-Gating)

A gating device is one designed to allow controlled penetration of the vehicle when impacted between the end and the beginning of the length of need (LON) of the device. The widely used breakaway cable terminal

(BCT) is a gating device. A non-gating device is designed to contain and redirect a vehicle when impacted downstream from the end of the device. A terminal or crash cushion with redirection capabilities along its entire length is a non-gating device.



Refer to the manufacturers specifications for information on installation for various speeds.

Refer to the Approved/Qualified Products (APL/QPL) for the acceptable products to be used. The APL/QPL is located at, www.dot.state.mn.us/products/.

[Include a section on barrier access.](#)

3.6.8 Truck/Trailer Mounted Attenuators

Truck-mounted attenuators are energy-absorbing devices attached to the rear of shadow trailers or trucks. When used, the shadow vehicle with the attenuator is located in advance of the work area, workers, or equipment to reduce the severity of rear-end crashes from errant vehicles. The vehicle is positive protection for the workers and the attenuator is positive protection for the driver.

Exhibit 3-12 Truck Mounted Attenuator



3.7 Portable Changeable Message Signs (PCMS)

Exhibit 3-13 illustrates a PCMS. See Section 2.6.9 for information on the CMS Manual of Practice.

Exhibit 3-13 Portable Changeable Message Sign



3.7.1 Definitions

Change Interval - The time interval which occurs between displays of each panel (during this time no message is displayed).

Character - It is composed of 35 pixels. The pixels are arranged in a seven high by five wide matrix.

Font - The pixel description of the alphanumeric character. The format used for highways for all alphanumeric characters (with the exception of the letter "I" and the number "1" is seven units high by five units wide.

Message sign panel - It presents or delivers the message to the motoring public. The message is displayed by forming various alpha-numeric characters.

Panel - A message (of up to three lines) displayed on a message sign panel.

Pixel – A pixel is one element of a total of 35 elements per character. A pixel changes its color electronically, which in turn will show the desired alpha-numeric character.

PCMS (Portable Changeable Message Sign) - A traffic control device with the flexibility to display a variety of messages to fit the needs of highway and street authorities. The components of a PCMS include: message sign panel, control system, power source and mounting and transporting equipment.



If permanent message signs are available, coordinate with the district for use during TTC periods.

3.7.2 Message Sign Panel

The message sign panel shall meet the following requirements under both day and night conditions:

Field Setup -- The sign shall be placed to be visible from a minimum of 800 feet. When locked in place, the front panel shall be tilted forward 3 to 5 degrees to reduce daylight and headlight glare on the sign face.

Minimum Performance Standard -- The message shall become legible a minimum of 800 feet for traffic on all lanes of the roadway. The message shall remain legible for at least 750 feet from the nearest travel lane from the message sign panel.

For approved PCMS products, see the Temporary Traffic Control Approved Product List on the Approved Products web page listed below.

The 750 feet distance is based on the ability of a driver to read two complete messages of two 2-second panels, which includes the change interval (0.5 seconds maximum) between panels, for a total of 8.0 seconds.

3.8 Portable Signal Systems

Portable Traffic Control Signals are either Trailer Mounted or Pedestal Mounted. Approved products and specifications for portable signal systems can be found on the [APL](#).

3.9 Automated Flagging Assist Device

Automated Flagging Assistance Devices (AFADs) enable the operator to be positioned out of the lane of traffic and are used to control road users through temporary, one-lane, two-way traffic control zones. These devices are capable of displaying a STOP message followed by a SLOW message without the need for a flagger in the immediate vicinity of the sign or on the roadway. They can be remotely operated by a one operator at a central location or by separate operators near each device location. A single operator may only be used on roadways with unobstructed sight lines, less than 1500 ADT, and less than 1000 feet between the devices.

3.10 Flashing Arrow Boards

Any flashing arrow board used for purposes of traffic control shall meet criteria as defined in Part 6 of the MN MUTCD.

For approved Flashing Arrow Board products, see the Temporary Traffic Control Approved Product List on the Approved Products web page listed below.

3.11 Little Known Resources

MnDOT may have resources available for use in temporary traffic control. Check with the districts on the availability and applicability of these resources. A few examples include, but are not limited to:

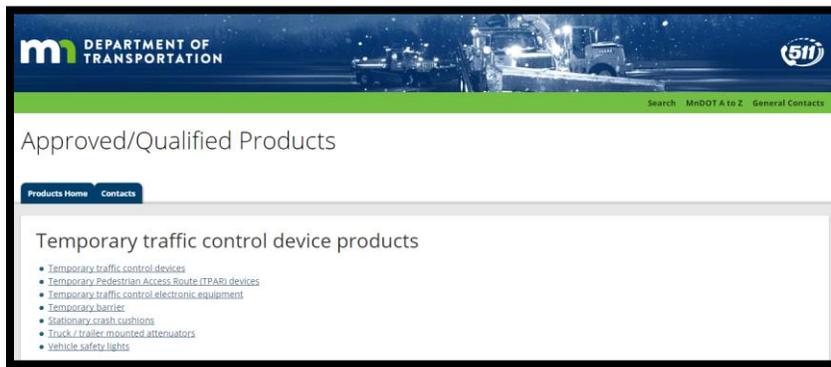
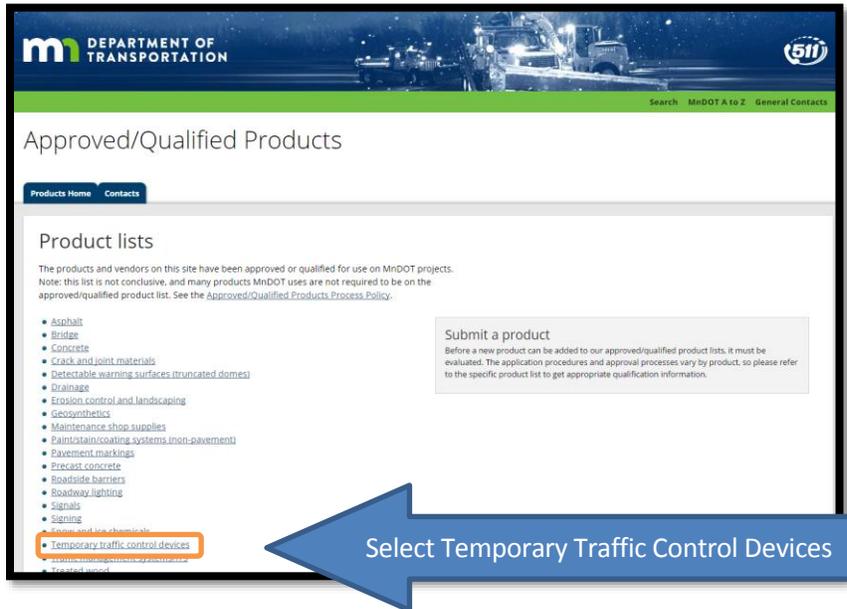
- ✓ A MnDOT owned temporary bridge
- ✓ Overhead sign structure
- ✓ Dynamic Speed Display Signs (DSDS)
- ✓ Automated flagger assistance device (AFADs)

3.12 Approved/Qualified Products (APL/QPL)

A list of approved products of each type is available on the Qualified Products List (QPL) for Work Zones, posted on the Office of Traffic, Security and Technology website at:

www.dot.state.mn.us/products/

Exhibit 3-14 Approved/Qualified Products Website



Elements of signing related to temporary traffic control (such as sheeting materials and surface mount delineators) are in the signing product list.

3.13 MN MUTCD Chapter 6F - Temporary Traffic Control Zone Devices

The following is a handout from the MN MUTCD Chapter on TTC Zone Devices. The MN MUTCD can be downloaded from the following web link:

www.dot.state.mn.us/trafficeng/publ/index.html

In Section 6F.1, note the information on crashworthiness. FHWA policy requires that all roadside appurtenances such as traffic barriers, barrier terminals and crash cushions, bridge railings, sign and light pole supports, and work zone hardware used on the National Highway System meet the crashworthy performance criteria contained in the National Cooperative Highway Research Program (NCHRP) Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features".

PART 6. TEMPORARY TRAFFIC CONTROL

Chapter 6F. Temporary Traffic Control Zone Devices

6F.1 Types of Devices

GUIDANCE:

The design and application of TTC devices used in TTC zones should consider the needs of all road users (motorists, bicyclists, and pedestrians), including those with disabilities.

SUPPORT:

FHWA policy requires that all roadside appurtenances such as traffic barriers, barrier terminals and crash cushions, bridge railings, sign and light pole supports, and work zone hardware used on the National Highway System meet the crashworthy performance criteria contained in the National Cooperative Highway Research Program (NCHRP) Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features". The FHWA website at "<http://safety.fhwa.dot.gov/programs/roadsideHardware.htm>" identifies all such hardware and includes copies of FHWA acceptance letters for each of them. In the case of proprietary items, links are provided to manufacturers' websites as a source of detailed information on specific devices. The website also contains an "Ask the Experts" section where questions on roadside design issues can be addressed.

Various Sections of the MUTCD require certain traffic control devices, their supports, and/or related appurtenances to be crashworthy. Such MUTCD crashworthiness provisions apply to all streets, highways, and private roads open to public travel. Also, State Departments of Transportation and local agencies might have expanded the NCHRP Report 350 crashworthy criteria to apply to certain other roadside appurtenances.

Crashworthiness and crash testing information on devices described in Part 6 are found in AASHTO's "Roadside Design Guide" (see Section 1A.11).

As defined in Section 1A.13, "crashworthy" is a characteristic of a roadside appurtenance that has been successfully crash tested in accordance with a national standard such as the NCHRP Report 350, "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

STANDARD:

Traffic control devices shall be defined as all signs, signals, markings, and other devices used to regulate, warn, or guide road users, placed on, over, or adjacent to a street, highway, private roads open to public travel (see definition in Section 1A.13), pedestrian facility, or bikeway by authority of a public body or official having jurisdiction.

All traffic control devices used for construction, maintenance, utility, or incident management operations on a street, highway, or private road open to public travel (see definition in Section 1A.13) shall comply with the applicable provisions of this Manual.

All signs, barricades, drums, weighted channelizers, and vertical panels shall be retroreflectorized. Cones and tubes shall be retroreflectorized if used at night.

Devices that are excessively worn, bent, damaged or have lost a significant amount of their retroreflectivity shall be promptly removed (see Chapter 6K, Quality Standards on pages 6K-87 through 6K-104).

GUIDANCE:

Particular attention should be given to assuring that all traffic control devices are maintained and kept clean, visible, and properly positioned at all times.

6F.2 General Characteristics of Signs

SUPPORT:

TTC zone signs convey both general and specific messages by means of words or symbols and have the same three categories as all road user signs: regulatory, warning, and guide.

STANDARD:

The colors for regulatory signs shall follow the Standards for regulatory signs in Table 2A-5 and Chapter 2B. Warning signs in TTC zones shall have a black legend and border on an orange background, except for the Grade Crossing Advance Warning (W10-1) sign which shall have a black legend and border on a yellow background, and except for signs that are required or recommended in Parts 2 or 7 to have fluorescent yellow-green backgrounds. Colors for guide signs shall follow the Standards in Table 2A-5 and Chapter 2D, except for guide signs as otherwise provided in Section 6F.55.

OPTION:

Where the color orange is required, the fluorescent orange color may also be used.

SUPPORT:

The fluorescent version of orange provides higher conspicuity than standard orange, especially during twilight.

HANDOUT

HANDOUT

OPTION:

Existing warning signs that are still applicable may remain in place.

In order to maintain the systematic use of yellow or fluorescent yellow-green backgrounds for pedestrian, bicycle, and school warning signs in a jurisdiction, the yellow or fluorescent yellow-green background for pedestrian, bicycle, and school warning signs may be used in TTC zones.

Standard orange flags or flashing warning lights may be used in conjunction with signs.

STANDARD:

When standard orange flags or flashing warning lights are used in conjunction with signs, they shall not block the sign face.

Except as provided in Section 2A.11, the sizes for TTC signs and plaques shall be as shown in Table 6F-1 and in Appendix C of this Manual. The sizes in the minimum column shall only be used on local streets or roadways where the 85th-percentile speed or posted speed limit is less than 35 mph.

OPTION:

The dimensions of signs and plaques shown in Table 6F-1 may be increased wherever necessary for greater legibility or emphasis.

STANDARD:

Deviations from standard sizes as prescribed in this Manual shall be in 6-inch increments.

SUPPORT:

Sign design details are contained in the MnDOT Standard Signs Manual and the FHWA "Standard Highway Signs and Markings" book (see Section 1A.11).

Section 2A.6 contains additional information regarding the design of signs, including an Option allowing the development of special word message signs if a standard word message or symbol sign is not available to convey the necessary regulatory, warning, or guidance information.

STANDARD:

All signs used at night shall be retroreflective with a material that has a smooth, sealed outer surface to show the same shape and similar color both day and night.

The requirement for sign illumination shall not be considered to be satisfied by street, highway, or strobe lighting.

OPTION:

Sign illumination may be either internal or external.

Signs may be made of rigid or flexible material.

STANDARD:

Mesh nonretroreflective signs shall not be used.

6F.3 Sign Placement

GUIDANCE:

Signs should be located on the right-hand side of the roadway unless otherwise provided in this Manual.

OPTION:

Where special emphasis is needed, signs may be placed on both the left-hand and right-hand sides of the roadway. Signs mounted on portable supports may be placed within the roadway itself. Signs may also be mounted on or above Type III barricades.

SUPPORT:

The provisions of this Section regarding mounting height apply unless otherwise provided for a particular sign elsewhere in this Manual.

STANDARD:

The minimum height, measured vertically from the bottom of the sign to the elevation of the near edge of the pavement, of signs installed at the side of the road in rural areas shall be 5 feet (see Figure 6F-1).

The minimum height, measured vertically from the bottom of the sign to the top of the curb, or in the absence of curb, measured vertically from the bottom of the sign to the elevation of the near edge of the traveled way, of signs installed at the side of the road in business, commercial, or residential areas where parking or pedestrian movements are likely to occur, or where the view of the sign might be obstructed, shall be 7 feet (see Figure 6F-1).

The minimum height, measured vertically from the bottom of the sign to the sidewalk, of signs installed above sidewalks shall be 7 feet.

OPTION:

The height to the bottom of a secondary sign mounted below another sign may be 1 foot less than the height provided in the previous Standard.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Sign or Plaque	Sign Designation	Section	Conventional Road	Freeway or Expressway	Minimum
Stop	R1-1	6F.6	30 x 30 *	---	---
Stop (on Stop/Slow Paddle)	R1-1	6E.3	18 x 18	---	---
Yield	R1-2	6F.6	36 x 36 x 36	48 x 48 x 48	30 x 30 x 30
To Oncoming Traffic	R1-2aP	6F.6	36 x 30	48 x 36	24 x 18
Speed Limit	R2-1	6F.12	24 x 30 *	36 x 48	---
Fines Higher (plaque)	R2-6P	6F.12	24 x 18	36 x 24	---
Fines Double (plaque)	R2-6aP	6F.12	24 x 18	36 x 24	---
\$XX Fine (plaque)	R2-6bP	6F.12	24 x 18	36 x 24	---
Begin Higher Fines Zone	R2-10	6F.12	24 x 30	36 x 48	---
End Higher Fines Zone	R2-11	6F.12	24 x 30	36 x 48	---
End Work Zone Speed Limit	R2-12	6F.12	24 x 36	36 x 54	---
Movement Prohibition	R3-1,2,3,4,18,27	6F.6	24 x 24 *	36 x 36	---
Mandatory Movement (1 lane)	R3-5	6F.6	30 x 36	---	---
Optional Movement (1 lane)	R3-6	6F.6	30 x 36	---	---
Right (Left) Lane Must Turn Right (Left)	R3-7	6F.6	30 x 30 *	---	---
Advance Intersection Lane Control	R3-30	6F.6	Varies x 30	---	---
Do Not Pass	R4-1	6F.6	24 x 30	36 x 48	---
Pass With Care	R4-2	6F.6	24 x 30	36 x 48	---
Keep Right	R4-7	6F.6	24 x 30	36 x 48	---
Narrow Keep Right	R4-7c	6F.6	18 x 30	---	---
Stay in Lane	R4-9	6F.11	24 x 30	36 x 48	---
Do Not Enter	R5-1	6F.6	30 x 30 *	36 x 36	---
Wrong Way	R5-1a	6F.6	36 x 24 *	42 x 30	---
One Way	R6-1	6F.6	36 x 12 *	54 x 18	---
One Way	R6-2	6F.6	24 x 30 *	36 x 48	---
No Parking (symbol)	R8-3	6F.6	24 x 24	36 x 36	---
Pedestrian Crosswalk	R9-8	6F.13	36 x 18	---	---
Sidewalk Closed	R9-9	6F.14	24 x 12	---	---
Sidewalk Closed, Use Other Side	R9-10	6F.14	24 x 12	---	---
Sidewalk Closed Ahead, Cross Here	R9-11	6F.14	24 x 18	---	---
Sidewalk Closed, Cross Here	R9-11a	6F.14	24 x 12	---	---
Wait on Stop/Go on Slow	R10-X1	6E.5	24 x 30	24 x 30	---
Road Closed	R11-2	6F.8	48 x 30	---	---
Road Closed, Local Traffic Only	R11-3a,3b,4	6F.9	60 x 30	---	---
Weight Limit	R12-1,2	6F.10	24 x 30	36 x 48	---
Weight Limit (with symbols)	R12-5	6F.10	24 x 36	36 x 48	---
Turn and Curve Signs	W1-1,2,3,4	6F.16	36 x 36	48 x 48	30 x 30
Reverse Curve (2 or more lanes)	W1-4b,4c	6F.48	36 x 36	48 x 48	30 x 30
One-Direction Large Arrow	W1-6	6F.16	48 x 24	60 x 30	---
Chevron Alignment	W1-8	6F.16	18 x 24	30 x 36	---
Stop Ahead	W3-1	6F.16	36 x 36	48 x 48	30 x 30
Yield Ahead	W3-2	6F.16	36 x 36	48 x 48	30 x 30
Signal Ahead	W3-3	6F.16	36 x 36	48 x 48	30 x 30
Be Prepared to Stop	W3-4	6F.16	36 x 36	48 x 48	30 x 30
Reduced Speed Ahead	W3-5	6F.16	36 x 36	48 x 48	30 x 30
XX MPH SpeedZone Ahead	W3-5b	6F.16	36 x 36	48 x 48	30 x 30
Traffic Control Change Ahead	W3-X5	6F.30	36 x 36	48 x 48	30 x 30

* See Table 2B-1 for minimum size required for signs facing traffic on multi-lane conventional roads

Notes: 1. Larger signs may be used wherever necessary for greater legibility or emphasis.

Table 6F-1 Temporary Traffic Control Zone Sign and Plaque Sizes (Sheet 1 of 3)

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Sign or Plaque	Sign Designation	Section	Conventional Road	Freeway or Expressway	Minimum
Merging traffic	W4-1,1a,5	6F.16	36 x 36	48 x 48	36 x 36
Lane Ends	W4-2	6F.24	36 x 36	48 x 48	30 x 30
Added Lane	W4-3,6	6F.16	36 x 36	48 x 48	30 x 30
No Merge Area (plaque)	W4-5P	6F.16	18 x 24	24 x 30	---
Road Narrows	W5-1	6F.16	36 x 36	48 x 48	30 x 30
Narrow Bridge	W5-2	6F.16	36 x 36	48 x 48	30 x 30
One Lane Bridge	W5-3	6F.16	36 x 36	48 x 48	30 x 30
Ramp Narrows	W5-4	6F.26	36 x 36	48 x 48	30 x 30
Divided Highway	W6-1	6F.16	36 x 36	48 x 48	30 x 30
Divided highway Ends	W6-2	6F.16	36 x 36	48 x 48	30 x 30
Two-Way Traffic	W6-3	6F.32	36 x 36	48 x 48	30 x 30
Two-Way Traffic	W6-4	6F.76	12 x 18	12 x 18	---
Hill (symbol)	W7-1	6F.16	36 x 36	48 x 48	30 x 30
Next XX Miles (plaque)	W7-3aP	6F.53	24 x 18	36 x 30	---
Bump	W8-1,1a	6F.16	36 x 36	48 x 48	30 x 30
Dip	W8-2	6F.16	36 x 36	48 x 48	30 x 30
Pavement Ends	W8-3	6F.16	36 x 36	48 x 48	30 x 30
Soft Shoulder	W8-4	6F.44	36 x 36	48 x 48	30 x 30
Slippery When Wet	W8-5	6F.16	36 x 36	48 x 48	30 x 30
Truck Crossing	W8-6	6F.36	36 x 36	48 x 48	30 x 30
Loose Gravel	W8-7	6F.16	36 x 36	48 x 48	30 x 30
Rough Road	W8-8	6F.16	36 x 36	48 x 48	30 x 30
Low Shoulder	W8-9	6F.44	36 x 36	48 x 48	30 x 30
Shoulder Drop-Off	W8-9a	6F.44.1	36 x 36	48 x 48	30 x 30
Uneven Lanes	W8-11	6F.45	36 x 36	48 x 48	30 x 30
No Center Stripe	W8-12a	6F.47	36 x 36	48 x 48	30 x 30
Fallen Rocks	W8-14	6F.16	36 x 36	48 x 48	30 x 30
Grooved Pavement	W8-15	6F.16	36 x 36	48 x 48	30 x 30
Motorcycle (plaque)	W8-15P	6F.54	24 x 18	30 x 24	---
Road May Flood	W8-18	6F.16	36 x 36	48 x 48	24 x 24
No Shoulder	W8-23	6F.44.3	36 x 36	48 x 48	30 x 30
Steel Plate Ahead	W8-24	6F.46	36 x 36	48 x 48	30 x 30
Shoulder Ends	W8-25	6F.16	36 x 36	48 x 48	30 x 30
Lane Ends	W9-1,2	6F.16	36 x 36	48 x 48	30 x 30
Grade Crossing Advance Warning	W10-1	6F.16	36 Diameter	---	---
Truck	W11-10	6F.36	36 x 36	48 x 48	30 x 30
Double Arrow	W12-1	6F.16	30 x 30	---	---
Low Clearance	W12-2	6F.16	36 x 36	48 x 48	30 x 30
Advisory Speed (plaque)	W13-1P	6F.52	24 x 24	30 x 30	18 x 18
On Ramp (plaque)	W13-4P	6F.25	36 x 36	36 x 36	---
No Passing Zone (pennant)	W14-3	6F.16	48 x 48 x 36	64 x 64 x 48	40 x 40 x 30
Emergency Scene Ahead	W14-X15	6I.1	36 x 36	48 x 48	---
XX Feet (plaque)	W16-2P	6F.16	24 x 18	30 x 24	---
Road Work Ahead	W20-1	6F.18	36 x 36	48 x 48	30 x 30
Detour Ahead	W20-2	6F.19	36 x 36	48 x 48	30 x 30
Road (Street) Closed Ahead	W20-3	6F.20	36 x 36	48 x 48	30 x 30
Trail Closed Ahead	W20-3a	6F.20.1	18 x 18	---	---

MN Rev. 1

MN Rev. 3

MN Rev. 3

* See Table 2B-1 for minimum size required for signs facing traffic on multi-lane conventional roads

- Notes: 1. Larger signs may be used wherever necessary for greater legibility or emphasis.
2. Dimensions are shown in inches and are shown as width x height.

Table 6F-1 Temporary Traffic Control Zone Sign and Plaque Sizes (Sheet 2 of 3)

HANDOUT

HANDOUT

Sign or Plaque	Sign Designation	Section	Conventional Road	Freeway or Expressway	Minimum
One Lane Road Ahead	W20-4	6F.21	36 x 36	48 x 48	30 x 30
Flagger (symbol)	W20-7	6F.31	36 x 36	48 x 48	30 x 30
Slow (on Stop/Slow Paddle)	W20-8	6E.3	18 x 18	---	---
Merge	W20-X3	6F.24.1	36 x 36	48 x 48	30 x 30
Bypass Ahead	W20-X6	6F.50	36 x 36	48 x 48	30 x 30
Narrow Lane (width shown)	W20-X11	6F.50	36 x 36	48 x 48	30 x 30
Right Two Lanes Closed	W20-X13	6F.22	36 x 36	48 x 48	30 x 30
Lanes Narrow	W20-X17	6F.50	36 x 36	48 x 48	30 x 30
Workers	W21-1	6F.33	36 x 36	48 x 48	30 x 30
Fresh Oil (Tar)	W21-2	6F.34	36 x 36	48 x 48	30 x 30
Road Machinery Ahead	W21-3	6F.35	36 x 36	48 x 48	30 x 30
Slow Moving Vehicle	W21-4	6G.6	36 x 18	---	---
Shoulder Work	W21-5	6F.37	36 x 36	48 x 48	30 x 30
Shoulder Closed	W21-5a	6F.37	36 x 36	48 x 48	30 x 30
Survey Crew	W21-6	6F.38	36 x 36	48 x 48	30 x 30
Survey Crew Ahead	W21-6a	6F.38	36 x 36	48 x 48	30 x 30
Utility Work Ahead	W21-7	6F.39	36 x 36	48 x 48	30 x 30
Mowing Ahead	W21-8	6G.6	36 x 36	48 x 48	30 x 30
Right (Left) Lane Closed	W21-X5	6F.22	36 x 36	48 x 48	30 x 30
Center Lane Closed	W21-X5c	6F.23	36 x 36	48 x 48	30 x 30
Crew Working Ahead	W21-X6	6F.38.1	36 x 36	48 x 48	30 x 30
High Shoulder	W21-X9	6F.44.2	36 x 36	48 x 48	30 x 30
Blasting Zone Ahead	W22-1	6F.41	36 x 36	48 x 48	30 x 30
Turn Off 2-Way Radio and Cell Phone	W22-2	6F.42	42 x 36	42 x 36	---
End Blasting Zone	W22-3	6F.43	42 x 36	42 x 36	36 x 30
Slow Traffic Ahead	W23-1	6F.27	48 x 24	48 x 24	---
New Traffic Pattern Ahead	W23-2	6F.30	36 x 36	48 x 48	30 x 30
Double Reverse Curve (1 lane)	W24-1	6F.49	36 x 36	48 x 48	30 x 30
Double Reverse Curve (2 lanes)	W24-1a	6F.49	36 x 36	48 x 48	30 x 30
Double Reverse Curve (3 lanes)	W24-1b	6F.49	36 x 36	48 x 48	30 x 30
All Lanes (plaque)	W24-1cP	6F.49	24 x 18	30 x 24	---
Road Work Next XX Miles	G20-1	6F.56	36 x 18	48 x 24	---
End Road Work	G20-2	6F.57	36 x 18	48 x 24	---
Pilot Car Follow Me	G20-4	6F.58	36 x 18	---	---
Work Zone (plaque)	G20-5aP	6F.12	24 x 18	36 x 24	---
Road Closed Beginning XXXX XX	G20-X1	6F.56.1	72 x 60	90 x 78	---
Exit Open	E5-2	6F.28	48 x 36	48 x 36	---
Exit Closed	E5-2a	6F.28	48 x 36	48 x 36	---
Exit Only	E5-3	6F.29	48 x 36	48 x 36	---
Detour	M4-8	6F.59	24 x 12	30 x 15	---
End Detour	M4-8a	6F.59	24 x 18	24 x 18	---
End	M4-8b	6F.59	24 x 12	24 x 12	---
Detour	M4-9	6F.59	30 x 24	48 x 36	---
Bike/Pedestrian	M4-9a	6F.59	30 x 24	---	---
Pedestrian Detour	M4-9b	6F.59	30 x 24	---	---
Bike Detour	M4-9c	6F.59	30 x 24	---	---
Detour	M4-10	6F.59	48 x 18	---	---

* See Table 2B-1 for minimum size required for signs facing traffic on multi-lane conventional roads

Notes: 1. Larger signs may be used wherever necessary for greater legibility or emphasis.
2. Dimensions are shown in inches and are shown as width x height.

Table 6F-1 Temporary Traffic Control Zone Sign and Plaque Sizes (Sheet 3 of 3)

HANDOUT

MN Rev. 1

MN Rev. 3

MN Rev. 2

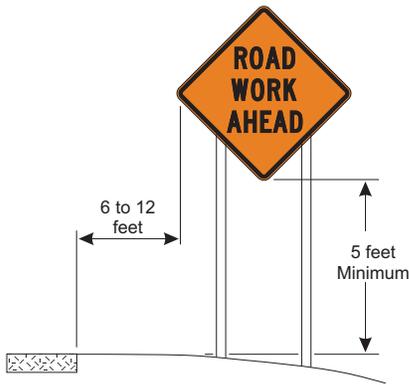
MN Rev. 3

HANDOUT

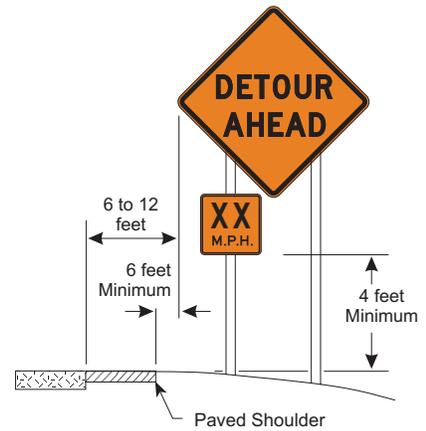
HANDOUT

HANDOUT

HANDOUT



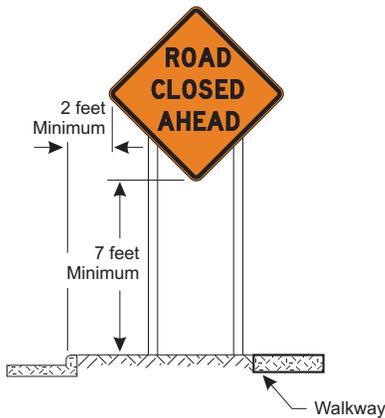
A. RURAL AREA



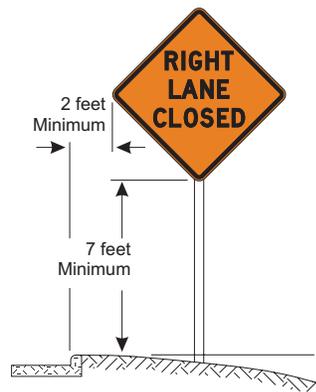
B. RURAL AREA WITH ADVISORY SPEED PLATE



Advance street name plaques or route markers may be installed above or below warning signs



C. BUSINESS, COMMERCIAL, OR RESIDENTIAL AREA



D. BUSINESS, COMMERCIAL, OR RESIDENTIAL AREA (WITHOUT CURB)

Figure 6F-1 Height and Lateral Location of Signs - Typical Installations

HANDOUT

HANDOUT

HANDOUT

HANDOUT

GUIDANCE:

Neither portable nor permanent sign supports should be located on sidewalks, bicycle facilities, or areas designated for pedestrian or bicycle traffic. If the bottom of a secondary sign that is mounted below another sign is mounted lower than 7 feet above a pedestrian sidewalk or pathway (see Section 6D.2), the secondary sign should not project more than 4 inches into the pedestrian facility.

STANDARD:

Where it has been determined that the accommodation of pedestrians with disabilities is necessary, signs shall be mounted and placed in accordance with Section 4.4 of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)" (see Section 1A.11)

Signs mounted on barricades, barricade/sign combinations shall be crashworthy.

GUIDANCE:

Except as provided in the following Option, signs anticipated to be in one place for more than 30 days should not be mounted on portable supports. Whenever this anticipated time period changes, signs mounted on portable supports should be re-evaluated.

OPTION:

Signs, whose location on a paved surfaces is necessary, may be mounted on portable supports for more than 30 days.

SUPPORT:

Methods of mounting signs other than on posts are illustrated in Figure 6F-2.

GUIDANCE:

Signs mounted on Type III barricades should not cover more than 50 percent of the top two rails or 33 percent of the total area of the three rails.

STANDARD:

All sign supports shall be crashworthy.

MN Rev. 1

Where large signs having an area exceeding 50 square feet are installed on multiple breakaway posts, the clearance from the ground to the bottom of the sign shall be at least 7 feet.

The bottom of a sign mounted on a barricade, or other portable support, shall be at least 1 foot above the traveled way.

HANDOUT

HANDOUT

In addition, regulatory signs installed on barricades or other portable supports shall be installed so that the center of the sign or sign assembly is at least 4 ft above the traveled way.

OPTION:

For mobile operations, a sign may be mounted on a work vehicle, a shadow vehicle, or a trailer stationed in advance of the TTC zone or moving along with it. The work vehicle, the shadow vehicle, or the trailer may or may not have an impact attenuator.

SUPPORT:

If alterations are made to specific traffic control device supports that have been successfully crash tested in accordance with NCHRP Report 350, the altered supports might not be considered to be crashworthy.

6F.4 Sign Maintenance

GUIDANCE:

Signs shall be properly maintained for cleanliness, visibility, and correct positioning.

Signs that have lost significant legibility shall be replaced as soon as possible after notification.

SUPPORT:

Section 2A.8 contains information regarding the retroreflectivity of signs, including the signs that are used in TTC zones.

6F.5 Regulatory Sign Authority

SUPPORT:

Regulatory signs inform road users of traffic laws or regulations and indicate the applicability of legal requirements that would not otherwise be apparent.

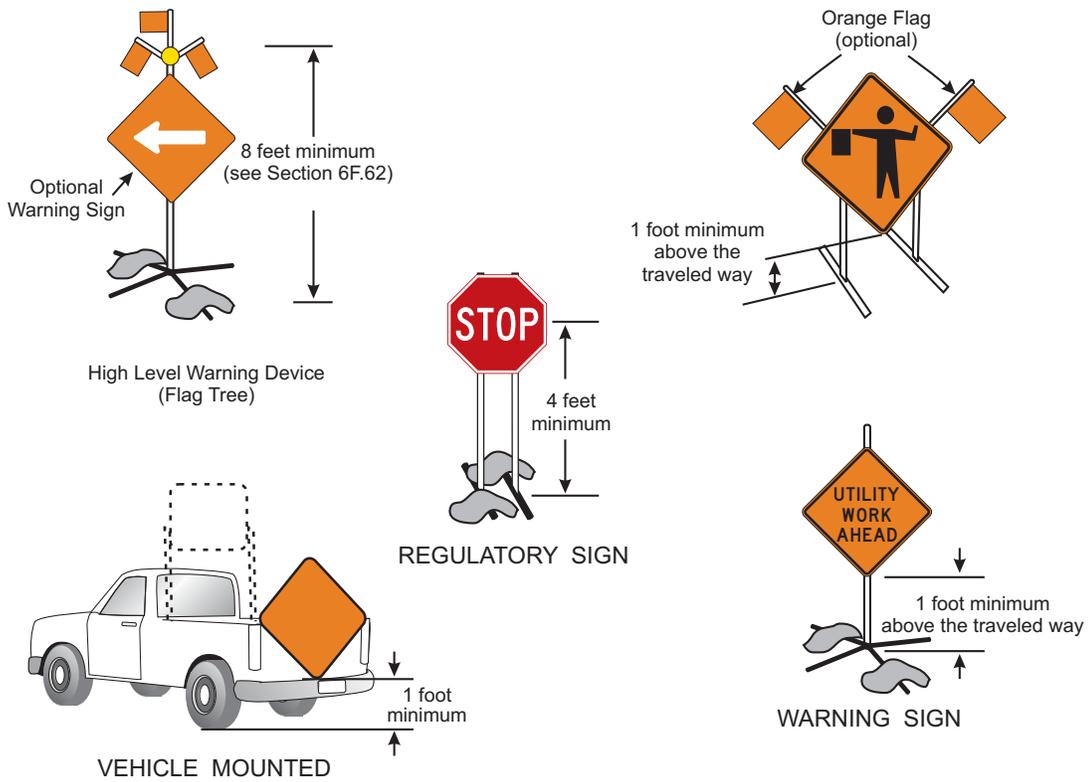
STANDARD:

Regulatory signs shall be authorized by the public agency or official having jurisdiction and shall conform with Chapter 2B.

6F.6 Regulatory Sign Design

STANDARD:

TTC regulatory signs shall comply with the Standards for regulatory signs presented in Part 2 and in the MnDOT Standard Signs Manual and the FHWA "Standard Highway Signs and Markings" book (see Section 1A.11).



PORTABLE AND TEMPORARY MOUNTINGS

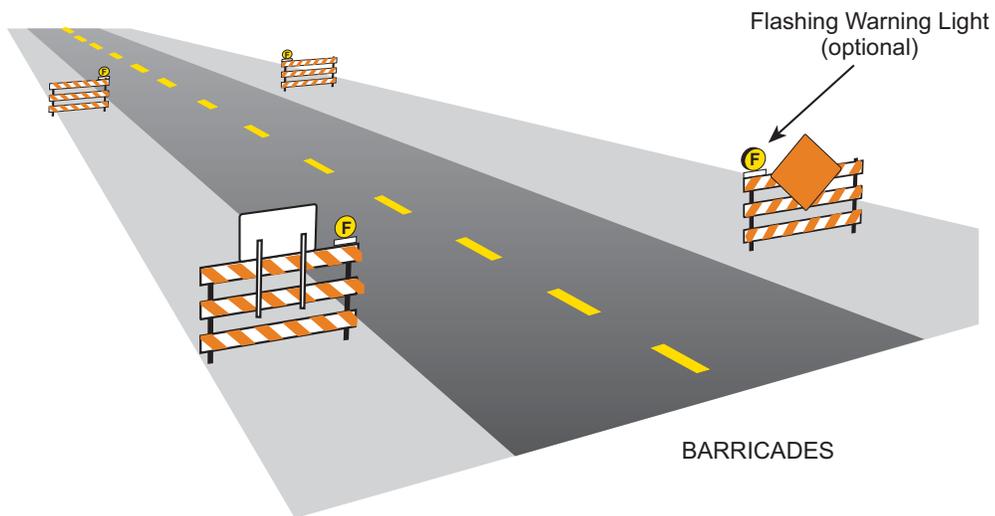


Figure 6F-2 Methods of Mounting Signs Other Than on Posts

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

SUPPORT:

Regulatory signs are generally rectangular with a black legend and border on a white background. Exceptions include the STOP, YIELD, DO NOT ENTER, WRONG WAY, and ONE WAY signs.

OPTION:

The ONE WAY sign may be either a horizontal or vertical rectangular sign.

6F.7 Regulatory Sign Applications

STANDARD:

If a TTC zone requires regulatory measures different from those existing, the existing permanent regulatory devices shall be removed or covered and superseded by the appropriate temporary regulatory signs. This change shall be made in compliance with applicable ordinances or statutes of the jurisdiction.

6F.8 ROAD (STREET) CLOSED Sign (R11-2)



R11-2

GUIDANCE:

The ROAD (STREET) CLOSED (R11-2) sign should be used when the roadway is closed to all road users except contractors' equipment or officially authorized vehicles. The R11-2 sign should be accompanied by appropriate warning and detour signing.

OPTION:

The words BRIDGE OUT (or BRIDGE CLOSED) may be substituted for ROAD (STREET) CLOSED where applicable.

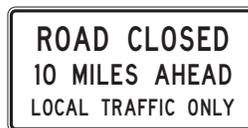
GUIDANCE:

The ROAD (STREET) CLOSED sign should be installed at or near the center of the roadway on or above a Type III barricade that closes the roadway (see Section 6F.68).

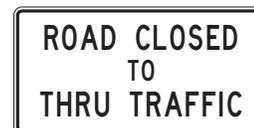
STANDARD:

The ROAD (STREET) CLOSED sign shall not be used where road user flow is maintained through the TTC zone with a reduced number of lanes on the existing roadway or where the actual closure is some distance beyond the sign.

6F.9 Local Traffic Only Signs (R11-3a, R11-4)



R11-3a



R11-4

GUIDANCE:

The Local Traffic Only signs should be used where road user flow detours to avoid a closure some distance beyond the sign, but where local road users can use the roadway to the point of closure. These signs should be accompanied by appropriate warning and detour signing.

The Local Traffic Only sign should have the legend ROAD CLOSED XX MILES AHEAD, LOCAL TRAFFIC ONLY (R11-3a).

OPTION:

In urban areas, the legend ROAD (STREET) CLOSED TO THRU TRAFFIC (R11-4) or ROAD CLOSED, LOCAL TRAFFIC ONLY may be used.

In urban areas, a word message that includes the name of an intersecting street name or well-known destination may be substituted for the words XX MILES AHEAD on the R11-3a sign where applicable.

The words BRIDGE OUT (or BRIDGE CLOSED) may be substituted for the words ROAD (STREET) CLOSED on the R11-3 or R11-4 sign where applicable.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

6F.10 Weight Limit Signs (R12-1a, R12-2, R12-5, R12-5 Supplements)



R12-1a



R12-2



R12-5



R12 Supplement Plaques

STANDARD:

A Weight Limit sign, which shows the gross weight or axle weight that is permitted on the roadway or bridge, shall be consistent with State or local regulations and shall not be installed without the approval of the authority having jurisdiction over the highway.

When weight restrictions are imposed, because of the activity in a TTC zone, a marked detour shall be provided for vehicles weighing more than the posted limit.

6F.11 STAY IN LANE Sign (R4-9)



R4-9

OPTION:

A STAY IN LANE (R4-9) sign may be used where a multi-lane shift has been incorporated as part of the TTC on a highway to direct road users around road work that occupies part of the roadway on a multi-lane highway.

6F.12 Work Zone and Higher Fines Signs and Plaques



G20-5aP



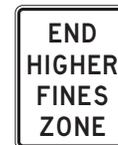
R2-12

OPTION:

A WORK ZONE (G20-5aP) plaque may be mounted above a Speed Limit sign to emphasize that a reduced speed limit is in effect within a TTC zone. An END WORK ZONE SPEED LIMIT (R2-12) sign may be installed at the downstream end of the reduced speed limit zone.



R2-10



R2-11

GUIDANCE:

A BEGIN HIGHER FINES ZONE (R2-10) sign should be installed at the upstream end of a work zone where increased fines are imposed for traffic violations, and an END HIGHER FINES ZONE (R2-11) sign should be installed at the downstream end of the work zone.

OPTION:

Alternate legends such as BEGIN (or END) DOUBLE FINES ZONE may also be used for the R2-10 and R2-11 signs.



R2-6P



R2-6aP



R2-6bP

A FINES HIGHER, FINES DOUBLE, or \$XX FINE plaque (see Section 2B.17) may be mounted below the Speed Limit sign if increased fines are imposed for traffic violations within the TTC zone.

Individual signs and plaques for work zone speed limits and higher fines may be combined into a single sign or may be displayed as an assembly of signs and plaques.

HANDOUT

HANDOUT

6F.13 PEDESTRIAN CROSSWALK Sign (R9-8)



R9-8

OPTION:

The PEDESTRIAN CROSSWALK (R9-8) sign may be used to indicate where a temporary crosswalk has been established.

STANDARD:

If a temporary crosswalk is established, it shall be accessible to pedestrians with disabilities in accordance with Section 6D.2.

6F.14 SIDEWALK CLOSED Signs (R9-9, R9-10, R9-11, R9-11a)



R9-9



R9-10



R9-11



R9-11a

GUIDANCE:

SIDEWALK CLOSED signs should be used where pedestrian flow is restricted or rerouted by work activities. Bicycle/Pedestrian Detour (M4-9a) signs or Pedestrian Detour (M4-9b) signs should be used where pedestrian flow is rerouted (see Section 6F.59).

The SIDEWALK CLOSED (R9-9) sign should be installed at the beginning of the closed sidewalk, at the intersections preceding the closed sidewalk, and elsewhere along the closed sidewalk as needed.

The SIDEWALK CLOSED, (ARROW) USE OTHER SIDE (R9-10) sign should be installed at the beginning of the restricted sidewalk when a parallel sidewalk exists on the other side of the roadway.

The SIDEWALK CLOSED AHEAD, (ARROW) CROSS HERE (R9-11) sign should be used to indicate to pedestrians that sidewalks beyond the sign are closed and to direct them to open crosswalks, sidewalks, or other travel paths.

The SIDEWALK CLOSED, (ARROW) CROSS HERE (R9-11a) sign should be installed just beyond the point to which pedestrians are being redirected.

SUPPORT:

These signs are typically mounted on a barricade to encourage compliance and to communicate with pedestrians that the sidewalk is closed. Printed signs are not useful to many pedestrians with visual disabilities. A barrier or barricade detectable by a person with a visual disability is sufficient to indicate that a sidewalk is closed. If the barrier is continuous with detectable channelizing devices for an alternate route, accessible signing might not be necessary. An audible information device is needed when the detectable barricade or barrier for an alternate channelized route is not continuous.

6F.15 Special Regulatory Signs

OPTION:

Special regulatory signs may be used based on engineering judgment consistent with regulatory requirements.

GUIDANCE:

Special regulatory signs should comply with the general requirements of color, shape, and alphabet size and series. The sign message should be brief, legible, and clear.

6F.16 Warning Sign Function, Design, and Application

SUPPORT:

TTC zone warning signs notify road users of specific situations or conditions on or adjacent to a roadway that might not otherwise be apparent.

STANDARD:

TTC warning signs shall comply with the Standards for warning signs presented in Part 2 and in the MnDOT Standard Signs Manual and the FHWA "Standard Highway Signs and Markings" book (see Section 1A.11). Except as provided in the following Option, TTC warning signs shall be diamond-shaped with a black symbol or message and border on an orange background, except for the W10-1 sign which shall have a black legend and border on a yellow background, and except for signs that are required or recommended in Parts 2 or 7 to have fluorescent yellow-green backgrounds.

HANDOUT

OPTION:

Warning signs used for TTC incident management situations may have a black legend and border on a fluorescent pink background.

Mounting or space considerations may justify a change from the standard diamond shape.

In emergencies, available warning signs having yellow backgrounds may be used if signs with orange backgrounds signs are not at hand.

GUIDANCE:

Where roadway or road user conditions require greater emphasis, larger than standard size warning signs should be used, with the symbol or legend enlarged approximately in proportion to the outside dimensions.

Where any part of the roadway is obstructed or closed by work activities or incidents, advance warning signs should be installed to alert road users well in advance of these obstructions or restrictions.

Where road users include pedestrians, the provision of supplemental audible information or detectable barriers or barricades should be considered for people with visual disabilities.

SUPPORT:

Detectable barriers or barricades communicate very clearly to pedestrians who have visual disabilities that they can no longer proceed in the direction that they are traveling.

OPTION:

Advance warning signs may be used singly or in combination.

Where distances are not shown on warning signs as part of the message, a supplemental plaque with the distance legend may be mounted immediately below the sign on the same support.

6F.16.1 Roll-Up Warning Signs

OPTION:

Roll-up warning signs may be used to provide advance warning signing for TTC zones.

STANDARD:

Roll-up warning signs shall have a black legend on a reflectorized orange or reflectorized fluorescent orange background. They may be used for daytime or nighttime only when workers are present to monitor the signs.

The mounting height of roll-up signs shall conform to the standards as shown in Section 6F.3.

GUIDANCE:

A 1 foot minimum height will be allowed for roll-up warning signs, but the signs should be mounted higher in order to improve their visibility.

6F.17 Position of Advance Warning Signs

GUIDANCE:

Where highway conditions permit, warning signs should be placed in advance of the TTC zone at varying distances depending on roadway type, condition, and posted speed. Table 6C-1 contains information regarding the spacing of advance warning signs. Where a series of two or more advance warning signs is used, the closest sign to the TTC zone should be placed approximately 100 feet for low-speed urban streets to 1,000 feet or more for freeways and expressways.

Where multiple advance warning signs are needed on the approach to a TTC zone, the ROAD WORK AHEAD (W20-1) sign should be the first advance warning sign encountered by road users.

OPTION:

Other similar signs such as BRIDGE WORK AHEAD (W20-X9) or SURVEY CREW AHEAD (W21-6a) may be used as a substitute for the ROAD WORK AHEAD (W20-1) sign.

SUPPORT:

Various conditions, such as limited sight distance or obstructions that might require a driver to reduce speed or stop, might require additional advance warning signs.

OPTION:

As an alternative to a specific distance on advance warning signs, the word AHEAD may be used.

SUPPORT:

At TTC zones on lightly-traveled roads, all of the advance warning signs prescribed for major construction might not be needed.

OPTION:

Utility work, maintenance, or minor construction can occur within the TTC zone limits of a major construction project, and additional warning signs may be needed.

GUIDANCE:

Utility, maintenance, and minor construction signing and TTC should be coordinated with the governing road authority so that road users are not confused or misled by the TTC devices.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

6F.18 ROAD (STREET) WORK AHEAD Sign (W20-1)



W20-1

GUIDANCE:

The ROAD (STREET) WORK AHEAD (W20-1) sign, which serves as a general warning of obstructions or restrictions, should be located in advance of the work space or any detour, on the road where the work is taking place, and on all intersecting roadways.

Where traffic can enter a TTC zone from a crossroad or a major (high-volume) driveway, an advance warning sign should be used on the crossroad or major driveway.

STANDARD:

The ROAD (STREET) WORK (W20-1) sign shall have the legend ROAD (STREET) WORK, XX FT, XX MILES, or AHEAD.

6F.19 DETOUR AHEAD Sign (W20-2)



W20-2

GUIDANCE:

The DETOUR AHEAD (W20-2) sign should be used in advance of a road user detour over a different roadway or route.

STANDARD:

The DETOUR sign shall have the legend DETOUR, XX FEET, XX MILES, or AHEAD.

6F.20 ROAD (STREET) CLOSED AHEAD Sign (W20-3)

GUIDANCE:

The ROAD (STREET) CLOSED AHEAD (W20-3) sign should be used in advance of the point where a highway is closed to all road users, or to all but local road users.

STANDARD:

The ROAD (STREET) CLOSED sign shall have the legend ROAD (STREET) CLOSED, XX FEET, XX MILES, or AHEAD.



W20-3



W20-3a

6F.20.1 TRAIL CLOSED AHEAD Sign (W20-3a)

GUIDANCE:

The TRAIL CLOSED AHEAD (W20-3a) sign should be used in advance of the point where a recreational trail is closed to all users.

6F.21 ONE LANE ROAD AHEAD Sign (W20-4)



W20-4

STANDARD:

The ONE LANE ROAD AHEAD (W20-4) sign shall be used only in advance of that point where motor vehicle traffic in both directions must use a common single lane (see Section 6C.10). It shall have the legend ONE LANE ROAD, XX FEET, XX MILES, or AHEAD.

GUIDANCE:

If the affected one lane roadway is not visible from one end to the other, or if the traffic is such that simultaneous arrivals at both ends occur frequently, flagging procedures, stop sign or signal control should be used to control alternate traffic flows.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

6F.22 Lane(s) Closed Signs (W21-X5, W20-X13)



W21-X5



W20-X13

STANDARD:

Lane closed signs shall be used in advance of that point where one or more through lanes of a multiple-lane roadway are closed.

For a single lane closure, the RIGHT (LEFT) LANE CLOSED (W21-X5) sign shall be used. Where two adjacent lanes are closed, the RIGHT (LEFT) TWO LANES CLOSED (W20-X13) shall be used.

6F.23 CENTER LANE CLOSED Sign (W21-X5c)

STANDARD:

The CENTER LANE CLOSED (W21-X5c) sign shall only be used on roadways where the posted speed limit is 30 MPH or less.

GUIDANCE:

The CENTER LANE CLOSED (W21-X5c) sign should be used in advance of that point where work occupies the center lane(s) and approaching motor vehicle traffic is directed to the right or left of the work zone in the center lane.



W21-X5c



W4-1a

6F.23.1 THRU TRAFFIC MERGE RIGHT (LEFT) Sign (W4-1a)

GUIDANCE:

The THRU TRAFFIC MERGE RIGHT (LEFT) (W4-1a) sign should be used in advance of an intersection where one or more lane closures on the far side of a multi-lane intersection require through motor vehicle traffic on the approach to the intersection to use the right (left) lane to proceed through the intersection.

MN Rev. 3

6F.24 Lane Ends Sign (W4-2)



W4-2R



W4-2L

OPTION:

The Lane Reduction (W4-2) symbol sign may be used to warn drivers of the reduction in the number of motor vehicle traffic lanes in the direction of travel on a multi-lane roadway.

6F.24.1 MERGE Sign (W20-X3)



W20-X3

GUIDANCE:

The MERGE sign (W20-X3) with a demountable arrow should be used when closing one or more lanes of a multi-lane roadway.

OPTION:

The MERGE sign (W20-X3) may be used in conjunction with the LANE REDUCTION Sign (W4-2).

6F.25 ON RAMP Plaque (W13-4P)



W13-4P

OPTION:

When work is being done on a ramp, but the ramp remains open, the ON RAMP (W13-4) plaque may be used to supplement the advance ROAD WORK sign.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

6F.26 RAMP NARROWS Sign (W5-4)

OPTION:

The RAMP NARROWS (W5-4) sign may be used in advance of the point where work on a ramp reduces the normal width of the ramp along a part or all of the ramp.



W5-4



W23-1

6F.27 SLOW TRAFFIC AHEAD Sign (W23-1)

OPTION:

The SLOW TRAFFIC AHEAD (W23-1) sign may be used on a shadow vehicle, usually mounted on the rear of the most upstream shadow vehicle, along with other appropriate signs for mobile operations to warn of slow moving work vehicles. A ROAD WORK (W20-1) sign may also be used with the SLOW TRAFFIC AHEAD sign.

6F.28 EXIT OPEN, EXIT CLOSED Signs (E5-2, E5-2a)



E5-2



E5-2a

OPTION:

An EXIT OPEN (E5-2) or EXIT CLOSED (E5-2a) sign may be used to supplement other warning signs where work is being conducted in the vicinity of an exit ramp and where the exit maneuver for motor vehicle traffic using the ramp is different from the normal condition.

GUIDANCE:

When an exit ramp is closed, an EXIT CLOSED panel with a black legend and border on an orange background should be placed diagonally across the interchange/intersection guide signs.

6F.29 EXIT ONLY Sign (E5-3)



E5-3

OPTION:

An EXIT ONLY (E5-3) sign may be used to supplement other warning signs where work is being conducted in the vicinity of an exit ramp and where the exit maneuver for vehicular traffic using the ramp is different from the normal condition.

6F.30 NEW TRAFFIC PATTERN AHEAD, TRAFFIC CHANGE AHEAD Signs (W23-2, W3-X5)



W23-2



W3-X5

OPTION:

A NEW TRAFFIC PATTERN AHEAD (W23-2) or TRAFFIC CONTROL CHANGE AHEAD sign (W3-X5) may be used on the approach to an intersection or along a section of roadway to provide advance warning of a change in traffic patterns, such as revised lane usage, roadway geometry, or signal phasing.

GUIDANCE:

To retain its effectiveness, the W23-2 or W3-X5 sign should be displayed for up to 2 weeks, and then it should be covered or removed until it is needed again.

HANDOUT

HANDOUT

6F.31 Flagger Sign (W20-7)



W20-7

GUIDANCE:

The Flagger (W20-7) symbol sign should be used in advance of any point where a flagger is stationed to control road users.

OPTION:

A distance legend may be displayed on a supplemental plaque below the Flagger sign. The sign may be used with appropriate legends or in conjunction with other warning signs, such as the BE PREPARED TO STOP (W3-4) sign. The FLAGGER (W20-7a) word message sign with distance legends may be substituted for the Flagger (W20-7) symbol sign.

STANDARD:

The Flagger sign shall be removed, covered, or turned away from road users when the flagging operations are not occurring.

6F.32 Two-Way Traffic Sign (W6-3)



W6-3

GUIDANCE:

When one roadway of a normally divided highway is closed, with two-way motor vehicle traffic maintained on the other roadway, the Two-Way Traffic (W6-3) sign should be used at the beginning of the two-way motor vehicle traffic section and at intervals to remind road users of opposing motor vehicle traffic.

OPTION:

When the lateral space between lanes is restricted, the Two-Way Traffic sign (W6-3) may be replaced with the Opposing Traffic Lane Divider (W6-4).

6F.33 Workers Sign (W21-1)



W21-1

OPTION:

A Workers (W21-1) symbol sign may be used to alert road users of workers in or near the roadway.

GUIDANCE:

In the absence of other warning devices, a Workers symbol sign should be used when workers are in the roadway.

OPTION:

The WORKERS (W21-1a) word message sign may be used as an alternate to the Workers (W21-1) symbol sign.

6F.34 FRESH OIL (TAR) Sign (W21-2)

GUIDANCE:

The FRESH OIL (TAR) (W21-2) sign should be used to warn road users of the surface treatment.



W21-2



W21-3

6F.35 ROAD MACHINERY AHEAD Sign (W21-3)

OPTION:

The ROAD MACHINERY AHEAD (W21-3) sign may be used to warn of machinery operating in or adjacent to the roadway.

HANDOUT

HANDOUT

**6F.36 Motorized Traffic Signs
(W8-6, W11-10)**



W8-6



W11-10

OPTION:

Motorized Traffic (W8-6, W11-10) signs may be used to alert road users to locations where unexpected travel on the roadway or entries into or departures from the roadway by construction vehicles might occur. The TRUCK CROSSING (W8-6) word message sign may be used as an alternate to the Truck Crossing symbol (W11-10) sign where there is an established construction vehicle crossing of the roadway.

SUPPORT:

These locations might be relatively confined or might occur randomly over a segment of roadway.

**6F.37 SHOULDER WORK Signs
(W21-5, W21-5a)**



W21-5



W21-5a

SUPPORT:

Shoulder Work signs warn of maintenance, reconstruction, or utility operations on the highway shoulder where the roadway is unobstructed.

STANDARD:

The Shoulder Work sign shall have the legend SHOULDER WORK (W21-5), RIGHT (LEFT) SHOULDER CLOSED (W21-5a), or RIGHT (LEFT) SHOULDER CLOSED XXX FT or AHEAD (W21-5b).

OPTION:

The Shoulder Work sign may be used in advance of the point on a nonlimited access highway where there is shoulder work. The Shoulder Work sign may be used singly or in combination with a ROAD WORK NEXT X MILES or ROAD WORK AHEAD sign.

GUIDANCE:

On freeways and expressways, the RIGHT (LEFT) SHOULDER CLOSED XXX FT or AHEAD (W21-5b) sign followed by RIGHT (LEFT) SHOULDER CLOSED (W21-5a) sign should be used in advance of the point where the shoulder work occurs and should be preceded by a ROAD WORK AHEAD sign.

6F.38 SURVEY CREW Sign (W21-6a)

GUIDANCE:

The SURVEY CREW AHEAD (W21-6a) sign should be used to warn of surveying crews working in or adjacent to the roadway.



W21-6a



W21-X6"

**6F.38.1 CREW WORKING AHEAD Sign
(W21-X6)**

GUIDANCE:

The CREW WORKING AHEAD (W21-X6) sign should be used for short duration activities being done on or off the roadway for such thing as filming, surveying, tree trimming, road inspection, lighting, signal work, utility work, and other activities where a crew is visible to traffic.

OPTION:

The CREW WORKING AHEAD (W21-X6) sign may be used in place of the SURVEY CREW (W21-6) sign or the SURVEY CREW AHEAD (W21-6a) sign.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

6F.39 UTILITY WORK AHEAD Sign (W21-7)



W21-7

OPTION:

The UTILITY WORK (W21-7) sign may be used as an alternate to the ROAD (STREET) WORK (W20-1) sign for utility operations on or adjacent to a highway.

SUPPORT:

Typical examples of where the UTILITY WORK sign is used appear in Chapter 6K (*the Field Manual*), Layouts 6K-3, 6K-9, 6K-13, 6K-22, 6K-28, 6K-40, and 6K-51.

STANDARD:

The UTILITY WORK sign shall carry the legend UTILITY WORK, XX FT, XX MILES, or AHEAD.

6F.40 Signs for Blasting Areas

SUPPORT:

Radio-Frequency (RF) energy can cause the premature firing of electric detonators (blasting caps) used in TTC zones.

STANDARD:

Road users shall be warned to turn off mobile radio transmitters and cellular telephones where blasting operations occur. A sequence of signs shall be prominently displayed to direct operators of mobile radio equipment, including cellular telephones, to turn off transmitters in a blasting area. These signs shall be covered or removed when there are no explosives in the area or the area is otherwise secured.

6F.41 BLASTING ZONE AHEAD Sign (W22-1)



W22-1

STANDARD:

The BLASTING ZONE AHEAD (W22-1) sign shall be used in advance of any TTC zone where explosives are being used. The TURN OFF 2-WAY RADIO AND CELL PHONE and END BLASTING ZONE signs shall be used in sequence with this sign.

6F.42 TURN OFF 2-WAY RADIO AND CELLULAR PHONE Sign (W22-2)

STANDARD:

The TURN OFF 2-WAY RADIO AND CELLULAR PHONE (W22-2) sign shall follow the BLASTING ZONE AHEAD sign and shall be placed at least 1,000 feet before the beginning of the blasting zone.



W22-2



W22-3

6F.43 END BLASTING ZONE Sign (W22-3)

STANDARD:

The END BLASTING ZONE (W22-3) sign shall be placed a minimum of 1,000 feet past the blasting zone.

OPTION:

The END BLASTING ZONE sign may be placed either with or preceding the END ROAD WORK sign.

6F.44 Shoulder Signs

SUPPORT:

The signs in the following sections are to be used as described.

MIN Rev. 1

MIN Rev. 1

HANDOUT

HANDOUT

HANDOUT

HANDOUT

6F.44.1 SHOULDER DROP OFF Sign (W8-9a)



W8-9a

STANDARD:

The SHOULDER DROP-OFF (W8-9a) sign shall be used when a shoulder drop-off, adjacent to the travel lane, exceeds 2 inches in depth and is not protected by portable barriers and the LOW SHOULDER sign (W8-9) is not used.

**6F.44.2 LOW SHOULDER Sign (W8-9)
HIGH SHOULDER (W21-X9)**



W8-9



W21-X9

STANDARD:

The LOW SHOULDER sign (W8-9) and the HIGH SHOULDER sign (W21-X9) shall be used for a shoulder drop-off or rise in accordance with the guidelines shown in Figure 6K-3 on page 6K-xxi.

6F.44.3 NO SHOULDER Sign (W8-23)



W8-23

STANDARD:

The NO SHOULDER sign (W8-23) shall be used for a shoulder drop-off in accordance with the guidelines shown in Figure 6K-4 and 6K-5 on pages 6K-xxii and 6K-xxiii.

MN Rev. 3

MN Rev. 3

6F.44.4 SOFT SHOULDER Sign (W8-4)

OPTION:

The SOFT SHOULDER sign (W8-4) may be used for a shoulder drop-off between 2 and 4 inches in height and the edge has been tapered and compacted at a rate of 6:1 so that a vehicle may safely drive on it.



W8-4



W8-11

6F.45 UNEVEN LANES Sign (W8-11)

STANDARD:

The UNEVEN LANES (W8-11) sign shall be used in accordance with the guidelines shown in Figure 6-3 on page xxi.

GUIDANCE:

The UNEVEN LANES (W8-11) sign should be used during operations that create a difference in elevation between adjacent lanes that are open to travel.

6F.46 STEEL PLATE AHEAD Sign (W8-24)



W8-24

OPTION:

A STEEL PLATE AHEAD (W8-24) sign may be used to warn road users that the presence of a temporary steel plate(s) might make the road surface uneven and might create slippery conditions during wet weather.

HANDOUT

HANDOUT

6F.47 NO CENTER STRIPE Sign (W8-12a)



W8-12a

STANDARD:

The NO CENTER STRIPE (W8-12a) sign shall be used as detailed in Section 6F.78.

GUIDANCE:

This sign should also be used at major connection, traffic generators, and/or at appropriate intervals to advise motorists entering the zone.

6F.48 Reverse Curve Signs (W1-4 Series)



W1-4



W1-4b



W1-4c

GUIDANCE:

In order to give road users advance notice of a lane shift, a Reverse Curve (W1-4, W1-4b, or W1-4c) sign (see Figure 6F-4) should be used when a lane (or lanes) is being shifted to the left or right. If the design speed of the curves is 30 mph or less, a Reverse Turn (W1-3) sign should be used.

STANDARD:

If a Reverse Curve (or Turn) sign is used, the direction of the reverse curve (or turn) symbol shall be consistent with the desired vehicle path. Except as provided in the following Option, the number of lanes illustrated on the sign shall be the same as the number of through lanes available to road users.

OPTION:

Where two or more lanes are being shifted, a W1-4 (or W1-3) sign with an ALL LANES (W24-1cP) plaque (see Figure 6F-4) may be used instead of a sign that illustrates the number of lanes.

Where more than three lanes are being shifted, the Reverse Curve (or Turn) sign may be rectangular.

6F.49 Double Reverse Curve Signs (W24-1, W24-1a, W24-1b)



W24-1



W24-1a



W24-1b

OPTION:

The Double Reverse Curve (W24-1, W24-1a, W24-1b) sign may be used where the tangent distance between two reverse curves is less than 600 feet, thus making it difficult for a second Reverse Curve (W1-4 series) sign to be placed between the curves. If the design speed of the curves is 30 mph or less, Double Reverse Turn signs should be used.

STANDARD:

If a Double Reverse Curve (or Turn) sign is used, the direction of the double reverse curve (or turn) symbol shall be consistent with the desired vehicle path. Except as provided in the first paragraph of the following Option, the number of lanes illustrated on the sign shall be the same as the number of through lanes available to road users.

OPTION:

Where two or more lanes are being shifted, a W24-1 (or Double Reverse Turn sign showing one lane) sign with an ALL LANES (W24-1cP) plaque may be used instead of a sign that illustrates the number of lanes.

Where more than three lanes are being shifted, the Double Reverse Curve (or Turn) sign may be rectangular.

6F.50 Other Warning Signs

OPTION:

Advance warning signs may be used by themselves or with other advance warning signs.

Besides the warning signs specifically related to TTC zones, several other warning signs in Part 2 may apply in TTC zones.

STANDARD:

Except as provided in Section 6F.02, other warning signs that are used in TTC zones shall have black legends and borders on an orange background.

HANDOUT

HANDOUT



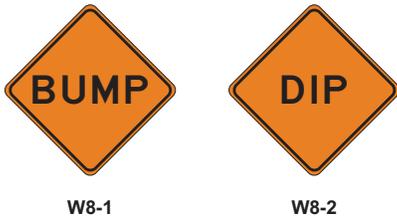
MN Rev. 1

Figure 6F-4 Other Warning Signs That May be Found in Temporary Traffic Control Zones

HANDOUT

HANDOUT

6F.50.1 BUMP and DIP Signs (W8-1, W8-2)



SUPPORT:

The BUMP and DIP signs (W8-1, W8-2) are intended for use to give warning of a sharp rise or depression in the profile of the road that is sufficiently abrupt to create a hazardous condition to cause considerable discomfort to passengers, to cause a shifting of cargo, or to deflect a vehicle from its true course at the normal driving speed for the road.

OPTION:

It may be desirable at some locations to supplement these signs with an Advisory Speed plaque (W13-1).

STANDARD:

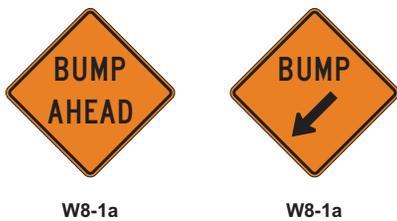
The DIP sign (W8-2) shall not be used at a short stretch of depressed alignment that may momentarily hide a vehicle. Such a condition shall be treated as a no-passing zone (see Section 3B-3 to 5).

Only one supplemental plaque shall be permitted beneath each sign.

GUIDANCE:

The use of a flashing beacon or orange flag is discretionary depending on the severity of the bump or dip. When used, they should be mounted on the advance sign assembly.

At less severe or multiple bumps, a BUMP AHEAD (W8-1a) or BUMPS (W8-1b) sign should be placed an adequate distance in advance of the site(s) to ensure that a motorist has sufficient warning before arriving at the location. An appropriate distance plaque, XXX FEET (W20-100p) or NEXT XX MILES (W7-3a) should be placed below the warning sign.



At the site of each severe bump or dip, a "down arrow" should be added to the sign face to identify the exact location of the bump or dip.

When there are multiple bumps of lesser severity or pavement breaks for a distance in excess of one mile, the ROUGH ROAD sign (W8-8) should be used.



OPTION:

The NEXT XX MILES (W7-3aP) may be used below the ROUGH ROAD sign (W8-8).

6F.50.2 BE PREPARED TO STOP Sign (W3-4)



OPTION:

The BE PREPARED TO STOP sign (W3-4) may be used in advance of conditions that may require the driver to stop.

SUPPORT:

The BE PREPARED TO STOP sign (W3-4) is usually used in conjunction with the FLAGGER AHEAD sign (W20-7a).

6F.51 Special Warning Signs

OPTION:

Advance warning signs may be used by themselves or with other advance warning signs.

Besides the warning signs specifically related to TTC zones, several other warning signs in Part 2 may apply in TTC zones.

GUIDANCE:

Special warning signs should conform to the general requirements of color, shape, and alphabet size and series. The sign message should be brief, legible, and clear.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

6F.52 Advisory Speed Plaque (W13-1P)



W13-1P

OPTION:

In combination with a warning sign, an Advisory Speed (W13-1P) plaque may be used to indicate a recommended safe speed through the TTC zone.

STANDARD:

The Advisory Speed plaque shall not be used in conjunction with any sign other than a warning sign, nor shall it be used alone. When used with orange TTC zone signs, this plaque shall have a black legend and border on an orange background. The sign shall be at least 24 x 24 inches in size when used with a sign that is 36 x 36 inches or larger. Except in emergencies, an Advisory Speed plaque shall not be mounted until the recommended speed is determined by the governing road authority.

6F.53 Supplemental Distance Plaque (W7-3aP)



W7-3aP

OPTION:

In combination with a warning sign, a Supplemental Distance (W7-3aP) plaque with the legend NEXT XX MILE may be used to indicate the length of highway over which a work activity is being conducted, or over which a condition exists in the TTC zone.

In long TTC zones, Supplemental Distance plaques with the legend NEXT XX MILES may be placed in combination with warning signs at regular intervals within the zone to indicate the remaining length of highway over which the TTC work activity or condition exists.

STANDARD:

The Supplemental Distance plaque with the legend NEXT XX MILES shall not be used in conjunction with any sign other than a warning sign, nor shall it be used alone. When used with orange TTC zone signs, this plaque shall have a black legend and border on an orange background. The sign shall be at least 30 x 24 inches in size when used with a sign that is 36 x 36 inches or larger.

GUIDANCE:

When used in TTC zones, the Supplemental Distance plaque with the legend NEXT XX (MILES) should be placed below the initial warning sign designating that, within the approaching zone, a temporary work activity or condition exists.

6F.54 Motorcycle Plaque (W8-15P)



W8-15P

OPTION:

A Motorcycle (W8-15P) plaque may be mounted below a LOOSE GRAVEL (W8-7) sign, a GROOVED PAVEMENT (W8-15) sign, a METAL BRIDGE DECK (W8-16) sign, or a STEEL PLATE AHEAD (W8-24) sign if the warning is intended to be directed primarily to motorcyclists.

6F.55 Guide Signs

SUPPORT:

Guide signs along highways provide road users with information to help them along their way through the TTC zone. The design of guide signs is presented in Part 2.

GUIDANCE:

The following guide signs should be used in TTC zones as needed:

- A. Standard route markings, where temporary route changes are necessary;
- B. Directional signs and street name signs; and
- C. Special guide signs relating to the condition or work being done.

STANDARD:

If additional guide signs are used in TTC zones, they shall have a black legend on an orange background.

OPTION:

When directional signs and street name signs are used in conjunction with detour routing, these signs may have a black legend on an orange background.

When permanent directional signs or permanent street name signs are used in conjunction with detour signing, they may have a white legend on a green background.

HANDOUT

HANDOUT

6F.56 ROAD WORK NEXT XX MILES Sign (G20-1)



G20-1

GUIDANCE:

The ROAD WORK NEXT XX MILES (G20-1) sign should be installed in advance of TTC zones that are more than 2 miles in length.

OPTION:

The ROAD WORK NEXT XX MILES sign may be mounted on a Type III barricade. The sign may also be used for TTC zones of shorter length.

STANDARD:

The distance shown on the ROAD WORK NEXT XX MILES sign shall be stated to the nearest whole mile.

6F.56.1 Closure Notice Sign (G20-X1)



G20-X1

OPTION:

The Closure Notice sign (G20-X1) may be used to advise motorists that road work activities begin at a future date.

GUIDANCE:

When used, the sign should be installed seven calendar days prior to the anticipated closure of the roadway.

STANDARD:

The sign has several possible legends. They include:

- BRIDGE, RAMP, or ROAD CLOSED
- BRIDGE, RAMP, or ROAD DETOURED
- SINGLE LANE BEGINS

6F.57 END ROAD WORK Sign (G20-2)



G20-2

GUIDANCE:

The ROAD WORK NEXT XX MILES (G20-1) sign should be installed in advance of TTC zones that are more than 2 miles in length.

OPTION:

The END ROAD WORK sign may be installed on the back of a warning sign facing the opposite direction of road users or on the back of a Type III barricade.

6F.58 PILOT CAR FOLLOW ME Sign (G20-4)



G20-4

STANDARD:

The PILOT CAR FOLLOW ME (G20-4) sign shall be mounted in a conspicuous position on the rear of a vehicle used for guiding one-way motor vehicle traffic through or around a TTC zone. A flagger shall be stationed on the approach to the activity area to stop motor vehicle traffic until the pilot vehicle is available.

HANDOUT

HANDOUT

6F.59 Detour Signs and Markers (M4-8, M4-8a, M4-8b, M4-9, M4-9a, M4-9b, M4-9c, and M4-10)



STANDARD:

Each detour shall be adequately marked with standard temporary route markers and destination signs.

OPTION:

Detour signs in TTC incident management situations may have a black legend and border on a fluorescent pink background.

The Detour Arrow (M4-10) sign may be used where a detour route has been established.

The DETOUR (M4-8) marker may be mounted at the top of a route marker assembly to mark a temporary route that detours from a highway, bypasses a section closed by a TTC zone, and rejoins the highway beyond the TTC zone.

GUIDANCE:

The Detour Arrow (M4-10) sign should normally be mounted just below the ROAD CLOSED (R11-2, R11-3a, or R11-4) sign. The Detour Arrow sign should include a horizontal arrow pointed to the right or left as required.

The DETOUR (M4-9) sign should be used for unnumbered highways, for emergency situations, for periods of short durations, or where, over relatively short distances, road users are guided along the detour and back to the desired highway without route markers.

For a long term detour, a Street Name sign should be placed above, or the street name should be incorporated into, a DETOUR (M4-9) sign to indicate the name of the street being detoured.

OPTION:

The END DETOUR (M4-8a or M4-8b) sign may be used to indicate that the detour has ended.

GUIDANCE:

When the END DETOUR sign is used on a numbered highway, the sign should be mounted above a marker after the end of the detour.

The Pedestrian/Bicycle Detour (M4-9a) sign should be used where a pedestrian/bicycle detour route has been established because of the closing of a pedestrian/bicycle facility to through traffic.

STANDARD:

If used, the Pedestrian/Bicycle Detour sign shall have an arrow pointing in the appropriate direction.

OPTION:

The arrow on a Pedestrian/Bicycle Detour sign may be on the sign face or on a supplemental plaque.

The Pedestrian Detour (M4-9b) sign or Bicycle Detour (M4-9c) sign may be used where a pedestrian or bicycle detour route (not both) has been established because of the closing of the pedestrian or bicycle facility to through traffic.

6F.60 Portable Changeable Message Signs

SUPPORT:

Portable changeable message signs (PCMS) are TTC devices installed for temporary use with the flexibility to display a variety of messages. In most cases, portable changeable message signs follow the same provisions for design and application as those given for changeable message signs in Chapter 2L. The information in this Section describes situations where the provisions for portable changeable message signs differ from those given in Chapter 2L.

Portable changeable message signs are used most frequently on high-density urban freeways, but have applications on all types of highways where highway alignment, road user routing problems, or other pertinent conditions require advance warning and information.

Portable changeable message signs have a wide variety of applications in TTC zones including: roadway, lane, or ramp closures; incident management; width restriction information; speed control or reductions; advisories on work scheduling; road user management and diversion; warning of adverse conditions or special events; and other operational control.

HANDOUT

HANDOUT

The primary purpose of portable changeable message signs in TTC zones is to advise the road user of unexpected situations. Portable changeable message signs are particularly useful as they are capable of:

- A. Conveying complex messages,
- B. Displaying real time information about conditions ahead, and
- C. Providing information to assist road users in making decisions prior to the point where actions must be taken.

Some typical applications include the following:

- A. Where the speed of motor vehicle traffic is expected to drop substantially;
- B. Where significant queuing and delays are expected;
- C. Where adverse environmental conditions are present;
- D. Where there are changes in alignment or surface conditions;
- E. Where advance notice of ramp, lane, or roadway closures is needed;
- F. Where crash or incident management is needed; and/or
- G. Where changes in the road user pattern occur.

GUIDANCE:

The components of a portable changeable message sign should include: a message sign, control systems, a power source, and mounting and transporting equipment. The front face of the sign should be covered with a protective material.

STANDARD:

Portable changeable message signs shall comply with the applicable design and application principles established in Chapter 2A. Portable changeable message signs shall display only traffic operational, regulatory, warning, and guidance information, and shall not be used for advertising messages.

SUPPORT:

Section 2L.2 contains information regarding overly simplistic or vague messages that is also applicable to portable changeable message signs.

STANDARD:

The colors used for legends on portable changeable message signs shall comply with those shown in Table 2A-5.

SUPPORT:

Section 2L.4 contains information regarding the luminance, luminance contrast, and contrast orientation that is also applicable to portable changeable message signs.

STANDARD:

The Portable Changeable Message Sign shall display reliable information. An accurate description of the work or incident location is critical.

GUIDANCE:

Portable changeable message signs should be visible from 1/2 mile under both day and night conditions.

SUPPORT:

Section 2B.13 contains information regarding the design of portable changeable message signs that are used to display speed limits that change based on operational conditions, or are used to display the speed at which approaching drivers are traveling.

GUIDANCE:

A portable changeable message sign should be limited to three lines of eight characters per line or should consist of a full matrix display.

Except as provided in the following Option, the letter height used for portable changeable message sign messages should be a minimum of 18 inches.

OPTION:

For portable changeable message signs mounted on service patrol trucks or other incident response vehicles, a letter height as short as 10 inches may be used. Shorter letter sizes may also be used on a portable changeable message sign used on low speed facilities provided that the message is legible from at least 650 feet.

The portable changeable message sign may vary in size.

GUIDANCE:

Messages on a portable changeable message sign should consist of no more than two phases, and a phase should consist of no more than three lines of text. Each phase should be capable of being understood by itself, regardless of the order in which it is read. Messages should be centered within each line of legend. If more than one portable changeable message sign is simultaneously legible to road users, then only one of the signs should display a sequential message at any given time.

SUPPORT:

Road users have difficulties in reading messages displayed in more than two phases on a typical three-line portable changeable message sign.

HANDOUT

HANDOUT

STANDARD:

Techniques of message display such as animation, rapid flashing, dissolving, exploding, scrolling, travelling horizontally or vertically across the face of the sign, or other dynamic elements shall not be used.

GUIDANCE:

When a message is divided into two phases, the display time for each phase should be at least 2 seconds, and the sum of the display times for both of the phases should be a maximum of 8 seconds.

Messages should be designed taking into account the following factors:

- A. Each phase should convey a single thought.
- B. If the message can be displayed in one phase, the top line should present the problem, the center line should present the location or distance ahead, and the bottom line should present the recommended driver action.
- C. The message should be as brief as possible.
- D. The entire display should be readable twice at the posted speed limit prior to work starting.

E. Any delay message should accurately reflect the traffic delay time.

F. When a message is longer than two phases, additional Portable Changeable Message signs should be used. When multiple portable changeable message signs are needed, they should be placed on the same side of the roadway and they should be separated from each other by a distance of at least 1,000 feet on freeways and expressways, and by a distance of at least 500 feet on other types of highways.

G. The use of abbreviations is discouraged. The entire word should be spelled out whenever space permits.

H. When abbreviations are used, they should be easily understood (see page 6K-xix).

OPTION:

The message sign panel may vary in size.

STANDARD:

Portable Changeable Message Signs shall meet the requirements detailed in Table 6F-2.

There are three types of Portable Changeable Message Signs as described in Table 6F-2.

Requirements	Type A	Type B	Type C
Line(s) of Message	1 Line	2 Lines	3 Lines
Typical Mounting	Vehicle Mounted	Vehicle or Trailer Mounted	Trailer Mounted
Allowed Usage	Emergency and Incident Mgmt.	Advance Warning	Advance Warning & Advance Notice
Legibility Distance Requirements	Legible at 350 feet	Legible at 750 feet	Legible at 900 feet
Minimum Character Height	10 inches	14 inches	18 inches
Maximum No. of Displays	1	2	* 40 mph or less = 3 * 45 mph or more = 2
Message Cycle	Constant	at least 2 seconds per display	at least 2 seconds per display
Minimum Sign Panel Height	5 feet (rural) 7 feet (urban)	5 feet (rural) 7 feet (urban)	5 feet (rural) 7 feet (urban)
Minimum PCMS Spacing	500 feet	1000 feet	1000 feet

* Posted speed limit prior to work starting.

Table 6F-2 Specifications for Portable Changeable Message Sign Use

HANDOUT

HANDOUT

STANDARD:

When the word messages shown in Tables 1A-1 or 1A-2 need to be abbreviated on a portable changeable message sign, the provisions described in Section 1A.15 shall be followed.

In order to maintain legibility, portable changeable message signs shall automatically adjust their brightness under varying light conditions.

The control system shall include a display screen upon which messages can be reviewed before being displayed on the message sign. The control system shall be capable of maintaining memory when power is unavailable.

Portable changeable message signs shall be equipped with a power source and a battery back-up to provide continuous operation when failure of the primary power source occurs.

The mounting of portable changeable message signs on a trailer, a large truck, or a service patrol truck shall be such that the bottom of the message sign shall be a minimum of 7 feet above the roadway in urban areas and 5 feet above the roadway in rural areas when it is in the operating mode.

GUIDANCE:

Portable changeable message signs should be used as a supplement to and not as a substitute for conventional signs and pavement markings.

When portable changeable message signs are used for route diversion, they should be placed far enough in advance of the diversion to allow road users ample opportunity to perform necessary lane changes, to adjust their speed, or to exit the affected highway.

Portable changeable message signs should be sited and aligned to provide maximum legibility and to allow time for road users to respond appropriately to the portable changeable message sign message.

Portable Changeable Message Signs should be placed off the shoulder.

STANDARD:

If a Portable Changeable Message sign is placed on the shoulder of the roadway, it shall be placed a minimum of 4 feet from the edge of the traveled lane, and it shall be delineated with a partial shoulder closure taper. If the 4 foot clearance cannot be met, then a full shoulder closure shall be provided.

GUIDANCE:

When portable changeable message signs are not being used to display TTC messages, they should be relocated such that they are outside of the clear zone or shielded behind a traffic barrier and turned away from traffic. If relocation or shielding is not practical, they should be

delineated with retroreflective TTC devices.

Portable changeable message sign trailers should be delineated on a permanent basis by affixing retroreflective material, known as conspicuity material, in a continuous line on the face of the trailer as seen by oncoming road users.

STANDARD:

If a Portable Changeable Message Sign is used as an arrow board, it shall meet all the requirements of an arrow board and shall be used solely as an arrow board.

6F.61 Arrow Boards

STANDARD:

An arrow board shall be a sign with a matrix of elements capable of either flashing or sequential displays. This sign shall provide additional warning and directional information to assist in merging and controlling road users through or around a TTC zone.

GUIDANCE:

An arrow board in the arrow or chevron mode should be used to advise approaching traffic of a lane closure along major multi-lane arterial roadways in situations involving heavy traffic volumes, high speeds, and/or limited sight distances, or at other locations and under other conditions where road users are less likely to expect such lane closures.

If used, an arrow board should be used in combination with appropriate signs, channelizing devices, or other TTC devices.

Arrow boards should be placed off the shoulder whenever possible.

STANDARD:

If an arrow board is placed on the shoulder of the roadway, it shall be placed a minimum of 4 feet from the edge of the traveled lane, and it shall be delineated with an appropriate shoulder closure taper.

STANDARD:

Arrow boards shall meet the minimum size, legibility distance, number of elements, and other specifications shown on Figure 6F-6.

SUPPORT:

Type A arrow boards are appropriate for use on low-speed urban streets. Type B arrow boards are appropriate for intermediate-speed facilities and for maintenance or mobile operations on high-speed roadways. Type C arrow boards are intended to be used on high-speed, high-volume motor vehicle traffic control projects. Type D arrow boards are intended for use on vehicles authorized by the State or local agency.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Operating Mode	Panel Display *
1. At least one of the following two modes shall be provided:	(Right arrow is shown, left arrow is similar)
Flashing Arrow	 Move/Merge Right
Sequential Arrow	 Move/Merge Right
Sequential Chevron	 Move/Merge Right
2. The following mode shall be provided:	 Flashing Double Arrow Move/Merge Right or Left
3. At least one of the following three modes shall be provided:	
Flashing Four Corners	
Flashing Bar	
Alternating Flashing Diamonds	 Caution

* Element layout for Type C panel shown

Panel Type	Minimum Size inches	Minimum Legibility Distance miles	Minimum Number of Elements	Recommended Usage
A	48 x 24	0.5	12	Low speed streets
B	60 x 30	0.75	13	Conventional roadways
C	96 x 48	1.0	15	Freeways and Expressways

Arrow Stick



Arrow Sticks may supplement other TTC devices, but shall not be used in place of arrow boards

MIN Rev. 1

Advance Warning Arrow Board Specifications

Figure 6F-6 Advance Warning Arrow Display Specifications

HANDOUT

HANDOUT

HANDOUT

HANDOUT

STANDARD:

Type A, B, and C arrow boards shall have solid rectangular appearances. A Type D arrow board shall conform to the shape of the arrow.

All arrow boards shall be finished in non-reflective black. The arrow board shall be mounted on a vehicle, a trailer, or other suitable support.

GUIDANCE:

The minimum mounting height, measured vertically from the bottom of the board to the roadway below it or to the elevation of the near edge of the roadway, of an arrow board should be 7 feet, except on vehicle-mounted arrow boards, which should be no lower than 3 feet.

A vehicle-mounted arrow board should be provided with remote controls.

STANDARD:

Arrow board elements shall be capable of at least a 50 percent dimming from full brilliance. The dimmed mode shall be used for nighttime operation of arrow boards.

GUIDANCE:

Full brilliance should be used for daytime operation of arrow boards.

STANDARD:

The arrow board shall have suitable elements capable of the various operating modes. The color presented by the elements shall be yellow.

GUIDANCE:

If an arrow board consisting of a bulb matrix is used, the elements should be recess-mounted or equipped with an upper hood of not less than 180 degrees.

STANDARD:

The minimum element on-time shall be 50 percent for the flashing mode, with equal intervals of 25 percent for each sequential phase. The flashing rate shall be not less than 25 nor more than 40 flashes per minute.

An arrow board shall have the following three mode selections:

- A. A Flashing Arrow, or Sequential Arrow, or Sequential Chevron mode;
- B. A flashing Double Arrow mode; and
- C. A flashing Caution or Alternating Diamond mode.

An arrow board in the arrow or chevron mode shall be used only for stationary or moving lane closures on multi-lane roadways.

For shoulder work, blocking the shoulder, for roadside work near the shoulder, or for temporarily closing one lane on a two-lane, two-way roadway, an arrow board shall be used only in the caution mode.

GUIDANCE:

For a stationary lane closure, the arrow board should be located on the shoulder at the beginning of the merging taper.

Where the shoulder is narrow, the arrow board should be located in the closed lane.

STANDARD:

When arrow boards are used to close multiple lanes, a separate arrow board shall be used for each closed lane.

GUIDANCE:

When arrow boards are used to close multiple lanes, if the first arrow board is placed on the shoulder, the second arrow board should be placed in the first closed lane at the upstream end of the second merging taper (see Figure 6H-37). When the first arrow board is placed in the first closed lane, the second arrow board should be placed in the second closed lane at the downstream end of the second merging taper.

For mobile operations where a lane is closed, the arrow board should be located to provide adequate separation from the work operation to allow for appropriate reaction by approaching drivers.

STANDARD:

A vehicle displaying an arrow board shall be equipped with high-intensity rotating, flashing, oscillating, or strobe lights.

Arrow boards shall only be used to indicate a lane closure. Arrow boards shall not be used to indicate a lane shift.

OPTION:

A portable changeable message sign may be used to simulate an arrow board display.

6F.62 High-Level Warning Devices (Flag Trees)

OPTION:

A high-level warning device (flag tree) may supplement other TTC devices in TTC zones.

SUPPORT:

A high-level warning device is designed to be seen over the top of typical passenger cars. A typical high-level warning device is shown in Figure 6F-2.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

STANDARD:

A high-level warning device shall consist of a minimum of two flags with or without a Type B high-intensity flashing warning light. The distance from the roadway to the bottom of the lens of the light and to the lowest point of the flag material shall be not less than 8 feet. The flag shall be 16 inches square or larger and shall be orange or fluorescent red-orange in color.

OPTION:

An appropriate warning sign may be mounted below the flags.

SUPPORT:

High-level warning devices are most commonly used in high-density road user situations to warn road users of short-term operations.

6F.63 Channelizing Devices

STANDARD:

Designs of various channelizing devices shall be as shown in Figure 6F-7. All channelizing devices exposed to vehicular traffic shall be crashworthy.

SUPPORT:

The function of channelizing devices is to warn road users of conditions created by work activities in or near the roadway and to guide road users. Channelizing devices include cones, tubular markers, vertical panels, drums, barricades, and longitudinal channelizing devices.

Channelizing devices provide for smooth and gradual vehicular traffic flow from one lane to another, onto a bypass or detour, or into a narrower traveled way. They are also used to channelize vehicular traffic away from the work space, pavement drop-offs, pedestrian or shared-use paths, or opposing directions of vehicular traffic.

STANDARD:

Devices used to channelize pedestrians shall be detectable to users of long canes and visible to persons having low vision.

Where channelizing devices are used to channelize pedestrians, there shall be continuous detectable bottom and top surfaces to be detectable to users of long canes. The bottom of the bottom surface shall be no higher than 2 inches above the ground. The top of the top surface shall be no lower than 32 inches above the ground.

OPTION:

A gap not exceeding 2 inches between the bottom rail and the ground surface may be used to facilitate drainage.

GUIDANCE:

Where multiple channelizing devices are aligned to form a continuous pedestrian channelizer, connection points should be smooth to optimize long-cane and hand trailing.

STANDARD:

There are three types of channelizing devices, Type A, B, and C as shown in Figure 6F-7.

The spacing, and the appropriate MN MUTCD section for each channelizing device is shown in Table 6F-2.

GUIDANCE:

The spacing between Type A and B channelizing devices should not exceed a distance in feet equal to 1.0 times the speed limit prior to work starting in mph when used for taper channelization and a distance in feet equal to 2.0 times the speed limit prior to work starting in mph when used for tangent channelization.

When channelizing devices have the potential of leading vehicular traffic out of the intended vehicular traffic space as shown in Layout 6J-4, the channelizing devices should be extended a distance in feet of 2.0 times the speed limit in mph beyond the downstream end of the transition area.

SUPPORT:

The spacing of channelizing devices shown in the TTC layouts are based on the distances contained in Table 6F-3.

OPTION:

Warning lights (see Section 6F.83) may be added to channelizing devices in areas with frequent fog, snow, or severe roadway curvature, or where visual distractions are present.

STANDARD:

Warning lights shall flash when placed on channelizing devices used alone or in a cluster to warn of a condition. Except for the sequential flashing warning lights discussed in the following Option and Standard paragraphs, warning lights placed on channelizing devices used in a series to channelize road users shall be steady-burn.

OPTION:

A series of sequential flashing warning lights may be placed on channelizing devices that form a merging taper in order to increase driver detection and recognition of the merging taper.

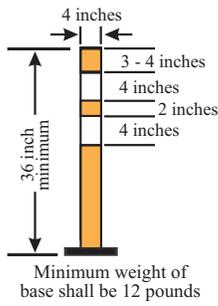
STANDARD:

When used, the successive flashing of the sequential warning lights shall occur from the upstream end of the merging taper to the downstream end of the merging taper in order to identify the desired vehicle path. Each warning light in the sequence shall be flashed at a rate of not less than 55 nor more than 75 times per minute.

HANDOUT

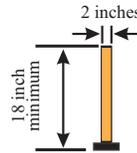
HANDOUT

HANDOUT

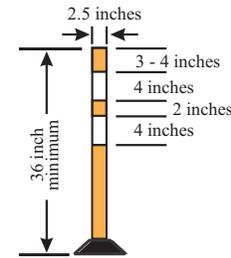


Night and/or Freeway
High Speed Roadway
Speed Limit 45 MPH
or greater

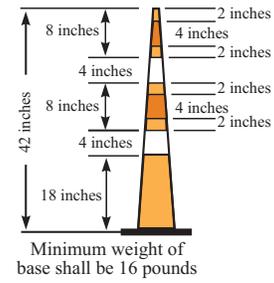
TUBULAR MARKER



Day and
Low Speed Roadway
Speed Limit 40 MPH
or less

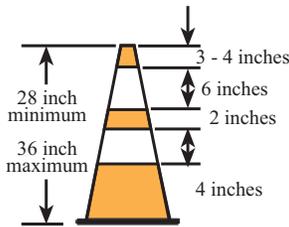


**SURFACE MOUNTED
DELINEATOR**



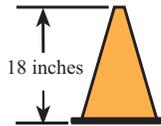
Night and/or Freeway
High Speed Roadway
Speed Limit 45 MPH
or greater

**WEIGHTED
CHANNELIZER**

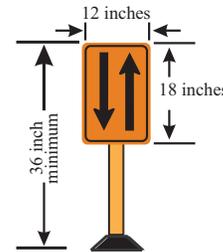


Night and/or Freeway
High Speed Roadway
Speed Limit 45 MPH
or greater

CONES



Day and Low Speed
Roadway
Speed Limit 40 MPH
or less



**OPPOSING TRAFFIC
LANE DIVIDER**

Where traffic may approach the channelizing device from either side, the channelizing device should be reflectorized on both sides or two channelizing devices back-to-back to provide visibility.

Type A Channelizing Devices

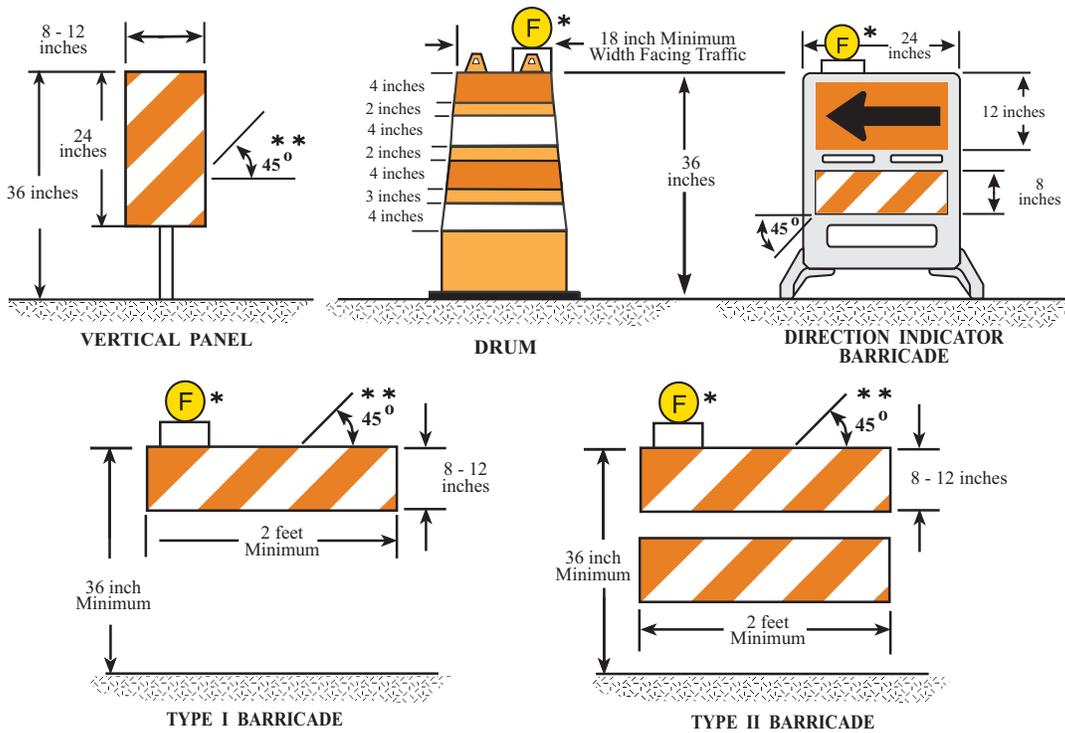
Figure 6F-7 Channelizing Devices
(Sheet 1 of 2)

HANDOUT

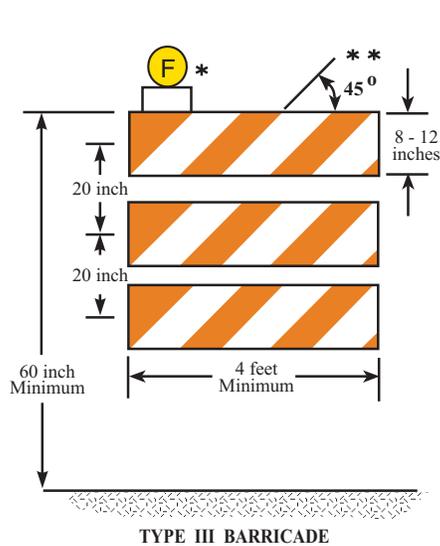
HANDOUT

HANDOUT

HANDOUT



Type B Channelizing Devices



Type C Channelizing Device

NOTES:

- * Warning lights are optional.
- ** Rail stripe widths shall be 4 inches on barricade rail boards less than 36 inches. Rail stripe widths shall be 6 inches on barricade rail boards wider than 36 inches.

Where traffic may approach the channelizing device from either side, the channelizing device should be reflectorized on both sides or two channelizing devices back-to-back to provide visibility.

Figure 6F-7 Channelizing Devices
 (Sheet 2 of 2)

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Channelizing Device	Device Type	Maximum Allowed Spacing		Recommended Spacing		MN MUTCD Section for complete information
		Transition Spacing	Tangent Spacing	Transition Spacing	Tangent Spacing	
		feet	feet			
Cone	A	S	2S	G	2G	6F.64
Tubular Marker	A	S	2S	G	2G	6F.65
Surface Mounted Delineator	A	S	2S	G	2G	6F.65.1
Weighted Channelizer	A	S	2S	G	2G	6F.65.2
Drum	B	S	2S	G	2G	6F.67
Vertical Panel	A	S	2S	G	2G	6F.66
Type I Barricade	B	S	2S	G	2G	6F.68
Type II Barricade	B	S	2S	G	2G	6F.68
Type III Barricade	C	N/A	20 S	N/A	20 G	6F.68
Direction Indicator Barricade	B	S	20 S	G	20 G	6F.649
Opposing Traffic Divider	A	S	2S	G	2G	6F.76

Notes:

N/A - Not Applicable

S - Posted speed limit (in mph) prior to work starting

G - Recommended spacing guide number for Field Manual

G = 25 feet for low speed roads (S of 40 mph or less)

G = 50 feet for high speed roads (S of 45 mph or greater)

Table 6F-3 Recommended Spacing of Type A, B, and C Channelizing Devices

The retroreflective material used on channelizing devices shall have a smooth, sealed outer surface that will display a similar color day or night.

OPTION:

The name and telephone number of the highway agency, contractor, or supplier may be shown on the non-retroreflective surface of all types of channelizing devices.

STANDARD:

The letters and numbers of the name and telephone number shall be non-retroreflective and not over 2 inches in height.

GUIDANCE:

Particular attention should be given to maintaining the channelizing devices to keep them clean, visible, and properly positioned at all times.

STANDARD:

Devices that are damaged or have lost a significant amount of their retroreflectivity and effectiveness shall be

replaced (see the Quality Standards in Section 6K).

6F.64 Cones

STANDARD:

Cones shall be predominantly orange and shall be made of a material that can be struck without causing damage to the impacting vehicle (see Figure 6F-7). For daytime and low-speed roadways, cones shall be not less than 18 inches in height. When cones are used on freeways and other high-speed highways or at night on all highways, or when more conspicuous guidance is needed, cones shall be a minimum of 28 inches in height.

For nighttime use, cones shall be retroreflectorized or equipped with lighting devices for maximum visibility. Retro-reflectorization of cones that are 28 to 36 inches in height shall be provided by a 6-inch wide white band located 3 to 4 inches from the top of the cone and an additional 4-inch wide white band located approximately 2 inches below the 6-inch band.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Retro-reflectorization of cones that are more than 36 inches in height shall be provided by horizontal, circumferential, alternating orange and white retroreflective stripes that are 4 to 6 inches wide. Each cone shall have a minimum of two orange and two white stripes with the top stripe being orange. Any non-retroreflective spaces between the orange and white stripes shall not exceed 3 inches in width.

Cones shall not be used on unattended work sites.

OPTION:

Traffic cones may be used to mark hazards or close roadways for short term emergency situations.

Traffic cones may be used in short term and intermediate term TTC zones to channelize road users, divide opposing motor vehicle traffic lanes, divide lanes when two or more lanes are kept open in the same direction, and delineate short term maintenance and utility work.

GUIDANCE:

Steps should be taken to minimize the possibility of cones being blown over or displaced by wind or moving vehicular traffic.

Cones should not be used for pedestrian channelization or as pedestrian barriers in TTC zones on or along sidewalks unless they are continuous between individual devices and detectable to users of long canes.

OPTION:

Cones may be doubled up to increase their weight.

SUPPORT:

Some cones are constructed with bases that can be filled with ballast. Others have specially weighted bases, or weight such as sandbag rings that can be dropped over the cones and onto the base to provide added stability.

GUIDANCE:

Ballast should be kept to the minimum amount needed.

6F.65 Tubular Markers

SUPPORT:

Tubular markers are portable devices constructed with weighted bases, or weights such as sandbag rings that can be dropped over the tubes and onto the base to provide added stability.

STANDARD:

Tubular markers shall be tubular, shall be predominantly orange, and shall be made of a material that can be struck without causing damage to the impacting vehicle (see Figure 6F-7). For daytime and low-speed roadways, tubular markers shall not be less than 18 inches high and 2 inches

in diameter. When tubular markers are used on freeways and other high-speed highways or at night on all highways, or when more conspicuous guidance is needed, tubular markers shall be a minimum of 36 inches high and 4 inches in diameter.

For nighttime use, tubular markers shall be retroreflectORIZED or equipped with lighting devices for maximum visibility. Retroreflectorization of 36 inch or larger tubular markers shall be provided by a white band 4 inches wide located 3 to 4 inches from the top of the marker and an additional 4 inch wide white band approximately 2 inches below the 4 inch band.

Tubular markers shall not be used to mark hazards or close roadways.

GUIDANCE:

Tubular markers have less visible area than other devices and should be used only where space restrictions do not allow for the use of other more visible devices.

Tubular markers should be stabilized by affixing them to the pavement, by using weighted bases, or weights such as sandbag rings that can be dropped over the tubular markers and onto the base to provide added stability. The weighted base should weigh at least 12 pounds.

OPTION:

Tubular markers may be used effectively to divide opposing lanes of road users, divide vehicular traffic lanes when two or more lanes of moving vehicular traffic are kept open in the same direction, and to delineate the edge of a pavement drop off where space limitations do not allow the use of larger devices.

6F.65.1 Surface Mounted Delineators

OPTION:

Surface mounted delineators are delineation devices that may be used as center lane dividers to separate opposing motor vehicle traffic on a two-lane, two-way operation.

Surface mounted delineators may also be used to provide other traffic delineation.

STANDARD:

Surface mounted delineators shall be predominantly orange, and shall be made of a material that can be struck without causing damage to the impacting vehicle (see Figure 6F-7). Surface mounted delineators shall be attached to the pavement surface to assure they remain in place. If a non-cylindrical tubular marker is used, it shall be attached to the pavement in a manner to display a minimum 2.5 inch width to all approaching road users.

HANDOUT

HANDOUT

Surface mounted delineators shall not be less than 36 inches high and 2.5 inches wide facing road users. The delineator shall be retroreflectorized for nighttime visibility with a white band 4 inches wide located 3 to 4 inches from the top of the delineator and an additional 4 inch wide white band approximately 2 inches below the 4 inch band.

6F.65.2 Weighted Channelizers

STANDARD:

Weighted Channelizers used for road user warning or channelization shall be predominantly orange in color and shall be constructed of lightweight, deformable materials (see Figure 6F-7). They shall be a minimum of 42 inches in height having a conical cross section a minimum of 4 inches wide at the top, regardless of orientation, and a minimum cross sectional area of 200 square inches. The weighted base shall be a minimum of 16 pounds.

The markings on weighted channelizers shall be horizontal, circumferential, alternating orange and white retroreflective stripes 4 to 6 inches wide with the top stripe being orange. Any non-retroreflective spaces between the horizontal orange and white stripes shall not exceed 2 inches in width.

OPTION:

Weighted channelizers may have a handle or lifting device, which extends above the 42 inch minimum device height.

GUIDANCE:

Weighted channelizers have less visible area than other devices and should therefore be used only where space is limited or the presence of larger devices will restrict sight.

The spacing of weighted channelizers should not exceed a distance in feet equal to the posted speed limit in mph when used for taper channelization. The spacing of weighted channelizers should not exceed a distance in feet equal to 2.0 times the posted speed limit in mph when used for tangent channelization.

OPTION:

Weighted channelizers may be used effectively to divide opposing lanes of traffic and delineate the edge of pavement drop-offs. Although weighted channelizers are most commonly used to channelize or delineate road user flow, they may also be used alone or in groups to mark specific locations.

6F.66 Vertical Panels

STANDARD:

Vertical panels (see Figure 6F-7) shall have retroreflective striped material that is 8 to 12 inches in width and at least 24 inches in height. They shall have alternating diagonal orange and white retroreflective stripes sloping downward at an angle of 45 degrees in the direction vehicular traffic is to pass.

Vertical panels used on expressways, freeways, and other high-speed roadways shall have a minimum of 270 square inches retroreflective area facing motor vehicle traffic.

Where the height of the retroreflective material on the vertical panel is 36 inches or more, a stripe width of 6 inches shall be used.

OPTION:

Where the height of the retroreflective material on the vertical panel is less than 36 inches, a stripe width of 4 inches may be used.

Where space is limited, vertical panels may be used to channelize vehicular traffic, divide opposing lanes, or replace barricades.

6F.67 Drums

STANDARD:

Drums used for road user warning or channelization shall be constructed of lightweight, deformable materials (see Figure 6F-7). They shall be a minimum of 36 inches in height and have at least an 18-inch minimum width regardless of orientation. Metal drums shall not be used. The markings on drums shall be horizontal, circumferential, alternating orange and white retroreflective stripes 4 to 6 inches wide. Each drum shall have a minimum of two orange and two white stripes with the top stripe being orange. Any non-retroreflectorized spaces between the horizontal orange and white stripes shall not exceed 2 inches wide. Drums shall have closed tops that will not allow collection of construction debris or other debris.

SUPPORT:

Drums are highly visible, have good target value, give the appearance of being formidable obstacles and, therefore, command the respect of road users. They are portable enough to be shifted from place to place within a TTC zone in order to accommodate changing conditions, but are generally used in situations where they will remain in place for a prolonged period of time.

HANDOUT

HANDOUT

OPTION:

Although drums are most commonly used to channelize or delineate road user flow, they may also be used alone or in groups to mark specific locations.

GUIDANCE:

Drums should not be weighted with sand, water, or any material to the extent that would make them hazardous to road users or workers when struck. Drums used in regions susceptible to freezing should have drain holes in the bottom so that water will not accumulate and freeze causing a hazard if struck by a road user.

STANDARD:

Ballast shall not be placed on the top of a drum.

6F.68 Type I, II, or III Barricades

SUPPORT:

A barricade is a portable or fixed device having from one to three rails with appropriate markings and is used to control road users by closing, restricting, or delineating all or a portion of the right-of-way.

Barricades are classified as Type I, Type II, or Type III. (see Figure 6F-7)

STANDARD:

Stripes on barricade rails shall be alternating orange and white retroreflective stripes sloping downward at an angle of 45 degrees in the direction road users are to pass. Except as noted in the following Option, the stripes shall be 6 inches wide.

OPTION:

When rail lengths are less than 36 inches, 4-inch wide stripes may be used.

STANDARD:

The minimum length for Type I and Type II Barricades shall be 24 inches and the minimum length for Type III Barricades shall be 48 inches. Each barricade rail shall be 8 to 12 inches wide. Barricades used on expressways, freeways and other high-speed roadways shall have a minimum of 270 square inches of retroreflective area facing road users.

GUIDANCE:

Where barricades extend entirely across a roadway, the stripes should slope downward in the direction toward which road users must turn.

Where both right and left turns are provided, the barricade stripes should slope downward in both directions from the center of the barricade or barricades.

Where no turns are intended, the stripes should be positioned to slope downward toward the center of the barricade or barricades.

Barricade rails should be supported in a manner that will allow them to be seen by the road user, and in a manner that provides a stable support that is not easily blown over or displaced.

The width of the existing pedestrian facility should be provided for the temporary facility if practical. Traffic control devices and other construction materials and features should not intrude into the usable width of the sidewalk, temporary pathway, or other pedestrian facility. When it is not possible to maintain a minimum width of 60 inches throughout the entire length of the pedestrian pathway, a 60 x 60-inch passing space should be provided at least every 200 feet to allow individuals in wheelchairs to pass.

Barricade rail supports should not project into pedestrian circulation routes more than 4 inches from the support between 27 and 80 inches from the surface as described in Section 4.4.1 of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)" (see Section 1A.11). MN Rev. -

OPTION:

For Type I Barricades, the support may include other unstriped horizontal panels necessary to provide stability.

GUIDANCE:

On high-speed expressways or in other situations where barricades may be susceptible to overturning in the wind, ballasting should be used.

OPTION:

Sandbags may be placed on the lower parts of the frame or the stays of barricades to provide the required ballast.

STANDARD:

Ballast shall not be placed on top of any striped rail. Barricades shall not be ballasted by non-deformable objects such as rocks or chunks of concrete. Ballast shall not extend into the accessible passage width of 60 inches.

SUPPORT:

Type I or Type II Barricades are intended for use in situations where road user flow is maintained through the TTC zone.

OPTION:

Barricades may be used alone or in groups to mark a specific condition or they may be used in a series for channelizing road users.

Type I barricades may be used on conventional roads or urban streets.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

GUIDANCE:

Type II or Type III Barricades should be used on freeways and expressways or other high-speed roadways. Type III Barricades should be used to close or partially close a road.

OPTION:

Type III Barricades used at a road closure may be placed completely across a roadway or from curb to curb.

GUIDANCE:

Where provision is made for access of authorized equipment and vehicles, the responsibility for Type III Barricades should be assigned to a person to ensure proper closure at the end of each workday.

SUPPORT:

When a highway is legally closed but access must still be allowed for local road users, barricades usually are not extended completely across the roadway.

STANDARD:

When a highway is legally closed but access must still be allowed for local traffic, a sign shall be installed with the appropriate legend concerning permissible use by local road users (see Section 6F.9). Adequate visibility of the barricades from both directions shall be provided by;

1. installing retroreflective sheeting on both sides of the barricade boards; or
2. by installing barricade boards back-to-back on the barricade.

OPTION:

Signs may be installed on barricades (see Section 6F.3).

6F.69 Direction Indicator Barricades

STANDARD:

The Direction Indicator Barricade shall consist of a retroreflective One-Direction Large Arrow (W1-6) sign mounted above a diagonal striped, horizontally aligned, retroreflective rail (see Figure 6F-7).

The One-Direction Large Arrow (W1-6) sign shall be black on an orange background. The stripes on the bottom rail shall be alternating orange and white retroreflective stripes sloping downward at an angle of 45 degrees in the direction road users are to pass. The stripes shall be 4 inches wide. The One-Direction Large Arrow (W1-6) sign shall be 24 x 12 inches. The bottom rail shall have a length of 24 inches and a height of 8 inches.

OPTION:

The Direction Indicator Barricade may be used in tapers, transitions, and other areas where specific directional guidance to drivers is necessary.

GUIDANCE:

If used, Direction Indicator Barricades should be used in series to direct the driver through the transition and into the intended travel lane.

6F.70 Temporary Traffic Barriers as Channelizing Devices

SUPPORT:

Temporary traffic barriers are not TTC devices in themselves; however, when placed in a position identical to a line of channelizing devices and marked and/or equipped with appropriate channelization features to provide guidance and warning both day and night, they serve as TTC devices.

STANDARD:

Temporary traffic barriers serving as TTC devices shall conform to requirements for such devices as set forth throughout Part 6.

Temporary traffic barriers (see Section 6F.85) shall not be used solely to channelize road users, but also to protect the work space. If used to channelize vehicular traffic, the temporary traffic barrier shall be supplemented with delineation, pavement markings, or channelizing devices for improved daytime and nighttime visibility.

GUIDANCE:

Temporary traffic barriers should not be used for a merging taper except in low-speed urban areas. Temporary traffic barriers should not be used for a constricted/restricted TTC zone.

When it is necessary to use a temporary traffic barrier for a merging taper in low-speed urban areas or for a constricted/restricted TTC zone, the taper shall be delineated and the taper length should be designed to optimize road user operations considering the available geometric conditions.

STANDARD:

When it is necessary to use a temporary traffic barrier for a merging taper in low-speed urban areas or for a constricted/ restricted TTC zone, the taper shall be delineated.

GUIDANCE:

When used for channelization, temporary traffic barriers should be of a light color for increased visibility.

HANDOUT

HANDOUT

6F.71 Longitudinal Channelizing Barricades

SUPPORT:

Longitudinal channelizing devices are lightweight, deformable devices that are highly visible, have good target value, and can be connected together.

STANDARD:

If used singly as Type 1, 2, or 3 barricades, longitudinal channelizing devices shall comply with the general size, color, stripe pattern, retroreflectivity, and placement characteristics established for the devices described in this Chapter.

GUIDANCE:

If used to channelize vehicular traffic at night, longitudinal channelizing devices should be supplemented with retroreflective material or delineation for improved nighttime visibility.

OPTION:

Longitudinal channelizing barricades may be used instead of a line of cones, drums, or barricades.

Longitudinal channelizing barricades may be hollow and filled with water as a ballast.

Longitudinal channelizing devices may be used for pedestrian traffic control.

STANDARD:

If used for pedestrian traffic control, longitudinal channelizing devices shall be interlocked to delineate or channelize flow. The interlocking devices shall not have gaps that allow pedestrians to stray from the channelizing path.

GUIDANCE:

Longitudinal channelizing devices have not met the crashworthy requirements for temporary traffic barriers and should not be used to shield obstacles or provide positive protection for pedestrians or workers.

6F.72 Temporary Lane Separators

OPTION:

Temporary lane separators may be used to channelize road users, to divide opposing vehicular traffic lanes, to divide lanes when two or more lanes are open in the same direction, and to provide continuous pedestrian channelization.

STANDARD:

Temporary lane separators shall be crashworthy. Temporary lane separators shall have a maximum height of 4 inches and a maximum width of 1 foot, and shall have sloping sides in order to facilitate crossover by emergency vehicles.

OPTION:

Temporary lane separators may be supplemented with any of the approved channelizing devices contained in this Chapter, such as tubular markers, vertical panels, and opposing traffic lane dividers.

STANDARD:

If appropriate channelizing devices are used to supplement a temporary lane separator, the channelizing devices shall be retroreflectorized to provide nighttime visibility. If channelizing devices are not used, the temporary lane separator shall contain retroreflectorization to enhance its visibility.

GUIDANCE:

A temporary lane separator should be stabilized by affixing it to the pavement in a manner suitable to its design, while allowing the unit to be shifted from place to place within the TTC zone in order to accommodate changing conditions.

STANDARD:

At pedestrian crossing locations, temporary lane separators shall have an opening or be shortened to provide a pathway that is at least 60 inches wide for crossing pedestrians.

6F.73 Other Channelizing Devices

OPTION:

Channelizing devices other than those described in this Chapter may be used in special situations based on an engineering study.

GUIDANCE:

Other channelizing devices should conform to the general size, color, stripe pattern, retroreflection, and placement characteristics established for the devices described in this Chapter.

6F.74 Detectable Edging for Pedestrians

SUPPORT:

Individual channelizing devices, tape or rope used to connect individual devices, other discontinuous barriers and devices, and pavement markings are not detectable by persons with visual disabilities and are incapable of providing detectable path guidance on temporary or realigned sidewalks or other pedestrian facilities.

GUIDANCE:

When it is determined that a facility should be accessible to and detectable by pedestrians with visual disabilities, a continuously detectable edging should be provided throughout the length of the facility such that it can be followed by pedestrians using long canes for guidance. This edging should protrude at least 6 inches above the surface of

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

the sidewalk or pathway, with the bottom of the edging a maximum of 2 inches above the surface. This edging should be continuous throughout the length of the facility except for gaps at locations where pedestrians or vehicles will be turning or crossing. This edging should consist of a prefabricated or formed-in-place curbing or other continuous device that is placed along the edge of the sidewalk or walkway. This edging should be firmly attached to the ground or to other devices. Adjacent sections of this edging should be interconnected such that the edging is not displaced by pedestrian or vehicular traffic or work operations, and such that it does not constitute a hazard to pedestrians, workers, or other road users.

SUPPORT:

Examples of detectable edging for pedestrians include:

- A. Prefabricated lightweight sections of plastic, metal, or other suitable materials that are interconnected and fixed in place to form a continuous edge.
- B. Prefabricated lightweight sections of plastic, metal, or other suitable materials that are interconnected, fixed in place, and placed at ground level to provide a continuous connection between channelizing devices located at intervals along the edge of the sidewalk or walkway.
- C. Sections of lumber interconnected and fixed in place to form a continuous edge.
- D. Formed-in-place asphalt or concrete curb.
- E. Prefabricated concrete curb sections that are interconnected and fixed in place to form a continuous edge.
- F. Continuous temporary traffic barrier or longitudinal channelizing barricades placed along the edge of the sidewalk or walkway that provides a pedestrian edging at ground level.
- G. Chain link or other fencing equipped with a continuous bottom rail.

GUIDANCE:

Detectable pedestrian edging should be orange, white, or yellow and should match the color of the adjacent channelizing devices or traffic control devices, if any are present.

MN Rev. 3

6F.74.1 Temporary Walkway Surface

SUPPORT:

There are areas of a work zone where an accessible pedestrian pathway will cross short segments of rough, soft or uneven ground or hazards. In addition, work vehicles might need to cross an accessible pedestrian pathway.

GUIDANCE:

As stated in 6D.1, a smooth, continuous hard surface should be provided throughout the entire length of a temporary pedestrian pathway.

A temporary walkway surface should be used to facilitate pedestrian movement through:

- A. Short segments of rough, soft or uneven ground surfaces; and
- B. segments where vehicles may cross the temporary pedestrian pathway and a detectable edge is not feasible, such as work vehicle access points.

OPTION:

If clear direction is not given for a temporary crosswalk by the grade break of the curb ramp (temporary or permanent), a temporary walkway surface may be provided to guide pedestrians along the temporary crosswalk to the receiving curb ramp or intended destination.

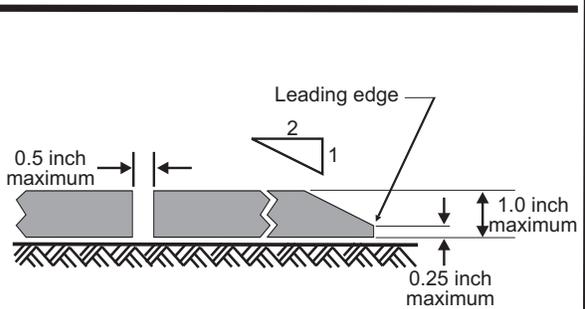
STANDARD:

The temporary walkway surface shall be firm, stable and slip resistant. The width of the temporary walkway surface shall be a minimum of 4 feet. Lateral joints between segments of the walkway surface shall be less than 0.5 inches.

If detectable edges (6F.74) are not used on a temporary walkway surface, the edges shall be marked with a contrasting 2- to 4-inch wide marking.

GUIDANCE:

Changes between the segments of the walkway surface should not exceed 0.5 inches. The side edges of the walkway surface should be between 0.25 inches and 1.0 inches thick. The leading and departing edges of the temporary walkway surface should follow the dimensions shown in Figure 6F-10 Temporary Walkway Surface Dimension.



Leading and departing edges are the same

Figure 6F-10 Temporary Walkway Surface Dimensions

MN Rev. 3

HANDOUT

HANDOUT

6F.75 Temporary Raised Islands

STANDARD:

Temporary raised islands shall be used only in combination with pavement striping and other suitable channelizing devices.

OPTION:

A temporary raised island may be used to separate vehicular traffic flows in two-lane, two-way operations on roadways having a vehicular traffic volume range of 4,000 to 15,000 average daily traffic (ADT) and on freeways having a vehicular traffic volume range of 22,000 ADT to 60,000 ADT.

Temporary raised islands also may be used in other than two-lane, two-way operations where physical separation of vehicular traffic from the TTC zone is not required.

GUIDANCE:

Temporary raised islands should have the basic dimensions of 4 inches high by 12 inches wide and have rounded or chamfered corners.

The temporary raised islands should not be designed in such a manner that they would cause a driver to lose control of the vehicle if the vehicle inadvertently strikes the temporary raised island. If struck, pieces of the island should not be dislodged to the extent that they could penetrate the occupant compartment or involve other vehicles.

STANDARD:

At pedestrian crossing locations, temporary raised islands shall have an opening or be shortened to provide at least a 60 inch wide pathway for the crossing pedestrian.

6F.76 Opposing Traffic Lane Divider and sign (W6-4)



W6-4

SUPPORT:

Opposing traffic lane dividers are delineation devices used as center lane dividers to separate opposing vehicular traffic on a two-lane, two-way operation.

STANDARD:

Opposing traffic lane dividers shall not be placed across pedestrian crossings.

The Opposing Traffic Lane Divider (W6-4) sign (see Figure 6F-4) shall be an upright, retroreflective orange-colored sign placed on a flexible support and sized at least 12 inches wide by 18 inches high.

6F.77 Pavement Markings

SUPPORT:

Pavement markings are installed or existing markings are maintained or enhanced in TTC zones to provide road users with a clearly defined path for travel through the TTC zone in day, night, and twilight periods under both wet and dry pavement conditions.

GUIDANCE:

The work should be planned and staged to provide for the placement and removal of the pavement markings in a way that minimizes the disruption to traffic flow approaching and through the TTC zone during the placement and removal process.

STANDARD:

Existing pavement markings shall be maintained in all long-term stationary (see Section 6G.2) TTC zones in accordance with Chapters 3A and 3B, except as otherwise provided for temporary pavement markings in Section 6F.78. Pavement markings shall match the alignment of the markings in place at both ends of the TTC zone. Pavement markings shall be placed along the entire length of any paved detour or temporary roadway prior to the detour or roadway being opened to road users.

For long-term stationary operations, pavement markings in the temporary traveled way that are no longer applicable shall be removed or obliterated as soon as practical. Pavement marking obliteration shall remove the non-applicable pavement marking material, and the obliteration method shall minimize pavement scarring. Painting over existing pavement markings with black paint or spraying with asphalt shall not be accepted as a substitute for removal or obliteration.

OPTION:

Removable, non-reflective, preformed tape that is approximately the same color as the pavement surface may be used where markings need to be covered temporarily.

6F.78 Interim Pavement Markings

SUPPORT:

Interim pavement markings are those that are allowed to remain in place until the earliest date when it is practical and possible to install pavement markings that meet the Part 3 standards for pavement markings.

GUIDANCE:

Interim pavement markings should not be in place for more than 14 calendar days unless justified by an engineering study.

White lane lines and yellow centerlines, including no passing zones should be installed before opening the roadway to traffic. If it is not possible or practical to install these markings before opening the roadway to traffic the interim markings should be installed at the end of each working day or provided by signing in accordance with the provisions of this section.

GUIDANCE:

The temporary use of edge lines, channelizing lines, lane reduction transitions, gore markings, and other longitudinal markings, and the various non-longitudinal markings (such as stop lines, railroad crossings, crosswalks, words or symbols) should be in accordance with the State's or highway agency's policy.

STANDARD:

Warning signs, channelizing devices, and delineation shall be used to indicate required road user paths in TTC zones where it is not possible to provide a clear path by pavement markings.

Except as otherwise provided in this Section, all interim pavement markings for no-passing zones shall comply with the requirements of Chapters 3A and 3B. All interim broken-line pavement markings shall use the same cycle length as permanent markings and shall have line segments that are at least 2 feet long.

GUIDANCE:

All pavement markings and devices used to delineate road user paths should be reviewed during daytime and nighttime periods.

OPTION:

Half-cycle lengths with a minimum of 2-foot stripes may be used on roadways with severe curvature (see Section 3A.6) for broken line center lines in passing zones and for lane lines.

For temporary situations of 14 calendar days or less, for a two- or three-lane road, no-passing zones may be identified by using DO NOT PASS (R4-1), PASS WITH CARE (R4-2), and NO PASSING ZONE (W14-3) signs (see Sections 2B.28, 2B.29, and 2C.45) rather than pavement markings. Also, DO NOT PASS, PASS WITH CARE, and NO PASSING ZONE signs may be used instead of pavement markings on roads with low volumes for longer periods in accordance with the State's or highway agency's policy.

GUIDANCE:

If used, the DO NOT PASS, PASS WITH CARE, and NO PASSING ZONE signs should be placed in accordance with Sections 2B.28, 2B.29, and 2C.45.

MN Rev. 1

If used, the NO CENTER STRIPE sign should be placed in accordance with Section 6F.47.

OPTION:

On low volume roads with an ADT (Average Daily Traffic) of less than 400 vehicles, the signs may be used in lieu of pavement markings for up to 14 calendar days (see Section 5A.1).

STANDARD:

If no passing zone signing is used in lieu of pavement markings the following shall be installed before opening the roadway to traffic:

- If no interim markings are used A NO CENTER STRIPE sign (W8-12a) shall be used for each direction of travel in accordance with Section 6F.47. This sign shall be repeated at major intersections or on one-mile intervals, whichever is greater.
- If interim no passing zone markings are not installed but interim broken markings are installed a NO CENTER STRIPE sign (W8-12a) shall be installed in advance of each no passing zone.
- If not already in place, a DO NOT PASS sign (R4-1) shall be installed on the right side of the road at the beginning of the zone opposite of the NO PASSING ZONE sign (W14-3).
- A PASS WITH CARE sign (R4-2) shall be installed on the right side of the road at the end of the no passing zone.

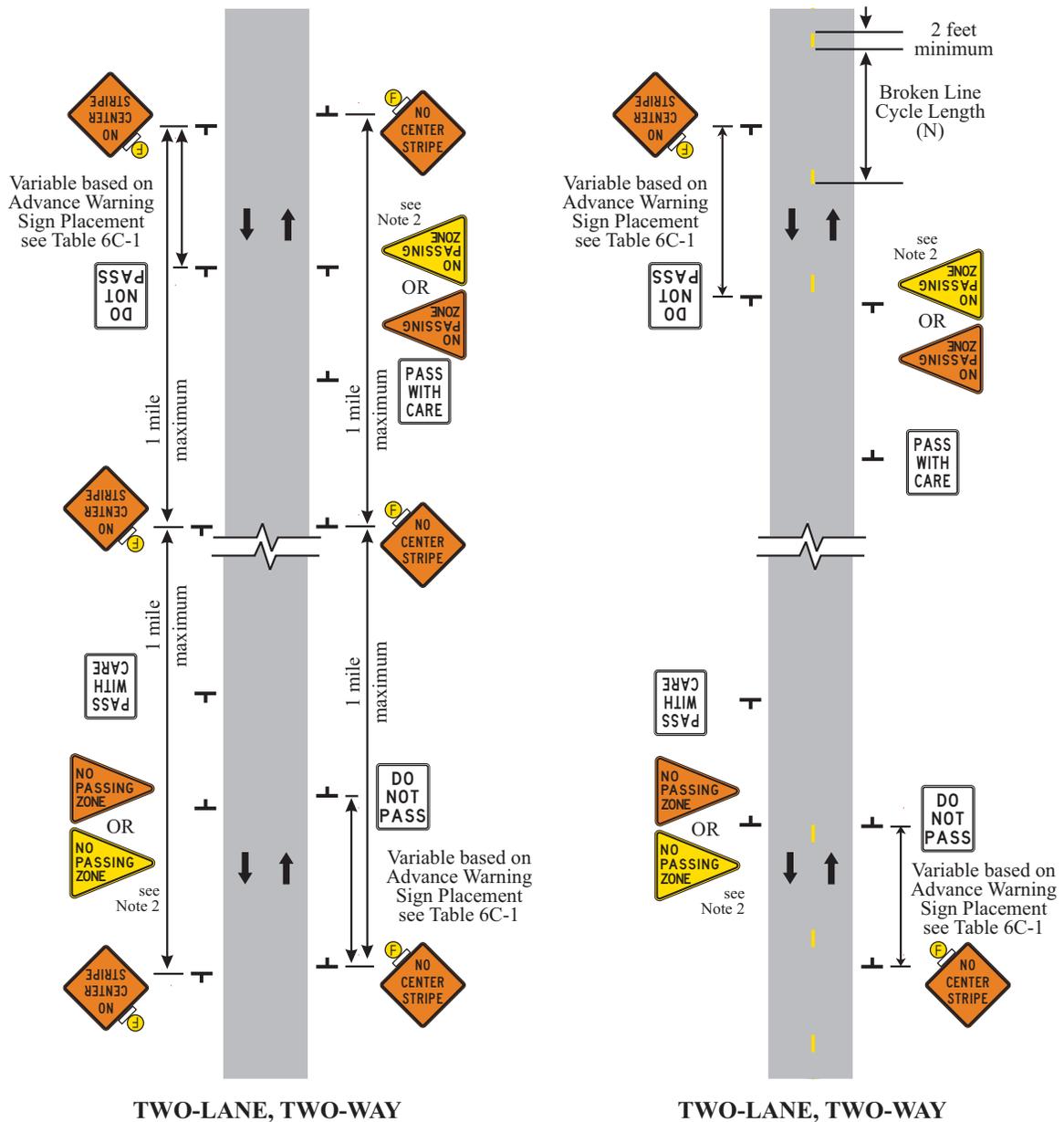
6F.79 Temporary Raised Pavement Markers

OPTION:

Retroreflective or internally illuminated raised pavement markers, or non-retroreflective raised pavement markers supplemented by retroreflective or internally illuminated markers, may be substituted for markings of other types in TTC zones.

HANDOUT

HANDOUT



TWO-LANE, TWO-WAY

TWO-LANE, TWO-WAY

NOTE:

1. Either layout may be used for up to 14 days when the Average daily Traffic is less than 400.
2. Any NO PASSING ZONE sign (W14-3) used in temporary traffic control zone that is applicable in its current location or will remain in place after completion of the construction project may have a black legend and border on a yellow retroreflective background.

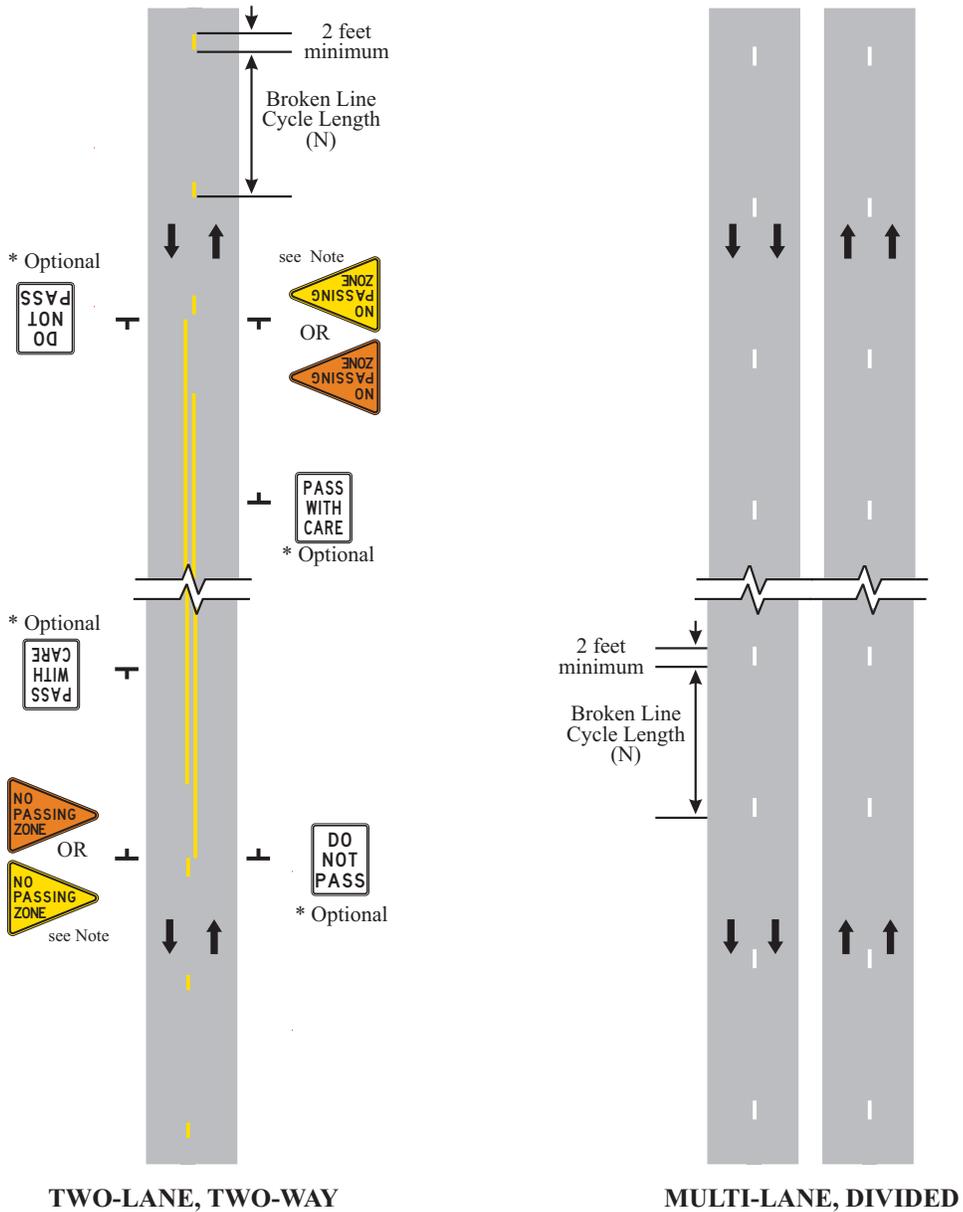
Figure 6F-8a Interim Pavement Markings - 3 Days or Less

HANDOUT

HANDOUT

HANDOUT

HANDOUT



NOTE:
Any NO PASSING ZONE sign (W14-3), used in a temporary traffic control zone that is applicable in its current location or will remain in place after completion of the construction project may have a black legend and border on a yellow retroreflective background.

Figure 6F-8b Interim Pavement Markings - 14 Days or Less

HANDOUT

HANDOUT

HANDOUT

HANDOUT

STANDARD:

If used, the color and pattern of the raised pavement markers shall simulate the color and pattern of the markings for which they substitute.

If temporary raised pavement markers are used to substitute for broken line segments, a group of at least three retroreflective markers shall be equally spaced at no greater than N/10 (see Section 3B.14). The value of N for a broken or dotted line shall equal the length of one line segment plus one gap.

If temporary raised pavement markers are used to substitute for solid lines, the markers shall be equally spaced at no greater than N/5, with retroreflective or internally illuminated units at a spacing no greater than N/2. The value of N referenced for solid lines shall equal the N for the broken or dotted lines that might be adjacent to or might extend the solid lines (see Section 3B.11).

OPTION:

Temporary raised pavement markers may be used to substitute for broken line segments by using at least two retroreflective markers placed at each end of a segment of 2 to 5 feet in length, using the same cycle length as permanent markings.

GUIDANCE:

Temporary raised pavement markers used on 2- to 5-foot segments to substitute for broken line segments should not be in place for more than 14 days unless justified by engineering judgment.

Raised pavement markers should be considered for use along surfaced diversions (bypasses) or temporary roadways, and other changed or new travel-lane alignments, because of the need to accentuate changed travel paths and their wet weather capabilities.

OPTION:

Retroreflective or internally illuminated raised pavement markers, or non-retroreflective raised pavement markers supplemented by retroreflective or internally illuminated markers, may also be used in TTC zones to supplement markings as prescribed in Chapters 3A and 3B.

6F.80 Post-Mounted Delineators

STANDARD:

When used, post-mounted delineators shall combine with or supplement other TTC devices. They shall be mounted on crashworthy supports so that the reflecting unit is approximately 4 feet above the near roadway edge. The standard

color for post-mounted delineators used along both sides of two-way streets and highways and the right side of one-way roadways shall be white. Post-mounted delineators used along the left side of one-way roadways shall be yellow.

GUIDANCE:

Spacing along roadway curves should be as set forth in Section 3F.4 and should be such that several delineators are always visible to the driver.

OPTION:

Post-mounted delineators may be used in TTC zones to indicate the alignment of the roadway and to outline the required vehicle path through the TTC zone.

6F.81 Lighting Devices

GUIDANCE:

Lighting devices should be provided in TTC zones based on engineering judgment.

When used to supplement channelization, the maximum spacing for warning lights should be identical to the channelizing device spacing requirements.

OPTION:

Lighting devices may be used to supplement retroreflectorized signs, barriers, and channelizing devices.

During normal daytime maintenance operations, the functions of flashing warning beacons may be provided by high-intensity rotating, flashing, oscillating, or strobe lights on a maintenance vehicle.

STANDARD:

Although vehicle hazard warning lights are permitted to be used to supplement high-intensity rotating, flashing, oscillating, or strobe lights, they shall not be used instead of high-intensity rotating, flashing, oscillating, or strobe lights.

6F.82 Floodlights

SUPPORT:

Utility, maintenance, or construction activities on highways are frequently conducted during nighttime periods when motor vehicle traffic volumes are lower. Large construction projects are sometimes operated on a double-shift basis requiring night work.

GUIDANCE:

When nighttime work is being performed, floodlights should be used to illuminate the work area, flagger stations, equipment crossings, and other areas.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

STANDARD:

Except in emergency situations, flagger stations shall be illuminated at night.

Floodlighting shall not produce a disabling glare condition for approaching road users, flaggers, or workers.

GUIDANCE:

The adequacy of the floodlight placement and elimination of potential glare should be determined by driving through and observing the floodlighted area from each direction on all approaching roadways after the initial floodlight setup, at night, and periodically.

SUPPORT:

Desired illumination levels vary depending upon the nature of the task involved. An average horizontal luminance of 5 foot candles can be adequate for general activities. Tasks requiring high levels of precision and extreme care can require an average horizontal luminance of 20 foot candles.

6F.83 Warning Lights

SUPPORT:

Type A, Type B, Type C, and Type D 360-degree warning lights are portable, powered, yellow, lens-directed, enclosed lights.

STANDARD:

Warning lights shall be in accordance with the current ITE "Purchase Specification for Flashing and Steady-Burn Warning Lights" (see Section 1A.11).

When warning lights are used, they shall be mounted on signs or channelizing devices in a manner that, if hit by an errant vehicle, they will not be likely to penetrate the windshield.

GUIDANCE:

The maximum spacing for warning lights should be identical to the channelizing device spacing requirements.

SUPPORT:

The light weight and portability of warning lights are advantages that make these devices useful as supplements to the retroreflectorization on signs and channelizing devices. The flashing lights are effective in attracting road users' attention.

OPTION:

Warning lights may be used in either a steady-burn or flashing mode.

STANDARD:

Except for the sequential flashing warning lights that are described in Paragraphs 8 and 9, flashing warning lights shall not be used for delineation, as a series of flashers fails to identify the desired vehicle path.

OPTION:

A series of sequential flashing warning lights may be placed on channelizing devices that form a merging taper in order to increase driver detection and recognition of the merging taper.

STANDARD:

If a series of sequential flashing warning lights is used, the successive flashing of the lights shall occur from the upstream end of the merging taper to the downstream end of the merging taper in order to identify the desired vehicle path. Each flashing warning light in the sequence shall be flashed at a rate of not less than 55 or more than 75 times per minute.

Type A Low-Intensity Flashing warning lights, Type C Steady-Burn warning lights, and Type D 360-degree Steady-Burn warning lights shall be maintained so as to be capable of being visible on a clear night from a distance of 3,000 feet. Type B High-Intensity Flashing warning lights shall be maintained so as to be capable of being visible on a sunny day when viewed without the sun directly on or behind the device from a distance of 1,000 feet.

Warning lights shall have a minimum mounting height of 30 inches to the bottom of the lens.

SUPPORT:

Type A Low-Intensity Flashing warning lights are used to warn road users during nighttime hours that they are approaching or proceeding in a potentially hazardous area.

OPTION:

Type A warning lights may be mounted on channelizing devices.

SUPPORT:

Type B High-Intensity Flashing warning lights are used to warn road users during both daylight and nighttime hours that they are approaching a potentially hazardous area.

OPTION:

Type B warning lights are designed to operate 24 hours per day and may be mounted on advance warning signs or on independent supports.

Type C Steady-Burn warning lights and Type D 360-degree Steady-Burn warning lights may be used during nighttime hours to delineate the edge of the traveled way.

HANDOUT

HANDOUT

GUIDANCE:

When used to delineate a curve, Type C and Type D 360-degree warning lights should only be used on devices on the outside of the curve, and not on the inside of the curve.

6F.83.1 Warning Lights on STOP Signs

SUPPORT:

Type A warning lights are portable, powered, red, lens-directed, enclosed lights.

STANDARD:

Warning lights shall be in accordance with the current ITE "Purchase Specification for Flashing and Steady-Burn Warning Lights" except except that they shall be red in color.

Warning lights shall flash when placed on STOP signs.

The warning lights shall be maintained according to the Type A Low-Intensity Flashing warning lights standard (see Section 6F.83).

6F.83.2 Steady-Burn Electric Lamps

SUPPORT:

Steady-Burn electric lamps are a series of low-wattage, yellow, electric lamps, generally hard-wired to a 110-volt external power source.

OPTION:

Steady-Burn electric lamps may be used in place of Type C Steady-Burn warning lights (see Section 6F.78).

6F.83.3 Roadway Lighting

SUPPORT:

On long term projects, the use of roadway lighting may be beneficial. Areas that may benefit from the installation of roadway lighting include high hazard areas, high volume areas, crossovers, diversions (bypasses), areas with sudden alignment changes, curves, intersections and transitions from multi-lane divided roadways to two-lane, two-way roadways.

STANDARD:

When possible, all roadway lighting shall be protected or have breakaway bases.

6F.84 Temporary Traffic Control Signals

STANDARD:

Temporary traffic control signals (see Section 4D.32) used to control road user movements through TTC zones and in other TTC situations shall meet the applicable provisions of Part 4.

SUPPORT:

Temporary traffic control signals are typically used in work zones such as temporary haul road crossings; temporary one-way operations along a one-lane, two-way highway; temporary one-way operations on bridges, reversible lanes, and intersections.

STANDARD:

A temporary traffic control signal that is used to control traffic through a one-lane, two-way section of roadway shall comply with the provisions of Section 4H.2.

GUIDANCE:

Where pedestrian traffic is detoured to a temporary traffic control signal, engineering judgment should be used to determine if pedestrian signals or accessible pedestrian signals (see Section 4E.9) are needed for crossing along an alternate route.

When temporary traffic control signals are used, conflict monitors typical of traditional traffic control signal operations should be used.

OPTION:

Temporary traffic control signals may be portable or temporarily mounted on fixed supports.

GUIDANCE:

Temporary traffic control signals should only be used in situations where temporary traffic control signals are preferable to other means of traffic control, such as changing the work staging or work zone size to eliminate one-way motor vehicle traffic movements, using flaggers to control one-way or crossing movements, using STOP or YIELD signs, and using warning devices alone.

SUPPORT:

Factors related to the design and application of temporary traffic control signals include the following:

- A. Safety and road user needs;
- B. Work staging and operations;
- C. The feasibility of using other TTC strategies (for example, flaggers, providing space for two lanes, or detouring road users, including bicyclists and pedestrians);
- D. Sight distance restrictions;
- E. Human factors considerations (for example, lack of driver familiarity with temporary traffic control signals);
- F. Road user volumes including roadway and intersection capacity;
- G. Affected side streets and driveways;
- H. Vehicle speeds;
- I. The placement of other TTC devices;
- J. Parking;
- K. Turning restrictions;
- L. Pedestrians;
- M. The nature of adjacent land uses (such as residential or commercial);
- N. Legal authority;
- O. Signal phasing and timing requirements;
- P. Full-time or part-time operation;
- Q. Actuated, fixed-time, or manual operation;
- R. Power failures or other emergencies;
- S. Inspection and maintenance needs;
- T. Need for detailed placement, timing, and operation records; and
- U. Operation by contractors or by others.

Although temporary traffic control signals can be mounted on trailers or lightweight portable supports, fixed supports offer superior resistance to displacement or damage by severe weather, vehicle impact, and vandalism.

GUIDANCE:

Other TTC devices should be used to supplement temporary traffic control signals, including warning and regulatory signs, pavement markings, and channelizing devices.

Temporary traffic control signals not in use should be covered or removed.

If a temporary traffic control signal is located within 1/2 mile of an adjacent traffic control signal, consideration should be given to interconnected operation.

STANDARD:

Temporary traffic control signals shall not be located within 200 feet of a grade crossing unless the temporary traffic control signal is provided with preemption in accordance with Section 4D.27, or unless a uniformed officer or flagger is provided at the crossing to prevent vehicles from stopping within the crossing.

6F.85 Temporary Traffic Barriers

SUPPORT:

Temporary traffic barriers are devices designed to help prevent penetration by vehicles while minimizing injuries to vehicle occupants, and designed to protect workers, bicyclists, and pedestrians.

There are five primary functions of temporary traffic barriers:

- A. To keep motor vehicle traffic from entering work areas, such as excavations or material storage sites;
- B. To separate workers, bicyclists, and pedestrians from motor vehicle traffic;
- C. To separate opposing directions of motor vehicle traffic; and
- D. To separate motor vehicle traffic, bicyclists, and pedestrians from the work area such as false work for bridges and other exposed objects; and
- E. To protect drop-offs of greater than 12 inches on longer term projects when a suitable buffer lane cannot be provided.

OPTION:

Temporary traffic barriers may be used to separate two-way motor vehicle traffic.

GUIDANCE:

Because of the risks to the driver and the risks involved in placement and removal of temporary traffic barriers, the following alternatives to using them should be strongly considered:

- A. Buffer lane closures;
- B. Nightly backfill of excavations;
- C. Temporary tapers;
- D. Temporary detours or crossovers;
- E. For lower speed projects, additional or closer spacing of channelizing devices in conjunction with extra delineation (TRPM's, pavement markings) and extra warning signs (in advance and within work area).

Because the protective requirements of a TTC situation have priority in determining the need for temporary traffic barriers, their use should be based on an engineering study. The following factors should be considered before using temporary traffic barriers:

- A. Speed/volume of traffic;
- B. Vertical/horizontal roadway alignment;
- C. Severity of hazard/excavation/obstacle;
- D. Lateral clearance to hazard;
- E. Duration of exposure;
- F. Duration of the TTC zone;
- G. Hazard presented by barrier itself once in place;
- H. Hazard presented to workers and traffic during barrier placement.

Tables 6F-5a and 6F-5b should be used to determine when temporary traffic barrier in edge drop-off situations.

Lateral Offset *	Depth of Drop-off
feet	inches
0 - 4	12 - 24
4 - 8	24 - 36
8 - 20	>36

* Lateral offset is measured from the edge of the traffic carrying lane to the edge of the vertical drop-off.

Table 6F-5a Drop-offs to Commonly Justify PCB Non-Construction Speed Limits of 45-55 mph

Lateral Offset *	Depth of Drop-off
feet	inches
0 - 4	12 - 24
4 - 12	24 - 36
12 - 20	>36

* Lateral offset is measured from the edge of the traffic carrying lane to the edge of the vertical drop-off.

Table 6F-5b Drop-offs to Commonly Justify PCB Non-Construction Speed Limits of 60-70 mph

STANDARD:

Temporary traffic barriers shall be supplemented with standard delineation, pavement markings, or channelizing devices for improved daytime and nighttime visibility if they are used to channelize vehicular traffic. The delineation color shall match the applicable pavement marking color.

All temporary traffic barriers shall be crashworthy.

Each type of temporary traffic barrier (steel, water-filled or concrete, etc.) requires a specific basic minimum length to achieve its crashworthy compliance. Refer to the barrier's crash testing results to determine the minimum length for predicted crash deflections. Shorter intermittent segments of temporary traffic barrier shall not be used because they nullify the containment and re-directive capabilities of the

temporary traffic barrier, increase the potential for serious injury both to vehicle occupants and pedestrians, and encourage the presence of blunt, leading ends. All upstream leading ends that are present shall be appropriately flared or protected with properly installed and maintained crashworthy cushions. Adjacent temporary traffic barrier segments shall be properly connected in order to provide the overall strength required for the temporary traffic barrier to perform properly.

In order to mitigate the effect of striking the end of a temporary traffic barrier, the end shall be installed in accordance with AASHTO's "Roadside Design Guide" (see Section 1A.11) by flaring until the end is outside the acceptable clear zone or by providing crashworthy end treatments (see Section 6F.76). See Figure 6F-9 for temporary traffic barrier placement and end treatments.

OPTION:

End attenuation may be necessary at both ends of barrier used on a two-lane two-way roadway.

GUIDANCE:

Since the barrier itself is a hazard, the use of it should be toward the overall safety benefit.

Excessive/acute tapers and pronounced turns/corners should be avoided. Tapers should be made as smooth as possible.

Sufficient area should be maintained behind the barrier to allow for deflection. Barriers should not typically be butted up to, or mounted on top of curbs or medians. Placing barriers across a curb section should be avoided.

Temporary traffic barriers should be anchored in any location that does not allow adequate area for deflection.

SUPPORT:

Temporary traffic barriers are designed to deflect when struck by a vehicle. Tapers, transition areas and barrier used outside of horizontal curves will see more deflection because of possibility higher angle hits. Tangent areas will generally see less deflection.

STANDARD:

Different designs of barrier shall not be intermixed on the same run of temporary traffic barrier. Barrier runs of different designs on the same project are acceptable, but the barrier runs shall not be connected.

GUIDANCE:

Separate shorter runs with different barrier design types should be discouraged if a longer run of one type is possible.

HANDOUT

STANDARD:

Normal vertical curbing shall not be used as a substitute for temporary traffic barriers when temporary traffic barriers are clearly needed.

OPTION:

Warning lights or steady-burn electric lamps may be mounted on temporary traffic barrier installations. When in transition/taper areas or close to traffic lanes, retroreflective barrier markers or tape may be placed on barriers.

Depending on roadway geometrics, temporary speed reduction may be used in barrier areas.

GUIDANCE:

When serving the additional function of channelizing motor vehicle traffic, temporary traffic barriers should be a light color for increased visibility.

SUPPORT:

Temporary traffic barrier is subjected to considerable abuse. The placement process itself can cause damage to the base and ends. Connection loops can be bent and deformed when being placed. Temporary traffic barrier can also degrade over the long term. Barrier is often in place for long periods and is subject to winter road salt spray and snow plows. Over a period, delamination can result, often to the point of section loss. Also, the repeated process of transport and handling causes a good deal of longitudinal flexure, which can cause cracking.

GUIDANCE:

Barrier sections and connections should be routinely inspected for damage.

SUPPORT:

Movable barriers are capable of being repositioned laterally using a transfer vehicle that travels along the barrier. Movable barriers enable short-term closures to be installed and removed on long-term projects. Providing a barrier-protected work space for short-term closures and providing unbalanced flow to accommodate changes in the direction of peak-period traffic flows are two of the advantages of using movable barriers.

Figure 6H-45 shows a temporary reversible lane using movable barriers. The notable feature of the movable barrier is that in both Phase A and Phase B, the lanes used by opposing traffic are separated by a barrier.

Figure 6H-34 shows an exterior lane closure using a temporary traffic barrier. Notes 7 through 9 address the option of using a movable barrier. By using a movable barrier, the barrier can be positioned to close the lane during

the off-peak periods and can be relocated to open the lane during peak periods to accommodate peak traffic flows. With one pass of the transfer vehicle, the barrier can be moved out of the lane and onto the shoulder. Furthermore, if so desired, with a second pass of the transfer vehicle, the barrier could be moved to the roadside beyond the shoulder.

More specific information on the use of temporary traffic barriers is contained in Chapters 8 and 9 of AASHTO's "Roadside Design Guide" (see Section 1A.11).

6F.86 Crash Cushions

SUPPORT:

Crash cushions are systems that mitigate the effects of errant vehicles that strike obstacles, either by smoothly decelerating the vehicle to a stop when hit head-on, or by redirecting the errant vehicle. The two types of crash cushions that are used in TTC zones are stationary crash cushions and truck-mounted attenuators. Crash cushions in TTC zones help protect the drivers from the exposed ends of barriers, fixed objects, shadow vehicles, and other obstacles. Specific information on the use of crash cushions can be found in AASHTO's "Roadside Design Guide" (see Section 1A.11).

STANDARD:

Crash cushions shall be crashworthy. They shall also be designed for each application to stop or redirect errant vehicles under prescribed conditions. Crash cushions shall be periodically inspected to verify that they have not been hit or damaged. Damaged crash cushions shall be promptly repaired or replaced to maintain their crashworthiness.

SUPPORT:

Stationary crash cushions are used in the same manner as permanent highway installations to protect drivers from the exposed ends of barriers, fixed objects, and other obstacles. More detailed information on the use of portable barriers and crash cushions can be obtained from Figure 6F-9.

STANDARD:

Stationary crash cushions shall be designed for the specific application intended.

Truck-mounted attenuators shall be energy-absorbing devices attached to the rear of shadow trailers or trucks. If used, the shadow vehicle with the attenuator shall be located in advance of the work area, workers, or equipment to reduce the severity of rear-end crashes from errant vehicles.

SUPPORT:

Trucks or trailers are often used as shadow vehicles to protect workers or work equipment from errant vehicles. These shadow vehicles are normally equipped with flashing arrows, changeable message signs, and/ or high-intensity

MIN Rev. 1

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

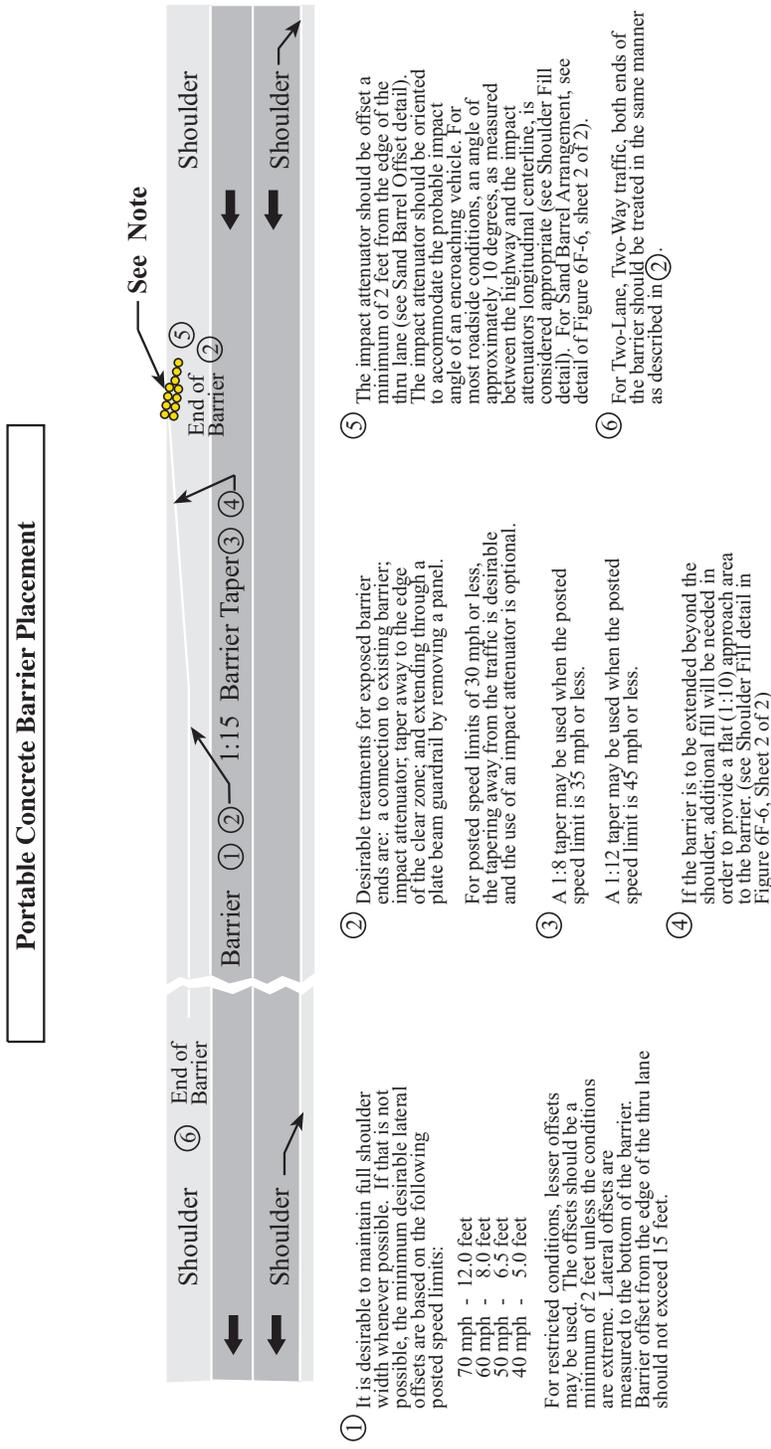
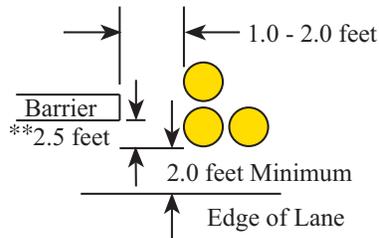


Figure 6F-9 Portable Concrete Barrier Placement and End treatments
(Sheet 1 of 2)

HANDOUT

HANDOUT

Sand Barrel Offset



** Distance may be reduced to a minimum of 1.25 feet. This is acceptable only where a greater offset would cause unacceptable interference with traffic.

Shoulder Fill

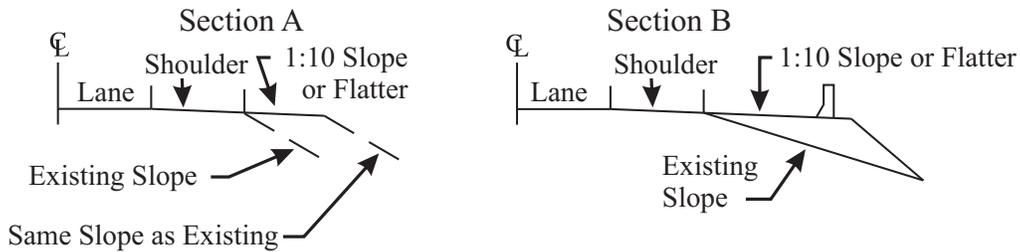
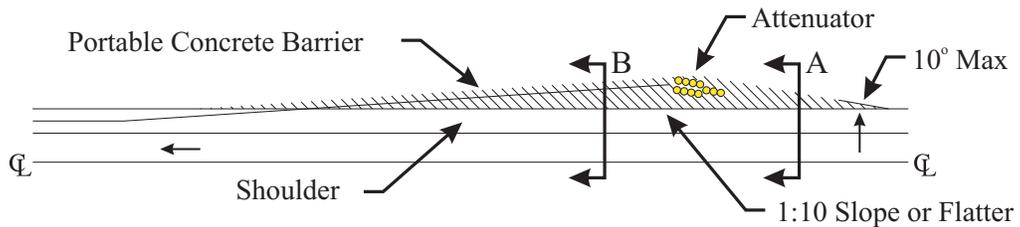


Figure 6F-9 Portable Concrete Barrier Placement and End treatments
(Sheet 2 of 2)

HANDOUT

HANDOUT

rotating, flashing, oscillating, or strobe lights located properly in advance of the workers and/or equipment that they are protecting. However, these shadow vehicles might themselves cause injuries to occupants of the errant vehicles if they are not equipped with truck-mounted attenuators.

GUIDANCE:

The shadow truck should be positioned in advance of the workers or equipment being protected so that there will be sufficient distance, but not so much so that errant vehicles will travel around the shadow truck and strike the protected workers and/or equipment. (see Chapter Part 6K-Temporary Traffic Control Zone Layouts for the recommended distance charts)

SUPPORT:

Chapter 9 of AASHTO's "Roadside Design Guide" (see Section 1A.11) contains additional information regarding the use of shadow vehicles.

GUIDANCE:

If used, the truck-mounted attenuator should be used in accordance with the manufacturer's specifications.

6F.87 Rumble Strips

SUPPORT:

Transverse rumble strips consist of intermittent, narrow, transverse areas of rough-textured or slightly raised or depressed road surface that extend across the travel lanes to alert drivers to unusual vehicular traffic conditions. Through noise and vibration they attract the driver's attention to such features as unexpected changes in alignment and to conditions requiring a stop.

Longitudinal rumble strips consist of a series of rough-textured or slightly raised or depressed road surfaces located along the shoulder to alert road users that they are leaving the travel lanes.

STANDARD:

If it is desirable to use a color other than the color of the pavement for a longitudinal rumble strip, the color of the rumble strip shall be the same color as the longitudinal line the rumble strip supplements.

If the color of a transverse rumble strip used within a travel lane is not the color of the pavement, the color of the rumble strip shall be white, black, or orange.

OPTION:

Intervals between rumble strips may be reduced as the distance to the approached conditions is diminished in order

to convey an impression that a closure speed is too fast and/or that an action is imminent. A sign warning drivers of the onset of rumble strips may be placed in advance of any rumble strip installation.

GUIDANCE:

Transverse rumble strips should be placed transverse to motor vehicle traffic movement. They should not adversely affect overall pavement skid resistance under wet or dry conditions.

In urban areas, even though a closer spacing might be warranted, transverse rumble strips should be designed in a manner that does not promote unnecessary braking or erratic steering maneuvers by road users.

Transverse rumble strips should not be placed on sharp horizontal or vertical curves.

Rumble strips should not be placed through pedestrian crossings or within marked bicycle lanes.

Transverse rumble strips should not be placed on roadways used by bicyclists unless a minimum clear path of 4 feet is provided at each edge of the roadway or on each paved shoulder as described in AASHTO's "Guide to the Development of Bicycle Facilities" (see Section 1A.11).

Longitudinal rumble strips should not be placed on the shoulder of a roadway that is used by bicyclists unless a minimum clear path of 4 feet is also provided on the shoulder.

6F.88 Screens

SUPPORT:

Screens are used to block the road users' view of activities that can be distracting. Screens might improve safety and motor vehicle traffic flow where volumes approach the roadway capacity because they discourage gawking and reduce headlight glare from oncoming motor vehicle traffic.

GUIDANCE:

Screens should not be mounted where they could adversely restrict motorist visibility and sight distance and adversely affect the safe operation of vehicles.

OPTION:

Screens may be mounted on the top of temporary traffic barriers that separate two-way motor vehicle traffic.

GUIDANCE:

Design of screens should be in accordance with Chapter 9 of AASHTO's "Roadside Design Guide" (see Section 1A.11).

HANDOUT

HANDOUT

HANDOUT

HANDOUT

(This page is intentionally left blank)

4. WORK ZONE APPLICATIONS

4.1 Common Work Zone Projects

A wide variety of projects require temporary traffic control for the work zone. The following project types are a sample of some that may require TTC. This list is not an all-inclusive list.

- ✓ Mill and Overlay
- ✓ CPI
- ✓ Left turn lane construction
- ✓ Bridge deck repair
- ✓ ADA jobs
- ✓ Full reconstruction (cross-over and detour)
- ✓ Culvert jobs
- ✓ Bridge painting
- ✓ Centerline Rumbles

4.1.1 Work Zone Management Strategies Matrix

The Federal Highway Administration has developed the manual, *Developing and Implementing Transportation Management Plans for Work Zones*. The information contained in appendix B is intended to support transportation agencies in the selection of work zone management strategies described in Section 2.2.1, Step 4 and Section 3.7 of the referenced manual. For the various work zone impact management strategies, Table B.1 presents some guidance for which strategies are anticipated to lead to an improvement in mobility or safety (motorist and worker), what project characteristics may trigger a strategy for consideration, pros and cons associated with the strategy, and other considerations.

The full document is available from the MnDOT's Transportation Management Plan (TMP) Course website, <http://www.dot.state.mn.us/trafficeng/training/tmp.html>.

4.2 Control Strategies

Temporary traffic control strategies, devices, and contracting/construction techniques and coordination are used to facilitate traffic flow and safety through and around work zones. Standards, guidance, and other information defining the proper use of the traffic control strategies and devices are provided in the field manual. Some of the typical TTC strategies are defined in the following sections.

4.2.1 Construction Phasing/Staging

Staging typically refers to how the contractor will position the equipment and materials. Phasing refers to the sequencing of the aspects of a project, completing portions of the project one part at a time. The impacts of a work zone on traffic may be minimized by using operationally-sensitive phasing and staging throughout the life of the project.

4.2.2 Full Roadway Closures

This strategy involves complete closure of the roadway for various time periods to minimize the duration of the project and improve worker safety by reducing traffic conflicts. Full closures may be brief (e.g.,

intermittent, off-peak), short-term (e.g., night, weekend), or long-term (e.g., continuous for the duration of the project).

Lane shifts or closures. Lane shifts or closures last for varying durations of time. They may be intermittent, off-peak, night, weekend, for a single project phase, or continuous for the duration of the project. This strategy involves multiple approaches including:

4.2.3 Reduced Lane Widths to Maintain Number of Lanes (Constriction)

This involves reducing the width of one or more lanes in order to maintain the existing number of lanes on the facility while permitting work access to part of the facility.

- ✓ Lane closures to provide worker safety. This strategy closes one or more existing traffic lanes to accommodate work activities.
- ✓ Reduced shoulder width to maintain number of lanes. This involves reducing the width of the inside and/or outside shoulder to maintain the existing number of lanes on the facility while allowing access for the work activities to take place.
- ✓ Shoulder closures to provide worker safety. This strategy closes the shoulder for use by the public, making it available to accommodate the work activities.
- ✓ Lane shift to shoulder/median to maintain number of lanes. This strategy involves diverting traffic onto the shoulder, or a portion of the shoulder, for use as a traffic lane.

4.2.4 One-Lane, Two-Way Operation

One lane, two-way traffic control involves using one lane for both directions of traffic, allowing work activities to occur in the other lane that is now closed.

4.2.5 Two-Way Traffic on One Side of Divided Facility (Crossover)

This strategy involves closing one side of a divided facility to permit the work to proceed without traffic interference while both directions of traffic are accommodated on the opposing side of the roadway.

4.2.6 Reversible Lanes

This strategy, also known as variable lanes or contra-flow lanes, involves sharing lane(s) of travel to accommodate peak-period traffic flow. The direction of travel in the shared lane varies by time of day or day of the week.

4.2.7 Ramp Closures/Relocation

Ramp closure involves closing one or more ramps in or near the work zone for specific time periods or construction phases to allow work access or improve traffic flow on the mainline.

4.2.8 Freeway-To-Freeway Interchange Closures

This strategy involves closing one or more freeway-to-freeway interchange connectors over a period of time.

4.2.9 Night Work

Work is performed at night (end of evening peak period to beginning or morning peak period) to minimize work zone impacts on traffic and adjacent businesses.

4.2.10 Weekend Work

Construction work (all or individual phases) is restricted to weekend periods from the end of the Friday afternoon peak period to the beginning of the Monday morning peak period.

4.2.11 Work Hour Restrictions for Peak Travel

This involves restricting work hours such that work that impacts traffic does not occur during periods of peak travel demand and congestion (e.g., peak hours, holidays, special events).

4.2.12 Pedestrian/Bicycle Access Improvements

This strategy involves providing alternate facilities for bicyclists and pedestrians (including those with disabilities in accordance with the Americans with Disabilities Act of 1990) in places where the work zone impacts their accessibility.

4.2.13 Business Access Improvements

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

4.2.14 Off-Site Detours/Use of Alternate Routes

This strategy involves re-routing some or all traffic off of the roadway under construction and to other existing roadways.

4.3 Common Work Zone Layout

The following is a handout from the MN MUTCD Chapter 6J, Long Term Temporary Traffic Control Zone Layouts. These pages are the typical layouts for various roadway types. These are represented in plan sheet form as shown in Section 4.4. The MN MUTCD can be downloaded from the following web link:

www.dot.state.mn.us/trafficeng/publ/index.html

It is important that the holder of this manual checks the above link for updates.



MnDOT OTST has a number of common layout templates available at,
<http://www.dot.state.mn.us/trafficeng/workzone/ttctemplates.html>.

PART 6. TEMPORARY TRAFFIC CONTROL

Chapter 6J. Long Term

Temporary Traffic Control Zone Layouts

6J-1 General

SUPPORT:

This section illustrates typical layouts which provide additional guidance for individuals with traffic engineering expertise.

GUIDANCE:

These layouts should be used during the development of detailed traffic control plans. They should only be used under the direction of a traffic engineering professional. They should be combined with the principles and figures contained elsewhere in this manual.

OPTION:

Some of these layouts may be used on short term construction or maintenance projects.

SUPPORT:

The concepts shown in the following layouts are only intended to be guidelines.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Symbols	Meaning
	Flagger or Operator of Automated Flagging Assistance Device
 AFAD	Automated Flagging Assistance Device (AFAD)
	Flashing Arrow Board
	Portable Changeable Message Sign (PCMS)
	Portable Equipment - includes testing devices, detection, surveying, etc.
	Portable Traffic Signal
	360-Degree Yellow Flashing Vehicle Light(s)
	Longitudinal Channelizer
	Type III Barricade
	Traffic Control Sign
	Reboundable Sign Support
	Type A Flashing Warning Light
	Surface mounted delineator
	Channelizing Device.
	A combination of Type A and B channelizing devices
	Direction of Traffic
	See Note; i.e. See Note 6
	Work Space

Figure 6J-1 Symbols Used in Typical Layouts

HANDOUT

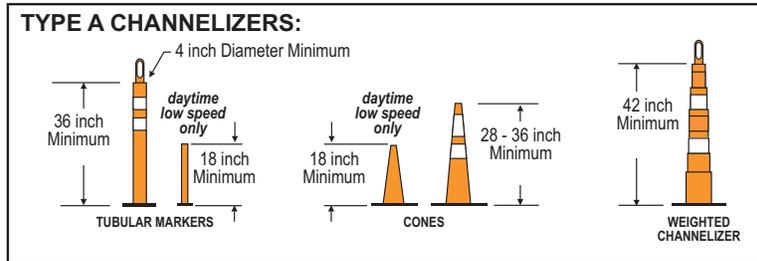
HANDOUT

Temporary Traffic Control Distance Charts

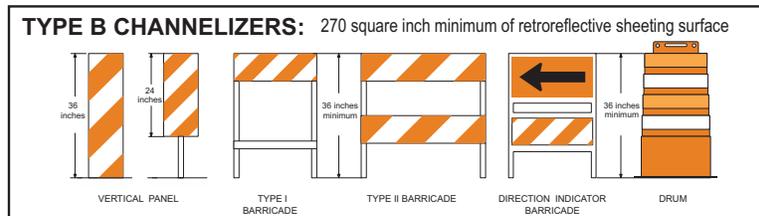
Posted Speed Limit Prior to Work Starting (mph)		Advance Warning Sign Spacing (A) feet	Decision Sight Distance (D) feet	Taper Length (12 ft lane) (L) feet	Shifting Taper (L/2) feet	Typical Shoulder Taper (L/3) feet
0 - 30	G = 25 ft					
35 - 40		325	700	325	175	125
45 - 50	G = 50 ft	600	900	600	300	200
55		750	1200	700	350	250
60 - 65		1000	1400	800	400	275
70 - 75		1200	1600	900	450	300

Posted Speed Limit Prior to Work Starting (mph)		Buffer Space (B) feet	Shadow Vehicle Following Distance (F) feet	Protection Vehicle Roll-Ahead Buffer Distance (with or without TMA) (R) feet	
				Moving (15 mph max) feet	Stopped feet
0 - 30	G = 25 ft	200	250 - 550	100	100
35 - 40		305	325 - 700	100	100
45 - 50	G = 50 ft	425	600 - 900	175	125
55		500	750 - 1200	175	125
60 - 65		650	1000 - 1400	225	175
70 - 75		820	1200 - 1600	225	175

Type A channelizing devices are typically used in attended temporary traffic control zones.*

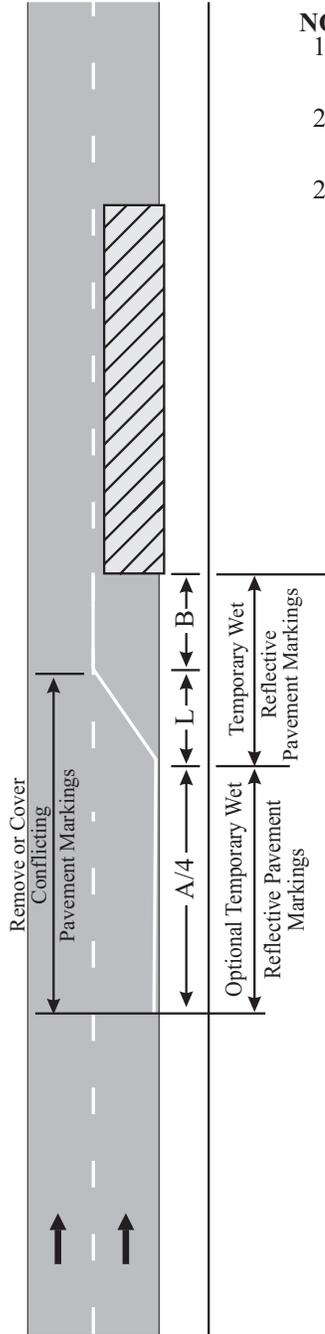


Type B channelizing devices shall be used if the temporary traffic control zone will be installed for more than 12 hours or if it is left unattended.*



* See the MN MUTCD, Part 6F for more details on application restrictions.

Figure 6J-2 Temporary Traffic Control Devices and Distance Charts



NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Traffic control devices are not shown. Use appropriate lane closure.
2. Install wet reflective edgelines through the transition and alignment change areas including lane closure tapers, sharp curves, exits, shifts onto temporary roadways, etc.

**TYPICAL STRIPING AND STRIPE REMOVAL
FOR LANE CLOSURE
MULTILANE DIVIDED ROAD**

LONG TERM

LAYOUT 6J-1

6J-1

December, 2011

HANDOUT

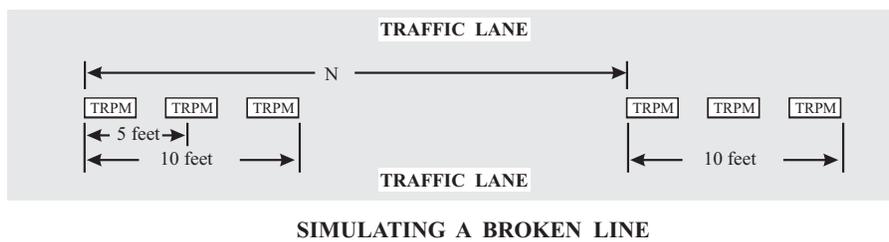
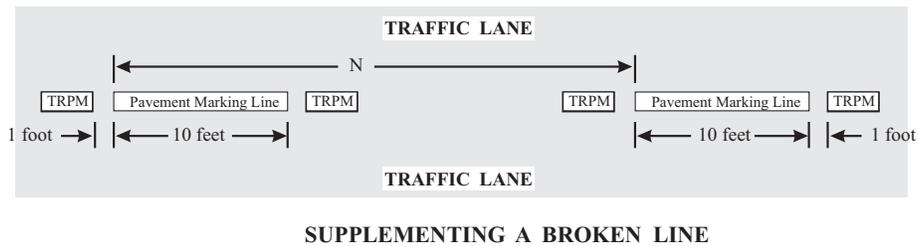
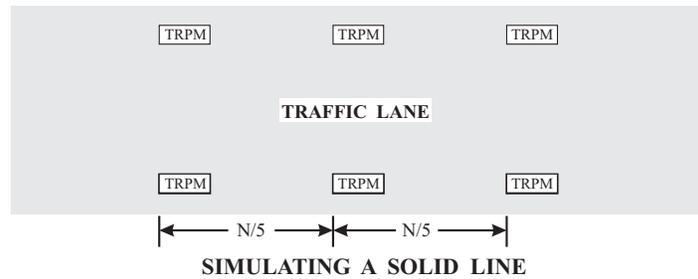
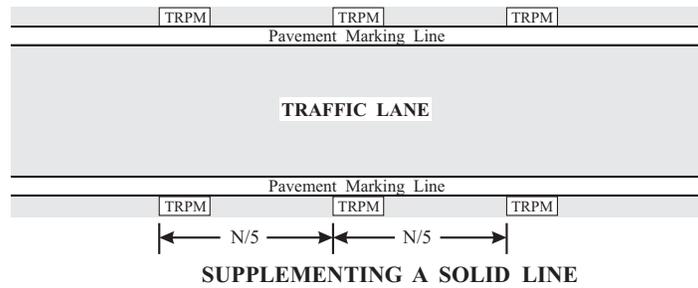
HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT



N = the length of one line segment plus one gap

PLACEMENT AND SPACING OF TEMPORARY RAISED PAVEMENT MARKERS (TRPMs)

LONG TERM

LAYOUT 6j-2

January, 2014

6J-2

HANDOUT

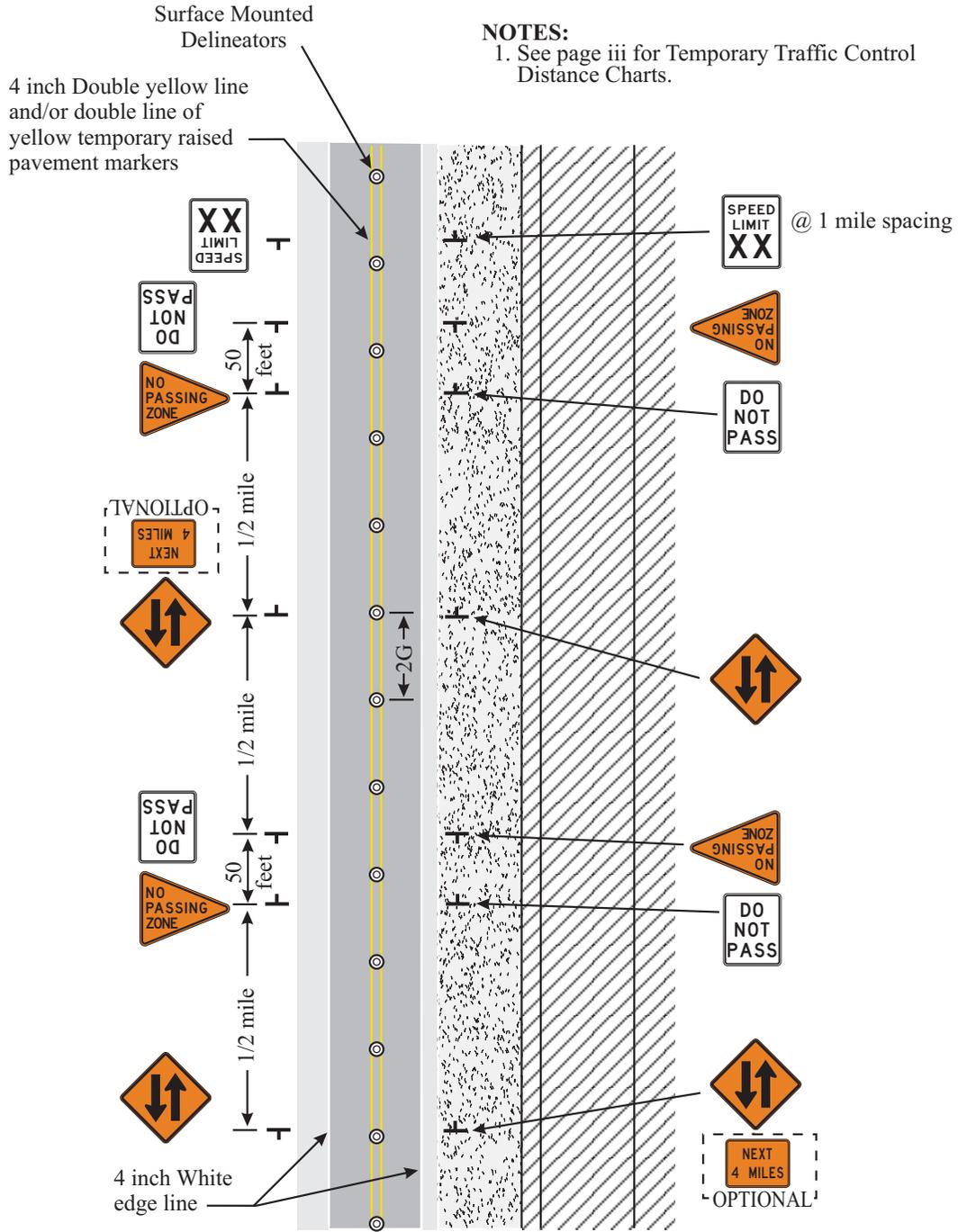
HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT



TYPICAL SECTION FOR TWO-LANE, TWO-WAY OPERATIONS MULTILANE DIVIDED ROAD

LONG TERM

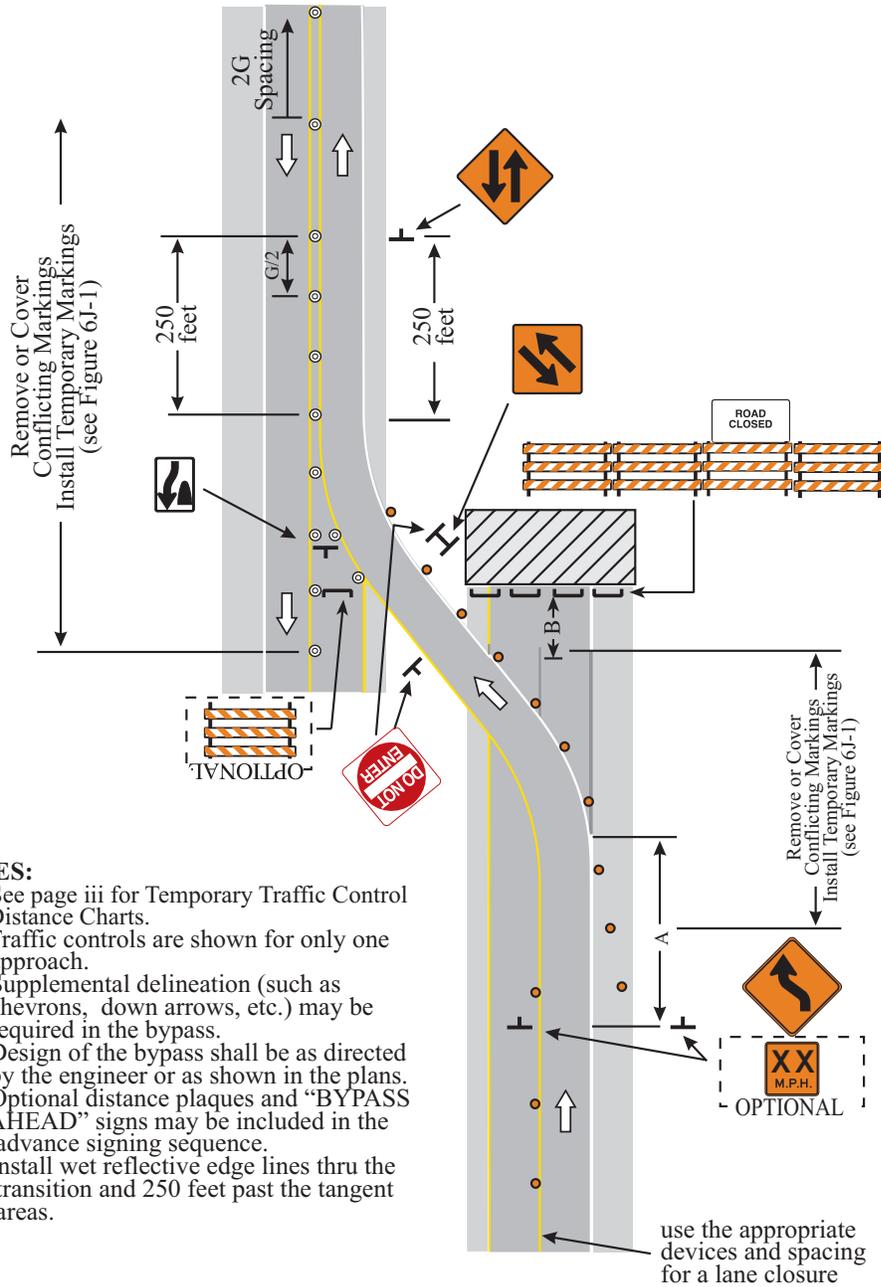
LAYOUT 6J-3

6J-3

December, 2011

HANDOUT

HANDOUT



NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Traffic controls are shown for only one approach.
3. Supplemental delineation (such as chevrons, down arrows, etc.) may be required in the bypass.
4. Design of the bypass shall be as directed by the engineer or as shown in the plans.
5. Optional distance plaques and "BYPASS AHEAD" signs may be included in the advance signing sequence.
6. Install wet reflective edge lines thru the transition and 250 feet past the tangent areas.

TYPICAL CROSSOVER TO TWO-LANE, TWO-WAY OPERATIONS MULTILANE DIVIDED ROAD

LONG TERM

LAYOUT 6j-4

January, 2014

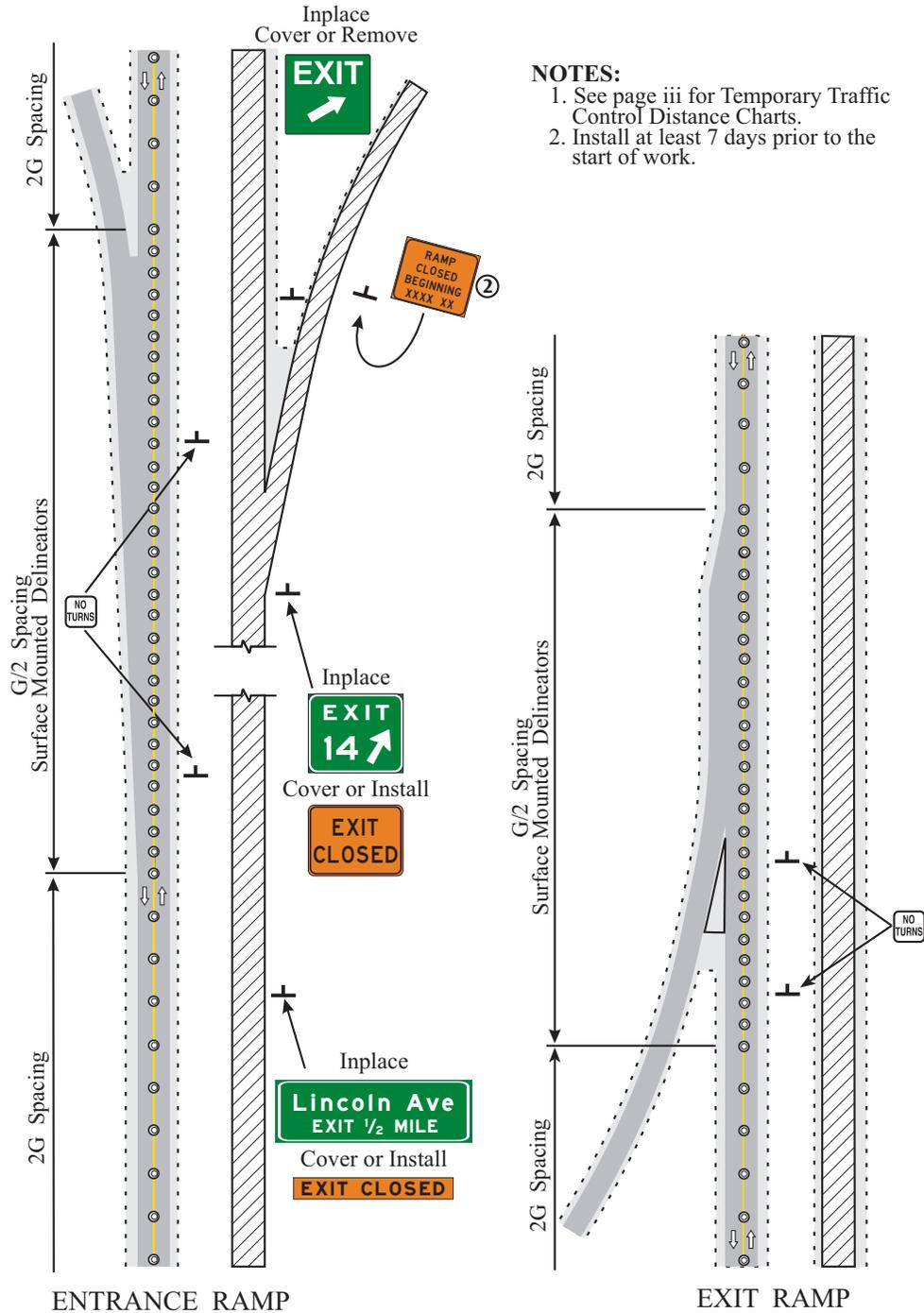
6J-4

HANDOUT

HANDOUT

HANDOUT

HANDOUT



TWO-LANE, TWO-WAY OPERATIONS AT RAMPS ON OPEN ROADWAY

LONG TERM

LAYOUT 6J-6

December, 2011

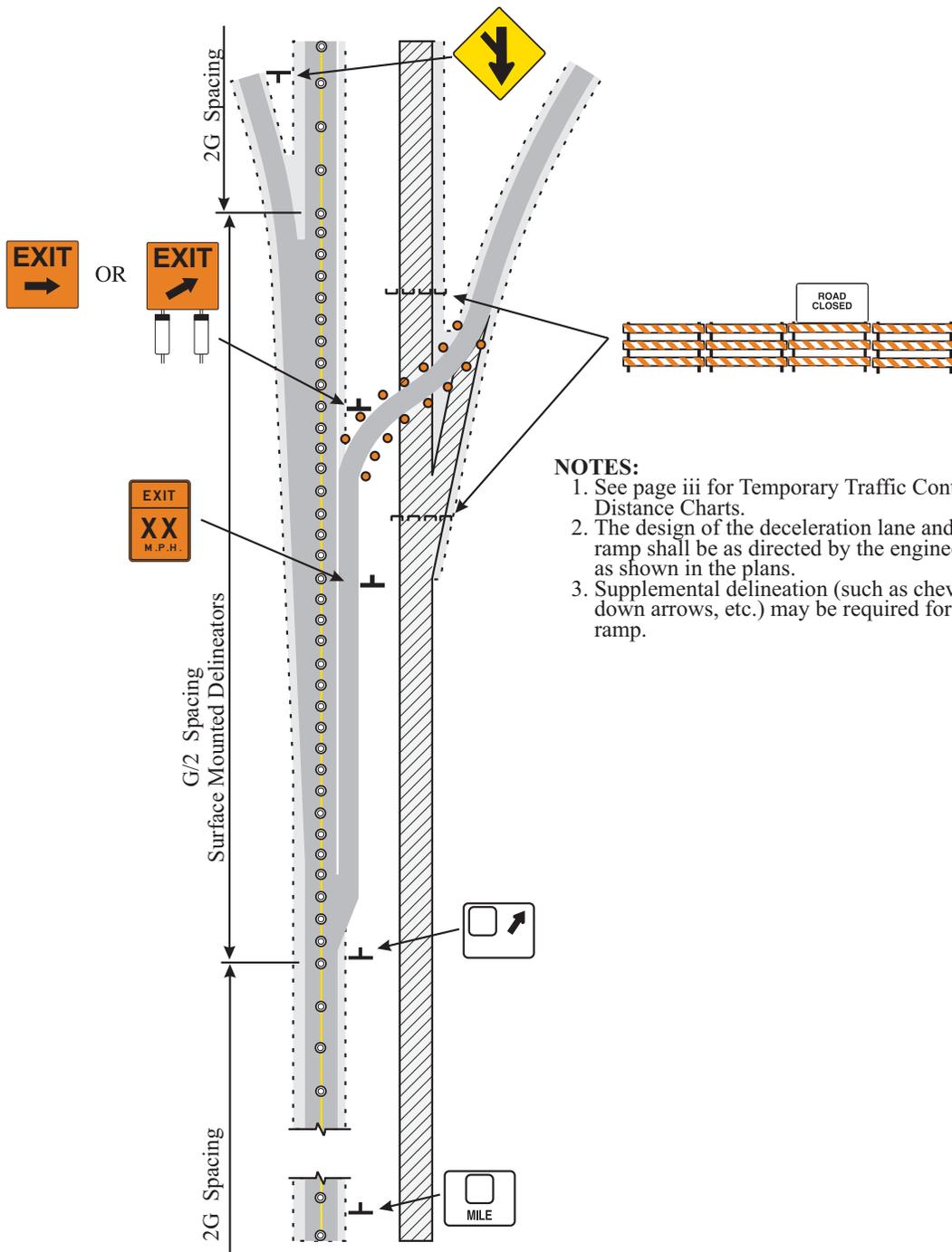
6J-6

HANDOUT

HANDOUT

HANDOUT

HANDOUT



- NOTES:**
1. See page iii for Temporary Traffic Control Distance Charts.
 2. The design of the deceleration lane and exit ramp shall be as directed by the engineer or as shown in the plans.
 3. Supplemental delineation (such as chevrons, down arrows, etc.) may be required for the ramp.

MN Rev. 3

TWO-LANE, TWO-WAY OPERATION AT EXIT RAMP ACROSS CLOSED ROADWAY

LONG TERM

LAYOUT 6J-7

6J-7

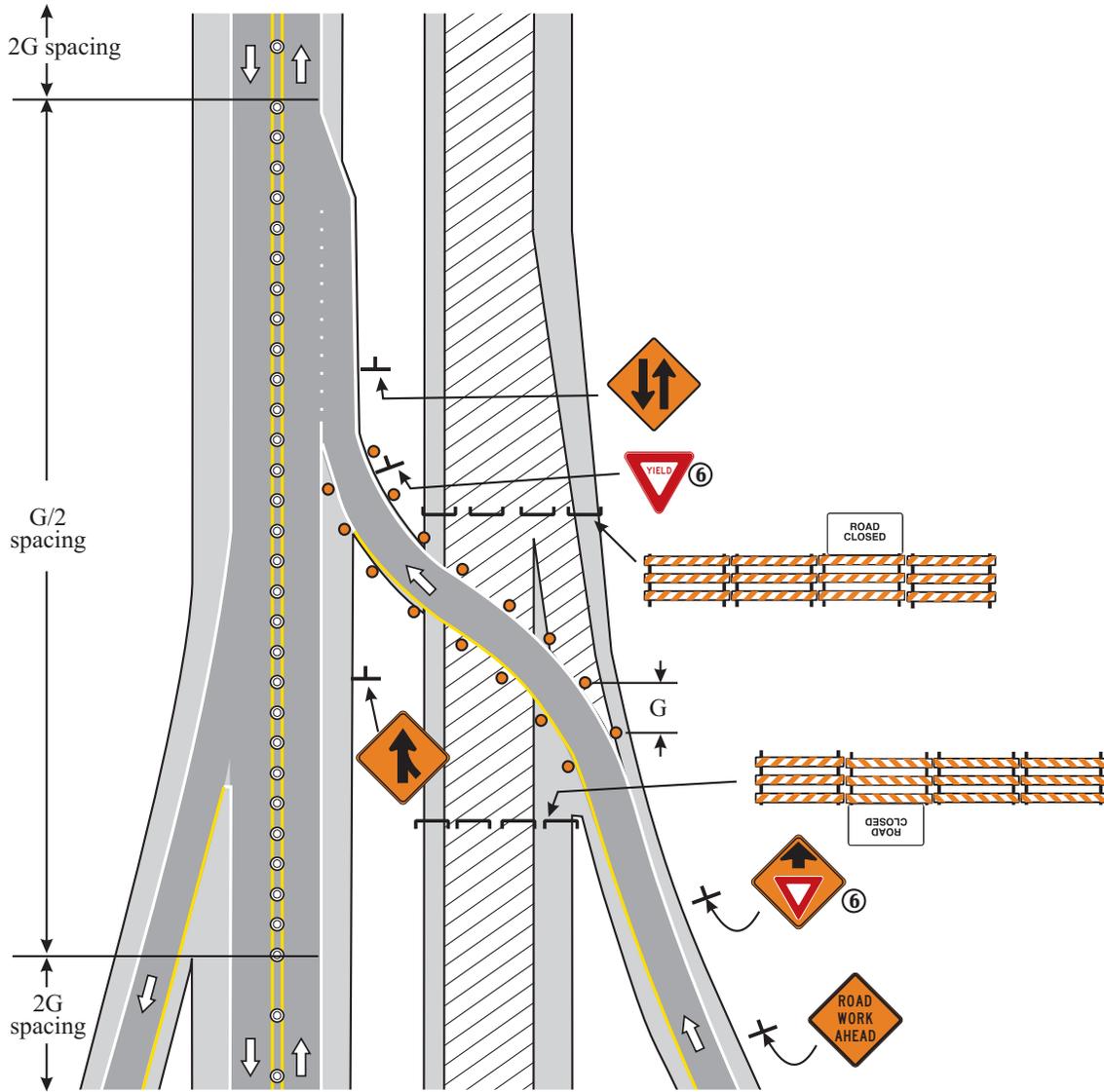
January, 2014

HANDOUT

HANDOUT

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. The design of the acceleration lane and entrance ramp shall be as directed by the engineer or as shown in the plans.
3. Supplemental delineation (such as chevrons, down arrows, etc.) may be required for the ramp.
4. The advance warning sign spacing is dependent on the ramp length and the location of in-place signing. The spacing should be as long as is practical.
5. Remove conflicting pavement markings and install temporary markings (see Figure 6J-1).
6. When an adequate acceleration lane is provided, this sign should be omitted.



TWO-LANE, TWO-WAY OPERATION AT ENTRANCE RAMP ACROSS CLOSED ROADWAY

LONG TERM

LAYOUT 6J-8

January, 2014

6J-8

MIN Rev. 3

MIN Rev. 3

HANDOUT

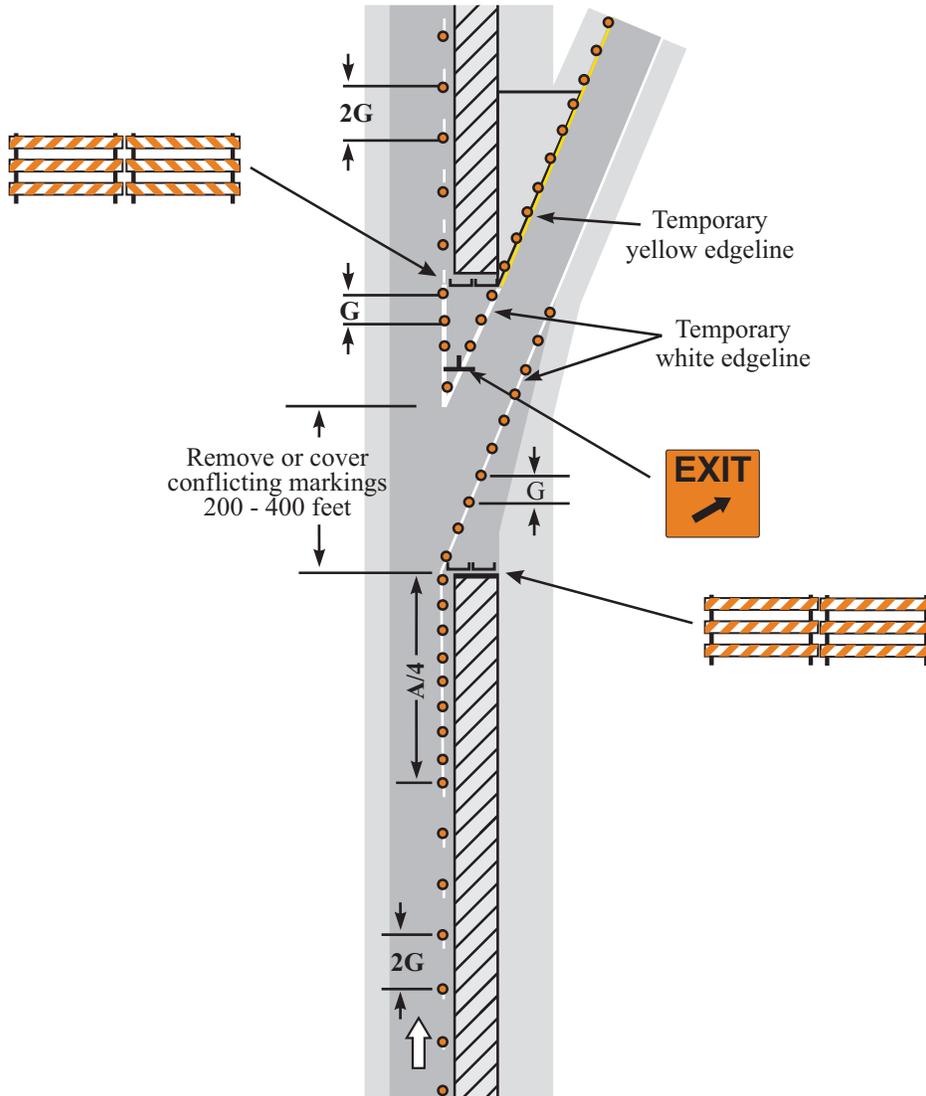
HANDOUT

HANDOUT

HANDOUT

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. The design of the deceleration lane and the exit ramp shall be as directed by the engineer or as shown in the plans.
3. The advance warning sign spacing is dependent on the ramp length and the location of in-place signing. The spacing should be as long as is practical.



Use appropriate devices and spacing for lane closure.

**MAINLINE RIGHT LANE CLOSED
EXIT RAMP OPEN**

LONG TERM

LAYOUT 6J-9

6J-9

December, 2011

HANDOUT

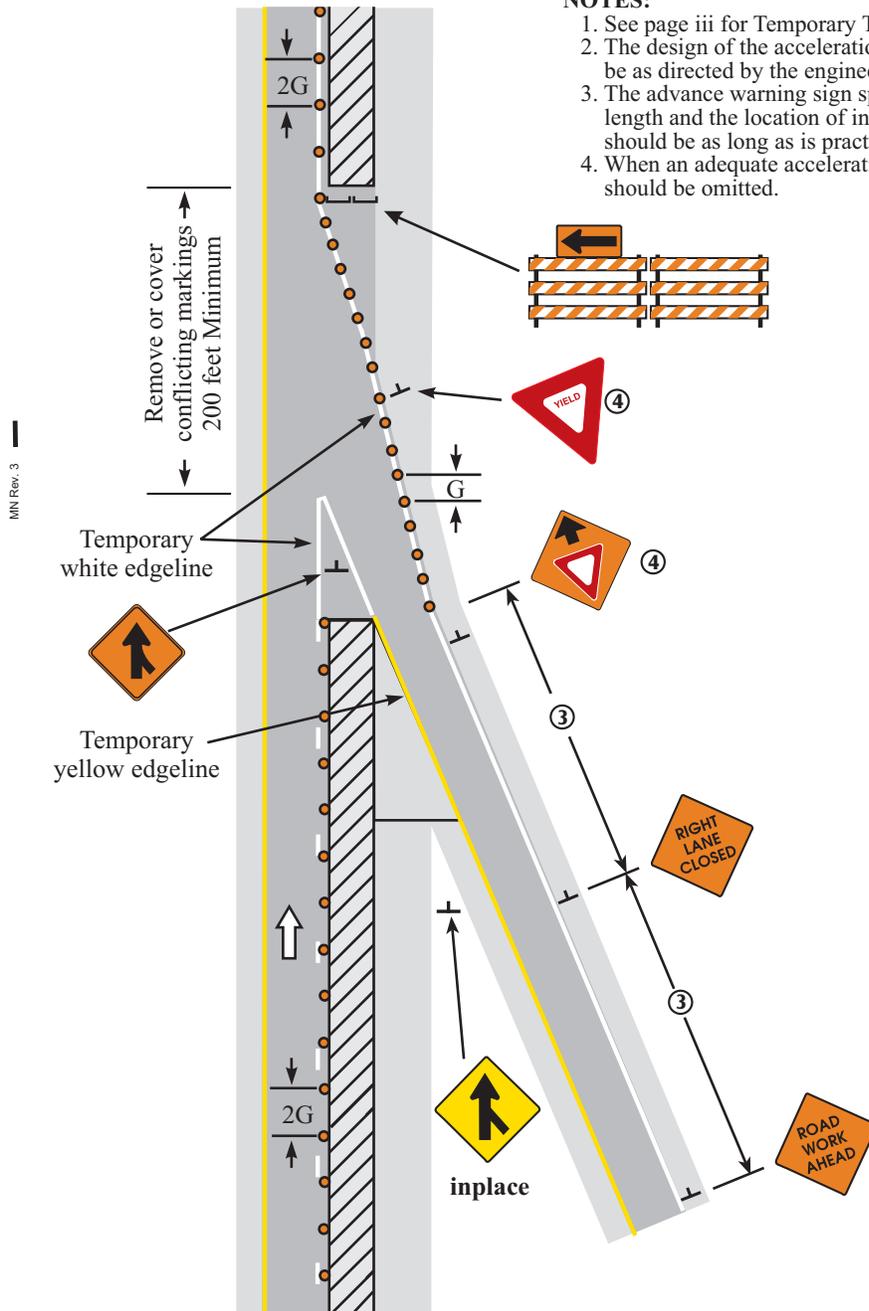
HANDOUT

HANDOUT

HANDOUT

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. The design of the acceleration lane and the entrance ramp shall be as directed by the engineer or as shown in the plans.
3. The advance warning sign spacing is dependent on the ramp length and the location of inplace signing. The spacing should be as long as is practical.
4. When an adequate acceleration lane is provided, this sign should be omitted.



Use the appropriate devices and spacing for a lane closure.

**MAINLINE RIGHT LANE CLOSED
ENTRANCE RAMP OPEN**

LONG TERM

LAYOUT 6J-10

January, 2014

6J-10

HANDOUT

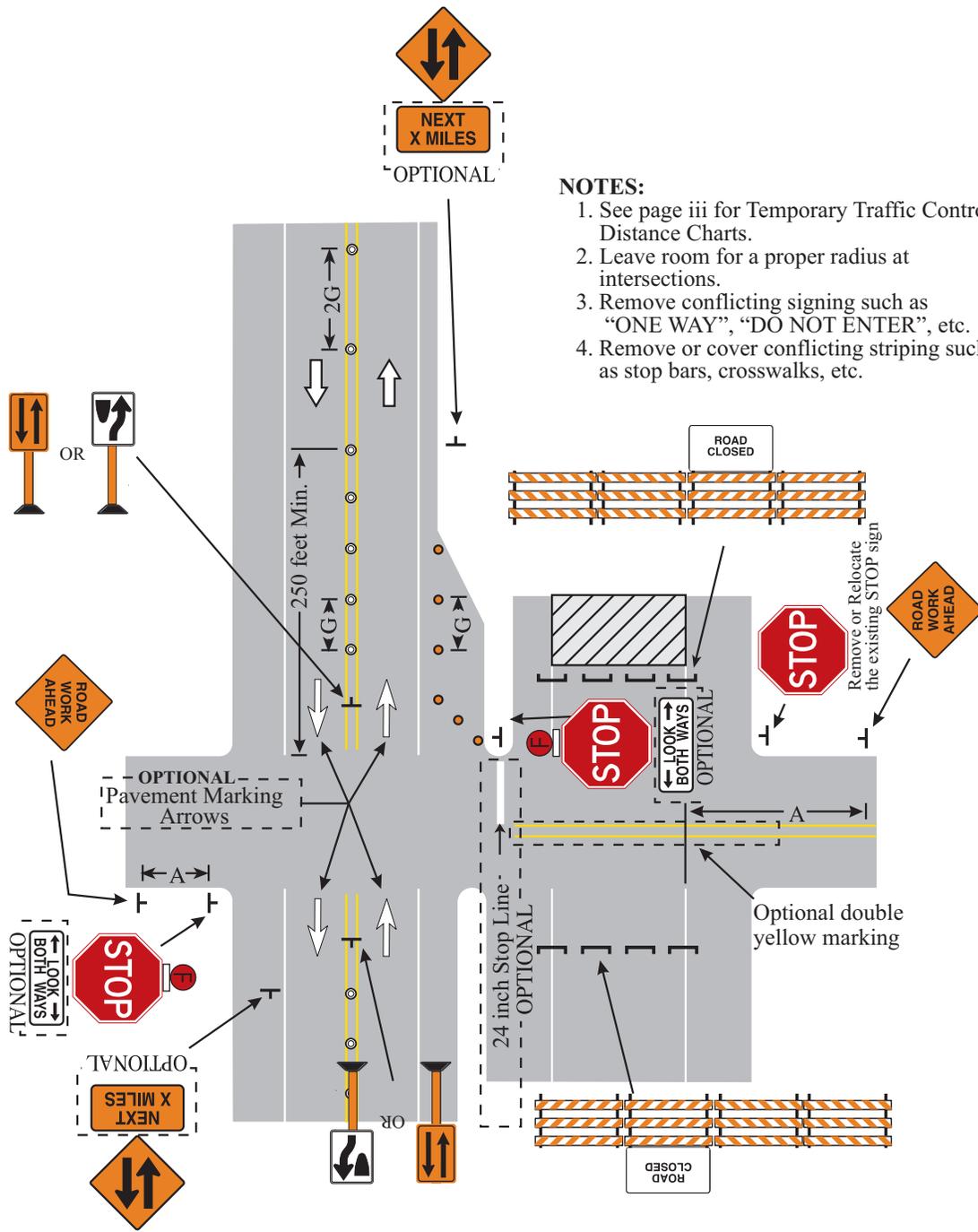
HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT



- NOTES:**
1. See page iii for Temporary Traffic Control Distance Charts.
 2. Leave room for a proper radius at intersections.
 3. Remove conflicting signing such as "ONE WAY", "DO NOT ENTER", etc.
 4. Remove or cover conflicting striping such as stop bars, crosswalks, etc.

MIN Rev. 3

MIN Rev. 3

TWO-LANE, TWO-WAY OPERATION THROUGH TYPICAL INTERSECTION

LONG TERM

LAYOUT 6J-11

6J-11

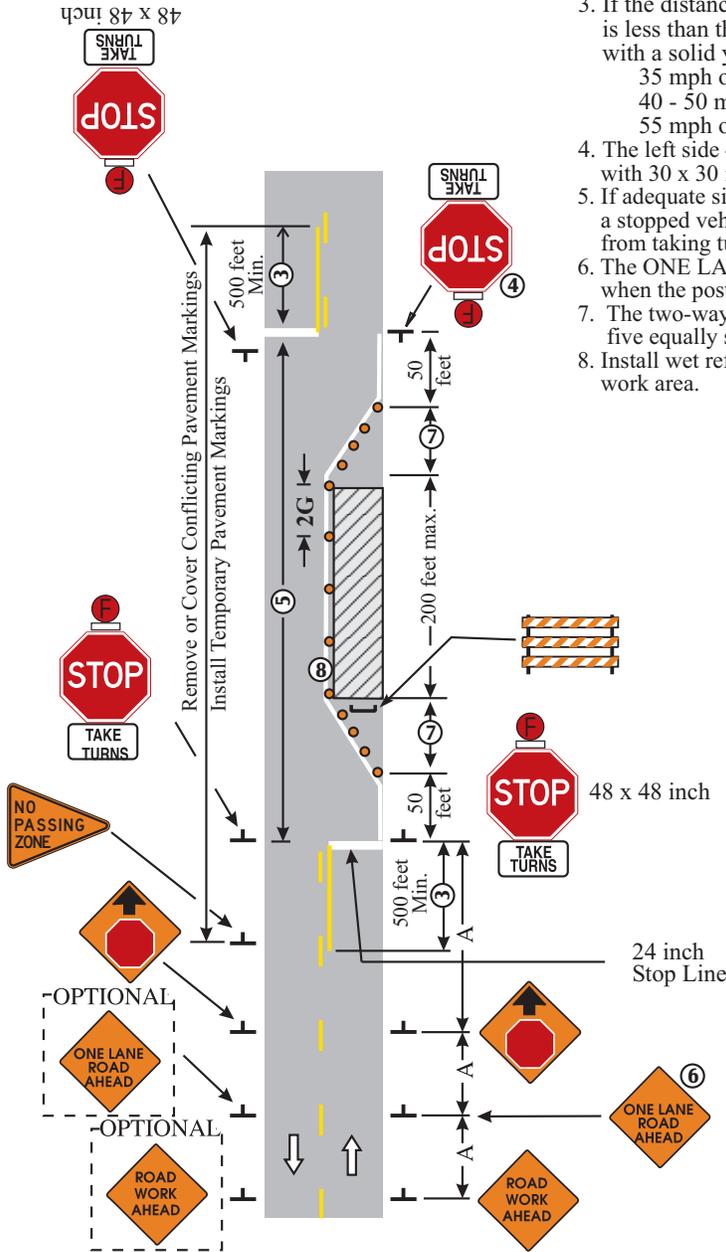
January, 2014

HANDOUT

HANDOUT

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Approach signs and marking is the the same in both directions.
3. If the distance from an in-place "NO PASSING ZONE" is less than the following, the zones shall be connected with a solid yellow line:
 - 35 mph or less - 500 feet
 - 40 - 50 mph - 600 feet
 - 55 mph or greater - 800 feet
4. The left side 48 x 48 inch STOP signs may be replaced with 30 x 30 inch STOP signs.
5. If adequate sight distance is not available to recognize a stopped vehicle or traffic volume restricts vehicles from taking turns through the open lane, use Layout 6J-13.
6. The ONE LANE ROAD AHEAD sign may be omitted when the posted speed limit is 40 mph or less.
7. The two-way taper should be 50 feet in length using five equally spaced channelizing devices.
8. Install wet reflective edgeline through tapers and the work area.



**LANE CLOSURE WITH STOP SIGNS
TWO-LANE, TWO-WAY ROAD**

LONG TERM

LAYOUT 6J-12

December, 2011

6J-12

HANDOUT

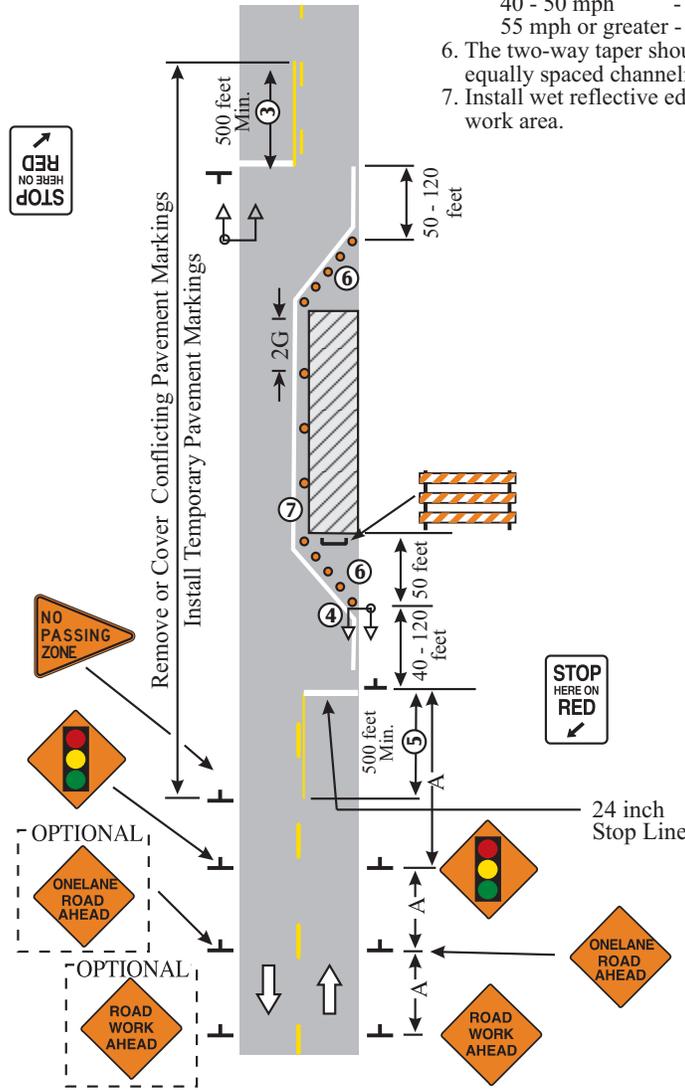
HANDOUT

HANDOUT

HANDOUT

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Approach signing and marking is the same in both directions.
3. Signal timing shall be established by qualified personnel.
4. Two signal heads shall be installed per approach. The first shall be installed on the right shoulder. The second signal head may be installed on either the left shoulder or mounted over head on the same structure as the first signal head.
5. If the distance from an inplace "NO PASSING ZONE" is less than the following, the zones shall be connected with a solid yellow line:
 - 35 mph or less - 500 feet
 - 40 - 50 mph - 600 feet
 - 55 mph or greater - 800 feet
6. The two-way taper should be 50 feet in length using five equally spaced channelizing devices.
7. Install wet reflective edgeline through tapers and the work area.



**LANE CLOSURE WITH SIGNALS
TWO-LANE, TWO-WAY ROAD**

LONG TERM

LAYOUT 6J-13

6J-13

December, 2011

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

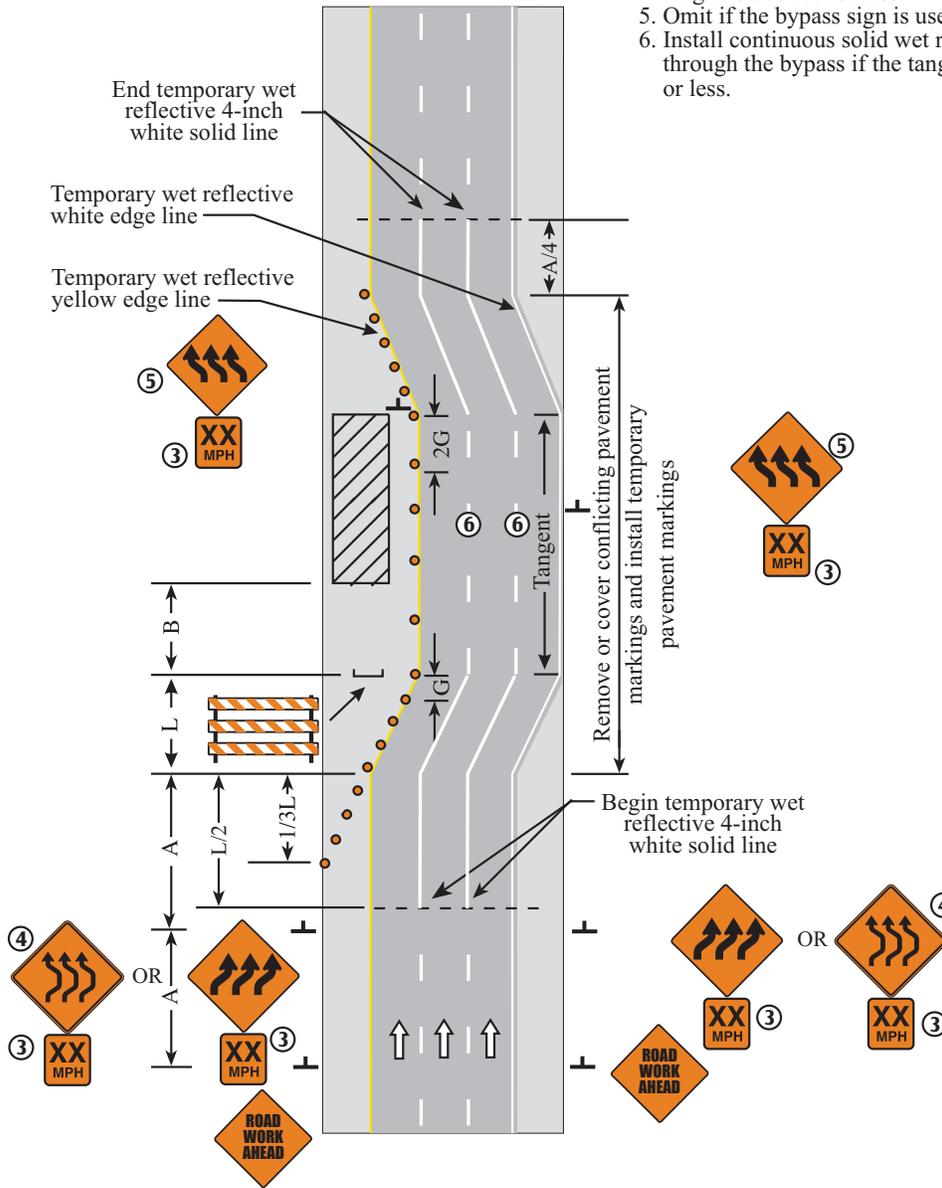
HANDOUT

HANDOUT

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. The minimum lane width shall be 10 feet.
3. The curve advisory speed will be determined by the Road Authority at the time of installation.
4. The bypass sign should be used when the tangent length is 600 feet or less.
5. Omit if the bypass sign is used.
6. Install continuous solid wet reflective lane lines through the bypass if the tangent is 600 feet or less.

MIN Rev. 3



**MULTIPLE LANE SHIFT
MULTILANE DIVIDED ROAD**

LONG TERM

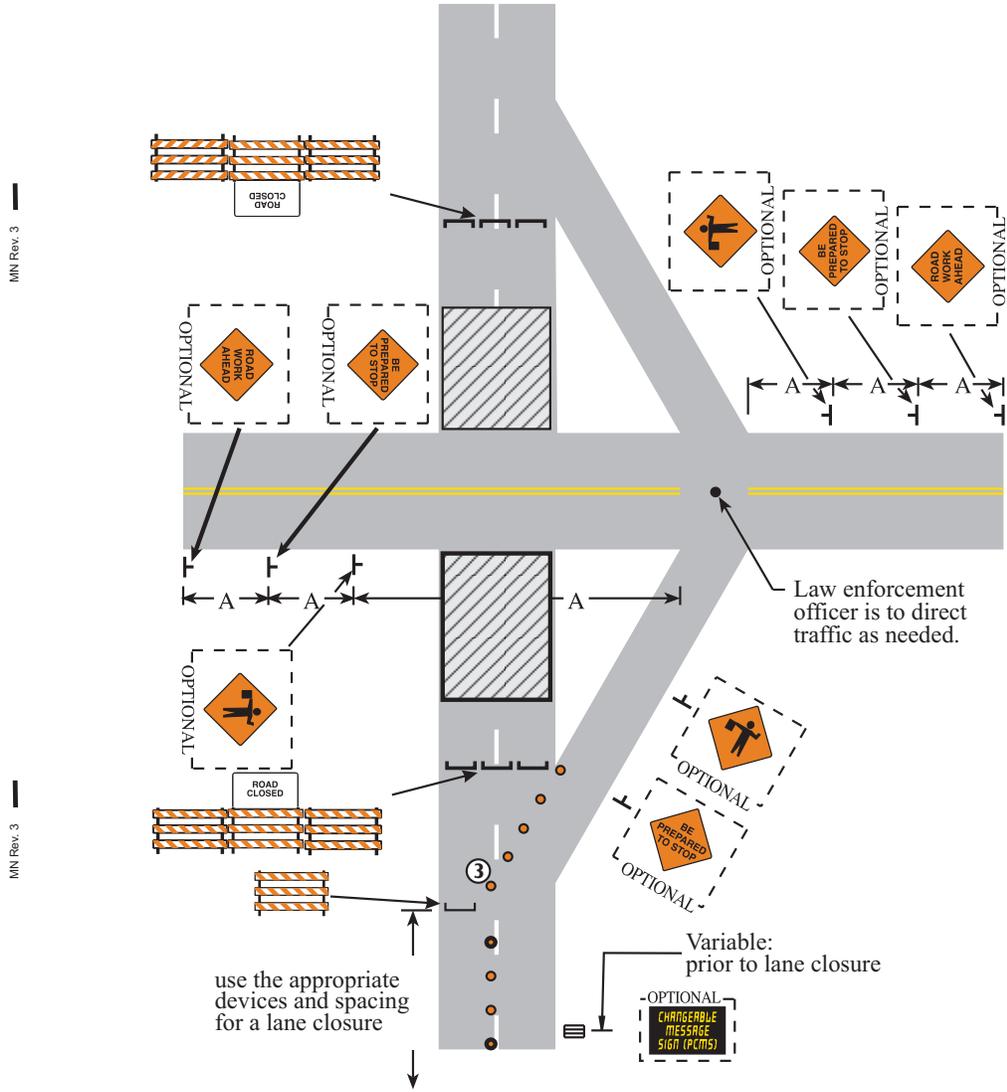
LAYOUT 6J-14

January, 2014

6J-14

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. The closed road volume should be below 800-1000 vehicles per hour.
3. Supplemental delineation such as chevrons, down arrows, etc. may be required in the bypass.



ROAD CLOSURE AT INTERCHANGE

SHORT TERM
LONG TERM

LAYOUT 6J-15

6J-15

January, 2014

HANDOUT

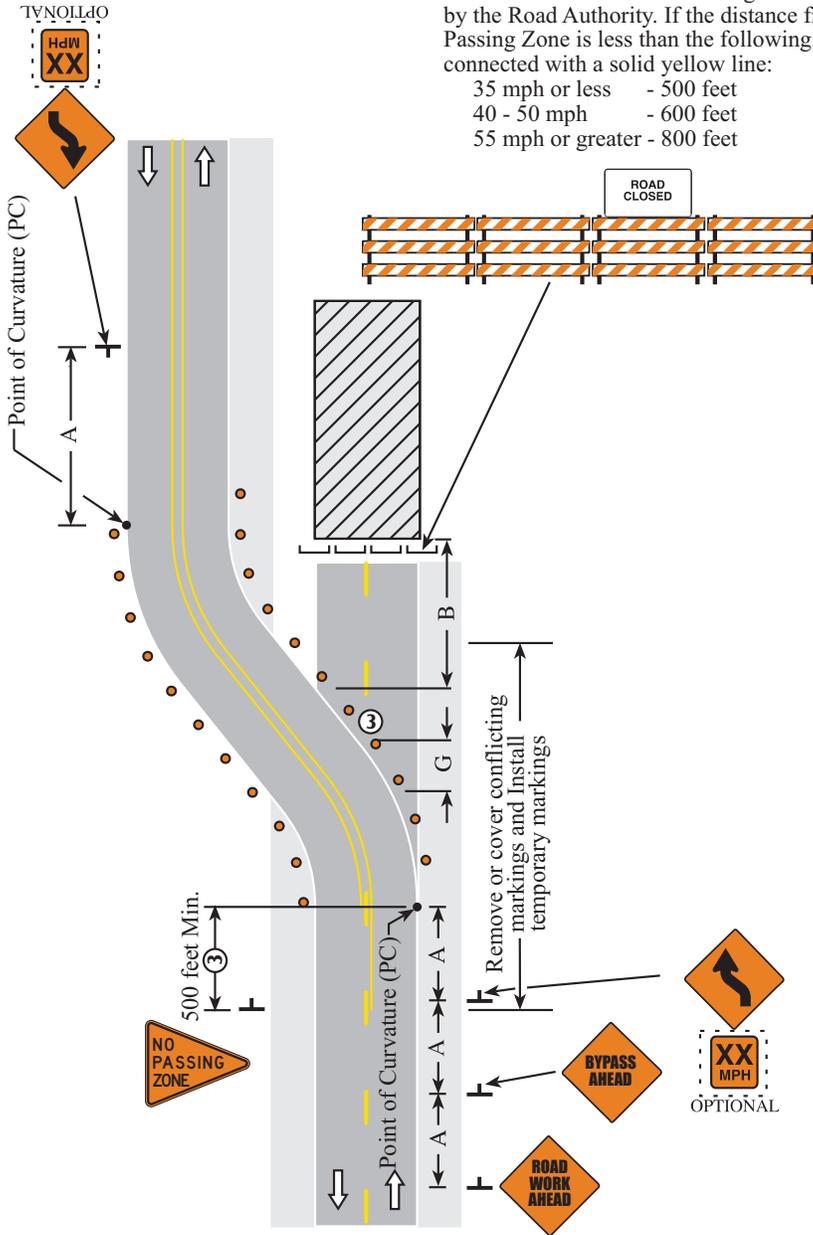
HANDOUT

HANDOUT

HANDOUT

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Typical traffic control is shown for one approach only.
3. Supplemental delineation (such as chevrons, down arrows, etc.) may be required on the bypass.
4. The exact location of No Passing Zones is to be determined by the Road Authority. If the distance from an in-place No Passing Zone is less than the following, the zones shall be connected with a solid yellow line:
 - 35 mph or less - 500 feet
 - 40 - 50 mph - 600 feet
 - 55 mph or greater - 800 feet



**ROAD CLOSURE WITH DIVERSION (BYPASS)
TWO-LANE, TWO-WAY ROAD**

LONG TERM

LAYOUT 6J-16

January, 2014

6J-16

HANDOUT

HANDOUT

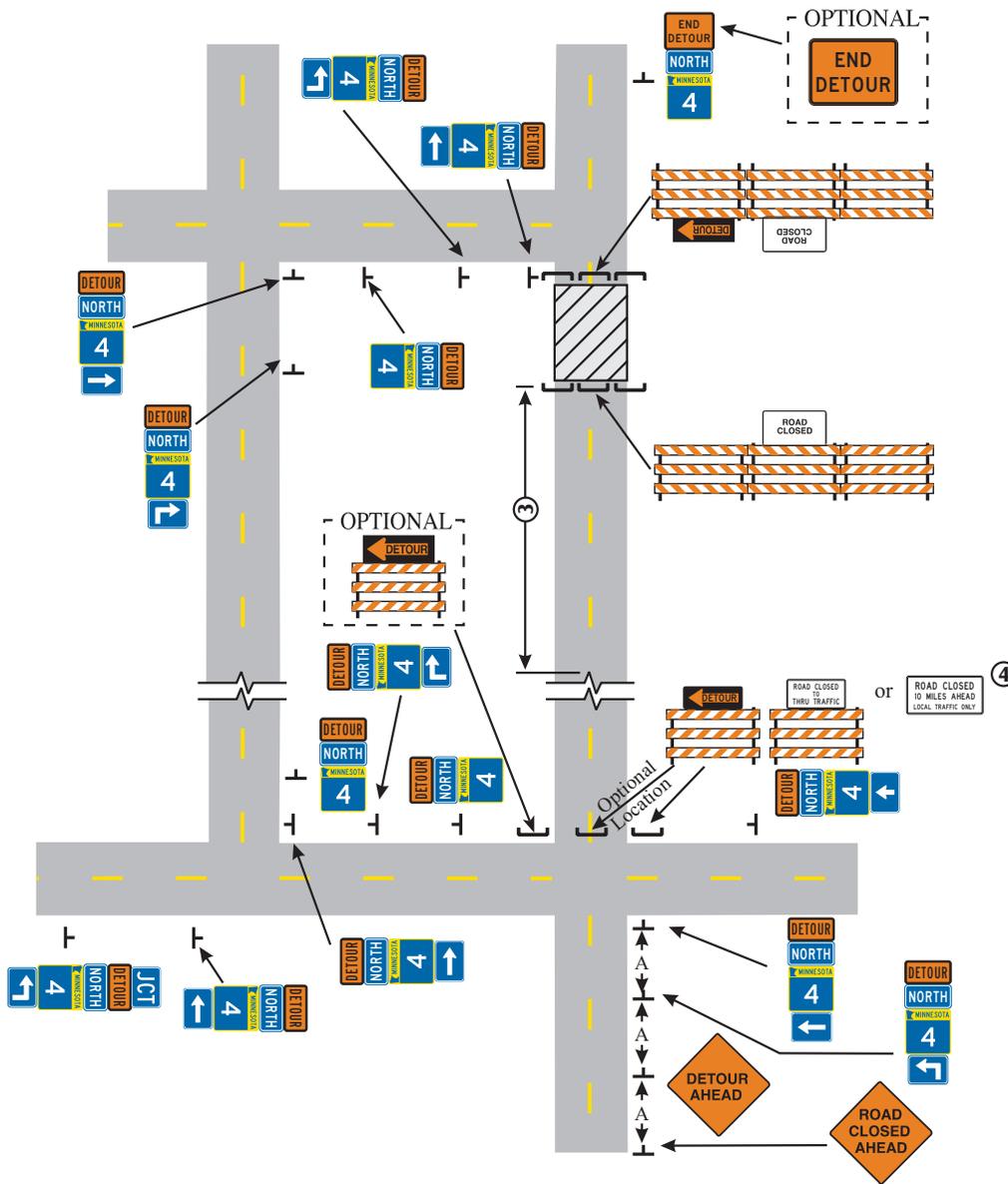
HANDOUT

HANDOUT

MIN Rev. 3

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Detour signing is shown for one direction only. The other direction shall be similar.
3. See Long Term Layout 6J-20 for devices and spacing.
4. Use this sign when it is 2 miles or greater to the road closure.



ROAD CLOSURE WITH DETOUR

LONG TERM

LAYOUT 6J-17

6J-17

January, 2014

HANDOUT

HANDOUT

HANDOUT

HANDOUT

MIN Rev. 3

MIN Rev. 3

MIN Rev. 2

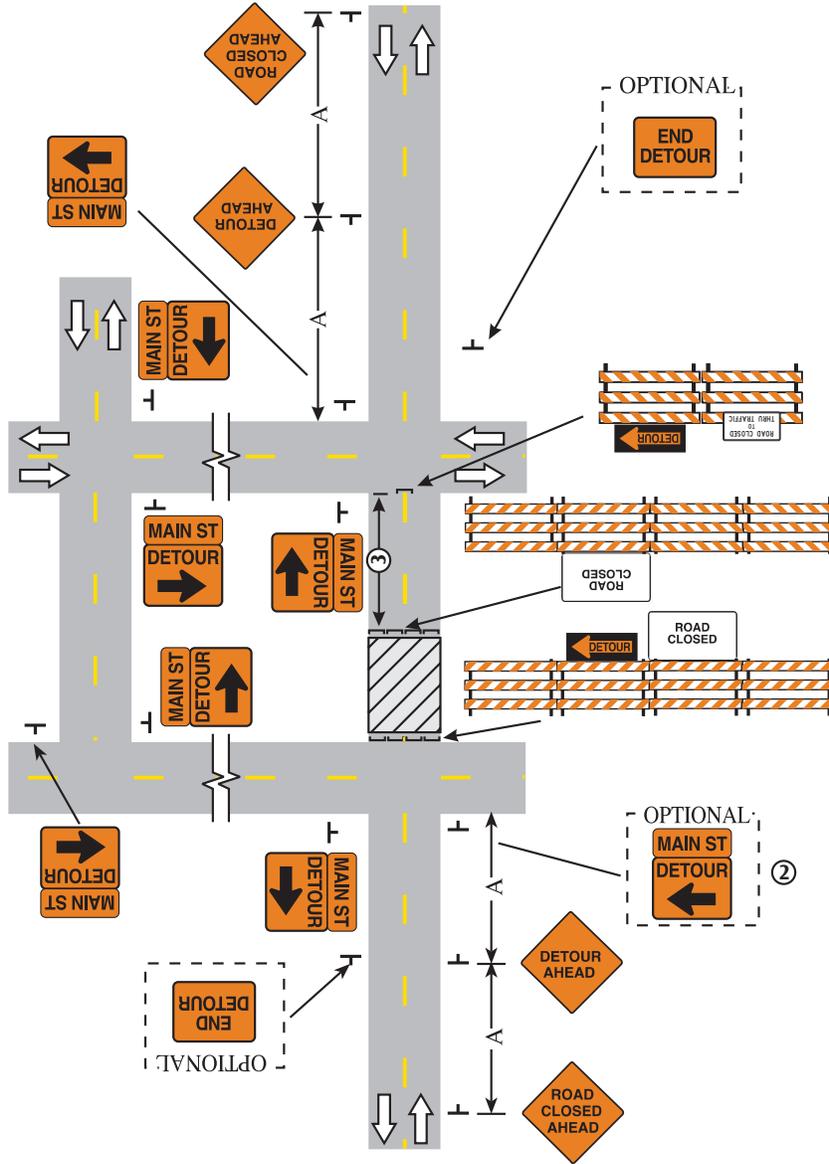
MIN Rev. 3

MIN Rev. 2

MIN Rev. 3

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. A M4-9 Detour Sign with an advance turn arrow may be used in advance of a turn. On multi-lane streets, such signs should be used.
3. See Long Term Layout 6J-20 for devices and spacing.



DETOUR FOR CLOSED STREET

LONG TERM

LAYOUT 6J-18

January, 2014

6J-18

HANDOUT

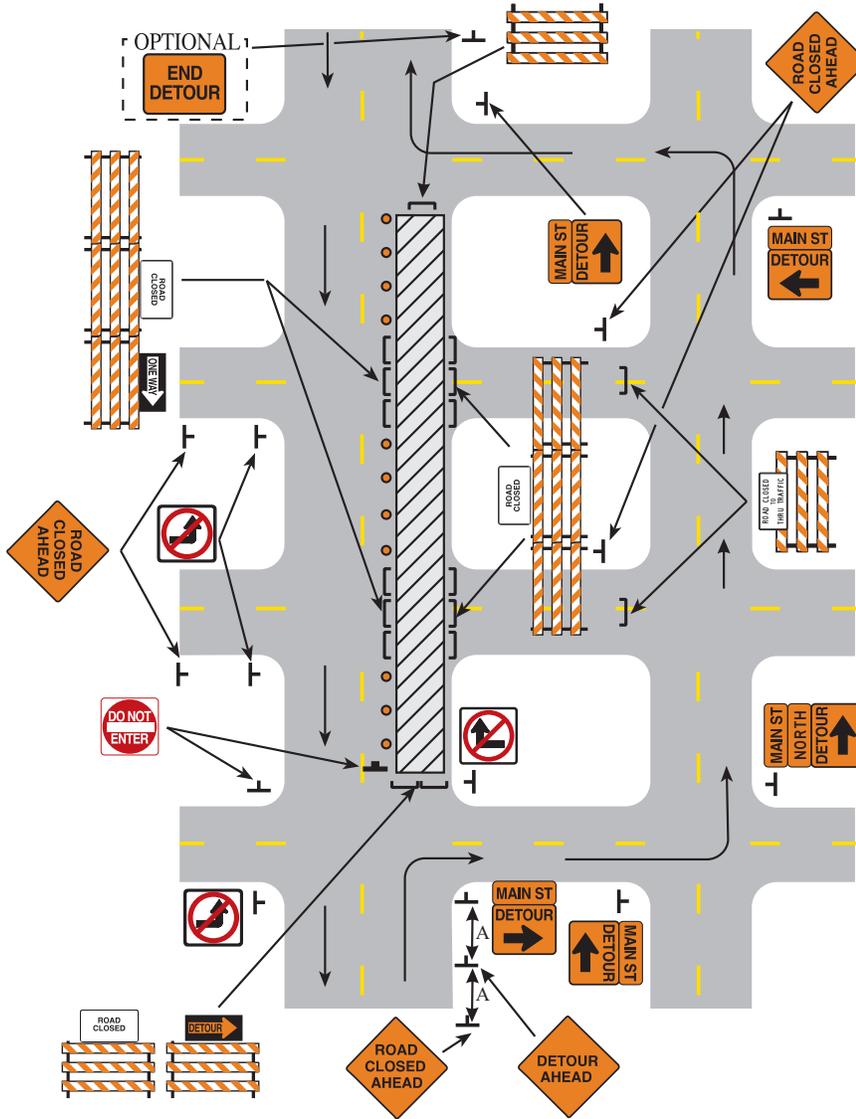
HANDOUT

HANDOUT

HANDOUT

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Additional "DO NOT ENTER" signs may be desirable at intersections with intervening streets.
3. For sidewalk and crosswalk closures, see Layouts 6K-24 and 6K-25.
4. Additional side street signs may be required.



DETOUR FOR ONE TRAVEL DIRECTION

LONG TERM

LAYOUT 6J-19

6J-19

January, 2014

MIN Rev. 3

HANDOUT

HANDOUT

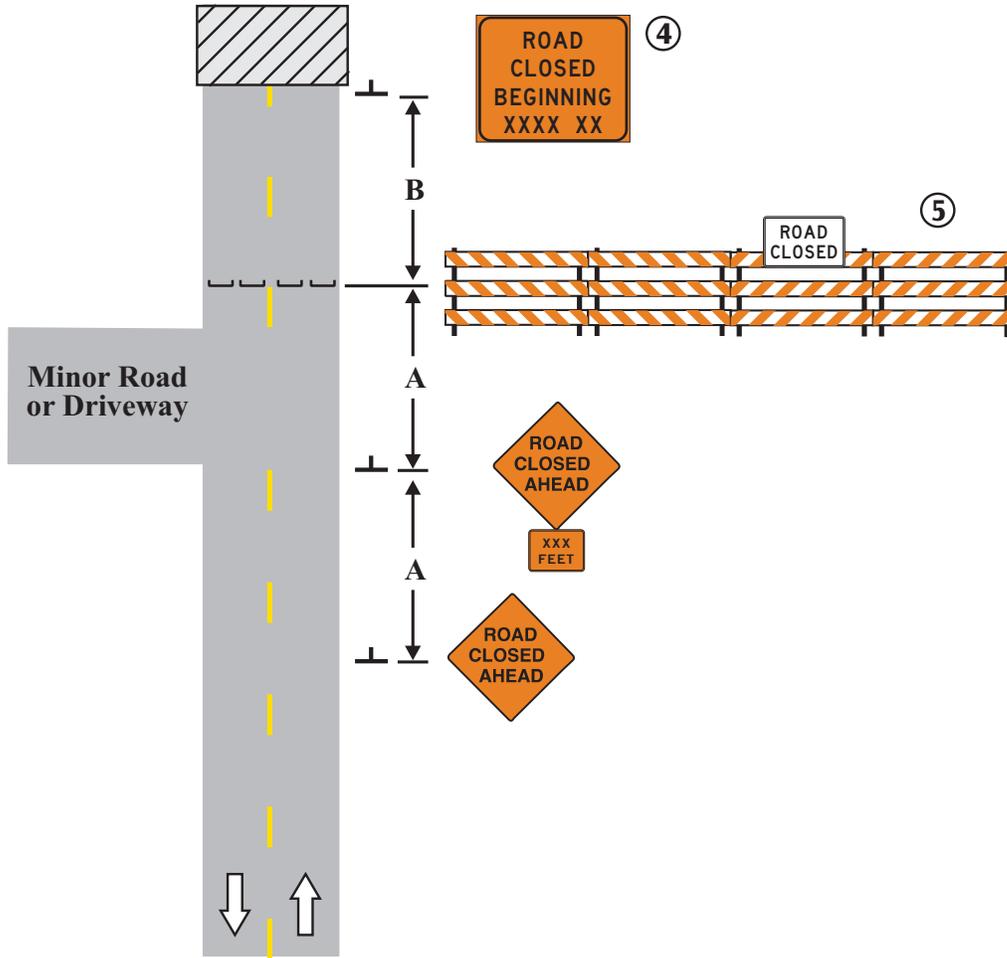
HANDOUT

HANDOUT

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. All devices are shown for one direction. Devices for the other direction should be similar.
3. The Road Authority will determine if a detour is required and specify the detour route.
4. Advance warning signs should be used seven days in advance of the closure.
5. Install at the last driveway or intersection beyond which there is no public access.

MN Rev. 3



MN Rev. 3

MN Rev. 3

MN Rev. 3

TYPICAL SIGNING FOR ROAD CLOSURE

LONG TERM

LAYOUT 6J-20

January, 2014

6J-20

HANDOUT

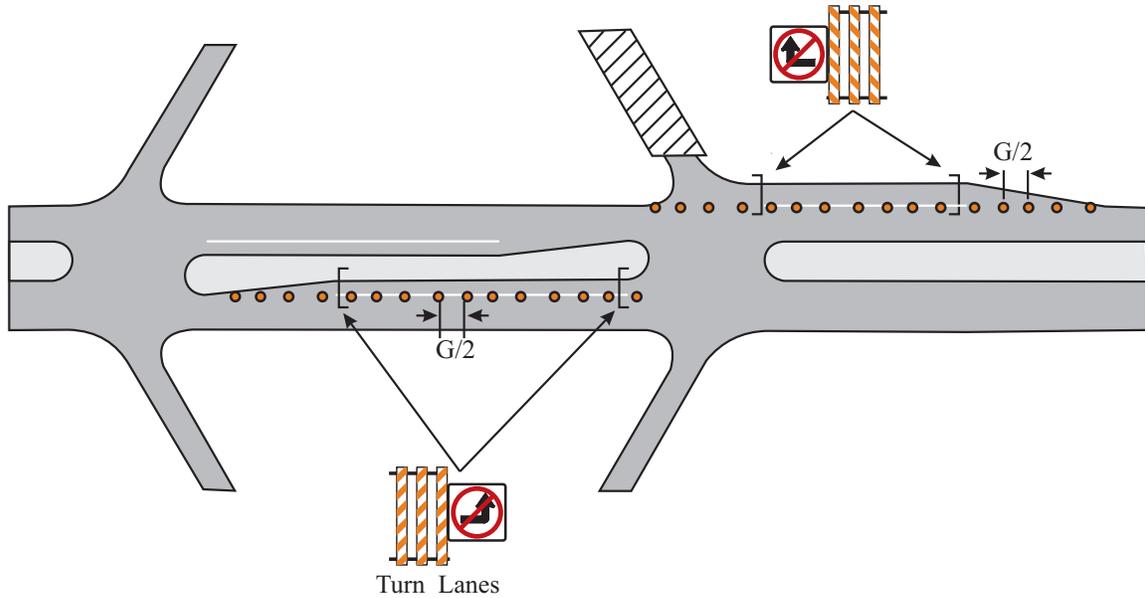
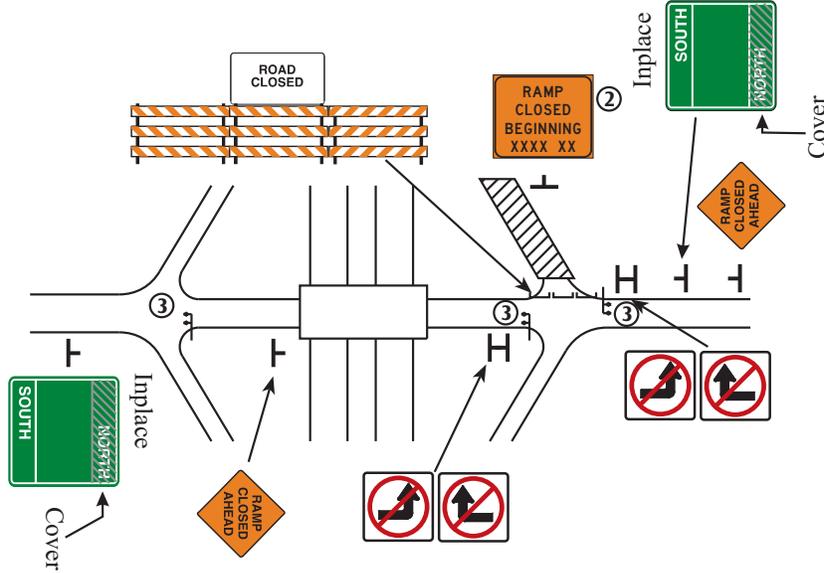
HANDOUT

HANDOUT

HANDOUT

NOTES:

1. See page iii for Temporary Traffic Control Distance Charts.
2. Advance warning signs should be used seven days in advance of the closure.
3. Cover all directional signing for the closed ramp.



ENTRANCE RAMP CLOSURES

LONG TERM

LAYOUT 6J-21

6J-21

January, 2014

HANDOUT

HANDOUT

HANDOUT

HANDOUT

MIN Rev. 3

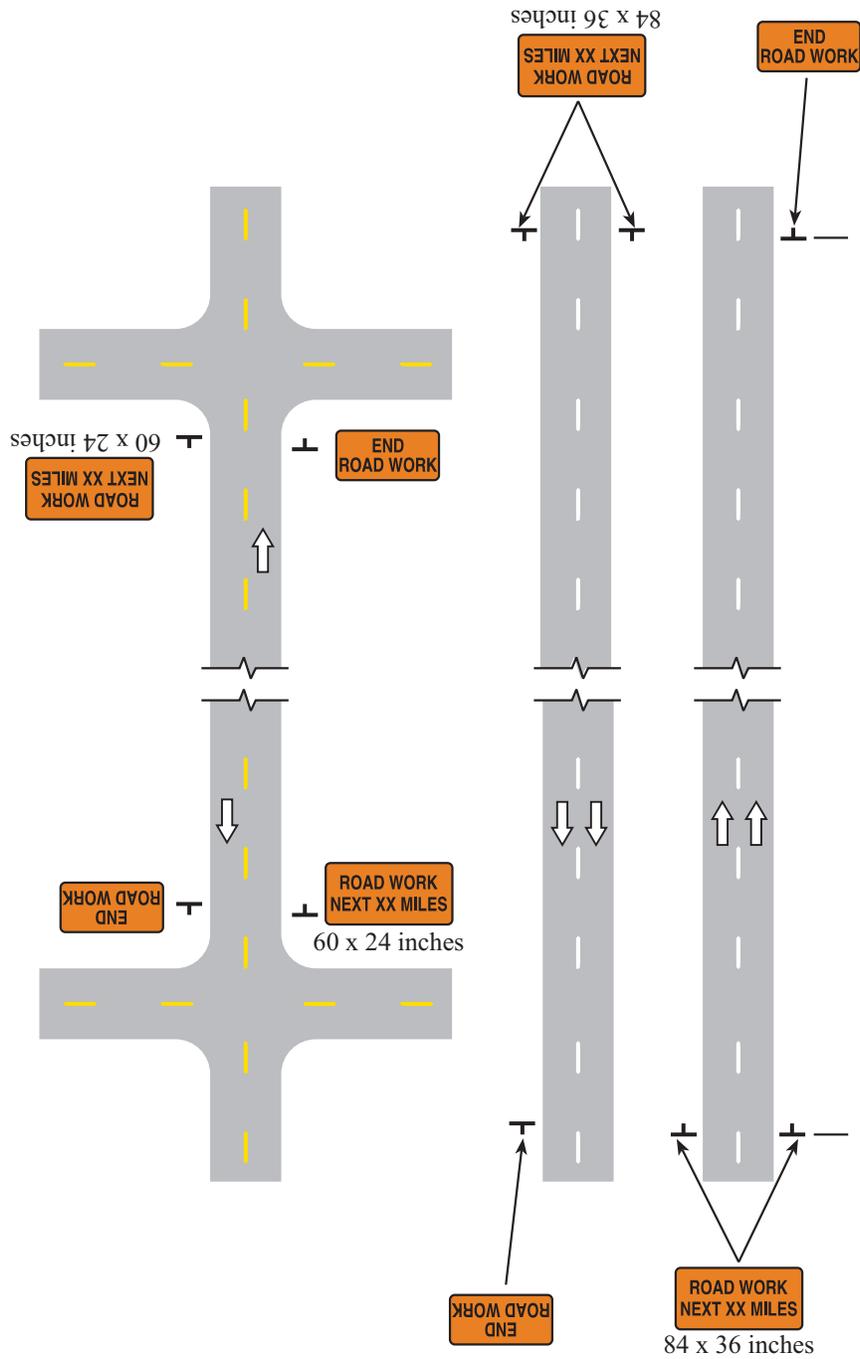
MIN Rev. 3

MIN Rev. 3

MIN Rev. 3

HANDOUT

HANDOUT



TYPICAL TERMINI SIGNING

LONG TERM

LAYOUT 6J-22

December, 2011

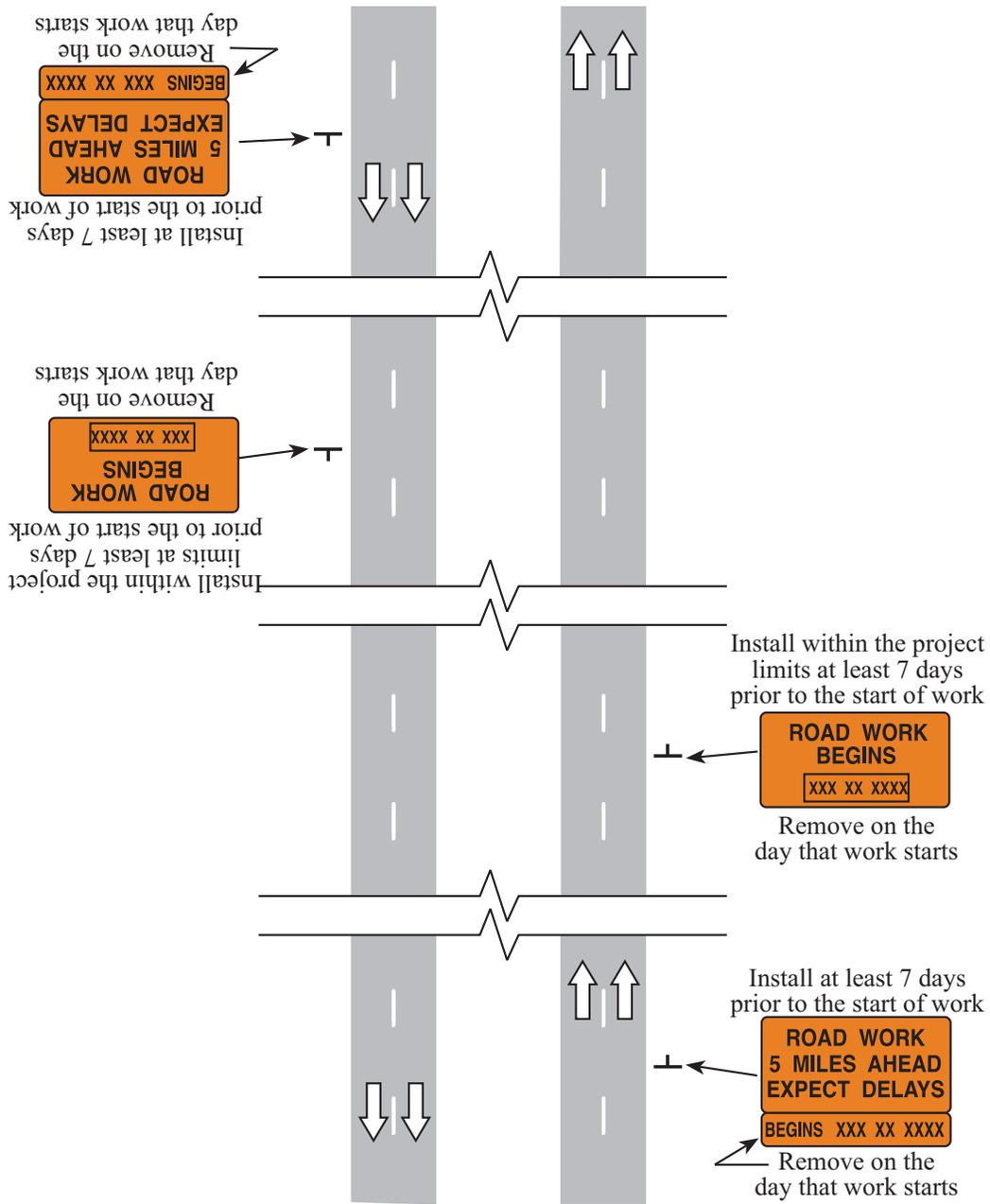
6J-22

HANDOUT

HANDOUT

HANDOUT

HANDOUT



TYPICAL ADVANCE SIGNING

LONG TERM

LAYOUT 6J-23

6J-23

December, 2011

HANDOUT

HANDOUT

NOTES:

1. When crosswalks, sidewalks or other pedestrian facilities are blocked, closed or relocated, temporary facilities shall include accessibility features consistent with the features present in the existing pedestrian facility.
2. The examples show only key typical dimensions. Refer to the MnDOT "Temporary Pedestrian Access Route" (TPAR) website (<http://www.dot.state.mn.us/trafficeng/workzone/tpar.html>) for standards, guidance and options when blocking, closing, or relocating pedestrian facilities.
3. Only traffic control devices controlling pedestrian flows are shown. Other devices may be needed to control traffic on the streets.
4. An approved audible message device or tactile message should be provided for sight-impaired pedestrians. When used, a message device should provide a complete physical description of the temporary pedestrian detour including duration, length of (and/or distance to) the bypass, any restrictions or hazards and project information as listed in note 5 below. The number and location of devices should be determined for each project prior to starting work. Devices may be placed prior to sidewalk work to warn regular users of the planned work.
5. Typical sign message for a temporary pedestrian detour should include information such as the duration of the walkway restrictions (beginning and/or end dates) and a project contact number for 24/7 questions or reporting hazards.
6. The International Symbol of Accessibility should be displayed when any walkway through a work zone has been determined to be TPAR compliant. The Symbol of Accessibility shall not be displayed if persons with disabilities should not use the primary temporary pedestrian detour. The reason for the non-compliance should be posted and an alternate route should be posted when the primary temporary pedestrian detour is non-compliant to TPAR standards.
7. Conditions that are beyond recommended standards should be documented. A walkway is non-compliant if it is missing key ADA elements such as curb ramp(s), truncated domes, and detectable edging. Other restrictions or hazards may include insufficient width or pinch-point widths, traffic conflicts, steep grades, non-continuous railings, tripping hazards, or uneven/rough/soft surface conditions, etc.
8. Pedestrian traffic signal displays controlling closed crosswalks shall be covered. Temporary pedestrian signals should be considered when creating a new crossing location.
9. Curb marking shall be prohibited for a minimum of 30 feet in advance of the mid-block pedestrian crossing. Crosswalk marking shall be installed and conflicting marking removed or covered. Curb ramps with detectable warnings shall be provided to transition from the sidewalk to the crosswalk.
10. Pedestrian detour trailblazing signs should be used if the pedestrian detour is located someplace other than across the street from the sidewalk closure.

CROSSWALK CLOSURES AND PEDESTRIAN DETOURS

LONG TERM

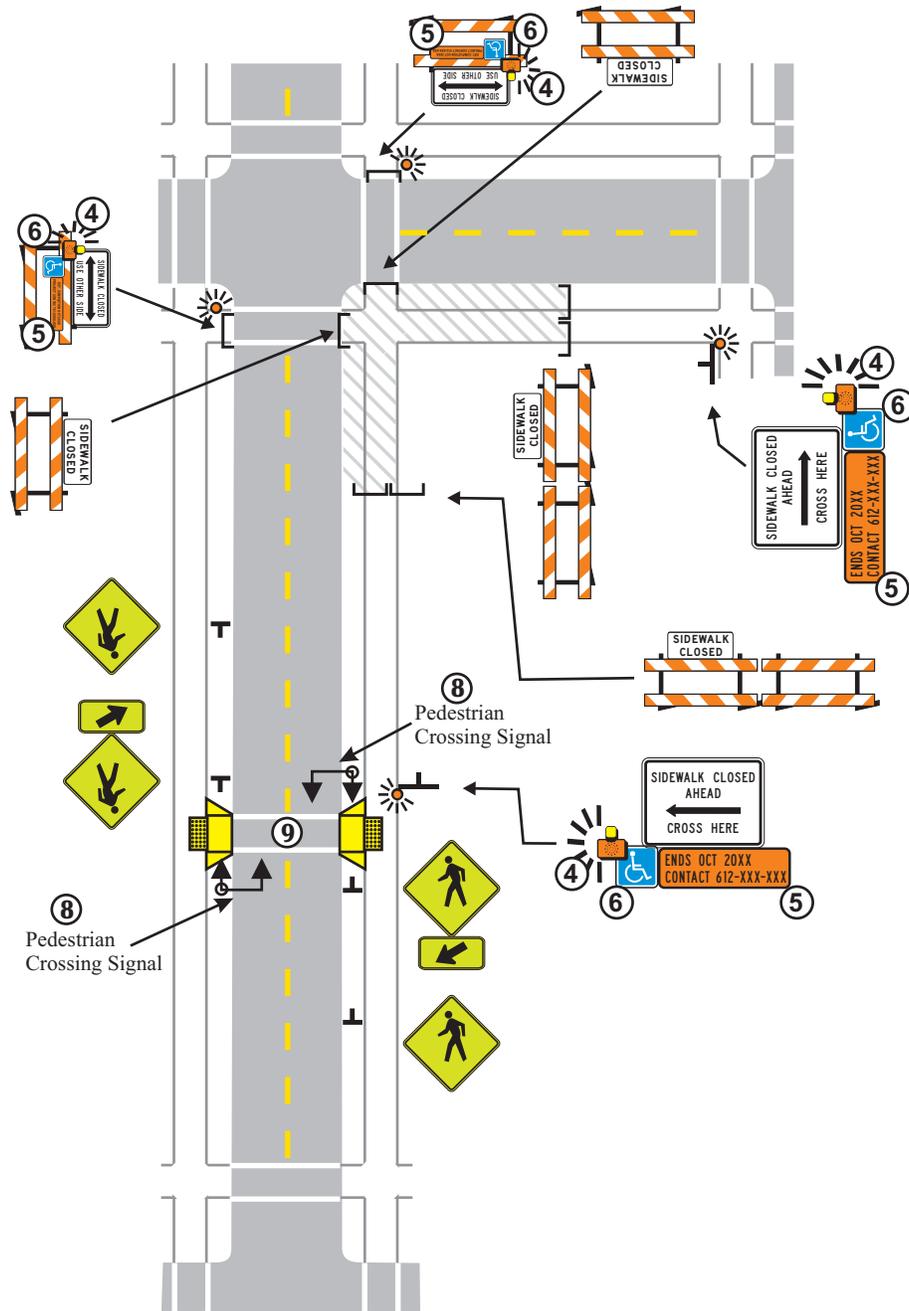
LAYOUT 6J-24a

January, 2014

6J-24a

HANDOUT

HANDOUT



MIN Rev. 3

HANDOUT

HANDOUT

CROSSWALK CLOSURES AND PEDESTRIAN DETOURS

LONG TERM

LAYOUT 6J-24b

6J-24b

January, 2014

NOTES:

1. When crosswalks, sidewalks or other pedestrian facilities are blocked, closed or relocated, temporary facilities shall include accessibility features consistent with the features present in the existing pedestrian facility.
2. The examples show only key typical dimensions. Refer to the MnDOT "Temporary Pedestrian Access Route" (TPAR) website (<http://www.dot.state.mn.us/trafficeng/workzone/tpar.html>) for standards, guidance and options when blocking, closing, or relocating pedestrian facilities.
3. Where high speeds and/or high traffic volumes are anticipated, barrier should be used to separate the temporary pedestrian walkway from vehicular traffic. When used, barriers shall be installed as detailed in the MN MUTCD, Part 6F.
4. Only traffic control devices controlling pedestrian flows are shown. Other devices may be needed to control traffic on the streets.
5. When both sides of a temporary pedestrian bypass require channelizing devices, then the devices should be a similar type (railing system, barricade, or fencing system), excluding when TTC barrier (such as concrete barrier) is used to protect pedestrians from an open traffic lane.
6. An approved audible message device or tactile message should be provided for sight-impaired pedestrians. When used, a message device should provide a complete physical description of the temporary pedestrian by-pass including duration, length of (and/or distance to) the bypass, any restrictions or hazards and project information as listed in note 7 below. The message device(s) may also describe an alternate route. The number and location of devices should be determined for each project prior to starting work. Devices may be placed prior to sidewalk work to warn regular users of the planned work.
7. Typical sign message for a temporary pedestrian bypass should include information such as the duration of the walkway restrictions (beginning and/or end dates) and a project contact number for 24/7 questions or reporting hazards.
8. The International Symbol of Accessibility should be displayed when any walkway through a work zone has been determined to be TPAR compliant. The Symbol of Accessibility shall not be displayed if persons with disabilities should not enter the temporary pedestrian bypass. An alternate route should be posted when the temporary pedestrian bypass is non-complaint to TPAR standards.
9. Conditions that are beyond recommended standards should be documented. A walkway is non-compliant if it is missing key ADA elements such as curb ramp(s), truncated domes, and detectable edging. Other restrictions or hazards may include insufficient width or pinch-point widths, traffic conflicts, steep grades, non-continuous railings, tripping hazards, or uneven/rough/soft surface conditions, etc.
10. When a sidewalk is closed but workers are present who will provide assistance or directions to pedestrians, then the devices as shown are not required.

SIDEWALK BYPASS

LONG TERM

LAYOUT 6J-25a

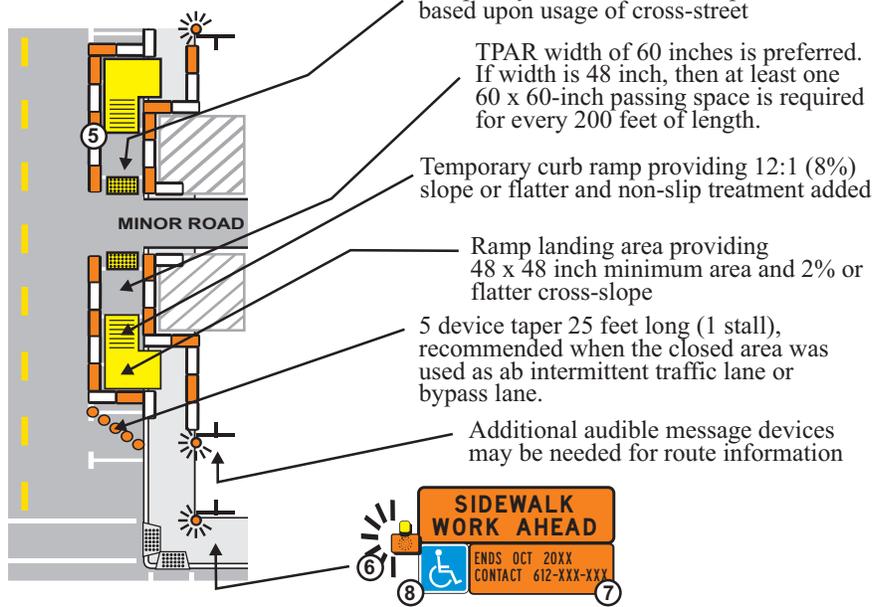
January, 2014

6J-25a

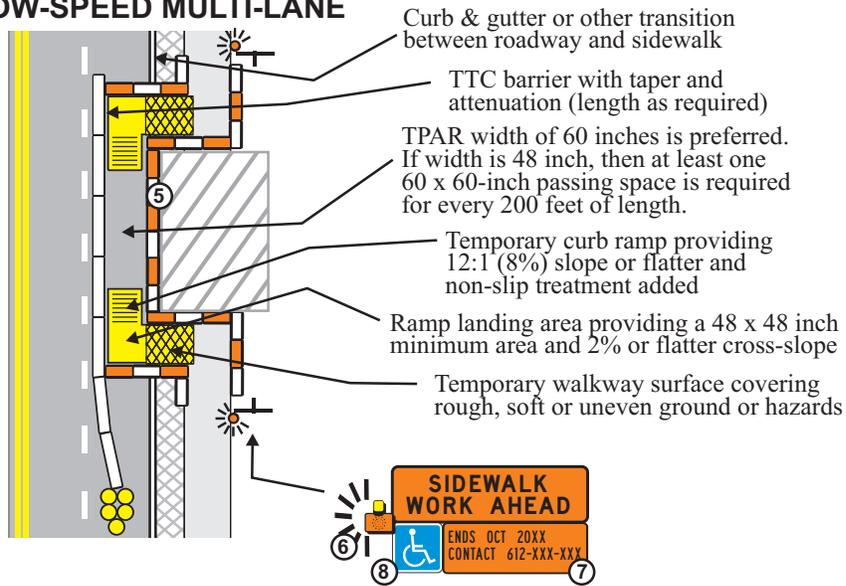
HANDOUT

HANDOUT

LOW-SPEED ROADWAY



HIGH-SPEED ROADWAY or LOW-SPEED MULTI-LANE



SIDWALK BYPASS

LONG TERM

LAYOUT 6J-25b

MIN Rev. 3

HANDOUT

HANDOUT

6J-25b

January, 2014

4.4 TTC Template Sheets for Stationary Work Zones

Temporary Traffic Control Plans for MnDOT projects follow a general format of style and information. Therefore, MnDOT maintains and provides a series of template layout sheets in DGN and PDF formats. These templates can be obtained from the following webpage:

<http://www.dot.state.mn.us/trafficeng/workzone/ttctemplates.html>.

The template sheets listed on the website may be added to a TTC Plan as needed for a particular project. The template sheet files (DGN format) may be imported into any TTC plan, but each template must be edited to comply with project specific construction situations. DESIGN NOTES are included on most template sheets and the designer should use them to make appropriate design considerations. When the final traffic control sheets are placed into the construction plans, all variables should be determined and entered on the sheet(s) directly and all the designer notes and charts should be removed from the sheets.

Exhibit 4-1 TTC Plan Template Sheets Website

mn DEPARTMENT OF TRANSPORTATION

Search MnDOT A to Z General Contacts

Traffic Engineering

Traffic Engineering Home Publications Training Organizations Contacts

Temporary Traffic Control Plan Template Sheets

TTC Template Sheets for Stationary Work Zones

Temporary Traffic Control Plans for MnDOT projects follow a general format of style and information. The Metro TTC Typical Sample Plan below may be used as reference for designing a TTC Plan for a MnDOT project, although each MnDOT District may have slightly different formats developed. The template sheets listed on this page may be added to a TTC Plan as needed for a particular project. The template sheet files (DGN format) may be imported into any TTC plan, but each template must be edited to comply with project specific construction situations. Design notes are included on most template sheets and the designer should use them to make appropriate design considerations. When the final traffic control sheets are placed into the construction plans, all variables should be determined and entered on the sheet(s) directly and all the designer notes and charts should be removed from the sheets.

Please note: the CADD files were created in Microstation Version 7 format; levels, colors and some legend symbols may not be up to [current CADD standards](#). These templates will be updated on a continuous basis. It is recommended that a designer retrieves the most current version of any sheet template before beginning the "Temporary Traffic Control Plan" design process.

Please report any errors or suggested changes to the Work Zone Standards Engineer at traffic_dtd@state.mn.us

Work Zone design tools

- [Overview](#)
- [Manuals and Guidelines](#)
- [TTC Reports](#)
- [Technical Memoranda](#)
- [TTC Device Standards](#)
- [ADA in Work Zones](#)
- [Special Provisions](#)
- [Sample TTC Plan \(PDF\)](#)
- [Sample TTC Plan \(DGN\)](#)

Layout Description	Multi-Lane Divided		Multi-Lane Undivided		Two Lane Two Way	
	Long Term	3 Days or Less	Long Term	3 Days or Less	Long Term	3 days or Less
Right Lane Closure	DGN PDF 01 10.22.14	DGN PDF 24 10.22.14	DGN PDF 35 11.05.14	DGN PDF 42 11.05.14		
	DGN PDF 02	DGN PDF 25				

Exhibit 4-2 Sample Template, Right Lane Close, Multi-Lane Undivided (Long Term)

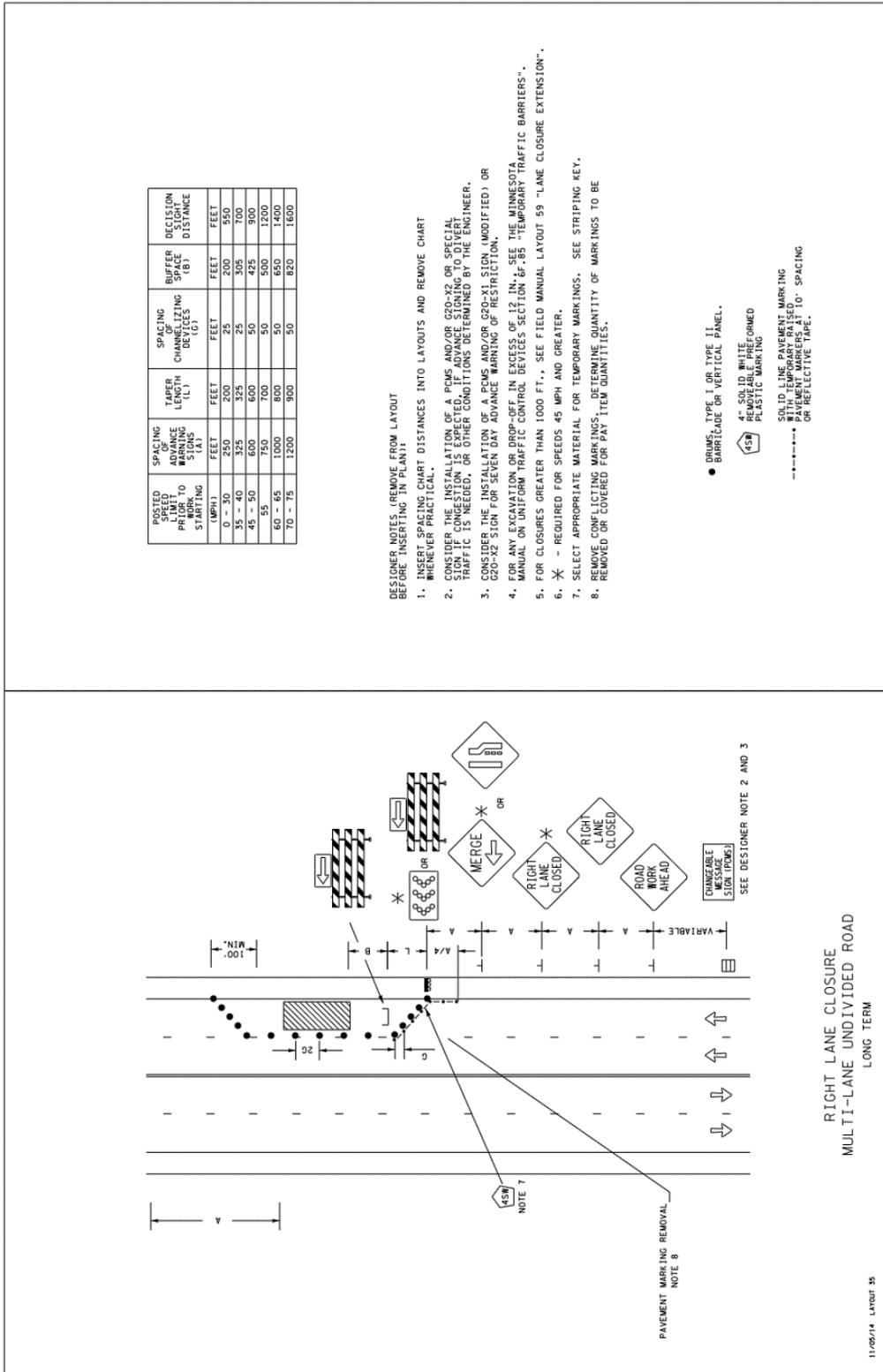


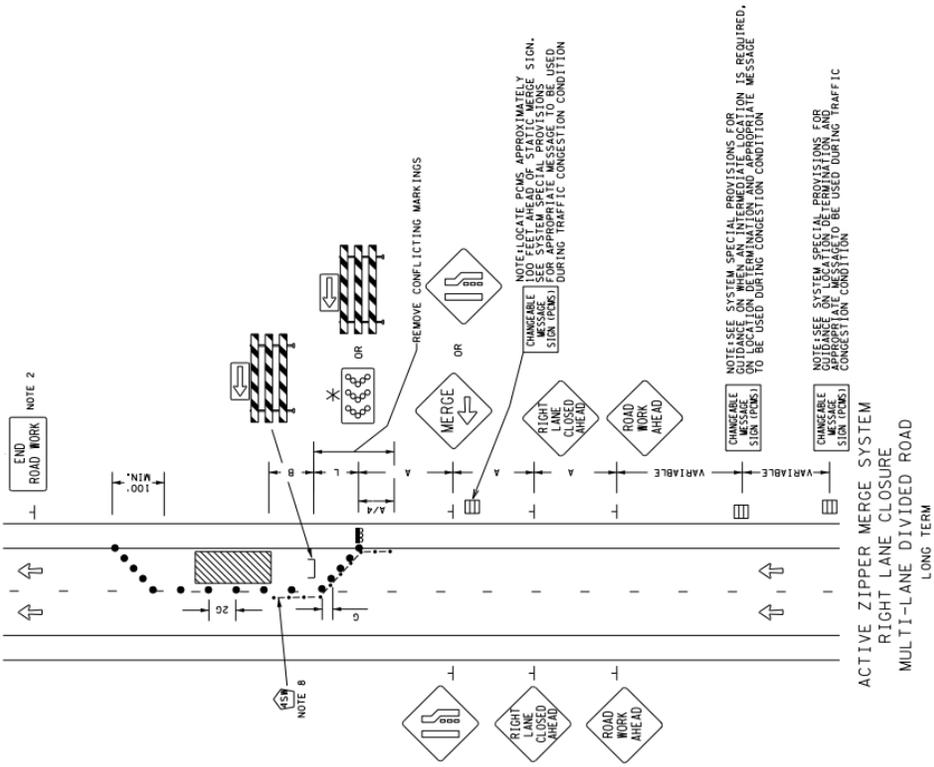
Exhibit 4-3 Sample Template, Dynamic Late Merge, Left Lane Closed

POSTED SPEED LIMIT TO PRELIMINARY WORK STARTING (MPH)	SPACING OF ADVANCE SIGNS (A)	TAPER LENGTH (L)	SPACING CHANNELIZING DEVICES (C)	BUFFER SPACE (B)	DECISION SIGHT DISTANCE
0 - 30	FEET	FEET	FEET	FEET	FEET
35 - 40	250	200	25	200	950
45 - 50	325	325	25	305	700
55 - 60	400	400	25	400	550
60 - 65	750	700	50	650	1200
65 - 70	1000	800	50	850	1400
70 - 75	1200	900	50	1000	1600

NOTE 1: NOT ALL INFORMATION IN THIS BOX MAY APPLY TO THIS DETAIL.

DESIGNER NOTES (REMOVE FROM LAYOUT BEFORE INSERTING IN PLAN):

1. INSERT SPACING CHART DISTANCES INTO LAYOUTS AND REMOVE CHART WHENEVER PRACTICAL.
2. DETERMINE IF "END ROAD WORK" SIGNS ARE NEEDED.
3. CONSIDER THE INSTALLATION OF POMS AND/OR G20-42 OR SPECIAL TRAFFIC IS NEEDED OR OTHER CONDITIONS DETERMINED BY THE ENGINEER.
4. CONSIDER THE INSTALLATION OF A POMS AND/OR G20-41 SIGN (MODIFIED) OR G20-42 SIGN FOR SEVEN DAY ADVANCE WARNING OF RESTRICTION.
5. FOR ANY EXCAVATION OR DROP-OFF IN EXCESS OF 12 IN., SEE THE MINNESOTA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES SECTION 8F-85, "TEMPORARY TRAFFIC BARRIERS."
6. FOR CLOSURES GREATER THAN 1000 FT., SEE FIELD MANUAL, LANE CLOSURE EXTENSION.
7. * - REQUIRED FOR SPEEDS GREATER THAN 45 MPH.
8. SELECT APPROPRIATE MATERIAL. - SEE STRIPING KEY.
9. IF 48"X48" ADVANCE WARNING SIGNS WILL NOT FIT ON THE LEFT SIDE BECAUSE OF A BARRIERE OR OTHER OBSTACLE, REDUCE THE LEFT SIDE SIGN SIZES OR ELIMINATE THE LEFT SIDE SIGNING. USE AN ADDITIONAL "RIGHT LANE CLOSED AHEAD" SIGN ON THE RIGHT.
10. AN ADDITIONAL SET OF "RIGHT LANE CLOSED AHEAD" SIGNS MAY BE ADDED ON HIGH VOLUME ROADS.
11. REMOVE CONFLICTING MARKINGS. DETERMINE MATERIAL, TYPE AND QUANTITY OF MARKINGS TO BE REMOVED OR COVERED FOR PAI ITEM QUANTITIES.



ACTIVE ZIPPER MERGE SYSTEM
RIGHT LANE CLOSURE
MULTI-LANE DIVIDED ROAD
LONG TERM

11/10/14 LAR02 64

5. WORK ZONE PLAN SETS

Typical layout detail sheets for traffic control plans can be found on the OTST website: www.dot.state.mn.us/trafficeng/

Traffic control plans are generally a portion of a larger construction project. They will be included in the overall project plans and will have sheet numbers that begin with “TC” (i.e., TC1, TC2, etc.).

Some of the sheets found on a TTC plan include, but are not limited to:

- ✓ Title Sheet
 - For Overall Plan
 - For TC Section
- ✓ Pay Item Tabulation Sheet
- ✓ Traffic Control Tabulation Sheet
- ✓ Special Signs
- ✓ Narrative
- ✓ Advanced Signing
- ✓ Detours
- ✓ Traffic Control Staging Sheets (Layout Sheets)
- ✓ Typical Sheets

The licensed professional engineer responsible for or under whose supervision the work is performed shall sign the title sheet.

A sample plan set is included in the Appendix on page 7-1. Most of the images shown in this Chapter come from the sample plan set. To see them in larger detail, refer to the Appendix handout. In addition, a few of the images come from other sources to illustrate items that may not be included in the sample plan. The MnDOT Work Zone website includes a small sample plan that can be downloaded from:

www.dot.state.mn.us/trafficeng/workzone/index.html

5.1 TTC Plan Development

5.1.1 General Information

During the roadway plan development, designers must be aware of the need for a Traffic Control Plan. The Plan will contain temporary traffic control devices (See Chapter 3, **TTC Devices**). These devices include barrels, cones, barricades, temporary signing, temporary striping, etc. and are used to direct and assist drivers in safely moving through the construction area.



It is important to note that the Project Manager is responsible for the TMP (see Section 2.7 and 2.8). This TMP will be valuable when developing the traffic control plans.

To develop the Traffic Control Plan, coordination meetings between Design, Construction and the Traffic Engineering Section are recommended throughout the duration of the project. The number and extent of these meetings will depend on the complexity, length, and duration of the project. Construction is a valuable resource since they can provide the time frames necessary for construction activities.

The Designer will likely need to provide construction sheets or general layout sheets (hard copy or electronic copy) to the Traffic Engineering Section for them to use as a base map to draft their traffic control plan.

The Traffic Engineering Section will develop their temporary traffic control plans based on three documents: the Traffic Engineering Manual, most recent date, the Minnesota Manual on Uniform Traffic Control Devices for Streets and Highways, most recent date and the Transportation Management Plan (TMP) for the project (See Section 2.4).

Designers can expect from the Traffic Engineering Section, a plan, a list of construction items and quantities to include into the Estimated Quantities tabulation. Note that the pay item numbers associated with the construction items should only be shown once, in the Estimated Quantities tabulation.

The Traffic Engineering Section should provide tabulation (within their plan) of their construction items for Design to reference and include in the Estimated Quantities tabulation.

The Designer should also add any Traffic Control Standard Plates i.e. 8000, 8337, etc. on to the list of project specific Standard Plates or make a reference to them.

The Traffic Control Plan sheets should also be included in the plan as shown on the Title Sheet's index. Page numbers for the Traffic Control Plan sheets will need to be coordinated after they are determined.

5.1.2 Standard Plates

Standard plates are approved by Department staff and Federal Highway Administration for the various structures essential to highway design and construction. They are for use by manufacturing firms in supplying products of culverts, sewers, erosion controls, signals, lights, guardrails, fences, etc. Also, standard drawings are used by contractors in constructing pavement, curb and gutters, retaining walls, miscellaneous structures, and in installing traffic barriers, fences, signals, lights, etc. The most current Standard Plates can be found at the following website:

<http://standardplates.dot.state.mn.us/StdPlate.aspx>.

5.1.3 MnDOT Plan Assembly Steps

As the designer progresses through the following numbered sequential steps in assembling a complete plan, refer to the appropriate sheets in the sample plans for clarification. The sample plan may be downloaded from the MnDOT OTST website in whole or in parts (e.g. the entire plan is saved in Adobe Reader Format .pdf and portions of the plan are available in Microstation Design File Format .dgn, such that these sheets may be included directing into a new plan).

1. To begin the **MnDOT** process, you'll start with ProjectWise.
2. Obtain the existing construction plans, including any staging.
3. Eliminate levels of detail (buildings, lot lines, etc) on roadway plan sheets.

REASON: So placement of traffic control devices on roadway sheets are not cluttered by underlying details.

4. Organize roadway plan sheets: all mainline roadway comes first with stationing generally increasing from left to right (include roadway through interchanges for depicting mainline TC through the interchange; next are interchange/intersection layouts for indicating TC on cross streets and at ramp terminals).

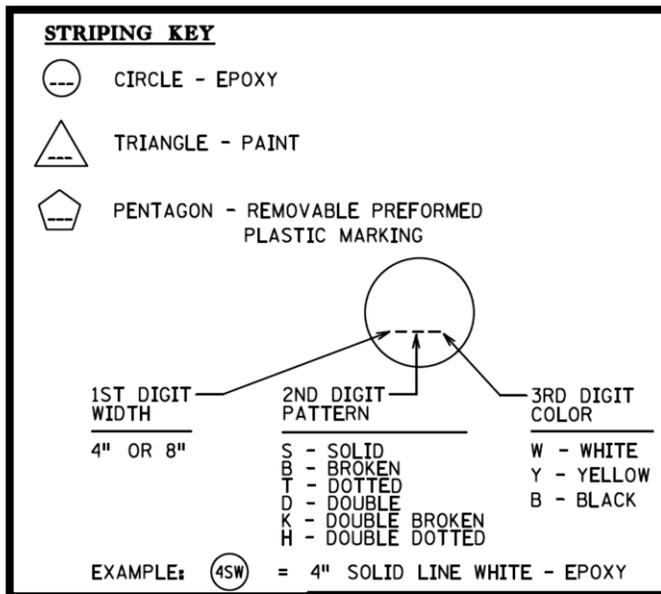
REASON: Consistency in design.

- Place traffic control elements on the roadway plan sheets for each direction of travel. Refer to the discussions in Chapter 3 (**TTC Devices**) and Chapter 4 (**Work Zone Applications**). Also refer to the typical drawings, TEM Chapter 8, the MUTCD Chapter 6 and other sources as noted in Section 2.4). Place signs on plan sheets as the signs would appear to a motorist (placement and spacing of signs are detailed in the MN MUTCD and the TEM, Chapter 6).



NOTE: It is important for the designer to make a field review to confirm the layout and discover issues that are not shown on the plan set.

- Label each type of pavement marking with the following numbering system:

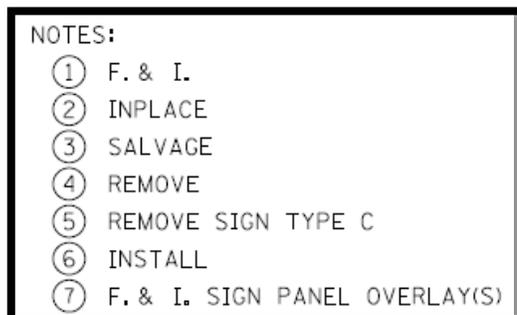


REASON: The uniqueness of each pavement marking material is bid differently by contractors.



NOTE: These keys do change over time. Be sure to ensure that the latest convention is used.

- For a detour plan, a circled note below the sign on the layout sheet indicates the action to take with the sign. Typical notes show include:



F. & I. = Furnish and Install
 INPLACE = Signs to keep in place
 SALVAGE = Signs that should be salvaged
 REMOVE = Signs that should be removed
 INSTALL = Signs that should be installed

8. Prepare list of standard plates applicable to project.
9. Prepare list of estimated quantities using the total quantity from each of the data boxes.
10. Assemble all necessary typical sheets.
11. Complete the title sheet.
12. Assemble ALL of the plan sheets in the proper order.
13. Number the roadway sheets sequentially beginning with the Title Sheet as Sheet TC1.
14. Fill in, and check, all sheet cross referencing throughout the plan.

The following is a simplified checklist for your plan set.

TRAFFIC CONTROL PLAN	-----	CHECKLIST
<input type="checkbox"/>	1.	Stationing shown
<input type="checkbox"/>	2.	Roadways Labeled
<input type="checkbox"/>	3.	North Arrow
<input type="checkbox"/>	4.	Bypasses shown and labeled
<input type="checkbox"/>	5.	Temporary Traffic Control Devices shown
<input type="checkbox"/>	6.	Staged construction shown, if applicable
<input type="checkbox"/>	7.	Legend
<input type="checkbox"/>	8.	Pay Items correspond with those shown in TRANSPORT
<input type="checkbox"/>	9.	Detours shown, if applicable
<input type="checkbox"/>	10.	Tab Letter and Sheet Numbers
<input type="checkbox"/>	11.	Bar Scale
<input type="checkbox"/>	12.	Cross references to other sheets (as applicable)
<input type="checkbox"/>	13.	Traffic Engineer's signature

Item 8 references the AASHTOWare list for Pay Items. The AASHTOWare list can be found at:

<http://bidlet.dot.state.mn.us/ItemSearch.aspx>.

5.1.4 Metro District Traffic Control Plan Checklist

The following pages are the Metro District Traffic Control checklist that can be used during plan set development. The original document can be found at:

<http://www.dot.state.mn.us/trafficeng/workzone/doc/TrafficControlChecklist.pdf>

July 1, 2000

TRAFFIC ENGINEERING MANUAL

CHECKLIST FOR TRAFFIC CONTROL

DATE _____

S.P. _____

LOCATION _____

LETTING DATE _____

DETOUR (Preliminary Design Stage)

	Yes	No	N/A	Spec Prov	Plan Det.
1. Will traffic be detoured? If no, go to #7.	<input type="checkbox"/>				
2. Are various detours adequate in terms of:	<input type="checkbox"/>				
A. Weight - Spring restrictions, height, width?	<input type="checkbox"/>				
B. Wide loads and oversized?	<input type="checkbox"/>				
C. Capacity and adequate traffic control devices?	<input type="checkbox"/>				
D. Railroad crossings and controls?	<input type="checkbox"/>				
E. Geometrics (turning radii, etc.) ?	<input type="checkbox"/>				
F. Bridge restrictions and other structures?	<input type="checkbox"/>				
G. Conflict with other detour in the area?	<input type="checkbox"/>				
H. Other local motorist routes available?	<input type="checkbox"/>				
I. Can the detour be carried over winter (snow removal) ?	<input type="checkbox"/>				
3. If the detour is to be established on other than trunk highways, has the preliminary contact been made with:					
A. County, City, or Townships?	<input type="checkbox"/>				
B. Who will stripe the detour?					
C. Does the signing require upgrading?					
D. Who will be responsible for routine maintenance l(i.e. patching)?					
4. Will all fronting businesses have acceptable ingress and egress and will other municipalities be served?	<input type="checkbox"/>				
A. Are TOD'S necessary for businesses?	<input type="checkbox"/>				

ACTION TAKEN: _____

HANDOUT

HANDOUT

HANDOUT

HANDOUT

July 1, 2000

TRAFFIC ENGINEERING MANUAL

	Yes	No	N/A	Spec Prov	Plan Det.
5. Should the following be contacted?	<input type="checkbox"/>				
A. School Bus	<input type="checkbox"/>				
B. Public Transit	<input type="checkbox"/>				
C. Police	<input type="checkbox"/>				
D. Fire	<input type="checkbox"/>				
E. Ambulance	<input type="checkbox"/>				
F. Postal Route	<input type="checkbox"/>				

6. Is a public information meeting required? _____

TRAFFIC CARRIED THROUGH THE PROJECT

7. Will capacity be restricted during the peak hours (Lane Closure)?	<input type="checkbox"/>				
A. Will alternate routes handle the diverted traffic?	<input type="checkbox"/>				
B. Have local governments been contacted?	<input type="checkbox"/>				
C. Number of lanes or reversible lanes needed?	_____				
8. Consider staging (i.e. lengths of permitted construction)	<input type="checkbox"/>				
A. Include in plans or let the contractor plan?	<input type="checkbox"/>				
B. Can contractor stage work differently than planned?	<input type="checkbox"/>				
9. Bypasses or temporary widening needed?	<input type="checkbox"/>				
A. What standards are used?	_____				
B. What locations?	_____				
C. Design speed?	_____				

10. Minimum width? _____

11. Will oversized load permits be affected?	<input type="checkbox"/>				
If yes, will it be signed?	<input type="checkbox"/>				
12. Will the project be in place over the winter months? If yes,	<input type="checkbox"/>				
A. Are traffic control devices adequate for winter?	<input type="checkbox"/>				
B. Are there provisions for the TCD's to be maintained over winter suspension?	<input type="checkbox"/>				

 If yes, who will maintain them? _____

HANDOUT

HANDOUT

HANDOUT

HANDOUT

July 1, 2000

TRAFFIC ENGINEERING MANUAL

GENERAL CHECKLIST (Detailed Design Stage)

Yes	No	N/A	Spec Prov	Plan Det.
-----	----	-----	-----------	-----------

- 13. Signing (State or Contractor)
 - A. Who maintains or inspects? _____
 - B. How often _____
 - C. TCP provided by State or Contractor? _____
 - D. Are any special signs needed Yes No N/A Spec Prov Plan Det
 If yes, where? _____
 - E. Is cross road signing needed? Yes No N/A Spec Prov Plan Det
 If yes, by whom (State or Contractor) _____
- 14. Are temporary signals needed? Yes No N/A Spec Prov Plan Det
 - A. If yes, what type? _____
 Manual _____
 Fixed time _____
 Actuated _____
- 15. Can inplace signals be shutdown? Yes No N/A Spec Prov Plan Det
 - If yes, during what hours? _____
 - Does a local municipality need to be contacted? Yes No N/A Spec Prov Plan Det
- 16. Is temporary street lighting needed? Yes No N/A Spec Prov Plan Det
 - If yes,
 - A. Who will install? (State or Contractor) _____
 - If State, is request letter needed? Yes No N/A Spec Prov Plan Det
 - B. Are breakaway or non-breakaway poles needed? Yes No N/A Spec Prov Plan Det
 - C. How will power be furnished? _____
 - D. Is an agreement needed with the power company? Yes No N/A Spec Prov Plan Det
 - E. Does inplace lighting need to be kept operational? Yes No N/A Spec Prov Plan Det
- 17. Is temporary barrier needed? Yes No N/A Spec Prov Plan Det
 - If yes,
 - A. Who will furnish, install, and maintain? _____
 - B. Barrier justification
 - High ADT _____
 - Excessive drop-off _____
 - C. Will it be incorporated into existing permanent barrier? Yes No N/A Spec Prov Plan Det
 - D. How will the barrier be delineated?
 - Warning lights (type) _____
 - Delineators (type) _____
 - E. How will the barrier ends be protected?
 - Taper buried out to the clear zone _____
 - GREAT attenuator _____
 - Barrel attenuator _____
 - F. Is a spare attenuator needed? Yes No N/A Spec Prov Plan Det

8.1-5

HANDOUT

HANDOUT

HANDOUT

HANDOUT

July 1, 2000

TRAFFIC ENGINEERING MANUAL

	Yes	No	N/A	Spec Prov	Plan Det.
18. Are equipment traffic controls going to be used?	<input type="checkbox"/>				
If yes, has the proper permission been obtained?	<input type="checkbox"/>				
19. Is the Contractor's equipment permitted to use crossovers?	<input type="checkbox"/>				
If yes, what type?					
A. Which ones?	_____				

B. Do the Contractor's vehicles need to be marked?	<input type="checkbox"/>				
20. Can the Contractor store equipment, material, and waste material on the construction site?	<input type="checkbox"/>				
If yes, must they follow AASHTO guidelines?	<input type="checkbox"/>				
If no, where?	_____				
21. Can the Contractor's workers park their vehicles on the construction site?	<input type="checkbox"/>				
If yes, where?	_____				
If no, where?	_____				
22. Are temporary pavement markings required?	<input type="checkbox"/>				
A. Who will furnish, install, and maintain?	_____				
B. What type?					
Paint _____					
Tape _____					
TRPM _____					
23. Do inplace stripes need to be replaced?	<input type="checkbox"/>				
A. If yes, where?					
Centerline _____					
Edgeline _____					
B. How will they be removed?	_____				
C. Who will accomplish this?	_____				
24. Is temporary post-mounted delineation needed?	<input type="checkbox"/>				
If yes, who will furnish, install, and maintain?	_____				
25. Will drop-offs and excavations exist?	<input type="checkbox"/>				
If yes,					
A. Will the drop-off exceed 50 mm (2 inches)?	<input type="checkbox"/>	<input type="checkbox"/>			
B. Will the drop-off exceed 100 mm (4 inches)?	<input type="checkbox"/>	<input type="checkbox"/>			
C. Will the drop-off exceed 150 mm (6 inches)?	<input type="checkbox"/>	<input type="checkbox"/>			

ACTION TAKEN

8.1-6

HANDOUT

HANDOUT

HANDOUT

HANDOUT

July 1, 2000

TRAFFIC ENGINEERING MANUAL

	Yes	No	N/A	Spec Prov	Plan Det.
26. Do in place signs have to be removed or relocated? If yes, by whom? _____	<input type="checkbox"/>				
27. Are flagging operations required? If yes, A. What type of operation is being considered? Radio communication _____ Pilot car _____ Flag carrying _____ B. Will the flagging operation be continued during daylight hours? If yes, is supplemental lighting needed?	<input type="checkbox"/>				
28. Is a construction or work zone speed limit needed? If yes, will they use advisories or regulatories? _____	<input type="checkbox"/>				
29. Will the project require any special devices Changeable Message Signs, how many? _____	<input type="checkbox"/>				
30. Will extra protection be required for other road users? pedestrians _____ bicyclists _____ snowmobiles _____ trail users _____ schools _____ parks _____	<input type="checkbox"/>				
31. Do utility operations affect traffic control?	<input type="checkbox"/>				
32. Will the project require dust control?	<input type="checkbox"/>				
33. Are there any restrictions for traffic control which can not be in place concurrently? (i.e. fire, police, and traffic routing) If yes, by where? _____	<input type="checkbox"/>				

ACTION TAKEN

HANDOUT

HANDOUT

HANDOUT

HANDOUT

July 1, 2000

TRAFFIC ENGINEERING MANUAL

	Yes	No	N/A	Spec Prov	Plan Det.
34. Will the source of material on or off the project interfere with traffic or a certain type of traffic?	<input type="checkbox"/>				
35. Does the Contractor have to give advance notice of traffic control changes?	<input type="checkbox"/>				
36. Is the starting or completion date controlled by a school, special events, or holidays? If yes, (event and date)	<input type="checkbox"/>				
37. Is a working day other than as specified, such as an 18 hour day? What is the work week?	<input type="checkbox"/>				
38. Is there as conflict between working hours and local ordinances due to noise, air, or water restrictions?	<input type="checkbox"/>				
39. Is there an incentive clause needed in the contract?	<input type="checkbox"/>				
40. Will working days be charged between November 15 and April 15 or suspended by a work order? (See 1806)	<input type="checkbox"/>				
41. Should there be <u>other than ordinary</u> liquidated damages such as additional penalties? (See 1807)	<input type="checkbox"/>				
42. Is there a possibility that another contract will delay the work of this project?	<input type="checkbox"/>				

ACTION TAKEN

HANDOUT

HANDOUT

HANDOUT

HANDOUT

5.2 Process A vs Process B

Prior to beginning the plan set, the decision of the letting process type needs to be determined (Process A or Process B). Process A or B is based on a set of rules, such as how many sheets. The Project Manager makes the determination. Information (internal to MnDOT) can be found at,

<http://ihub/projectdelivery/files/intro/append/Project-Delivery-Process.pdf>

The process A projects are small projects, which are minor in scope. These projects contain no more than 50 plan sheets and comprise less than 20 pay items. Process A MAY be 8 ½ x 11 inch sheets. If process A, coordinate with the main plan designers on what they are doing.

The typical process B project consists of plans that need Central Office approval. Typical process B projects constitute approximately 75% - 80% of the current Pre-Letting workload. The typical process B project may require special provisions (such as lighting, signals, TMC, and signing) prepared by the District specialty units. The typical process B project will require utility coordination, and possible agreements.

5.3 Common TTC Plan Set Issues

The following is a list of some of the common issues with TTC plan sets from MnDOT reviewers. These are not in any order of importance.

- ✓ The designer uses PLACE instead of INSTALL. Whenever INSTALL is used by itself it implies that the material is either salvaged or supplied. It is preferred to use PLACE, FURNISH AND INSTALL (F & I), or CONSTRUCT.
 - INSTALL by itself implies that material is either salvaged or supplied. If this IS the case, it is OK to leave it (usually, this is not the case). When it is not INSTALL, and as previously noted, use PLACE, F & I, or CONSTRUCT.
- ✓ When using reference points, they need to be written in the standard format of XXX+XX.XXX.
- ✓ Ensure to label the mainline and cross streets as well as bridges and what the bridges cross over/under.
 - For Bridge labeling, use the Bridge Number as shown in the rest of the plan. Also label what it is over/under such as roadway, railroad, river name, etc.
- ✓ Check that the labelling at the bottom of the sheet matches the rest of the plan (e.g. SP XXXX-XX (TH XX)).
- ✓ The Begin/End starting points don't have to be on the traffic control sheets. If they are, then both are needed and they must match the rest of the plan. Since they are not necessary, it is suggested to not show them.
- ✓ Make sure the legend matches what is shown in the plan (e.g. the legend shows solid circle and plan shows darkened circle for drums).
- ✓ Check that the sheet numbers in the signature block are correct and that they include their printed name.
- ✓ Ensure that pay items agree with what's shown on the plan and that all items are accounted for.
- ✓ It is helpful to estimate the sign quantities as lump sum.

- ✓ Often, impact attenuators are not paid for correctly and are shown incorrectly on the plan (e.g. barrels vs systems).
- ✓ Be sure to show the test level on the attenuators and whether they are permanent or temporary.
- ✓ Labelling impact attenuators for TL and Temporary or permanent installation. Pay for barrels as each and the systems as assembly. See the Design Scene Chapter 14.
- ✓ Take into account guardrail (end treatments and design specials) if traffic will be re-routed to the other roadway (mainly applies to split roadways).
- ✓ Raised pavement markers need to state the color and if they are one way or two way.
- ✓ Often there is confusion on the APR items, e.g., what does/doesn't go in a plan and how it's paid for. Review the resources available in this manual and the MnDOT Work Zone website.
- ✓ Make sure all signs are accounted for in the tab/summary, especially the special signs.
- ✓ Manual details are not necessary in the plan as they are in the manuals. If they are, make sure the notes and references all make sense.

5.3.1 Design Scene

Design Scene is a guidance document for designers, technicians and engineers to help improve the quality and reduce cost and time of plan preparation. The Design Scene website is,

<http://www.dot.state.mn.us/pre-letting/scene/>.

An example of the Design Scene newsletter, and some select Design Scene topics are included as a handout in the Appendix (see Section 7.2).



5.4.2 Project Number(s)

In the block you will find the state project number(s) that are applicable to the project. In addition, the following information is provided (by SP number):

- ✓ Gross Length (Feet and Miles)
- ✓ Bridges – Length (Feet and Miles)
- ✓ Exceptions Length (Feet and Miles)
- ✓ Net Length (Feet and Miles)
- ✓ Starting Reference Point (Station)
- ✓ Ending Reference Point (Station)

STATE PROJ. NO. 6910-96 (T.H. 23)
GROSS LENGTH.....17429 FEET 3.301 MILES
BRIDGES-LENGTH.....106 FEET 0.020 MILES
EXCEPTIONS-LENGTH..... FEET..... MILES
NET LENGTH.....17429 FEET 3.301 MILES
REF. POINT 340+00.069 TO REF. POINT 343+00.364.

STATE PROJ. NO. 8821-202 (TH 23)	STATE PROJ. NO. 8821-202 (TH 65)	STATE PROJ. NO. 8821-202 (TH 210)
GROSS LENGTH.....107147 FEET 20.293 MILES	GROSS LENGTH.....55229 FEET 10.460 MILES	GROSS LENGTH.....117876 FEET 22.325 MILES
BRIDGES-LENGTH.....308 FEET 0.058 MILES	BRIDGES-LENGTH.....N/A FEET N/A MILES	BRIDGES-LENGTH.....471 FEET 0.089 MILES
EXCEPTIONS-LENGTH.....N/A FEET N/A MILES	EXCEPTIONS-LENGTH.....N/A FEET N/A MILES	EXCEPTIONS-LENGTH.....N/A FEET N/A MILES
NET LENGTH.....107147 FEET 20.293 MILES	NET LENGTH.....55229 FEET 10.460 MILES	NET LENGTH.....117876 FEET 22.325 MILES
REF POINT 315+00.500 TO REF POINT 335+00.793	REF POINT 96+00.940 TO REF POINT 107+00.400	REF POINT 196+00.233 TO REF POINT 218+00.558

5.4.3 Governing Specifications and Index of Sheets

This defines the governing specifications for the project, the project funding and the index of the sheets contained within the plan set. Generally it is located in the upper right hand corner of the title sheet, under the Federal Project number or statement “STATE FUNDS”.

INDEX	
SHEET NO.	DESCRIPTION
1	TITLE SHEET
2 - 6	ESTIMATED QUANTITIES
7 - 8	SOILS AND CONSTRUCTION NOTES, SPECIAL DITCH GRADES, & STANDARD PLATES
9 - 26	CONSTRUCTION CHARTS
27 - 36	PUBLIC UTILITIES
37 - 43	TYPICAL SECTIONS
44 - 89	CONSTRUCTION DETAILS
90 - 117	STANDARD PLAN SHEETS
118	ALIGNMENT TABULATION
119	SUPERELEVATION PLANS
120 - 143	ALIGNMENT, TOPOGRAPHY, R /W & REMOVALS
144 - 167	PLANNED CONSTRUCTION
168 - 191	DRAINAGE & EROSION CONTROL
192 - 206	STORM SEWER PROFILES
207 - 214	PROFILES
215 - 217	SWPPP
T1 - T99	TRAFFIC CONTROL
T100 - T139	PAVEMENT MARKING & SIGNING
SS1 - SS17	SIGNALS
C1 - C13	CITY OF DULUTH - UTILITY PLAN
X1 - X9	PIPE CULVERT CROSS SECTIONS
X10 - X33	CROSS SECTIONS

Be sure to use the appropriate governing specification year for your project. The sample here is from an older plan set.

5.4.4 Plan Preparation Certification Note

This identifies:

- ✓ Who the plan set was developed by (or under the direct supervision of)
- ✓ That individual's state registration information.

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINT NAME: _____ LICENSE _____

DATE: _____ SIGNATURE: *[Handwritten Signature]* _____

DESIGN SQUAD: _____

5.4.5 Project Numbers and Sheet Numbers

The project numbers and sheet numbers are shown in the lower right hand corner of the title sheet and on all other sheets.

A SP in the project number stands for State Project. A SP is necessary for any project on a trunk highway signal. A SAP is a State Aid Project number indicating that the local agency is using State Aid funds to finance their share of the project. If the project has federal funding the SAP becomes a SP. All state aid numbers should be listed on all sheets to which they apply.

The general format for a SP is "CCNN-A". CC is the county number in alphabetical order (i.e., Anoka County is 02). NN is the control section number within the county unique to the roadway in the County. A is the number of the project on that control section (i.e., -269 means that there have been 268 other projects on this section of roadway prior to this project).

The general format for an SAP is CCC-NNN-A. CCC is a 3-digit city number, a two digit number is a county number. NNN is a number related to the roadway and project type. A is the number of the project in that city or county of that type.

STATE PROJ. NO. 0208-146 (T.H. 65 = 5) SHEET NO. 1 OF 106 SHEETS

5.4.6 Signature Block

The Designer should consult with the MnDOT project manager to ensure that the appropriate signature block is used.

I HEREBY CERTIFY THAT SHEETS 1-25 WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINT NAME: _____ LICENSE # _____

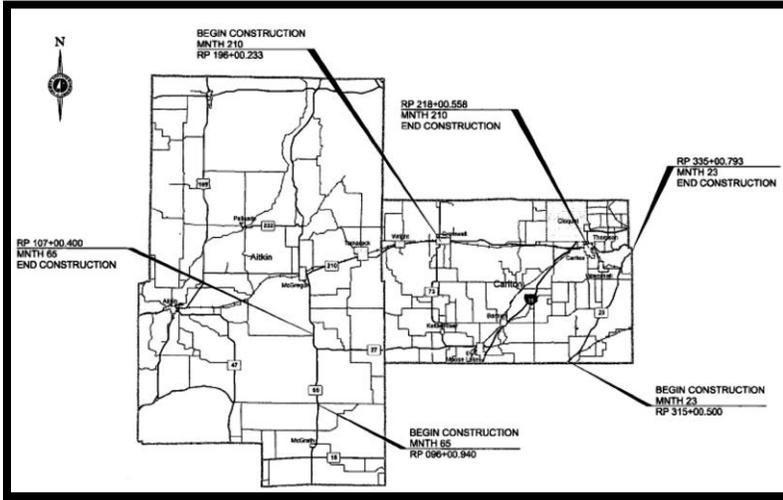
DATE: _____ SIGNATURE: _____

DESIGN SQUAD _____

5.4.7 Index Map

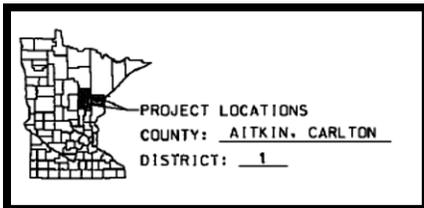
The index map is used to identify the location of the project(s). Provide leader lines from the beginning and end of the project limits to the appropriate points on the map. This is generally located near the center of the title sheet.

If appropriate, identify all State Aid project numbers applicable to the project. Also, label all traffic signal systems.



5.4.8 Project Location

The information included in this block is the generalized location (county and city). This is generally located in the lower right part of the title sheet, left of the signature block and above the project number block.



5.4.9 Plan Revisions Block

The block is included so that future plan revisions can be documented. This is generally located in lower portion of the title sheet. Pencil in the charge identifier number. MnDOT plan processing will edit this as necessary.

PLAN REVISIONS		
DATE	SHEET NO.	APPROVED BY

5.5 Traffic Control Plan Title Sheet

As noted earlier, the traffic control (TC) sheets are part of a larger construction project. The first sheet of the plan is the overall plan sheet (see the previous section) and the image below shows an example of the first sheet for the portion on temporary traffic control. The most current version of this plan set is available on the MnDOT Work Zone website, www.dot.state.mn.us/trafficeng/workzone/index.html.

NOTES & GUIDELINES	TRAFFIC CONTROL DEVICES & SYMBOLS LEGEND	INDEX																				
<p>GENERAL INFORMATION:</p> <ol style="list-style-type: none"> 1. THE CONTRACTOR SHALL FURNISH, INSTALL AND MAINTAIN THE DEVICES IN THIS TRAFFIC CONTROL PLAN UNLESS OTHERWISE NOTED. 2. FIELD CONDITIONS MAY REQUIRE MODIFICATIONS OF THIS LAYOUT AS DEEMED NECESSARY BY THE ENGINEER. 3. ALL DISTANCES ARE APPROXIMATE. 4. THE CONTRACTOR IS RESPONSIBLE FOR PROTECTING ANY WORK AREAS NEAR TRAFFIC IN ACCORDANCE WITH THE MN MUTCD. 5. AN ANNUAL FALL REVIEW OF ALL TRAFFIC CONTROLS WILL BE MADE TO PREPARE FOR WINTER MAINTENANCE OF THE PROJECT. THIS MAY INCLUDE ADJUSTMENTS OR EXCHANGE OF ONE TRAFFIC CONTROL DEVICE FOR ANOTHER. READJUSTMENTS MAY AGAIN BE REQUIRED IN THE SPRING. 6. IF THE CONTRACTOR DESIRES TO PERFORM THE CONSTRUCTION WORK IN A SEQUENCE OTHER THAN SHOWN IN THIS TRAFFIC CONTROL PLAN THE CONTRACTOR SHALL PROVIDE COMPLETE REVISED TRAFFIC CONTROL PLANS TO BE APPROVED BY THE ENGINEER. <p>SIGNING:</p> <ol style="list-style-type: none"> 1. ALL TRAFFIC CONTROL DEVICES, INCLUDING OVERHEAD SIGNS, ON ROADS OPEN TO TRAFFIC THAT ARE NOT CONSISTENT WITH TRAFFIC OPERATION SHALL BE COVERED, REMOVED OR REVISED AS DIRECTED BY THE ENGINEER. 2. WHEN SIGNS ARE PLACED, THEY SHALL BE MOUNTED ON POSTS DRIVEN INTO THE GROUND AT THE PROPER HEIGHT AND LATERAL OFFSET AS SHOWN IN THE "TYPICAL TEMPORARY SIGN FRAMING & INSTALLATION DETAILS" IN THE PLAN. IF THIS IS NOT POSSIBLE, THEY WILL BE MOUNTED ON PORTABLE SUPPORTS AS APPROVED BY THE ENGINEER. WHEN THE SIGNS ARE REMOVED THE SIGN POSTS SHALL ALSO BE REMOVED AS SOON AS POSSIBLE. 3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY EXTRA SIGNING NEEDED TO FACILITATE TRAFFIC SWITCHES OR FOR TRANSFERING TRAFFIC FROM ONE STAGE TO ANOTHER. 4. ALL ORANGE WARNING AND ORANGE GUIDE SIGNS SHALL BE FABRICATED WITH SIGN SHEETING MATERIAL AS LISTED ON THE MNDOT APPROVED PRODUCT LIST FOR SHEETING FOR RIGID TEMPORARY WORK ZONE SIGNS, DELINEATORS, AND MARKERS. 5. BARRICADES SHALL BE FABRICATED WITH SIGN SHEETING MATERIAL AS LISTED ON THE MNDOT APPROVED PRODUCT LIST FOR "BARRICADE SHEETING". 6. LONGITUDINAL DROPOFFS SHALL BE SIGNED AS SHOWN IN THE "TEMPORARY TRAFFIC CONTROL ZONE LAYOUTS" FIELD MANUAL UNLESS OTHERWISE SPECIFIED IN THESE PLANS. 7. THE CONTRACTOR SHALL COORDINATE THE PLACEMENT OF THE FINAL SIGNS TO ASSURE THAT THE FINAL SIGNS ARE PLACED AS NEEDED, OR PROVIDE TEMPORARY SIGNING AT THEIR EXPENSE UNTIL THE FINAL SIGNING IS PLACED. <p>PAVEMENT MARKING:</p> <ol style="list-style-type: none"> 1. THE ENGINEER'S INVOLVEMENT IN THE APPLICATION OF THE MATERIAL SHALL BE LIMITED TO FIELD CONSULTATION AND INSPECTION. THE CONTRACTOR WILL PLACE NECESSARY "SPOTTING" AT APPROPRIATE POINTS TO PROVIDE HORIZONTAL CONTROL FOR STRIPING AND TO DETERMINE NECESSARY STARTING AND CUTOFF POINTS, LONGITUDINAL JOINTS, PAVEMENT EDGES AND EXISTING MARKINGS MAY SERVE AS HORIZONTAL CONTROL WHEN SO DIRECTED. 2. OBLITERATE ANY CONFLICTING PAVEMENT MARKINGS AS DIRECTED BY THE ENGINEER. 3. TRANSITIONS AND TAPERS FOR TEMPORARY STRIPING SHALL BE WET REFLECTIVE OR SUPPLEMENTED WITH TEMPORARY RAISED PAVEMENT MARKERS AND SHOULD BE A MINIMUM OF 6" IN WIDTH. 4. INTERIM STRIPING SHALL CONSIST OF ALL CENTERLINE, NO PASSING ZONES, PAINTED ISLANDS, AND LANE LINES (INCLUDING TURN LANE LINES). 5. THIN'S (TEMPORARY RAISED PAVEMENT MARKERS) SHOULD BE USED TO SUPPLEMENT THE LONG TERM (MORE THAN 3 DAYS) EDGELINES ON ALL TRANSITION AREAS. 6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LOCATION AND PLACEMENT OF TEMPORARY AND FINAL STRIPING. MNDOT TRAFFIC PERSONNEL WILL ASSIST IN THE SPOTTING OF TRANSITION AREAS, GORES AND TAPERS. <p>BARRIER & DELINEATION:</p> <ol style="list-style-type: none"> 1. THE CONTRACTOR SHALL FURNISH, INSTALL AND MAINTAIN TOP MOUNTED BARRIER DELINEATORS WITH A MINIMUM OF 24 SQ. IN. OF REFLECTIVE SURFACE AREA AND BE PLACED AT 25' SPACES ON TOP OF THE BARRIER WHEN THE BARRIER IS WITHIN 10' OF TRAFFIC UNLESS OTHERWISE NOTED OR AS DIRECTED BY THE ENGINEER. IF THE TRAFFIC ENGINEER REQUIRES SIDE MOUNTED BARRIER DELINEATORS, THEY WILL HAVE A MINIMUM OF 12 SQ. IN. OF REFLECTIVE SURFACE AREA AND BE PLACED AT 12.5' SPACES. IF A SMALLER APPROVED BARRIER DELINEATOR IS USED IT SHALL BE AT ONE HALF THE SPACING AND ONE HALF THE BID PRICE. <p>CONSTRUCTION INFORMATION SIGNING:</p> <ol style="list-style-type: none"> 1. THE CONTRACTOR SHALL USE CONSTRUCTION INFORMATION SIGNING AS SHOWN IN THE PLAN AND WHICH ARE TO BE USED AS FOLLOWS: 2. G20-X1 CLOSURE NOTICE SIGNS PAIRED WITH G20-X3 WORK ENDS SIGNS TO DISPLAY THE CORRECT START DATE AND AN ESTIMATED FINISH DATE AS APPROVED BY THE PROJECT ENGINEER. 3. G20-X2 WORK ZONE ADVANCE NOTICE SIGNS WITH THE CORRECT STARTING DATE DISPLAYED BEFORE WORK BEGINS. ONCE WORK BEGINS, THE START DATE LEGEND SHALL BE COVERED BY THE SUGGESTED PLAQUE CONTAINED IN THIS PLAN. IF NO ALTERNATE MESSAGE IS SUGGESTED OR IF DIRECTED BY THE PROJECT ENGINEER, THE CORRECT ESTIMATED FINISH DATE MONTH OF SEASON SHALL BE DISPLAYED. 4. CONSTRUCTION INFORMATION SIGNING NOT VISIBLE TO THE MOTORING PUBLIC ONCE WORK BEGINS WILL BE COVERED BY THE CONTRACTOR TO A SITE IN ADVANCE OF THE WORK ZONE OR CLOSURE AS DIRECTED BY THE PLAN OR PROJECT ENGINEER. 	<p>TRAFFIC CONTROL DEVICES & SYMBOLS LEGEND</p> <p>SYMBOL DESCRIPTION</p> <p> AREA CLOSED TO TRAFFIC / WORK AREA</p> <p> TRAFFIC CONTROL SIGN</p> <p> TYPE C BARRICADE = </p> <p> DRUM-LIKE CHANNELIZER (TYPE B) = </p> <p> TYPE A FLASHING WARNING LIGHT</p> <p> FLASHING ARROW BOARD TYPE C = (4' X 8' UNLESS OTHERWISE NOTED).</p> <p> SOLID LINE PAVEMENT MARKING WITH TEMPORARY RAISED PAVEMENT MARKERS AT 10' SPACES</p> <p> CONCRETE BARRIER WITH DELINEATORS AT 30' SPACES</p> <p> IMPACT ATTENUATOR</p> <p> PAVEMENT MESSAGE (LEFT ARROW SHOWN)</p> <p>STRIPING KEY</p> <p> CIRCLE - EPOXY</p> <p> TRIANGLE - PAINT</p> <p> PENTAGON - REMOVABLE PREFORMED PLASTIC MARKING</p> <p>EXAMPLE: = 4" SOLID LINE WHITE - EPOXY</p> <p>1ST DIGIT WIDTH: 4" OR 8"</p> <p>2ND DIGIT PATTERN: S - SOLID, B - BROKEN, D - DOTTED, H - DOUBLE, H - DOUBLE DOTTED</p> <p>3RD DIGIT COLOR: W - WHITE, Y - YELLOW, B - BLACK</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">TRAFFIC CONTROL SHEET NO.</th> <th style="text-align: center;">DESCRIPTIONS</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>TITLE SHEET</td> </tr> <tr> <td style="text-align: center;">2</td> <td>PAY ITEM TABULATION SHEET</td> </tr> <tr> <td style="text-align: center;">3</td> <td>TRAFFIC CONTROL TABULATION SHEET</td> </tr> <tr> <td style="text-align: center;">4</td> <td>SPECIAL SIGN DETAILS</td> </tr> <tr> <td style="text-align: center;">5</td> <td>ADVANCED SIGNING</td> </tr> <tr> <td style="text-align: center;">6</td> <td>DETOURS</td> </tr> <tr> <td style="text-align: center;">7</td> <td>ALTERNATE PEDESTRIAN ROUTE</td> </tr> <tr> <td style="text-align: center;">8</td> <td>STAGING</td> </tr> <tr> <td style="text-align: center;">9</td> <td>TYPICALS</td> </tr> </tbody> </table>	TRAFFIC CONTROL SHEET NO.	DESCRIPTIONS	1	TITLE SHEET	2	PAY ITEM TABULATION SHEET	3	TRAFFIC CONTROL TABULATION SHEET	4	SPECIAL SIGN DETAILS	5	ADVANCED SIGNING	6	DETOURS	7	ALTERNATE PEDESTRIAN ROUTE	8	STAGING	9	TYPICALS
TRAFFIC CONTROL SHEET NO.	DESCRIPTIONS																					
1	TITLE SHEET																					
2	PAY ITEM TABULATION SHEET																					
3	TRAFFIC CONTROL TABULATION SHEET																					
4	SPECIAL SIGN DETAILS																					
5	ADVANCED SIGNING																					
6	DETOURS																					
7	ALTERNATE PEDESTRIAN ROUTE																					
8	STAGING																					
9	TYPICALS																					
<p>I HEREBY CERTIFY THAT SHEETS THROUGH OF THIS PLAN WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA</p> <p>DATE: 5/31/2016 L.E. NO. _____ DESIGNER: TECH. NAME HERE</p> <p>TITLE: TRAFFIC CONTROL TITLE SHEET</p> <p>STATE PROJ. NO. 0000-000 (TH 000) SHEET NO. _____ OF _____ SHEETS</p>																						

5.5.1 Notes and Guidelines

An important element for the traffic control plan are the notes and guidelines. Methods and materials are constantly changing regarding traffic control; therefore these notes are an important element of the plan. Be sure to visit the OTST website for the most current sample plan set with the narrative references.

The following sections illustrate the notes on:

- ✓ General Information
- ✓ Signing Notes
- ✓ Pavement Marking Notes
- ✓ Barrier and Delineation Notes
- ✓ Construction Information Signing Notes

General Information

GENERAL INFORMATION:

1. THE CONTRACTOR SHALL FURNISH, INSTALL AND MAINTAIN THE DEVICES IN THIS TRAFFIC CONTROL PLAN UNLESS OTHERWISE NOTED.
2. FIELD CONDITIONS MAY REQUIRE MODIFICATIONS OF THIS LAYOUT AS DEEMED NECESSARY BY THE ENGINEER.
3. ALL DISTANCES ARE APPROXIMATE.
4. THE CONTRACTOR IS RESPONSIBLE FOR PROTECTING ANY WORK AREAS NEAR TRAFFIC IN ACCORDANCE WITH THE MN MUTCD.
5. AN ANNUAL FALL REVIEW OF ALL TRAFFIC CONTROLS WILL BE MADE TO PREPARE FOR WINTER MAINTENANCE OF THE PROJECT. THIS MAY INCLUDE ADJUSTMENTS OR EXCHANGE OF ONE TRAFFIC CONTROL DEVICE FOR ANOTHER. READJUSTMENTS MAY AGAIN BE REQUIRED IN THE SPRING.
6. IF THE CONTRACTOR DECIDES TO PERFORM THE CONSTRUCTION WORK IN A SEQUENCE OTHER THAN SHOWN IN THIS TRAFFIC CONTROL PLAN THE CONTRACTOR SHALL PROVIDE COMPLETE REVISED TRAFFIC CONTROL PLANS TO BE APPROVED BY THE ENGINEER.

Signing Notes

SIGNING:

1. ALL TRAFFIC CONTROL DEVICES, INCLUDING OVERHEAD SIGNS, ON ROADS OPEN TO TRAFFIC THAT ARE NOT CONSISTENT WITH TRAFFIC OPERATION SHALL BE COVERED, REMOVED OR REVISED AS DIRECTED BY THE ENGINEER.
2. WHEN SIGNS ARE PLACED, THEY SHALL BE MOUNTED ON POSTS DRIVEN INTO THE GROUND AT THE PROPER HEIGHT AND LATERAL OFFSET AS SHOWN IN THE "TYPICAL TEMPORARY SIGN FRAMING & INSTALLATION DETAILS" IN THE PLAN. IF THIS IS NOT POSSIBLE, THEY WILL BE MOUNTED ON PORTABLE SUPPORTS AS APPROVED BY THE ENGINEER. WHEN THE SIGNS ARE REMOVED THE SIGN POSTS SHALL ALSO BE REMOVED AS SOON AS POSSIBLE.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY EXTRA SIGNING NEEDED TO FACILITATE TRAFFIC SWITCHES OR FOR TRANSITIONING TRAFFIC FROM ONE STAGE TO ANOTHER.
4. ALL ORANGE WARNING AND ORANGE GUIDE SIGNS SHALL BE FABRICATED WITH SIGN SHEETING MATERIAL AS LISTED ON THE MnDOT APPROVED PRODUCT LIST FOR "SHEETING FOR RIGID TEMPORARY WORK ZONE SIGNS, DELINEATORS, AND MARKERS".
5. BARRICADES SHALL BE FABRICATED WITH SIGN SHEETING MATERIAL AS LISTED ON THE MnDOT APPROVED PRODUCT LIST FOR "BARRICADE SHEETING".
6. LONGITUDINAL DROPOFFS SHALL BE SIGNED AS SHOWN IN THE "TEMPORARY TRAFFIC CONTROL ZONE LAYOUTS" FIELD MANUAL UNLESS OTHERWISE SPECIFIED IN THESE PLANS.
7. THE CONTRACTOR SHALL COORDINATE THE PLACEMENT OF THE FINAL SIGNS TO ASSURE THAT THE FINAL SIGNS ARE PLACED AS NEEDED, OR PROVIDE TEMPORARY SIGNING AT THEIR EXPENSE UNTIL THE FINAL SIGNING IS PLACED.

Pavement Marking Notes

PAVEMENT MARKING:

1. THE ENGINEER'S INVOLVEMENT IN THE APPLICATION OF THE MATERIAL SHALL BE LIMITED TO FIELD CONSULTATION AND INSPECTION. THE CONTRACTOR WILL PLACE NECESSARY "SPOTTING" AT APPROPRIATE POINTS TO PROVIDE HORIZONTAL CONTROL FOR STRIPING AND TO DETERMINE NECESSARY STARTING AND CUTOFF POINTS. LONGITUDINAL JOINTS, PAVEMENT EDGES AND EXISTING MARKINGS MAY SERVE AS HORIZONTAL CONTROL WHEN SO DIRECTED.
2. OBLITERATE ANY CONFLICTING PAVEMENT MARKINGS AS DIRECTED BY THE ENGINEER.
3. TRANSITIONS AND TAPERS FOR TEMPORARY STRIPING SHALL BE WET REFLECTIVE OR SUPPLEMENTED WITH TEMPORARY RAISED PAVEMENT MARKERS AND SHOULD BE A MINIMUM OF 6" IN WIDTH.
4. INTERIM STRIPING SHALL CONSIST OF ALL CENTERLINE, NO PASSING ZONES, PAINTED ISLANDS, AND LANE LINES (INCLUDING TURN LANE LINES).
5. TRPM'S (TEMPORARY RAISED PAVEMENT MARKERS) SHOULD BE USED TO SUPPLEMENT THE LONG TERM (MORE THAN 3 DAYS) EDGELINES ON ALL TRANSITION AREAS.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LOCATION AND PLACEMENT OF TEMPORARY AND FINAL STRIPING. MnDOT TRAFFIC PERSONNEL WILL ASSIST IN THE SPOTTING OF TRANSITION AREAS, GORES AND TAPERS.

Barrier and Delineation Notes

BARRIER & DELINEATION:

1. THE CONTRACTOR SHALL FURISH, INSTALL AND MAINTAIN TOP MOUNTED BARRIER DELINEATORS WITH A MINIMUM OF 24 SQ. IN. OF REFLECTIVE SURFACE AREA AND BE PLACED AT 25' SPACES ON TOP OF THE BARRIER WHEN THE BARRIER IS WITHIN 10' OF TRAFFIC UNLESS OTHERWISE NOTED OR AS DIRECTED BY THE ENGINEER. IF THE TRAFFIC ENGINEER REQUIRES SIDE MOUNTED BARRIER DELINEATORS, THEY WILL HAVE A MINIMUM OF 12 SQ. IN. OF REFLECTIVE SURFACE AREA AND BE PLACED AT 12.5' SPACES. IF A SMALLER APPROVED BARRIER DELINEATOR IS USED IT SHALL BE AT ONE HALF THE SPACING AND ONE HALF THE BID PRICE.

Construction Information Signing Notes

CONSTRUCTION INFORMATION SIGNING:

1. THE CONTRACTOR SHALL USE CONSTRUCTION INFORMATION SIGNING AS SHOWN IN THE PLAN AND WHICH ARE TO BE USED AS FOLLOWS:
2. G20-X1 CLOSURE NOTICE SIGNS PAIRED WITH G20-X3 WORK ENDS SIGNS TO DISPLAY THE CORRECT START DATE AND AN ESTIMATED FINISH DATE AS APPROVED BY THE PROJECT ENGINEER.
3. G20-X2 WORK ZONE ADVANCE NOTICE SIGNS WITH THE CORRECT STARTING DATE DISPLAYED BEFORE WORK BEGINS. ONCE WORK BEGINS, THE START DATE LEGEND SHALL BE COVERED BY THE SUGGESTED PLAQUE CONTAINED IN THIS PLAN. IF NO ALTERNATE MESSAGE IS SUGGESTED OR IF DIRECTED BY THE PROJECT ENGINEER, THE CORRECT ESTIMATED FINISH DATE, MONTH, OR SEASON SHALL BE DISPLAYED.
4. CONSTRUCTION INFORMATION SIGNING NOT VISIBLE TO THE MOTORING PUBLIC ONCE WORK BEGINS WILL BE MOVED BY THE CONTRACTOR TO A SITE IN ADVANCE OF THE WORK ZONE OR CLOSURE AS DIRECTED BY THE PLAN OR PROJECT ENGINEER.

5.5.2 **Traffic Control Plan Index**

INDEX	
TRAFFIC CONTROL SHEET NO.	DESCRIPTIONS
1	TITLE SHEET
2	PAY ITEM TABULATION SHEET
3	TRAFFIC CONTROL TABULATION SHEET
4	SPECIAL SIGN DETAILS
5	ADVANCED SIGNING
6	DETOURS
7	ALTERNATE PEDESTRIAN ROUTE
8	STAGING
9	TYPICALS

From Sample on OTST Website

INDEX	
TRAFFIC CONTROL SHEET NO.	DESCRIPTIONS
24	TRAFFIC CONTROL TITLE AND PAY ITEM TABULATION SHEET
25	TRAFFIC CONTROL TABULATION SHEET
26 - 28	TRAFFIC CONTROL SPECIAL SIGN DETAILS
29	TRAFFIC CONTROL DETOUR PLAN - EXISTING SIGNS
30	TRAFFIC CONTROL DETOUR LAYOUT
31	TRAFFIC CONTROL DETOUR LAYOUT - ROAD CLOSURE
32	TRAFFIC CONTROL TEMPORARY SIGN FRAMING AND INSTALLATION DETAILS

From a Detour Plan Set

5.5.3 Traffic Control Devices and Symbols Legend

TRAFFIC CONTROL DEVICES & SYMBOLS LEGEND	
SYMBOL	DESCRIPTION
	AREA CLOSED TO TRAFFIC / WORK AREA
	TRAFFIC CONTROL SIGN
	TYPE C BARRICADE = 
	DRUM-LIKE CHANNELIZER (TYPE B) = 
	TYPE A FLASHING WARNING LIGHT
	FLASHING ARROW BOARD TYPE C = (4' X 8' UNLESS OTHERWISE NOTED). 
	SOLID LINE PAVEMENT MARKING WITH TEMPORARY RAISED PAVEMENT MARKERS AT 10' SPACES
	CONCRETE BARRIER WITH DELINEATORS AT 30' SPACES
	IMPACT ATTENUATOR
	PAVEMENT MESSAGE (LEFT ARROW SHOWN)

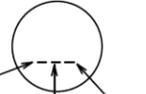
From Sample on OTST Website

TRAFFIC CONTROL DEVICES & SYMBOLS LEGEND	
SYMBOL	DESCRIPTION
	AREA CLOSED TO TRAFFIC / WORK AREA
	TRAFFIC CONTROL SIGN
	CONSTRUCTION INFORMATION SIGN
	TYPE III BARRICADE = 
	TYPE A FLASHING WARNING LIGHT

From a Detour Plan Set

The TTC Plan includes symbols and materials and devices that need to be described. The legends shown above are shown on the TC title sheet. This includes items such as traffic cones, closed area, barricades, etc.

5.5.4 Traffic Control Key Legend

STRIPING KEY		
	CIRCLE - EPOXY	
	TRIANGLE - PAINT	
	PENTAGON - REMOVABLE PREFORMED PLASTIC MARKING	
		
1ST DIGIT WIDTH	2ND DIGIT PATTERN	3RD DIGIT COLOR
4" OR 8"	S - SOLID B - BROKEN T - DOTTED D - DOUBLE K - DOUBLE BROKEN H - DOUBLE DOTTED	W - WHITE Y - YELLOW B - BLACK
EXAMPLE: 	= 4" SOLID LINE WHITE - EPOXY	

From Sample on OTST Website

The striping key legend could include:

- ✓ Symbols used (crosswalk, arrows, HOV markings, air plane markers, etc.)
- ✓ A striping key symbol (only include items that are used on the project)
 - Circle indicates epoxy
 - Square indicates poly preform

- Triangle is for paint
- Pentagon for removable preformed plastic
- ✓ A three digit striping key
 - First digit is for width
 - Second digit is for pattern
 - Third digit is for color

5.5.5 Title, Signature, Project Number and Sheet Number Block

I HEREBY CERTIFY THAT SHEETS THROUGH OF _____ THIS PLAN WERE PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA		DATE <u>5/31/2016</u> LIC. NO. _____ DESIGNER <u>TECH NAME HERE</u>
TITLE: TRAFFIC CONTROL TITLE SHEET		
STATE PROJ. NO. 0000-000 (TH 000) SHEET NO _____ OF _____ SHEETS		

For the TC title sheet, a separate block is included for the plan certification signature. It also includes the sheet title, project number and plan sheet number. Notice that TC sheets are number with “TC” at the beginning of the number (i.e., TC1, TC2, etc.).

5.6 Traffic Control Tabulation

TRAFFIC CONTROL QUANTITIES (1) (4)								AA
ITEM	UNIT	QUANTITY						TOTAL
		STAGE 1	STAGE 2	STAGE 3	PHASE 1	PHASE 2	PHASE 3	
PAVEMENT MARKING REMOVAL	SQ FT	96	240					336
PAVEMENT MARKING REMOVAL	LIN FT	4649	5382	749				10780
IMPACT ATTENUATOR NO. 2	ASSEMBLY						2	2 (2)
TUBE DELINEATOR	EACH		20					20
REPLACE TUBE DELINEATOR	EACH		10					10
TEMPORARY SIGNAL SYSTEM	SYSTEM		1	1				1 (3)
REMOVABLE PREFORMED PLASTIC MARKING 4" WET REMOVABLE TAPE- SOLID WHITE	LIN FT	3322	560	2660				6542
REMOVABLE PREFORMED PLASTIC MARKING 4" WET REMOVABLE TAPE- SOLID YELLOW	LIN FT	2494	1550	2314				6358
REMOVABLE PREFORMED PLASTIC MARKING 24" WET REMOVABLE TAPE- SOLID WHITE	LIN FT		44	44				88 (4)
REMOVABLE PREFORMED PLASTIC MASK (BLACK)	LIN FT	70	70	70				210
4" SOLID LINE WHITE PAINT	LIN FT	1604						1604
4" SOLID LINE YELLOW PAINT	LIN FT			395				395
4" DOUBLE SOLID LINE YELLOW PAINT	LIN FT	14561	16792	16383	2267			50003

SPECIFIC NOTES:
 (1) SOME QUANTITIES SHOWN IN STAGE 1 WILL REMAIN INPLACE FOR STAGE 2 AND SOME QUANTITIES SHOWN IN STAGE 2 WILL REMAIN INPLACE FOR STAGE 3.
 (2) TEST LEVEL 2 REQUIRED.
 (3) TEMPORARY SIGNAL SYSTEM INCLUDES 3 TRAILER MOUNTED SIGNALS. THE TRAILER MOUNTED SIGNALS SHALL BE OPERATED AS A SYSTEM TO CONTROL TRAFFIC AT THE INTERSECTION OF ARBOR STREET AND T.H. 23. SEE SPECIAL PROVISIONS FOR SPECIFIC REQUIREMENTS.
 (4) PAID FOR AS EQUIVALENT LENGTH OF 4" MATERIAL.
 EQUIVALENT LENGTH = 528 LIN FT. QUANTITY BASED ON 88' OF 24" MATERIAL PRORATED AS 4" MATERIAL (88' X 24")/4= 528 LIN FT.

There is a difference between a specific note and note. Specific note is specifically for that sheet.

Shown on the sheet T1 of the sample plan included in the Appendix are the estimated quantities. This will include the ITEM name, UNIT, QUANTITY (by Stage and Phase) and TOTAL amount. If staging occur (as is done in this plan, the staging quantities are listed in separate columns. These elements can be estimated with GEOPAK. The PAY ITEM description used should match Short Description shown in the AASHTOWare Project Item List (<http://bidlet.dot.state.mn.us/ItemSearch.aspx>).

5.6.1 Traffic Control Supervisor

The Traffic Control Supervisor is a pay item that can have three different units (Hour, Each, Lump Sum). This is to be used when you have complex traffic control or a switch. It has been noted that this pay item seems to be over used. If you use lump sum, technically this person is needed at all times. Using 'Hour' is more flexible.

Be sure to talk to the project engineer beforehand related to this item. If no project engineer has been identified, talk to the resident engineer. In addition, talk with the construction office during the design phase to determine what/if this is required.

TRAFFIC CONTROL SUPERVISOR	HOUR
TRAFFIC CONTROL SUPERVISOR	EACH
TRAFFIC CONTROL SUPERVISOR	LUMP SUM

5.7 Traffic Control Tabulation Charts Sheet

The tabulation charts include a summary of signs that are included within the project.

TRAFFIC CONTROL TABULATION SHEET

"R" SERIES			
SIGN	SIGN NO.	COLOR	SIZE
	R11-2R	BLACK ON WHITE	48" X 30"
	R3-2	BLACK AND RED ON WHITE	24" X 24"
	R3-1	BLACK AND RED ON WHITE	24" X 24"
	R16-X7R	BLACK ON WHITE	48" X 60"

"W" SERIES			
SIGN	SIGN NO.	COLOR	SIZE
	W20-1	BLACK ON ORANGE	48" X 48"
	W1-X1R	BLACK ON ORANGE	48" X 48"
	W21-X5	BLACK ON ORANGE	48" X 48"
	W4-2R	BLACK ON ORANGE	48" X 48"
	W20-X13	BLACK ON ORANGE	48" X 48"
	W1-4	BLACK ON ORANGE	48" X 48"
	W1-6	BLACK ON ORANGE	48" X 24"
	W13-1	BLACK ON ORANGE	30" X 30"
	W4-1R	BLACK ON ORANGE	48" X 48"
	W20-X16	BLACK ON ORANGE	48" X 48"

"G" SERIES			
SIGN	SIGN NO.	COLOR	SIZE
	G20-2A	BLACK ON ORANGE	48" X 24"
	G20-X1	BLACK ON ORANGE	54" X 48"
	G20-X7	BLACK ON ORANGE	48" X 48"

"M" SERIES			
SIGN	SIGN NO.	COLOR	SIZE
	M4-9S	BLACK ON ORANGE	42" X 36"
	M4-9M	BLACK ON ORANGE	42" X 36"
	M4-9M	BLACK ON ORANGE	42" X 36"
	M4-8	BLACK ON ORANGE	24" X 12"
	M3-3m	BLACK ON WHITE	24" X 12"
	M3-1m	BLACK ON WHITE	24" X 12"
	M1-4o	BLACK ON WHITE	30" X 24"
	M5-1	BLACK ON WHITE	21" X 15"
	M6-1	BLACK ON WHITE	21" X 15"
	M6-3	BLACK ON WHITE	21" X 15"

TRAFFIC CONTROL TABULATION CHART

STATE PROJ. NO. 2772-96 (TH 169) SHEET NO. TC3 OF TC33 SHEETS

DRAWN BY: SNM CHECKED BY: KF CERTIFIED BY: *Jeffrey A. De...* LIC. NO. 40535 DATE 11/29/2012

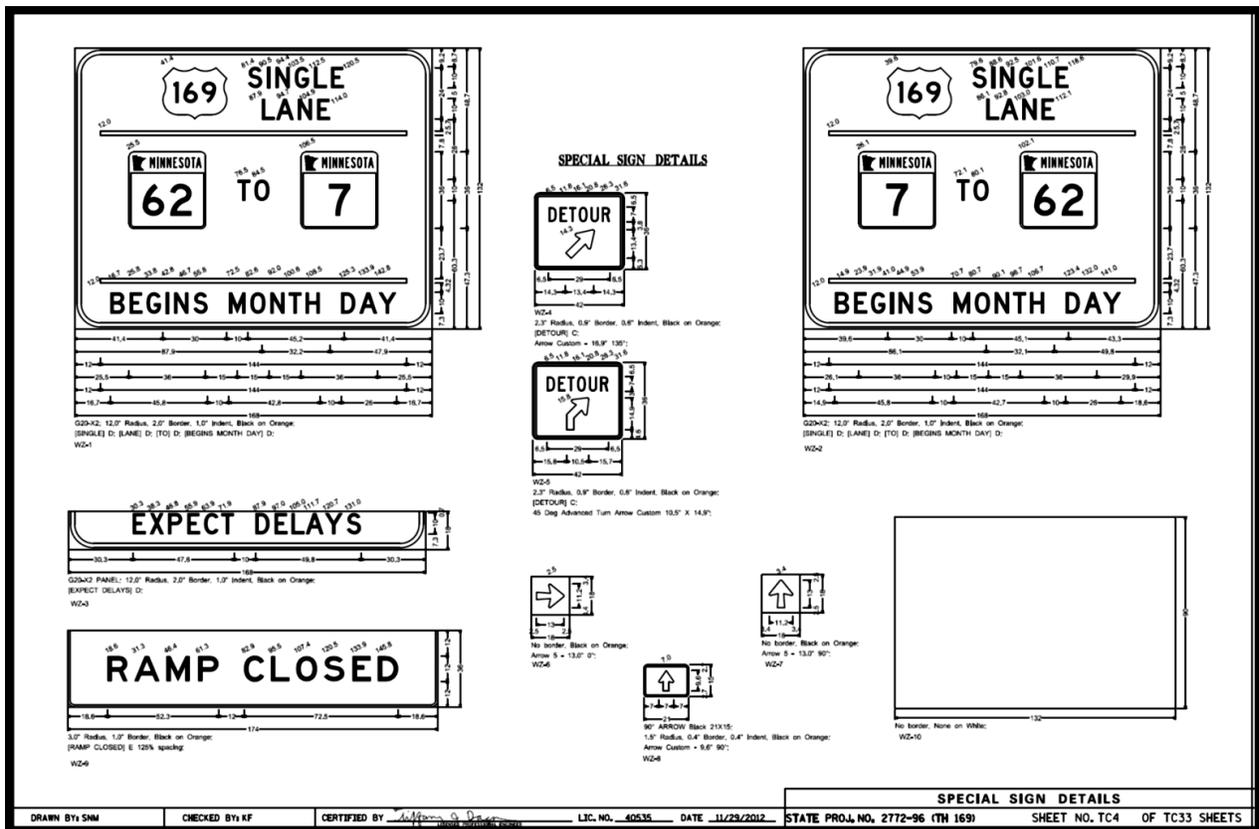
The tables include the SIGN, SIGN NO., COLOR and SIZE. Each sign shown on the plans will be summarized in these tables. These tables will be created after the signs have been placed on the layout sheets.

Do NOT put quantities on this sheet.

"W" SERIES			
SIGN	SIGN NO.	COLOR	SIZE
	W20-1	BLACK ON ORANGE	48" x 48"
	W1-X1R	BLACK ON ORANGE	48" x 48"

"G" SERIES			
SIGN	SIGN NO.	COLOR	SIZE
	G20-2A	BLACK ON ORANGE	48" X 24"
	G20-X1	BLACK ON ORANGE	54" X 48"

5.8 Special Sign Details



SPECIAL SIGN DETAILS

SINGLE LANE (Left Panel):
 169 SINGLE LANE
 MINNESOTA 62 TO 7 MINNESOTA
 BEGINS MONTH DAY
 G20X2: 12.0" Radius, 2.0" Border, 1.0" Inset, Black on Orange.
 (SINGLE) D; (LANE) D; (TO) D; (BEGINS MONTH DAY) D;
 W2-1

SINGLE LANE (Right Panel):
 169 SINGLE LANE
 MINNESOTA 7 TO 62 MINNESOTA
 BEGINS MONTH DAY
 G20X2: 12.0" Radius, 2.0" Border, 1.0" Inset, Black on Orange.
 (SINGLE) D; (LANE) D; (TO) D; (BEGINS MONTH DAY) D;
 W2-2

DETOUR (Top):
 2.0" Radius, 0.5" Border, 0.5" Inset, Black on Orange.
 (DETOUR) C;
 Arrow Custom - 18.0" x 18.0"
 W2-3

DETOUR (Middle):
 2.0" Radius, 0.5" Border, 0.5" Inset, Black on Orange.
 (DETOUR) C;
 45 Deg Advanced Turn Arrow Custom 18.0" x 14.0"
 W2-5

EXPECT DELAYS (Bottom Left):
 G20X3 PANEL: 12.0" Radius, 2.0" Border, 1.0" Inset, Black on Orange.
 (EXPECT DELAYS) D;
 W2-4

RAMP CLOSED (Bottom Right):
 3.0" Radius, 1.0" Border, Black on Orange.
 (RAMP CLOSED) E 125% spacing
 W2-9

Other Details:
 W2-6: No border, Black on Orange; Arrow 5 - 13.0" D;
 W2-7: No border, Black on Orange; Arrow 5 - 13.0" 90°;
 W2-10: No border, None on White;

SPECIAL SIGN DETAILS
 DRAWN BY: SMW | CHECKED BY: KF | CERTIFIED BY: [Signature] | LIC. NO.: 40535 | DATE: 11/29/2012 | STATE PROJ. NO.: 2772-96 (TH 169) | SHEET NO. TC4 | OF TC33 SHEETS

When sign panels exist, the layout details will be shown on these sheets. MnDOT uses the software SignCad® to layout guide signs.

5.9 Narrative Sheet

Below are sample narratives of the traffic control plan set. It is a summary of the work that is being performed and the TC for each stage of the project. It may be possible to fit this on the title sheet, if not too long.

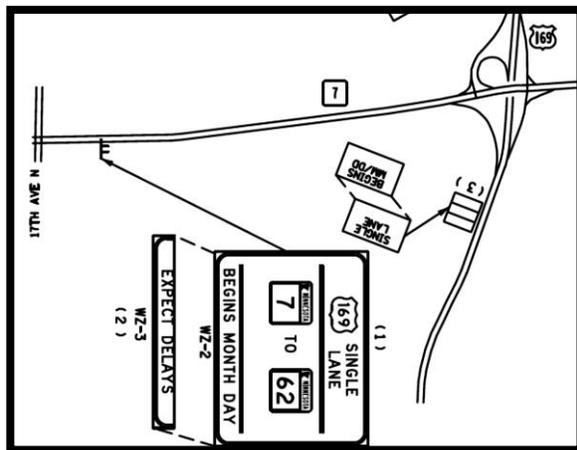
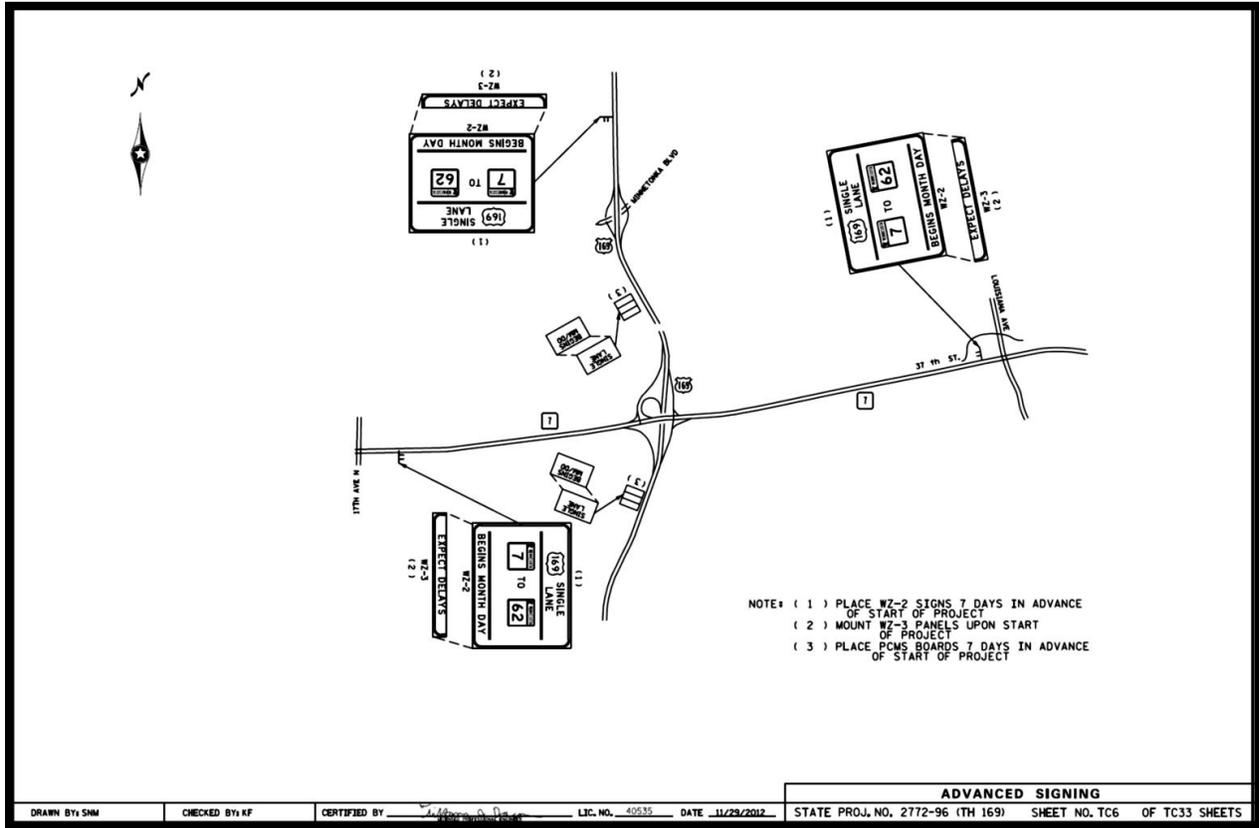
TRAFFIC CONTROL NARRATIVE	
STAGE 1	
CONSTRUCTION:	<ul style="list-style-type: none"> ▪ CURB & GUTTER AND SIDEWALK ON OUTSIDE LANES (NB & SB), UTILITIES AND BRIDGE #69091.
TRAFFIC:	<ul style="list-style-type: none"> ▪ CLOSE OUTSIDE LANES (NB & SB). ▪ MAINTAIN TRAFFIC ON INSIDE LANES (NB & SB).
STAGE 2	
CONSTRUCTION:	<ul style="list-style-type: none"> ▪ MILL & OVERLAY NB LANES, UTILITIES AND BRIDGE #69091.
TRAFFIC:	<ul style="list-style-type: none"> ▪ CLOSE NB LANES. ▪ MAINTAIN 2 WAY TRAFFIC ON SB LANES.
STAGE 3	
CONSTRUCTION:	<ul style="list-style-type: none"> ▪ MILL & OVERLAY SB LANES, UTILITIES AND BRIDGE #69091.
TRAFFIC:	<ul style="list-style-type: none"> ▪ CLOSE SB LANES. ▪ MAINTAIN 2 WAY TRAFFIC ON NB LANES.
<p>STAGES 1-3 ON GOING DURING PHASES 1-3 FOR MEDIAN REMOVAL STA. 313+00 TO 333+00.</p>	
PHASE 1	
CONSTRUCTION:	<ul style="list-style-type: none"> ▪ PROFILE CHANGE ON SB LANES, MILL & OVERLAY SB LANE.
TRAFFIC:	<ul style="list-style-type: none"> ▪ CLOSE SB LANES. ▪ MAINTAIN 2 WAY TRAFFIC ON NB LANES.
PHASE 2	
CONSTRUCTION:	<ul style="list-style-type: none"> ▪ REMOVE MEDIAN AND GUARDRAIL.
TRAFFIC:	<ul style="list-style-type: none"> ▪ CLOSE INSIDE LANES (NB & SB). ▪ MAINTAIN TRAFFIC ON OUTSIDE LANES (NB & SB).
PHASE 3	
CONSTRUCTION:	<ul style="list-style-type: none"> ▪ CURB & GUTTER AND SIDEWALK ON OUTSIDE LANES (NB & SB).
TRAFFIC:	<ul style="list-style-type: none"> ▪ CLOSE OUTSIDE LANES (NB & SB). ▪ MAINTAIN TRAFFIC ON INSIDE LANES (NB & SB).

Below is an additional Narrative example (not included as a sample plan set):

STAGING NARRATIVE
<ol style="list-style-type: none"> 1. PIPE REPLACEMENT CROSSING OAKLAND AVE AT TH105 WILL BE DONE USING THE DETOUR ON SHEET T3. 2. PIPE REPLACEMENTS CROSSING 2ND AVE. AND 8TH AVE. WILL BE DONE WITH ROAD CLOSURES AS SHOWN ON SHEET T4. 3. PED RAMPS AND OTHER PIPE WORK WILL BE COMPLETED USING SHOULDER/PARKING LANE CLOSURES. ALL OTHER WORK WILL BE COMPLETED USING SHORT TERM LANE CLOSURES IN MULTI-LANE SECTIONS AND FLAGGERS IN 2 LANE SECTIONS.

5.10 Advanced Signing

(Image below is not part of example plan)



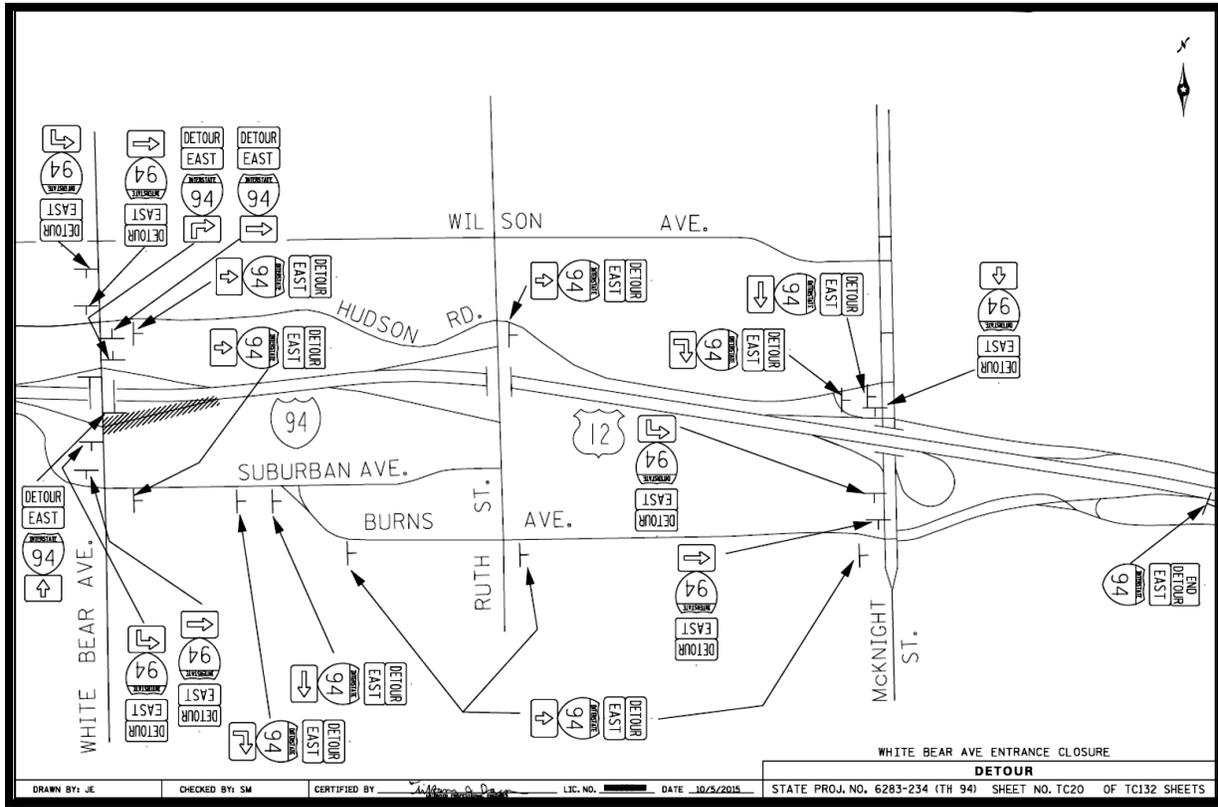
- (1) PLACE WZ-2 SIGNS 7 DAYS IN ADVANCE OF START OF PROJECT
- (2) MOUNT WZ-3 PANELS UPON START OF PROJECT
- (3) PLACE PCMS BOARDS 7 DAYS IN ADVANCE OF START OF PROJECT

Advanced Signing Sheets illustrate the signs in advance of the work zone. As the notes indicate, the signs will be placed in advance of the project start date. This example also illustrates the use of Portable Changeable Message Signs (PCMS).

If PCMS is conveying a timeframe, avoid using dates when the timeframe of condition is under 7 days.

5.11 Detour Sheets

(Image below is not part of example plan)

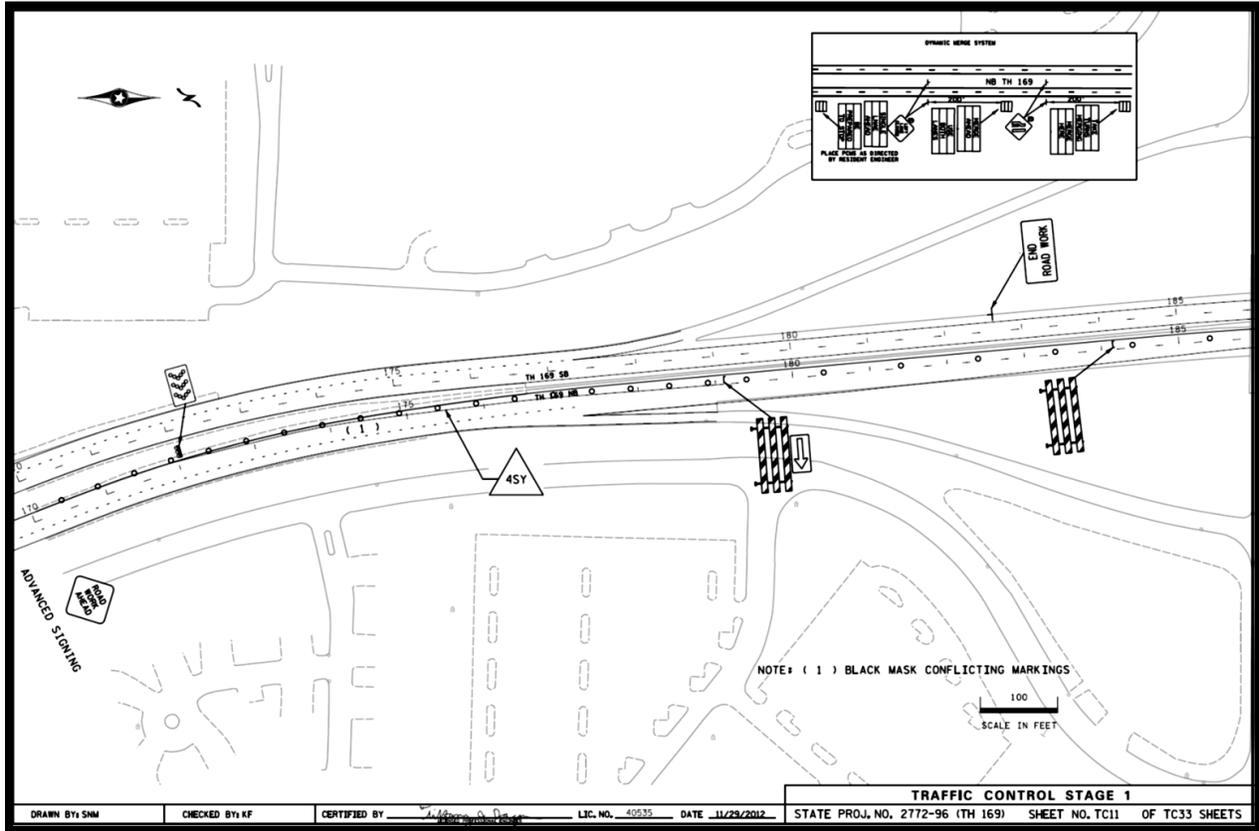


The Detour Sheets layout the detour for the various stages of the project.

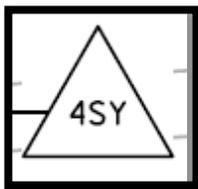
For these sheets, they need to be understandable for individuals in the field. Numbers for the sign assembly's don't work well for them. Make sure the signs are big enough that they can be read.

5.12 TC Layout Sheets

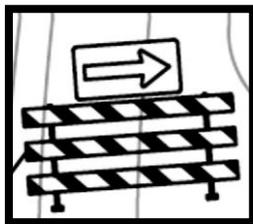
The following are a few select examples from the traffic control plan layouts. The first example is sheet TC11 illustrating details during stage 1.



The following items are found on this sheet. Use the Symbols and Materials Legend discussed earlier.

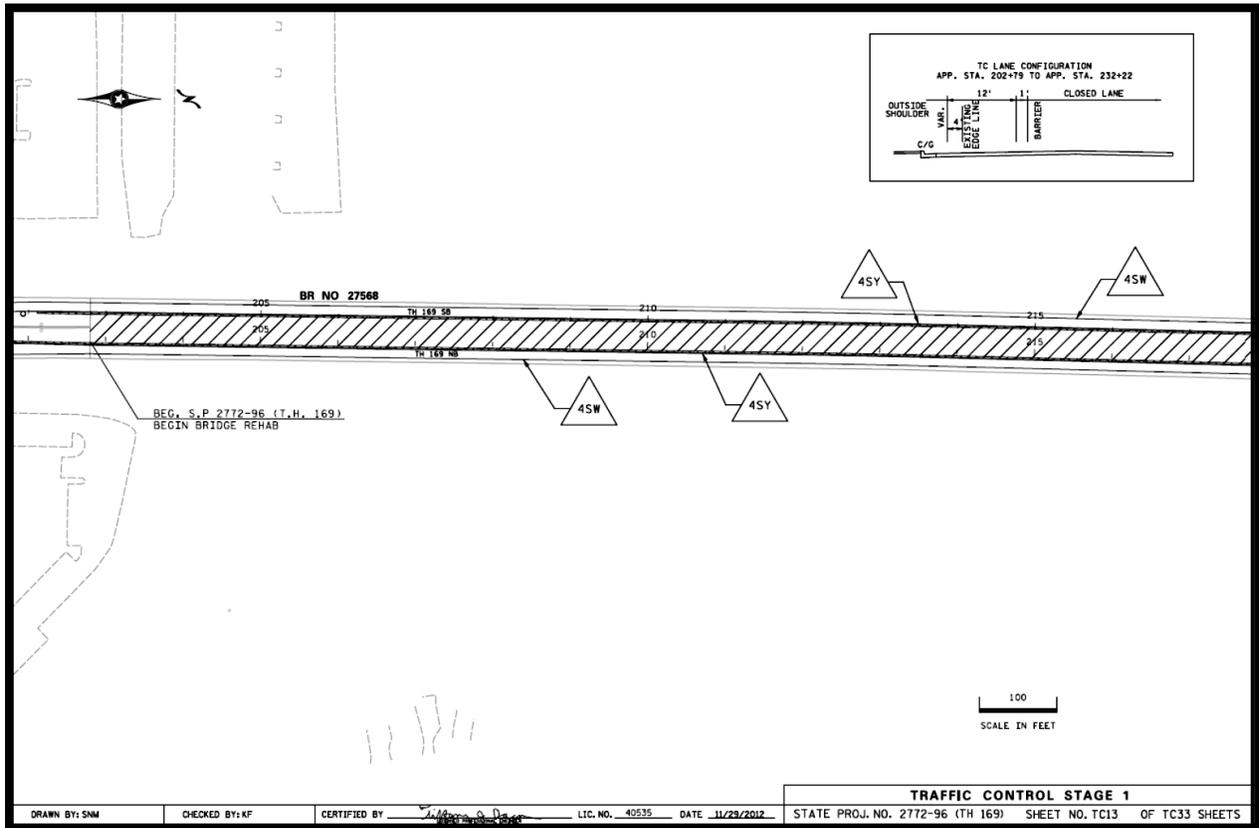


- ✓ The triangle represents Paint
- ✓ 1st Digit "4" indicates a 4 inch line
- ✓ 2nd digit "S" indicates a Solid line
- ✓ 3rd digit "Y" indicates a Yellow line

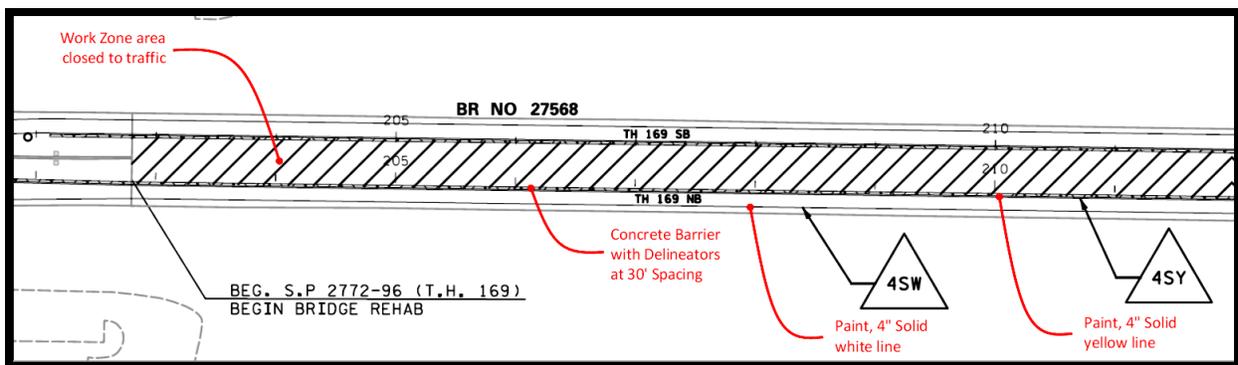


- ✓ Illustrates a Type III barricade
- ✓ Includes a Large Arrow (W1-6) sign

The example below is from the same project S.P. 2772-96 (TH 169) Sheet number TC 13.

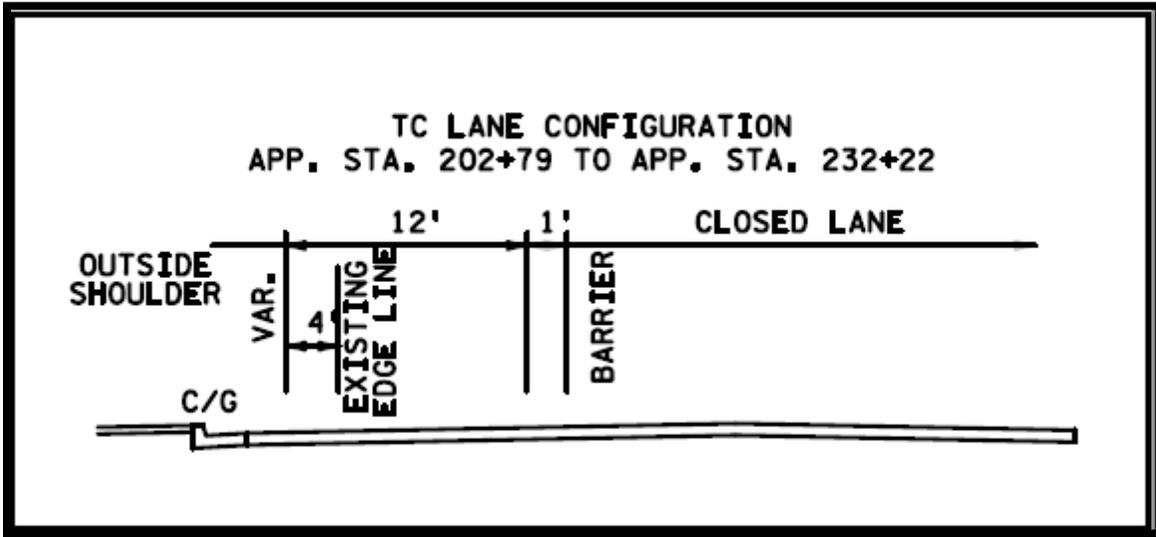


The image below illustrates some of the elements shown on the plan sheet TC13.

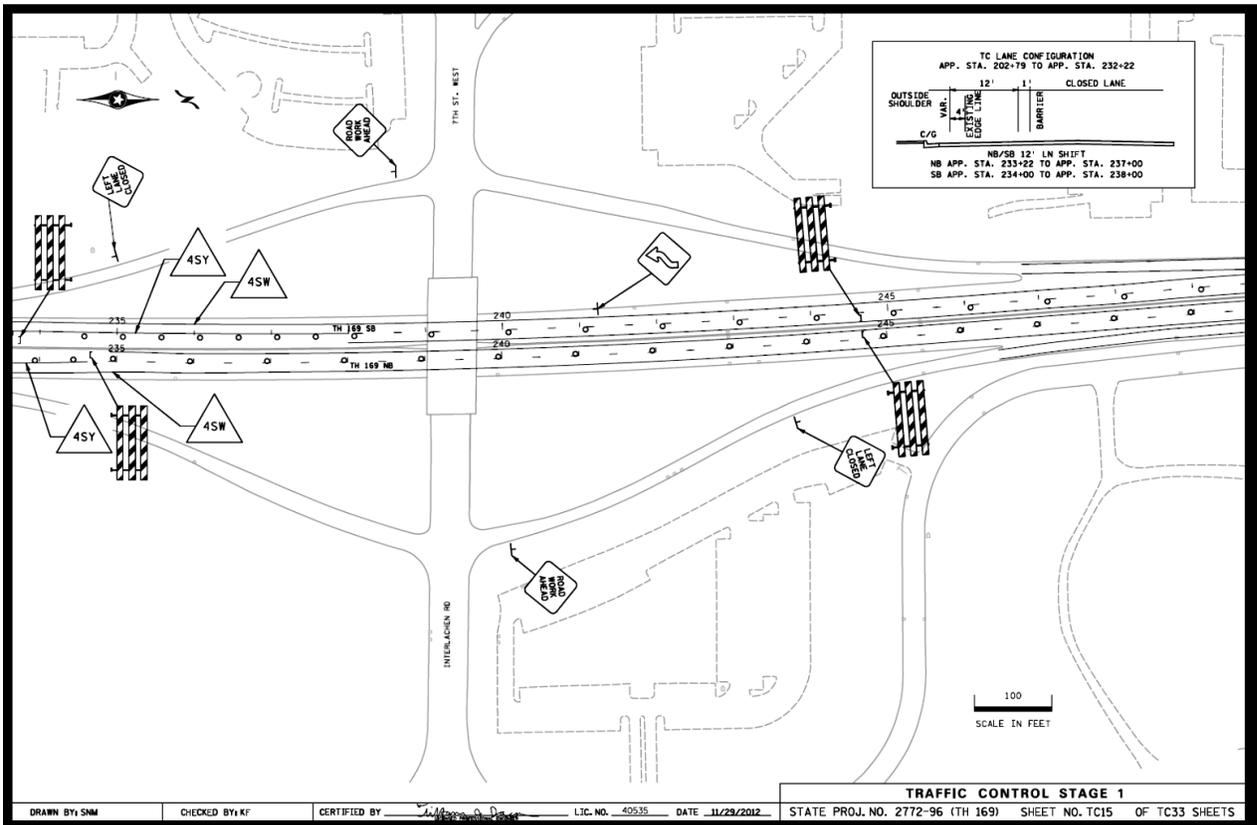


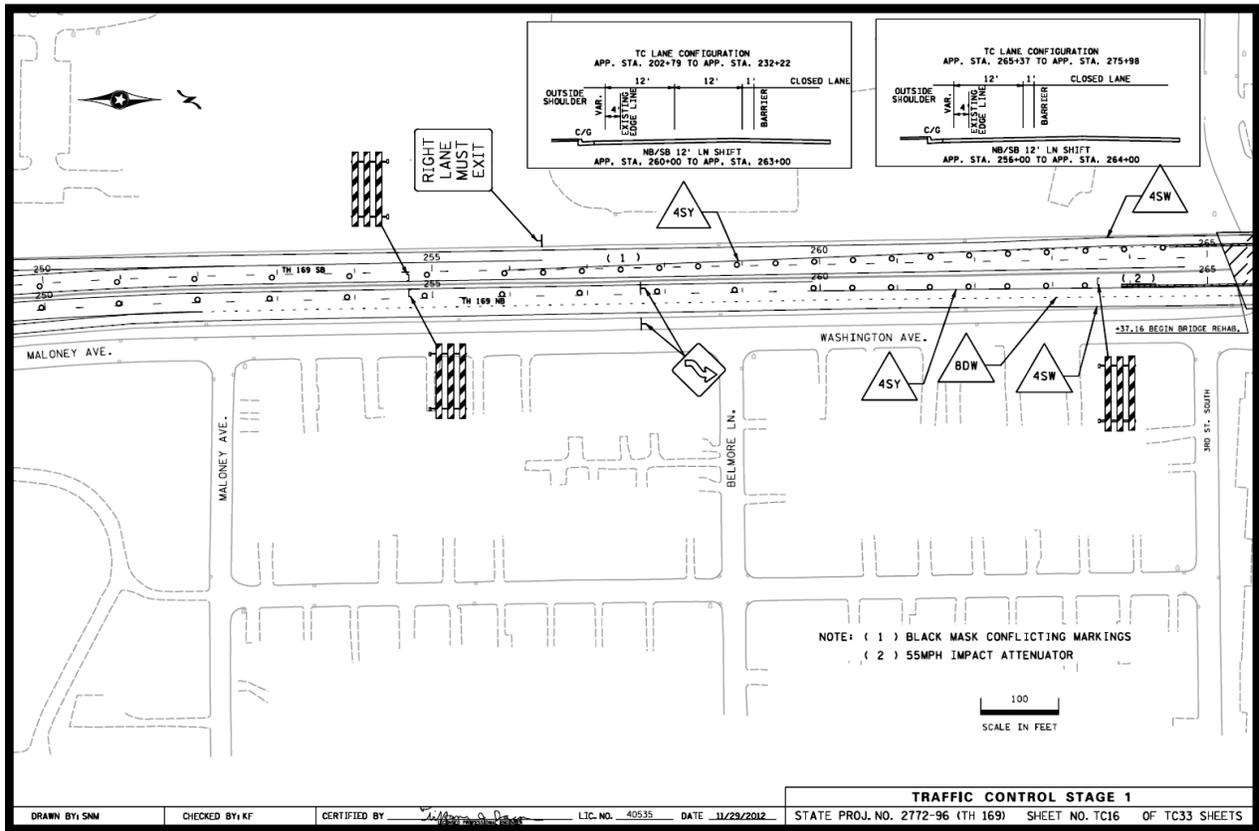
The example below is from the same S.P. 2772-96 (TH 169) Sheet number TC 13.

The plan also shows a cross-section with the TC lane configuration.

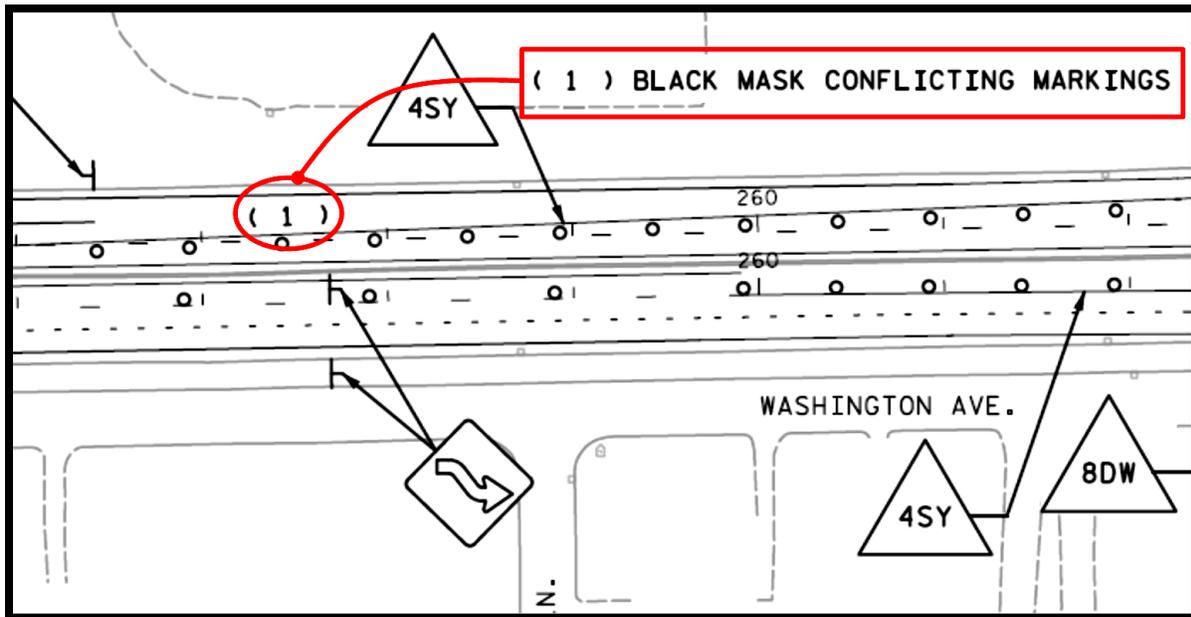


Sheet TC15 illustrates TC in the vicinity of an interchange. Notice the signing on the ramps.

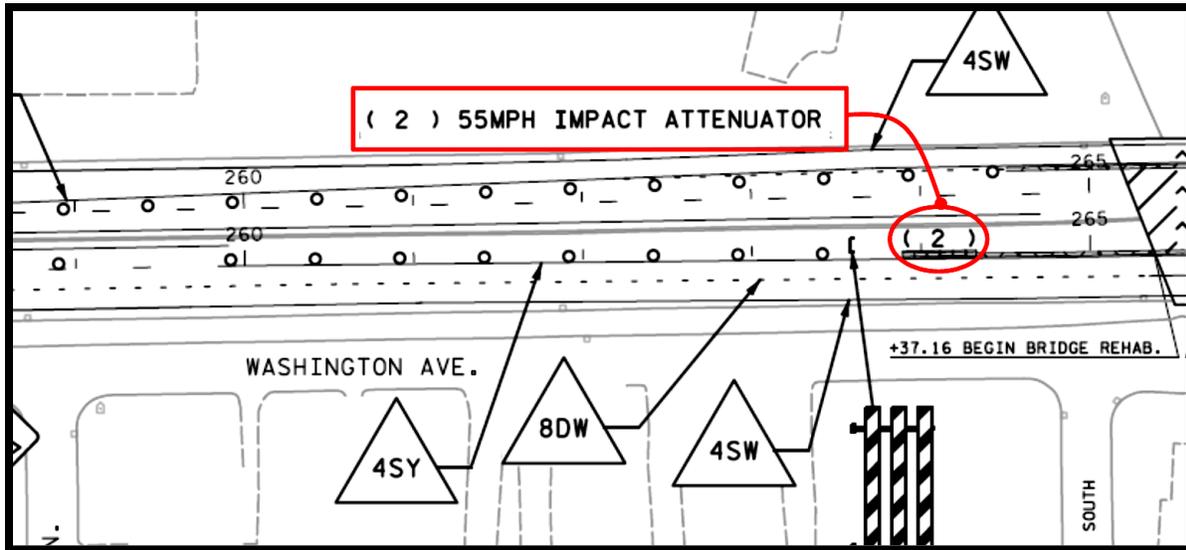




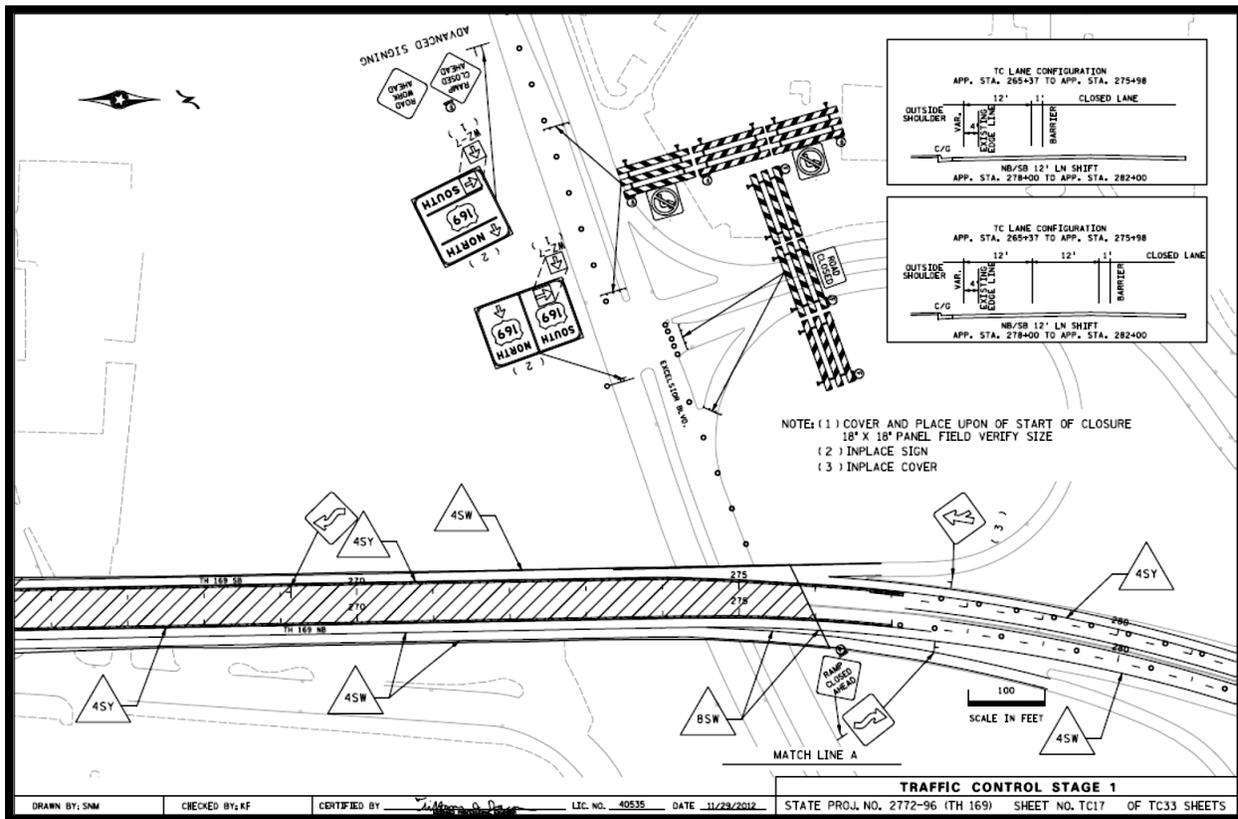
Notice the notes on sheet TC16. Note (1) indicates black mask conflicting markings.



Note (2) indicates a 55 MPH Impact Attenuator. This sample is from an older plan. The note should now include the attenuator level (TL-2 or TL-3).



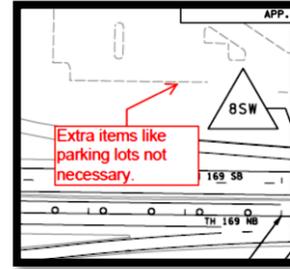
Sheet TC17 shows a ramp closure.



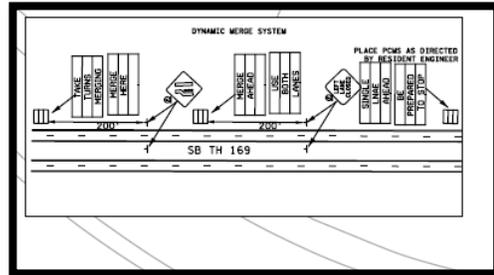
Additional sheets show similar elements for the stage 2 TC plan. Refer to the sample plan in the Appendix.

5.12.1 Layout Sheet Tips

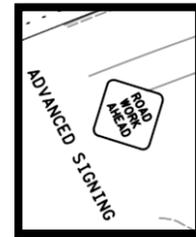
- ✓ On the Layout sheets, all the extra elements are not needed (like parking lots).



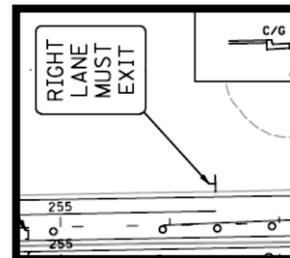
- ✓ Don't be afraid to use insets.
- ✓ If possible, can break in half and show two sheets on one.



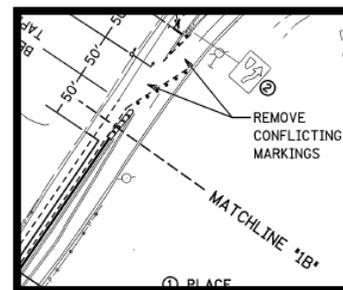
- ✓ Avoid having sheets with limited information on it. For instance, Advanced Signing may be the only thing on a sheet (if break lines are not used). This helps to remove unnecessary sheets that just show one sign. A distance isn't needed since it can be found in other references already stated in this material.

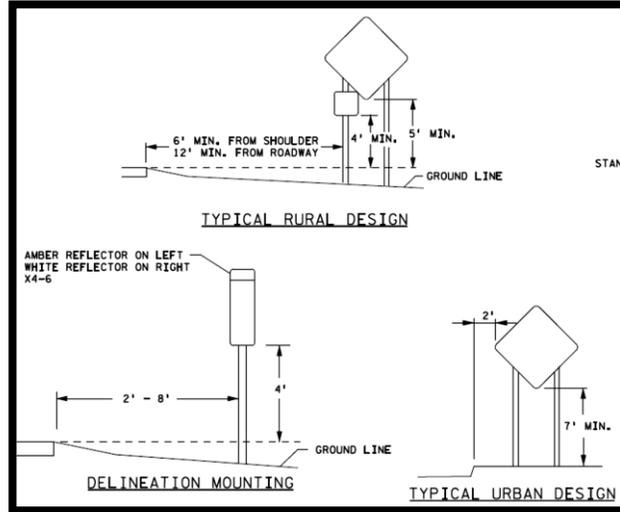
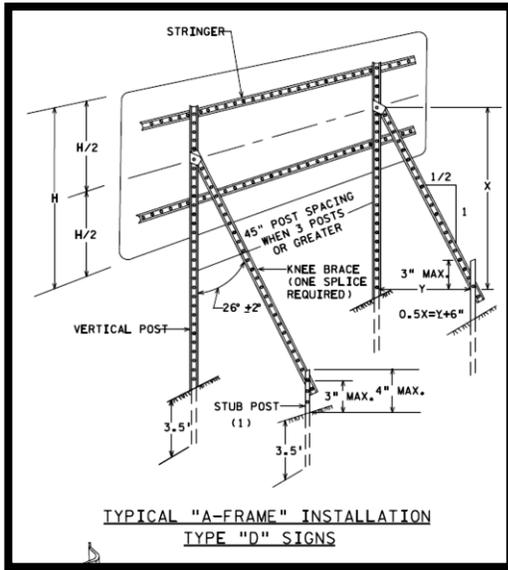


- ✓ If the "Right Lane Must Exit" is permanent, this should be noted such.
- ✓ Not all signs need to be shown, just the ones that are impacted by the TC plan.
- ✓ If a sign is being covered, that should be noted.
- ✓ If anything is in-place and relative to the installation, show it. An example such as Adopt a Highway would not be shown.



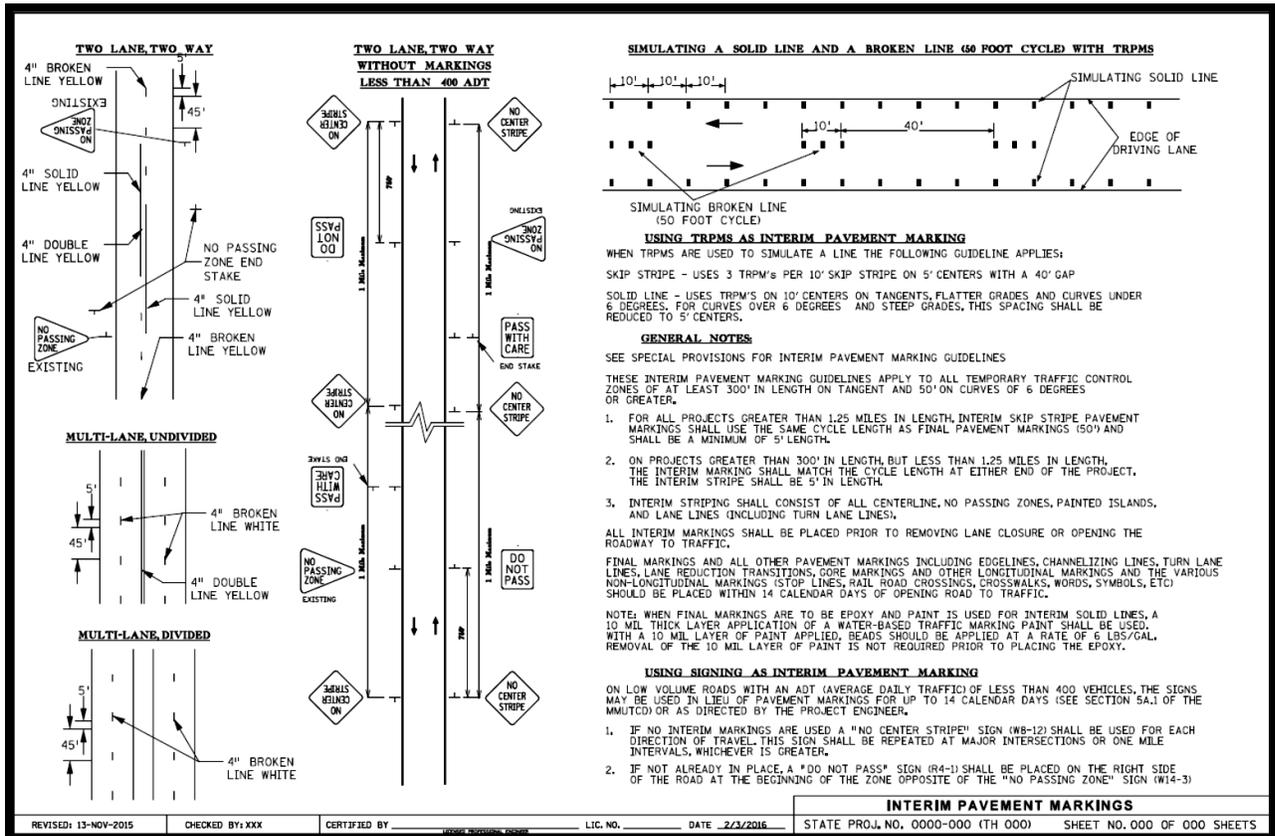
- ✓ Use match-lines or break-lines when possible or feasible.
- ✓ Dimensions instead of a scale can be used.
- ✓ When you have sheets that have redundant info, such as pavement marking, don't need to show every single pavement marking. Include typicals and break lines in-between.



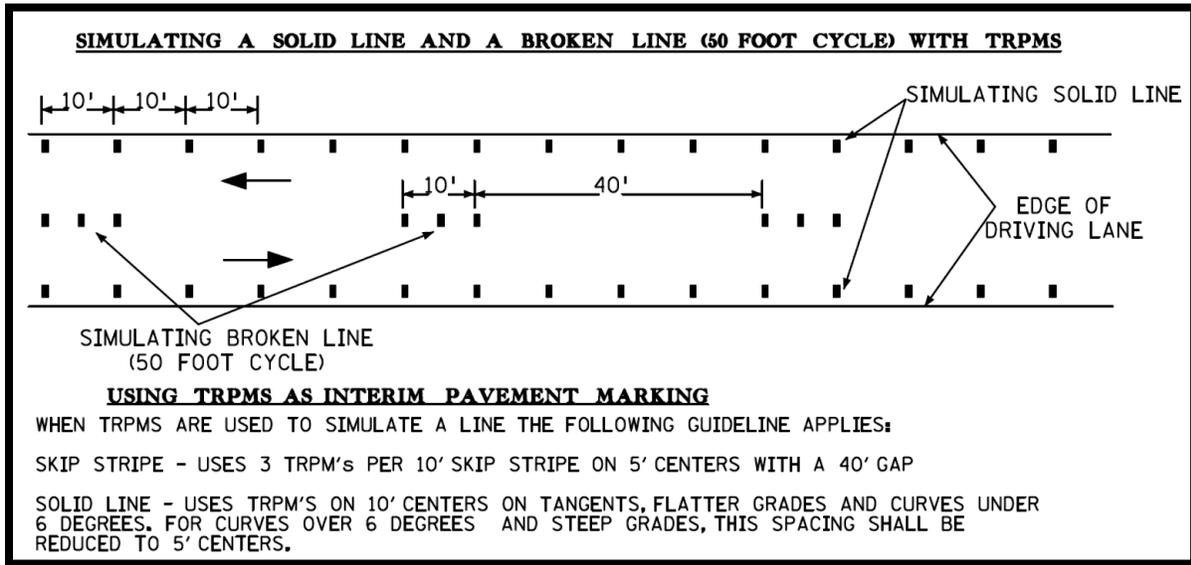


5.13.1 Interim Pavement Markings

The image below is from the sample TC plan on the website illustrating interim pavement markings.

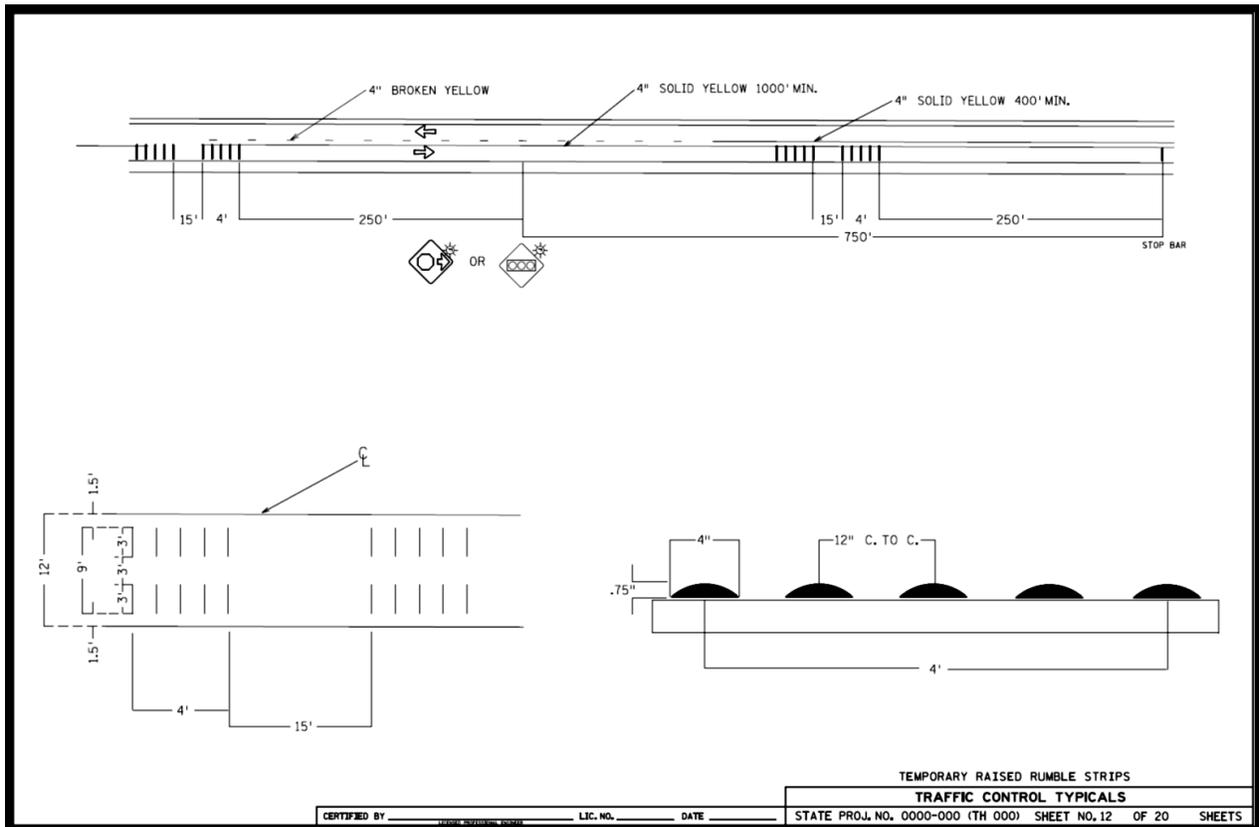


Below is an enlarged sample from the above plan sheet.

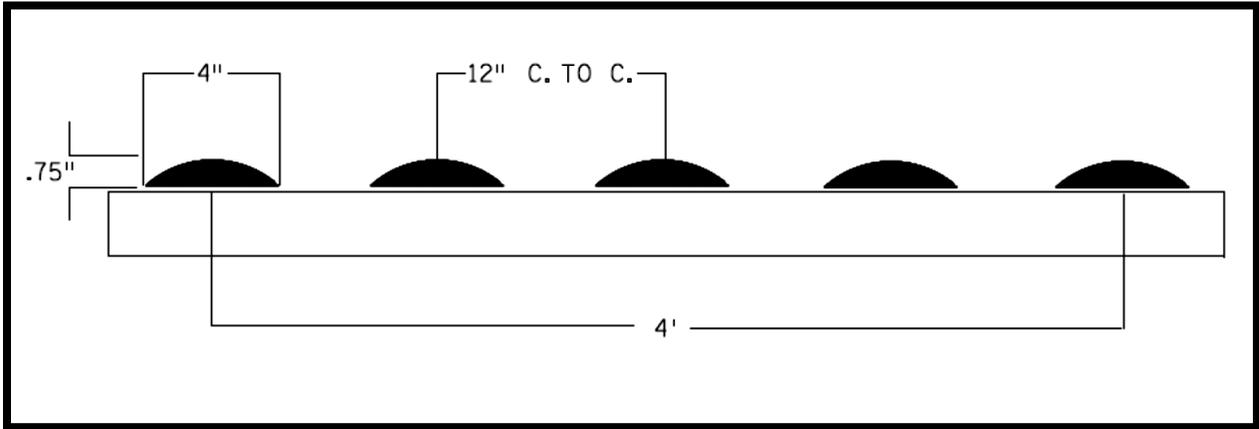


5.13.2 Temporary Raised Rumble Strips

The image below illustrates the typical drawing for Temporary Raised Rumble Strips.



Below is an enlarged sample from the above plan sheet.



(This page is intentionally left blank)

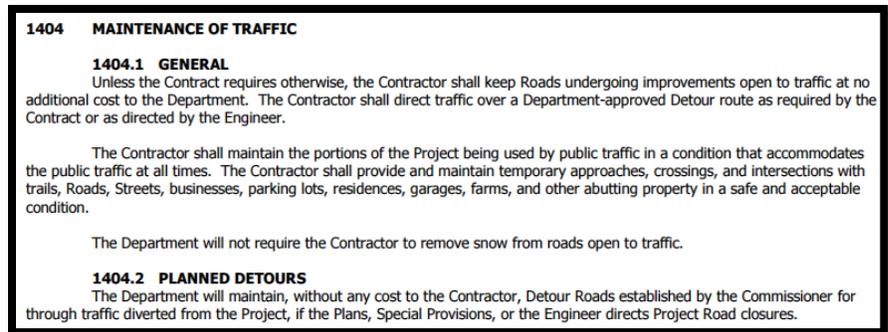
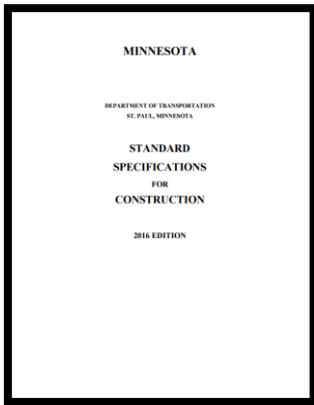
6. SPECIFICATIONS AND SPECIAL PROVISIONS

6.1 MnDOT Standard Specification for Construction Book (Spec Book)

The “Spec Book” () contains standard specifications to be used and referred to in the design of plans and in the preparing of Special Provisions. Plan designers need to be aware of the specifications contained in the Spec Book that may apply to their individual project.

The Spec Book includes both metric and non-metric units of measure conversions. The Spec book includes modifications to the prior Spec Book.

Exhibit 6-1 Standard Specifications for Construction Book (Spec Book)



6.1.1 Format of the “Spec Book”

The Spec Book is made of three divisions:

- ✓ Division I - General Requirements and Covenants
- ✓ Division II - Construction Details
- ✓ Division III - Materials

DIVISION I — General Requirements and Covenants

Each Division I Specification number begins with “1” (1101 - 1911). Note that each section of Division I is given a numeric series. For example, Scope of Work is the 1400 series (1401 - 1408). This Division is divided into nine (9) sections, the following is a closer look at two of these sections:

- ✓ 1404 MAINTENANCE OF TRAFFIC
- ✓ 1710 TRAFFIC CONTROL DEVICES

<http://www.dot.state.mn.us/pre-letting/spec/index.html>.

1403.5

- (1) Confirmation of the need for a contract revision. The Contractor shall pursue time extensions in accordance with 1806, "Determination and Extension of Contract Time," and compensation in accordance with 1904, "Compensation for Contract Revisions," or
- (2) Denial of the request for a contract revision, in which case the Engineer will make clear, by reference to the Contract, why the issue does not represent a revision to the contract.
- (3) A request for additional information, in which case the Engineer will state clearly what is needed and by when; the Engineer will issue a final response within 10 business days of receiving the additional requested information.

1403.6 CONTRACTOR'S RECOURSE

If the Contractor disagrees with the Engineer's final written response or the Engineer's response is untimely, the Contractor may pursue a claim in accordance with 1517, "Claims for Compensation Adjustment." The Contractor shall give the Engineer written notice of the intent to pursue a claim within 5 business days of receiving the Engineer's final written response.

1404 MAINTENANCE OF TRAFFIC**1404.1 GENERAL**

Unless the Contract requires otherwise, the Contractor shall keep Roads undergoing improvements open to traffic at no additional cost to the Department. The Contractor shall direct traffic over a Department-approved Detour route as required by the Contract or as directed by the Engineer.

The Contractor shall maintain the portions of the Project being used by public traffic in a condition that accommodates the public traffic at all times. The Contractor shall provide and maintain temporary approaches, crossings, and intersections with trails, Roads, Streets, businesses, parking lots, residences, garages, farms, and other abutting property in a safe and acceptable condition.

The Department will not require the Contractor to remove snow from roads open to traffic.

1404.2 PLANNED DETOURS

The Department will maintain, without any cost to the Contractor, Detour Roads established by the Commissioner for through traffic diverted from the Project, if the Plans, Special Provisions, or the Engineer directs Project Road closures.

1404.3 CONTRACTOR'S REQUEST FOR DETOUR

The Contractor may request from the Engineer a Detour for through traffic. The Contractor shall specify the Detour routes and submit justification information with the Detour request. The Department will consider and may, at its sole discretion, approve the Detour request and establish a Detour in accordance with the following:

- (1) The Contractor shall design, provide, install, maintain, and remove traffic control devices on the Detour Roads at no additional cost to the Department. The Contractor shall submit the proposed Detour layout to the Engineer for approval at least 7 calendar days before the Contractor begins to use the Detour.
- (2) The Contractor shall maintain and restore Detour Roads at no additional cost to the Department. The Department will remove snow from Detour Roads at the Department's expense.
- (3) The Contractor shall provide, install, and maintain traffic control devices and other traffic protection measures required to maintain local traffic.

1404.4 CONTRACTOR'S REQUEST FOR TEMPORARY BY-PASSES

The Contractor shall design, construct, maintain, and remove other Temporary By-pass facilities requested by the Contractor and approved by the Engineer at no additional cost to the Department.

1404.5 MAINTENANCE DIRECTED BY THE ENGINEER

The Contractor shall perform maintenance work or provide dust control for the benefit of the public as directed by the Engineer. The Department will pay for the Engineer-directed work at Contract Unit Prices or as Extra Work in accordance with 1402, "Contract Revisions." The Department will not pay for Contractor Work performed on Contractor requested Detours and Contractor selected haul Roads.

1404.6 CONTRACTOR'S USE OF CROSSOVERS

Unless otherwise prohibited by the Engineer and in accordance with pertinent traffic laws and regulations, the Contractor may use freeway or expressway maintenance crossovers in or near the construction area to change the travel direction of the construction equipment.

1404.7 WINTER SUSPENSION

During periods of winter suspension, the Contractor shall open the Project's Roads to traffic to eliminate the need to maintain Detour Roads during the suspension period.

During periods of authorized winter suspension, the Department will perform routine maintenance on the Project's Roads at the Department's expense. The Department will maintain traffic control devices in accordance with 1710, "Traffic Control

1407

Devices." If Contractor-owned traffic control devices are damaged or destroyed, the Department will pay the Contractor for the value of the traffic control device as determined by the Engineer.

The Contractor shall not suspend operations for the winter until meeting the requirements of 1710, "Traffic Control Devices," and 1803.6, "Temporary Suspensions."

When resuming Work after winter suspension, the Contractor shall remove and replace, or correct Work lost or damaged during the suspension, as directed by the Engineer, and shall remove, to the extent directed by the Engineer, any temporary construction or Materials used in the maintenance thereof by the Department. The Department will pay for this work at the Contract Unit Prices or as Extra Work in accordance with 1402, "Contract Revisions."

1405 USE OF MATERIALS FOUND ON THE PROJECT

The Contractor shall not destroy or use Materials found on the Right of Way or on other land acquired for the Project for any other purposes than those specified in the Contract, unless otherwise approved by the Engineer.

The Engineer may authorize the Contractor to temporarily use Materials salvaged for the Department from existing structures. The Contractor is responsible for all damage to the Materials used temporarily. The Contractor shall repair, replace, or otherwise correct by means acceptable to the Engineer the Materials damaged by the temporary use, or the Department will deduct, from any moneys due or becoming due to the Contractor, an amount equivalent to the reasonable value or replacement cost of the Material.

The Engineer may authorize the Contractor to use acceptable Material found on the Project as a substitute for Material required by the Contract and provided by the Contractor from outside sources. Authorization to remove and use the substitute Material for unspecified purposes to the Contractor's advantage is at the sole discretion of the Engineer, subject to the conditions established by the Engineer and the requirements of the Contract.

The Department will make Material found on the Project available for use on the Project to the best advantage and without charge to the Contractor in the interest of providing maximum utilization of existing Materials. The Contractor shall understand that the Department will not incur additional costs resulting from the use of this Material. If Contractor needs this Material for other construction purposes on the Project, the Contractor shall provide replacement Material acceptable to the Engineer, at no additional cost to the Department.

1406 PRESERVATION OF HISTORICAL OBJECTS

Immediately upon discovery of potential historical objects of an archeological or paleontological nature within the Project Site, the Contractor shall do the following:

- (1) Restrict or suspend operations in the immediate area of the discovery to preserve the potential historical objects, and
- (2) Notify the Engineer of the presence of potential historical objects.

The Engineer will make arrangements for their disposition or record the desired relevant data.

The Contractor shall support the preservation and salvage effort directed by the Engineer. The Contractor shall not perform work related to the preservation and salvage efforts that the Contractor considers Extra Work without the written approval of the Engineer.

The Department may restrict or suspend the Contractor's operations in the immediate area of the historical objects for a period not to exceed 72 h, without a Contractor claim for damages. The Department will not impose restrictions over 72 h, unless agreed by the Contractor and the Department in writing.

1407 FINAL CLEANUP

Before requesting final inspection in accordance with 1516.2, "Project Acceptance," the Contractor shall remove the following from the Project Site and other locations outside of the Project Site used in performing the Work:

- (1) Surplus and discarded Materials,
- (2) Equipment,
- (3) Rubbish,
- (4) Temporary structures, and
- (5) Other items not on the Project Site before execution of the Contract.

The Contractor shall also leave the Project Site, including borrow pits, in a condition acceptable to the Engineer. The cost of final cleanup is included in the Contract Unit Prices of the Contract Items.

1710.5

- (4) If using cranes or construction Equipment positioned outside of the 25 ft [7.62 m] horizontal zone having component parts that, if tipped or dropped, could damage the Railway facilities and equipment.

The Contractor shall coordinate flagging and protective services and devices with the Railway to protect Railway property, employees, trains, engines, and facilities as directed by the Railway Roadmaster during the following:

- (1) If performing excavation below the bottom of the elevation and if the Railway Roadmaster determines that the track or other Railway facilities may move or settle,
- (2) If Work interferes with the safe operation of trains at timetable speeds, and
- (3) If the presence of persons, Materials, Equipment, or blasting operations present a hazards to Railway track, communications, signal, electrical, or other facilities.

The Contractor shall obtain special permission from the Railway before moving heavy or cumbersome objects or Equipment that could render the track impassable.

Unless the Contract requires otherwise, the Department will reimburse the Railway for the costs of necessary flagging, other protective services, and devices required to protect the Railway's facilities, personnel, equipment, and traffic.

1709 NAVIGABLE WATERWAYS

The Contractor shall not interfere with free navigation of waterways or impair existing navigable depths when performing Work on navigable waters, unless approved by a permit. For information regarding permits that are required for this Work, contact the MnDOT Office of Freight and Commercial Vehicle Operations.

1710 TRAFFIC CONTROL DEVICES

1710.1 GENERAL

The Contractor shall provide traffic control devices and methods meeting the requirements of the MN MUTCD, Part I and Part II of the Minnesota Standard Signs Manuals, and the applicable Material Specifications. The Contractor shall also provide traffic control devices and methods in accordance with the following:

- (1) Reflectorize all signs, paddles, and other traffic control devices, including those used for daytime operations; and
- (2) Signs shall meet the crash testing requirements of NCHRP 350 as specified by the MN MUTCD and the Manual for Assessing Safety Hardware (MASH).

The Project Engineer may require the Contractor to provide a Letter of Compliance stating that all of the Contractors devices are NCHRP 350 compliant and also meet the requirements of MASH. The Letter of Compliance must also include approved drawings of the different signs and devices.

1710.2 PROVIDE, MAINTAIN, AND REMOVE

The Contractor shall provide and maintain traffic control devices as required by the Department in accordance with the contract and the MN MUTCD that perform the following functions:

- (1) Advise, warn, and alert the traveling public of construction in advance of the Project termini and on all Roads, Streets, and public trails approaching or crossing the Project;
- (2) Control and guide traffic through the Project, which may include using flag persons and pilot vehicles as required by the Contract; and
- (3) Protect, warn, and exclude traffic and protect workers at all work sites.

If the Contractor fails to properly provide, install, maintain, or remove any of the required traffic control devices, the Department reserves the right to correct the deficiency and to deduct the costs from any moneys due or becoming due to the Contractor in accordance with 1512, "Unacceptable and Unauthorized Work."

1710.3 PLANNED DETOURS

The Department, at its expense, will design traffic control devices necessary to control and guide traffic over planned Detours required by the Contract.

1710.4 (BLANK)

1710.5 TEMPORARY BY-PASSES

The Contractor shall construct, maintain, and remove traffic control devices on other temporary by-passes requested by the Contractor and approved by the Engineer at no additional cost to the Department.

1710.6

1710.6 CONTRACTOR'S RESPONSIBILITY

The Engineer's approval of the traffic control devices and the Contractor's method of application of traffic control measures as specified in this section will not relieve the Contractor of responsibility for protecting the work, the workers, and the traveling public in accordance with 1511, "Inspection of Work."

The Contractor shall protect traffic signs not removed or relocated by the Department before construction in their original location for the duration of the work, except as otherwise approved by the Engineer. The Contractor may adjust or remove and reset a sign interfering with construction to a temporary location, if approved by the Engineer and if the original location is not critical and the Contractor resets the sign at the permanent location as soon as construction operations allow. The Contractor shall notify the Engineer before removing or disturbing a traffic sign.

The Department will make no direct payment for removing, protecting, and replacing traffic signs as specified in this section unless provided for elsewhere in the Contract. The Department will not provide additional compensation to the Contractor for delays, inconvenience, or damage from special construction required performing the work in the presence of traffic signs.

1710.7 ENGINEER'S AUTHORITY

In accordance with 1501, "Authority of the Engineer," the Engineer will accept or reject a traffic control device provided by the Contractor, but not incorporated in the final construction, based on acceptable day and night performance.

If requested by the Engineer, the Contractor shall provide representative samples or remove traffic control devices for testing at no additional cost to the Department.

1710.8 (BLANK)

1711 USE OF EXPLOSIVES

If using explosives to complete the Work, the Contractor shall not endanger life, property, or new Project Work. The Contractor is responsible for property damage, personal injury, and death resulting from the use of explosives.

The Contractor shall use explosives, securely store explosives, and mark explosive storage locations in accordance with applicable laws. If laws do not identify storage requirements, the Contractor shall store explosives at least 1,000 ft [300 m] away from the Road or from places of human occupancy, and as approved by the Engineer.

The Contractor shall notify property owners and public utility companies in the vicinity of the proposed detonation before using explosives to allow the property owners and public utility companies to protect property.

The Department advises the Contractor of the potential hazard of premature explosion of electric blasting caps due to propagation of radio frequency energy by transmitters of radio and related services such as television, radar, and wireless communications. The Contractor shall provide advance notification of blasting operations and any other precautions in accordance with Minnesota Rule 7500.1200.

1712 PROTECTION AND RESTORATION OF PROPERTY

1712.1 PROPERTY

The Contractor is responsible for the preservation of all public and private property of any character in performing the Work.

A Monuments

The Contractor shall preserve all land and property corner monuments, Right Of Way monuments, and vertical and horizontal control point monuments indicated in the Contract or provided in writing by the Engineer before the start of Work in the vicinity of the monument. If the Engineer determines that a monument designated for preservation was disturbed during construction activities, the Department will deduct a charge of \$1,000.00 per monument from the moneys due or becoming due the Contractor. The Engineer will determine the number of monuments disturbed or destroyed by the Contractor. If the Engineer determines that a monument requires removal to allow construction, the Department will not deduct the charge of \$1,000.00 per monument from moneys due or becoming due the Contractor.

B Utilities1507

C Protection and Restoration of Vegetation2572

D Preservation of Historical Objects1406

1712.2 ADVANCE NOTICE

The Contractor shall give advance notice to the owners of all private property where the Contractor's operations will interfere with the property. The notice shall advise the private property owners of the nature of the interference and indicate the Contractor's intention to arrange for the protection of their property.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

A section of Division I that all designers need to be particularly aware of is shown in .

Exhibit 6-2 Spec Book 1504, Coordination of Contract Documents

1504 COORDINATION OF CONTRACT DOCUMENTS
 A requirement appearing in one of the Contract documents is as binding as though the requirement appears in all. If discrepancies exist between the Contract documents, the following order of precedence applies:

- (1) Addenda,
- (2) Special Provisions,
- (3) Project-Specific Plan Sheets,
- (4) Supplemental Specifications,
- (5) Standard Plan Sheets and Standard Plates,
- (6) Standard Specifications.

If discrepancies exist between dimensions in the Contract documents, the following order of precedence applies:

- (1) Plan dimensions,
- (2) Calculated dimensions,
- (3) Scaled dimensions.

The Department and Contractor shall inform each other as to any discrepancy or defect they discover. Neither the Contractor nor the Engineer shall take advantage of any discrepancy or defect. The Engineer will review the alleged discrepancy or defect to determine if a contract revision is necessary in accordance with 1402, "Contract Revisions." The Engineer will decide all issues concerning a discrepancy or defect.

DIVISION II — Construction Details

Each Division II Specification number begins with "2" (2021 - 2582) and as in Division I, each section is given a numeric series. This Division is divided into six sections:

1. General (2021 - 2051)
2. Grading (2101 - 2131)
3. Pavement Marking Removal (2102)
4. Base Construction (2211- 2232)
5. Pavement Construction (2301 - 2399)
6. Bridges and Structures (2401 - 2481)
7. Miscellaneous (2501 - 2582)

Each section is generally divided into the following sections:

1. Description
2. Materials
3. Construction Requirements
4. Method of Measurement
5. Basis of Payment

6.1.2 DIVISION III — Materials

Each Division III Specification number begins with "3" (3101 - 3973) and as in Divisions I and II, each section is given a numeric series. This Division is divided into eighteen sections. Division II cross references various sections of this Division.

6.2 MnDOT Contract Proposal

6.2.1 Contents

Each MnDOT project has a proposal. The proposal contains items such as:

- ✓ Addendums
- ✓ Notices to Bidders
- ✓ Appendices
- ✓ Special Provisions (by division, for example: Division A, Divisions S, Division SS, Division SL, Division ST, etc.)
- ✓ Attachments
- ✓ Contract Schedule (Bid Prices)

6.3 Special Provisions

Special Provisions are defined as:

“Additions and revisions to the Standard and Supplemental Specifications covering conditions peculiar to an individual project.”

Special Provisions are just that: **“SPECIAL”** provisions. If an item(s) is adequately addressed or specified in the Spec Book, Standard Plates, Plan, or other Contract documents, then that item(s) should not be duplicated within the Special Provisions.

Topics that are always covered by Special Provisions include:

- ✓ Construction Start Dates
- ✓ Completion Dates
- ✓ Traffic Control
- ✓ Special Pay Items (those where the digit after the period is a '6')

The Special Provisions need to cover every special pay item from the Plan. A special pay item is any item whose fifth digit is a '6' (this is the digit after the period). If the Spec. Book adequately described the work to be done, and what is included in the item, then all that is needed is how the item is to be measured and paid for.

Division S is for general projects. Special Provisions may be formatted into more than one S section. For example:

Time and Traffic (Division S)

- ✓ S-1 Contact Information
- ✓ S-2 (1404) Maintenance of Traffic and (2563) Traffic Control
- ✓ S-3 (1710) Traffic Control Devices
- ✓ S-4 (1806) Determination and Extension of Contract Time
- ✓ S-5 (1807) Failure to Complete The Work on Time
- ✓ S-6 (2563) Traffic Control Supervisor

A typical set of Special Provisions are formatted similar to the Spec Book; however, the actual format of the Special Provisions may vary somewhat when compared to the Spec Book format. The following sections can be found in the Special Provisions:

- ✓ Opening Descriptive Paragraph
- ✓ General Section
- ✓ Materials
- ✓ Construction Requirements
- ✓ Measurement and Payment

Special Provisions may also include detail drawings that are pertinent to the specific project.

6.3.1 Special Provision Boiler Plates

Standard special provisions have been developed for use on MnDOT Construction projects. These can be obtained from the following website:

www.dot.state.mn.us/pre-letting/prov/

The following is a handout of the “boilerplate” for:

- ✓ Time & Traffic Provisions
 - (1404) MAINTENANCE OF TRAFFIC
 - (1803) LIMITATION OF OPERATIONS - NIGHT CONSTRUCTION
 - (1806) DETERMINATION AND EXTENSION OF CONTRACT TIME
 - (1806) DETERMINATION AND EXTENSION OF CONTRACT TIME (LANDSCAPING)
 - (1807) FAILURE TO COMPLETE THE WORK ON TIME
 - (2102) PAVEMENT MARKING REMOVAL
 - (2563) TRAFFIC CONTROL SUPERVISOR
 - (2563) INTELLIGENT WORK ZONE SYSTEM
 - (2563) ALTERNATE PEDESTRIAN ROUTE
 - (2563) WORKERS PRESENT SPEED LIMIT
 - (2563) TRUCK/TRAILER MOUNTED IMPACT ATTENUATOR (TMA)
 - (2582) TEMPORARY PAVEMENT MARKINGS
- ✓ Boiler Plate SP2016
 - (2554) TRAFFIC BARRIERS
 - (2557) FLEXIBLE PLASTIC GLARE SCREEN

HANDOUT

Time and Traffic Provisions (tamdt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

Created August 20, 2015
 Page 5

S.P. Number of Your Job goes here

Failure to complete the work within the established number of Calendar Days stated by the Contractor will be subject to monetary deductions and/or damages as shown in Section **S-1807** (FAILURE TO COMPLETE THE WORK ON TIME) of these Special Provisions.

Use the following clause only if you are including an incentive for early completion.

S-3.6

INCENTIVE

In the event that the Completion of Work as defined in Section **S-X.2** of this Special Provision is completed in advance of established number of Calendar Days stated by the Contractor in Item 2016.621 (Contract Time), payment otherwise due in the Contract will be adjusted with an incentive as shown in Section **S-1806** (DETERMINATION OF CONTRACT TIME) of these Special Provisions.

S-4

(1404) MAINTENANCE OF TRAFFIC AND (2563) TRAFFIC CONTROL
The following write-up was created by the Traffic Control Specification Review Committee. Whoever in the District is putting together the time and traffic for the job, needs to go through the following write-up and pick and choose which portions are needed on the job.
THE SPECIAL PROVISIONS UNIT CAN NOT DO THIS FOR YOU.
REVISED 01/12/17 ▲DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS
 SP2016-18

All traffic control devices shall conform and be installed in accordance to:

- the "Minnesota Manual on Uniform Traffic Control Devices" (MN MUTCD);
- Part 6, "Field Manual for Temporary Traffic Control Zone Layouts" (Field Manual);
- the Speed Limits in Work Zones Guideline
- the Minnesota Flagger Handbook;
- the MnDOT Standard Signs and Markings Manual;

And the provisions of MnDOT 1404 and 1710, the Plan, and these Special Provisions.

The Contractor shall furnish, install, maintain, and remove all traffic control devices required to provide safe movement of vehicular traffic through the Project during the life of the Contract from the start of Contract operations to the completion thereof. The Engineer will have the right to modify the requirements for traffic control as deemed necessary due to existing field conditions. The highways shall be kept open to traffic at all times, except as modified below.

Traffic control devices include, but are not limited to, barricades, warning signs, trailers, flashers, cones, and drums, as required and sufficient barricade ballasts to maintain barricade stability.

Use the following paragraph on jobs that have FEDERAL FUNDING on them.

The Contractor is advised of the changes to the Prevailing Wage Coverage as noted in the Notice to Bidders – Traffic Control Prevailing Wage Coverage contained in the front of this Proposal.

S-4.1

TRAFFIC CONTROL

- (A) If traffic control layouts are not present in the Plan, or if the Contractor modifies the layout or sequence from the Plan, the Contractor shall submit the proposed traffic control layout to the Engineer, for approval, at least seven (7) days prior to the start of construction. The Contractor does not need to submit layouts that can be found in the Field Manual. All other layouts that are not found in the plan or Field Manual shall be submitted. At least 24 hours prior to placement, all traffic control devices shall be available on the Project for inspection by the Engineer. The Contractor shall modify his/her proposed traffic control layout and/or devices as deemed necessary by the Engineer.

HANDOUT

Time and Traffic Provisions (tamdt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

Created August 20, 2015
 Page 6

S.P. Number of Your Job goes here

(B) The Contractor shall be responsible for the immediate repair or replacement of all traffic control devices that become damaged, moved or destroyed, of all lights that cease to function properly, and of all barricade ballasts that are damaged, destroyed, or otherwise fail to stabilize the barricades. The Contractor shall further provide sufficient surveillance of all traffic control devices at least once every 24 hours.

Choose one of the following:

The Contractor shall furnish the Engineer names, addresses and phone numbers of at least two (2) local persons responsible for all traffic control devices.

OR

The Contractor shall furnish names, addresses, and phone numbers of at least three (3) individuals responsible for the placement and maintenance of traffic control devices. These individuals shall be "on call" 24 hours per day, seven days per week during the times any traffic control devices, furnished and installed by the Contractor, are in place. The required information shall be submitted to the Engineer at the Pre-construction Conference.

(C) The Contractor shall inspect, on a daily basis, all traffic control devices, which the Contractor has furnished and installed, and verify that the devices are placed in accordance with the **Traffic Control Layouts**, these Special Provisions, and/or the MN MUTCD. Any discrepancy between the placement and the required placement shall be immediately corrected.

The Contractor shall be required to respond immediately to any call from the Engineer or his designated representative concerning any request for improving or correcting traffic control devices. **If the Contractor is negligent in correcting the deficiency within one hour of notification the Contractor shall be subject to an hourly charge assessed at a rate of \$250.00 per hour for each hour or any portion thereof with which the Engineer determines that the Contractor has not complied.**

The Contractor is required to meet the traffic control device quality standards as determined in the Field Manual. The Contractor shall immediately replace traffic control devices that are deemed unacceptable. Signs that are dirty and result in a noticeable loss of reflectivity at night are also considered unacceptable and shall be cleaned or replaced. The Contractor shall be required to respond immediately to any call from the Engineer or his designated representative concerning the notification of unacceptable traffic control devices. **If the Contractor is negligent in correcting the deficiency within one day of notification the Contractor shall be subject to a daily charge assessed at a rate of \$500 for each day or any portion thereof with which the Engineer determines that the Contractor has not complied.**

(D) The person performing the inspection in paragraph (C) above shall be required to make a daily log. This log shall also include the date and time any changes in the stages, phases, or portions thereof go into effect. The log shall identify the location and verify that the devices are placed as directed or corrected in accordance with the Plan. All entries in the log shall include the date and time of the entry and be signed by the person making the inspection. The Engineer reserves the right to request copies of the inspection logs, as he deems necessary.

The Contractor shall provide copies of the inspection logs on a weekly basis on a day of the week determined by the Engineer. Additionally, the Engineer may request copies of the logs at any time he deems necessary. **If the Contractor is negligent in providing the inspection logs on the predetermined weekly date or at the Engineer's request, the Contractor shall be subject to a daily charge assessed at a rate of \$250.00 per day for each day or any portion thereof with which the Engineer determines that the Contractor has not complied.**

HANDOUT

HANDOUT

S.P. Number of Your Job goes here

(E) If, at any time, the Contractor fails to, in a timely manner, properly furnish, install, maintain or remove any of the required traffic control devices, the Department reserves the right to correct the deficiency. **Each time the Department takes such corrective action, the costs thereof, including mobilization, plus \$5,000 will be deducted from monies due or coming due to the Contractor.**

S-4.2 GENERAL REQUIREMENTS

(A) All portable sign assemblies shall be perpendicular to the ground. No roll-up signs will be allowed unless authorized by the Engineer. No traffic control device (signs, channelizing devices, arrowboards, etc.) shall be weighted so they become hazardous to motorists and workers. The approved ballast system for devices mounted on temporary portable supports is sandbags, unless it is designed, crash tested, and approved for the specific device. During freezing conditions, the sand for bags shall be mixed with a de-icer to prevent the sand from freezing. The sandbags shall be placed and maintained at the base of the traffic control device to the satisfaction of the Engineer.

When signs will remain in the same location for more than 30 consecutive days the signs shall be post mounted. This would not include portable signs, which are set up and taken down at the beginning and end of each work shift. The signs must be post mounted according to the Typical Temporary Sign Framing and Installation Detail Sheet found in the Plan or in these Special Provisions.

(B) When signs are installed, they shall be mounted on posts driven into the ground at the proper height and lateral offset as detailed in the MN MUTCD. **When signs are removed, the sign posts and stub posts shall also be removed from the Right of Way within two (2) weeks or the Contractor shall be subject to a daily charge assessed at a rate of \$100.00 per day for each day or portion thereof with which the Engineer determines that the Contractor has not complied.**

(C) All temporary rigid signs shall be fabricated with an approved retroreflective sheeting material of the appropriate color, and be listed under the Approved/Qualified Products List (APL/QPL) for either "Sheeting for Rigid Temporary Work Zone Signs, Delineators, and Markers (Type IX and XI)" or "Sheeting for Rigid Permanent Signs, Delineators, and Markers (Type IX and XI)". Signs remaining in place that still apply during temporary operations need no change in sign sheeting.

Signs shall have an easily identifiable marking on the face to make the identification of approved retroreflective sign sheeting on temporary rigid signs in the field easier. This marking verifies that the sign sheeting has been approved for temporary rigid signs. Temporary rigid signs 4 sq. feet and under in size and all barricades and route markers will be exempt from this marking. The appropriate marking shall be used for each type of the approved sheeting types. Refer to the instructions for the marking of temporary signs that are on the APL or directly at the following link: <http://www.dot.state.mn.us/products/signing/pdf/typeIabel.pdf>

The sheeting materials APL/QPL, including the retroreflective sheeting types, is located at <http://www.dot.state.mn.us/products/signing/sheeting.html>

Fill in the blanks in the following paragraph.

(D) At the beginning of the Project, the Contractor shall store at least [] extra Type III barricades and [] extra retroreflective drums, at a convenient location within the Project limits, to be used at the discretion of the Engineer. Furnishing and erecting these traffic control devices shall be incidental.

If additional devices, beyond the quantity specified above, are ordered by the Engineer the Contractor will be compensated according to Section **S-1404.10** (ADDITIONAL TRAFFIC CONTROL DEVICES AND EXTENDED USE OF TRAFFIC CONTROL DEVICES) of this Special Provision.

Districts should use the following to designate which operations, if any, will be allowed to utilize the Type A channelizers instead of barrels.

S.P. Number of Your Job goes here

(E) On [] operations, weighted channelizers (Type A) may be used in place of drums (Type B) for delineation in non-transition areas and may also be used to delineate the edge of a pavement drop-off of 4 inches or less. Except as authorized by the Engineer, these devices will only be allowed during daytime operations and cannot be used in unattended work zones.

On [] operations, 36 inch tubular markers (Type A) may be used in place of drums (Type B) for delineation in non-transition areas or to delineate the edge of pavement drop-off of 4 inches or less. Except as authorized by the Engineer, these devices will only be allowed during daytime operations and cannot be used in unattended work zones.

Use (F) only if it applies to the Project!

(F) **In Place Signing**

All in place signs and delineators mounted on less than three posts (not including back bracing) and which interfere with the Contractor's normal operation, shall be relocated outside of the work area by the Contractor at the direction of the Engineer. Any signs that are removed and might be reused are to be stored in such a manner as to protect the sign from scratching, fading, or other harmful results until said signs are reinstalled or delivered to MnDOT. All signs mounted on three or more posts requiring relocation will be relocated by State forces. The Contractor shall notify the Engineer **xxx** Working Days prior to the required relocation work. Signs mounted on three or more posts that must be removed but not relocated shall be removed by the Contractor. Upon completion of work at each sign location, or at the direction of the Engineer, the signs shall be replaced as near to their original locations as possible or to a location designated by the Engineer. Signs and structures damaged by the Contractor shall be replaced by him at his own expense. Regulatory signs, not otherwise covered by this Contract, may only be removed, replaced, or relocated by MnDOT personnel.

All costs incurred to relocate, salvage, and reinstall in place signing shall be incidental work.

OR

(F) **In Place Signing**

All in place signs and delineators that interfere with the Contractor's normal operation shall be relocated outside of the work area or removed by the Contractor at the direction of the Engineer. **This includes any other sign that interfere with the Contractor's operation.** Signs that are removed and will be reused are to be stored in such a manner as to protect the sign from scratching, fading, or other harmful effects until said signs are reinstalled. Upon completion of work at each sign location, or at the direction of the Engineer, the signs shall be replaced as near to their original locations as possible or to a location designated by the Engineer. **Signs and structures damaged by the Contractor shall be replaced by him at his own expense.**

The reinstalled sign posts shall be plumb and the sign panels shall be level. The minimum mounting height shall be 7 feet above the elevation of the traveled roadway. The minimum embedment length of the stub posts shall be 3.5 feet. The splice between the stub post and the riser post shall be a minimum of 12 inches. **The Contractor will be assessed a \$100 charge for each sign that does not comply with the In Place Signing requirements. In addition the Contractor will be required to correct the deficiency at his own cost within 2 weeks of being notified by MnDOT. If the deficiency has not been corrected within 2 weeks, the Contractor will be charged \$50 per sign per day until the deficiency has been corrected.**

All costs incurred to relocate, salvage, and reinstall in place signing shall be incidental.

(G) Open excavation adjacent to the existing pavement will not be permitted on opposite sides of the roadway at the same time.

(H) **The Contractor shall provide protective devices necessary to protect traffic from excavations, drop-offs, falling objects, splatter or other hazards that may exist during construction. This work shall be incidental.** The Contractor will not be allowed to suspend material, equipment, tools and personnel

HANDOUT

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 9
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

S.P. Number of Your Job goes here

over traffic unless a lane closure is established below. All costs associated with the lane closure will be considered incidental.

(I) The Contractor will not be permitted to park vehicles or construction equipment in a location that obstructs any traffic control device. The parking of workers' private vehicles will not be allowed within the Project limits unless so approved by the Engineer.

Optional: Use this paragraph when you do not want the Contractor unloading or loading equipment without a full shoulder closure.

Note 1 of Layout 2 of the Field Manual is hereby deleted. The Contractor will not be allowed to load or unload material or equipment on the shoulders of the roadway without a full shoulder closure using appropriate signs, barricades and channelizing devices as directed by the Engineer.

(J) The Contractor will not be allowed to store materials or equipment within 30 feet of through traffic unless approved by the Engineer. If materials or equipment must be stored within 30 feet of through traffic, the Contractor shall provide Type B channelizers, barricades or barriers, placed near the object to warn and protect traffic.

(K) High Visibility Apparel

All workers within the road Right-of-Way who are exposed to either traffic or to construction equipment shall wear reflectorized high-visibility safety apparel.

High-visibility safety apparel means personal protective clothing that is intended to provide conspicuity during both daytime and nighttime usage, and meets the minimum performance Class 2 requirements of the ANSI/ISEA 107 – 2004 publication entitled "American National Standard for High-Visibility Safety Apparel and Headwear".

Long Pants) Additional Requirements: ANSI/ISEA 107-2004 Class 3 Requirements (Class 2 Vest with Class E

- **Flaggers**—In addition to an ANSI Class 2 vest, shirt, or jacket, flagger shall wear high visibility Class E long pants and a hat.
- **Nighttime and Low Light Conditions** – All workers working at night or in low light conditions shall wear high visibility Class E long pants in addition to an ANSI Class 2 vest, shirt, or jacket and retro-reflective headgear.

All high visibility apparel must be worn in the manner for which it was designed. All apparel worn on the torso must be closed in the front to provide contiguous 360 degree visibility. If a worker's high-visibility apparel becomes faded, worn, torn, dirty, or defaced, reducing the conspicuity of the apparel, the apparel shall be removed from service and replaced with new apparel.

The Contractor will be subject to a non-compliant charge for failure to adhere to the clothing requirements as listed above. Non-compliance charges, for each incident, will be assessed at a rate of **\$500.00 per incident** that the Engineer determines that the Contractor has not complied.

(L) Night Work

When work will be performed between the official hours of sunset and sunrise, all appropriate practices for night work will apply.

The Contractor shall provide sufficient numbers of light plants to illuminate the work area as determined by the Engineer. All costs incurred to provide such light plants shall be incidental.

HANDOUT

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 10
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

S.P. Number of Your Job goes here

The Contractor shall provide a sufficient amount of 2 inch wide highly reflective vehicle marking tape to be applied to Contractor vehicles and equipment. This tape shall be considered incidental and shall be on the Approved Products List for "Conspicuity Vehicle Sheetting (Type VII)" as found at: <http://www.dot.state.mn.us/products/signing/sheetting.html>. Vehicle examples to be marked with tape are Contractor rollers, pavers, millers and other equipment normally found in the lane closure.

The State will assess monetary deductions in the amount of **\$1000.00 for each Calendar Day** or portion thereof, that the Contractor fails to provide sufficient numbers of light plants as described in this Section **S-2563**. As light plants may be dedicated or otherwise made available to the Project, this assessment will be chargeable even if reasons beyond the control of the Contractor such as breakdowns, late delivery of materials, weather delays, or other unanticipated problems cause the work to be accomplished in non-daylight hours.

Use (M) when there is a pay item for Workers Present Speed Limit

(M) Workers Present Speed Limit

A "Workers Present Speed Limit" will be required on this project at all times that lane closures are in use and workers are present in the lane adjacent to through traffic. Provide speed limits signs and assemblies in accordance with the "Speed Limits in Work Zone Guidelines." This publication may be obtained from the Office of Traffic, Safety and Technology, the District Traffic Engineer or at the following website: <http://www.dot.state.mn.us/speed/pd/WZSpeedLimitGuideLine.pdf>.

Payment for workers present speed limits will be made by the Unit Day as provided in Section **S-2563 (WORKERS PRESENT SPEED LIMIT)** of these Special Provisions.

OR

All costs incurred to provide workers present speed limits shall be incidental.

(N) The Contractor shall provide a Traffic Control Supervisor. Payment and measurement will be made as provided in Section **S-2566 (TRAFFIC CONTROL SUPERVISOR)** of these Special Provisions.

(O) In temporary traffic control zones only, a 12" x 18" black on white "Keep Right" sign, may be used in lieu of the sizes stated in the Standard Signs Manual.

S-4.3 VEHICLE WARNING LIGHT SPECIFICATION

All Contractors, subcontractors and suppliers mobile equipment, operating within the limits of the Project with potential exposure to passing traffic, shall be equipped with operable warning lights that meet the appropriate requirements of the SAE specifications. This would include closed roads that are open to local traffic only. This also includes any vehicle that enters the traveled roadway at any time. The SAE specification requirements are as follows:

Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles- SAE Specification 1845

Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles - SAE Specification 1595

Lights shall be mounted so that at least one light is visible at all times from a height of 3.5 feet and from a 60 foot radius about the equipment. In order to meet the 360 degree at 60 foot radius requirements supplemental lighting may be used in addition to the lights on the Approved Products List. All supplemental lights must be SAE Class 1 certified. This specification is to be used for both day and night time operations. All costs incurred to provide warning lights shall be at no cost to the Department. These warning lights shall also be operating and visible when a vehicle decelerates to enter a construction work zone and again when a vehicle leaves the work zone and enters the traveled traffic lane.

HANDOUT

Non-compliance with the above requirements will be assessed a rate of \$100.00 per incident that the Engineer determines that the Contractor has not complied.

S-4-4 LANE CLOSURE REQUIREMENTS

Use only the paragraphs that apply to this Project!

Use for Metro District

(A) Temporary lane closures or other traffic restrictions by the Contractor, during work hours and consistent with the time restrictions, will be permitted only during those hours and at those locations approved by the Engineer. Requests for temporary lane closures shall be made at least 2 business days prior to the closure. When a temporary lane closure is used by the Contractor, the closure shall be incidental work.

The Contractor shall contact the Regional Transportation Management Center (RTMC) at 651-234-7093 at the time when a freeway lane or ramp closure begins and again at the time when the freeway lane or ramp closure ends. The Contractor shall also contact the RTMC at the beginning and end times of full freeway roadway closures.

Use for all Districts, except Metro

(A) Temporary lane closures or other traffic restrictions by the Contractor, during work hours and consistent with the time restrictions, will be permitted only during those hours and at those locations approved by the Engineer. Requests for temporary lane closures shall be made at least 24 hours prior to such closures. When a temporary lane closure is used by the Contractor, the closure shall be incidental work.

Choose the appropriate (B)

Use for Metrowide projects and/or projects with multiple locations.

(B) Temporary lane restrictions will only be allowed as described in 1) and 2) below. If 1) and 2) conflict, the more restrictive condition will apply.

(1) Work that will restrict or interfere with traffic will not be permitted between the hours of _____ A.M. and _____ A.M. and between the hours of _____ P.M. and _____ P.M. Work that will restrict or interfere with traffic shall not be performed between 12:00 noon on the day preceding and 9:00 A.M. on the day following any consecutive combination of a Saturday, Sunday and legal holiday.

(2) Temporary lane closures will be permitted in accordance with the hours and number of lanes allowed as indicated in the Metro Lane Closure Manual, <http://www.dot.state.mn.us/metro/trafficlane/closure/index.html>. Lane closures that cross segments as defined in the Manual shall follow the more restrictive limits.

The Engineer will have the right to lengthen, shorten, or otherwise modify the foregoing periods of restrictions as actual traffic conditions may warrant. If the Contractor is negligent in adhering to the established time schedules, he shall be subject to an hourly charge assessed at a rate of \$500.00 per hour for each hour or any portion thereof with which the Engineer determines that the Contractor has not complied.

OR

(B) Work that will restrict or interfere with traffic will not be permitted between the hours of _____ A.M. and _____ A.M. and between the hours of _____ P.M. and _____ P.M. Work that will restrict or interfere with traffic shall not be performed between 12:00 noon on the day preceding and 9:00 A.M. on the day following any consecutive combination of a Saturday, Sunday and legal holiday. The Engineer will have the right to

lengthen, shorten, or otherwise modify the foregoing periods of restrictions as actual traffic conditions may warrant. If the Contractor is negligent in adhering to the established time schedules, he shall be subject to an hourly charge assessed at a rate of \$500.00 per hour for each hour or any portion thereof with which the Engineer determines that the Contractor has not complied

OR

(B) Temporary lane closures will be permitted in accordance with the hours and number of lanes allowed as indicated in the Metro Lane Closure Manual, <http://www.dot.state.mn.us/metro/trafficlane/closure/index.html>. Lane closures that cross segments as defined in the Manual shall follow the more restrictive limits. The Engineer will have the right to lengthen, shorten, or otherwise modify the foregoing periods of restrictions as actual traffic conditions may warrant. If the Contractor is negligent in adhering to the established time schedules, he shall be subject to an hourly charge assessed at a rate of \$500.00 per hour for each hour or any portion thereof with which the Engineer determines that the Contractor has not complied.

OR

(B) Temporary lane closures or other traffic restrictions will only be permitted between the official hours of sunrise and sunset. Work that will restrict or interfere with traffic shall not be performed between 12:00 noon on the day preceding and 9:00 A.M. on the day following any consecutive combination of a Saturday, Sunday and legal holiday. The Engineer will have the right to lengthen, shorten, or otherwise modify the foregoing periods of restrictions as actual traffic conditions may warrant. If the Contractor is negligent in adhering to the established time schedules, he shall be subject to an hourly charge assessed at a rate of \$500.00 per hour for each hour or any portion thereof with which the Engineer determines that the Contractor has not complied.

OR

(B) The Contractor shall maintain traffic as follows at the locations and times listed below:

THERE SHALL BE NO INTERFERENCE WITH TRAFFIC AT THE FOLLOWING LOCATIONS AND TIMES (24 HOUR CLOCK):

T.H. (direction)	Location	Sun.	Mon.	T, W, Th	Fri.	Sat.

The Engineer will have the right to lengthen, shorten, or otherwise modify the foregoing periods of restrictions as actual traffic conditions may warrant. If the Contractor is negligent in adhering to the established time schedules, he shall be subject to an hourly charge assessed at a rate of \$500.00 per hour for each hour or any portion thereof with which the Engineer determines that the Contractor has not complied.

OR

(B) Insert TMC Chart here

The Engineer will have the right to lengthen, shorten, or otherwise modify the foregoing periods of restrictions as actual traffic conditions may warrant. If the Contractor is negligent in adhering to the established time schedules, he shall be subject to an hourly charge assessed at a rate of \$500.00 per hour for each hour or any portion thereof with which the Engineer determines that the Contractor has not complied.

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

Created August 20, 2015
 Page 13

S.P. Number of Your Job goes here

(C) Unless otherwise approved by the Engineer, any temporary lane closure that is adjacent to traffic, and is extending to or beyond 1,000 feet shall have a minimum of one Type III barricade, or three drums, placed in the closed lane for every 1,000 feet of extension. Any lane closure that is adjacent to traffic and in place 3 days or more, shall use the Type III barricade only.

(D) All lane closures shall have Drum (Type B) Channelizers with fluorescent reflectorized sheeting in the lane closure taper and in any shifts in traffic alignment.

(E) Short Term Duration lane closures will not be permitted during inclement weather, nor any other time when, in the opinion of the Engineer, the lane closure will be a greater than normal hazard to traffic.

Optional: Use this paragraph when there will be work performed in areas that have minimal shoulder or median widths and high speeds and volumes.

(F) When working on the shoulder or median the Contractor shall only perform this work using a lane closure on mainline and adhering to the above lane closure restrictions.

OR

When working on the shoulder or median the Contractor shall install the traffic control according to Layout 2 (Work on Shoulder) of the Field Manual. Notes 1 and 2 are deleted on Layout 2.

(G) Temporary lane restrictions and/or closures for removing and/or erecting overhead structures are permitted between the hours of **5:00** A.M. and **5:00** A.M. as approved by the Engineer. If the Contractor requests to close the road and the Engineer approves that it is necessary to temporarily detour traffic in order to remove or set the structures, the Contractor shall furnish the detour as directed by the Engineer. The temporary detour shall be incidental work. **If the Contractor is negligent in adhering to the established time schedules, he shall be subject to an hourly charge assessed at a rate of \$1500.00 per hour for each hour or any portion thereof with which the Engineer determines that the Contractor has not complied.**

The Contractor may stop all traffic on any road open to traffic to erect or remove overhead structures for periods not to exceed fifteen minutes only from 1:30 A.M. to 5:00 A.M. The Contractor shall allow sufficient clearance time between stopped periods to minimize the delay to traffic. **If the Contractor is negligent in adhering to the established time schedules, he shall be subject to an hourly charge assessed at a rate of \$1500.00 per hour for each hour or any portion thereof with which the Engineer determines that the Contractor has not complied.**

(H) No center lane closures will be permitted. Only double lane closures as shown in the Field Manual will be allowed at the times as directed by the Engineer. This may require night lane closures if traffic volumes warrant.

(I) The Contractor shall maintain a minimum of 1.25 miles (two km) between temporary lane closures, except if allowed by the Engineer.

(J) Flashing Arrow Boards

The Contractor shall provide one vehicle or trailer mounted flashing arrow board for each lane of each work area where traffic is restricted. The arrow board shall meet the requirements of the MN MUTCD, and be on the Temporary Traffic Control Electronic Equipment Approved/Qualified Products List for "Flashing Arrow Boards" found at: <http://www.dot.state.mn.us/products/temporarytrafficcontrol/ecelectroniccequipment.html>. The flashing arrow board shall be equipped with a light that is visible to personnel in the work area to indicate that the unit is in operation. All costs incurred to provide the flashing arrow board shall be incidental.

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

Created August 20, 2015
 Page 14

S.P. Number of Your Job goes here

It is imperative that the Contractor continually operate each Flashing Arrow Board at maximum legibility. Many factors, such as mechanical problems, insufficient charging, incorrect intensity settings, or other factors can degrade performance.

The Flashing Arrow Board shall be stored off the shoulder when not in use, except if allowed by the Engineer. In the event the Engineer allows the arrow board to remain on the shoulder, the arrow board shall be delineated according to Layout 4 (Partial Shoulder Closure) in the Field Manual, as determined by the Engineer.

When not being actively used as a traffic control device, the Flashing Arrow Board shall be stored beyond the clear zone distance. **Non-compliant charges, for each incident, will be assessed at a rate of \$500.00 per incident that the Engineer determines that the Contractor has not complied.**

Use (K) when portable changeable message sign is required

(K) Portable Changeable Message Signs

The Contractor will provide a Portable Changeable Message sign (s) on this project to communicate real time information as shown in the plans or directed by the Engineer.

(PCMS) Type C Trailer Mounted Message Signs will be permitted and shall be on the Approved Products List for "Changeable Message Signs: Type C - Three Lines, Trailer Mounted" as found at: <http://www.dot.state.mn.us/products/temporarytrafficcontrol/ecelectroniccequipment.html>. It is imperative that the Contractor continually operate each PCMS at maximum legibility. Many factors, such as mechanical problems, insufficient charging, incorrect intensity settings, or other factors can degrade performance. If at any time the Contractor fails to operate a Portable Changeable Message Sign at maximum legibility, as determined by the Engineer, no payment will be made for each day that the Message Sign is deemed inadequate.

Except as approved by the Engineer, the message sign shall be stored off the shoulder when not in use. In the event the Engineer allows the message board to remain on the shoulder the message sign shall be delineated according to Layout 4 (Partial Shoulder Closure) in the Field Manual, as determined by the Engineer.

When not being actively used as a traffic control device, the Portable Changeable Message Sign shall be stored beyond the clear zone distance. **Non-compliant charges, for each incident, will be assessed at a rate of \$500.00 per incident that the Engineer determines that the Contractor has not complied.**

Payment for Portable Changeable Message Signs furnished and installed, as directed by the Engineer, will be made for each PCMS by the Unit Day as specified in Section S-2563 (PORTABLE CHANGEABLE MESSAGE SIGN) of these Special Provisions.

(L) Truck/Trailer Mounted Attenuators (TMAs) For Mobile Operations

If the Contractor establishes any temporary traffic control zone defined as "Mobile" by the Field Manual: Truck/Trailer Mounted Attenuators (TMA) SHALL be used on all work vehicles or equipment operating totally or partially in the traffic lane. All references to "should" in the Field Manual in regards TMA use for Mobile layouts are hereby changed to "shall". The truck mounted attenuator shall meet the requirements of NCHRP 350 or AASHTO's Manual for Assessing Safety Hardware (MASH). If on a high-speed roadway, the TMA shall meet Test Level 3 requirements.

(1) If any work vehicle, equipment or manual work zone is not equipped with a TMA, a shadow vehicle equipped with a TMA shall be utilized in lieu thereof. The TMA mounted shadow vehicle shall maintain a minimum distance as per manufacturers specifications from any operation that is otherwise unprotected by a TMA.

(2) This requirement shall apply to all operations utilizing a Mobile work zone; including, but not limited to interim and permanent traffic striping and marking, stripe removal,

HANDOUT

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

Created August 20, 2015
 Page 15

S.P. Number of Your Job goes here

rubble strip grinding, bituminous core cutting, running of the profilograph, and any other operations meeting the criteria for Mobile operations, as shown in the Field Manual.

Any Truck/Trailer Mounted Attenuators used shall be on the Mobile Crash Attenuator Approved/Qualified Products List for "Truck/Trailer Mounted Attenuators" found at: <http://www.dot.state.mn.us/products/temporartafficcontrol/mobilecrashattenuators.html>

If any work vehicle, equipment or manual work zone is not equipped with a TMA, a shadow vehicle equipped with a TMA shall be utilized in lieu thereof. The TMA mounted shadow vehicle shall maintain a minimum distance of 200 and maximum distance of 300 feet from any operation that is otherwise unprotected by a TMA.

This requirement shall apply to all operations utilizing a Mobile work zone; including, but not limited to interim and permanent traffic striping and marking, stripe removal, rumble strip grinding, bituminous core cutting, running of the profilograph, and any other operations meeting the criteria for Mobile operations, as shown in the Field Manual.

Payment for Truck Mounted Attenuator (TMAs), as directed by the Engineer, will be made for each Truck/Trailer Mounted Attenuator by the Unit Day as specified in Section **S-2563** (TRUCK/TRAILER MOUNTED IMPACT ATTENUATOR (TMA)) of these Special Provisions.

S-4-5 FLAGGER TRAINING AND REQUIREMENTS

(A) Any person acting as a flagger on this Project shall have attended a training session taught by a Contractor's qualified trainer. The Contractor's qualified trainer shall have completed a "MnDOT Flagger Train the Trainer Session" in the five years before the start date of this Contract and shall be on file as a qualified flagger trainer with the Department. The Flagger Trainer's name and Qualification Number shall be furnished by the Contractor at the pre-construction meeting. The Contractor shall provide all flaggers with the MnDOT Flagger Handbook and shall observe the rules and regulations contained therein. This handbook shall be in the possession of all flaggers while flagging on the Project. The Contractor shall obtain handbooks from the Department. Flaggers shall not be assigned other duties while working as authorized flaggers. The "Checklist for Flagger training" form shall be furnished to the Engineer any time a new flagger reports to work on the Project. The "Checklist for Flagger Training" form is found at: <http://www.dot.state.mn.us/const/wzs/documents/flaggertrainingchecklist.pdf>.

(B) The Contractor shall furnish flaggers as required to adequately control traffic. Flaggers shall conform to the requirements set forth in the MN MUTCD. Payment for flaggers will be made by the unit hour for each flagger as provided elsewhere in these Special Provisions.

OR

(B) The Contractor shall furnish flaggers as required to adequately control traffic. Flaggers shall conform to the requirements set forth in the MN MUTCD. All costs incurred to provide such flaggers shall be incidental.

OR

(B) The Contractor shall furnish flaggers as required to adequately control traffic. Flaggers shall conform to the requirements set forth in the MN MUTCD. Measurement and payment will be made as provided in Section **S-2563** (FLAGGER) of these Special Provisions.

(C) The Contractor shall provide two-way radios for flaggers.

HANDOUT

HANDOUT

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

Created August 20, 2015
 Page 16

S.P. Number of Your Job goes here

Flaggers shall wear high visibility retroreflective safety vests, pants and hats at all times while actively flagging on the Project. High visibility apparel shall also comply with current Minnesota OSHA Rules 5207.0100 and 5207.1000. The flaggers clothing shall be considered incidental.

The Contractor shall keep the separation distance between the last sign in the "flagger ahead" signing sequence and the actual flagger to the amount shown in the Field Manual, whenever it is practical. The maximum separation distance allowed from the signs to the flagger shall be ½ mile. The Contractor shall use multiple flagger signing set-ups or continuously move the signing for moving flagging operations to keep within the distance limit. The "flagger ahead" signing sequence shall not be in place when flagging operations are not in effect.

The maximum distance between flaggers shall be ½ mile unless otherwise authorized by the Engineer. In the event a distance longer than one mile is authorized, the Engineer may order the Contractor to provide two pilot cars at no additional cost to MnDOT.

All signs associated with the flagging operation must be removed or covered when flagging operations are not present.

The Contractor will be subject to a non-compliant charge for failure to adhere to the requirements listed in this Section **S-4**. These requirements include: providing two-way radios for flaggers, properly attired flaggers, flagging operation length requirements, and distance limit between the flagger and the last sign in the flagger sequence, and removing or covering flagger signs when flagging operations are not present. **Non-compliance charges, for each incident will be assessed at a rate of \$500 per incident that the Engineer determines that the Contractor has not complied.** The charges may be assessed equally, separately, and may be assessed concurrently.

The Contractor shall coordinate the flagging operations in a manner that causes as little delay to the traveling public as possible, and at no time shall the delay exceed 10 minutes. In the event that the Contractor is unable to meet the maximum delay requirements, operations shall shut down until such time a new traffic control plan is developed which does meet the maximum delay requirement.

If hauling operations create hazards for the traveling public, the Contractor will be required to provide additional flaggers, as directed by the Engineer. All costs incurred to provide the additional flaggers shall be incidental.

Use (D) only if it applies to the Project!

(D) The Contractor shall furnish at least one pilot car and driver for leading traffic through the work zone. Pilot Car operations shall be in accordance with the following:

1. Pilot cars shall be utilized on all two lane roadways.
2. Pilot Vehicles shall:
 - (a) Be capable of being turned around quickly in a small area.
 - (b) Equipped with lights that meet the requirements of Section **S-1404.3** (VEHICLE WARNING LIGHT SPECIFICATION) of this Special Provision.
 - (c) Have a standard sign G20-4, "PILOT CAR, FOLLOW ME", mounted on the rear of the vehicle. Mounting height of sign should be minimum of one foot from the ground.
3. Flaggers shall:
 - (a) have portable radio communication with the pilot car.
 - (b) not park vehicles at the flagging station.
4. The Contractor shall:
 - (a) take necessary precautions to prevent any traffic that enters the highway between flaggers from going in the opposite direction as the pilot car caravan.

HANDOUT

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

Created August 20, 2015
 Page 17

S.P. Number of Your Job goes here

- (b) In no case allow or force traffic onto the shoulders because of their operations without prior approval of the Engineer.
5. The Contractor's equipment shall follow in line and use the roadway in a manner similar to all other through traffic during the time of lane, speed, and pilot car restrictions.

Optional Language:

6. The Contractor shall:
- (a) Use two pilot cars for night operations, one pilot car for each direction.
- (E) The Contractor shall furnish off-duty police officers in uniform with cars and a reflectorized high-visibility safety vest to direct traffic if deemed necessary and so ordered by the Engineer. "Police Officer" means every officer authorized to direct or regulate traffic or to make arrests for violations of traffic rules. Payment for police officers will be made by the unit hour as provided elsewhere in these Special Provisions.

Use only the paragraphs in S-6 that apply to the Project!

MILLING, SEALCOATING, AND PAVING OPERATIONS

Use the (A) paragraph that applies to the Project

- (A) Milling and paving operations shall be completed over the full width of all traffic carrying lanes, including turn lanes, bypass, etc., under construction on each day's run.

OR

- (A) The Contractor shall schedule milling and bituminous paving operations such that milled areas will be covered with a wear course within 24 hours of completion of the milling, except for delays caused by inclement weather.

OR

- (A) Traffic will be allowed on the milled surface; however, the Contractor shall be responsible for furnishing and installing interim striping as directed by the Engineer. Payment for Interim striping will be made as provided elsewhere in these Special Provisions.

- (B) When traffic is allowed to drive on the milled surface, the Contractor shall furnish and install "GROOVED PAVEMENT" and "BUMP" signs with "Advisory Speed" plates at locations determined by the Engineer. Payment for these signs shall be included in the lump sum payment for traffic control.

- (C) Any drop-off where traffic will cross from or to the in place surface, or from or to the milled surface, shall be tapered and/or chamfered so as to provide for the safe passage of traffic.

- (D) The Contractor shall schedule construction operations to minimize traffic exposure to uneven lanes, milled edges, and edge drop-offs. Only after every attempt has been made to avoid these conditions and one or more of them are deemed necessary, the Contractor shall provide and maintain the appropriate traffic control in accordance with the "DROP OFF GUIDELINES" in the Field Manual.

- (E) The Contractor shall not mill any notches for surfacing tapers until immediately prior to paving, except that with the Engineer's permission, the Contractor may mill the notches, and install and maintain temporary bituminous tapers to provide for the safe passage of traffic until the surfacing taper is installed.

- (F) Constructing and milling tapers and/or chamfers shall be incidental.

If the Project location has Aggregate shoulders, use the following

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

Created August 20, 2015
 Page 18

S.P. Number of Your Job goes here

- (G) The Contractor is directed to Section S-2.232 (MILL PAVEMENT SURFACE) of these Special Provisions for additional requirements to maintain shoulders.

Use the (H) paragraph that applies to the Project

- (H) The Contractor shall maintain traffic with a minimum of delay during milling and paving operations at intersections controlled by signals or by all-way stop signs. The Contractor shall provide off-duty police officers, at no expense to the Department, to direct and control traffic around and through milling and paving operations at those intersections. "Police officer" means every officer authorized to direct or regulate traffic or to make arrests for violations of traffic rules.

OR

- (H) The Contractor shall maintain traffic with a minimum of delay during milling and paving operations at intersections controlled by signals or by all-way stop signs. The Contractor shall provide off-duty police officers to direct and control traffic around and through milling and paving operations at those intersections. "Police officer" means every officer authorized to direct or regulate traffic or to make arrests for violations of traffic rules. Payment for police officers will be made by the unit hour as provided elsewhere in these Special Provisions.

- (I) The Contractor may close intersecting streets to traffic, other than at intersections controlled by signals or "All Way Stop" signs during milling and paving operations in the intersection, but only if there are adequate alternate routes for the intersecting street traffic. The Contractor shall not close adjacent intersecting streets to traffic concurrently. The Contractor shall notify the local road authorities of its schedule to close intersecting streets 48 hours in advance of the closure.

Use (J) on seal coating projects

- (J) When traffic is allowed to drive on the sealed surface, the Contractor shall furnish and install "LOOSE GRAVEL" and "FRESH OIL" signs with "Advisory Speed" plates at locations determined by the Engineer. Payment for these signs shall be included in the lump sum payment for traffic control.

S-7 should only be used when signals and lighting systems may be impacted by the Project SIGNAL AND LIGHTING SYSTEMS

- The Contractor shall not interfere with the operation of any traffic signal system, except as required by the Contract. The Contractor shall notify the Engineer at least 24 hours prior to beginning any work that will interfere with any traffic signal system or its detectors.

Use only the paragraphs that apply to this Project!

- The in place signal system(s) shall remain in operation until the new signal system(s) become operational.

- The Contractor shall furnish off-duty police officers with cars for directing and controlling traffic during such times as the existing or temporary signal system at each location is out of operation. "Police officer" means every officer authorized to direct or regulate traffic or to make arrests for violations of traffic rules. Off-duty police officers shall be furnished in such numbers as deemed necessary by the Engineer to direct traffic. Payment for police officers will be made by the unit hour as provided elsewhere in these Special Provisions.

- During the period when the existing signal system is de-energized and the new signal system is energized, the Contractor shall furnish, erect, and maintain "Stop Ahead" signs and "Stop" signs. The quantity and size of the temporary signs as well as their placement in the field shall be as directed by the Engineer. The Contractor shall furnish and install materials to keep these signs upright and stationary. The signs shall remain the property of the Contractor.

- The Contractor shall maintain street lighting by means of the in place lights, the newly constructed lights, or a combination thereof, except as otherwise authorized in writing by the Engineer.

HANDOUT

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book Created August 20, 2015
 Last Revision by CO Special Provisions: 01/12/17 Page 20
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

S.P. Number of Your Job goes here

(H) The Contractor may ban parking within the construction limits [redacted] All necessary signing is the responsibility of the Contractor and shall be installed, as directed by the Engineer, 24 hours prior to the parking ban. The Contractor shall remove that signing as soon as the work in the area has been completed.

The Contractor shall notify the City of [redacted], phone number [redacted] at least 24 hours prior to posting any parking ban within the City.

(I) The Contractor shall keep the Right-of-Way fence closed up, except during work hours, by means of the in place fence, newly constructed fence, temporary fence (at the Contractor's expense), or a combination thereof.

(J) No access to or from any public road will be permitted for the Contractor's equipment, material deliveries, the hauling of excavated materials of any kind, or employees' private vehicles, except at in place public road intersections, or at locations and in such manner as approved by the Engineer.

(K) As each road is completed, the Contractor shall install the final signing and pavement markings required to safely open that road to traffic. This work shall be completed on or before the date of opening as approved by the Engineer. Overhead signs may be temporarily ground mounted at the Contractor's expense.

S-4.10 MEASUREMENT AND PAYMENT

Choose one of the following:

All traffic control required under this Contract shall be performed as incidental work.

OR

No measurement will be made of the various Items that constitute Traffic Control but all such work will be construed to be included in the single Lump Sum payment under Item 2563.601 (Traffic Control).

OR

Traffic control will be measured and paid for as follows:

No measurement will be made of the various items that constitute Traffic Control, but all such work shall be construed to be included in the lump sum payment under Item 2563.601 (Traffic Control). The lump sum payment shall be compensation in full for all costs of furnishing, installing, maintaining and removing the individual traffic control devices except for items as listed in the Statement of Estimated Quantities.

OR

Traffic Control will be measured and paid for as follows:

Payment for furnishing, installing, maintaining, relocating and subsequently removing traffic control devices (including flaggers) as required will be made as a lump sum under Item 2563.601 (Traffic Control) and according to the following schedule:

- (1) When 5 percent of the Contract amount is earned, 50 percent of the amount bid for traffic control will be paid.
- (2) When 10 percent, or more, of the Contract amount is earned, an additional 25 percent of the amount bid for traffic control will be paid.

HANDOUT

HANDOUT

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book Created August 20, 2015
 Last Revision by CO Special Provisions: 01/12/17 Page 19
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

S.P. Number of Your Job goes here

S-4.8 PORTABLE SIGNAL SYSTEM

The Contractor shall provide two (2) portable signals, to control traffic and all necessary advance signing as directed by the Engineer. The portable signals shall meet the requirements of the MN MUTCD and beyond the Temporary Traffic Control Equipment Approved/Qualified Products List for "Portable Signal Systems – Trailer Mounted" or "Portable Signal Systems – Pedestal Mounted" found at: <http://www.dot.state.mn.us/products/temptraffictcontrol/electronicquipment.html>. Time the signal to cause as little delay as possible to the traveling public, and at no time shall the delay exceed [redacted] minutes. The signal timing of each portable traffic signal system will be reviewed by District Traffic Engineering staff.

Payment for the portable signal system will be made for each Portable Traffic Signal by the Unit Day. See Section S- [redacted] (PORTABLE SIGNAL SYSTEM) of these Special Provisions for additional information.

Use only the paragraphs in S- 9 that apply to the Project!

S-4.9 MAINTENANCE AND STAGING OF TRAFFIC CONTROL

(A) The Contractor shall maintain, at all times, the existing traffic movements at the following intersections: [redacted]; [redacted]; and [redacted].

(B) Pedestrian traffic shall be maintained and guided through the Project at all times. See Section S-2563 (ALTERNATE PEDESTRIAN ROUTE) of these Special Provisions.

(C) and (D) apply ONLY if there is not a tab in the Plan - fill in the # of signs

(C) On the day operations on the road begin, the Contractor shall provide [redacted] G20-1 "ROAD WORK NEXT [redacted] MILES" signs and [redacted] G20-2A "END ROAD WORK" signs to be placed, as directed by the Engineer. These signs will be placed at the end(s) of the Project. Payment for these signs shall be included in the lump sum payment for traffic control.

(D) The Contractor shall furnish, install, and maintain [redacted] "ROAD WORK AHEAD" and [redacted] "END ROAD WORK" signs in advance of and beyond each end of the construction limits as directed by the Engineer. The Contractor shall also furnish, install, and maintain [redacted] "ROAD WORK AHEAD" signs in advance of the construction limits on all intersecting roads and streets as directed by the Engineer. The signs shall conform to the standards shown in the MN MUTCD. Furnishing and erecting these signs shall be incidental. The signs shall remain the property of the Contractor.

(E) The Contractor shall cover all signs that are not consistent with traffic operations. The cover should be a plate of solid material covering the entire legend or all of that part of the legend that is inappropriate. Bolt the cover to the sign and place a minimum of 1/8 inch spacers (such as plastic or rubber) between the sign face and the cover. See the Typical Temporary Sign Framing and Installation Details Sheet found in the Plan or at <http://www.dot.state.mn.us/trafficeng/workzone/avz-templates/pdf/layou%2020.pdf> for details. This work will be done as required by the Engineer.

(F) Street identification signage shall be maintained at all times. Where the only existing signs are small city or county signs located at the intersection, street names and address numbers shall be maintained by temporary installations as required by the Engineer. This is necessary to maintain the 911 emergency system.

(G) The Contractor shall maintain a lane width of not less than [redacted] feet in each direction. In no case shall traffic be allowed or forced onto the shoulders as a result of the Contractor's operations without prior approval of the Engineer.

During the time of lane, speed, and pilot car restrictions, the Contractor's equipment shall follow in line and use the roadway in a manner similar to all other through traffic.

HANDOUT

S.P. Number of Your Job goes here

- (3) When 50 percent, or more, of the Contract amount is earned, an additional 20 percent of the amount bid for traffic control will be paid.
- (4) The remaining 5 percent bid for traffic control will be paid when all work has been completed and accepted.
- (5) In all items above, the original Contract amount shall be the total value of all Contract Items including the traffic control item, but the percentage earned in each case shall be exclusive of the traffic control item.

OR

Traffic Control will be measured and paid for as follows:

Payment for all traffic control required to complete the Project as shown in the Plans and specified in these Special Provisions shall be made as a lump sum payment under Item 2563.601 (Traffic Control). Payment includes all costs associated with furnishing, installing, maintaining, relocating and subsequently removing traffic control devices (including flaggers) as required. No additional measurement for payment will be made for individual activities and devices that constitute Traffic Control, except for other traffic control Bid Items specifically provided in the Contract.

Traffic Control layouts or devices not shown in the plan or stated in these Special Provisions that are a necessary part of the Contractor's operations to complete the project as shown in the plan are included in the lump sum traffic control item. There will be no increase or decrease in the lump sum payment or additional payment for other traffic control Contract Items, except as provided in the following paragraph.

If the Engineer orders a change in traffic control because of a Plan error, omission, changed condition or change of project scope, payment for such changes will be made as Extra Work.

The Traffic Control Payment Schedule will be as follows:

- (1) When 5 percent of the Contract amount is earned, 50 percent of the amount bid for traffic control will be paid.
- (2) When 10 percent, or more, of the Contract amount is earned, an additional 25 percent of the amount bid for traffic control will be paid.
- (3) When 50 percent, or more, of the Contract amount is earned, an additional 20 percent of the amount bid for traffic control will be paid.
- (4) The remaining 5 percent bid for traffic control will be paid when all work has been completed and accepted.
- (5) In all items above, the original Contract amount shall be the total value of all Contract Items including the traffic control item, but the percentage earned in each case shall be exclusive of the traffic control item.

OR

Traffic Control will be measured and paid for as follows:

Lump Sum Traffic Control under Item(s) 2563.601 (Traffic Control).

The lump sum payment(s) shall be compensation in full for all costs of furnishing, installing, maintaining, relocating, and removing the individual traffic control devices as shown on the Traffic Control Layouts in the Plans and/or as specified in these Special Provisions. The lump sum shall also include any extra signing needed to facilitate traffic switches or for transitioning traffic from one stage to another.

S.P. Number of Your Job goes here

If the Contractor requests changes in traffic control as shown on the Traffic Control Layout(s) and these changes are implemented, there will be no increase or decrease in the lump sum payment(s) for the stage(s) of traffic control.

Partial payments for lump sum Item 2563.601 (Traffic Control) will be made as follows:

- (1) When all traffic control devices for an individual stage, as shown on the Traffic Control Layouts, have been installed, 75% of the Contract Unit Price for that stage will be paid.
- (2) When all work in an individual stage and all traffic control devices for that stage are removed, the remaining 25% of the Contract Unit Price for that stage will be paid.

Use S-11 for all Projects. The items shown below are in addition to what is covered by the traffic control pay item. Therefore nothing needs to be deleted from S-12. (For example, if flaggers are incidental they should still be left in S-12. The flaggers listed in S-12 are in addition to the flaggers covered by the traffic control pay item.)
ADDITIONAL TRAFFIC CONTROL DEVICES AND EXTENDED USE OF TRAFFIC CONTROL DEVICES

The Engineer may require extra traffic control devices in addition to the traffic control devices shown on the plan Traffic Control Layouts, or in the Field Manual, as warranted by traffic conditions. The Department will pay for extra traffic control devices ordered under this section according to the schedule of predetermined prices in Table 2563-1. The Department will also use the predetermined prices in Table 2563-1 to pay for (1) additional temporary lane closures for Extra Work; and (2) extended use for all traffic control devices which are impacted by excusable and compensable delays, as defined in MnDOT 1806.2B.

The Department will not use the predetermined unit prices listed in Table 2563-1 if payment for a device is specifically provided for elsewhere in the Contract.

(A) General Requirements:

The Contractor must furnish the additional traffic control devices as ordered by the Engineer.

The devices installed must meet contract requirements and be in a functional and legible condition as determined in the sole discretion of the Engineer. Devices not meeting these requirements must be immediately replaced or repaired.

(B) Measurement:

Flashers, barricades, reflectorized drums, portable changeable message signs, 48 x 48 inch signs, and flashing arrow boards will be measured by the number of individual units of each type multiplied by the number of Calendar Days each unit is in service.

Driven post supports and all mounting hardware for 48 inch x 48 inch signs and Standard Signs are considered incidental.

Standard Signs, other than 48 x 48 inch signs, will be measured by the face area of signs furnished multiplied by the number of Calendar Days each square foot of sign is in service.

Standard Signs with Portable Supports will be calculated and paid for as follows: Total Standard Sign Sq. Ft + Portable Support Cost (listed in Table 2563-1) = Standard Signs with Portable Supports Cost per day.

Construction Signs - Special will be measured by the sign face area thereof furnished, installed including supports, and removed as specified.

Temporary Molded Plastic Barrier and Temporary Concrete Barrier will be measured by the number of linear feet furnished multiplied by the number of Calendar Days each linear foot the barrier is in service.

Time and Traffic Provisions (amdt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 23
▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

S.P. Number of Your Job goes here

Flaggers and Police Officers will be measured by the number of hours each is in service on the job. Police Officers shall be equipped with a patrol vehicle at all times on the job.

(C) Payment:
 For contracts without a sub-contract agreement for traffic control services; reasonable invoices may be accepted for additional traffic control devices obtained. The reasonableness of the invoice for additional traffic control is subject to audit in accordance with MnDOT 1721.

Total compensation for Additional Traffic Control Devices and the Extended Use of Traffic Control Devices will have a maximum payout allowance based on average lifespan as determined by the department.

The following devices will have a 180 Day maximum pay out allowance: ReflectORIZED Cones/Weighted Channelizer Devices, Surface Mounted/Weighted Delimiters, Opposing Traffic Lane Divider, ReflectORIZED Safety Drum, ReflectORIZED Safety Drum w/Down Arrow, Flasher Type A (Low Intensity), Flasher Type B (High Intensity) and Flasher Type C (Steady Burn).

The following devices will have a 365 Day maximum pay out allowance: Type I Barricade, Type II Barricade, Direction Indicator Barricade, Type III Barricade, 48 X 48 Inch Standard Sign, 48 X 48 Inch Standard Sign with Portable Supports, Standard Signs with Portable Supports, Standard Signs Portable Support Cost per day, Construction Sign - Special, Temporary Plastic Molded Barrier and Temporary Concrete Barrier Energy Absorption End Treatment System.

The following devices have a maximum pay out allowance five years or greater: Temporary Concrete Barrier, Portable Changeable Message Board, Flashing Arrow Board and Portable Radar Trailer.

(C.1) Devices, Flagger and Police Officers:
 Payment for all additional traffic control devices, Flaggers and police officers, as ordered by the Engineer, will be made in accordance with the following schedule:

Table 2563-1 ADDITIONAL TRAFFIC CONTROL DEVICES, FLAGGERS and POLICE OFFICERS

Item Number	Item	Unit	Pre-determined Price
2563.610	Flagger	Hour	* 1
2563.610	Police Officer	Hour	* 2
2563.613	ReflectORIZED Cones/Weighted Channelizer Devices	Each/Day	\$0.16
2563.613	Surface Mounted/Weighted Delimiters	Each/Day	\$0.25
2563.613	Opposing Traffic Lane Divider	Each/Day	\$1.44
2563.613	Type I Barricade	Each/Day	\$0.34
2563.613	Type II Barricade	Each/Day	\$0.31
2563.613	Direction Indicator Barricade	Each/Day	\$0.46
2563.613	Type III Barricade	Each/Day	\$1.76
2563.613	ReflectORIZED Safety Drum	Each/Day	\$0.61
2563.613	ReflectORIZED Safety Drum w/Down Arrow	Each/Day	\$0.75
2563.613	Flasher Type A (Low Intensity)	Each/Day	\$0.29
2563.613	Flasher Type B (High Intensity)	Each/Day	\$0.61

Time and Traffic Provisions (amdt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 24
▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

S.P. Number of Your Job goes here

Item Number	Item	Unit	Pre-determined Price
2563.613	Flasher Type C (Steady Burn)	Each/Day	\$0.26
2563.613	48 X 48 Inch Standard Sign	Each/Day	\$0.86
2563.613	48 X 48 Inch Standard Sign W/Port. Sup.	Each/Day	\$1.39
2563.613	Roll up Sign W/Stand	Each/Day	\$1.43
2563.617	Standard Signs	Square Foot/Day	\$0.17
2563.613	Standard Signs W/ Portable Supports	Each/Day	\$TBD
	Standard Sign Portable Support Cost per day		\$0.53
2563.618	Construction Sign Special * 5	Square Foot	\$44.09
2563.603	Temporary Plastic Molded Barrier	Linear Foot/Day	\$0.29
2563.603	Temporary Concrete Barrier	Linear Foot/Day	\$0.05
2563.613	Temp. Concrete Barrier Energy Absorption End Treat. Sys.	Each/Day	\$39.10
2563.613	Portable Changeable Message Board * 3	Each/Day	\$25.65
2563.613	Flashing Arrow Board * 4	Each/Day	\$7.88
2563.613	Portable Radar Trailer * 4	Each/Day	\$24.40

*1 Will be paid in accordance with MnDOT 1904.4A.

*2 Will be paid at the invoice price plus 10%.

*3 (PCMS) Type C Trailer Mounted Message Signs will be permitted. The Contractor shall continually operate each PCMS at maximum legibility.

*4 The Contractor shall continually operate each Flashing Arrow Board or Portable Radar Trailer at maximum legibility.

*5 Construction Signs - Special includes fabrication, installation, supports and removal as specified. Construction Signs - Special are not eligible for additional compensation due to extended use as described in Sections C.2 "Labor" and C.3 "Equipment" listed below.

(C.2) Labor:

Payment for labor to furnish, install, and remove additional traffic control devices listed in Table 2563-1 as set forth in C.1 "Devices, Flagger and Police Officers", will be in accordance with 1904.3(4) or 1904.4A.

Payment for labor to inspect and maintain additional traffic control devices will be incidental to the 2563.601 (Traffic Control) item already contained in the Plan during the original contract period, unless a contract revision meets the requirements listed in MnDOT 1402.3.

Payment for labor to inspect and maintain all traffic control devices, when an extension of contract time is due to an excusable and compensable delay in accordance with MnDOT 1806.2B, will be in accordance with MnDOT 1904.3(4) or 1904.4A.

(C.3) Equipment:

Payment for equipment to furnish, install, and remove additional traffic control devices listed in Table 2563-1 as set forth in C.1 "Devices, Flagger and Police Officers", shall be in accordance with MnDOT 1904.3(4) or 1904.4C.

Payment for equipment to inspect and maintain additional traffic control devices will be incidental to the 2563.601 (Traffic Control) item already contained in the Plan during the original contract period, unless a contract revision meets the requirements listed in MnDOT 1402.3.

S.P. Number of Your Job goes here

Major Item of Work	Non-Work Days for Major Items of Work by Month											
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Removals	NA	NA	NA	NA	1	2	3	2	3	2	1	0
Excavation and embankment	NA	NA	NA	NA	4	5	7	6	8	5	3	1
Subgrade (granular embankment)	NA	NA	NA	NA	4	5	7	6	8	5	3	1
Base	NA	NA	NA	NA	1	2	3	2	3	2	1	0
Surfacing	NA	NA	NA	NA	1	2	3	2	3	2	1	0
Bridge Substructure	NA	NA	NA	NA	3	4	6	5	6	3	2	1
Bridge Superstructure	NA	NA	NA	NA	1	2	3	2	3	2	1	0
Utility and culvert work	NA	NA	NA	NA	4	5	7	6	8	5	3	1
Lighting and electrical	NA	NA	NA	NA	1	2	3	2	3	2	1	0
Turf establishment	NA	NA	NA	NA	4	5	7	6	8	5	3	1

Major Item of Work	Non-Work Days for Major Items of Work by Month											
	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June
Removals	3	2	3	2	1	0	NA	NA	NA	NA	NA	NA
Excavation and embankment	7	6	8	5	3	1	NA	NA	NA	NA	NA	NA
Subgrade (granular embankment)	7	6	8	5	3	1	NA	NA	NA	NA	NA	NA
Base	3	2	3	2	1	0	NA	NA	NA	NA	NA	NA
Surfacing	3	2	3	2	1	0	NA	NA	NA	NA	NA	NA
Bridge Substructure	5	5	6	3	2	1	NA	NA	NA	NA	NA	NA
Bridge Superstructure	3	2	3	2	1	0	NA	NA	NA	NA	NA	NA
Utility and culvert work	7	6	8	5	3	1	NA	NA	NA	NA	NA	NA
Lighting and electrical	3	2	3	2	1	0	NA	NA	NA	NA	NA	NA
Turf establishment	7	6	7	4	3	1	NA	NA	NA	NA	NA	NA

S-6 (1803) LIMITATION OF OPERATIONS - NIGHT CONSTRUCTION
 Include for Metro projects when applicable. Metro Construction will decide when this is to be used on their project. **Metro Construction needs to fill in the blanks for the times in the first sentence.**
 SP2016-49

Modify MnDOT 1803.5, "Limitation of Operations", with the following:

S-6.1 Night Construction means construction between the hours of [] p.m. to [] a.m. occurring within 500 feet of any sensitive areas such as:

- Hospitals;
- Nursing homes;
- Private residences including condos and apartments;
- Businesses;
- Hotels/motels.

The Contractor must not perform the following activities during Night Construction:

- Pile driving/removal;
- Concrete pavement demolition;
- Sawing for pavement removal;
- Crushing operations;
- Jack-hammering.

The Engineer must approve any deviation from these prohibitions.

S.P. Number of Your Job goes here

The Contractor must have a supervisor on site during Night Construction. The supervisor must have satisfactorily completed the "MnDOT Noise Mitigation for Night Construction" training within the past five years, as shown in the Department's records. This free 30 minute training is available online at <http://www.dot.state.mn.us/onlinelearning/construction/noisemitigation>. The Contractor must provide the Engineer with the nighttime supervisor's name and a copy of the current certification prior to beginning Night Construction.

In addition, the Contractor must:

- Notify owners or occupants of all buildings in sensitive areas (within 500 feet of the Night Construction). Notify owners or occupants of the type, location, and duration of the work. Provide notice in writing no later than five calendar days prior to beginning the work. Provide a copy of the notification to the Engineer and the City.
- Provide a contact person who is on site to ensure that any issues related to Night Construction are immediately addressed.
- Use only equipment having OSHA- approved ambient sound-sensing backup alarms or, as an alternative, use an observer may in accordance with OSHA standards.
- Allow for equipment to turn-around in lieu of backing-up (this includes equipment entering/exiting the project).
- Construct temporary noise mitigation enclosures or curtains around stationary equipment (e.g., generators, compressors) that are within 500 feet of sensitive areas.
- Ensure that tailgates on trucks are not slammed. Truck drivers unable to control the tailgates from slamming must be removed from the project.
- Ensure that all engines and engine driven equipment used for hauling or construction are equipped with an adequate muffler in constant operation and properly maintained to prevent excessive or unusual noise.

If the Engineer determines that the Contractor is not in compliance with the Night Construction requirements, the Engineer will suspend Night Construction. The suspension will remain in effect until the Contractor remedies the non-compliance or obtains the Engineer's acceptance of an action plan that satisfactorily addresses the non-compliance. The suspension will be considered an avoidable delay.

S-7 (1806) DETERMINATION AND EXTENSION OF CONTRACT TIME
 Use on all jobs.

NOTE: All Special Provisions relating to Contract Time should either be in 1806 or 1807 - NOT 1803 - 1404 or any other spec.

REVISED 12/02/16 - DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS
 SP2016-50

The Department will determine Contract Time in accordance with the provisions of MnDOT 1806 and the following:

S-7.1 Contractor must start construction operations by [date], or no later than eight calendar days after the date of Notice Contract Approval, whichever is later. Contractor must not begin construction operations before contract approval.

OR

Use the following if you have a flexible start date on your project.

S-7.2 This Contract allows for a flexible starting date between [date] and [date]. However, the Contractor may not start construction operations prior to Contract Approval. The Contractor shall determine their

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

Created August 20, 2015
 Page 31

S.P. Number of Your Job goes here

construction starting date between the above listed dates. The Contractor must notify the Engineer, in writing, at least two (2) weeks prior to the selected date.

OR

Use the following two paragraphs when clearing operations need to be performed prior to the start date due to there being Long Eared Bats in the project limits. Designer review and insert appropriate date to complete clearing operations by.

S-7.3 Contractor must start clearing operations on [date] or no later than eight Calendar days after the date of Notice Contract Approval, whichever is later. Contractor shall complete clearing operations required for this project prior to [date]. Contractor must not begin clearing operations before contract approval.

S-7.4 Contractor must start remaining construction operations on or no later than eight Calendar days after [date]. Contractor must not begin construction operations before contract approval.

OR

Use the following two paragraphs when migratory bird protection needs to be performed prior to the start date. Include 2016-149 (REMOVAL OF EXISTING BRIDGES).

S-7.5 Contractor must start construction operations involving migratory bird protection in accordance with Section S- [] (REMOVAL OF EXISTING BRIDGES) on [date] or no later than eight Calendar days after the date of Notice Contract Approval, whichever is later.

S-7.6 Contractor must start remaining construction operations on or no later than eight calendar days after [date]. The Contractor, with written approval from the Engineer, may begin construction operations prior to [date]. Contractor must not begin construction operations before contract approval.

Insert remaining sections as necessary.

S-7.7 Contractor must complete all work required under this Contract, except maintenance work and Final Clean Up, in no more than [] Working Days.

OR

S-7.8 Contractor must complete all work required under this Contract, except maintenance work and Final Clean Up, on or before []

Use the following for Intermediates

S-7.9 In addition to the other Contract Time requirements, the Contractor must complete all work required to [] ("in no more than [X] working days", "in no more than [X] calendar days", or "on or before [a completion date]").

If using A+B, use S-10.

S-7.10 All work required for the Completion of Work as defined in Section S-1301 (CONSIDERATION OF PROPOSALS (A+B METHOD)) under this Contract, shall be completed within the time frame specified by the Contractor as set forth in Section S-1301 (CONSIDERATION OF PROPOSALS (A+B METHOD)) of these Special Provisions.

Add the following if you are including an incentive:

a) In the event that the Completion of Work is completed in advance of this time frame, payment otherwise due in the Contract will be adjusted with an incentive payment of \$XX,000.00 (xxxxx Dollars) for each Calendar Day that the Completion of Work specified in is completed prior to the specified time frame. The total incentive amount shall not exceed \$XX,000 (xxxxx dollars).

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

Created August 20, 2015
 Page 32

S.P. Number of Your Job goes here

Payment of the incentive will be made on the first partial estimate voucher processed after the Completion of Work has concluded.

Use S-11 on all jobs.

S-7.11 Unless authorized in writing by the Engineer, the Contractor must not begin construction operations that impact, restrict, or interfere with traffic, before receiving NTP2. The Engineer will determine whether operations impact, restrict, or interfere with traffic in the Engineer's sole discretion.

Do not use if DIST. has section like this in their (1404).

S-7.12 The Contractor must not perform work that will restrict or interfere with traffic between 12:00 noon on the day before and 9:00 A.M. on the day after any consecutive combination of a Saturday, Sunday, and legal holiday. The Contractor may request exceptions to this requirement. Exceptions must be approved in writing by the Engineer.

(A) If the Contractor chooses not to work at all on the day before the holiday period, then the Department will not assess working day charges.

(B) If the Contractor chooses to work before 12:00 noon on the day before the holiday period (or later than 12:00 noon if approved by the Engineer), then the Department will assess working day charges only for the actual hours worked.

Use the following on all multiyear projects whether they are completion day contracts or working day contracts (per Contract Admin) or late in year.

S-7.13 The following language is deleted from MnDOT 1806.3: "(3) During the inclusive period from November 15 through April 15, except as specified in 1806.11, "Determination and Extension of Contract Time, General".

Use the following when needed on the project. Use only on working day contracts.

S-7.14 The following phrase is deleted from MnDOT 1806.3: "(2) On Saturdays, Sundays, and legal holidays"; and is replaced with: "(2) On Sundays and legal holidays". The effect of this modification is that MnDOT will assess Working Day charges six (6) days per week, Monday through Saturday, excluding legal holidays.

Use the following when needed on the project. Use only on working day contracts.

S-7.15 The Department will base working day charges on a ten hour working day.

Use the following when needed on the project. Use only on completion day contracts. Revise accordingly.

S-7.16 The Department based Contract Time (Completion Date) on an anticipated six day work week, Monday through Saturday.

Do not use S-17 for DIST. 1 jobs

S-7.17 When, in the opinion of the Engineer, the Contractor cannot perform work on the Project due to failure of material delivery beyond the control of the Contractor, the Engineer will agree to suspend Work in conformance with MnDOT 1803.6, or will cease the charging of working days, as determined by the Engineer.

The Engineer will issue a Resumption of Work Order, or resume the charging of working days, after the Contractor has received delivery of the required material.

Always use S-18 when using SP2016-117 (HIGH PERFORMANCE DOWEL BAR - 32 mm (1.25 inch)) or when using SP2016-118 (HIGH PERFORMANCE DOWEL BAR - 38 mm (1.5 inch)).

S-7.18 The following language is added to 1806.2.C: "(6) Delays of any kind due to furnishing and installing Stainless Steel-Type Dowels."

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book Created August 20, 2015
 Last Revision by CO Special Provisions: 01/12/17 Page 33
▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

S.P. Number of Your Job goes here

S-8 (1806) DETERMINATION AND EXTENSION OF CONTRACT TIME (LANDSCAPING)

Only use on jobs that are 100% landscaping. Do not use SP2016-50 (DETERMINATION AND EXTENSION OF CONTRACT TIME) on 100% landscaping jobs. Use SP2016-51 instead.

The Department will determine Contract Time in accordance with the provisions of MnDOT 1806 and the following:

- S-8.1 Contractor may start preparatory work after **Month XX, 20XX** or upon Notice Contract Approval, whichever is later.
- S-8.2 This project is located in **Zone X** and Plant Installation Period is **Spring 20XX**.
- S-8.3 Complete the installation of all plant species during the Plant Installation Period as specified in S-1.2 and the following table:

Plant Installation Period (PIP) – Zone 3			
Type (Species)	Spring Period	Fall Period	
Coniferous	April 21 st to June 1 st	August 25 th to September 15 th	
Deciduous Container and B&B	April 21 st to June 30 th	August 25 th to October 15 th	
Deciduous Bare Root	April 21 st to June 1 st	October 1 st to November 1 st	
Perennial	May 1 st to June 30 th	August 25 th to September 15 th	
Seedlings	April 21 st to June 1 st	

Plant Installation Period (PIP) – Zone 4			
Type (Species)	Spring Period	Fall Period	
Coniferous	April 7 th to May 17 th	August 25 th to September 15 th	
Deciduous Container and B&B	April 7 th to June 30 th	August 25 th to November 1 st	
Deciduous Bare Root	April 7 th to June 1 st	October 10 th to November 15 th	
Perennial	May 1 st to June 30 th	August 25 th to September 15 th	
Seedlings	April 7 th to June 1 st	

- S-8.4 The Contractor must furnish written evidence showing that all orders have been placed as needed to complete all work on this Project. The Contractor must furnish this written evidence to the Engineer no later than **X** days after Notice Contract Approval. Evidence must include written verification from growers, manufacturers, suppliers and subcontractors that all ordered materials will be delivered at a date sufficient to complete the Project as specified in this section S-.... Written verification must identify the anticipated calendar date of delivery of the ordered materials.
- S-8.5 Incidental turf repair includes completely restoring and establishing turf during the **Spring 20XX (Use year of plant installation)** Season of Planting for seed mixture(s) 25-141, 33-261, and 33-361. In ditch or flow areas use seed mixture 33-261, in areas within 10 feet of pond edges use seed mixture 33-361, in all other areas use seed mixture 25-141.
- S-8.6 The Engineer may extend any Plant Installation Period (PIP) depending on the Engineer's assessment of planting conditions.
- S-8.7 If the Contractor has not completed the work by the end of a PIP, the Engineer may extend the time allowed to complete the plant installation to the next appropriate PIP only if the Contractor can demonstrate the

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book Created August 20, 2015
 Last Revision by CO Special Provisions: 01/12/17 Page 34
▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

S.P. Number of Your Job goes here

delays encountered were beyond the Contractor's control in accordance with MnDOT 1806.2. The time extension will be in proportion to the original time allotted to complete the work.

- S-8.8 Contractor must complete all work required under this Contract, except plant establishment work and Final Clean Up, on or before **July 15, 20xx (Use year of plant installation)**.
- S-8.9 Plant Establishment Work as defined in (2571) Plant Installation and Establishment will extend for a period of two years from the date of Plant Installation completion.
- S-8.10 The Contract Time, for all other work not previously exempted herein, will be determined in accordance with the provisions of MnDOT 1806.

S-9 (1807) FAILURE TO COMPLETE THE WORK ON TIME

The District needs to choose the appropriate paragraphs which apply to their project. Use on all jobs. REVISED 09/25/15 ▲DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS

The provisions of MnDOT 1807 are supplemented as follows:

- If using A+B, use S-.1.*
 - S-9.1 The State will deduct from any monies due or coming due to the Contractor an amount equal to **(RUC value)** per Calendar Day for failure to complete all the work specified in Section S-1806 (DETERMINATION AND EXTENSION OF CONTRACT TIME) that remains uncompleted after the expiration of Calendar Days established by the Contractor in accordance with Section S-1301 (CONSIDERATION OF PROPOSALS (A+B METHOD)) of these Special Provisions.
 - S-9.2 *Use S-2 for intermediate dates.*
 The Department will assess the Contractor a monetary deduction in an amount equal to \$_____ for each **Calendar Day** that any of the work specified in Section S-1806.____ (DETERMINATION AND EXTENSION OF CONTRACT TIME) of these Special Provisions remains incomplete after the expiration of the working period provided therefore.
 - S-9.3 *Use S-3 to reduce damages for final cleanup*
 The Department may reduce the daily liquidated damages to \$_____ when the only remaining items are maintenance or Final Cleanup.
- Choose the applicable rows in the table shown below and modify (if needed).*
 For informational purposes only, bidders are advised that in addition to the requirements of MnDOT 1807, other Sections of these Special Provisions, as shown below, contain requirements for assessment of monetary deductions to this Contract:

S.P. Number of Your Job goes here

1404	MAINTENANCE OF TRAFFIC AND (2563) TRAFFIC CONTROL
1706	EMPLOYEE HEALTH AND WELFARE
2331	PAVEMENT JOINT ADHESIVE
2331	BITUMINOUS PAVEMENT CRACK TREATMENT CLEAN AND SEAL
2533	PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337
2533	PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337 - ANCHORED
2563	TRAFFIC CONTROL SUPERVISOR
2563	INTELLIGENT WORK ZONE SYSTEM
2563	ALTERNATE PEDESTRIAN ROUTE
2563	WORKERS PRESENT SPEED LIMIT
2563	PORTABLE CHANGEABLE MESSAGE SIGN
2580	INTERIM PAVEMENT MARKING

S-9.5 The liquidated damages set forth in MnDOT 1807 and any monetary deductions as set forth above may apply equally, separately, and may be assessed concurrently.

S-10 (2011) CONSTRUCTION SURVEYING (METRO)

This write-up is to be used on all Metro jobs when construction Project surveying is to be done by the Contractor. Construction needs to fill in sections S-2 B & C. Do not use any 1508 special provision when using this writing.
NEW WRITTEUP 08/28/15

The provisions of MnDOT 1508 are hereby modified and supplemented as follows:

S-10.1 GENERAL SURVEY SPECIFICATIONS

This Contract provides for the Contractor to accomplish the Construction Surveying for this Project. MnDOT 1508 is herewith modified to the extent that the Contractor shall meet all the requirements of, and provide all the services listed in, MnDOT 1508 which would otherwise be provided by MnDOT. Furthermore, in accordance with MnDOT 1401, the Contractor is advised that the Contract may not fully describe every detail or make specific allowances for all probable exceptions and contingencies related to the Construction Surveying requirements for this Project. Additional best management practices (BMP's) for Construction Surveying are identified in Appendix A of the MnDOT Surveying and Mapping Manual, in addition to the requirements shown below:

S-10.2 SURVEYING TO BE PERFORMED BY MnDOT

(A) MnDOT will set the initial horizontal and vertical control points in the field for the Project as indicated in the Plans. Upon request, MnDOT will also provide electronic data on the control so established. This electronic data will be provided in the format that was used in the accomplishment of the surveys for the Construction Plan, and in Construction Plan development itself. However, due to the many different processes that the design survey data goes through and the large variety of sources of input in the final production of the Plan itself, no warranty is made as to the value or adaptability of the electronic data to the Surveyor. No warranty is made that the data systems used by MnDOT or any consultants employed by MnDOT for Surveying or Construction Plan preparation will be compatible with the systems used by the Contractor's Surveyor. Information shown on the printed "Plan" shall always govern over any electronic "Plan" data.

At the discretion of the MnDOT Engineer, spot checks may be performed upon the Contractor's surveying calculations, records, field procedures, and actual staking. If the Engineer determines that the work is not

S.P. Number of Your Job goes here

(G) The Contractor will gain approval no later than 15 working days after initial submittal of the final package to MnDOT. Any discrepancies will be resolved by the Contractor prior to final approval and/or acceptance by MnDOT.

S-11.2 MARK-UP DRAWINGS

The following provisions shall apply for regional traffic management systems, lighting, and drainage/stormwater features:

(A) The original "as-designed" contract plan set should be marked-up to show all additions, deletions, and other changes made during construction.

- (1) Track any plan note modifications
- (2) Two copies of the marked up plans must be submitted to the Construction Project Engineer in .pdf format at the time of initial submittal of the electronic data as specified in Section S-11.1.G.
- (3) As-built drawings shall be accurate and are an official record of the project at the time of construction completion.

S-11.3 MEASUREMENT AND PAYMENT

No measurement will be made of the various items that constitute As-builts but all such work will be construed to be included in the single Lump Sum payment under Item 2011.601 (As Built), which shall be compensation in full for all costs incidental thereto, including but not limited to data collection, electronic formats, required features, as-built drawings, and all materials and labor necessary.

S-12 (2102) PAVEMENT MARKING REMOVAL

Lead Work - Use S-1 only when requested by District. Use S-2 when there is any pavement marking removal on the job. Construction needs to choose which option at the end of S-2 is to be used.
REVISED 08/28/15 - DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS

The provisions of MnDOT 2102 are modified and/or supplemented with the following:

Use S-1 only when requested by District.

S-12.1 In addition to the requirements above, the Contractor is responsible for determining what work areas have lead concentration above OSHA's Permissible Exposure Limit. Provide the information to the Project Engineer and MnDOT's Inspectors.

(A) Site access

To ensure that no one is accidentally exposed to lead, people are not permitted into areas of high lead concentration without protection. Signs are used to indicate where unprotected people must not go. The signs shall say:

Warning. Lead Work Area. Poison. No Smoking or Eating.

(B) Protective Clothing

Provide protective clothing for MnDOT inspectors in any area with lead exposure above 30 µg/m³ or where the lead concentration is unknown. The clothing can be disposable or reusable. It must include coveralls or equivalent, shoe covers, and head covers. Launder the clothing and provide clean clothing at least weekly or for daily disposal of the clothing. If the contaminated clothing can be reused, the Contractor is responsible for storing it.

(C) Wash facilities

*** HANDOUT ***

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 43

▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

S.P. Number of Your Job goes here

All Pavement marking removal shall be done utilizing grinding equipment.

S-13 (2563) TRAFFIC CONTROL SUPERVISOR

THE DESIGNER NEEDS TO MODIFY SECTION S-13.3 AS TO WHEN THE TRAFFIC CONTROL SUPERVISOR WILL BE REQUIRED.

WHENEVER YOU USE THIS WRITEUP, YOU HAVE TO HAVE THE PAY ITEM FOR THIS ON THE PLAN. IT CANNOT BE INCIDENTAL.

SP2016-230

The Contractor shall provide a Traffic Control Supervisor for all major traffic control modifications to the Project, in accordance with Contract provisions and as directed by the Engineer.

S-13.1 The Contractor shall provide a Traffic Control Supervisor for all major traffic control modifications listed below:

1. Initial startup of the Project
2. Whenever any bypass is placed into operation
3. Winter suspension traffic control adjustment operation
4. Spring start-up traffic control adjustment operation
5. Completion of the Project
6. Any other major changes to the Traffic Control set-up (due to Contractors staging of operations)

The Traffic Control Supervisor shall be on site 3 days prior to all major traffic control modifications listed above until the major traffic control modification is functioning properly allowing for safe, long term accommodations for traveling public.

During the 3 day time period prior to the major traffic control modification, the Traffic Control Supervisor will be expected to be on-site to develop a site plan for the major traffic control modification, to determine and ensure timely delivery of the proper quantity of traffic control devices, and to develop staging plans for the major traffic control modification operation. The Traffic Control Supervisor shall then coordinate and direct the installation of the devices as well as the staging of the traffic control modification to ensure a safe and efficient transition is completed. Following the transition, the Traffic Control Supervisor shall monitor the traffic flow of the site(s) in question and make modifications necessary to provide for the safe and efficient passage of the traveling public.

S-13.2 The Traffic Control Supervisor shall be certified as a worksite supervisor by MnDOT. A copy of the Traffic Control Supervisor's certification shall be provided to the Engineer at the Project pre-construction conference.

MnDOT certification as a Traffic Control Supervisor can be obtained by attending a 3 day MnDOT Traffic Control Supervisor Course within the last 5 years. Additional information on MnDOT's certification can be obtained by contacting Leigh Kriewall at 651-366-4217.

The National ATSSA Traffic Control Supervisor Certification will not be accepted.

(A) The Contractor shall, at the pre-construction conference, designate a Traffic Control Supervisor who shall be responsible for and perform the traffic control management. The Traffic Control Supervisor shall be either an employee of the Contractor other than the superintendent, or an employee of a firm which has a subcontract for overall traffic control management for the project. The Traffic Control Supervisor shall be responsible for the management of the traffic control operations of the Project, including those of the Contractor, subcontractors, and suppliers. The primary responsibility of the Traffic Control Supervisor shall be the Traffic Control Management of this Project.

*** HANDOUT ***

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 42

▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

S.P. Number of Your Job goes here

Provide soap, water, and towels to enable MnDOT's inspectors to wash at the site. If showers are provided for the Contractor's employees, they must be available for MnDOT's inspectors, also.

Provide a means to remove surface contamination from the inspector's clothing. That may be a HEPA vacuum, a downdraft booth (with the exhaust captured and cleaned), or other effective means that do not increase the concentration of airborne lead.

(D) Inspection Delay

MnDOT's inspectors will not enter a blasting containment area until at least fifteen minutes after blasting and other lead dust-producing activities have stopped, to permit the dust to settle. There will be no extra payment or penalty against MnDOT for this delay.

Use S-2 when there is any pavement marking removal on the job.

S-12.2 MnDOT 2102.3 is hereby deleted and replaced with the following:

Before making a change in traffic pattern, remove conflicting pavement markings as required by the contract and as directed by the Engineer without damaging the pavement structure or surface texture. If determined by the Engineer, repair damaged areas as directed by the Engineer at no additional cost to the Department.

Remove pavement markings on the basis of nominal widths and actual lengths as originally applied and still visible at the time of pavement marking removal. Remove irregularly shaped markings by enclosing them within rectangular boundaries of least dimension as determined by the Engineer.

Control or restrict operations to avoid exposing traffic to hazardous conditions in accordance with 1701, "Laws to be Observed," 1707, "Public Convenience and Safety," and 1717, "Air, Land, and Water Pollution." Remove expended materials or agents used in the pavement marking removal process from the pavement surface as the work progresses. Dispose of removed marking material in accordance with 1701, "Laws to be Observed," and 1717, "Air, Land, and Water Pollution."

Removed pavement marking material shall become the property of the Contractor.

Construction needs to choose which option shown below is to be used.

All pavement marking removal shall be done utilizing either waterblasting or sandblasting equipment. GRINDER-TYPE CUTTING HEADS SHALL NOT BE USED for pavement marking removal.

OR

All Pavement marking removal shall be done utilizing either grinding, water-blasting, or sandblasting equipment.

OR

All Pavement marking removal shall be done utilizing water-blasting equipment.

OR

All Pavement marking removal shall be done utilizing sandblasting equipment.

OR

*** HANDOUT ***

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 44
▲ DONOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

S.P. Number of Your Job goes here

(B) The Traffic Control Supervisor shall have the authority needed to effectively require modifications and maintenance of traffic controls. This includes having the authority necessary to obtain and use all labor, equipment, and materials needed to provide and maintain traffic control in routine and in emergency situations.

(C) The Traffic Control Supervisor shall have an up-to-date copy of the Part VI of the MN MUTCD (Minnesota Manual on Uniform Traffic Control Devices), including the "Field Manual for Temporary Traffic Control Zone Layouts," and "A Guide to Establishing Speed Limits in Highway Work Zones."

S-13.3 Traffic control management by the Traffic Control Supervisor includes, but is not limited to:

Choose applicable items which apply to the Project ONLY

1. Ensuring that traffic control devices are functioning as required. This includes the repair or replacement of all signs, barricades, and other traffic devices that become damaged, moved, or destroyed, or lights that cease to function properly, and barricade weights that are damaged or otherwise fail to stabilize barricades.
2. Providing sufficient surveillance of signs, barricades, and other traffic control devices. This includes inspecting traffic control devices on every calendar day that traffic control devices are in use (by the Traffic Control Supervisor or his approved representative). Routine surveillance reports shall be submitted to the Project engineer weekly.
3. The Traffic Control Supervisor will be on the Project every working day, "on call" at all times, and available within 45 minutes of notification, at other than normal working hours. The Contractor shall give the Engineer, the names, addresses, and phone numbers of at least three individuals (one of which is the Traffic Control Supervisor) responsible to provide and ensure immediate attention to the traffic control management. **[The Designer needs to modify this section as to when the Traffic Control Supervisor will be required]**

S-13.4 Traffic Control Supervisor shall be provided by the Contractor during the time periods indicated above. **For any period of time the Traffic Control Supervisor is not available to provide traffic control management, the Contractor will be subject to an hourly charge assessed at a rate of \$250.00 per hour each hour or any portion thereof which the Engineer determines that the Contractor has not complied.**

WHENEVER YOU USE THIS WRITEUP, YOU HAVE TO HAVE THE PAY ITEM FOR THIS ON THE PLAN. IT CANNOT BE INCIDENTAL.

S-13.5 Measurement for Traffic Control Supervisor will be made by the per day of service (Unit Day) as specified. Payment for Traffic Control Supervisor provided, as directed by the Engineer, and per these Special Provisions, will be made under Item 2563.613 (Traffic Control Supervisor) at the Contract bid price per Unit Day, which shall be compensation for costs incidental thereto.

OR

WHENEVER YOU USE THIS WRITEUP, YOU HAVE TO HAVE THE PAY ITEM FOR THIS ON THE PLAN. IT CANNOT BE INCIDENTAL.

S-13.6 No measurement will be made of the various duties of the Traffic Control Supervisor, but all such work shall be construed to be included in the lump sum payment under Item 2563.601 (Traffic Control Supervisor). The lump sum payment shall be compensation for all costs incidental thereto.

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 45
▲ DONOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

S.P. Number of Your Job goes here

S-14 (2563) INTELLIGENT WORK ZONE SYSTEM
REVISED 03/01/16 (DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS
SP2016-231

S-14.1 SYSTEM OVERVIEW

This project will utilize a Stopped Traffic Warning System which will be referred to as the "system". The system shall be a fully automated, stand-alone system, capable of providing real-time warnings for Stopped Traffic Queues.

For the Stopped Traffic Warnings, the system will post static signs with remote actuated warning lights at locations shown in the Plan. Sensors along the roadway will detect traffic queues and activate the appropriate warning signs. *The data collected by the sensors will be aggregated with the system activations and delivered via email at the end of each day to the appropriate personnel to identify system functionality and appropriate set points.*

S-14.2 SYSTEM REQUIREMENTS

This Pay Item shall consist of furnishing, installing, relocating, operating, maintaining and removing an automated, portable, real-time system meeting the requirements noted herein, during the duration the Project is in a single lane operation. Included in the operational responsibilities is the assuming of all communication costs such as cellular telephone, satellite, generating operational data, and internet subscription charges. In addition to these requirements, the Contractor shall assume all responsibility for any damaged equipment due to crashes, vandalism, adverse weather, etc. that may occur during the systems deployment.

The system for this Project shall consist of at least the following components:

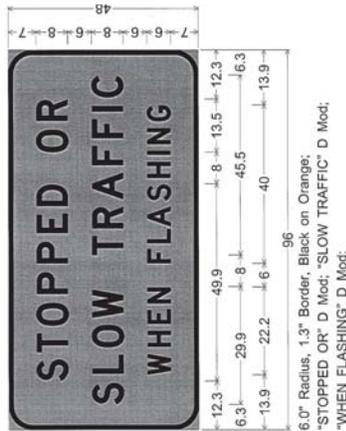
- (A) Temporary "warning signs"; **STOPPED OR SLOW TRAFFIC, WHEN FLASHING (G20-X14)**. Two signs shall be placed at each location (one left side and one right side). These warning signs may be ground mounted on approved crashworthy sign supports or mounted on trailers. *If ground mounted, the solar/battery assembly shall be crashworthy or located outside the clear zone.* See the Traffic Control Plan for the proposed sign locations. The signs will be located at the direction of the Engineer. The initial installation will be in advance of the any lane closures. The signs shall remain in place until the completion of the Project.
- (B) Sufficient traffic detection device(s) to sequentially activate the stopped traffic flashers as the queue extends. The system shall be capable of identifying stopped/slowed traffic conditions in advance of the lane closure taper. The system shall self-test for communication or sensor failures. All sensors shall be of a type whose accuracy is not degraded by inclement weather or degraded visibility conditions including precipitation, fog, darkness, excessive dust, and road debris. *The operational status of the sensors shall be shown in the daily reports.*
- (C) The system shall have a reliable communication system and provide warnings to the system manager and the Project Engineer when communication or device failures are detected.
- (D) The system shall have reporting features to a secure website, and/or text message or email. The website shall, at a minimum, show the current speeds at each detector location and whether the warning flashers are activated. *The text messages and/or email notifications shall be generated in real time when the system has detected an event and provide event detail and system operational status.* The website shall provide access to archival data for the duration of the Project. This archival data shall be printable.
- (E) The system shall provide data logging of system events and key detection data. The data should include the dates and times that the system was activated, which signs were activated, duration of the activation, and average speeds at each detection device. This data shall be provided to the Engineer on a DVD/CD in a CSV format at the close of the Project, or pushed in a selectable daily/weekly report basis, in a graphical representation to the Engineer.

Time and Traffic Provisions (tamdt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

Created August 20, 2015
 Page 46

S.P. Number of Your Job goes here

(F) The system shall use 12" LED beacons mounted 12" above the sign display. The flash rate shall be 55 flash cycles per minute, as defined by the MUTCD. The sign panel shall be:



S-14.3 SYSTEM OPERATION AND PERFORMANCE
 The system shall be capable of continuous 24/7 operation.

The remote web access shall allow the system manager or Project Engineer to shut-down the system during apparent failures.

The Stopped Traffic Warning System shall activate the warning signs whenever average traffic speeds fall below 40 mph and turn-off when the average speed returns to above 55 mph. These speeds are only suggested and actual field trials will determine the appropriate trigger values to be approved by the Engineer. *The adjustments to set points shall be incidental to the system.* The system shall be configured so that during low volume time periods such as early morning, the lack of traffic does not produce an average speed that activates the stopped traffic flashers.

If during the duration of the Project, it is found that the detectors or warning signs need to be relocated due to a change in the Project's traffic conditions or queuing patterns, the Contractor shall provide this adjustment *at the system relocation price.* The replacement, repositioning or the addition of detectors to maintain the system's *designed* operational accuracy may be required throughout the Project duration and will be considered incidental to the system.

S-14.4 SYSTEM TRAINING
 Interested *project personnel/partners* shall attend an education and training session at or near the time and place of the construction kick-off meeting. The training shall include at least one representative from each of the following entities:

- Prime Contractor
- Department of Transportation representative (Project Engineer and District Traffic Engineer)
- Others – such as local police, state patrol, local EMS, local media

The training shall consist of at least a review of the following:

Time and Traffic Provisions (tamdt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

Created August 20, 2015
 Page 47

S.P. Number of Your Job goes here

- In the event of an emergency, instructions on how to override the system flashers.
- In the event of a power failure, instructions detailing how to power cycle the system.
- List of telephone numbers to call to request technical support.
- Data Logging, printing reports, and interpreting the reports.

S-14.5 SYSTEM WARRANTY, MAINTENANCE, AND SUPPORT

The system shall be maintained and supported through the duration of the deployment. The Contractor (system provider) shall assign a system manager for the system deployment. The system manager shall respond to system failures.

The Contractor shall be required to respond immediately to any call from the Engineer or his designated representative concerning any request for correcting any deficiency in the system. **If the Contractor is negligent in correcting the deficiency within two hours of notification, the Contractor shall be subject to the hourly charge of \$250.00.**

S-14.6 MEASUREMENT
 Measurement will be made by the Lump Sum.

S-14.7 RELOCATE
Measurement will be made by the PER EACH DEVICE.

S-14.8 PAYMENT
 Payment will be made under Item 2563.601 (Intelligent Work Zone System) at the Contract bid price per Lump Sum, which shall be compensation in full for furnishing, installing, relocating, operating, maintaining and removing the system. The system shall remain the property of the Contractor.

S-15 (2563) ALTERNATE PEDESTRIAN ROUTE

To be used on all projects in which pedestrian movements may be impacted by construction – including sidewalks; intersection pedestrian crossings; as well as access to businesses, residences, schools and other pedestrian destinations. All projects that impact pedestrian movements shall include Alternate Pedestrian Routes (APRs). An APR maintains the existing level of ADA accessibility.

The Designer needs to work with the District Traffic and Construction offices to determine how to meet pedestrian requirements for a particular job. The following write-up or some form of it may be used to help meet these requirements or the District may use their own language. The language may be included in the Time and Traffic or this writeup can be used if the District prefers to use a pay item. Please contact Ken Johnson at 651-234-7386 or Ted Ulven at 651-366-4222 for help with this if needed. THE SPECIAL PROVISIONS UNIT CAN NOT DO THIS FOR YOU.

REVISED 08/04/16 ◀ DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS
 SP2016-232

S-15.1 Maintain and guide pedestrian traffic through the Project at all times using continuous Alternate Pedestrian Routes (APRs) per standards set forth in the MN MUTCD Chapter 6D. Provide each APR to the same level of accessibility of each existing access and walkway prior to construction. Incorporate accessible pedestrian signals (APS), temporary curb ramps, pedestrian barricades, pedestrian channelizers, detectable edges, temporary walkway surfaces and other accessible design features as necessary. Provide continuous walkway surfaces that are smooth, stable and slip resistant in relevant weather conditions. Utilize accessible device standards as shown in Figures 6K-12 and 6K-13 in the Field Manual. For bypasses and detours, utilize Layouts 84 and 85 in the Field Manual. If temporary walkway surface devices are to be used for short segments of rough, soft or uneven ground, utilize 6F-74.1 from the MN MUTCD.

HANDOUT

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book

Last Revision by CO Special Provisions: 01/12/17

▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

S.P. Number of Your Job goes here

Created August 20, 2015

Page 48

S-15.2 Minimize disruption to pedestrians to the maximum extent feasible by providing APRs in the following order of preference:

1. Provide the APR on the same side of the street as the disrupted route utilizing bypasses.
2. Where it is not feasible to provide a same side APR, provide an APR on the other side of the street.
3. Where it is not feasible to provide an APR on the other side of the street, provide an APR detour with trailblazing signs.

If existing parking spots are desired to be used for an APR route within the project limits, contact the **█ (name of local agency)** for approval and parking banning notification procedures.

S-15.3 Schedule and coordinate the replacement of pedestrian access to accommodate the needs of businesses and residences **█** days prior to the replacement. Leave the existing sidewalks in-place until such time that it is required to remove them to accommodate new construction. Pedestrian access may be provided to businesses and homes through the use of any public access from adjacent parking lots and side streets. Provide front door access to buildings without alternate public entrances.

S-15.4 Protect the pedestrian route with pedestrian barricades or pedestrian channelizing devices if it is adjacent to construction, excavation drop-offs, traffic, or other hazards. Protect the pedestrian route with portable barrier if it is on the shoulder, in a parking lane, or in a closed lane adjacent to traffic on a multilane road or if the speed limit is greater than 40 mph. When both sides of a pedestrian route require channelizing devices, use similar types, unless portable barrier is used to protect pedestrians from traffic.

Use if pedestrian curb ramp work is included in project

S-15.5 No pedestrian curb ramp or blended transition work shall occur concurrently at adjacent intersections.

Use if needed

S-15.6 No closures for sidewalk or pedestrian curb ramp or blended transition related work are allowed along **route** between the hours of **8:30 AM and 3:30 PM**.

Use if needed

S-15.7 The Contractor is advised that the corridor has Transit service. Re-locations of stops can only be made with the approval of the Engineer. The Contractor is hereby directed to Section **S-1707 (PUBLIC CONVENIENCE AND SAFETY)** of these Special Provisions.

S-15.8 Notify the Engineer in writing at least **█** hours prior to the start of any construction operation that will necessitate a change in pedestrian access.

S-15.9 Furnish the name, address, email, and phone number of at least one individual responsible for the maintenance of the APR. This individual shall be "on call" 24 hours a day, seven days per week during the times any devices, furnished and installed by the Contractor, are in place. Submit the required information to the Engineer at the pre-construction meeting.

Answer calls immediately and begin corrective measures needed, within one hour. **If the Contractor is negligent in correcting the deficiency within one hour of notification the Contractor shall be subject to a monetary deduction at the rate of \$100.00 per hour when only one residence or location is affected and at the rate of \$500.00 per hour in all other cases that the Engineer determines the Contractor has not complied.**

Use without pay item

HANDOUT

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book

Last Revision by CO Special Provisions: 01/12/17

▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

S.P. Number of Your Job goes here

Created August 20, 2015

Page 49

S-15.10 No measurement will be made of the various items that constitute APRs. Payment for all costs of the APRs, including furnishing, installing, maintaining and removing the individual devices, shall be included in the lump sum payment for traffic control.

OR

Use with pay item

S-15.11 No measurement will be made of the various items that constitute Alternate Pedestrian Route, but all such work shall be construed to be included in the lump sum payment under Item 2563.601 (Alternate Pedestrian Route). The lump sum payment shall be compensation in full for all costs of furnishing, installing, maintaining and removing the individual devices.

S-16 (2563) WORKERS PRESENT SPEED LIMIT

REVISED 01/12/17 ▲DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS

A "Workers Present Speed Limit" of **█** MPH will be required on this Project at all times that lane closures are in use and workers are present in the lane adjacent to through traffic. Provide speed limit signs and assemblies in accordance with the plan and the "Speed Limits in Work Zones Guidelines." This publication may be obtained from the Office of Traffic, Safety and Technology; the District Traffic Engineer; or at the following website: <http://www.dot.state.mn.us/speed/pdf/WZSpeedLimitGuideline.pdf>.

Install workers present speed limit signs and assemblies when a lane closure is in use and workers are present in the lane adjacent to through traffic. Remove or cover workers present speed limit signs and assemblies when workers are not present in the lane adjacent to through traffic. Document the installation and removal of the workers present speed limit. In place statutory speed limit (30, 55, 65 or 70 mph) signs may be covered at the start of the Project and remain covered until the Workers Present Speed Limit is no longer needed. For other in place posted speed limits, uncover the in place speed limit signs at the end of each work shift.

Cover all speed limit signs that are not consistent with the workers present speed limit. The cover should be a plate of solid material covering the entire legend or all of that part of the legend that is inappropriate. Attach the cover to the sign and place a minimum of 1/8 inch plastic spacers between the sign face and the cover. See the Typical Temporary Sign Framing and Installation Details Sheet found in the Plan or at <http://www.dot.state.mn.us/trafficeng/workzone/wz-templates/pdf/layout%2020.pdf> for details.

If the work area is protected by positive protection, such as temporary barrier, a workers present speed limit shall not be used.

The contractor may use an Electronic Workers Present Speed Limit system any electronic speed limit system used shall meet the following:

(A) **SYSTEM REQUIREMENTS**

This Project will utilize changeable Light Emitting Diode (L.E.D.) Speed Limit Panels which will be used to display speed limits as motorists drive through the work zone and is referred to as the "system". This system shall be deployed as shown in the traffic control plan.

This work includes furnishing, installing, operating, maintaining, relocating and removing the L.E.D signs according to the requirements defined herein and in the Traffic Control Plans, and providing the maintenance and operation of the complete system during the duration of the Project. The Contractor shall assume all responsibility for any damaged equipment due to crashes, vandalism, adverse weather, etc. that may occur during the system's deployment.

HANDOUT

HANDOUT

HANDOUT

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

Created August 20, 2015
 Page 50

S.P. Number of Your Job goes here

Each character (number) shall be 1 8 inches in height and 12 inches in width. The sign shall be clearly visible and legible from a distance of 1,000 feet under both day and night conditions. The L.E.D. speed limit signs shall be able to be changed remotely (Hand held remote).

When the system is activated, all signs installed on roads open to traffic that are not consistent with traffic operations shall be covered or removed as directed by the Engineer. The cover should be a rigid panel covering the entire legend or all of that part of the legend that is inappropriate. Bolt the cover to the sign and place a minimum of 1/8 inch spacers (such as plastic or rubber) between the sign face and the cover. See the Typical Temporary Sign Framing and Installation Details Sheet found in the Plan or at <http://www.dot.state.mn.us/trafficeng/workzone/wz-templates/pdf/layout20.pdf> for details.

The system shall operate continuously 24 hours a day, 7 days a week, displaying either the workers present or 24/7 speed limit as appropriate. The system shall collect and store speed limit data and be archived into a database with time and date stamps which will be provided to the Engineer upon request, and at completion of the project.

(B) **SYSTEM WARRANTY, MAINTENANCE AND SUPPORT**

The system shall be maintained, supported, and warranted against material defects by its supplier through the duration of the deployment.

Respond immediately to any call from the Engineer or his designated representative concerning any request for correcting any deficiency in the system. **If the Contractor is negligent in correcting the deficiency within two hours of notification, the Contractor will be subject to the hourly charge of \$250.00 per hour for each hour or any portion thereof with which the Engineer determines that the Contractor has not complied.**

S-16.1 Measurement for Workers Present Speed Limit will be made by the Unit Day.

S-16.2 Payment will be made under Item 2563.613 (Workers Present Speed Limit) at the Contract bid price per unit day, which shall be compensation in full for all work and material necessary, regardless of number of set ups and lane closures.

S-17 (2563) TRUCK/TRAILER MOUNTED IMPACT ATTENUATOR (TMA)
NEW WRITUP 03/01/16 ◀DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS
 SP2016-239.1

The Contractor shall provide Truck Mounted Impact Attenuators in accordance with the applicable MnDOT Standard Specifications, as directed by the Engineer, and the following:

S-17.1 If the Contractor establishes a lane and/or shoulder closure on a high-speed roadway, a vehicle equipped with a truck mounted attenuator that meets the requirements of NCHRP 350 (or AASHTO's Manual for Assessing Safety Hardware (MASH)) shall be placed in the closed lane/shoulder next to traffic prior to the active work site, as directed by the Engineer. The lane/shoulder closures shall meet the requirements described in the appropriate Field Manual layout.

S-17.2 Measurement will be made by the number of Truck Mounted Impact Attenuators provided per day of service (Unit Day) as specified.

S-17.3 Payment for Truck Mounted Impact Attenuators provided, as directed by the Engineer, will be made under Item 2563.613 (Truck Mounted Impact Attenuator) at the Contract bid price per Unit Day, which shall be compensation in full for all costs relative thereto. The Truck Mounted Impact Attenuators shall remain the property of the Contractor.

HANDOUT

Time and Traffic Provisions (tandt2016.doc) for use with the 2016 spec book
 Last Revision by CO Special Provisions: 01/12/17
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

Created August 20, 2015
 Page 51

S.P. Number of Your Job goes here

S-18 (2582) TEMPORARY PAVEMENT MARKINGS
NEW WRITUP 03/01/16 ◀DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS
 SP2016-250.1

Choose one of the following:

S-18.1 The Contractor shall be required to supply manpower to assist MnDOT personnel in pavement marking related projects such as, but not inclusive to, collecting data from in place lane lines and marking final pavement marking alignments. MnDOT personnel shall be given a minimum of 24 hours' notice to provide this service. This shall also include any lane closures or traffic control necessary to complete these projects safely. Payment for said pavement marking related projects shall be incidental.

OR

The Contractor shall be responsible for pavement marking related activities such as, but not inclusive to, collecting data from in place lane lines and marking permanent pavement marking alignments. This shall also include any lane closures or traffic control necessary to complete these projects safely. MnDOT personnel will assist in the location of gores, messages and tapers for permanent pavement marking alignments. MnDOT personnel shall be given a minimum of 24 hours' notice to provide this assistance.

The Contractor shall be responsible for the location and placement of temporary pavement markings. MnDOT personnel will be available to assist in the spotting of transition areas, gores, messages and tapers, and shall be given a minimum of 24 hours' notice to provide this assistance.

S-18.2 Payment for said pavement marking related projects shall be incidental with no direct compensation made.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

The following pages are:

- (2554) TRAFFIC BARRIERS, and
- (2557) FLEXIBLE PLASTIC GLARE SCREEN

from the large Boiler Plate SP 2016

[http://www.dot.state.mn.us/pre-
letting/prov/](http://www.dot.state.mn.us/pre-letting/prov/)

HANDOUT

HANDOUT

S-227 (2554) TRAFFIC BARRIERS
Always use when any plate beam guardrail installation. Use for all Districts including Metro.
REVISED 11/01/16 **DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS**
 S-227.1 MATERIALS

Special Provisions - SP2016 BOOK
 Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 368
DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.
 S.P. Number of Your Job goes here

Guardrail blockouts of composite or recycled material which meet the criteria of NCHRP 350 or MASH may be substituted for wood blockouts in the construction of Type 8307 and Type 8338 Plate Beam Guardrail systems.

Guardrail blockouts of composite or recycled material which meet the criteria of MASH may be substituted for wood blockouts in the construction of Type 31 Plate Beam Guardrail systems.

- (A) **Guardrail Blockouts**
 Guardrail blockouts of composite or recycled material which meet the criteria of NCHRP 350 or MASH may be substituted for wood blockouts in the construction of Type 8307 and Type 8338 Plate Beam Guardrail systems.
- (B) **Delineation**
- (1) Provide I-beam post delineators with retroreflective sheeting meeting the specifications of MnDOT 3352.2.A.2g Sign Sheeting Type XI for fluorescent yellow and MnDOT white sign sheeting.
 - (2) The contractor shall select I-beam post delineator from the Approved Products List.

S-227.2 CONSTRUCTION REQUIREMENTS

- (A) **Guardrail Blockouts**
 Install composite or recycled guardrail blockouts as recommended by the manufacturer.
- (B) **Delineation**
- (1) Install the I-beam delineators at the top of the I-beam post throughout the install at a maximum separation of 50 feet. Attach the delineators as recommended by the manufacturer.
 - (2) Apply the retroreflective sheeting measuring at least 3 in by 3 in to the delineators.
 - (3) For median installations apply the sheeting to both sides of the post and for roadside installations apply the sheeting only to the side of the post facing traffic.
 - (4) The sheeting shall be retroreflective fluorescent yellow or white and shall be the same color as the adjacent edge line.
- S-227.3 METHOD OF MEASUREMENT**
 The Traffic Barrier will be measured by the linear feet of traffic barrier installed. The guardrail blockouts, retroreflective sheeting and I-beam delineators are included in the pay item.
- S-227.4 BASIS OF PAYMENT**
 Payment for the Traffic Barrier will be made under Items 2554.501 (Traffic Barrier Design B8338), 2554.501 (Traffic Barrier Design B8307), or 2554.501 (Traffic Barrier Design Type 31) by linear feet, which shall be payment in full for all costs involved to complete the work as specified.

S-228 BLANK
DELETED 11/01/16
 SP2016-199

Special Provisions - SP2016 BOOK
 Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 369
DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.
 S.P. Number of Your Job goes here

S-229 (2554) TRAFFIC BARRIER DESIGN SPECIAL A
 SP2016-200

This work shall consist of furnishing and installing Traffic Barrier Design Special A in accordance with the applicable MnDOT Standard Specifications, the Plan detail, at the locations shown in the Plan, and the following:

Payment under Item 2554.501 (Traffic Barrier Design Special A) will include the costs of removing existing guardrail if necessary, furnishing and installing additional new posts, furnishing and installing new B8307 Plate Beam Guardrail on the face of the existing guardrail, furnishing and installing C6x8.2 tub rail, and all other materials and work required to reconstruct the guardrail as specified.

S-230 (2554) END TREATMENT - ENERGY ABSORBING TERMINAL
 SP2016-201

This work shall consist of constructing a commercial type energy absorbing terminal in accordance with the applicable provisions of MnDOT 2554, as recommended by the manufacturer, as directed by the Engineer, and the following:

S-230.1 The energy absorbing terminal shall be a flared terminal utilizing steel posts. The steel posts shall be steel breakaway posts as specified by the manufacturer.

S-230.2 The adhesive marker is sold separately from the terminal and shall be incidental. The object marker to use with the energy absorbing terminal is striped yellow and black.

S-230.3 The Contractor is responsible for obtaining the most current details from the manufacturer. The Contractor shall provide one copy for the Engineer.

S-231 BLANK
DELETED 11/01/16
 SP2016-202

S-232 BLANK
DELETED 11/01/16
 SP2016-203

S-233 (2554) END TREATMENT - TANGENT TERMINAL
 Use for all Districts including Metro.

REVISED 11/01/16 **DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS**
 SP2016-204

This work consists of constructing a commercial type energy absorbing terminal in accordance with MnDOT 2554, the details in the Plan, as recommended by the manufacturer, as directed by the Engineer, and the following:

S-233.1 MATERIALS:

SPECIAL PROVISIONS - SP2016 BOOK
 Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 370
▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

S.P. Number of Your Job goes here

- A. Energy Absorbing Terminals**
 Install the Energy Absorbing Tangent Terminal option indicated in the Plan. For object markers and delineation of any energy absorbing terminal provide retroreflective sheeting meeting the specifications of MnDOT 3352.2.A-2g Sign Sheeting Type XI for fluorescent yellow and white sign sheeting.
- B. SKT-350 Sequential Kinking Terminal**
 - (1) Provide SKT-350 Sequential Kinking Terminals manufactured by Road Systems, Inc., Big Spring, Texas.
 - (2) Provide post option as specified in the Plan.
 - (3) Fabricate one 18 in x 18 in adhesive X4-4 (R, L or C) object marker according to the standard drawings in the MnDOT Standard Signs Manual. The alternating black and retroreflective fluorescent yellow stripes shall be sloped down at an angle of 45 degrees toward the side on which traffic is to pass the obstruction (R or L design). If traffic can pass to either side of the obstruction, the alternating black and retroreflective fluorescent yellow stripes shall form chevrons that point upwards (C design).

- C. ET-PLUS**
 - (1) Provide ET-PLUS Extruder Terminals manufactured by Trinity Highway Products, LLC, Dallas, Texas.
 - (2) Provide post option as specified in the Plan.
 - (3) Fabricate one 12 in x 18 in adhesive X4-4 (R, L or C) object marker according to the standard drawings in the MnDOT Standard Signs Manual. The alternating black and retroreflective fluorescent yellow stripes shall be sloped down at an angle of 45 degrees toward the side on which traffic is to pass the obstruction (R or L design). If traffic can pass to either side of the obstruction, the alternating black and retroreflective fluorescent yellow stripes shall form chevrons that point upwards (C design).

- D. Delineation**
 - (1) Provide I-beam post delineators with retroreflective sheeting.
 - (2) The Contractor shall select I-beam post delineator from the Approved Products List.

- E. Snowplow Marker and Post**
 Provide a snow plow marker (X4-5) with retroreflective sheeting and a 3 lb./ft. delineator post (MnDOT 3401).

S-233.2 CONSTRUCTION REQUIREMENTS:

- A. Energy Absorbing Terminals**
 The Contractor is responsible for obtaining the most current details from the manufacturer and providing the Engineer with two copies of the current details and installation manuals. These must be provided at the pre-construction meeting.
- B. SKT-350 Sequential Kinking Terminal**
 - (1) Install the end treatment as specified by the manufacturer.
 - (2) Install the X4-4 adhesive object marker to the end treatment head.
- C. ET-PLUS Extruder Terminal**
 - (1) Install the end treatment as specified by the manufacturer.
 - (2) Install the X4-4 adhesive object marker to the end treatment head.
- D. Delineation**

SPECIAL PROVISIONS - SP2016 BOOK
 Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 371
▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

S.P. Number of Your Job goes here

- (1) Install the I-beam delineators at the top of the first five (5) I-beam posts of the upstream end treatment and the last five (5) I-beam posts of the downstream end treatment. Attach the delineators as recommended by the manufacturer.
- (2) Apply the retroreflective sheeting measuring at least 3 in by 3 in to the delineator.
- (3) For median installations apply the sheeting to both sides of the post and for roadside installations apply the sheeting only to the side of the post facing traffic.
- (4) The sheeting shall be retroreflective yellow or white and shall be the same color as the adjacent edge line.

E. Snowplow Marker and Post

- (1) Install the post with marker at the beginning and end of each guardrail run that was furnished and installed in this project.
- (2) Install the marker post a minimum of 42 in into the ground.
- (3) The top of the post shall be 3 ft above the height of the guardrail. The post with marker shall be 6 in behind the end treatment and/or terminal end as shown on the end treatment detail(s) in the Construction Plan.

S-233.3 METHOD OF MEASUREMENT:

The Energy absorbing terminal will be measured by the number of tangent terminals installed. The retroreflective sheeting, I-beam delineators, and snowplow markers are included in the pay item.

S-233.4 BASIS OF PAYMENT:

Payment for the Energy absorbing terminal will be made under item 2554.523 (End Treatment-Tangent Terminal) by the each, which shall be payment in full for all costs involved to complete the work as specified.

S-234 (2554) END TREATMENT – TYPE 31 TANGENT TERMINAL

Use for all Districts including Metro.

NEW WRITE-UP 11/01/16 <DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS>
 SP2016-204.1

This work consists of constructing a commercial type energy absorbing terminal in accordance with MnDOT 2554, the details in the Plan, as recommended by the manufacturer, as directed by the Engineer, and the following:

S-234.1 MATERIALS:

- A. Energy Absorbing Terminals**
 Install the Energy Absorbing Tangent Terminal option indicated in the Plan. For object markers and delineation of any energy absorbing terminal provide retroreflective sheeting meeting the specifications of MnDOT 3352.2.A-2g Sign Sheeting Type XI for fluorescent yellow and white sign sheeting.
- B. MSKT Sequential Kinking Terminal**
 - (1) Provide MSKT Sequential Kinking Terminals manufactured by Road Systems, Inc., Big Spring, Texas.
 - (2) Provide post option as specified in the Plan.
 - (3) Fabricate one 18 in x 18 in adhesive X4-4 (R, L or C) object marker according to the standard drawings in the MnDOT Standard Signs Manual. The alternating black and retroreflective fluorescent yellow stripes shall be sloped down at an angle of 45 degrees toward the side on which traffic is to pass the obstruction (R or L design). If traffic can pass to either side of the obstruction, the alternating black and retroreflective fluorescent yellow stripes shall form chevrons that point upwards (C design).

HANDOUT

SPECIAL PROVISIONS - SP2016 BOOK Created August 20, 2015
 Last Revision by CO Special Provisions: 01/12/17 Page 373
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**
 S.P. Number of Your Job goes here

S-234.3 METHOD OF MEASUREMENT:
 The retroreflective sheeting, I-beam delineators, and snowplow markers are included in the pay item.

S-234.4 BASIS OF PAYMENT:
 Payment for the Energy absorbing terminal will be made under item 2554.523 (End Treatment-Tangent Terminal) by the each, which shall be payment in full for all costs involved to complete the work as specified.

S-235 BLANK
DELETED 11/01/16
 SP2016-206

S-236 (2554) END TREATMENT – FLARED TERMINAL
 Use for all Districts including Metro.

REVISED 11/01/16 ▲ DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS

This work shall consist of constructing a commercial type energy absorbing terminal in accordance with MnDOT 2554, the details in the Plan, as recommended by the manufacturer, as directed by the Engineer, and the following:

S-236.1 MATERIALS:

A. Energy Absorbing Terminals
 Install one of the Energy Absorbing Flared Terminal options indicated in the Plan. For object markers and delineation of any energy absorbing terminal provide retroreflective sheeting meeting the specifications of MnDOT 3352.2.A.2.g Sign Sheeting Type XI for fluorescent yellow and white sign sheeting.

B. FLEAT-350 Energy Absorbing Terminal
 (1) Provide FLEAT-350 Energy Absorbing Terminal manufactured by Road Systems, Inc., Big Spring, TX.
 (2) Provide post option as specified in the Plan.
 (3) Fabricate one 18 in x 18 in adhesive X4-4 (R, L or C) object marker according to the standard drawings in the MnDOT Standard Signs Manual. The alternating black and retroreflective fluorescent yellow stripes shall be sloped down at an angle of 45 degrees toward the side on which traffic is to pass the obstruction (R or L design). If traffic can pass to either side of the obstruction, the alternating black and retroreflective fluorescent yellow stripes shall form chevrons that point upwards (C design).

C. SRT-350 Energy Absorbing Terminal
 (1) Provide SRT-350 Slotted Rail Terminal manufactured by Trinity Highway Products, LLC, Dallas, TX.
 (2) Provide the post option as specified in the Plan.
 (3) Fabricate one 12 in x 12 in adhesive X4-4 (R, L or C) object marker according to the standard drawings in the MnDOT Standard Signs Manual. The alternating black and retroreflective fluorescent yellow stripes shall be sloped down at an angle of 45 degrees toward the side on which traffic is to pass the obstruction (R or L design). If traffic can pass to either side of the obstruction, the alternating black and retroreflective fluorescent yellow stripes shall form chevrons that point upwards (C design).

D. Delineation

HANDOUT

SPECIAL PROVISIONS - SP2016 BOOK Created August 20, 2015
 Last Revision by CO Special Provisions: 01/12/17 Page 372
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**
 S.P. Number of Your Job goes here

C. SoftStop
 (1) Provide SoftStop Extruder Terminals manufactured by Trinity Highway Products, LLC, Dallas, Texas.

(2) Provide post option as specified in the Plan.
 (3) Fabricate one 6 in x 18 in adhesive X4-4 (R, L or C) object marker according to the standard drawings in the MnDOT Standard Signs Manual. The alternating black and retroreflective fluorescent yellow stripes shall be sloped down at an angle of 45 degrees toward the side on which traffic is to pass the obstruction (R or L design). If traffic can pass to either side of the obstruction, the alternating black and retroreflective fluorescent yellow stripes shall form chevrons that point upwards (C design).

D. Delineation
 (1) Provide I-beam post delineators with retroreflective sheeting.
 (2) The Contractor shall select I-beam post delineator from the Approved Products List.

E. Snowplow Marker and Post
 Provide a snow plow marker (X4-5) with retroreflective sheeting and a 3 lb./ft. delineator post (MnDOT 3401).

S-234.2 CONSTRUCTION REQUIREMENTS:

A. Energy Absorbing Terminals
 The Contractor is responsible for obtaining the most current details from the manufacturer and providing the Engineer with two copies of the current details and installation manuals. These must be provided at the pre-construction meeting.

B. MSKT Sequential Kinking Terminal
 (1) Install the end treatment as specified by the manufacturer.
 (2) Install the X4-4 adhesive object marker to the end treatment head.

C. SoftStop Extruder Terminal
 (1) Install the end treatment as specified by the manufacturer.
 (2) Install the X4-4 adhesive object marker to the end treatment head.

D. Delineation
 (1) Install the I-beam delineators at the top of the first five (5) I-beam posts of the upstream end treatment and the last five (5) I-beam posts of the downstream end treatment. Attach the delineators as recommended by the manufacturer.
 (2) Apply the retroreflective sheeting measuring at least 3 in by 3 in to the delineator.
 (3) For median installations apply the sheeting to both sides of the post and for roadside installations apply the sheeting only to the side of the post facing traffic.
 (4) The sheeting shall be retroreflective yellow or white and shall be the same color as the adjacent edge line.

E. Snowplow Marker and Post
 (1) Install the post with marker at the beginning and end of each guardrail run that was furnished and installed in this project.
 (2) Install the marker post a minimum of 42 in into the ground.
 (3) The top of the post shall be 3 ft above the height of the guardrail. The post with marker shall be 6 in behind the end treatment and/or terminal end as shown on the end treatment detail(s) in the Construction Plan.

HANDOUT

SPECIAL PROVISIONS - SP2016 BOOK
 Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 374
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**
 S.P. Number of Your Job goes here

- (1) Provide I-beam post delineators with retroreflective sheeting.
- (2) The contractor shall select I-beam post delineator from the Approved Products List.

E. Snow Plow Post and Marker
 Provide a snow plow marker (X4-5) with retroreflective sheeting and a 3 lb./ft. delineator post (MnDOT 3401).

S-236.2 CONSTRUCTION REQUIREMENTS:

A. Energy Absorbing Terminals
 The Contractor is responsible for obtaining the most current details from the manufacturer and providing two copies of the current details to the Engineer. These must be provided at the pre-construction meeting.

B. FLEAT-350 Energy Absorbing Terminal
 (1) Install the end treatment as specified by the manufacturer.
 (2) Install the adhesive X4-4 object marker to the end treatment head.

C. SRT-350 Energy Absorbing Terminal
 (1) Install the end treatment as specified by the manufacturer.
 (2) The first length of guardrail attached to the anchor shall be a "half-section" of 1.2 ft 6 in.
 (3) Install the adhesive X4-4 object marker to the end treatment head.

D. Delineation
 (1) Install the I-beam delineators at the top of the first five (5) I-beam posts of the upstream end treatment and the last five (5) I-beam posts of the downstream end treatment. Attach the delineators as recommended by the manufacturer.
 (2) Apply the retroreflective sheeting measuring at least 3 in by 3 in to the delineator.
 (3) For median installations apply the sheeting to both sides of the post and for roadside installations apply the sheeting only to the side of the post facing traffic.
 (4) The sheeting shall be retroreflective fluorescent yellow or white and shall be the same color as the adjacent edge line.

E. Snowplow Marker and Post
 (1) Install the post with marker at the beginning and end of each guardrail run that was furnished and installed in this project.
 (2) Install the marker post a minimum of 42 in into the ground.
 (3) The top of the post shall be 3 ft above the height of the guardrail. The post with marker shall be 6 in behind the end treatment and/or terminal end as shown on the end treatment detail(s) in the Construction Plan.

S-236.3 METHOD OF MEASUREMENT:
 The Energy absorbing terminal will be measured by the number of tangent terminals installed. The retroreflective sheeting, I-beam delineators, and snowplow markers are included in the pay item.

S-236.4 BASIS OF PAYMENT:
 Payment for the Energy absorbing terminal will be made under Item 2554.523 (End Treatment-Flared Terminal) by the each, which shall be payment in full for all costs involved to complete the work as specified.

SPECIAL PROVISIONS - SP2016 BOOK
 Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 375
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**
 S.P. Number of Your Job goes here

S-237 BLANK
REVISED 08/04/16 ◀ DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS
 SP2016-207

S-238 (2554) IMPACT ATTENUATOR BARRELS
Ask District if these are Contractor owned or permanent installation. If permanent, delete the words and remove from S.-3
 SP2016-208

This work shall consist of furnishing and installing commercial type inertial barrier systems in accordance with the applicable provisions of MnDOT 2554, and the following:

The barrier shall be of a type as indicated on the Qualified Product List. The Qualified Product List can be found on the MnDOT Office of Traffic, Safety and Technology website. The Contractor will not be allowed to mix modules, only one barrel system will be allowed at a given location.

MATERIALS

- (A) Inertial barriers shall consist of barrel-type modules complete with parts for proper retention of predetermined sand content and tight fitting covers.
- (B) Sand for filling the modules shall be reasonably dry and mixed with a minimum of 5% by weight of sodium chloride.

S-238.2 CONSTRUCTION REQUIREMENTS

(A) The modules shall be placed at the location shown in the Plan and as directed by the Engineer in accordance with the manufacturer's recommendations, all to the satisfaction of the Engineer. The Contractor is responsible for obtaining the most current details from the manufacturer. The Contractor shall provide one copy for the Engineer.

(B) The Contractor shall maintain a sufficient supply of replacement modules on hand during the course of this Contract to maintain or replace the installations. The Contractor shall replace any modules which get damaged within as short a time period as possible, and shall supply to the Engineer three names of Contractor personnel who can be contacted in case of damage occurring during non-work hours.

S-238.3 MEASUREMENT AND PAYMENT

Measurement will be made by the number of impact attenuator barrels furnished, installed, maintained and removed as specified. Payment will be made under Item 2554.602 (Impact Attenuator Barrels) at the Contract bid price per each, which shall be compensation in full for all costs relative to furnishing, installing, maintaining, and removing the barrels complete in place as specified.

S-239 (2554) RELOCATE IMPACT ATTENUATOR BARRELS
 SP2016-209

This work shall consist of relocating impact attenuator barrels within the Project limits as directed by the Engineer, and the following:

S-239.1 The relocated impact attenuator barrels shall be filled with the proper sand content in accordance with the manufacturer's recommendations.

HANDOUT

SPECIAL PROVISIONS - SP2016 BOOK

Last Revision by CO Special Provisions: 01/12/17
 ▲ **DONOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

Created August 20, 2015
 Page 376

S.P. Number of Your Job goes here

S-239.2 When impact attenuator barrels have to be removed from the Project roadways, but will be needed again in a later phase of the work, the Engineer may direct that they be stockpiled on or near the Project site. When this is done, payment will be made under Item 2554.602 (Relocate Impact Attenuator Barrels). Payment will be made once for removing the impact attenuator barrels from the roadway and placing them in the stockpile; and again for removing them from the stockpile and installing them on the roadway.

S-239.3 Measurement will be made by the number of impact attenuator barrels relocated. Payment will be made under Item 2554.602 (Relocate Impact Attenuator Barrels) at the Contract bid price per each, which shall be payment in full for all costs incidental thereto.

S-240 (2554) CONNECTING PIN

SP2016-210

This work shall consist of furnishing and installing connecting pins to tie portable precast median barriers, where directed by the Engineer. This work shall be performed in accordance with the current MnDOT Standard Plate No. 8337 - Temporary Portable Precast Concrete Barrier, as directed by the Engineer, and the following:

Measurement will be made by the number of connecting pins furnished and installed as specified. Payment will be made under Item 2554.602 (Connecting Pin) at the Contract bid price per each, which shall be payment in full for all costs incidental thereto.

S-241 (2554) POST ASSEMBLY - PLATE BEAM

SP2016-211

This work shall consist of furnishing and installing plate beam guardrail post assemblies in accordance with the provisions of MnDOT 2554, the Plan detail, and the following:

S-241.1 Guardrail posts shall have a 3.5 foot [1.1 meter] spacing at the end of concrete walls.

S-241.2 Measurement will be made by the number of post assemblies furnished and installed as specified. Payment will be made under Item 2554.602 (Post Assembly - Plate Beam) at the Contract bid price per each, which shall be payment in full for all costs incidental thereto, including but not limited to drilling holes and furnishing and installing the necessary hardware.

S-242 (2554) GUARDRAIL TERMINAL POST

SP2016-212

Guardrail terminal posts shall be furnished and installed in accordance with the applicable provisions of MnDOT 2554, except as modified by the following:

S-242.1 **Concrete Terminal Posts** - The reinforcement bars shall be deformed epoxy coated bars as shown on the Plan sheet or Standard Plate. The concrete shall be as specified in MnDOT 3101 and approved by the Engineer.

S-242.2 **H Pile or Wide Flange Posts** - Guardrail terminal posts shall conform to the shape, size and weight per foot [mass per meter], as specified in the Plans, and with the provisions of MnDOT 3306 for wide flange posts or MnDOT 3372 for H pile posts. At least the upper 3 feet [1 m] of the steel posts shall be galvanized in accordance with the provisions of MnDOT 3394.

HANDOUT

SPECIAL PROVISIONS - SP2016 BOOK

Last Revision by CO Special Provisions: 01/12/17
 ▲ **DONOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

Created August 20, 2015
 Page 377

S.P. Number of Your Job goes here

S-242.3 Guardrail terminal posts will be measured by the number of posts furnished and installed complete in place as specified. Payment will be made under Item 2554.602 (Guardrail Terminal Post) at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto.

S-243 (2554) GUARDRAIL POST SEAT

SP2016-213

This work shall consist of constructing guardrail post seats in accordance with the provisions of MnDOT 2554, and the following:

S-243.1 Guardrail Post Seat shall be constructed in accordance with the details shown on the current MnDOT Standard Plate 8316.

S-243.2 Measurement will be made by each installation constructed as specified. Payment will be made under Item 2554.602 (Guardrail Post Seat) at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto, including but not limited to, any cutting of guard rail posts to make the installation at the correct standard height.

S-244 (2554) T-BARRIER BRIDGE CONNECTION DESIGN 8318

SP2016-214

This work shall consist of furnishing and installing T-Barrier Bridge Conn. Terminals in accordance with MnDOT 2554, and the following:

Measurement will be made by the number of terminals furnished and installed as specified. Payment will be made under Item 2554.602 (T-Barrier Bridge Connection Design 8318) at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto.

S-245 (2554) GUIDE POST TYPE SPECIAL

REVISED 11/01/16 **▲DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS**
 SP2016-215

This work shall consist of furnishing and installing flexible delineators for use as guide posts in accordance with the applicable specifications of MnDOT 2554 and the following:

S-245.1 The guide posts shall be furnished in a length sufficient to meet the embedment specified by the manufacturer and the top of post shall extend not less than 4 feet and not more than 5 feet out of the ground.

S-245.2 The posts shall be gray in color and the upper 1 foot of post shall be furnished with a 3 inch wide strip of yellow microprismatic sheeting meeting the requirements of ASTM Type IX.

S-245.3 Measurement will be made by the number of posts furnished and installed as specified. Payment will be made under Item 2554.602 (Guide Post Type Special) at the Contract bid price per each, which will include all costs relative to furnishing and installing the posts.

HANDOUT

HANDOUT

SPECIAL PROVISIONS - SP2016 BOOK

Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 378

▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

S.P. Number of Your Job goes here

S-246 (2554) INSTALL CONCRETE ANCHOR BLOCK

This work shall consist of installing concrete anchor blocks, salvaged elsewhere under this Contract, in accordance with the current MnDOT Standard Plate 8319, the provisions of MnDOT 2554, and the following:

Measurement will be made by the number of salvaged blocks installed as specified. Payment will be made under Item 2554.602 (Install Concrete Anchor Block) at the Contract bid price per each, which shall be payment in full for all costs involved.

S-247 (2554) INSTALL ANCHOR ASSEMBLY - 3 CABLE

This work shall consist of installing Anchor Assembly - 3 cable in accordance with the provisions of MnDOT 2554 and the following:

Measurement will be made by the number of anchor assemblies installed complete in place as specified. Payment will be made under Item 2554.602 (Install Anchor Assembly - 3 Cable) at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto.

S-248 (2554) INSTALL ANCHOR ASSEMBLY - PLATE BEAM

This work shall consist of installing salvaged plate beam anchor assemblies in accordance with the provisions of MnDOT 2554, and the following:

Measurement will be made by each installation constructed as specified. Payment will be made under Item 2554.602 (Install Anchor Assembly-Plate Beam) at the Contract bid price per each, which shall be compensation in full for all costs incidental thereto.

S-249 (2554) WATER FILLED BARRIER

SP2016-219

This work shall consist of furnishing, installing, and maintaining water filled barriers in accordance with the applicable MnDOT Standard Specifications and the following:

S-249.1 All barrier shall be placed as shown in the Traffic Control Plans and as directed by the Engineer.

S-249.2 The barrier shall not be removed until the Engineer approves the removal.

S-249.3 The barrier shall remain the property of the Contractor.

S-249.4 Measurement will be made by the length of barrier furnished and installed complete in place as specified.

S-249.5 Payment will be made under Item 2554.603 (Water Filled Barrier) at the Contract bid price per linear foot [meter], which shall be compensation in full for costs relative thereto, including but not limited to moving or removing the barrier as specified when approved by the Engineer, unless the relocation thereto are compensated for separately under this Contract.

SPECIAL PROVISIONS - SP2016 BOOK

Last Revision by CO Special Provisions: 01/12/17
 Created August 20, 2015
 Page 379

▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**

S.P. Number of Your Job goes here

S-250 (2554) RELOCATE WATER FILLED BARRIER

This work shall consist of relocating water filled barrier within the Project limits as directed by the Engineer.

Measurement will be made by the length of water filled barrier relocated. Payment will be made under Item 2554.603 (Relocate Water Filled Barrier) at the Contract bid price per linear foot [meter], which shall be compensation in full for all costs related thereto.

S-251 (2554) TENSION CABLE GUARDRAIL

Designer needs to fill in number of days needed in S-12.

REVISED 05/13/16 (DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS)

This work shall consist of constructing High Tension Cable Barrier (HTCB) in accordance with MnDOT 2554, as directed by the Engineer, and the following:

S-251.1 High Tension Cable Barrier systems shall satisfy all the following criteria:

- 1) Satisfy the requirements for test level 4 (TL-4) as defined by the criteria of NCHRP Report 350 or MASH for 1:6 slopes or flatter.
- 2) Satisfy the requirements for test level 3 (TL-3) as defined by the criteria of NCHRP Report 350 or MASH on slopes steeper than 1:6, and up to 1:4.
- 3) Utilize four (4) pre-stretched cables.
- 4) Unless specified or shown in the Plan, line post socket foundation shall be steel.
- 5) End anchorage assembly foundations must be concrete.
- 6) All end anchorage assemblies and intermediate line post foundations shall be designed in accordance with the latest edition of the AASHTO LRFD Bridge Design Specifications, including all interims, herein referred to as "AASHTO LRFD."

S-251.2 Follow manufacturers' recommendations for vertical tolerance of cables with respect to the ground level.

S-251.3 The alignment and location of the HTCB shall be according to the Plan. The HTCB shall have a maximum line post spacing of 10 feet, center to center. Line posts shall be plumbed within the sockets. Any socket or foundation that doesn't produce a plumb post shall be removed and replaced.

S-251.4 Avoid all utilities by adjusting the post spacing longitudinally, without exceeding the maximum line post spacing.

S-251.5 High tension cable systems shall be furnished with cable splices/turnbuckles as a means of adjusting the tension of individual ropes at a maximum interval of 1000 feet.

S-251.6 Use only swage type fittings for all line cable connections. The fitting must be superior in strength to the cable itself. End anchorage assembly cable connections must be per manufacturer's detail.

S-251.7 Do not locate turnbuckles and cable connections at, on, or abutting any line posts in the assembly, unless such placement is indicated as crash-worthy, in the FHWA eligibility letter (two splices per line post max.).

S-251.8 The Contractor shall replace any edge drains damaged during the drilling or excavation for posts or end anchorage assemblies as per MnDOT 2502. Reroute any edge drains encountered but not damaged around the post location. Payment for such replacement or rerouting (as applicable) will be paid for under MnDOT 1402.5.

S-251.9 Tension the HTCB system according to the manufacturer's recommendations at the time of installation. The Contractor shall check and adjust the tension approximately three (3) weeks after installation. No additional compensation will be provided for any subsequent tensioning actions.

S-251.10 Design driven sockets within any curved sections to resist the additional lateral component of the tension forces from the cable.

S-251.11 A Minnesota Licensed Professional Engineer will design all end anchorage assemblies and intermediate line post foundations in accordance with the current version and all interims of AASHTO LRFD Bridge Design Specifications. The Plan will contain all the necessary details and design information, including required embedment depth, to construct end anchorage assemblies, line posts, and line post foundations. The soil parameters used in the design will be based on the borings taken at the end anchorage assembly locations during the site investigation except that the soil strengths used in the design will not exceed a friction angle of 35° for the end anchorage assemblies and 30° for the intermediate line posts for cohesion-less soils or 1000 pounds per cubic foot for cohesive soils for the end anchorage assemblies and intermediate line posts. Support or resistance provided by the top 3 feet of soil shall not be included in the design of end anchorage assemblies.

Designer needs to fill in number of days needed in S-12.

S-251.12 Design of end anchorage assemblies, line posts and line post foundations shall meet the following requirements:

- Design load shall be based on the PLASTIC MOMENT CAPACITY of the cable supporting posts.
- Maximum lateral deflection, under design load, at the top of end anchorage assembly, concrete foundation, or steel socket foundation to be one inch.
- End anchorage assemblies, concrete foundations and steel socket foundations shall be in accordance with the current version and all interims of AASHTO LRFD strength and serviceability requirements under normal load cases. These foundations shall survive the loads due to the vehicular impact induced loads. These loads shall not be treated as extreme loads.
- The bottom of the end anchorage assemblies, concrete foundations and steel socket foundations shall be at least 5 feet below the finished grade to meet frost depth requirements.
- The acting forces and moments on the end anchorage assemblies and steel sockets shall be derived from the most current version of TL-Pile or similar software for analysis of piles under lateral loads in different horizontal directions, based on the true structure configurations, such as socket with soil plate.
- Reinforcement bars for all concrete foundations shall be epoxy coated in accordance with MnDOT 3301.

Prior to installing the HTCB system, the Contractor shall have [redacted] (working days, calendar days) to provide the Engineer with two (2) sets of Manufacturer prepared design calculations and notes in accordance with AASHTO LRFD, shop drawings, and construction specifications certified by a Minnesota Licensed Professional Engineer. The Contractor shall allow at least twenty one (21) calendar days for the review process and shall not begin installation until receiving approval. The shop drawings and calculations shall detail the end anchorage assemblies, and line post Steel Socket and/or Concrete Foundations. The recommended depths for the end anchorage assemblies, line post Steel Socket Foundation and/or Concrete Foundation and the design of the end anchorage assemblies and line post Steel Socket Foundations shall be approved and certified by a Minnesota Licensed Professional Engineer. The Engineer, in concurrence with the MnDOT Bridge and Foundation Offices, will review and comment prior to installation. The time required to get the shop drawings approved will not be allowed as justification for extension in the contract time.

Materials & Road Research

1400 Gervais Ave
 Maplewood, MN 55128-3307
Gary Person 651/366-5598
Gary.Person@state.mn.us

Bridge Office

3485 Hadley Avenue North
 Oakdale, MN 55128-3307
Jibshya Lin 651/366-4490
Jibshya.Lin@state.mn.us

S-251.13 Steel socket foundations shall be designed in accordance with the current version and all interims of AASHTO LRFD Bridge Design Specifications including the lateral soil pressure due to the design loads on the top of the foundation and shall include the use of soil plates to resist foundation tipping or movement on both tangent and curved alignments. Install steel socket foundations with a drop hammer capable of producing plumb post without resulting in damage or mushrooming of the foundation components. The socket for concrete line post foundations shall be installed inside the foundation rebar cage. The top of the rebar cage shall be secured 3 inches below the planned top of concrete, prior to concrete placement. Refer to MnDOT Standard Plate 8342 for additional details. Remove steel or concrete line post foundations not at the proper height or alignment and install a new foundation.

Galvanize socket for cable line post after fabrication per MnDOT 3392 and 3394.

S-251.14 Delineate HTCB installations with retroreflective sheeting. Apply the sheeting to the last five (5) posts at each end of the terminal. Apply the sheeting throughout the remainder of the installation at a maximum of 50 foot intervals. The sheeting shall meet the requirements of MnDOT 3352.2.A.2g Sign Sheeting Type XI for fluorescent yellow sign sheeting and MnDOT 3352.2.A.2b Sign Sheeting Type IV for white sign sheeting. The retroreflective sheeting should be on flat surface, perpendicular to traffic and shall have a minimum dimension of 3 inches. Attach the sheeting near the top of the post as recommended by the manufacturer of the cable system. Apply the sheeting to both sides of the post for median installations. Apply the sheeting only to the side of the post facing traffic for roadside installations. The sheeting shall be fluorescent yellow or white and shall be the same color as the adjacent edge line.

S-251.15 Install snow plow marker (X4-5) with a 2 lb./ft. delineator post 10 feet long driven into the ground a minimum of 48 inches. Extend post a minimum of 5 feet above the ground line and 6 inches adjacent to end anchorage assembly. Install marker at the beginning and end of each run. Snowplow markers and post shall be incidental.

S-251.16 The following High Tension Cable Barrier systems are approved for use, as listed below:

- District 1
 - Brifen TL-4 (4-Rope) WRSF
 - Trinity Highway Products CASS-S3 (1:4 Slope) 4-Cable Guardrail Safety System
- District 2
 - Brifen TL-4 (4-Rope) WRSF
 - Trinity Highway Products CASS-S3 (1:4 Slope) 4-Cable Guardrail Safety System
- District 3
 - Brifen TL-4 (4-Rope) WRSF
 - Gibraltar TL-4, 4 Cable Barrier System
- District 4
 - Brifen TL-4 (4-Rope) WRSF
 - Gibraltar TL-4, 4 Cable Barrier System

SPECIAL PROVISIONS - SP2016 BOOK Created August 20, 2015 Page 382
 Last Revision by CO Special Provisions: 01/12/17
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**
 S.P. Number of Your Job goes here

- Metro
 - Brifen TL-4 (4-Rope) WRSF
 - Gibraltar TL-4, 4 Cable Barrier System
 - Trinity Highway Products CASS-S3 (1:4 Slope) 4-Cable Guardrail Safety System
- District 6
 - Brifen TL-4 (4-Rope) WRSF
 - Gibraltar TL-4, 4 Cable Barrier System
- District 7
 - Brifen TL-4 (4-Rope) WRSF
 - Gibraltar TL-4, 4 Cable Barrier System
- District 8
 - Brifen TL-4 (4-Rope) WRSF
 - Trinity Highway Products CASS-S3 (1:4 Slope) 4-Cable Guardrail Safety System

S-251.17 **METHOD OF MEASUREMENT**
 Each HTCB beginning and end, must be terminated with an end anchorage assembly. The end anchorage assembly shall be as specified by the manufacture of the HTCB system. The Engineer will measure the number of end anchorage assemblies by the number installed.

The Engineer will measure the length of each High Tension Cable Barrier system furnished and installed from end to end, including end anchorage assembly lengths.

S-251.18 **BASIS OF PAYMENT**
 End Anchorage Assemblies payment will be made under Item 2554.521 (Anchorage Assembly – Tension Cable) at the Contract bid price per each, which shall be payment in full for all costs involved necessary to complete the work as specified.

High Tension Cable Barrier payment will be made under Item 2554.603 (Tension Cable Guardrail) at the Contract bid price per linear foot [meter], which shall be payment in full for all costs involved necessary to complete the work as specified.

S-252 **(2554) TENSION CABLE GUARDRAIL WARRANTY**
 Designer needs to make sure that the District has identified who will be responsible for checking the Warranty Work. If HTCB is part of the overall project, use S-2 and indicate the value of the bond.

The Contractor shall provide a one-year warranty for the Tension Cable Guardrail required in Section S-2554 (TENSION CABLE GUARDRAIL) of these Special Provisions.

S-252.1 **DEFINITIONS AND TERMS**

Final Construction Acceptance (FCA). The date when the warranted Tension Cable Guardrail is complete and the roadway is open to the public without restrictions. This date constitutes the start of the warranty period.

Warranty Bond. A surety that guarantees that the warranty requirements are met.

Warranty Period. The Warranty Period shall be one (1) year, starting at the Final Construction Acceptance (FCA).

SPECIAL PROVISIONS - SP2016 BOOK Created August 20, 2015 Page 383
 Last Revision by CO Special Provisions: 01/12/17
 ▲ **DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**
 S.P. Number of Your Job goes here

Warranty Work. Corrective actions taken to bring the warranted work into Contract compliance for release of the warranty bond.

S-252.2 **WARRANTY BOND**
Amount and Term. The Contractor must furnish a single-term warranty bond in the amount of \$_____ The bond shall be furnished to the Department at the same time as the other Contract Bonds specified in MnDOT 1305. The effective starting date of the warranty bond must be the FCA. The warranty bond will be released at the end of the Warranty Period or after all warranty work has been completed, whichever is last. The form of the warranty bond shall be acceptable to the Contracting Authority.

S-253 **(2554) IMPACT ATTENUATOR**
 SP2016-223
 This work shall consist of furnishing, installing, maintaining, replacing if damaged or destroyed, and removing Impact Attenuators as shown in the Plan. This work shall be performed in accordance with the applicable MnDOT Standard Specifications and the following:

S-253.1 The Impact Attenuator shall be on the MnDOT Approved Product List for Temporary Crash Attenuators. The list is found on the MnDOT website at <http://www.dot.state.mn.us/products/temporarycrashcontrol/temporarycrashcushions.html>. It shall be the responsibility of the Contractor to obtain all required details to install these systems.

S-253.2 The Contractor shall choose an Impact Attenuator that fits the site specific requirements for the Project.

S-253.3 Measurement will be made by the number of impact attenuators furnished, installed, and removed as specified. Payment will be made under Item 2554.615 (Impact Attenuator) at the Contract bid price per assembly, which shall be compensation in full for all costs relative thereto.

S-254 **(2554) IMPACT ATTENUATOR (C-A-T)**
 SP2016-224
 This work shall consist of furnishing all materials for, and installing complete and in place, commercial type energy absorbing impact attenuators in accordance with MnDOT 2554 and the following:

S-254.1 The end protection for the concrete median barrier shall be the Crash-Cushion/Attenuating Terminal, (C-A-T), system manufactured by Trinity Highway Products, LLC, Dallas, TX.

S-254.2 The Contractor shall maintain a sufficient supply of replacement parts on hand during the course of this Contract to maintain or repair the installations. The Contractor shall repair any attenuators which get damaged within as short a time period as possible, and shall supply to the Engineer three names of Contractor personnel who can be contacted in case of damage occurring during non-work hours.

S-254.3 The Contractor is responsible for obtaining the most current details from the manufacturer. The Contractor shall provide one copy for the Engineer.

S-254.4 **MEASUREMENT AND PAYMENT**
 Measurement will be made of the number of Crash-Cushion/Attenuating Terminal (C-A-T) energy absorbing terminal impact attenuator assemblies furnished and installed complete in place.

SPECIAL PROVISIONS - SP2016 BOOK

Last Revision by CO Special Provisions: 01/12/17

Created August 20, 2015

Page 384

▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

S.P. Number of Your Job goes here

Payment will be made under Item 2554.615 (Impact Attenuator) at the Contract bid price per assembly, which shall be compensation in full for all costs relative to furnishing and installing the assemblies complete in place as specified.

S-255 (2554) IMPACT ATTENUATOR (QUAD GUARD)

SP2016-225

This work shall consist of furnishing and installing Quad Guard Construction Zone Attenuator Systems for use as temporary impact attenuators at locations tabulated on Sheet No. ___ of the Plan. This work shall be performed in accordance with the applicable MnDOT Standard Specifications and the following:

- S-255.1 It shall be the responsibility of the Contractor to obtain all required details to install these systems.
- S-255.2 Quad Guard Construction Zone Systems are manufactured by Energy Absorption Systems Inc., One East Wacker Drive, Chicago, Ill. 60601-2076, Telephone: 312-467-6750, or an approved equal.

S-255.3 MEASUREMENT AND PAYMENT

Measurement will be made by the number of impact attenuators furnished, installed, and removed as specified. Payment will be made under Item 2554.615 (Impact Attenuator) at the Contract bid price per assembly, which shall be compensation in full for all costs relative thereto.

S-256 (2554) IMPACT ATTENUATOR (SMART CUSHION)

NEW WRITUP 11/06/15 - DO NOT REMOVE THIS. IT NEEDS TO STAY IN FOR THE CONTRACTORS

SP2016-225.1

This work shall consist of furnishing and installing the Impact Attenuator as shown in the Plan. This work shall be performed in accordance with the applicable MnDOT Standard Specifications and the following:

S-256.1 MATERIALS

- (A) Provide the SMART Cushion impact attenuator as indicated in the Plan.
Manufacturer: Work Area Protection Corporation
Product: SCI100GM Impact Attenuator (SMART Cushion)
 - (B) For delineation of any impact attenuator provide two 18 in x 18 in adhesive object marker striped black and retroreflective fluorescent yellow. Provide fluorescent yellow sign sheeting meeting the specifications of MnDOT 3352.2.A.2-g Sign Sheet Type XI.
 - (C) Provide a SMART Cushion delineator panel.
- S-256.2 CONSTRUCTION REQUIREMENTS**
- (A) The Contractor is responsible for obtaining the most current details from the manufacturer and providing a copy of the current details to the Engineer.
 - (B) Install the impact attenuator as specified by the manufacturer.
 - (C) Install the delineator panel as specified by the manufacturer. The alternating black and retroreflective fluorescent yellow stripes shall be sloped down at an angle of 45 degrees toward the side on which traffic is to pass the impact attenuator. If traffic can pass to either side of the impact attenuator, the alternating black and retroreflective fluorescent yellow stripes shall form chevrons that point upwards.

SPECIAL PROVISIONS - SP2016 BOOK

Last Revision by CO Special Provisions: 01/12/17

Created August 20, 2015

Page 385

▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.

S.P. Number of Your Job goes here

S-256.3 METHOD OF MEASUREMENT

Measurement will be made by the number of impact attenuators installed. The retroreflective sheeting, delineator panel, and concrete pad are included in the pay item.

S-256.4 BASIS OF PAYMENT

Payment for the Impact Attenuator will be made under Item 2554.615 (Impact Attenuator) by the assembly, which shall be payment in full for all costs involved to complete the work as specified.

S-257 (2554) RELOCATE IMPACT ATTENUATOR

SP2016-226

This work shall consist of relocating impact attenuator assemblies within the Project site as directed by the Engineer and the following:

- S-257.1 Payment will be made for relocating the impact attenuator assemblies under any of the following conditions:
 - (A) Relocating the assemblies within the Project roadways.
 - (B) Relocating the assemblies from Project roadway to stockpile for later use on Project roadways.
 - (C) Relocating the assemblies from stockpile to Project roadways.

S-257.2 Measurement will be made on the basis of each separate impact attenuator assembly relocated. Payment will be made under Item 2554.615 (Relocate Impact Attenuator) at the Contract bid price per assembly, which shall be compensation in full for all costs incidental thereto.

S-258

SP2016-227

This work shall consist of constructing flexible polyethylene headlight blades on concrete median barrier in accordance with the applicable MnDOT Standard Specifications, the details shown on the Plans, and the following:

S-258.1 MATERIALS

The plastic blades and other components shall conform to the requirements shown on current MnDOT Standard Plate 8326.

S-258.2 CONSTRUCTION REQUIREMENTS

- The plastic blades shall be installed in accordance with the manufacturer's recommendations and the following:
 - (A) All blades shall be installed vertical and true to line.
 - (B) The base plate brackets shall be installed as level as is possible, to the satisfaction of the Engineer.
 - (C) After the plastic blades are installed in their final position (vertical and true to line) the nuts shall be drawn up tight on the washers to prevent any movement of the blades.
 - (D) Any damage to the concrete median barrier which may be caused by installation of the flexible glare screen thereon shall be repaired to the satisfaction of the Engineer, and without direct cost to the State.

SPECIAL PROVISIONS - SP2016 BOOK

Last Revision by CO Special Provisions: 01/12/17

Created August 20, 2015

Page 386

▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**S.P. Number of Your Job goes here****S-258.3 MEASUREMENT AND PAYMENT**

Measurement will be made by the length of median barrier on which flexible plastic glare screen is constructed as specified. Payment will be made under Item 2557.603 (Flexible Plastic Glare Screen) at the Contract bid price per linear foot [meter], which shall be compensation in full for all costs incidental thereto.

S-259 (2557) TEMPORARY GLARE SCREEN

SP2016-228

This work shall consist of constructing modular units of flexible polyethylene headlight blades to be attached to temporary concrete median barrier in accordance with the applicable MnDOT Standard Specifications, and the following:

S-259.1 MATERIALS

The plastic blades and other components shall conform to the requirements shown on current MnDOT Standard Plate 8326, or may be any other temporary glare screen acceptable to the Engineer.

S-259.2 CONSTRUCTION REQUIREMENTS

The temporary modular glare screen shall be installed in accordance with the manufacturer's recommendations and the following:

- (A) Base plate brackets for the modular units shall be 10 feet [3 m] long and be bolted to the barrier at three locations. The distance between the end of the bracket and the first bolt shall be 6 inches [150 mm]. Bolt holes in the base plate brackets shall be slotted to allow for expansion and contraction. Base plate brackets made of timber will not be allowed.
 - (B) All blades shall be installed vertical and true to line.
 - (C) The base plate brackets shall be installed as level as possible, to the satisfaction of the Engineer.
 - (D) After the plastic blades are installed in their final position (vertical and true to line) the nuts shall be drawn up tight on the washers to prevent any movement of the blades.
 - (E) Any damage to the concrete median barrier which may be caused by installation of the temporary modular glare screen thereon shall be repaired to the satisfaction of the Engineer, and without direct cost to the State.
 - (F) Shop drawings of the temporary modular glare screen shall be submitted to the Engineer for approval prior to installation of the glare screen.
 - (G) Plastic blades or base plate brackets damaged by the Contractor during subsequent handling shall be replaced by the Contractor at no cost to the State.
- S-259.3 MEASUREMENT AND PAYMENT**
Measurement will be made by the length of median barrier on which temporary glare screen is constructed as specified. Payment will be made under Item 2557.603 (Temporary Glare Screen) at the Contract bid price per linear foot [meter], which shall be compensation in full for all costs incidental thereto.
- Relocation of the temporary glare screen shall be considered incidental.

SPECIAL PROVISIONS - SP2016 BOOK

Last Revision by CO Special Provisions: 01/12/17

Created August 20, 2015

Page 387

▲ DO NOT DELETE THE ABOVE REVISION DATE. This is how we tell which version of the SP2016 book you used when preparing your specs for your job.**S.P. Number of Your Job goes here****S-260 (2557) INSTALL CHAIN LINK FENCE**

SP2016-229

This work shall consist of installing chain link fence salvaged elsewhere under this Contract in accordance with the following:

Measurement will be made by the length in linear feet [meters] of fence installed complete in place as specified. Payment will be made under Item 2557.603 (Install Chain Link Fence) at the Contract bid price per linear foot [meter], which shall be compensation in full for all costs incidental thereto, including but not limited to: 1) installing fence components removed and salvaged elsewhere under this Contract in the new locations as specified, and 2) furnishing and installing any other new fence components as may be required for the complete installation, in addition to those materials available from the salvage operations.

S-261 (2563) TRAFFIC CONTROL SUPERVISOR

The designer needs to modify Section S-3 as to when the Traffic Control Supervisor will be required.

WHENEVER YOU USE THIS WRITEUP, YOU HAVE TO HAVE THE PAY ITEM FOR THIS ON THE PLAN. IT CANNOT BE INCIDENTAL.

SP2016-230

The Contractor shall provide a Traffic Control Supervisor for all major traffic control modifications to the Project, in accordance with Contract provisions and as directed by the Engineer.

S-261.1 The Contractor shall provide a Traffic Control Supervisor for all major traffic control modifications listed below:

1. Initial startup of the Project
2. Whenever any bypass is placed into operation
3. Winter suspension traffic control adjustment operation
4. Spring start-up traffic control adjustment operation
5. Completion of the Project
6. Any other major changes to the Traffic Control set-up (due to Contractors staging of operations)

The Traffic Control Supervisor shall be on site 3 days prior to all major traffic control modifications listed above until the major traffic control modification is functioning properly allowing for safe, long term accommodations for traveling public.

During the 3 day time period prior to the major traffic control modification, the Traffic Control Supervisor will be expected to be on-site to develop a site plan for the major traffic control modification, to determine and ensure timely delivery of the proper quantity of traffic control devices, and to develop staging plans for the major traffic control modification operation. The Traffic Control Supervisor shall then coordinate and direct the installation of the devices as well as the staging of the traffic control modification to ensure a safe and efficient transition is completed. Following the transition, the Traffic Control Supervisor shall monitor the traffic flow of the site(s) in question and make modifications necessary to provide for the safe and efficient passage of the traveling public.

S-261.2 The Traffic Control Supervisor shall be certified as a worksite supervisor by MnDOT. A copy of the traffic Control Supervisor's certification shall be provided to the Engineer at the Project pre-construction conference.

MnDOT certification as a Traffic Control Supervisor can be obtained by attending a 3 day MnDOT Traffic Control Supervisor Course within the last 5 years. Additional information on MnDOT's certification can be obtained by contacting Leigh Kriewall at 651-366-4217.

6.4 Addendum

At times it may become necessary to provide additional information, corrections, additions, or deletions to the Special Provisions, Plans, and/or Spec Book after the Project is put on sale, but before the actual letting of the Project. This information is provided to bidders by creating an “addendum”. This addendum is then sent out to Contractors, suppliers, etc. that have purchased the Contract documents for the specific project. This addendum is sent out with enough lead time to allow bidders the opportunity to consider the addendum in preparing their bid. The *addendum will be located in the front portion of the MnDOT project proposal.*

6.5 Supplemental Agreements

It is important that Plans and Special Provisions are clear, accurate, and adequately indicate the work that the Contractor is required to perform. However, when that does not happen, or if some item(s) is inadvertently omitted from the project documents, MnDOT will negotiate a supplemental agreement with the Contractor to rectify the situation. There are occasions when supplemental agreements are necessary due to field conditions that were not apparent at the time of the project design. It is, however, in the best interest of everyone to try and keep supplemental agreements to a minimum.

6.6 Pay Items

Information on Pay Items can be obtained from the AASHTOWare Project Item List website:

<http://bidlet.dot.state.mn.us/ItemSearch.aspx>

The website includes a search box to look for individual items (See **Exhibit 6-3**). The results will list the item by:

- ✓ Item Number
- ✓ Short Description
- ✓ Long Description
- ✓ Unit Name
- ✓ Plan Unit Description
- ✓ Specification Year

The results, or the entire AASHTOWare list can be export to PDF and CSV formats.

Exhibit 6-3 AASHTOWare Website

MnDOT Standard Specifications For Construction
AASHTOWare Project Item List

Pre Letting | Post Letting | References | Quick Links

AASHTOWare Project Item List Search

(Search by item description)

Spec Year 2016 Spec Year 2014

Export list to PDF or CSV format

Export To PDF:(Export The Entire Spec Book) [Export To PDF](#)

Export To CSV:(Export The Entire Spec Book) [Export To CSV](#)

Enter the item in the "Search" box

Search results with: Item Number, Short and Long Description, Unit Name, Plan Unit Description, Spec Year

Export To CSV:(Export Only Selected Items From Search Page) [Export To CSV](#)

Item Number	Short Description	Long Description	Unit Name	Plan Unit Description	Spec Year
2563.602/00098	TUBE DELINEATOR	TUBE DELINEATOR	EACH	EACH	16
2563.602/00099	REPLACE TUBE DELINEATOR	REPLACE TUBE DELINEATOR	EACH	EACH	16
2563.602/00100	YELLOW TUBE DELINEATOR	YELLOW TUBE DELINEATOR	EACH	EACH	16
2563.602/00101	REPLACE YELLOW TUBE DELINEATOR (NEW)	REPLACE YELLOW TUBE DELINEATOR (NEW)	EACH	EACH	16
2563.602/00102	REPLACE YELLOW TUBE DELINEATOR (SALV)	REPLACE YELLOW TUBE DELINEATOR (SALV)	EACH	EACH	16
2563.602/00103	REPLACE YELLOW TUBE DELINEATOR	REPLACE YELLOW TUBE DELINEATOR	EACH	EACH	16
2563.602/00105	REPLACE TUBE DELINEATOR (NEW)	REPLACE TUBE DELINEATOR (NEW)	EACH	EACH	16
2563.602/00106	REPLACEMENT TUBE DELINEATOR	REPLACEMENT TUBE DELINEATOR	EACH	EACH	16
2563.613/00040	YELLOW TUBE DELINEATORS	YELLOW TUBE DELINEATORS	UDAY	UNIT DAY	16
2563.613/00042	TUBE DELINEATORS	TUBE DELINEATORS	UDAY	UNIT DAY	16

Total number of record(s) found = 10

Record Per page: ▼

7. APPENDIX

7.1 Metro Website TMP Resources

The following information is from MnDOT Metro district's work zone website. The information is located at:

http://www.dot.state.mn.us/metro/trafficeng/control_striping.html.

The following are included:

- ✓ TMP Process and Components
- ✓ TMP Scoping Worksheet
- ✓ TMP Worksheet
- ✓ TMP Template
- ✓ Red Flag Checklist
- ✓ Work Zone Mobility Impact Assessment Worksheet

7.1.1 TMP Process and Components

6/22/2015

Metro District Transportation Management Plan (TMP) Process

TMP Development During Scoping and Design

1. The Project Manager is the steward of the TMP-related documents during scoping and design and is responsible for ensuring that they get completed, with responsibilities as described under “components of TMP”.
 - a. Project Manager will work with MnDOT Offices of Construction, Traffic, Public Affairs, Business Liaison, Area Engineer, RTMC, and FHWA as needed (this group will be the TMP team).
2. The TMP Scoping Worksheet will be completed during project scoping. This worksheet consists of the Work Zone Mobility Impact Assessment Worksheet, Red Flag Checklist (including consideration of ABC techniques), and TMP Scoping Conclusions. The Work Zone Mobility Impact Assessment Worksheet will determine whether the Red Flag Checklist needs to be completed during scoping, and whether a TMP, Basic TMP, or no TMP is needed during project development.
3. For projects that do not go through the MnDOT scoping process, the Work Zone Mobility Impact Assessment Worksheet and Red Flag Checklist will be completed.
4. If it is determined that a TMP or Basic TMP is needed for a project, a first run of the TMP worksheet will be done prior to 30% plan completion.
 - a. It is recommended that the Project Manager has a meeting with the TMP team to discuss known or possible impacts and mitigation considerations.
 - b. If answers to items are not yet known, “Possible” can be entered in the checklist.
When the checklist is complete, all “Possible” items must be changed to “Yes”, “No” or “N/A”.
5. If a TMP is needed, a draft TMP will be sent to FHWA (for federally funded projects) prior to the 60% plan completion.
6. For locally led projects, a draft TMP will be submitted with the 60% submittal and the “final” TMP will be submitted with the 90% submittal.
7. The MnDOT Metro Traffic Work Zone group will work directly with RTMC regarding RTMC and ITS traffic mitigation measures, and to coordinate RTMC and work zone traffic control.
8. When the MnDOT Metro Construction office is preparing the Time and Traffic special provisions, the construction Project Engineer will refer to the TMP worksheet to confirm provisions/commitments that were made. If there are conflicts between the T&T and the TMP worksheet, the TMP team will discuss.

6/22/2015

TMP Modifications During Construction (projects with MnDOT Metro contract administration)

9. After the project is let, the Resident Engineer will become the steward of the document for construction administration. If other functional areas have additional documentation (RTMC changes, monitoring, etc), they will add it to the TMP folder in ProjectWise.
10. If any significant changes are made during construction that conflict with provisions or commitments made in the TMP, the Project Engineer will document this as a "Change to the TMP".
 - a. Prior to making these changes, the Project Engineer will discuss them with the applicable TMP Modification Contacts. The TMP Modification Contacts will be listed in the TMP document, and will include the Project Manager, Traffic Work zone supervisor, Area Engineer, Project Business Liaison, Resident Engineer and others as needed.
 - b. Examples of changes requiring documentation include
 - i. Significant revision of duration of ramp or lane closures
 - ii. Closing ramps or lanes that were noted in the TMP as remaining open
 - iii. Closing access to residences or businesses that were noted in the TMP as being maintained
 - iv. Extending allowed maximum time for ramp, road, or staged lane closures that were noted in the TMP
 - v. Increase in established number of mainline road closures
 - vi. Other significant changes as needed
 - c. The details regarding the change, and the reason for the change, will be documented and e-mailed to a list of TMP Modification Contacts. The MnDOT Metro Traffic office will add this information to the TMP folder in ProjectWise.
11. If performance standards for mobility and safety that were established in the TMP are not met, the additional mitigation strategy recommendations will be documented as a "Change to the TMP" and sent to the TMP Modifications Contacts by the MnDOT Metro Traffic office.

6/22/2015

Components of TMP (with responsible team member)

1. Title Sheet (PM)
2. Table of Contents (PM)
3. Project Description (PM)
 - a. Corridor discussion and project scope
 - b. TMP team
4. TMP Scoping Worksheet (PM)*
5. TMP worksheet (assigned to TMP team by PM)
6. Traffic Analysis (as needed) (Traffic)
7. Traffic and Staging Discussion (Traffic)
8. Time and Traffic special provisions discussion (Traffic)
9. Public Information Communications Plan (PAC)
10. TMP Modifications Process (PM)
11. Appendices
 - a. Modeling output
 - b. Meeting minutes
 - c. Correspondence
 - d. Traffic Control plans
 - e. Time and Traffic Special Provisions
 - f. Modifications to TMP (Construction/Traffic)
 - g. Others as needed

The size of the document will be dependent on the complexity of the project. For projects with relatively minor traffic impacts, the TMP will be simple. For complex projects with major traffic impacts, the TMP will be more detailed, with more analysis, discussion, and mitigations.

Components of Basic Transportation Management Plan (with responsible team member)

1. TMP Scoping Worksheet (PM)*
2. TMP Worksheet (assigned to TMP team by PM)**
3. Traffic Control Plans (if applicable) (Traffic)
4. Time and Traffic Special Provisions (Construction)

*If project did not go through MnDOT scoping process, include Work Zone Mobility Impact Assessment Worksheet and Red Flag Checklist

** If project does not impact traffic flow or access (such as shoulder work), a summary of the traffic control and description of work may be substituted for the TMP worksheet.

7.1.2 TMP Scoping Worksheet

TMP Scoping Worksheet

WORK ZONE MOBILITY IMPACT ASSESSMENT WORKSHEET

Prepared By: _____ Date: _____

Project Information:

SP:	TH:	Let Date:	Project Length:
Project Description (work type, area type, anticipated duration):			

1. Project has an effect on which type of roadway?
 - Effect is on 2 lane – 2 way roadway – go to line 2
 - Effect is on a multi-lane roadway – go to line 3
 - Has no effect on roadway – **STOP; Red Flag Checklist, Transportation Management Plan or Basic Transportation Management Plan are not needed.**

2. Will traffic be delayed for greater than 15 minutes?
 - Yes – go to line 6
 - No – go to line 7

3. Is the project location included within the MnDOT [Metro Lane Closure Manual](#) (LCM)?
 - Yes – go to line 4
 - No – go to line 5

4. Is the work in accordance with the LCM?
 - Yes – go to line 7
 - No – go to line 6

5. Will demand be greater than 1800 veh/lane/hr for the open lanes?
 - Yes – go to line 6
 - No – go to line 7

6. Can the lane closure or traffic delay be re-staged or rescheduled to avoid the lane closure and/or delay restriction(s)?
 - Yes – go to line 7
 - No – Continue to Red Flag Checklist and Prepare Transportation Management Plan with traffic analysis * during project development**

7. Is work planned to take more than 3 consecutive days at one location?
 - Yes – Continue to Red Flag Checklist and prepare Basic Transportation Management Plan during project development.**
 - No – STOP; Red Flag Checklist is not needed. Basic Transportation Management Plan can consist of 1404 special provisions and appropriate layouts in the Field Manual.**

*Coordinate with MnDOT Metro Traffic office regarding level of analysis for projects with Metro Trunk Highway impacts.

TMP Scoping Worksheet SP XXXX-XX

HANDOUT

HANDOUT

HANDOUT

HANDOUT

TMP Scoping Worksheet

TMP SCOPING RED FLAG CHECKLIST

Make a preliminary determination during scoping of whether the following issues are present or should be considered during project development.

Prepared By: _____ Date: _____

Project Information:

SP:	TH:	Let Date:	Project Length:
Project Description (work type, area type, anticipated duration):			

	Yes	No	Needs further study	N/A	Comments
1. Is the existing shoulder in good enough condition to support traffic during construction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. Could temporary structures and/or additional width be needed on culverts, bridges or shoulders to maintain traffic on the existing route or a detour route?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3. Is there a pedestrian/bicycle path, trail, or access that needs to be maintained during construction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4. Will a Temporary Pedestrian Access Route (TPAR) be required (route meets ADA and PROWAG standards)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5. Are there critical features or services on the route that need to be considered (e.g. hospital, emergency services, transit, school buses)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6. Could crossovers be needed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7. Are there any issues regarding construction timeframes (e.g. time of day, time of year limits, major events, permits, bird nesting, fish spawning, high water)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

TMP Scoping Worksheet SP XXXX-XX

HANDOUT

HANDOUT

HANDOUT

HANDOUT

TMP Scoping Worksheet

	Yes	No	Needs further study	N/A	Comments
8. Could there be a need to maintain railroad traffic?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9. Might temporary traffic signals be required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10. Does it appear that maintenance of traffic will require additional right-of-way?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
11. Will/Can the traffic be detoured? If yes, list proposed routes and answer the following:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Is the local alternate detour route in good condition?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Will the detour route have a detrimental impact on emergency vehicles, school buses, or other sensitive traffic?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Are there bridge/culvert width or height restrictions on the detour?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Are there issues regarding the suitability of the detour route (load limit restrictions, length, speed limit, travel time, etc)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Are modifications needed at intersections on detour/alternate routes?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
12. Could construction have business impacts that could affect project staging and/or require mitigation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
13. Could Intelligent Work Zone (IWZ) devices be needed to mitigate traffic impacts?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

TMP Scoping Worksheet SP XXXX-XX

Page 3 of 6

10/22/2015 tjd

HANDOUT

HANDOUT

HANDOUT

HANDOUT

TMP Scoping Worksheet

	Yes	No	Needs further study	N/A	Comments
14. Could moveable barrier be needed/desirable to mitigate traffic impacts or for constructibility?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
15. Are there other projects in the area that should be coordinated or avoided?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16. Are there geotechnical issues (poor soils, contaminated material, etc) that may affect construction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
17. Are there utility issues that may affect construction staging?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
18. Is the delay to traffic anticipated to be greater than 10 minutes?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
19. Could the project benefit from innovative contracting (if Yes, contact OCIC to schedule a procurement method selection meeting)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

HANDOUT

HANDOUT

HANDOUT

HANDOUT

TMP Scoping Worksheet SP XXXX-XX

Page 4 of 6

10/22/2015 tjd

TMP Scoping Worksheet

Consideration of Accelerated Bridge Construction (ABC) Techniques

Complete this section if project includes bridge construction (this checklist may need to be completed multiple times if multiple bridges with different staging complexity are included in project).

Bridge No.:	SP:	TH:	ADT On:	ADT Under:
-------------	-----	-----	---------	------------

Question/Issue	Yes	No	Needs further study	N/A	Comments
20. Is it likely that this project will include complex traffic control schemes, long detours, or significant user impacts due to bridge construction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
21. Is it likely that this project will have an extended duration (more than one construction season, or extend into late fall) due to bridge construction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
22. Is bridge construction on the critical path of this project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
23. Does the existing bridge have features that make it difficult to accommodate staging (truss bridge, slab span, beam spacing issues, etc)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
24. Are there significant risks or other factors (site complexity) that could be mitigated by accelerating bridge construction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

ABC Consideration Conclusion:**

Based on the findings & comments above, further consideration of accelerated bridge construction is warranted:

YES NO Project Manager Name: _____ Date: _____

If further consideration is warranted the Project Manager should contact the Bridge Office Preliminary Plans Unit and the Regional Bridge Construction Engineer for assistance in selecting appropriate ABC alternatives and techniques.

****Please send a completed copy of this page to the Preliminary Plans Unit at MS 610.**

HANDOUT

HANDOUT

HANDOUT

HANDOUT

TMP Scoping Worksheet

TMP Scoping Conclusions:

1. Describe proposed base staging plan and estimated cost using traditional construction/staging methods, then go to line 2.

2. Based on the answers to red flag questions above, might additional mitigation be needed or can the project be constructed/staged using the proposed base staging plan?
 Proposed base staging plan acceptable – STOP, and include cost above in scoping database
 Additional mitigation may be needed – go to line 3

3. Is a recommended alternate staging concept known that addresses the concerns raised in the Red Flag Checklist?
 Yes – go to line 4
 No – go to line 5

4. Describe the alternate staging and additional estimated cost compared to proposed base staging (including mitigation measures such as schedule acceleration, ABC, IWZ systems, moveable barrier, improvements to alternate routes,...), then STOP, and include proposed base staging cost plus additional mitigation cost in scoping database.

5. Can TMP analysis be conducted using available internal resources or might a Consultant contract for TMP analysis be needed during predesign to determine and analyze staging alternatives?
 Consultant contract may be needed – go to line 6
 Available internal resources can conduct analysis – go to line 7

6. Describe analysis needed, estimated cost and timeframe needed for analysis, then go to line 7

7. Estimate the cost of additional traffic mitigation measures (if sufficient information is not known, use 5% of project cost as a value) and STOP, then create a Need in the scoping database without contingency (PM to create Need), and include proposed base staging cost plus additional mitigation cost in scoping database.

TMP Scoping Worksheet SP XXXX-XX

Page 6 of 6

10/22/2015 tjd

HANDOUT

HANDOUT

HANDOUT

HANDOUT

7.1.3 TMP Worksheet

TRANSPORTATION MANAGEMENT PLAN (TMP) WORKSHEET

Prepared By (PM):

Date:

Project Information:

SP:	TH:	Let Date:	Project Length:
Project Description (work type, area type, anticipated duration):			

WORK ZONE DESIGN, SAFETY AND IMPACT CONSIDERATIONS

<i>For internal MnDOT projects, section completed by PM</i>	Prepared By:
Yes , No, Poss, NA	
Choose an item.	1. Temporal variations in demand (hourly, daily or weekly): <i>Comment for Yes response</i>
Choose an item.	2. Seasonal variations in demand: <i>Comment for Yes response</i>
Choose an item.	3. Special events: <i>Comment for Yes response</i>
Choose an item. Choose an item. Choose an item. Choose an item. Choose an item. Choose an item. Choose an item.	4. Type of Travel a. Commuter: <i>Comment for Yes response</i> b. Tourist: <i>Comment for Yes response</i> c. Freight: <i>Comment for Yes response</i> d. Transit: <i>Comment for Yes response</i> e. Pedestrian/Bicycle: <i>Comment for Yes response</i> f. Permit/House Moving Route: <i>Comment for Yes response</i> g. Farming considerations: <i>Comment for Yes response</i>
Choose an item. Choose an item.	5. Impacts on parallel corridors, alternate routes, transportation Network or other modes of transportation: a. Local: <i>Comment for Yes response</i> b. Regional: <i>Comment for Yes response</i>
Choose an item.	6. Project coordination a. Coordination w/ other projects: <i>Comment for Yes response</i>
Choose an item.	b. State Projects: <i>Comment for Yes response</i>
Choose an item.	c. Local Projects: <i>Comment for Yes response</i>
Choose an item.	d. Utilities coordination: <i>Comment for Yes response</i>
Choose an item.	e. R/W coordination: <i>Comment for Yes response</i>
Choose an item.	f. Coordination with other transportation infrastructure: <i>Comment for Yes response</i>

HANDOUT

HANDOUT

HANDOUT

HANDOUT

TRANSPORTATION MANAGEMENT PLAN (TMP) WORKSHEET

HANDOUT

HANDOUT

Choose an item. Choose an item. Choose an item. Choose an item.	7. Impacts on nearby transportation infrastructure c. Key intersections/interchanges: <i>Comment for Yes response</i> d. Railroad crossings: <i>Comment for Yes response</i> e. Public transit junctions: <i>Comment for Yes response</i> f. Malls, distribution centers, etc.: <i>Comment for Yes response</i>
Choose an item. Choose an item. Choose an item. Choose an item. Choose an item. Choose an item.	8. Impacts on other infrastructure a. Evacuation Routes: <i>Comment for Yes response</i> b. Parks/Recreation Areas: <i>Comment for Yes response</i> c. Fire Stations: <i>Comment for Yes response</i> d. Police Stations: <i>Comment for Yes response</i> e. Hospitals: <i>Comment for Yes response</i> f. Schools: <i>Comment for Yes response</i>
Choose an item.	9. Impacts on pedestrians/bicyclists: <i>Comment for Yes response</i>
Choose an item.	10. Impacts on private and public property access: <i>Comment for Yes response</i>
Choose an item.	11. Cross-sectional issues (lane width, shoulder availability and width, number of lanes): <i>Comment for Yes response</i>
Choose an item.	12. Longitudinal issues (taper widths, taper lengths, stopping sight distance): <i>Comment for Yes response</i>
Choose an item.	13. Horizontal and vertical sight distance issues: <i>Comment for Yes response</i>
Choose an item.	14. Work area separation and delineation: <i>Comment for Yes response</i>
Choose an item.	15. Work site access issues: <i>Comment for Yes response</i>
Choose an item.	16. Local ordinance issues: <i>Comment for Yes response</i>
Choose an item.	17. Speed issues: <i>Comment for Yes response</i>
Choose an item.	18. Traffic incident management issues: <i>Comment for Yes response</i>
Choose an item.	19. Business liaison needs: <i>Comment for Yes response</i>

WORK ZONE MANAGEMENT STRATEGY CONSIDERATIONS

I. Temporary Traffic Control (TTC)

<i>For internal MnDOT projects, TTC section completed by Traffic</i>		Prepared By:
Yes , No, Possible, Not Applicable	IA. Control Strategies	
Choose an item.	IA1. Construction phasing/staging <i>Comment for Yes/No responses</i>	
Choose an item.	IA2. Full roadway closures <i>Comment for Yes/No responses</i>	
Choose an item.	IA3. Lane shifts or closures <i>Comment for Yes/No responses</i>	
Choose an item.	Reduced lane widths to maintain number of lanes <i>Comment for Yes/No responses</i>	
Choose an item.	Lane closures <i>Comment for Yes/No responses</i>	
Choose an item.	Short-term <i>Comment for Yes/No responses</i>	
Choose an item.	Long-term <i>Comment for Yes/No responses</i>	

HANDOUT

HANDOUT

TRANSPORTATION MANAGEMENT PLAN (TMP) WORKSHEET

Choose an item.	Shoulder closures <i>Comment for Yes/No responses</i>
Choose an item.	Lane shift to shoulder/median to maintain number of lanes <i>Comment for Yes/No responses</i>
Choose an item.	IA4. One-lane, two-way operation <i>Comment for Yes/No responses</i>
Choose an item.	IA5. Two-way traffic on one side of divided facility (crossover) <i>Comment for Yes/No responses</i>
Choose an item.	IA6. Reversible lanes <i>Comment for Yes/No responses</i>
Choose an item.	Moveable barrier <i>Comment for Yes/No responses</i>
Choose an item.	IA7. Ramp closures/relocation <i>Comment for Yes/No responses</i>
Choose an item.	IA8. Freeway-to-freeway interchange closures <i>Comment for Yes/No responses</i>
Choose an item.	IA9. HOV lane closures <i>Comment for Yes/No responses</i>
Choose an item.	IA10. Bus shoulder closures <i>Comment for Yes/No responses</i>
Choose an item.	IA11. Night work <i>Comment for Yes/No responses</i>
Choose an item.	IA12. Weekend work <i>Comment for Yes/No responses</i>
Choose an item.	IA13. Work hour restrictions during peak travel <i>Comment for Yes/No responses</i>
Choose an item.	IA14. Pedestrian/bicycle access improvements (due to construction) <i>Comment for Yes/No responses</i>
Choose an item.	IA15. Business access improvements (due to construction) <i>Comment for Yes/No responses</i>
Choose an item.	IA16. Detours/use of alternate routes <i>Comment for Yes/No responses</i>
Choose an item.	IA17. Traffic Control Supervisor <i>Click here to enter text.</i>
Choose an item.	IA18. Temporary Pedestrian Access Route (TPAR) <i>Click here to enter text.</i>

Yes , No, Possible, Not Applicable	IB. TTC Devices
Choose an item.	IB1. Changeable message signs (CMS) <i>Click here to enter text.</i>
Choose an item.	Permanent <i>Comment for Yes response</i>
Choose an item.	Temporary <i>Comment for Yes/No responses</i>
	<i>Note: Temporary CMS is part of many information components. Please define the purpose and identify who will manage the temporary CMS.</i>
Choose an item.	IB2. Channelizing devices <i>Click here to enter text.</i>
Choose an item.	IB3. Pedestrian barricade <i>Comment for Yes/No responses</i>
Choose an item.	IB4. Pedestrian curb ramp <i>Click here to enter text.</i>
Choose an item.	IB5. Temporary pavement markings <i>Click here to enter text.</i>
Choose an item.	IB6. Flaggers and/or uniformed traffic control officers <i>Click here to enter text.</i>

TRANSPORTATION MANAGEMENT PLAN (TMP) WORKSHEET

Choose an item.	IB7. Temporary traffic signals <i>Click here to enter text.</i>
Choose an item.	IB8. Temporary lighting <i>Comment for Yes/No responses</i>

Yes , No, Possible,	IC. Contracting, and Innovative Construction Strategies
Choose an item.	IC1. Contracting strategies <i>Comment for Yes/No responses</i>
Choose an item.	Design-build <i>Comment for Yes/No responses</i>
Choose an item.	A+B bidding <i>Comment for Yes/No responses</i>
Choose an item.	Incentive/disincentive <i>Comment for Yes/No responses</i>
Choose an item.	Lane rental <i>Comment for Yes/No responses</i>
Choose an item.	Maintenance of Traffic (MOT) performance spec <i>Comment for Yes/No responses</i>
	Guidance: Consider if ITS/IWZ is part of separate project or construction contract. Please provide adequate time for ITS/IWZ installation and testing to ensure system is fully operational prior to construction start date.
Choose an item.	Other: <i>Comment for Yes/No responses</i>
Choose an item.	IC2. Innovative construction techniques (precast members, rapid cure materials) <i>Click here to enter text.</i>

II. Transportation Operations

	Prepared By: <i>For internal MnDOT projects, section completed by Traffic</i>
Yes , No, Possible, Not Applicable	IIA. Corridor Network Management
Choose an item.	IIA1. Signal timing/coordination improvements <i>Comment for Yes/No responses</i>
Choose an item.	IIA2. Temporary traffic signals (due to increased demand) <i>Comment for Yes/No responses</i>
	Guidance: Consider if temp signal will significantly reduce delay of rerouted traffic or improve potential safety issue
Choose an item.	IIA3. Street/intersection improvements (due to increased demand) <i>Comment for Yes/No responses</i>
Choose an item.	IIA4. Bus turnouts <i>Comment for Yes/No responses</i>
Choose an item.	IIA5. Turn restrictions <i>Comment for Yes/No responses</i>
Choose an item.	IIA6. Emergency pull offs <i>Comment for Yes/No responses</i>
Choose an item.	IIA7. Parking restrictions <i>Comment for Yes/No responses</i>
Choose an item.	IIA8. Truck/heavy vehicle restrictions <i>Comment for Yes/No responses</i>
Choose an item.	IIA9. Separate truck lanes <i>Comment for Yes/No responses</i>
Choose an item.	IIA10. Ramp closures (to reduce delay) <i>Comment for Yes/No responses</i>
Choose an item.	IIA11. Zipper Merge (dynamic or static) <i>Click here to enter text.</i>

TRANSPORTATION MANAGEMENT PLAN (TMP) WORKSHEET

HANDOUT

HANDOUT

	<i>Guidance: Consider if backups are anticipated as a result of the lane closure.</i>
Choose an item.	IIA12. Dynamic speed display sign <i>Click here to enter text.</i>
	<i>Guidance: Consider if excessive speed in the work zone is a concern.</i>
Choose an item.	IIA13. Highway advisory radio (HAR) <i>Comment for Yes response</i>

	Prepared By: <i>For internal MnDOT projects, section completed by Traffic</i>
Yes , No, Possible, Not Applicable	IIB. Work Zone Safety Management
Choose an item.	IIB1. Speed limit reduction <i>Comment for Yes/No responses</i>
Choose an item.	Construction <i>Comment for Yes/No responses</i>
Choose an item.	Work Zone <i>Comment for Yes/No responses</i>
Choose an item.	Advisory <i>Click here to enter text.</i>
Choose an item.	IIB2. Temporary traffic barrier <i>Comment for Yes/No responses</i>
Choose an item.	IIB3. Impact attenuators <i>Comment for Yes/No responses</i>
Choose an item.	IIB4. Temporary rumble strips <i>Comment for Yes/No responses</i>
Choose an item.	IIB5. Queue warning system <i>Comment for Yes/No responses</i>
	<i>Guidance: Consider in areas where reoccurring congestion or stopped traffic is not common/expected during normal conditions</i>
Choose an item.	IIB6. Intrusion alarms <i>Comment for Yes/No responses</i>
	<i>Guidance: Consider in areas where traffic cannot be barrier separated from workers present in work zone</i>
Choose an item.	IIB7. Automated Flagger Assistance Devices (AFADs) <i>Comment for Yes/No responses</i>
Choose an item.	IIB8. On-site project work zone safety group <i>Comment for Yes/No responses</i>
Choose an item.	IIB9. Work zone traffic control inspection/review <i>Comment for Yes/No responses</i>

	Prepared By: <i>For internal MnDOT projects, section completed by Traffic</i>
Yes , No, Possible, Not Applicable	IIC. Enforcement
Choose an item.	IIC1. Dedicated (paid) police enforcement <i>Comment for Yes/No responses</i>
Choose an item.	IIC2. Cooperative police enforcement <i>Comment for Yes/No responses</i>

	Prepared By: <i>For internal MnDOT projects, section completed by PM</i>
Yes , No, Possible,	IID. Demand Management

HANDOUT

HANDOUT

TRANSPORTATION MANAGEMENT PLAN (TMP) WORKSHEET

Not Applicable	
Choose an item.	IID1. Transit service improvements <i>Comment for Yes/No responses</i>
Choose an item.	IID2. Transit incentives <i>Comment for Yes/No responses</i>
Choose an item.	IID3. Shuttle services <i>Comment for Yes/No responses</i>
Choose an item.	IID4. Ridesharing/carpooling incentives <i>Comment for Yes/No responses</i>
Choose an item.	IID5. Park-and-ride promotion <i>Comment for Yes/No responses</i>
Choose an item.	IID6. MnPASS/HOV lanes <i>Comment for Yes/No responses</i>
Choose an item.	IID7. Promote variable work hours <i>Comment for Yes/No responses</i>
Choose an item.	IID8. Promote teleworking <i>Comment for Yes/No responses</i>

	Prepared By: <i>For internal MnDOT projects, section completed by RTMC</i>
Yes , No, Possible, Not Applicable	IIE. Traffic/Incident Management
Choose an item.	IIE1. Closed circuit television (CCTV) <i>Comment for Yes/No responses</i> <i>Guidance: Consider if connection of video to RTMC is possible and there is need to monitor performance and/or incident management is important</i>
Choose an item.	IIE2. Temporary detection/ travel time signs <i>Comment for Yes/No responses</i> <i>Guidance: Consider if delays are expected to change daily and/or if the corridor already has existing travel time signs.</i>
Choose an item.	IIE3. Ramp metering (due to increased demand) <i>Comment for Yes/No responses</i> <i>Guidance: Consider for work zones if they replace permanent meters during construction or if an unmetered location would benefit from a ramp meter during construction. Coordinate and confirm design needs with RTMC.</i>
Choose an item.	IIE4. Temporary suspension of ramp metering <i>Comment for Yes/No responses</i>
Choose an item.	IIE5. Interconnect PCMS <i>Comment for Yes/No responses</i> <i>Guidance: Answer No, if PCMS is covered in other systems (e.g. queue warning).</i>
Choose an item.	IIE6. Enhanced mile-post markers <i>Comment for Yes/No responses</i>
Choose an item.	IIE7. Tow/FIRST <i>Comment for Yes/No responses</i>
Choose an item.	IIE8. Local detour routes during incidents <i>Comment for Yes/No responses</i> <i>Guidance: Consider if incident management is critical and local routes may have approval from local agency</i>
Choose an item.	IIE9. Contract support for incident mgmt. <i>Comment for Yes/No responses</i>
Choose an item.	IIE10. Incident/emergency response plan <i>Comment for Yes/No responses</i>

III. Public Information (PI)

<i>For internal MnDOT projects, PI section completed by PAC</i>	Prepared By:
---	---------------------

TRANSPORTATION MANAGEMENT PLAN (TMP) WORKSHEET

Yes , No, Possible, Not Applicable	IIIA. Control Strategies
Choose an item.	IIIA1. Brochures and mailers <i>Comment for Yes/No responses</i>
Choose an item.	IIIA2. Press releases/media alerts <i>Comment for Yes/No responses</i>
Choose an item.	IIIA3. Paid advertisements <i>Comment for Yes/No responses</i>
Choose an item.	IIIA4. Walk-in office <i>Comment for Yes/No responses</i>
Choose an item.	IIIA5. Project web site <i>Comment for Yes/No responses</i>
Choose an item.	IIIA6. Public meetings/hearings <i>Comment for Yes/No responses</i>
Choose an item.	IIIA7. Community task forces <i>Comment for Yes/No responses</i>
Choose an item.	IIIA8. Coordination with schools/businesses/ emergency services <i>Comment for Yes/No responses</i>
Choose an item.	IIIA9. Coordination with other Public Agencies <i>Comment for Yes/No responses</i>
Choose an item.	IIIA10. Coordination with other Transportation Districts/Agencies <i>Comment for Yes/No responses</i>
Choose an item.	IIIA11. Coordination with other Government Agencies (township, city, county, tribal) <i>Comment for Yes/No responses</i>
Choose an item.	IIIA12. Coordination with Transit providers. <i>Comment for Yes/No responses</i>
Choose an item.	IIIA13. Work zone education and safety campaigns <i>Comment for Yes/No responses</i>
Choose an item.	IIIA14. Rideshare promotions <i>Comment for Yes/No responses</i>
Choose an item.	IIIA15. Visual information (videos, slides, presentations) for meetings and web <i>Comment for Yes/No responses</i>
Choose an item.	IIIA16. Public Communications Coordinator <i>Comment for Yes/No responses</i>
Choose an item.	IIIA17. Public Affairs consultants <i>Comment for Yes/No responses</i>
Choose an item.	IIIA18. Media interviews <i>Comment for Yes/No responses</i>
Choose an item.	IIIA19. Freight travel information [North/West Passage (I-94, I-494, I-694), GLRTOC (I-94, I-494, I-694, I-35, I-35E, I-35W)] <i>Comment for Yes/No responses</i>
Choose an item.	IIIA20. Social media outreach <i>Comment for Yes/No responses</i>

HANDOUT

HANDOUT

HANDOUT

HANDOUT

TRANSPORTATION MANAGEMENT PLAN (TMP) WORKSHEET

PERFORMANCE STANDARDS FOR MOBILITY AND SAFETY

For internal MnDOT projects, TTC section completed by Traffic		Prepared By:
Yes, No	Traffic Monitoring	
Choose an item.	1. Monitor delay on impacted roadways (define method of monitoring) Comments	
	<i>Guidance: Consider this may require temporary detection systems and data archiving systems</i>	
Choose an item.	2. Monitor queue length on impacted roadways (define method of monitoring) Comments	
	<i>Guidance: Consider using ITS/ IWZ systems for real time monitoring of queue length</i>	
Choose an item.	3. If delay exceeds XX min above base delay of XX min after the first 7-10 calendar days of impact, consider additional mitigation strategies. Comments	
Choose an item.	4. If queues exceed XX miles after the first 7-10 calendar days of impact, consider additional mitigation strategies. Comments	

Yes, No	Crash Data Review	
Choose an item.	1. Review available crash data on impacted roadways Comments	
Choose an item.	2. Review available crash data on alternate routes Comments	
Choose an item.	3. Compare to existing crash data. If significant increase in crashes on corridor or at a location is observed, consider additional mitigation strategies. Comments	

Possible , No, Not Applicable	Additional Mitigation Strategies (Possible indicates that the item may be considered by an evaluation team)	
Choose an item.	1. Assemble team to evaluate strategies based on actual conditions encountered Comments	
Choose an item.	2. Adjust traffic control devices Comments	
Choose an item.	3. Provide additional traffic control devices Comments	
	<i>Guidance: Consider ITS/IWZ systems for mitigation of unique conditions to enhance safety, worker protection, routing, distracted driving, or delay</i>	
Choose an item.	Static devices Comments	
Choose an item.	IWZ devices Comment for Yes response	
	<i>Guidance: Review IWZ Toolbox. Then, please consult with Traffic Engineer, RTMC, or OTST for unique situations not covered by IWZ Toolbox.</i>	
Choose an item.	4. Revise geometrics Comments	
Choose an item.	5. Provide additional/revised public awareness strategies Comments	
Choose an item.	6. Adjust signal/ramp meter timing Comments	
Choose an item.	7. Close ramp/loop Comments	

HANDOUT

HANDOUT

HANDOUT

HANDOUT

TRANSPORTATION MANAGEMENT PLAN (TMP) WORKSHEET

Choose an item.	8. Restrict movements at intersections <i>Comments</i>
Choose an item.	9. Adjust lane closure requirements <i>Comments</i>
Choose an item.	10. Provide/enhance police enforcement <i>Comments</i>
Choose an item.	11. Provide law enforcement to direct traffic for specific times or locations <i>Comments</i>
Choose an item.	12. Reevaluate staging <i>Comments</i>
Choose an item.	13. Alternate route traffic control modifications <i>Comments</i>

HANDOUT

HANDOUT

HANDOUT

HANDOUT

7.1.4 TMP Template



Transportation Management Plan

Expected
Construction:
DATES

Title and Location of Project

SP Number

Insert map of project location

Your Destination... Our Priority



HANDOUT

HANDOUT

HANDOUT

HANDOUT

Hard copy of document printed on: **1/30/2017**

Table of Contents

Project Description 1

 Corridor Discussion and Project Scope 1

 TMP Team 1

 TMP Scoping Worksheet (if not completed during scoping, include Work Zone Mobility Impact
Assesment Worksheet and Red Flag Checklist) 1

 TMP worksheet 2

 Public Information Communications Plan 2

 Traffic Analysis 2

 Traffic Control Plans and Construction Staging 2

 Time and Traffic Special Provisions..... 2

 TMP Modification Process 2

 Appendices..... 3

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Project Description

This section includes information on <project background and project scope> as well as a description and listing of membership on the TMP Team.

Letting date: insert date

Anticipated construction schedule: insert date

Corridor Discussion and Project Scope

Discussion of background of corridor and proposed scope. Background should include need and purpose of project and description of previous work in the area.

TMP Team

Insert description of TMP Team members and meeting schedule.

Each TMP team will include representation from the following areas (with specific personnel for this project in parentheses):

- Project Manager (personnel)
- Construction (personnel)
- Traffic (personnel)
- Public Affairs (personnel)
- Area Management (personnel)
- RTMC (personnel)
- Business Liaison, if assigned (personnel)
- Others??

TMP Scoping Worksheet

The TMP scoping worksheet includes the Work zone Mobility Impact Assessment Worksheet, Red Flag Checklist (including consideration of ABC techniques), and TMP Scoping Conclusions.

If TMP scoping worksheet was not completed during scoping, include the Work Zone Mobility Impact Assessment Worksheet and Red Flag Checklist.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Insert TMP Scoping Worksheet

TMP worksheet

Insert TMP worksheets and comments.

Public Information Communications Plan

Insert communications plan from Public Affairs.

Traffic Analysis

Insert Traffic Analysis from Metro Traffic.

Traffic Control Plans and Construction Staging

Traffic control plans will be included in the Appendix. Insert table, figure, or description of approach to construction staging and general approach to develop temporary traffic control plans.

Time and Traffic Special Provisions

Time and traffic special provisions will be included in the Appendix. Include discussion of any significant items in the specifications.

TMP Modification Process

Following letting, the Construction Resident Engineer or one of his/her representatives if so designated will become the steward of the TMP document during construction administration. Before approving changes in traffic control, allowable lane or ramp closures, or other deviations from the TMP,

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Construction personnel will consult the TMP and appropriate Traffic, Area Management, Public Information, Design, RTMC, Business Liaison, or other parties as appropriate.

The following outlines the process for TMP modifications during construction:

1. If any significant changes as defined in Mn/DOT Metro TMP Process documentation are made during construction that conflict with provisions or commitments made in the TMP, the Project Engineer will document this as a “Change to the TMP”. When practical, Construction personnel should discuss significant proposed changes with appropriate TMP Team members before approving.
2. If additional traffic mitigation measures are implemented during construction, these will also be documented as a “Change to the TMP” by Construction personnel.
3. If other functional areas have additional documentation (RTMC changes, monitoring, etc), they will add it to the document in ProjectWise.
4. The details regarding changes, and the reason for the change, will be documented and e-mailed to a list of TMP Modification Contacts, as detailed below:

TMP Modification Contacts

Insert names and contact information of those who are interested in being notified of TMP changes. Typically this list will include TMP Team members and FHWA area engineer if there is federal funding. Other interested parties can be included.

Appendices

Typically included in appendix:

Meeting Minutes from the following:

- Modeling output, if any
- Meeting Minutes from TMP team meetings, construction staging meetings, and others related to TMP
- Other records of correspondence
- Traffic Control Plans
- Time and Traffic special provisions
- Modifications to TMP, to be added by resident construction engineer

HANDOUT

HANDOUT

7.1.5 Red Flag Checklist

RED FLAG CHECKLIST

Complete this checklist for projects that do not go through the MnDOT scoping process or were scoped prior to March 2015. For projects currently being scoped, complete the TMP Scoping Worksheet, which includes the Red Flag Checklist, Work Zone Impact Assessment Worksheet, and TMP Scoping Conclusions).

Prepared By: _____ Date: _____

Project Information:

SP:	TH:	Let Date:	Project Length:
Project Description (work type, area type, anticipated duration):			

	Yes	No	Needs further study	N/A	Comments
1. Is the existing shoulder in good enough condition to support traffic during construction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. Could temporary structures and/or additional width be needed on culverts, bridges or shoulders to maintain traffic on the existing route or a detour route?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3. Is there a pedestrian/bicycle path, trail, or access that needs to be maintained during construction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4. Will a Temporary Pedestrian Access Route (TPAR) be required (route meets ADA and PROWAG standards)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5. Are there critical features or services on the route that need to be considered (e.g. hospital, emergency services, transit, school buses)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6. Could crossovers be needed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7. Are there any issues regarding construction timeframes (e.g. time of day, time of year limits, major events, permits, bird nesting, fish spawning, high water)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Red Flag Checklist SP XXXX-XX

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

	Yes	No	Needs further study	N/A	Comments
8. Could there be a need to maintain railroad traffic?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9. Might temporary traffic signals be required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10. Does it appear that maintenance of traffic will require additional right-of-way?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
11. Will/Can the traffic be detoured? If yes, list proposed routes and answer the following:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Is the local alternate detour route in good condition?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Will the detour route have a detrimental impact on emergency vehicles, school buses, or other sensitive traffic?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Are there bridge/culvert width or height restrictions on the detour?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Are there issues regarding the suitability of the detour route (load limit restrictions, length, speed limit, travel time, etc)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Are modifications needed at intersections on detour/alternate routes?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
12. Could construction have business impacts that could affect project staging and/or require mitigation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
13. Could Intelligent Work Zone (IWZ) devices be needed to mitigate traffic impacts?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

HANDOUT

HANDOUT

Red Flag Checklist SP XXXX-XX

Page 2 of 4

6/22/2015 tjd

HANDOUT

HANDOUT

	Yes	No	Needs further study	N/A	Comments
14. Could moveable barrier be needed/desirable to mitigate traffic impacts or for constructibility?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
15. Are there other projects in the area that should be coordinated or avoided?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16. Are there geotechnical issues (poor soils, contaminated material, etc) that may affect construction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
17. Are there utility issues that may affect construction staging?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
18. Is the delay to traffic anticipated to be greater than 10 minutes?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
19. Could the project benefit from innovative contracting (if Yes, contact OCIC to schedule a procurement method selection meeting)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

HANDOUT

HANDOUT

Red Flag Checklist SP XXXX-XX

Page 3 of 4

6/22/2015 tjd

Consideration of Accelerated Bridge Construction (ABC) Techniques

Complete this section if project includes bridge construction (this checklist may need to be completed multiple times if multiple bridges with different staging complexity are included in project).

Bridge No.:	SP:	TH:	ADT On:	ADT Under:
-------------	-----	-----	---------	------------

Question/Issue	Yes	No	Needs further study	N/A	Comments
20. Is it likely that this project will include complex traffic control schemes, long detours, or significant user impacts due to bridge construction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
21. Is it likely that this project will have an extended duration (more than one construction season, or extend into late fall) due to bridge construction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
22. Is bridge construction on the critical path of this project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
23. Does the existing bridge have features that make it difficult to accommodate staging (truss bridge, slab span, beam spacing issues, etc)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
24. Are there significant risks or other factors (site complexity) that could be mitigated by accelerating bridge construction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

ABC Consideration Conclusion:**

Based on the findings & comments above, further consideration of accelerated bridge construction is warranted:

YES NO Project Manager Name: _____ Date: _____

If further consideration is warranted the Project Manager should contact the Bridge Office Preliminary Plans Unit and the Regional Bridge Construction Engineer for assistance in selecting appropriate ABC alternatives and techniques.

****Please send a completed copy of this page to the Preliminary Plans Unit at MS 610.**

HANDOUT

HANDOUT

HANDOUT

HANDOUT

7.1.6 Work Zone Mobility Impact Assessment Worksheet

WORK ZONE MOBILITY IMPACT ASSESSMENT WORKSHEET

Complete this worksheet for projects that do not go through the MnDOT scoping process or were scoped prior to March 2015. For projects currently being scoped, complete the TMP Scoping Worksheet, which includes the Red Flag Checklist, Work Zone Impact Assessment Worksheet, and TMP Scoping Conclusions).

Prepared By: _____ Date: _____

Project Information:

SP:	TH:	Let Date:	Project Length:
Project Description (work type, area type, anticipated duration):			

- Project has an effect on which type of roadway?
 - Effect is on 2 lane – 2 way roadway – go to line 2
 - Effect is on a multi-lane roadway – go to line 3
 - Has no effect on roadway – **STOP; Red Flag Checklist, Transportation Management Plan or Basic Transportation Management Plan are not needed.**
- Will traffic be delayed for greater than 15 minutes?
 - Yes – go to line 6
 - No – go to line 7
- Is the project location included within the MnDOT [Metro Lane Closure Manual](#) (LCM)?
 - Yes – go to line 4
 - No – go to line 5
- Is the work in accordance with the LCM?
 - Yes – go to line 7
 - No – go to line 6
- Will demand be greater than 1800 veh/lane/hr for the open lanes?
 - Yes – go to line 6
 - No – go to line 7
- Can the lane closure or traffic delay be re-staged or rescheduled to avoid the lane closure and/or delay restriction(s)?
 - Yes – go to line 7
 - No – Continue to Red Flag Checklist and Prepare Transportation Management Plan with traffic analysis * during project development**
- Is work planned to take more than 3 consecutive days at one location?
 - Yes – Continue to Red Flag Checklist and prepare Basic Transportation Management Plan during project development.**
 - No – STOP; Red Flag Checklist is not needed. Basic Transportation Management Plan can consist of 1404 special provisions and appropriate layouts in the Field Manual.**

*Coordinate with MnDOT Metro Traffic office regarding level of analysis for projects with Metro Trunk Highway impacts.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

7.2 Design Scene Write-Ups and Sample News Letter

DESIGN SCENE



OFFICE OF PROJECT MANAGEMENT & TECHNICAL SUPPORT

PROJECT DESIGN SERVICES UNIT

June 2014 - Page 7

Chapter 14 – Impact Attenuators

By: Y. Crocker with assistance from Kevin Farraher

In order to avoid external conflicts and maintain consistency within MnDOT, we will be changing how we call out temporary and permanent impact attenuators on our traffic control plans.

We will be specifying whether they are TL3's or TL2's (test level's) instead of posted speed limits.

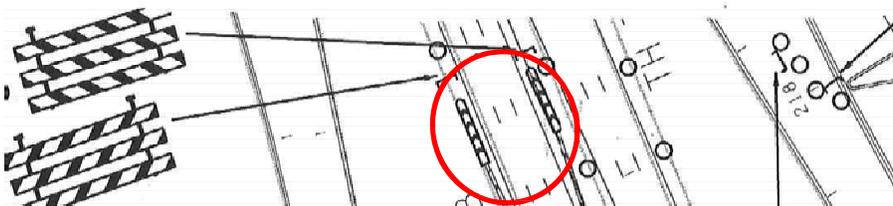
All Temporary Impact Attenuators that are to be placed on roads with the speeds of 50 mph or greater will now be TL3 and those that are 45 mph or less shall be TL2.

These will be noted on our Pay Item Tabulation sheets like we have been doing. If the project requires both TL3 and TL2 attenuation, then they should be labeled on the plan sheets for clarification.

Examples: Same test level for all...

PAY ITEM TABULATION		TC
PAY ITEM	UNIT	TOTAL
PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337	LIN FT	400
PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337-ANCHORED	LIN FT	792
(1) IMPACT ATTENUATOR	ASSEMBLY	4
TRAFFIC CONTROL	LUMP SUM	1
(2) MEDIAN BARRIER DELINEATOR	EACH	40
PORTABLE CHANGEABLE MESSAGE SIGN	UNIT DAY	14
(3) REMOVABLE PREFORM PAVEMENT MARKING TAPE	LIN FT	5798
REMOVABLE PREFORMED PLASTIC MASK (BLACK)	LIN FT	3470

- (1) TL3 ASSEMBLIES
- (2) 20 WHITE, 20 YELLOW- ALL ONE WAY
- (3) 3052' 4" SOLID LINE WHITE, 840' 4" BROKEN LINE WHITE, 1906' SOLID LINE YELLOW



No need to label attenuators

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Select Design Scene write-ups for Temporary Traffic Control Design Course

Chapter 2 - WORK ZONE ITEM CHANGES

As a result of recent updates to the 1404 MAINTENANCE OF TRAFFIC and 2563 TRAFFIC CONTROL provisions two traffic control pay items have changed.

2563.613 WORK ZONE SPEED LIMIT by UNIT DAY is now “Workers Present Speed Limit”
2563.610 FLAG PERSON by HOUR is now “Flagger”

Chapter 6 – TRAFFIC ON OPPOSING ROADWAY

During staging the traffic is sometimes placed on the opposing traffic roadway on divided highways. When this happens the guardrail end treatments and bridge connections need to be made safe. This may require adding design specials, impact attenuators, and/or guardrail end treatments.

Chapter 14 - IMPACT ATTENUATOR BARRELS

Engineering Cost Data and Estimating Unit is responsible for determining reasonable prices for supplemental agreement to construction projects alerted us to the fact that our past practice has been to have a pay item for these barrel attenuators as an assembly, perhaps ten (10) barrels comprising an installation (assembly).

If a second or third installation was required on the project, with a different number of barrels, we could have 2 or 3 pay items. Also, if these installations are used for traffic control, the contract reads that the contractor would replace any units at his expense. This is difficult for a contractor to bid. Also we don't want to pay for a whole system (10 barrels) if only a couple barrels need replacing.

We will use impact attenuator barrels, (each). If additional barrels may be needed for replacement, include a quantity for this and subnote the item on the estimate sheet. The cost of each barrel has been coming out the same, regardless of the amount of sand/salt required. If a paved area is required, it should be allowed for separately. The attenuator should be shown in the plans per past practice, the number of barrels, spacing and weight of sand/salt shown.

All Temporary Impact Attenuators that are to be placed on roads with the speeds of 50 mph or greater will now be TL3 and those that are 45 mph or less shall be TL2.

These will be noted on our Pay Item Tabulation sheets like we have been doing. If the project requires both TL3 and TL2 attenuation, then they should be labeled on the plan sheets for clarification.

The plan should also contain a note stating if it is a temporary or permanent installation

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Chapter 14 - IMPACT ATTENUATORS

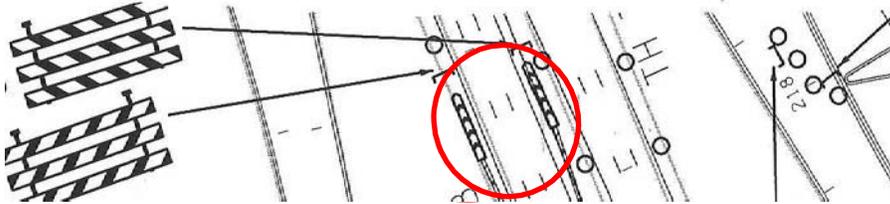
In order to avoid external conflicts and maintain consistency within MnDOT, we will be changing how we call out temporary and permanent impact attenuators on our traffic control plans.

We will be specifying whether they are TL3's or TL2's (test level's) instead of posted speed limits.

Examples: Same test level for all...

PAY ITEM TABULATION		TC
PAY ITEM	UNIT	TOTAL
PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337	LIN FT	400
PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337-ANCHORED	LIN FT	792
(1) IMPACT ATTENUATOR	ASSEMBLY	4
TRAFFIC CONTROL	LUMP SUM	1
(2) MEDIAN BARRIER DELINEATOR	EACH	40
PORTABLE CHANGEABLE MESSAGE SIGN	UNIT DAY	14
(3) REMOVABLE PREFORM PAVEMENT MARKING TAPE	LIN FT	5798
REMOVABLE PREFORMED PLASTIC MASK (BLACK)	LIN FT	3470

- (1) TL3 ASSEMBLIES
- (2) 20 WHITE, 20 YELLOW- ALL ONE WAY
- (3) 3052' 4" SOLID LINE WHITE, 840' 4" BROKEN LINE WHITE, 1906' SOLID LINE YELLOW

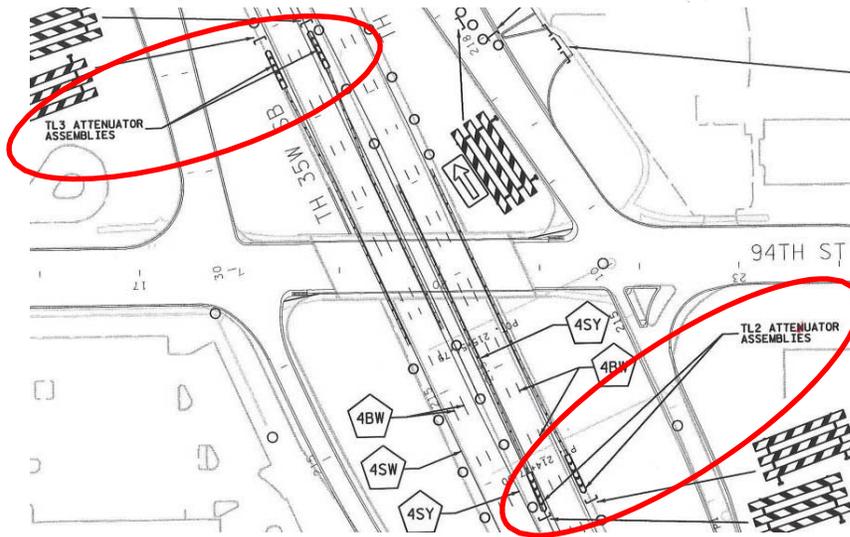


No need to label attenuators

Example: Different test levels and temporary situation...

PAY ITEM TABULATION		TC
PAY ITEM	UNIT	TOTAL
PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337	LIN FT	400
PORTABLE PRECAST CONCRETE BARRIER DESIGN 8337-ANCHORED	LIN FT	792
(1) IMPACT ATTENUATOR	ASSEMBLY	4
TRAFFIC CONTROL	LUMP SUM	1
(2) MEDIAN BARRIER DELINEATOR	EACH	40
PORTABLE CHANGEABLE MESSAGE SIGN	UNIT DAY	14
(3) REMOVABLE PREFORM PAVEMENT MARKING TAPE	LIN FT	5798
REMOVABLE PREFORMED PLASTIC MASK (BLACK)	LIN FT	3470

- (1) 2-TL2, 2-TL3 ASSEMBLIES
- (2) 20 WHITE, 20 YELLOW- ALL ONE WAY
- (3) 3052' 4" SOLID LINE WHITE, 840' 4" BROKEN LINE WHITE, 1906' SOLID LINE YELLOW



Need to label all attenuators as to what level they are.

Example: Different test levels and permanent situation, you need to label as different attenuators both on the table and in the plan view (see example above)...

PAY ITEM TABULATION		TC
PAY ITEM	UNIT	TOTAL
(1) IMPACT ATTENUATOR	ASSEMBLY	2
(2) IMPACT ATTENUATOR NO 1	ASSEMBLY	2
(3) TRAFFIC CONTROL	LUMP SUM	1
MEDIAN BARRIER DELINEATOR	EACH	40

- (1) TL-3, PERMANENT
- (2) TL-2, PERMANENT
- (3) 20 WHITE, 20 YELLOW - ALL ONE WAY

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Chapter 14 - PORTABLE PRECAST CONCRETE BARRIER

PPCB, (Type III), Standard Plate No. 8337 is for temporary usage only. It is not designed to be used for a permanent barrier.

The Type III PPCB is required on many bridge construction sites and their immediate approaches (normally, (120 ft.) adjacent to the bridge end) when the PPCB is designated as the means of protecting the construction site. The Type III barrier will also be required along deep drop-offs immediately adjacent to lanes used to carry traffic. Type III PPCB is required for major maintenance work on bridges, which will take a considerable length of time and if a positive barrier is needed.

Adequate flare (desirably about 1:10) or end protection, such as a crash cushion, to prevent impact with exposed barrier ends must continue to be provided.

Chapter 16- CENTERLINE MARKINGS

When paying for the double centerline yellow markings do not pay for them as two 4” solid line white but rather use the pay item...

2014 Spec...2582.502 4” DOUBLE SOLID LINE YELLOW – *material* by LIN FT.

2016 Spec...2582.502 4” DOUBLE SOLID LINE –*material* by LIN FT

Chapter 16 - INTERIM PAVEMENT MARKINGS – ITEM 2580

There has been confusion regarding the use of this pay item and the quantities to be included. A group has been reviewing the use of interim markings and several problems have been identified. This pay item should only be used for same day pavement markings to be placed on bituminous lifts and milled surfaces. Striping for detours or full striping of the project for suspensions should be paid for under pavement marking (2582) pay items. (Normally paint).

Interim markings do not include edge lines and the length of the skip will be 5 ft. with a 45 ft. gap. Quantities must include centerline marking for each lift including any milled surfaces. For two lane, two way roads, quantities for the no passing zones need to be included. These quantities are kept on record in the District Traffic Offices. When being paid for by the linear foot, the plan needs to indicate how many lifts were estimated, the amount of solid yellow line, yellow broken line (skip) and white broken line (skip).

If the interim markings are being paid for by the lump sum this information is not included in the plan but will be in the Projectwise restricted file folder.

In either situation, the plan must contain the detail for the interim pavement markings.

Chapter 16 - PAVEMENT MESSAGES

Pavement messages are now paid for by the square foot. Individual messages (placing and removing) should be listed in a tab. The following chart shows square areas for both removal of messages, which includes a larger area around the marking, and installation, which only includes the

HANDOUT

HANDOUT

HANDOUT

HANDOUT

www.dot.state.mn.us/pre-letting/scene/index.html

area of material installed. The chart can be found
at...<http://www.dot.state.mn.us/products/pavementmarkings/pdf/characterareas.pdf>

The reason that the removal areas are larger than the placement areas is because the removal is a rectangular area.

- It is easier for the contractor to grind out a rectangle than the shape.
- When the shape is removed at night it can still look like the message.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

www.dot.state.mn.us/pre-letting/scene/index.html

Pavement Marking Character Areas

Areas are in square feet.

Pavement letters are 96" tall.

Character	Installed Area	Removal Area	Message	Installed Area	Removal Area
A	= 5.27	10.67	ONLY	= 20.76	47.00
B	= 7.19	10.67	PED	= 17.45	37.00
C	= 4.79	10.67	SCHOOL	= 31.86	74.00
D	= 6.26	10.67	SIGNAL	= 29.84	67.20
E	= 5.84	10.67	STOP	= 20.44	50.00
F	= 4.61	10.67	XING	= 20.18	42.00
G	= 5.89	10.67	YIELD	= 22.31	54.27
H	= 5.94	10.67	—		
I	= 2.56	2.67	X	= 61.72	204.00
J	= 3.76	10.67	↶	= 15.00	48.00
K	= 5.71	10.67	↶	= 12.01	35.00
L	= 3.79	10.67	↶	= 26.16	95.00
M	= 8.13	10.67	↶↷	= 25.87	88.00
N	= 7.07	10.67	↶↷	= 37.04	70.00
O	= 6.04	10.67	↶	= 42.55	44.00
P	= 5.35	10.67	↶↷	= 18.87	67.20
Q	= 6.30	10.67	↶↷	= 25.10	93.39
R	= 6.33	10.67	◊	= 9.75	30.00
S	= 5.89	10.67	▼	= 0.75	1.50
T	= 3.79	10.67	▼	= 3.00	6.00
U	= 5.75	10.67	↶↷	= 5.79	8.00
V	= 4.70	10.67	↶↷	= 8.69	18.00
W	= 6.18	10.67	↶↷	= 11.58	32.00
X	= 4.66	10.67	↶↷	= 7.63	32.07
Y	= 3.86	10.67	↶↷	= 3.53	14.12
Z	= 5.00	10.67			
1	= 2.56	10.67			
2	= 5.68	10.67			
3	= 5.59	10.67			
4	= 5.13	10.67			
5	= 6.18	10.67			
6	= 6.35	10.67			
7	= 3.80	10.67			
8	= 6.76	10.67			
9	= 6.35	10.67			
0	= 6.04	10.67			
Message	Installed Area	Removal Area			
AHEAD	= 28.58	64.99			
BIKE	= 21.30	42.00			
LANE	= 21.97	42.00			

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Chapter 16 - RADIUS CORNERS ON TYPE D SIGNS

Currently, there is a standard note that is placed on the Type D Sign Panel Layouts in the Signing Plan. It states: “Corners of the sign panels extending beyond the border shall not be trimmed.”

The MNMUTCD allows for corners of sign panels to be trimmed. Please remove the above note from all future plans for Type D signs.

It is important to note that by removing the note in the construction signing plan, it does not mean that all MnDOT Type D signs are required to have the corners trimmed. It simply means that if Type D signs are manufactured with the corners trimmed MnDOT will accept them.

Chapter 16 - RAISED PAVEMENT MARKERS TEMPORARY

When including temporary raised pavement markers in the plan, show only one pay item. “Raised Pavement Markers Temporary” - and add footnote to the item indicating how many are one-way, two-way, and what color. We have a specification to attach to the proposal that only includes this pay item. (There is very little difference in cost for the different types.)

Chapter 16 - ALTERNATE PEDESTRIAN ROUTE (APR)

A wide range of pedestrians can be expected at work sites, including the young, elderly, and people with disabilities such as hearing, visual, or mobility. These pedestrians need a clearly delineated and usable travel path.

MnDOT has begun the development of guidance for Alternate Pedestrian Route (APR) with new 2011 layouts added to the Minnesota Temporary Traffic Control Zone Layouts - Field Manual. These pages may be downloaded in pdf format. A shop-drawing of the newly approved MnDOT Type IV ADA Pedestrian Barricade as shown in the 2011 Field Manual, is also available online. This barricade has not been crash-tested, and should only be used on or adjacent to walkways.

If the TTC zone affects the movement of pedestrians, adequate pedestrian access and walkways shall be provided. If the TTC zone affects an accessible and detectable pedestrian facility, the accessibility and detectability shall be maintained along the alternate pedestrian route.

Consideration should be made to separate pedestrian movements from both work site activity and motor vehicle traffic.

It is strongly encouraged to pay for this as...
2563.601 ALTERNATE PEDESTRIAN ROUTE by the LUMP SUM.

However, the ADA Office recommends making APR on mill and overlay projects incidental unless there are multiple curb line changes which require removal of large areas of pavement.

When APR is not practical pinch the staging timelines so that pedestrian facilities are interrupted for as little time as possible.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

Chapter 16 - TRAFFIC CONTROL- TABULATION

Traffic control items that are included with the lump sum should not show quantities on the tabulation. This information will be supplied in the current tabulated or listed format via a stand alone document to the Cost Estimating Engineer and the Project Design Services the Projectwise restricted file folder only, at the time of project submittal. The Preliminary Estimate and Data Base file (*.mdb) will be located in the specific projects ProjectWise location (a right protected folder), with AD group name of “DxEstimates” and a Folder name of “Estimates_Restricted” which restricts access for anyone except newly established AD group (Ex. Design Engineer, Lead Designer & District Cost Estimating Engineer).

Quantities can only be given in the plan for the items which are being paid for separately. However, The items which are paid for separately (not part of the lump sum) should be shown as a tabulation for traffic control and noted as being paid for separately. Items such as, but not limited to

...

- ❖ 2533.507 Portable Precast Conc Barrier Des 8337
- ❖ 2563.602 Tube Delineator
- ❖ 2563.xxx Portable Changeable Message Sign
- ❖ 2563.602 Raised Pavement Marker Temporary
- ❖ 2533 PORTABLE PRECAST CONCRETE BARRIER DES 8337
- ❖ 2554 IMPACT ATTENUATOR BARRELS
- ❖ 2554 IMPACT ATTENUATOR
- ❖ 2563 PORTABLE CHANGEABLE MESSAGE SIGN
- ❖ 2563 RAISED PAVEMENT MARKER TEMPORARY
- ❖ 2563 TUBE DELINEATOR
- ❖ 2582 TEMPORARY STRIPING

Chapter 16 - WET REFLECTIVE MARKINGS

There has been a request to have specific pay items for the wet reflective pay items so that they can track where these items are used and to obtain historical price data on them.

Therefore, when the plan contains wet reflective pay items the following should be used on the Statement of Estimated Quantities....

2014 Spec....

- ❖ 2582.602 PAVT MSSG (*usual striping pay item description*)PAINT (WR) by EACH
- ❖ 2582.602 PAVT MSSG (*usual striping pay item description*) EPOXY (WR) by EACH
- ❖ 2582.603 (*usual striping pay item listing size, style, color*) - EPOXY (WR) by LIN FT
- ❖ 2582.603 (*usual striping pay item listing size, style, color*) - PAINT (WR) by LIN FT
- ❖ 2582.618 CROSSWALK MARKING – PAINT (WR) by SQ FT
- ❖ 2582.618 CROSSWALK MARKING – EPOXY (WR) by SQ FT

2016 Spec

- ❖ 2582.501 PAVT MSSG PAINT GR IN (WR) by SQ FT
- ❖ 2582.501 PAVT MSSG EPOXY GR IN (WR) by SQ FT, *if contrast list it*
- ❖ 2582.501 PAVT MSSG PREF TAPE GR IN (WR) by SQ FT, *if contrast list it*

HANDOUT

HANDOUT

- ❖ 2582.502 usual striping pay item listing size, style, material GR IN (WR) by LIN FT, if contrast list it
- ❖ 2582.503 CROSSWALK *material* GR IN (WR) by SQ FT, *if contrast list it*

These wet reflective items are required to be ground-in per Technical Memorandum No. 14-11-T-02. It is suggested that you note on the SEQ or tab if they are NOT ground-in, such as when they placed in a sinusoidal rumble.

For the temporary wet reflective markings the standard pay items will continue to be used.

Permanent wet reflective/refractive Poly-Preform tape is presently NOT allowed on MnDOT projects.

Chapter 18- DEFINITION OF INSTALL

There has been some confusion recently on the definition of “Install”. Whenever the word “install” (or variation thereof) is used it implies that the materials are being supplied (or are from salvaged items). If this is the case then using the word “install” by itself is correct.

If however, the materials are not being supplied (or are not from salvaged items) then one of the following words (and/or their variation) should be used.... place, construct, furnish & install.

Chapter 18 - DRAFTING STANDARDS

There are complaints that some plans are sent in with white out and/or stick up material on the originals. These materials cause problems with our reproduction procedures and plans processing. The use of these materials should not be used on the originals that are sent to the Central Office.

In order to produce a copy, which when scanned, would be at the highest possible clarity and resolution, the designer should keep in mind the following requirements for good reproduction.

- ❖ Uniformity
- ❖ Large open lettering
- ❖ High density of drafted lines
- ❖ 4 Good contrast

A general resource for drafting standards to use/adhere to would be...

- ❖ MnDOT CADD Data Standards (PDF) <http://www.dot.state.mn.us/caes/files/pdf/mndot-caddstandardsdocumentation.pdf>
 - a. Text Sizing on page 12-13 for English based on Annotation Scaling in 11X 17 output. (Annotation scaling of 1:20 equates to 1” = 20’)
- ❖ MnDOT CADD Data Standards (resource files)...

www.dot.state.mn.us/pre-letting/scene/index.html

<http://www.dot.state.mn.us/caes/files/zip/mndot-caddstandards.zip>

- a. External partners that do not have MicroStation/GEOPAK may download Bentley View
 - b. Compressed Bentley MicroStation and Bentley GEOPAK resources
- i. GEOPAK drafting databases contain information on text labels for size/scale. May require Bentley GEOPAK software to open/read.
 - 1. MnDOT.DDB = Design drafting standards for GEOPAK automated drafting tools.
 - 2. MNDOT.SMD = Surveys/Mapping drafting standards for GEOPAK Automated drafting tools
- 3. RWTEXT.LSF = Right of Ways Labeling Style file (font an size preset)
 - ii. MicroStation
 - 1. Fonts – Mondotfont.rsc contains the fonts approved for use in MnDOT files
 - 2. Cell Libraries – some contain text labels that are built to MnDOT standard when placed correctly .

A large percentage of our plans do have these qualities, but improvement is needed in the remainder.

There has also been some issues with the line weights being too light. When this is the case the lines do NOT show up when scanned. Make sure that the line weights are dark enough for scanning/copying.

Chapter 18 - INCIDENTAL WORK VS. INCLUDED IN WORK

Because of conditions unique to a project, a pay item may include work that is not described by the standard specifications. Designers must anticipate these conditions and provide for them in the plans with a note. Additional work might be considered included in the cost of an existing pay item and can be provided for with a note if the scope of the work is directly related to an existing pay item, and is short in duration or low in cost.

"Directly related" to an existing pay item generally means either the work is performed on that item or is a direct result of the work on that item.

"Low in cost" frequently is assumed to mean less than \$1000.

For example, if the plans require a new sewer pipe to be tied into an existing pipe, the cost of tying in the pipe could be considered incidental.

When bidding, a contractor must be made aware of pay items involving incidental work so that the bid price for the item can be adjusted to compensate for the additional cost. Therefore, it is desirable to include all notes for incidental work in the footnotes of the Statement of Estimated Quantities.

Work for which *no direct payment* is to be made is included for payment in one of two ways:

HANDOUT

HANDOUT

HANDOUT

HANDOUT

1. If the Method of Measurement or Basis of Payment defined in the Standard Specifications for Construction for the pay item *describes the work as included*, the work is included in a specific pay item. Then a note is written as a footnote to the Statement of Estimated Quantities for the pay item that describes the work, so it can be estimated accurately, and uses the word “included or includes.” For example, the placement of a 45° elbow with the construction of a 18 in. CS Pipe Culvert is included for payment as illustrated by the next Statement of Estimated Quantities and the note provided as a footnote to that tabulation.

STATEMENT OF ESTIMATED QUANTITIES			
ITEM NO.	DESCRIPTION	UNIT	QUANTITY
2104.501	REMOVE PIPE CULVERTS	Lin Ft	432
2104.509	REMOVE PIPE APRONS	EACH	78
2104.509	REMOVE STAIRS	EACH	2
2104.521	SALVAGE SPRINKLER SYSTEM	Lin Ft	325
2104.521	SALVAGE CHAIN LINK FENCE		765
2501.511	18" CS PIPE CULVERT (1)	Lin Ft	256
2503.541	30" RC PIPE SEWER	Lin Ft	13

- (1) LENGTH OF PIPE INCLUDES 45° ELBOW

The Method of Measurement of the pipe length defined by the Specifications for the pay item 2501.511 “18” CS PIPE CULVERT *includes* the length of the elbow. Therefore, the elbow *is* included in the specific pay item “18” CS PIPE CULVERT,” but the contractor needs to know the dimensions of the elbow in order to prepare a bid.

2. If the work *is not described* as included by the Method of Measurement or Basis of Payment defined in the Standard Specifications for a pay item, the work may be *made* incidental. Then a note is written as a footnote to the Statement of Estimated Quantities for the pay item that describes the work, so it can be estimated accurately, *and* uses the words “this shall be considered incidental.” Or just “incidental” For example: the removal of a bulkhead from an existing pipe sewer and the connection of a 30 in. RC Pipe sewer to the existing pipe is included for payment by placing a note as a footnote to the statement of Estimated Quantities:

STATEMENT OF ESTIMATED QUANTITIES			
ITEM NO.	DESCRIPTION	UNIT	QUANTITY
2104.501	REMOVE PIPE CULVERTS	Lin Ft	432
2104.509	REMOVE PIPE APRONS	EACH	78
2104.509	REMOVE STAIRS	EACH	2
2104.521	SALVAGE SPRINKLER SYSTEM	Lin Ft	325

2104.521	SALVAGE CHAIN LINK FENCE	Lin Ft	765
2501.511	18" CS PIPE CULVERT (1)	Lin Ft	256
2503.541	30" RC PIPE SEWER (2)	Lin Ft	13

(2) REMOVAL OF INPLACE BULKHEAD AND CONNECTING PIPE TO INPLACE PIPE SHALL BE INCIDENTAL.

The removal of the bulkhead and the connection to the in-place pipe is *not* described in either the Method of Measurement or in the Basis of Payment for the pay item 2503.541 ___" RC PIPE SEWER.

Another example of indicating incidental work this way on the Statement of Estimated Quantities is a small amount of work directly caused by completing other work that is a pay item, such as the replacement of a few trees and shrubs disturbed only by the salvaging of a sprinkler system (a pay item).

STATEMENT OF ESTIMATED QUANTITIES			
ITEM NO.	DESCRIPTION	UNIT	QUANTITY
2104.501	REMOVE PIPE CULVERTS	Lin Ft	432
2104.509	REMOVE PIPE APRONS	EACH	78
2104.509	REMOVE STAIRS	EACH	2
2104.521	SALVAGE SPRINKLER SYSTEM (3)	Lin Ft	325
2104.521	SALVAGE CHAIN LINK FENCE		765
2501.511	18" CS PIPE CULVERT (1)	Lin Ft	256
2503.541	30" RC PIPE SEWER (2)	Lin Ft	13

(3) AT BRIDGE OFFICE CENTER (13100 JESSICA BLVD.). TREES AND SHRUBS WHICH ARE REMOVED SHALL BE REPLACED WITH EQUAL SIZE AND TYPE. THIS WORK SHALL BE CONSIDERED INCIDENTAL.

Chapter 18 - LUMP SUM ITEMS

The term, "lump sum," when used as a unit of measurement for payment, means complete payment for that item of work *as described by the contract*. A description of the work to be paid for as a "lump sum" is included in the plans so that contractors bidding on the project will know exactly what work and materials are included in the pay item. These "lump sum" items usually include work items that are used on many projects. Either a bill of materials has been developed for them (such as standardized traffic control or traffic control interconnection systems) or they are routine work items that do not vary significantly from project to project (such as maintenance or restoration of haul roads).

Clear definition in the plan of what is expected in each case contributes to harmony and better results at less cost during construction. More accurate estimates are promoted as well. If the estimated quantity of an item is such that it cannot be determined at the design stage an item and quantity should be set up in the estimate and proposal to establish a contract bid price. However,

HANDOUT

HANDOUT

there is no good substitute for careful research and determination of reasonably accurate quantities. Pursuing this a bit further - occasionally a plan provides for direct payment for certain items yet advises bidders that certain like items of unknown quantity required to be furnished by the contractor as included in one thing or another will not be measured for payment. This can only be disadvantageous to the state. The bidder must again include a sufficient sum somewhere in his proposal to cover the costs of the unknown quantity to protect themselves and then still demand direct payment of the engineer. How can direct payment be justified for the known quantity but not for the unknown. Better to provide that the unknown quantities will be paid for at the appropriate contract price. Gives estimators a break, too. The preceding cases are even more confusing when the extent of the unknown quantities is subject to “as direct (or ordered) by the engineer.”

Chapter 18 - PROPRIETARY ITEMS IN PLANS

As you are aware, proprietary items are those items specified that have less than 3 known manufacturers or suppliers. Whenever a proprietary item is specified, the Project Manager is to write a request for certification request to the State Design Engineer requesting Certification or a PIF for proprietary items stating why it is in the public interest to use that brand name item. It is very difficult for us in the Central Office to know why a proprietary item must be used. We therefore request that when designers specify a proprietary item, they prepare a memo indicating why this product was chosen. Reasons may be to match an existing system or design constraints.

Send the memo to the Special Provisions Engineer as soon as possible. The Special Provisions Engineer will work with the FHWA on the Public Interest Finding (PIF). For questions regarding the appropriate request (PIF or Certification) please contact the Special Provisions Engineer.

Chapter 18 - ROADWAY LABELS

When labeling trunk highways within a plan (tabulations, plan views, etc.) be sure to use the precursor “TH” not “I”. This is the standard way we label our trunk highways in all MnDOT plans

Chapter 18 - TRACKING CHANGES TO SPECIAL PROVISIONS

Because of problems in the field of modifications to the Special Provisions by both contractors and field personnel, we will now start identifying those changes in the proposals.

When preparing and submitting draft special provisions please follow the following process:

Start by downloading the most current SP2014 or SP 2016. *The Special Provisions Unit **will not** be accepting provisions copied from prior spec books unless no current alternative exists and the specification has been brought into conformance with the current spec year.*

- (A) If you want to use a C.O. SP2014 or C.O. SP 2016 write-up of an item but WILL NOT be making any changes within the write-up, then do the following:

HANDOUT

HANDOUT

Show Section Name and number

Example:

S-X (1910) FUEL ESCALATION CLAUSE
SP2014-50

Just show the Section Name and Number. When you leave the SP2014 (or SP2016)-Number intact, this will indicate to the Special Provisions Unit that you have not changed the section and want the most current write-up.

(B) If you want to use a C.O. SP 2014 or C.O. SP 2016 write-up, but WILL be making changes within the write-up, then do the following prior to sending us your file:

Show Section Name and SP2014 or SP 2016 number, followed by "modified".

Example:

S-X (1910) FUEL ESCALATION CLAUSE
SP2014-50 - MODIFIED

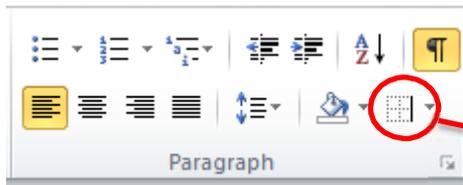
Show entire special provision, including your revisions. Make it as easy as possible for the Special Provisions Unit to recognize your changes. Highlight changes to the provisions in yellow so they are easily identified. In addition, select the paragraph and add a right border where the modifications were made as shown below.

HANDOUT

HANDOUT

HANDOUT

HANDOUT



The Department reserves the right to revise the Proposal Package at any time before the date and time for opening Proposals. The Department will issue a numbered and dated Addendum for any revision of the Proposal Package. The Department will electronically post each Addendum as announced in an e-mail notification to each Bidder on the Department's list of Bidders. The Department will include each Addendum with all Proposal Forms issued to the Bidder after the date of the Addendum.

If you DO NOT show the sections as “modified”, the Special Provision Unit will most likely assume you want the current section from the SP 2016. So, you may not get what you want.

Draft Design Scene articles....to be available soon?

CHAPTER 16 - PAVEMENT MESSAGES (DRAFT)

There was an error in chapter 14 of the design scene under...**PAVEMENT MESSAGES**. This should be replaced with....

Pavement messages are now paid for by the square foot. Individual messages (placing and removing) should be listed in a tab. The following chart shows square areas for both removal of messages, which includes a larger area around the marking, and installation, which only includes the area of material installed. The chart can be found at...

<http://www.dot.state.mn.us/trafficeng/pavement/typicaldetail/index.html>

The reason that the removal areas are larger than the placement areas is because the removal is a rectangular area.

- It is easier for the contractor to grind out a rectangle than the shape.
- When the shape is removed at night it can still look like the message.

CHAPTER 16 - PAVEMENT MARKING TYPICALS (DRAFT)

The standard details for the pavement markings have been created and are located at....

<http://www.dot.state.mn.us/trafficeng/pavement/typicaldetail/index.html>

It is recommended that designers start using these typicals in their plans as soon as possible. They will be required for all plans starting January 27, 2017 letting. They will be included in the plans typical border with signature.

If the designer modifies the typical follow the same procedures as those outlined for standard plan sheets. Also fill in the modified date and designer initial in the bottom corner of the typical.

When clarifying a typical the designer does not need to follow the modification procedure.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

The designer should be aware that when adding some of these typicals in the .DGN file it may look as though there is some overwriting occurring. It will self-correct when loaded into ProjectWise with MnDOT fonts. This will also self-correct when printed with MnDOT print cues so do not be concerned about it.

The designer notes and asterisk are on the “CAPT BLK” level. If they turn off that level all of that should disappear.

CHAPTER 16 - INTERIM STRIPING TYPICAL (DRAFT)

A signature block has been added to the Interim Striping typical. Make sure that this sheet is signed when used in the plan.

The interim striping typical can go in either the Traffic control section or the permanent pavement marking section. It should only be in one section and must be the typical as shown on the striping typical website. Make sure that the pay item is included in the Statement of Estimated Quantity.

HANDOUT

HANDOUT

HANDOUT

HANDOUT

7.3 Sample Plan Sets