

2024 Work Zone Safety Design Basic Training

4-10-24

Chris Brookes
Chuck Bergmann
Sarah Hoffman

*If you have any questions after today's training,
please contact us at:*

MDOT-DesignBasicTraining@michigan.gov

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please contact us at:*

**MDOT-
DesignBasicTraining@michigan.gov**

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Contractor Liability

- These materials are intended to assist employers, workers, and others as they strive to improve work zone safety. All of the pictures, video and information in the following presentation are to be utilized for training purposes only. Any individuals or companies named or shown can not be retroactively perused based upon information gained during this presentation as it is being utilized for training and education purposes.

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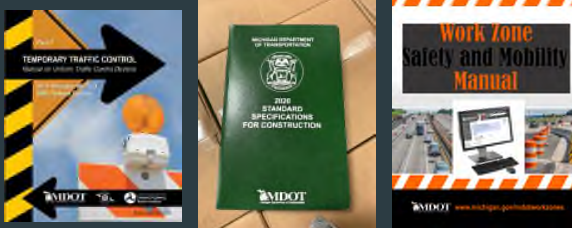
House Keeping

- Raise your hand for questions or use the chat
- This is NOT being recorded.
- Please make sure you are on mute when not talking.
- CEH's are being offered
 - Follow up with
 - MDOT-DesignBasicTraining@michigan.gov

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Reference Materials



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Work Zone Safety

- ▶ The MMUTCD, Part 6 states:
 - ▶ The primary function of TTC is to provide for the reasonably safe and efficient movement of road users through or around TTC zones while reasonably protecting workers, responders to traffic incidents, and equipment.

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Work Zone “Defined”

- ▶ “Work zone” means a portion of a street or highway that meets any of the following:
 - (a) Is between a “work zone begins” sign and an “end road work” sign.
 - (b) For construction, maintenance, or utility work activities conducted by a work crew and more than 1 moving vehicle, is between a “begin work convoy” sign and an “end work convoy” sign.

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Work Zone “Defined”

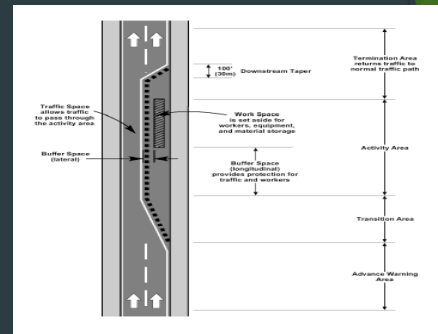
- ▶ (c) For construction, maintenance, surveying, or utility work activities conducted by a work crew and 1 moving or stationary vehicle exhibiting a rotating beacon or strobe light, is between the following points:
 - (i) A point that is 150 feet behind the rear of the vehicle or that is the point from which the beacon or strobe light is first visible on the street or highway behind the vehicle, whichever is closer to the vehicle.
 - (ii) A point that is 150 feet in front of the front of the vehicle or that is the point from which the beacon or strobe light is first visible on the street or highway in front of the vehicle, whichever is closer to the vehicle.

8

Four Components

- ▶ What are the four components of a work zone?
 - ▶ Advance Warning
 - ▶ Transition
 - ▶ Activity
 - ▶ Termination

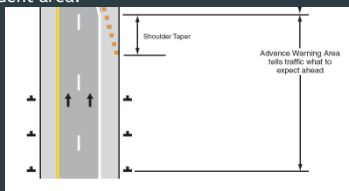
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Advance Warning Area

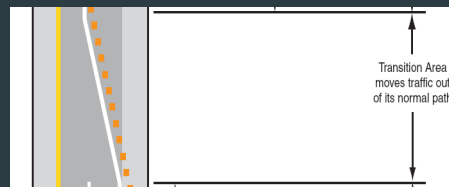
- ▶ The section of highway where road users are informed about the upcoming work zone or incident area.



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Transition Area

- ▶ Redirects motorists out of their normal path.
- ▶ Channelizing devices are required.



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Activity Area

- ▶ This is where the work takes place.
- ▶ Closed to traffic and set aside for workers.
- ▶ the portion which is used route traffic through the activity (work) area.
- ▶ Includes motorized and non-motorized

The diagram illustrates the layout of a work zone. From left to right: a 'Buffer Space (optional)' provides protection for traffic and workers; a 'Traffic Space' allows traffic to pass through the activity area; a 'Work Space' is set aside for workers, equipment, and material storage; and the 'Activity Area' is where work takes place. A 'Buffer Space (longitudinal)' provides protection for traffic and workers between the work space and the activity area.

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Termination Area

- ▶ Used to return traffic to its normal path and speed.
- ▶ Speed limit sign
- ▶ "END ROAD WORK" sign, placed after the speed limit sign, if a "WORK ZONE BEGINS" sign is used to define the work zone.

The diagram shows the termination area of a work zone. It includes a 'Downstream Taper' leading into a 'Termination Area' where traffic resumes normal operations. A 'Buffer Space (longitudinal)' is shown between the taper and the termination area. Signs for speed limit and 'END ROAD WORK' are indicated.

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DISTANCE BETWEEN TRAFFIC SIGNS, "D"

"D" DISTANCES	25	30	35	40	45	50	55	60	65	70	75
D (FEET)	250	300	350	400	450	500	550	600	650	700	750

GUIDELINES FOR LENGTH OF LONGITUDINAL BUFFER SPACE, "B"

"B" LENGTHS	SPEED* MPH PRIOR TO WORK AREA											
B (FEET)	20	25	30	35	40	45	50	55	60	65	70	75
	33	50	83	132	181	230	279	329	411	476	542	625

* POSTED SPEED, OFF-PEAK 85TH PERCENTILE SPEED PRIOR TO WORK STARTING, OR THE ANTICIPATED OPERATING SPEED.

MINIMUM MERGING TAPER LENGTH, "L" (FEET)

OFFSET (FEET)	POSTED SPEED LIMIT, MPH PRIOR TO WORK AREA											
Offset	25	30	35	40	45	50	55	60	65	70	75	
1	11	15	21	27	45	50	55	60	65	70	75	
2	21	30	41	54	90	100	110	120	130	140	150	
3	32	45	62	80	135	150	165	180	195	210	225	
4	42	60	82	107	180	200	220	240	260	280	300	
5	53	75	103	134	225	250	275	300	330	350	375	
6	63	90	123	160	270	300	330	360	390	420	450	
7	73	105	143	187	315	350	385	420	455	490	525	
8	84	120	164	214	360	400	440	480	520	560	600	
9	94	135	184	240	405	450	495	540	585	630	675	
10	105	150	205	267	450	500	550	600	650	700	750	
11	115	165	224	294	495	550	605	660	715	770	825	
12	125	180	245	320	540	600	660	720	780	840	900	
13	136	195	266	347	585	650	715	780	845	910	975	
14	146	210	286	374	630	700	770	840	910	980	1050	
15	157	225	307	400	675	750	825	900	975	1050	1125	

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Typicals

Manuals

- [Work Zone Safety and Mobility Manual](#)
- [Maintenance Work Zone Traffic Control Guidelines](#)
- [MDOT 2020 Standard Specifications for Construction](#)
- [MUTCD Part 8 - Temporary Traffic Control](#)

Documents

- [Work Zone Audit Report](#)
- [MDOT Traffic and Safety Typicals](#)
- [Traffic Resurfacing Manual June 2002](#)
- [Work Zone Device MASH Files](#)
- [Manual for Assessing Safety and Traffic Control Compliance Guidance for Temporary Traffic Control Devices in Work Zones](#)
- [Roadside Safety Hardware Assessment and Implementation Plan](#)
- [MDOT Special Details](#)
- [MUTCD Special Provisions](#)

Resources

- [Work Zone Transportation Management Plans](#)
- [Work Zone Safety and Mobility F110WA Final Rule](#)
- [Mobility Impact Map](#)
- [COP Analysis](#)

Additional Contacts

Local Agency Programs
[Bruce Kadlubar](#), Manager, 517-335-2222

Utility and Construction Permits
[Jazz Hogg](#), Statewide Construction Permit Coordinator, 517-241-2103

Railroad Infrastructure
[Mica Erdos](#), TL, Grade Crossing Engineer, 517-589-4014
[Paul Koppala](#), TL, Grade Separation Engineer, 517-262-5540

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The screenshot shows the MDOT website interface. The main heading is 'Michigan Department of Transportation Traffic and Safety/Standards and Special Details'. There is a 'General' section with a disclaimer and a 'Viewing Information' section. A green arrow points to the 'Viewing Information' section.

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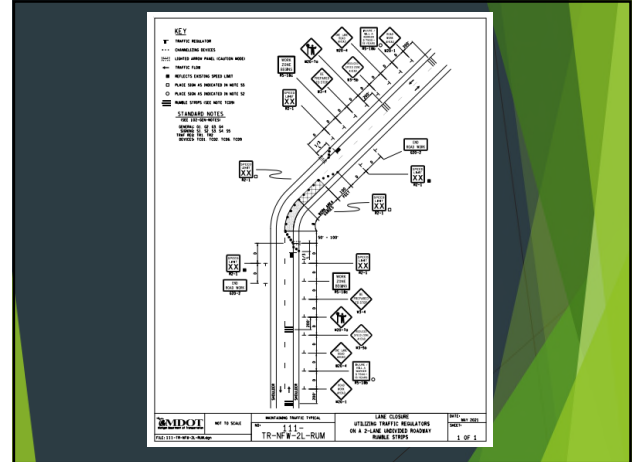
The screenshot shows the 'Work Zone Special Details' page. It features a table with columns for 'Sub-Category', 'Plan', 'Title - Download', and 'Last Updated'. A green arrow points to the table.

Sub-Category	Plan	Title - Download	Last Updated
Work Zone Device Special Details	Change List	Change List for Work Zone Devices	04/25/2018
Work Zone Device Special Details	WZD-100-A - 0in	WZD-100-A - 0in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 6in	WZD-100-A - 6in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 12in	WZD-100-A - 12in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 18in	WZD-100-A - 18in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 24in	WZD-100-A - 24in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 30in	WZD-100-A - 30in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 36in	WZD-100-A - 36in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 42in	WZD-100-A - 42in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 48in	WZD-100-A - 48in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 54in	WZD-100-A - 54in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 60in	WZD-100-A - 60in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 66in	WZD-100-A - 66in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 72in	WZD-100-A - 72in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 78in	WZD-100-A - 78in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 84in	WZD-100-A - 84in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 90in	WZD-100-A - 90in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 96in	WZD-100-A - 96in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 102in	WZD-100-A - 102in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 108in	WZD-100-A - 108in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 114in	WZD-100-A - 114in (077 T-475)	04/24/2018
Work Zone Device Special Details	WZD-100-A - 120in	WZD-100-A - 120in (077 T-475)	04/24/2018

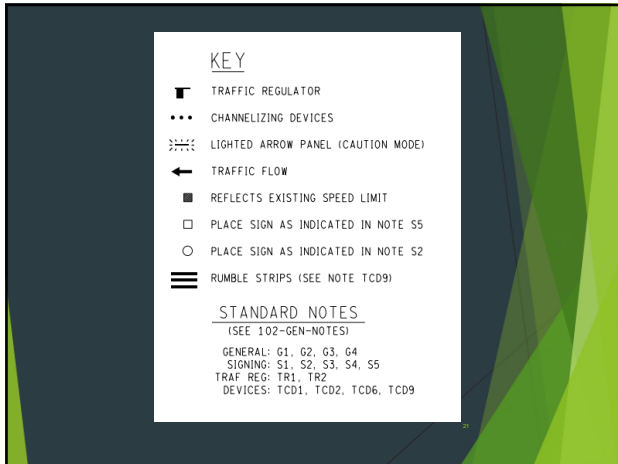
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Sub-Category	Plan	Title - Download	Last Updated
Maintaining Traffic Typical (pdf)	0-Maintenance Traffic Control Typical.pdf	Maintenance Traffic Control Typical	05/30/2021
Maintaining Traffic Typical (pdf)	0-Maintenance Traffic Control Typical.pdf	0-Maintenance Traffic Control Typical.pdf (4.053.32 KB)	
Maintaining Traffic Typical (pdf)	0-Construction Typical Spillage Calculation Sheet.xlsx	0-Construction Typical Spillage Calculation Sheet.xlsx	10/04/2022
Maintaining Traffic Typical (pdf)	0-Construction Typical Spillage Calculation Sheet.xlsx	0-Construction Typical Spillage Calculation Sheet.xlsx (294.49 KB)	
Maintaining Traffic Typical (pdf)	0-Maintenance and Survey Typical Sign Calculation Sheet.xlsx	0-Maintenance and Survey Typical Sign Calculation Sheet.xlsx	04/02/2021
Maintaining Traffic Typical (pdf)	0-Maintenance and Survey Typical Sign Calculation Sheet.xlsx	0-Maintenance and Survey Typical Sign Calculation Sheet.xlsx (116.59 KB)	
Maintaining Traffic Typical (pdf)	0-Surveying Traffic Control Typical.pdf	Surveying Traffic Control Typical.pdf	05/20/2021
Maintaining Traffic Typical (pdf)	0-Surveying Traffic Control Typical.pdf	0-Surveying Traffic Control Typical.pdf (3.133.28 KB)	
Maintaining Traffic Typical (pdf)	00-Traffic Control Typical - Complete Set.pdf	Traffic Control Typical - Complete Set	04/19/2022
Maintaining Traffic Typical (pdf)	00-Traffic Control Typical - Complete Set.pdf	00-Traffic Control Typical - Complete Set.pdf (11,157.93 KB)	
Maintaining Traffic Typical (pdf)	100-GEN-KEY.pdf	100-GEN-KEY.pdf	12/28/2021
Maintaining Traffic Typical (pdf)	100-GEN-KEY.pdf	100-GEN-KEY.pdf (100.99 KB)	
Maintaining Traffic Typical (pdf)	101-GEN-SPACING-CHARTS.pdf	101-GEN-SPACING-CHARTS.pdf	05/10/2021
Maintaining Traffic Typical (pdf)	101-GEN-SPACING-CHARTS.pdf	101-GEN-SPACING-CHARTS.pdf (214.92 KB)	
Maintaining Traffic Typical (pdf)	102-GEN-NOTES.pdf	Traffic Control Typical Notes Sheet	05/01/2022
Maintaining Traffic Typical (pdf)	102-GEN-NOTES.pdf	102-GEN-NOTES.pdf (412.87 KB)	
Maintaining Traffic Typical (pdf)	103-GEN-SIGN.pdf	Maintaining Traffic Typical Sign Sheet	07/01/2021
Maintaining Traffic Typical (pdf)	103-GEN-SIGN.pdf	103-GEN-SIGN.pdf (901.88 KB)	
Maintaining Traffic Typical (pdf)	104-GEN-AB.pdf	Use of Arrow Board on Hill or Curve	05/10/2021
Maintaining Traffic Typical (pdf)	104-GEN-AB.pdf	104-GEN-AB.pdf (54.27 KB)	
Maintaining Traffic Typical (pdf)	105-GEN-SPEED-FW.pdf	Supplemental Speed Limit Treatment on Limited Access Roadways	05/10/2021
Maintaining Traffic Typical (pdf)	105-GEN-SPEED-FW.pdf	105-GEN-SPEED-FW.pdf (63.31 KB)	

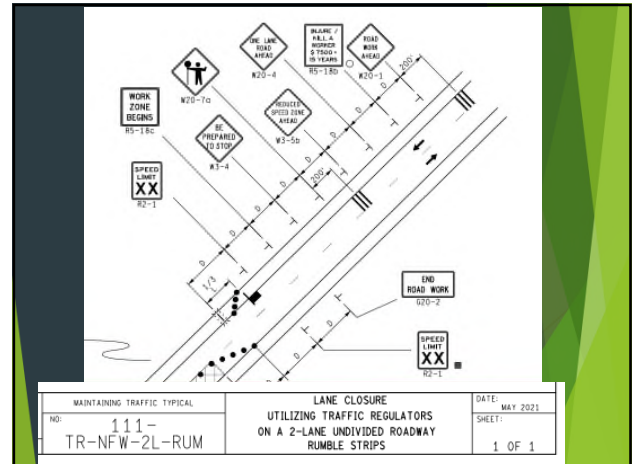
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MOT Design

- You can still make additional Traffic Control layouts
- Let us know if you think there is something missing
- Check MMUTCD Part 6

Figure 6H-36. Lane Shift on a Freeway (TA-36)

Typical Application 36

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Reference Materials

TEMPORARY TRAFFIC CONTROL Manual of Uniform Traffic Control Devices

2021 STANDARD SPECIFICATIONS FOR CONSTRUCTION MICHIGAN DEPARTMENT OF TRANSPORTATION

Work Zone Safety and Mobility Manual

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Reference Materials

- Did you check all the other manuals?

HELP! I GOT CAUGHT IN A TITLE WAVE

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www.Michigan.gov/mdotworkzones

Michigan Department of Transportation

Work Zone Mobility

Questions? [Click Here](#)

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Did you get the Update?

From: Michigan Dept of Transportation <MDOT@govsubscriptions.michigan.gov>
Subject: Work Zone Safety and Mobility Manual and MOT Boilerplate Update

Having trouble viewing this email? [Click here](#) or [call 517-242-6466](#)

Everyone,

The [Work Zone Safety and Mobility Manual](#) was updated on 2/20/2024. The updates include changes to sections 1.02.08 Freeway MOT Decision Tree Process, Appendix O, and 2.02.04 A Boilerplate Document. These changes are based on the passing of PA 164 and to improve the MOT Boilerplate. The boilerplate is now [version 3.0](#) and will be expected to be utilized starting with the July 4th merge.

Chris Brooks
Work Zone Engineer
BrooksC@Michigan.gov
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Sent 2/29/2024 at 10:00 AM

Michigan DOT - Bulletin Detail Report

Subject: Work Zone Safety and Mobility Manual and MOT Boilerplate Update

Sent: 02/29/2024 10:00 AM EST

Sent By: BrooksC@michigan.gov

Sent To: Subscribers of Work Zone Safety and Mobility

3,473 Recipients

91% Delivered

0% Pending
9% Bounced
31% Open Rate
10% Click Rate

Hours	Cumulative Attempted
3	91%
5	95%
10	95%
30	95%
60	95%
120	95%

Delivery Metrics - Details		Bulletin Analytics	
3,473	Total Sent	3,127	Total Opens
3,144 (91%)	Delivered	967 (31%)	Unique Opens
0 (0%)	Pending	492	Total Clicks
329 (9%)	Bounced	328 (10%)	Unique Clicks
0 (0%)	Unsubscribed	17	# of Links

30

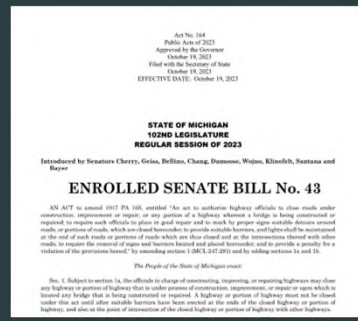
What Changed in the Work Zone Safety and Mobility Manual?

- Section 1.02.08 Freeway MOT Decision Tree Process
 - Decision Tree encourages the use of detours, crossovers, and positive protection to safely guide traffic through the work zone and past work crews as they engage in rebuilding, repairing, and/or maintaining our infrastructure.
 - Public Act 164 of 2023 (Senate Fiscal Analysis as Enacted)
 - Require MDOT to use concrete barriers or equivalent crashworthy temporary traffic barriers when closing a freeway or a portion of freeway for construction, improvement, or repair.
 - Specify that this requirement does not apply if the freeway or portion of freeway is closed for not more than three days for an emergency repair, utility crossing, maintenance, or other short-duration operation.
 - Allow MDOT to exercise its engineering judgement in designing and placing concrete barriers or equivalent crashworthy temporary traffic barriers and associated traffic control devices for each closure of a freeway or portion of freeway.

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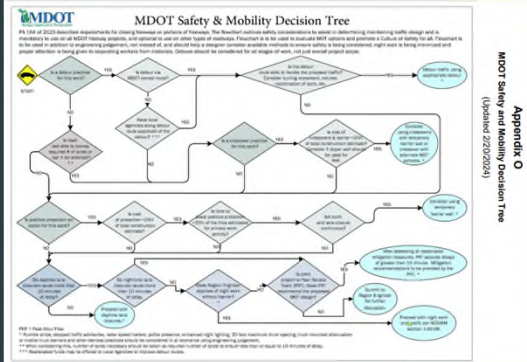
Google: Public Act (PA) 164 of 2023

(for full details)



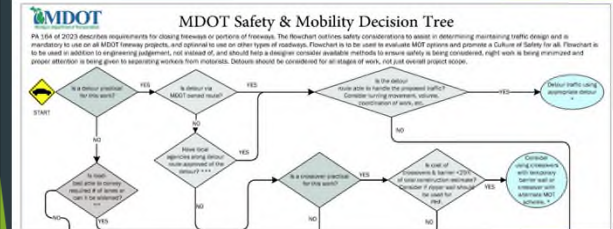
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Appendix O - The MDOT Safety & Mobility Decision Tree



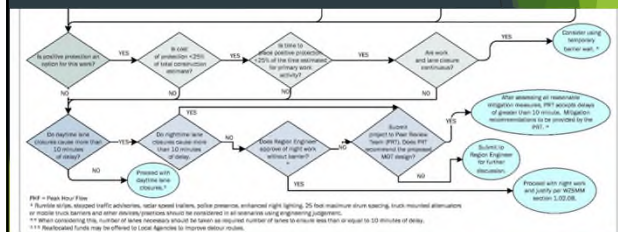
33

MDOT Safety & Mobility Decision Tree



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MDOT Safety & Mobility Decision Tree



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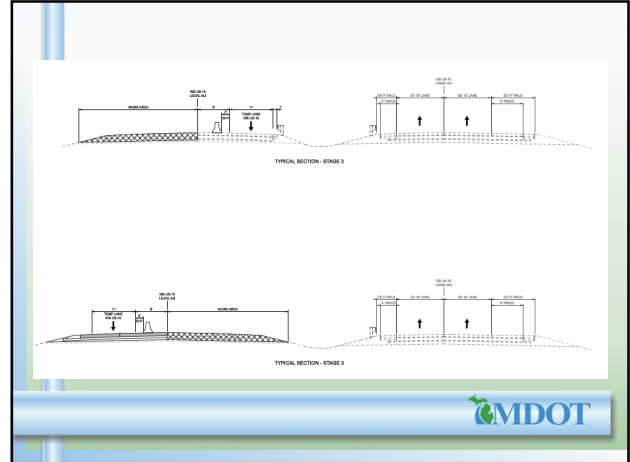
Section 1.02.08

- A freeway, for use with the decision tree, will be defined as meaning "a divided arterial highway for through traffic with full control of access and with all crossroads separated in grade from pavements for through traffic."
- The Decision Tree should be used in conjunction with Engineering judgement, as it is documented that the use of these MOT concepts may be difficult to apply typically statewide and may have regional considerations that must be evaluated.
- Justification Process
 - If Significant - TMP would be referenced in a signed Memo from the Region Engineer.
 - If NOT Significant - Information will change based on the scope scale and complexity of the project
 - C03 Analysis
 - Crash History
 - MOT Alternative Matrix
- Share examples please!

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MOBILITY ANALYSIS/MAINTAINING TRAFFIC ALTERNATIVES FOR RECONSTRUCTING WESTBOUND US-10 FROM BAY CITY LIMITS TO 7 MILE ROAD INCLUDING ROUNDABOUT CONSTRUCTION AT MACKINAW ROAD INTERCHANGE				
Alternative 1: One Lane of traffic WB to be maintained on WB using temporary widening. This alternative would have no impact to EB US-10.				
	Stage 1 3 Mile Rd to Bay City Limits Detour	Stage 2 & 3 7 Mile Rd to 3 Mile Rd		Total User Delay Cost/Day
WB US-10 Peak Increased Travel Time	5.17 min	9.3 min		\$14,011
EB US-10 Peak Increased Travel Time	0	0		\$0.00
Project Schedule (weeks)				28
Total User Delay Cost Per Day for Length of Project				\$2,748,216
Work Zone Traffic Control Estimate	\$73,212.00	\$1,516,864.95		
Total Maintaining Traffic Control Cost				\$1,430,076.95
Maintaining Traffic % of Total Job				6%
Advantages	EB US-10 traffic will not be affected resulting in no user delay for EB. Reduced WZTC less worker separation for the construction workers, lower level of constructability with longer work schedule. Inability to get to potential traffic incident/safety issue. Depth of cut sections may be a hazard.			
Disadvantages				
Project Significance	Non-Significant			

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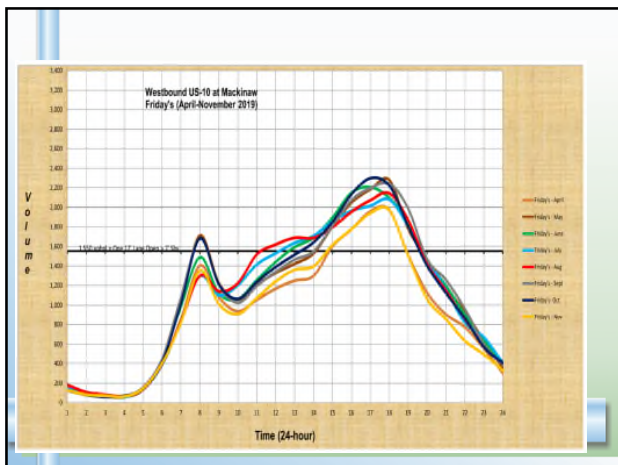
38

MOBILITY ANALYSIS/MAINTAINING TRAFFIC ALTERNATIVES FOR RECONSTRUCTING WESTBOUND US-10 FROM BAY CITY LIMITS TO 7 MILE ROAD INCLUDING ROUNDABOUT CONSTRUCTION AT MACKINAW ROAD INTERCHANGE				
Alternative 2: One Lane of traffic EB & WB to be maintained on EB US-10 using overpasses and a concrete barrier wall.				
	Stage 1 3 Mile Rd to Bay City Limits Detour	Stage 2 & 3 7 Mile Rd to 3 Mile Rd		Total User Delay Cost/Day
WB US-10 Peak Increased Travel Time	5.17 min	9.3 min		\$14,011
EB US-10 Peak Increased Travel Time	0	0		\$0.00
Project Schedule (weeks)				28
Total User Delay Cost Per Day for Length of Project				\$5,619,712
Work Zone Traffic Control Estimate	\$73,212.00	\$3,018,393.00		
Total Maintaining Traffic Control Cost				\$3,091,605.00
Maintaining Traffic % of Total Job				11%
Advantages	High level of Worker Safety, high level of Constructability, Reduced construction schedule.			
Disadvantages	Higher traffic delays, higher cost for WZTC, higher user delay cost, reduced stress for emergency responders.			
Project Significance	Non-significant			

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MOBILITY ANALYSIS/MAINTAINING TRAFFIC ALTERNATIVES FOR RECONSTRUCTING WESTBOUND US-10 FROM BAY CITY LIMITS TO 7 MILE ROAD INCLUDING ROUNDABOUT CONSTRUCTION AT MACKINAW ROAD INTERCHANGE				
Alternative 3: One Lane of traffic WB to be maintained on WB using temporary widening. This alternative would have no impact to EB US-10.				
	Stage 1 3 Mile Rd to Bay City Limits Detour	Stage 2 & 3 7 Mile Rd to 3 Mile Rd		Total User Delay Cost/Day
WB US-10 Peak Increased Travel Time	5.17 min	9.3 min		\$14,011
EB US-10 Peak Increased Travel Time	0	0		\$0.00
Project Schedule (weeks)				28
Total User Delay Cost Per Day for Length of Project				\$2,748,216
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Disadvantages				
Project Significance	Non-Significant			

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MDOT ROADWAY & BRIDGE PRODUCTION RATES - UPDATED 2018				
Work Item	Production Rate	Production Rate	Production Rate	Comments
Concrete Patching	40 SY/Day	80 SY/Day	100 SY/Day	Use Low rate for congested areas with higher traffic control requirements/ numerous small patches, average rate for urban areas, and high rate for rural areas with less traffic control requirements and/or larger patch areas.
HMA Pavement - Mainline B Shoulder - Freeway	1000 Tons/Day	1,700 Tons/Day	2,500 Tons/Day	Use Low rate for small thicknesses and small areas and High rate for large lifts and large areas.
HMA Pavement - Mainline B Shoulder - Non-Freeway	600 Tons/Day	1,300 Tons/Day	2,100 Tons/Day	Use Low rate for small thicknesses and small areas and High rate for large lifts and large areas.
HMA Pavement - Misc	100 Tons/Day	200 Tons/Day	500 Tons/Day	Use Low rate for small thicknesses and small areas and High rate for large lifts and large areas.
Cold Milling	2,000 SY/Day	8,000 SY/Day	15,000 SY/Day	Use Low rate for milling thick sections with poor access and High rate for thin sections with easier access.

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Production Rates

- ▶ Factors Affecting Production Rates:
 - ▶ Location
 - ▶ Regional weather limitations
 - ▶ Access
 - ▶ Staging
 - ▶ Traffic conditions
 - ▶ Complexity
 - ▶ Soil conditions
 - ▶ Quantities of work
 - ▶ Previous work history
 - ▶ Materials and suppliers
 - ▶ Utilities/Railroads/third parties
 - ▶ Working hours (daylight, noise ord.)

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Contract Times

- ▶ Unreasonably short contract time may:
 - ▶ Increase bid prices
 - ▶ Deter qualified bidders from bidding
 - ▶ Potentially reduce quality of the work
 - ▶ Increase contract overruns in cost and time
 - ▶ Increase possibility of claims
 - ▶ Increase administration, engineering, and inspection costs due to premium time
 - ▶ Increase project management burden and contentiousness
 - ▶ Decrease the chance of successfully completing the project within the contract time requirements

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Contract Times

- ▶ Excessive number of working days and are too long may:
 - ▶ Inconvenience the traveling public with ongoing construction activities and work zone closures and/or extended detour time frames
 - ▶ Allow contractors to stop work or minimize resources for extended periods causing a potential negative public perception of both the Department and the project
 - ▶ Discourage industry innovation to complete projects in a more efficient and timely manner
 - ▶ Increase administration, engineering, and inspection costs due to extended duration
 - ▶ Affect road users by extended travel distance, additional travel time, and potentially a decrease in safety.

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Contract Time Determination

- ▶ Schedule should be developed in a way that:
 - ▶ Allows the contractor sufficient time to complete the project
 - ▶ Is based upon at least one reasonable and feasible solution
 - ▶ Minimizes inconvenience to the traveling public and economic impacts to local communities
 - ▶ Includes considerations to accelerated construction practices when applicable
 - ▶ Utilizes any valuable information that has been developed in the planning of the engineers estimate (if applicable)
 - ▶ Accounts for all known limitations of construction operations
 - ▶ Considers any unusual circumstances that impact the time related aspects of the construction

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▶ Construction Scheduling (michigan.gov)

Construction Scheduling

Home > Business > Construction > Construction Scheduling

Contract Time Determination (CTD)
[MDOT Guide for Construction Contract Time Determination Procedures](#)
[MDOT Guide for Contract Time Determination Procedures](#)
[MDOT Contract Time Determination Tool](#)
[CTD Tool Examples \(MDOT PW Users\)](#)

Progress Schedule
[2020 Spec Book Progress Schedule - For Information Only](#)
[2020 Spec Book Progress Schedule Template](#)
[Construction Manual Guidance](#)

Critical Path Method (CPM) Scheduling
[Special Procedures for Critical Path Method Scheduling](#)

Examples:


- [Interim Baseline Schedule](#)
- [Road Reconstruction Baseline Schedule](#)
- [Reshape/Reconstruction Baseline Schedule](#)
- [CD Baseline Schedule](#)
- [Traffic Signal Modernization Baseline Schedule](#)
- [Baseline Narrative](#)

Contact
[Brad Daavettala](#)
 Scheduling Specialist
 517-281-4295

47

What is a TMP?


- A TMP lays out a set of strategies for managing the work zone impacts of a project.
 - A TMP is a dynamic document that provides strategies, elements, and details for managing WZSM impacts during construction, maintenance, permits, and local agency work zones. The TMP is updated and revised throughout the life of the project.
- “TMPs would streamline the process through which road user impacts due to work zones can be properly analyzed and addressed”



48

What Are the Benefits of a TMP? (FHWA)

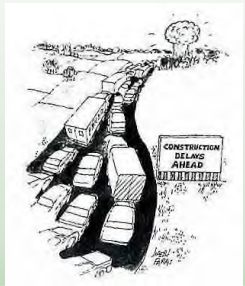

- Address the broader safety and mobility impacts of work zones at the corridor and network levels.
- Promote more efficient and effective construction staging, duration, and costs.
- Improve work zone safety for construction workers and the traveling public.
- Minimize traffic and mobility impacts.
- Improve public awareness.
- Minimize impacts to local communities and businesses.
- Improve intra and interagency coordination.



49

Moving Traffic and Freight Safely & Efficiently



- Improve safety and mobility in work zones by reducing congestion and traffic incidents
- Federal regulation 23 CFR 630, Subpart J, Work Zone Safety and Mobility Rule
- Effective Date: September 1, 2007

50

Parts of a TMP



- Transportation Management Plans (TMP)
 - Temporary Traffic Control Plan (TTCP)
 - Includes: maintaining traffic special provision, typicals, plans, etc.
 - Transportation Operations Plan (TOP)
 - Plans for transit, maintaining non-motorized traffic, traffic signal coordination, proposed mitigation measures, etc.
- Public Information Plan (PIP)
 - How will the public be informed and through which media, media campaigns, newspapers, billboards, etc.

51

MDOT Work Zone Safety & Mobility Policy

- All projects are classified as:
 - Significant
 - Non-Significant
- Significant Project TMP's include: TOP, TTCP and PIP
- Non-Significant Project TMP's include at a minimum, a TTCP





52

2.01 Project Significance

Significant Project: can be defined as one of the following:


- Project predicted to result in greater than 10 minutes of additional work zone delay, over normal conditions for the entire duration of the project.
- Project let as a Design Build
- Project let with an ATC for MOT.



53

10 Minute Rule

- Can we have over 10 Minutes of delay?
 - YES!**
- Can we have night work without barrier wall?
 - Yes, with Region Engineer Approval



54

1.02.03 PRT

- PRT (Peer Review Team) is lead by Region Operations Engineer for consistency.
- PRT members should be from the region the project is located in, but not the TSC.
- Members from outside regions may be considered based on past knowledge of area or work type being completed.
 - Similar project in another region



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55

1.02.03

- PRT Personal
 - (*not required to have everyone but everyone should be invited)
 - Region Engineer
 - TSC Manager
 - WZMU representative
 - Project Manager
 - Construction Engineer
 - Traffic and Safety Engineer
 - Operations Engineer

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PRT Meetings

- These meeting will take place as needed.
- Region Operation Engineer or designated representative should schedule and coordinate PRT meetings.
 - Some regions have standing meetings

MDOT

57

Traffic Analysis – CO3

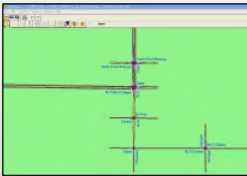
- Freeways most common method at MDOT is CO3.
- Can do Traffic Regulator Operations
- Used on non-freeway in non signalized areas

MDOT

58

Traffic Analysis – Synchro

- Preferred method for signalized areas



- Most areas have had a signal retiming model that can be used for a base model

MDOT

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TMP Submittal - TTCP

- Temporary Traffic Control Plan (TTCP) items reviewed:
 - Discuss the traffic control plan options based on the impact of the work and the type of system.
 - What options are feasible?
 - List all feasible options
 - What options are not?
 - Compare TTCP to similar projects in the past

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60

TTCP – Alternatives

- Fix options
 - Full closure/Expedited Schedule
 - Directional Closure
 - Off-peak Work Hours
 - Detours
 - Weekend Only
 - Split Merge
 - Night Work
 - Rip off the Band Aide



61

TTCP - Alternative Selection

- Factors to Consider
 - Work Days Required
 - Travel Delay
 - Worker & Motorist Safety
 - Complexity
 - Constructability
 - Production Rates
 - Added Costs
 - Quality of Product



62

TTCP Concept – Reasonable and Logical

- Describe the Geometrics of the Work Zone
 - Lane Widths
 - Shoulder Widths
 - Typical Cross Sections
- Constraints for this project
 - Work Requirements
 - Travel Requirements
 - Local Businesses/Schools



63

Environmental Impacts

- Animals
- Clearing Areas
- Material Disposal
- Others ...



64

TTCP – Alternative Selection

- Benefit Cost Analysis for all feasible options, include in the TMP.
- Discussion in the TMP related to **WHY** the final selection was made.
 - Compare MOT scheme with past projects & discuss in TMP.



65

Identify MOT Selection



66

TTCP - Crash Analysis

- Pull and review the most current 3 years of crash data for the project area, including detours and anticipated queue lengths.
- Crashes should be pulled for dates corresponding to construction.
 - Estimated dates and locations are acceptable



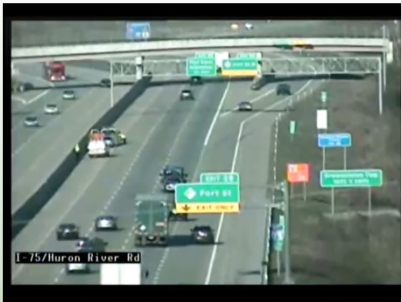
67

TTCP - Crash Analysis

- Recommend reading all UD-10's
- Provide the crash numbers in reviewable format in the TMP
 - One option, provide: "Summary of Crash Statistics Report" from Roadsoft
 - Discuss any trends/patterns in the data.
 - Discuss how these concerns will be handled.
 - Note any expected changes in crash rates/trends during construction.



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69

TTCP – Internal WZ Traffic Control Plan

- Requirements are listed in 104.11.B of the Spec Book.
 - Haul Routes
 - Access Points
 - Maintenance of TTCD
- Make sure you think about where the workers are going to park.



70



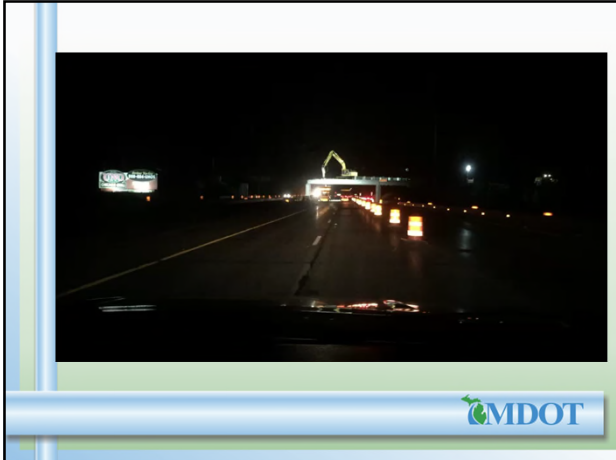
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Mitigation During Construction

- Ingress and egress points/times
- Close Ramps
- Shorten closure length
- Increase lane width
- Extend 'no work' periods
- Stop bar adjustment
- Close crossroads for traffic to detour on ramp
- Signal timing (in and around project)
- Additional traffic control adjustments



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73



74

Transportation Operations Plan (TOP) Items


- Delay mitigation techniques applied appropriately
- Maintain pedestrian, local transit and non-motorized traffic
- Emergency Responder access
- Commercial Vehicle access
- Project combined or bundled
- Corridor Impacts

75

Mitigation Strategies – Moveable Barrier Wall


- Used with high directional traffic
- Cost vs. benefit from User Delay should be looked at per project

76

Reasonable Work Times


- Can the work be completed in the time frame provided
 - Are your hours based all on traffic or the item of work, or a factor of both
 - How did you develop your time frames
- Do we need the restriction
 - Affect on traffic
 - Other options
- Noise / Public Perception



77

4.03.05 Accommodations Table

Activity	Maintaining Traffic Considerations
Survey of Existing/Field Measurements; Restoration & Cleaning; Mowing; Delivery of Materials	These activities have minimal impact to traffic and may include stationary shoulder closures. If shoulders are not available, consider how contractor equipment and materials will safely be delivered to the work site. If minimal impact work is expected to be completed at night because of closure restrictions, include specifying night work for these activities. Avoid working in contract language indicating that "all work shall be performed at night."
Shoulder Corrugations; aggregate shoulders	Production rates for this work is approximately 1 mile per hour. To minimize worker exposure of multiple closure setups, extended lane closure lengths should be considered during design for this operation and included in the contract language. For non-freeway work, "iso-frag" operations should be considered as a best practice. Extended closure lengths for this work will not be a determination of project significance regarding a TMP.



78

Workers in an open trench	Trench work should be planned for daytime operations. In the event of required night work, a lighting plan must be approved per the contract documents, and the duration and occurrence of the work operation should be minimized.
Concrete pavement repairs	Patches should be marked utilizing stationary lane closure with mobile attenuators. Layout at night is not recommended. Utilize a mobile attenuator for saw-cutting operations. Shift traffic away from patches when feasible. Shoulder improvements including widening may be necessary to accommodate shifted traffic. If widening is not feasible, then daytime closure or a full closure should be utilized. For roadways with 3 or more lanes, adjacent lanes should be closed for active work and reopened for exiting. Patches in the vicinity of an entrance ramp may require a full ramp closure or other restrictions on the ramp; traffic shifts into a ramp merge area require either a ramp closure or yieldstop conditions for the ramp.
Structures: Bridge painting, bridge deck work	For work on scaffolding or lifts and/or work with no means of escape, utilize positive protection such as mobile attenuators, mobile barrier wall, or concrete barrier.
Setup, drop off, removal of temporary traffic control.	These activities are permitted to be completed with a mobile shoulder operation and should avoid peak times for a particular roadway. Narrow work areas less than ten feet should utilize a moving closure with attenuator/work canopy using the appropriate typical.



79

Temporary Rumble Strips (Orange) in Advance of a Work Zone	Include off-peak stationary lane closure and/or mobile lane closure times in the maintaining traffic special provision. Mobile attenuators should be included for this work.
Work Convoys, Pothole patching, guardrail, and attenuator maintenance	Repairs and maintenance within a lane of traffic on freeways that require immediate attention must utilize mobile operations with mobile attenuators unless a stationary closure can be set up. Law enforcement assistance should be considered. Preventative repairs should utilize off-peak moving closure depending on work type.
Traffic switches/shifts	Freeway traffic switches may require closing of additional lanes and ramps, these time frames should be detailed in the maintenance of traffic special provision. Consideration should be given to allow extended ramp closure for the traffic switch operations without a detour plan depending on ramp volumes. Projects with temporary markings require detailed staging plans. If a traffic switch is planned at night, MDOT should coordinate law enforcement presence into the contract. See section 6.05.11 and 6.05.12 for more detailed information.



80

Table 4-6

Covering signs	Consider how signs will be covered when not within planned lane closure limits.
Signal work	Avoid wording in contract indicating that "...work is only allowed between 9am - 3pm". Less impactful closures (e.g. closing turn lanes, sidewalk work) should be considered prior to 9am and after 3pm.

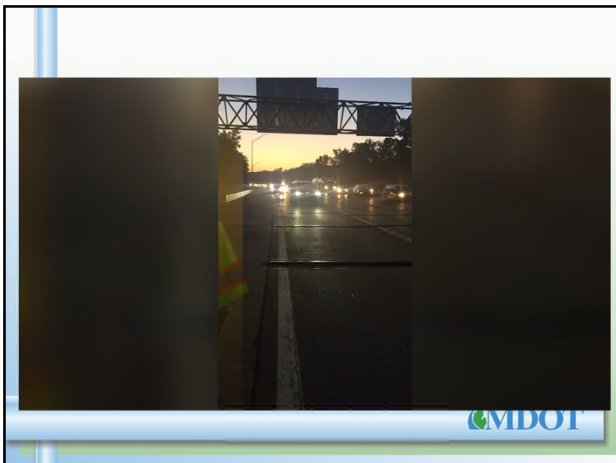


81

- Work Area**
- Can the work be completed safely
 - Shy distance and lane widths
 - What type of TTC is being used
 - Lighting plan for night work
 - Work Access
 - Equipment and materials
 - Workers



82

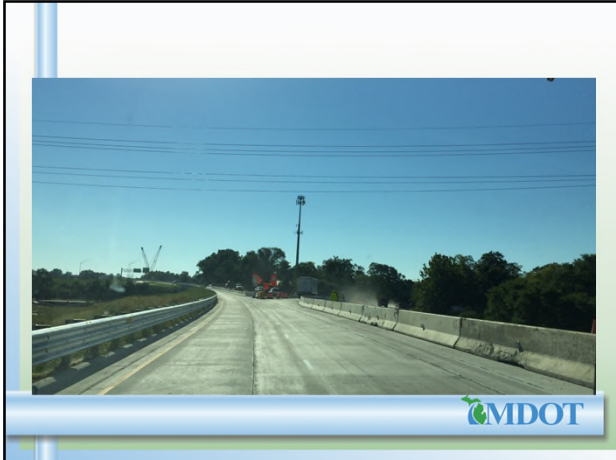


83

- Mitigation Strategies –
Non-Freeway One Way Detours**
- Used with limited road section
 - Good alternate route available
 - Work with community and business to get acceptance of MOT plan



84



85

Emergency Responders

- What level of influence is your project going to have
 - Full closures, detours
 - Document any discussion that affected your selected MOT method
 - Meeting minutes can be referenced

86

Commercial Vehicles

- Permits
 - Narrow Lanes
 - Truck Detours
 - Height Restrictions
- Business Access Points
 - Is delivery of materials affected
 - Any affect on staging
 - Car dealership example – one way detour

87



88



89

Other Work on Corridor

- What other major projects are around
 - Did you check your detour route
 - Local diversion routes also should be checked
- How did you try and gather this information?
 - Local office contact
 - WZBT
- Any reason you need to modify change your work time should be noted

90

Design Build TMP

- 1.02.06 DB TMP
- Review to take place before contract advertisement
- Book 2 section 18
 - This is the section that will be reviewed during the meeting



91

DB TMP – Personal

- Region or TSC in which the project is taking place
 - This is to reduce the time frame for review
 - TSC Project Manager or a designated representative will chair the review
- Suggested team:
 - TSC Manager
 - Work Zone Delivery Engineer, or designated representative(s)
 - MDOT Project Manager or designated representative (Chair)
 - MDOT Deputy Project Manager
 - MDOT Construction Engineer
 - Region or TSC Operation Engineer
 - Region or TSC Traffic and Safety Engineer/Technician



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DB TMP Submittals

- Based on Book 2 section 18
 - Submittals required per section 18.4 Deliverables
 - The review and approval of submittals will serve as the TMP documentation.
 - Plans must be approved by MDOT prior to any restriction in traffic or pedestrian access.
 - Documents can be approved separately, not required to be in one submittal.



93

ATC TMP

- Alternate Technical Concept (ATC)
 - Innovative TMP
 - MDOT must select a base MOT
 - Contractor can propose before bidding
 - What are the constraints of the project?
 - How do communicate this?
 - How do we track this process so everyone is aware?



94

TACT Plan

- Template Alternate Concept Traffic Plan
- Required to be filled out and placed in the RID
 - RID – Reference Information Documents
- TACT Plan – Appendix N
 - Goal: share project related limitations or restrictions
 - Increase the overall quality of ATC submittals



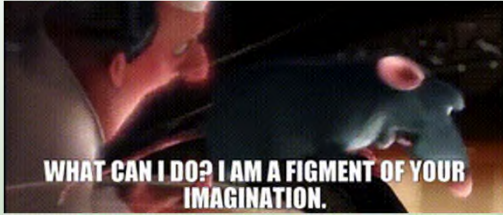
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So what is a TACT Plan




96

TACT Plan




WHAT CAN I DO? I AM A FIGMENT OF YOUR IMAGINATION.



97

TACT Plan = TMP


- If base MOT is used, then the TACT Plan and the base MOT will be considered the official Innovative TMP.
- If an alternative MOT is awarded the approved submittal will be added to the TACT Plan as an addendum and this will be the official innovative TMP.



98

Did the Review Take Place?


- Review of the alternative designs will be considered the innovative TMP review.
 - This process is covered in the Innovative Construction Contracting Guide
- Review Team
 - MDOT Project Manager (Chairperson)
 - Innovative Contracting Staff Engineer
 - TSC Manager
 - Work Zone Delivery Engineer, or their delegate
 - TSC Operation Engineer
 - TSC Traffic and Safety Engineer
 - Region Traffic and Safety Engineer
 - MDOT Construction Engineer
 - FHWA Area Engineer (on RBP projects only)
 - Design Engineer (MDOT or Consultant)



99

DB & ATC TMPs

- Due to the nature of the review and submittals the process does not change therefore all DB and ATC projects are considered significant
 - Time sensitive projects
 - Review was already taking place
 - No need to have a secondary group and why this is now the accepted process.



100

MOT Boilerplate Version 4.0

- Required for use in all projects in July 2024 letting and later
- What's new & different?
 - The boilerplate instructions document was eliminated, all instructions are included within the boilerplate document
 - Removed language that is repeat from the 2020 Spec Book
 - Grammar corrections and clarification of language
 - Language added to reflect PA 164 of 2023

101

101

MOT Boilerplate Version 4.0

- Language added to reflect PA 164 of 2023
- Link in WZSMM – Section 2.02.04.A

Closure Type	Start Time	End Time	M	Tu	W	Th	F	Sa	Su
Shoulder Closures	00:00	24:00	##	##	##	##	##	##	##
Single Lane Closures	00:00	08:00	##	##	##	##	##	##	##
	08:00	18:00	##	##	##	##	0	0	0
Single Lane Closures	18:00	24:00	##	##	##	##	##	##	##
	00:00	07:00	4	4	4	4	4	2	2
Double Lane Closures	07:00	19:00	0	0	0	0	0	2	2
	19:00	24:00	4	4	4	4	4	2	2

☉ = half hour before sunrise as defined by the National Oceanic and Atmospheric Administration (NOAA)
 ▼ = half hour after sunset as defined by NOAA
 # = Closure is allowed, and the frequency is not limited during the project timeframe
 ## = The number of times closures can take place during the project timeframe.

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Work Zone FUSPs

- 812A-02 Mobile Attenuator
 - Modified conditions for use
 - Changed number of days from 3 to 7 for notification of a crash
 - Requirements for inspection of repaired or replaced MA updated.
- 812B-01 Work Zone Signing for Local Agency Projects
 - No changes, only for local agencies
- 812C-01 Portable Water Filled Barrier
 - Use when called for in plans

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812A-02 Mobile Attenuator



105

812A-02 Mobile Attenuator



106

812A-02 Mobile Attenuator



107

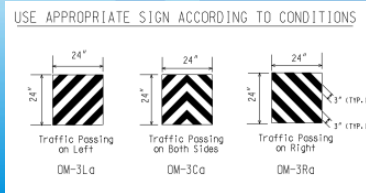
812A-02 Mobile Attenuator

- Use in all projects that require pavement markings to be placed under traffic in a convoy. Also, use in all projects where personnel are exposed to traffic under conditions defined in the special provision for use of shadow or barrier vehicles, aerial operations and mobile/short duration operations. Mobile attenuators are not intended to be used for the removal, installation or maintenance of traffic signals.
- Appropriate number
 - Work Locations

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812A-02 Mobile Attenuator

- The face of the mobile attenuator, visible to approaching traffic must have reflectorized alternating yellow and black stripes, sloping downwards in both directions from the center of the attenuator.
- WZD-150-A Impact Attenuator Object Marker



109

Work Zone FUSPs

- 812D-01 Temporary Portable Rumble Strips
 - Use in all truckline projects with existing speed limits 45mph or higher where traffic regulating will be in place longer than 4 hours. Optional for local and other projects
- 812E-01 Temporary Pedestrian Type II Barricade
 - Use when included, paid for as Each
- 812F-01 Temporary Pedestrian Type II Channelizer
 - Use when included, paid for by Foot.
- 812G-02 Temporary Pedestrian Path
 - Use when included, paid for as Foot.
 - Passing Space included in pay item when needed as of 2-5-21

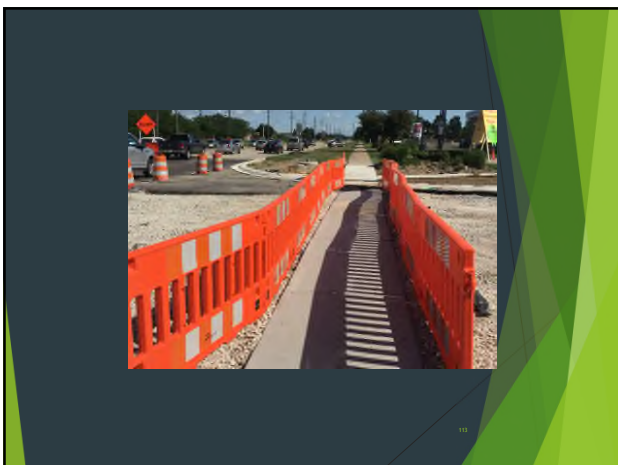
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111



112



113

Work Zone FUSPs

- 812H-01 Temporary Pedestrian Ramp
 - Use with pay item, paid for as Each.
- 812I-02 Rebuilding Michigan Signs
 - Use in all projects with rebuilding Michigan funding, or any projects designated as backfill projects as part of Rebuilding Michigan. Do not use in Local Agency Projects.
- 812J-01 Temporary Speed Radar Trailer
 - Use in all Freeway projects where the existing speed limit is 55 mph or higher and a speed reduction is required during construction for longer than 3 days. Optional for all other projects.

114



115

Work Zone FUSPs

- 812K-01 Temporary Glade Screen Blades
 - Use in all project with pay item. Optional for local Agencies
 - Modifies height to allow 24” or 30”
- Locations
 - Safe Systems Approach

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Work Zone FUSPs

- 20SP-812L-01 20SP-812L-01
 - TEMPORARY PORTABLE TRAFFIC SIGNALS -Use in all projects with the pay items PTS, Temp, Furn or PTS, Temp Oper.
- 20SP-812M-01 20SP-812M-01
 - ROLL-UP SIGNS - Use in all trunkline projects requiring temporary traffic control. This FUSP is optional in local agency projects.

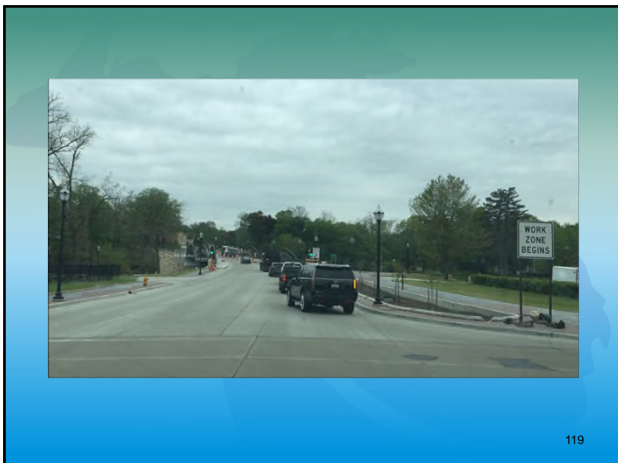
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Temporary Signals

- 30 days – recommended post mounting
- Trailer Mounted vs Pedestal-Mounted
 - Signal Not in use 72 hours flash allowed, longer suggest removing
- Paid for as each



118



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Temporary Signal Count Down Timer

120

120





121



122

AFADs

- Specification
 - Automated Flagger Assistance Device-20CO812(A050).docx
optional use
- Typicals
 - 115 and 116
 - Two options
 - Removal of traffic regulator sign

123

AFADs

STOP
HERE ON
RED

R10-6b

* FOR USE WITH A RED/YELLOW LENS AFAD, ELIMINATE SIGN IF A RED/YELLOW LENS AFAD WITH A R10-6 SIGN MOUNTED TO THE DEVICE IS PROVIDED

WAIT
ON
STOP

R1-7

△ FOR USE WITH A STOP/SLOW AFAD

124



125



126



127

Traffic Regulators

- Temporary Portable Rumble Strips
 - FUSP 812D
 - Use on all trunkline projects with existing speed limits 45mph or higher where traffic regulating will be in place longer than 4 hours. Optional for local agency and all other truckline projects.
 - Paid for each – per strip
 - If moving in field, consider extending spacing

TCD9: RUMBLE STRIPS ARE TO BE PLACED AS SPECIFIED IN THE CONTRACT. IF NOT SPECIFIED IN THE CONTRACT, PLACE RUMBLE STRIPS AS SHOWN, AND IN ACCORDANCE WITH THE RUMBLE STRIP MANUFACTURER'S RECOMMENDATIONS. AN ARRAY OF RUMBLE STRIPS CONTAINS THREE RUMBLE STRIPS, PLACE THE RUMBLE STRIPS IN THE ARRAY AT A CONSISTENT DISTANCE, BETWEEN 10' AND 20' APART.

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129



130

812.03.D.14

- Temporary Rumble Strips (Orange).
 - a. Temporary Rumble Strips (Orange) in Advance of a Stop Condition
 - See picture for layout
 - b. Temporary Rumble Strips (Orange) in Advance of a Work Zone
 - See Spec book for layout

Figure 812-1: Temporary Rumble Strips for Use in Advance of a Stop

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Rumble Strips

- Orange – paid for by length
 - Long Term Location
- Portable – paid for by each
 - Short Term – Non-Freeway

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Temporary Pavement Marking (Resources)

- Work Zone Safety and Mobility Manual
 - 6.01.12 Temporary Pavement Markings
- Spec Book
 - 812.03.D.12 (page 8-89)
 - 922.06 (page 9-215)
- PAVE-904-B Temporary longitudinal line type and placement
- Phone a friend
 - 517-388-5228
 - 1-800-you can call Mr. Bergmann and ask

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Pavement Markings What to think about...

- Project length
 - (and duration)
- Number of lanes and stage changes
- Traffic Shifts
- Time between stages
- Don't forget you have to remove existing markings
 - Possibly temporary Remove
- Final Striping
- WZSMM – 6.01.12

135

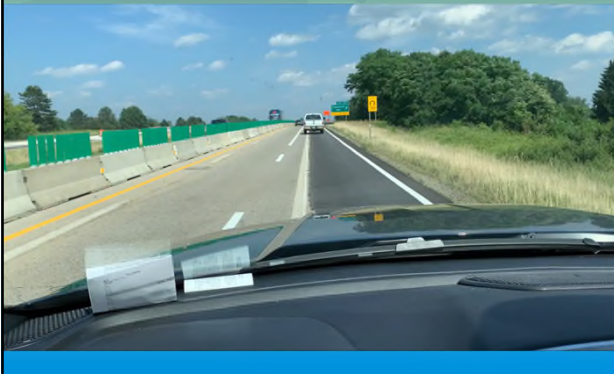
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WZSMM 6.01.12.B

- 6-inch solid edge and lane lines must be placed 300 feet prior to the traffic shift, through the shift, and 300 feet after the traffic shift. This is required for both entry and exit shifts.
- The leading and trailing markings described above are used to provide motorists with additional guidance and reassure the driver they are in the correct location, as the lane lines will have just been modified.
- This is being missed in both design and construction on a number of projects.

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6.01.12.B – Good Example



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Estimation on Quantities

- These are paid for when delivered to the jobsite
- Furn – Doesn't get paid until items are used
- Temp Pavement Markings

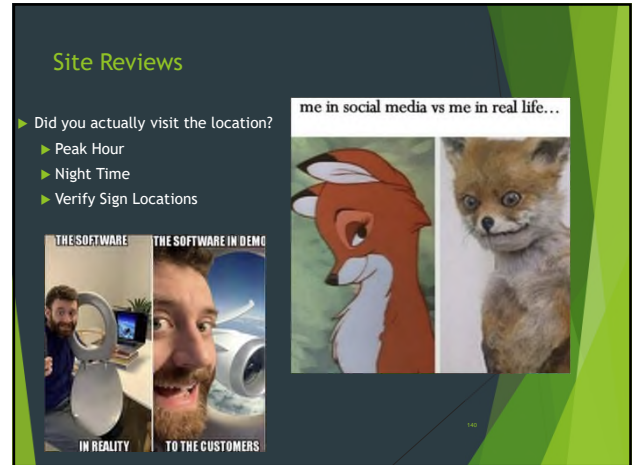


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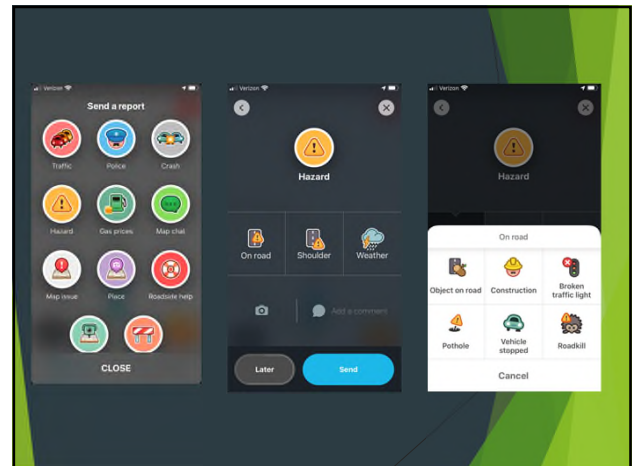
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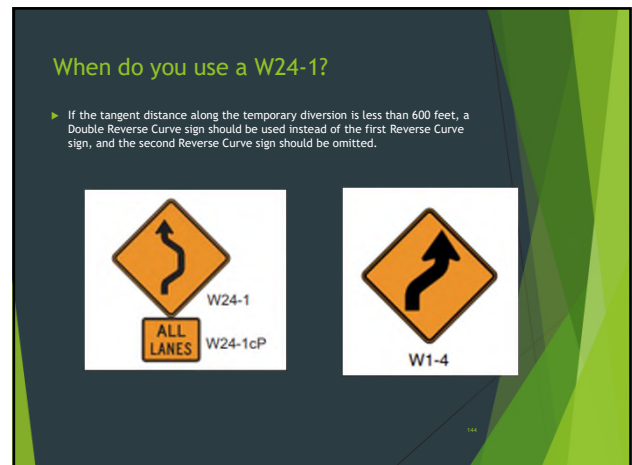
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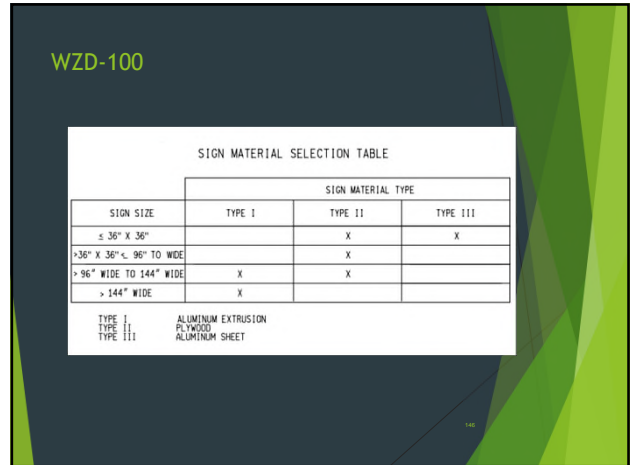
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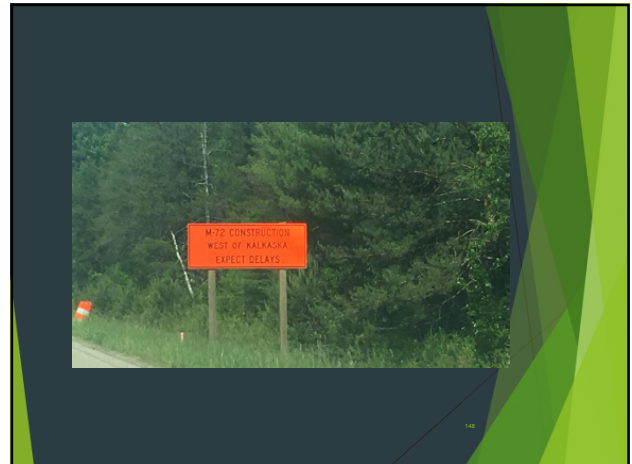
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147



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Sign Sizes - Appendix K Standard Highway Signs

- This is being updated
- MUTCD - min size is 24 x 24
- * is for when using within a guide sign
- 30 x 24 for 3 digits

INTERSTATE 75

M1-5
INDICATE ROUTE NUMBER

FOR FULL DIMENSIONS OF THE SIGNS REFER TO TABLES OF THE MUTCD

Sign	Sign Designation	Section	Conventional Road	Minimum	Oversized
Interstate Route Sign (1 or 2 digits)	M1-1	20-11	24 x 24	24 x 24	30 x 36
Interstate Route Sign (3 digits)	M1-1*	20-11	30 x 24	30 x 24	45 x 36
Off-Interstate Route Sign (1 or 2 digits)	M1-2-3	20-11	24 x 24	24 x 24	30 x 36
Off-Interstate Route Sign (3 digits)	M1-2-3*	20-11	30 x 24	30 x 24	45 x 36
U.S. Route Sign (1 or 2 digits)	M1-4	20-11	24 x 24	24 x 24	30 x 36
U.S. Route Sign (3 digits)	M1-4*	20-11	30 x 24	30 x 24	45 x 36
State Route Sign (1 or 2 digits)	M1-5	20-11	24 x 24	24 x 24	30 x 36
State Route Sign (3 digits)	M1-5*	20-11	30 x 24	30 x 24	45 x 36
County Route Sign (1 or 2 digits)	M1-6	20-11	24 x 24	24 x 24	30 x 36
County Route Sign (3 digits)	M1-6*	20-11	24 x 24	18 x 18	30 x 36
Forest Route (1, 2, or 3 digits)	M1-7	20-11	24 x 24	18 x 18	30 x 36
Junction	M2-1	20-13	21 x 15	21 x 15	30 x 21
Construction Junction (2 route signs)	M2-2	20-14	45 x 48*		

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History of the MUTCD

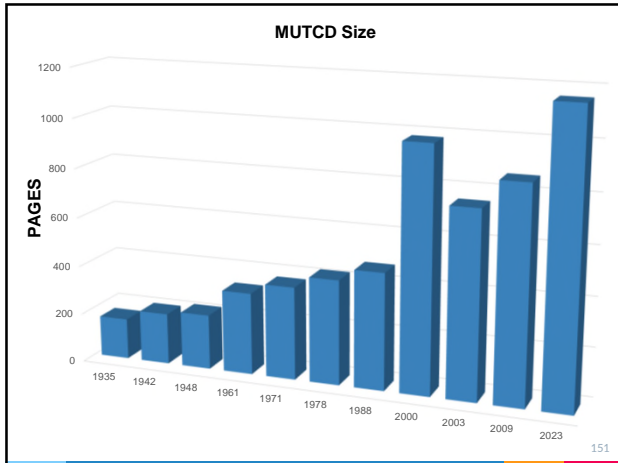
Manual on Uniform Traffic Control Devices for Streets and Highways Fifth Edition December 2015

▶ USDOT/FHWA Document since 1971

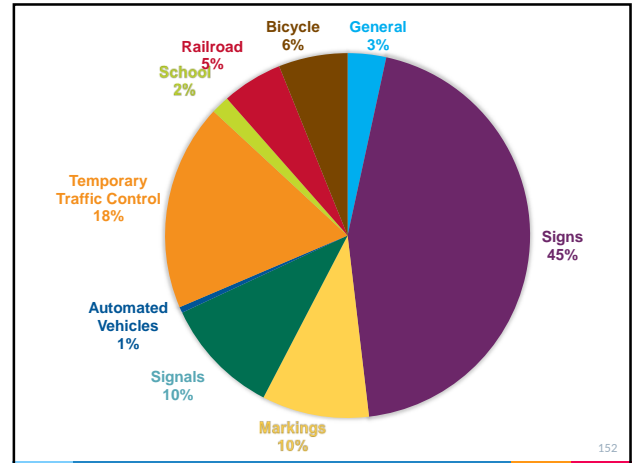
1935 Future

Source: H. Gene Hawkins, Jr., Phd. P.E.

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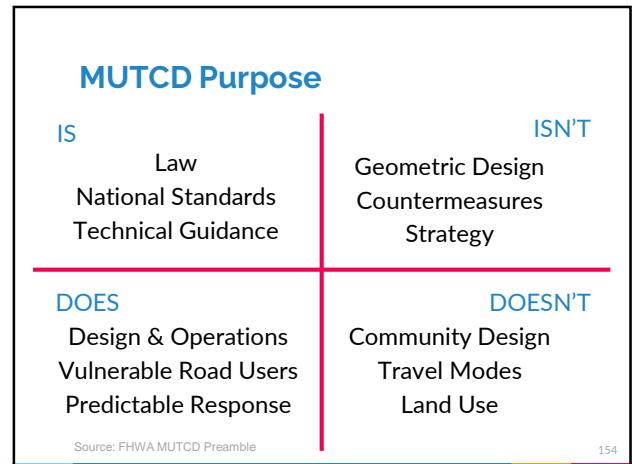
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MUTCD Purpose And Use

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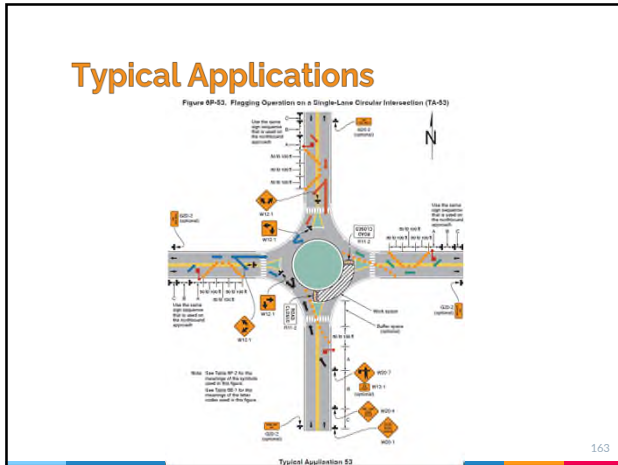
State Adoption

** Use 2009 until otherwise directed

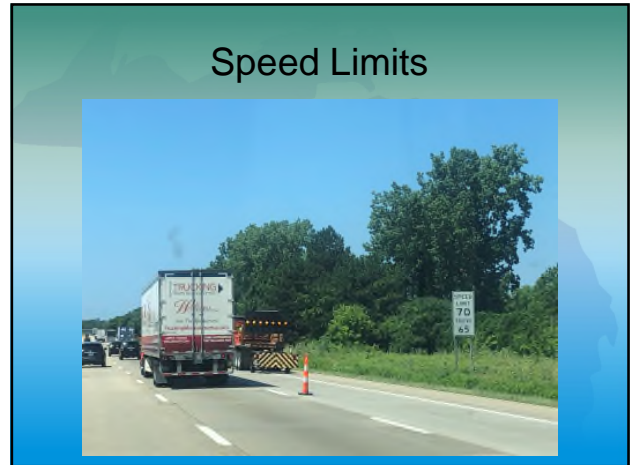
155

- ## State Adoption of MUTCD
- ▶ States have until January 18, 2026 to:
 - Adopt national MUTCD
 - Adopt national MUTCD and state supplement
 - Adopt state MUTCD
 - ▶ State MUTCD/supplement shall be in substantial conformance
 - All **shalls** and *shoulds* must be in state document
 - No document can negate a **shall** or *should*
- Source: H. Gene Hawkins, Jr., Phd. P.E.

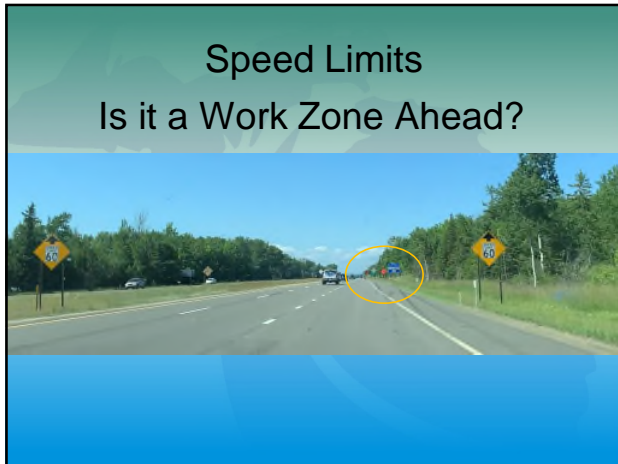
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Michigan Vehicle Code

- The state transportation department, a county road commission, or a local authority shall post speed limit signs in each work zone described in section 79d(a) that indicate the speed limit in that work zone and shall identify that work zone with any other traffic control devices necessary to conform to the Michigan manual on uniform traffic control devices.
- For a work zone that has a speed limit in effect only where workers are present, the state transportation department, a county road commission, or a local authority is authorized to include 1 or more flashing lights and an illuminated changeable digital message displaying the speed limit on the speed limit sign required under this subsection.

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Where Workers Present

- (a) "Illuminated changeable digital message" means an electronic message that displays the speed limit in a numerical format.
- (b) "Present" means located in proximity to a roadway that is not protected by a guardrail or barrier.
- (c) "Speed limit sign" includes, but is not limited to, a sign that displays illuminated changeable digital messages

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Do you know the Speed Limit?



169

Do you know the Speed Limit?



170

Do you know the Speed Limit?



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6.02 Work Zone Speed Limits

- If the work is located within 2 feet of the traveled lane, a temporary TCO is required for speed reductions greater than 10 mph and reductions lowering the speed limit below 30 MPH, excluding the posting of 45 mph Where Workers Present (WWP).
- Appendix E – Full Details
- Do you have to drop the speed in a work zone?
 - Not a requirement

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Do you know the Speed Limit?



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Sign Covers

- For permanent signs, other than overhead signs and signs larger than 60 square feet, cover the entire front of the sign panel.
- For temporary signs on fixed supports, cover the entire sign legend.

174

Do you know the Speed Limit?



175

Winter Maintenance Do you have a plan?



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PCMS Messaging

- Do you have a plan?
- Appendix F
- PCMS boards should clearly identify what is happening within the work zone area. It should provide useful, actionable information to the motorist. Vague or generic messaging should not be used.

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PCMS Plan

- Is there DMS that can be used?
- Did you check with Construction
 - Verify the amount
 - Plan locations
 - P stands for Portable
 - Boards can move once work has started
- Is the Location providing motorist with enough time to divert?

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Connected Arrow Boards

- SP with new pay item being drafted
- Some states already require for all smart arrow boards
 - Can help with MI Drive posting
 - Contact the Work Zone Unit if interested

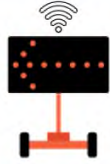
181


CONNECTED ARROW BOARDS

REAL-TIME ACTIVE LANE CLOSURE INFORMATION
ENHANCED DRIVER AWARENESS = SAFER WORK ZONES

BENEFITS

- Know **WHERE** lane closures are in **real time**.
- Log **WHEN** lane closures happened.
- Alert drivers of **WHICH** way to merge.
- Reduce crashes before **closure/taper**.
- Add to **ANY** existing equipment (in less than an hour).
- Nothing new to learn for field personnel.
- Real-time data using **WZDx** protocols for **ACTIVE** lane closures.






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GET ON BOARD & GET CONNECTED


Get on board with this proven safety tactic that already has **more than 3,000** Connected Arrow Boards on the road!

Iowa DOT has used Connected Arrow Boards on interstate and state highway projects for several years ... with no issues and at an extra cost of only about \$1.85/day (rental cost/unit).

Don't let anything stop you from making your roads **SAFER** today!



Inform Motorists of ALL ACTIVE Lane Closures

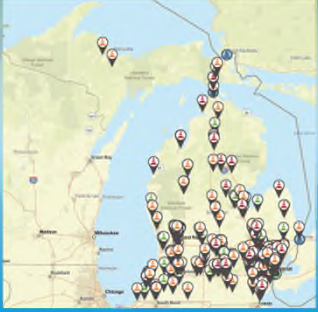


Contact ATSSA's Innovation & Technical Services Team for sample specs and details: Media.Medra@atssa.com

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MI Drive

- Should be correct
 - Do you tell friends and family to use this?
- One MDOT



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High Priority – Innovative Technology Deployment 2021 & 2022 Grant Projects

CONNECTED AUTOMATED VEHICLES & ELECTRIFICATION



SAFEZONE 2021 & PAWZ 2022



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Bench Testing



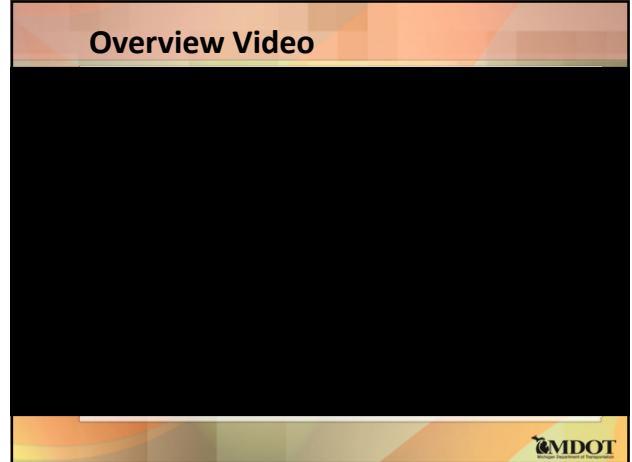




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System Concepts

Mobile trailers
with cameras with on-board intelligent video analytics for detection of vehicles, workers, and traffic conditions

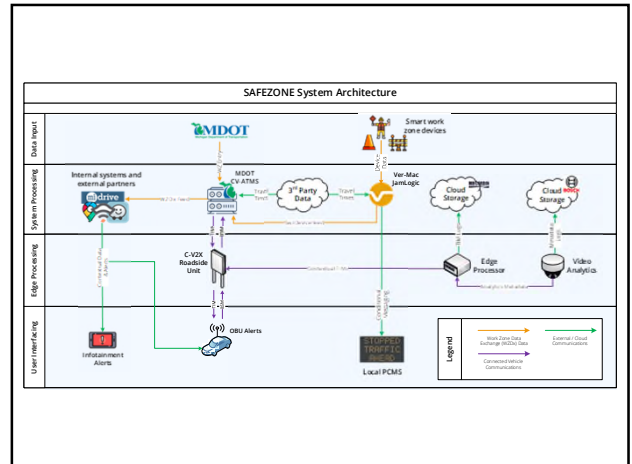
Smart work zone equipment, including traffic sensors and real-time work condition messaging

Real-time in-vehicle alerts through on-board devices and third-party users, such as Waze or Google Maps

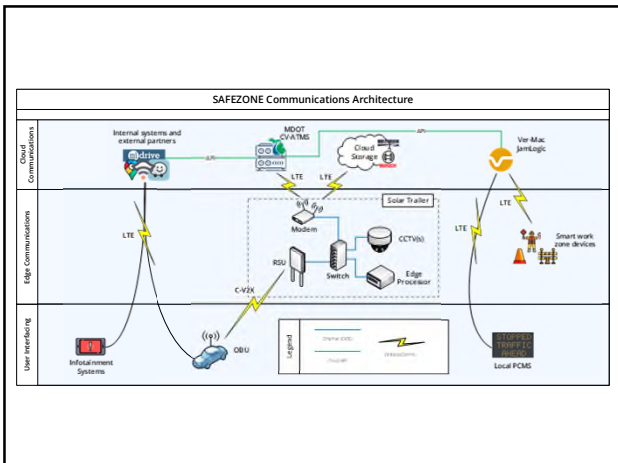
Communications systems to support collection and dissemination of data.

DATA WILL BE INTEGRATED INTO MDOT'S BACK-OFFICE SYSTEM

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SAFEZONE vs PAWZ

SAFEZONE
Safety Alerts For (Work) Zones

Figure 6 Safety Alerts For work ZONE (SAFEZONE) system overview

- 1) Detect Inadequate Traffic Volume & Speeds
- 2) Detect Construction activities
- 3) Communications
- 4) Secure Backend Cloud Services
- 5) Real-time In-vehicle and work zone alerts






2021 HP-ITD grant
Static work zones


PAWZ
Partnering Automated Work Zones

2022 HP-ITD grant
Mobile work zones

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PAWZ System Overview

1 Connected Traffic Control Objects	2 Vendor Backend Data Aggregation	3 Agency Backend Data Publication	4 CMV Data Distribution Mediums	5 Near Real-Time In-Vehicle & Work Zone Alerts
				
<ul style="list-style-type: none"> Work zone vehicles Crane Arrow boards Worker vests Light 	<ul style="list-style-type: none"> VeriMac and iCase vehicles Collecting the traffic control object data Aggregating it into a single WZDev4 compatible VeriDeviceFeed 	<ul style="list-style-type: none"> CV ATMS and data collection Combining data with manually entered work zone information from MDOT staff Publishing both the VeriDeviceFeed and WZDev4Feed to CMV subscribers 	<ul style="list-style-type: none"> Waze, Google, CMV, Fleet dispatch systems, DeviceVise Agency feed subscribers 	<ul style="list-style-type: none"> CMV transponders On board CV modules Smartphone applications Infotainment systems CMV routing & dispatch systems



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Demonstrating V2X Communication

SMART Devices Feed on I-96



SMART Work Zone Devices


- Arrow Boards: location & arrow pattern display
- Camera Trailers: location & URL for latest still image
- Portable Message Signs: location & current message
- Flashing Beacons: location, application & message
- Hybrid Signs: static text with dynamic LED display
- Location Markers: critical GPS location markers
- Traffic Sensors: location & traffic data over intervals






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Real-time Work Zone Information In GPS



CONNECTED WORK ZONE NOTIFICATION SYSTEM

Near real-time work zone notifications to encourage safer and efficient decision making



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Protecting Road Workers




We can now indicate a worker's presence in connected vehicles and on navigation systems




Pictured: VeriMac Connected Vest



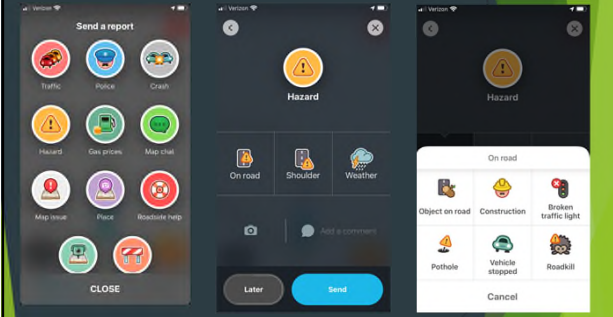
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Using Waze to Improve Safety





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Work Zone Innovations

- What are you doing?
- Do you have anything to share?
- Do you have any problems?



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Pilot Project – Speed Limits



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202

Pilot: MDOT – Fall 2023

- Goal: Reducing speed close to the workers
- I-96, 70 MPH road, reduced to 60 and 45 MPH
- 5 miles one lane closure, only delineators
- Multiple weeks
- Multiple crews



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Digital Speed Limit

- Goal: Increase speed compliancy
- 6 DSL installed within the work zone. Spaced every 1/2 mile



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Expected scenarios and challenges

- Who will change the limits
- Lowest latency
- How to record the change for speed enforcement

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DSL automation with Worker Presence

- Worker Presence devices given to crews
 - One model with ON/OFF switch
 - Another model always ON
- GPS location updated every 1 minute
- DSL changed based on workers position

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Workers typical day

2023-04-10 09:58:46

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Conclusion

- Technology is ready
- Some limitations
 - Single bound
 - Human forgets sometime
- Interesting elements to figure out
 - In-car alert fatigue
 - DSL location and their radius of influence
 - Filtering out in-transit presence.

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Research and Pooled Funds

- Smart Work Zone Deployment Initiative

Mar. 2024	Improving the Effectiveness of Speed Feedback Trailers in Freeway Work Zones
SEP. 2023	Evaluation of Messaging Techniques to Increase Vehicle Spacing at Work Zones
OCT. 2023	Work Zone Speed Limits and Motorist Compliance
APR. 2022	Work Zone Activity Data Logging - Phase II
JAN. 2022	Effective Signing Strategies and Signal Displays for Work Zone On-ramp Assistance Devices (OADs)
DEC. 2021	Investigation of Autonomous/Connected Vehicles in Work Zones
OCT. 2021	Field Testing of Non-Motorized Road User Accommodations for Work Zones
JUN. 2021	Using Smart Work Zone Trailer Data to Evaluate and Predict Lane Closure Impacts with a Consideration of Work Intensity
MAR. 2021	Guidance on Active Work Zone Data Archival
JUL. 2020	Assessing Driver Behavior at Back of Queue Implications for Queue Warning System in Work Zones
JUL. 2020	Development of Adjustment Factors for HCM Sixth Edition Freeway Work Zone Capacity Methodology
JAN. 2020	Development of a Low-Cost Work Zone Queue Warning System
JUN. 2019	Smart Work Zone Activity App (SWZAPP)
APR. 2018	Extension of Safety Assessment Tool for Construction Work Zone Phasing Plans
NOV. 2018	MMSD 2018 Evaluation of a Non-Preparatory Type III Barricade
JUN. 2018	Analytical Methods for Work Zone Travel Time Reliability
APR. 2018	Change Work Zone Placement Marking Method Field Test
JAN. 2018	Understanding the Impacts of Work Zone Activities on Traffic Flow Characteristics
OCT. 2017	Traffic Impact Assessment Tool for Moving Work Zone Operations
JUL. 2017	Developing a Data-Driven Traffic Impact Assessment Tool for Work Zones
NOV. 2017	Testing and Evaluation of MASH TL-3 Transition Between Guardrail and Portable Concrete Barriers

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Research and Pooled Funds

- Work Zone Analytics
 - July 2023
 - FHWA, IL, MI, PADOT, TX, UT, WI
- Using hard braking data from work zones

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Research and Pooled Funds

- MDOT Projects
 - C03
 - More coming soon
 - Do you have any ideas??

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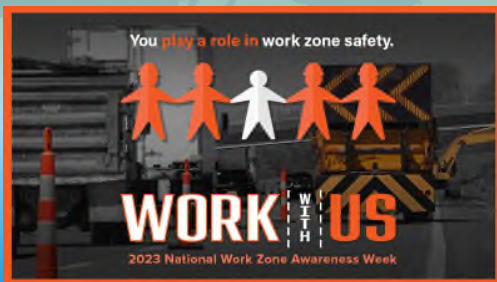


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Questions...?



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