

# **Work Zone Transportation Management Plan Development Course**

SESSION 2 –  
TMP Structure and  
Guidance

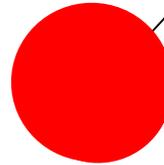
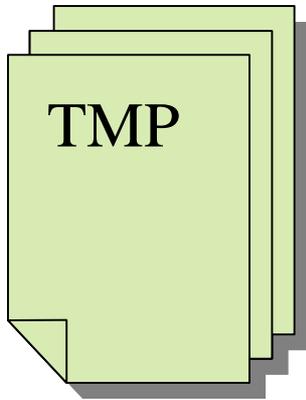


# Transportation Management Plan: Goals and Preparation Guidance

- Promote Safety
  - Workers
  - Public
- Minimize Impact of Work Zones on Transportation System
- Coordinate Efforts
- Improve Policy and Process



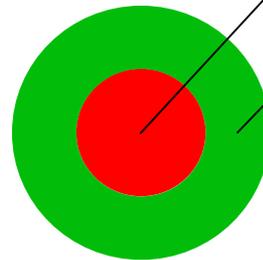
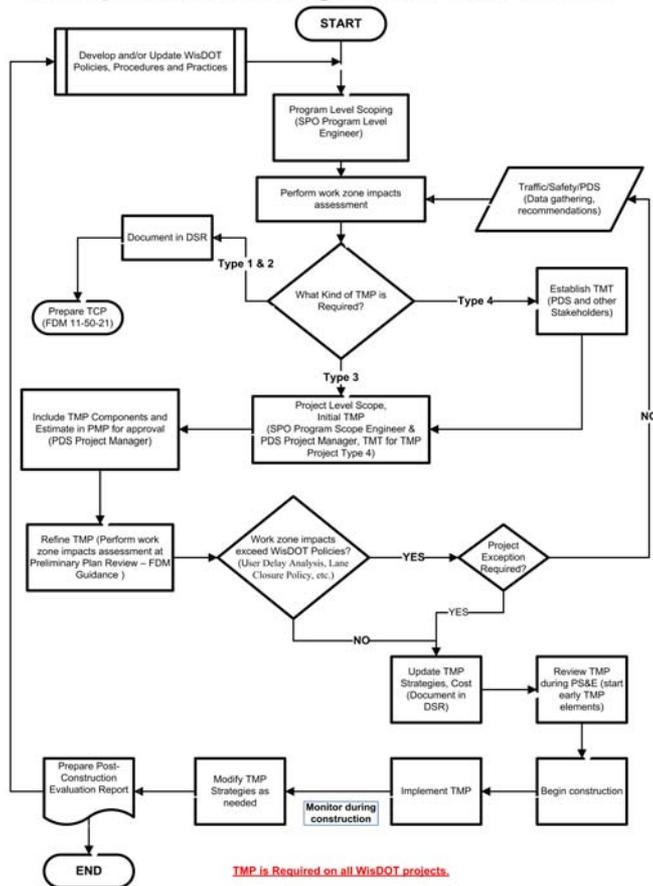
# Transportation Management Plan: Living TMP Document



TMP Document

# Transportation Management Plan: Process

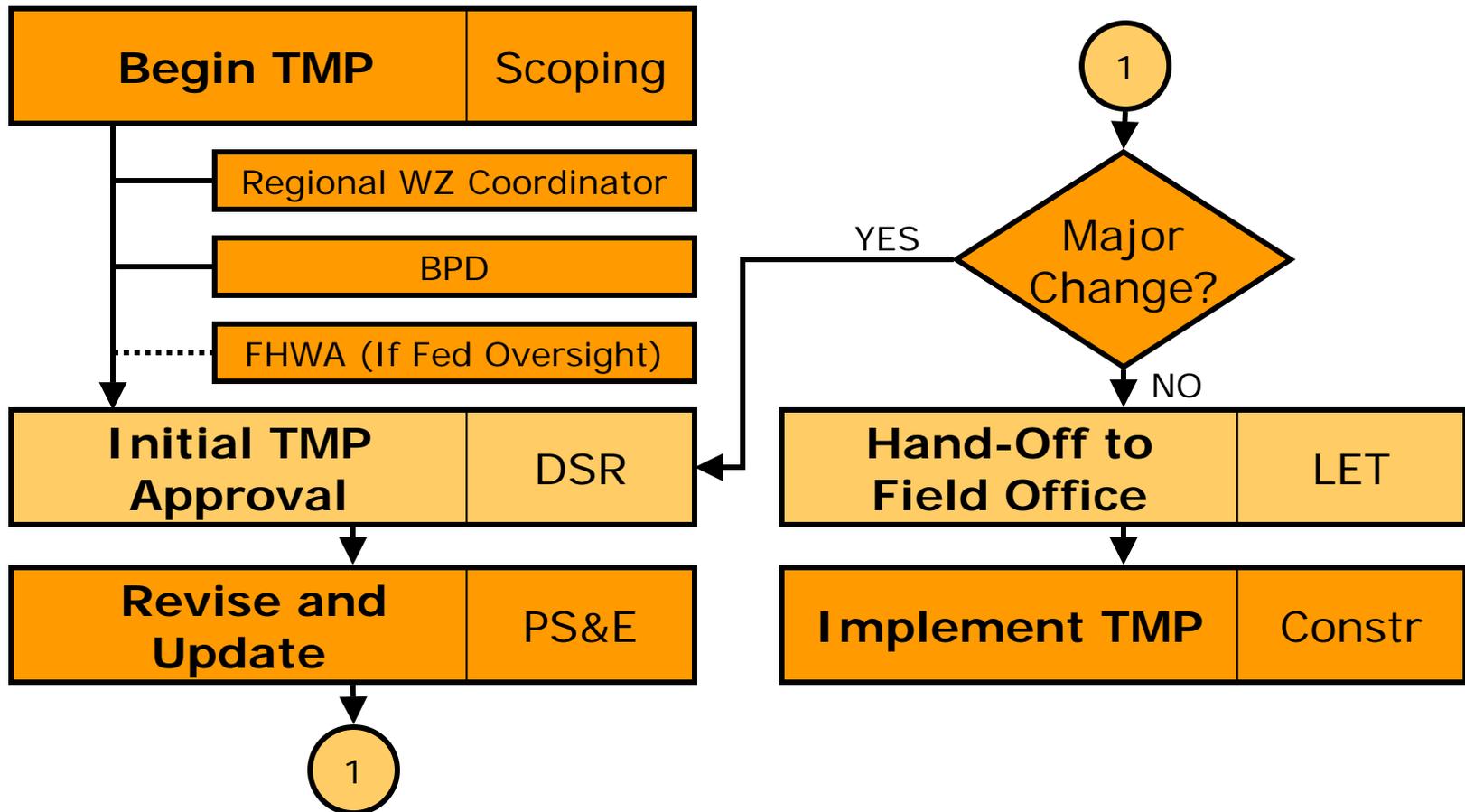
Transportation Management Plan Process



TMP Document

Process

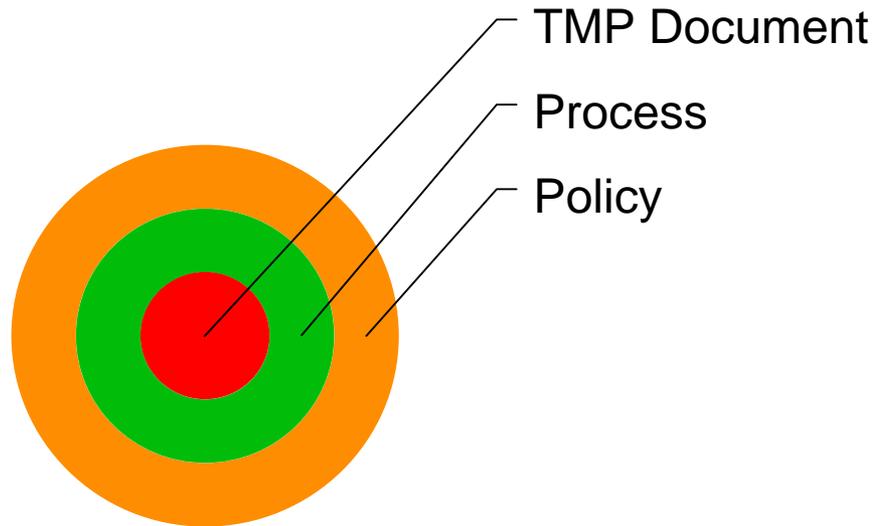
# TMP Administrative Process



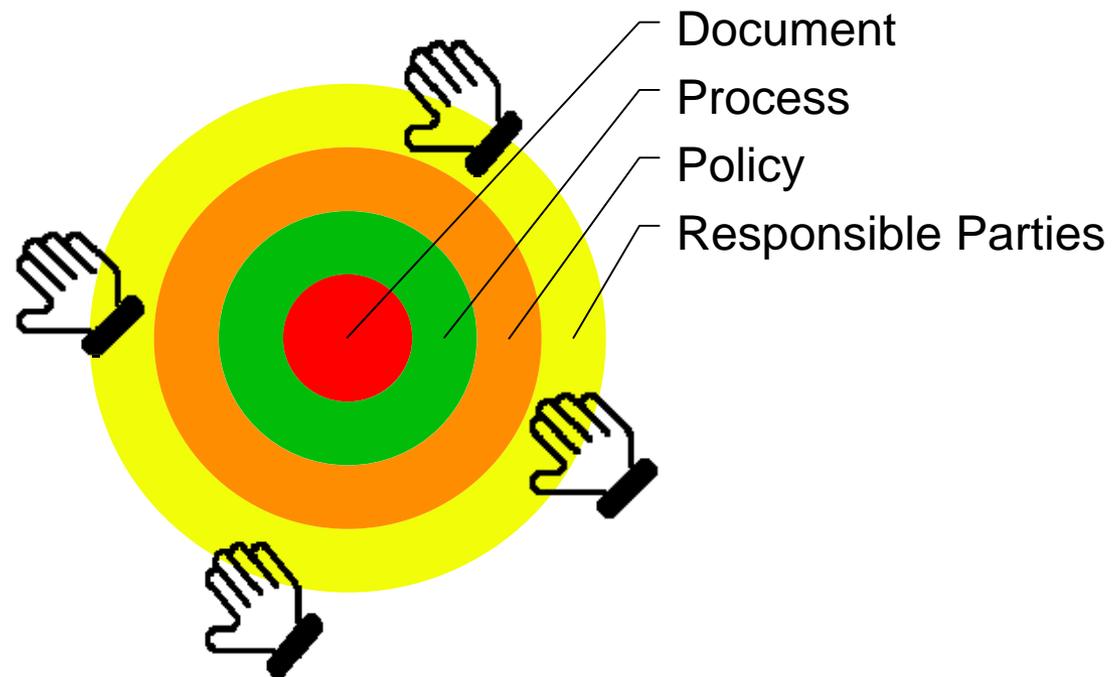
# What is “Federal Oversight”

- Defined by FHWA Oversight Agreement
- Large High-Dollar Projects (Usually)
- Interstate System and NHS Routes
- Most Federally-funded projects are *not* “Federal Oversight” projects.

# Transportation Management Plan: Policy



# Transportation Management Plan: Responsible Parties



# Transportation Management Plan: Guidelines

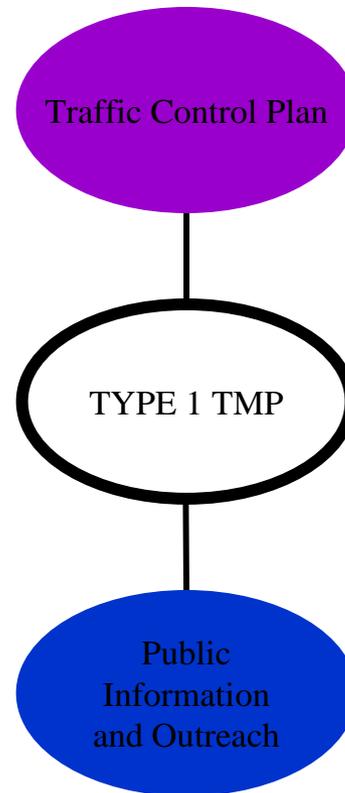
Wisconsin Department of Transportation

GUIDELINES FOR  
DEVELOPING

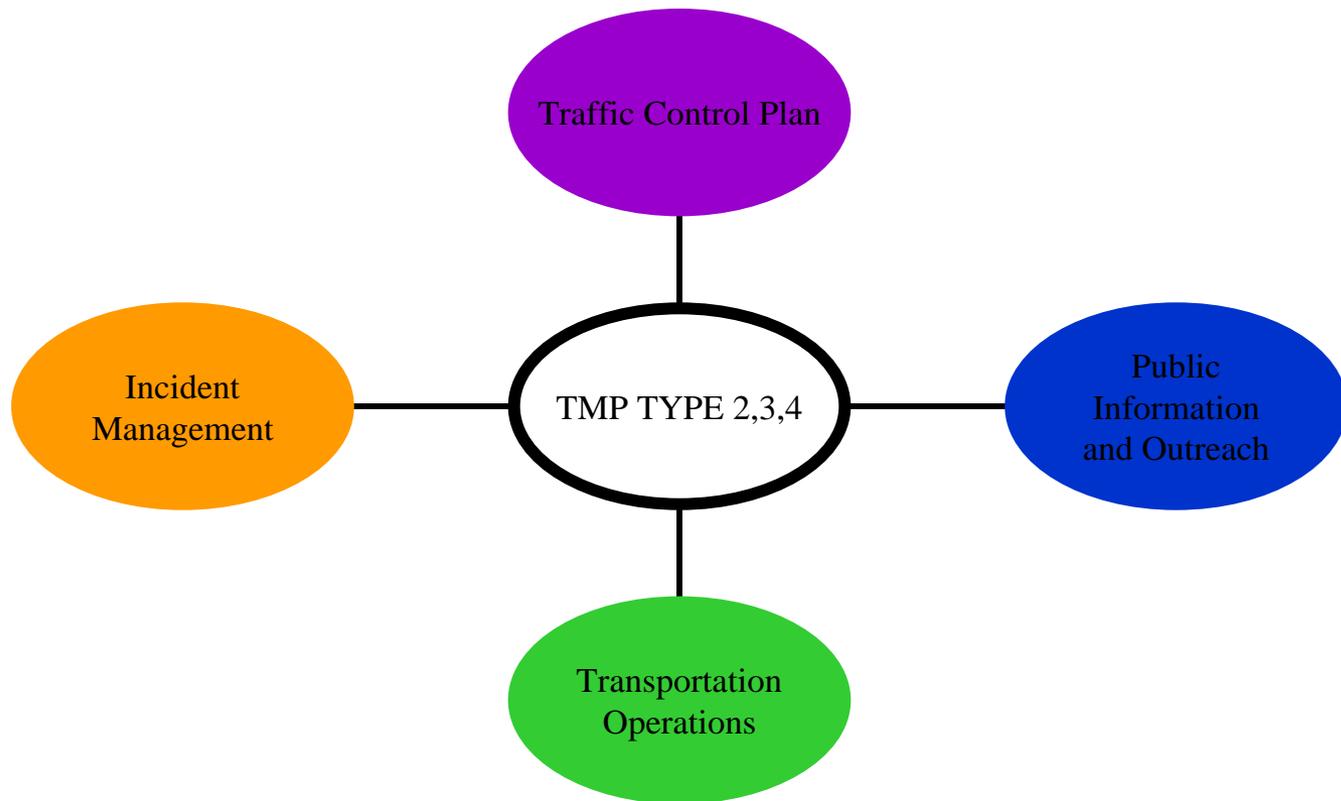


Work Zone  
Transportation Management Plans

# Transportation Management Plan: Typical TMP Types



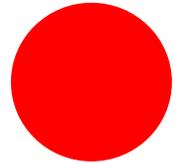
# Transportation Management Plan: Typical TMP Types



# Transportation Management Plan: Guidelines

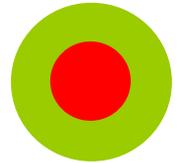


- Document Content
  - Traffic Control Plan
  - Public Information and Outreach
  - Incident Management
  - Transportation Operations



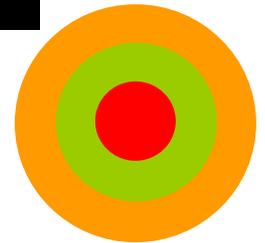
# Transportation Management Plan: Guidelines

- Process
  - Work Zone Impacts Assessment
  - Determine Type of TMP
  - Prepare Initial TMP
  - Update, Implement, Monitor
  - Evaluate After Project



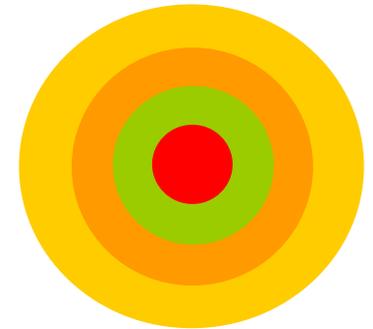
# Transportation Management Plan: Guidelines

- Policy
  - FDM 11-50-1
    - Crash Reduction
    - Conducive Environment for Safety and Mobility
    - Limit delays to 15 minutes
    - Provide Traveler Information
    - Define Stakeholder Responsibilities
    - Develop Work Zone Training
    - Evaluate and Improve Work Zone Safety and Mobility Performance



# Transportation Management Plan: Guidelines

- Responsible Parties, Stakeholders (FDM 11-50-1)
  - FHWA
  - Bureau of Highway Operations
  - Bureau of Project Development
  - Regional WisDOT Offices
  - Project Development Chief
  - Operations Chief
  - Regional Planners
  - Regional Traffic Engineers
  - Project Managers
  - Project Designer
  - Contractor
  - Law Enforcement
  - Other Stakeholders



# Transportation Management Plan: Guidelines

So far... We know:

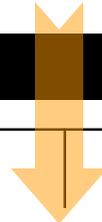
- What we are trying to create: TMP
- How : Through A Process
- According to what: Policy
- Who : We
- When?

# Transportation Management Plan



**TMP**

**TMP TMP**



<b>Life Cycles</b>	LC 00 Unprogrammed	LC 10 Authorized	LC 11 Program Level Scoping	LC 12 PMP Approved	LC 15 DSR	LC 20 PS&E	LC 40 Award	
<b>PMP Development Phases</b>	Prior to project existing in PMP	Prior to project existing in PMP	Program Level Scoping	PMP Approval	Preliminary Plan Review	DSR	PS&E	Design Project Closeout
<b>Project Initiation Process</b>	Needs Identification Identify candidate projects	Program Reviews Concept Definition Report Request authorization	Program Level Scoping	PMP Approval				

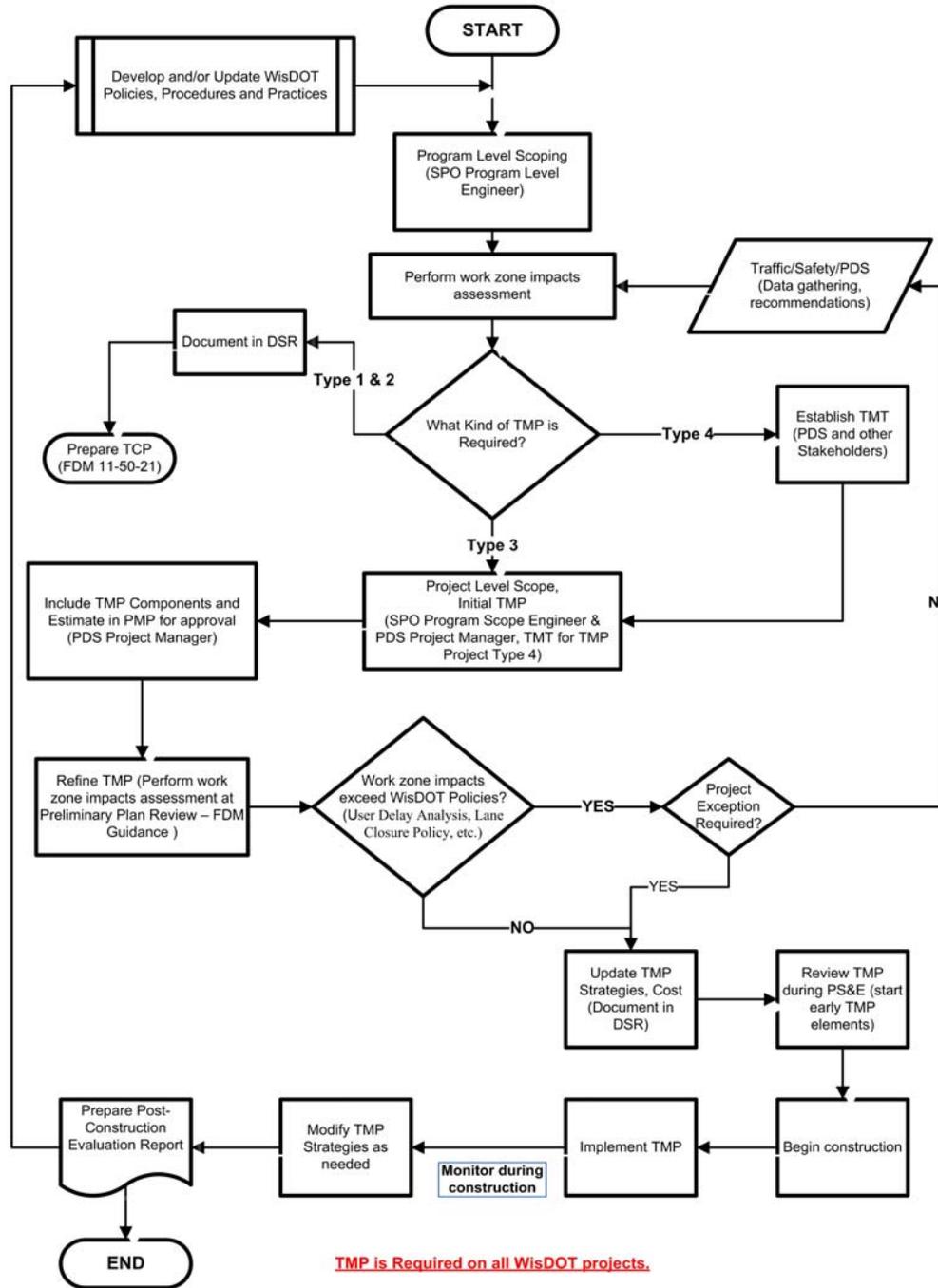
# Project Coordination



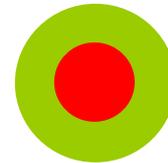
- Projects along a corridor.
- Detours to other STH.
- Detours to county and local roads.



# Transportation Management Plan Process



**TMP is Required on all WisDOT projects.**



# Transportation Management Plan: Guidelines

- Outline of Guidelines
  - 1- Introduction
  - 2- Purpose
  - 3- Scope
  - 4- Project Development Process
  - 5- TMP Development Process
  - 6- Components of a TMP
  - 7- TMP Application
  - 8- TMP Type Description
  - 9- Work Zone Impacts
  - 10- Accommodation of Pedestrian and Bicycle Traffic
  - 11- Traffic Control Plan
  - 12- Public Information and Outreach
  - 13- Transportation Operations Plan
  - 14- Incident Management Plan

# Transportation Management Plan: Guidelines

## Guidance Material

- FDM 11-50-1
  - Goals and Objectives of WZ Policy
  - Organizational Responsibilities
  - Individual Responsibilities

	<i>State of Wisconsin</i> <i>Department of Transportation</i>
Facilities Development Manual	
ORIGINATOR Director, Bureau of Highway Operations	11-50-1
CHAPTER 11	Work Zone Traffic Control
SECTION 50	Traffic Control
SUBJECT 1	Work zone policy statement

# Transportation Management Plan: Guidelines

## Guidance Material

- FDM 11-50-23 WZ Freeway & Expressway Lane Closure and Delay Guidelines
  - Guide to anticipating congestion
  - Highway Capacity Analysis
  - Example

# Transportation Management Plan: Guidelines

## Guidance Material

- FDM 11-50-21 WZ Traffic Control Plan Process
  - Process and responsibilities

ORIGINATOR Director, Bureau of Highway Development		PROCEDURE 11-50-21
CHAPTER	11	Design
SECTION	50	Traffic Control
SUBJECT	21	Work Zone Traffic Control Plan Process

# Transportation Management Plan: Guidelines

## Guidance Material

- FDM 11-50-20 Safety in Work Zones
  - Requirements
  - Use of Standard Drawings
  - Work zone on divided highways
  - Crossovers
  - Speed Limits
  - TCP Design

ORIGINATOR Director, Bureau of Highway Development	PROCEDURE 11-50-20
CHAPTER 11	Design
SECTION 50	Traffic Control
SUBJECT 20	Safety in Work Zones

# Transportation Management Plan: Guidelines

## Guidance Material

- FDM 11-50-25 & 11-50-30 Safety in Work Zones
  - Compliments 11-50-20
  - Detours
  - Involvement of law enforcement

ORIGINATOR Director, Bureau of Highway Development		PROCEDURE 11-50-30
CHAPTER 11	Design	
SECTION 50	Traffic Control	
SUBJECT 30	Law Enforcement in Work Zones	

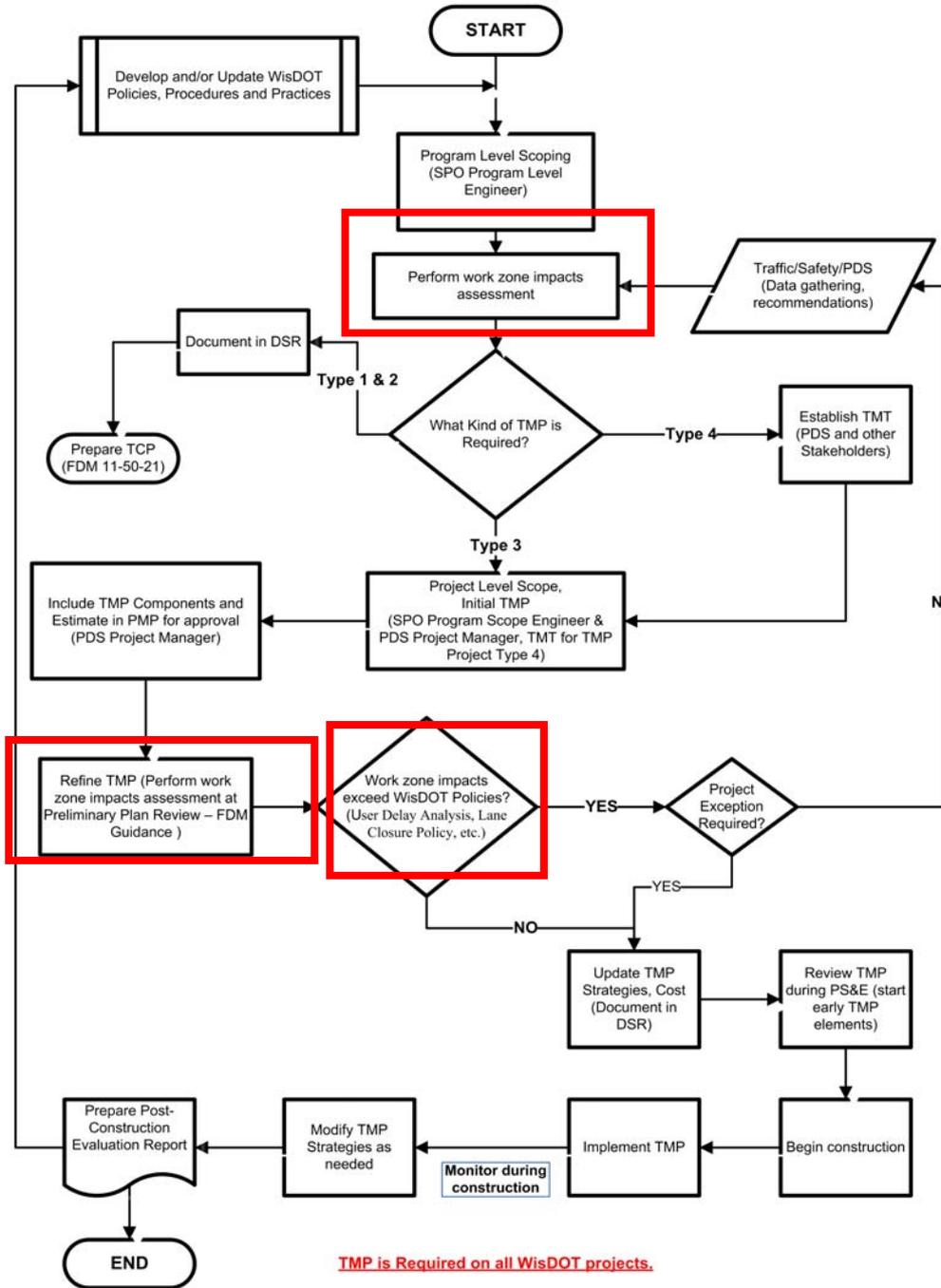
ORIGINATOR Director, Bureau of Highway Development		PROCEDURE 11-50-25
CHAPTER 11	Design	
SECTION 50	Traffic Control	
SUBJECT 25	Detours/Construction Under Traffic	

# **Work Zone Transportation Management Plan Development Course**

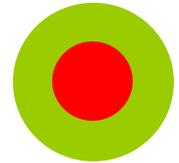
Work Zone Impact  
Analysis



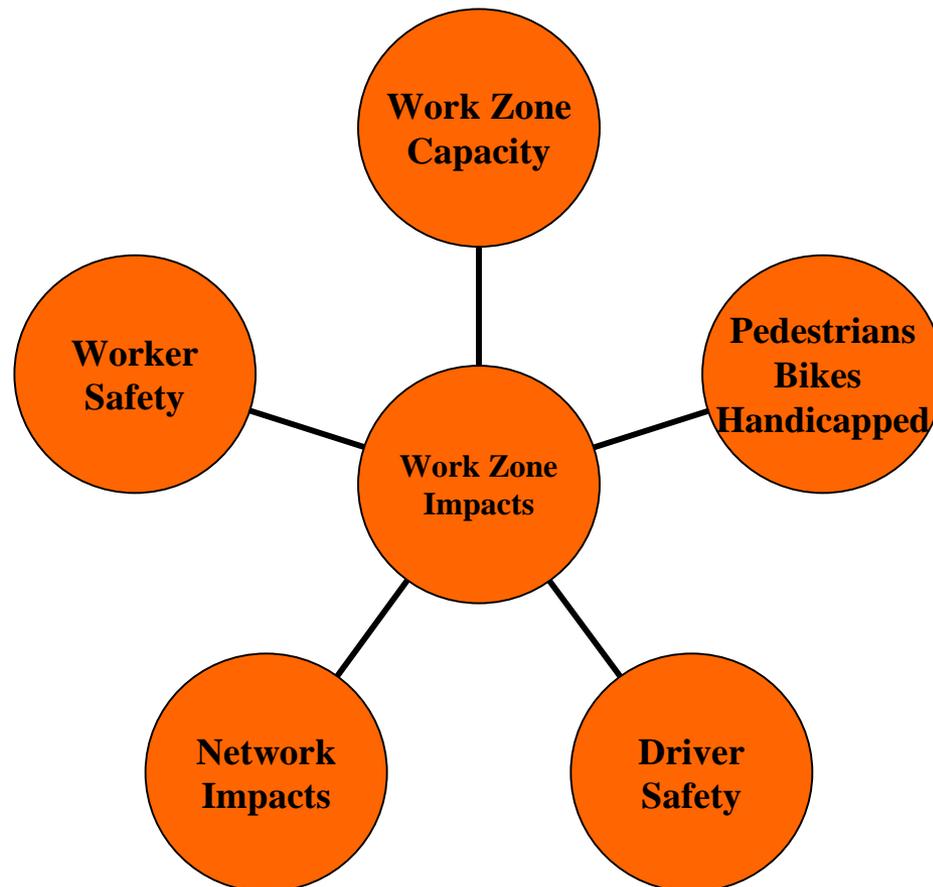
# Transportation Management Plan Process



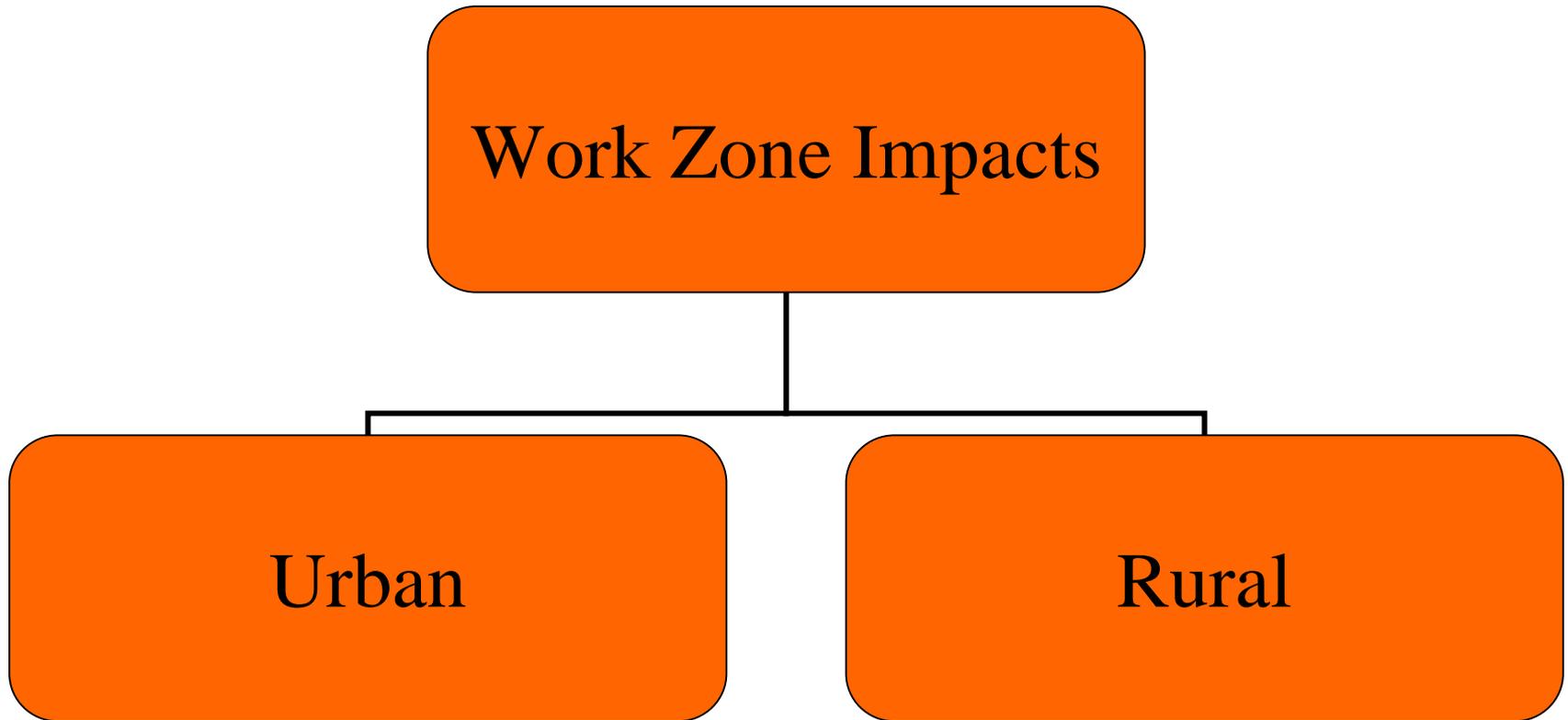
**TMP is Required on all WisDOT projects.**



# Transportation Management Plan: Work Zone Impacts Assessment



# Transportation Management Plan: Work Zone Impacts **Context**



# Transportation Management Plan: Work Zone Impacts

## Urban

### Work Zone Impacts In Urban Areas

- More detour routes available
- More recurrent congestion is present
- Signing is tougher
- Variety of traffic to assess
- Scheduling
- R/W restrictions

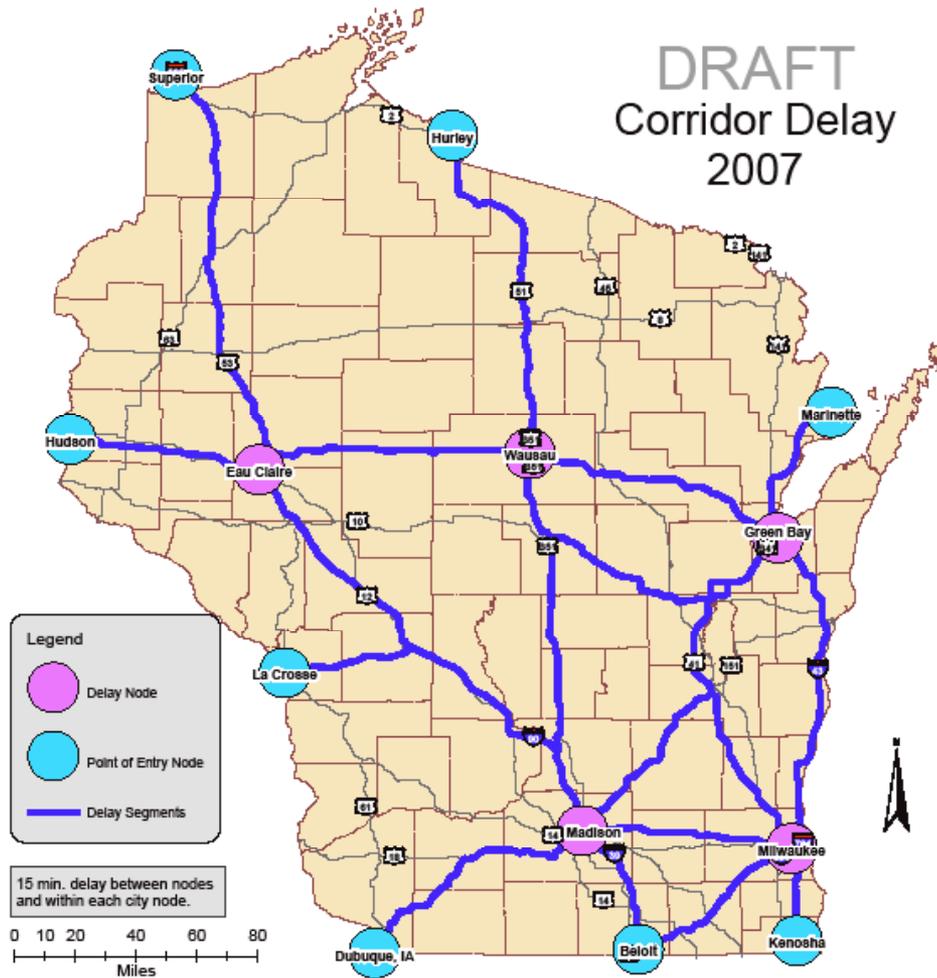
# Transportation Management Plan: Work Zone Impacts

Rural

## Work Zone Impacts In Rural Areas

- Fewer detour routes available, but longer
- Less recurrent congestion is present
- Unfamiliar motorists, tourists
- Heavy vehicle alternate routes limited

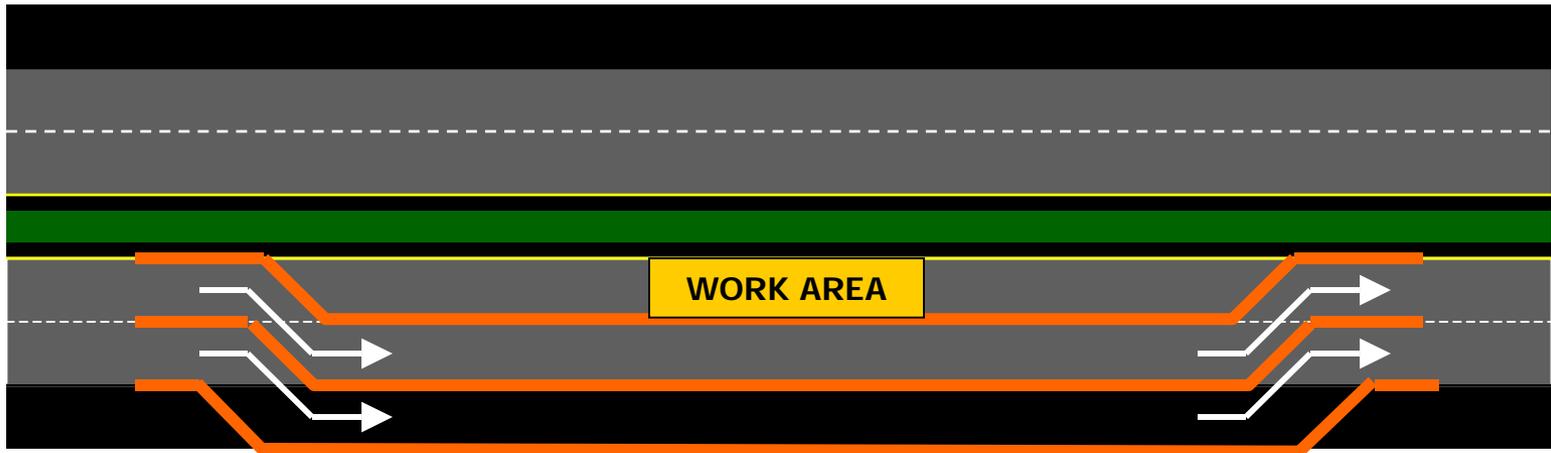
# Transportation Management Plan: Delay



# Some Typical Work Zone Traffic Control Strategies



# Lateral Lane Shift

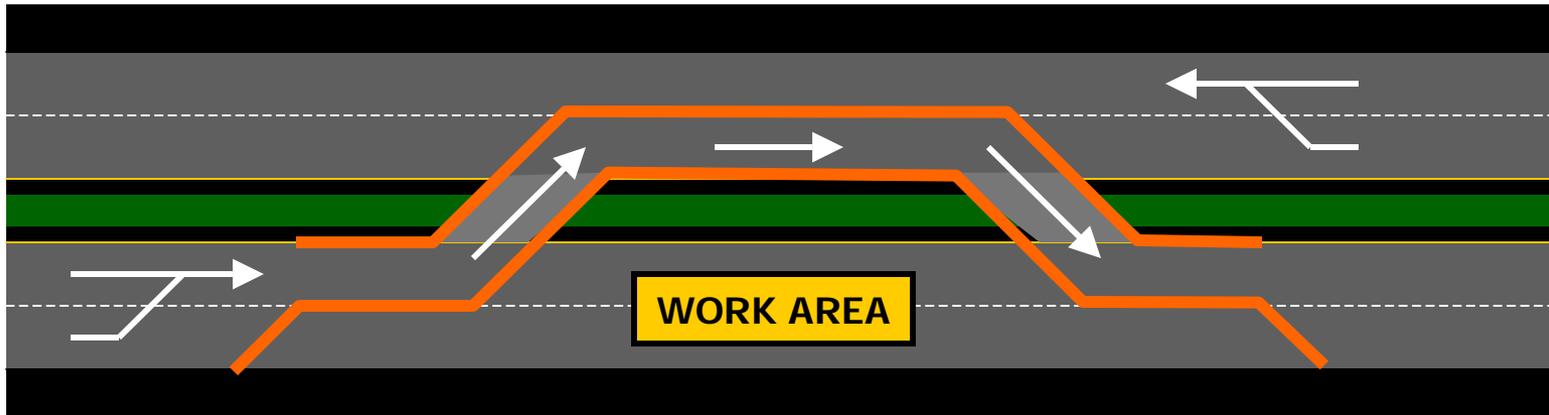


# Lane Closure

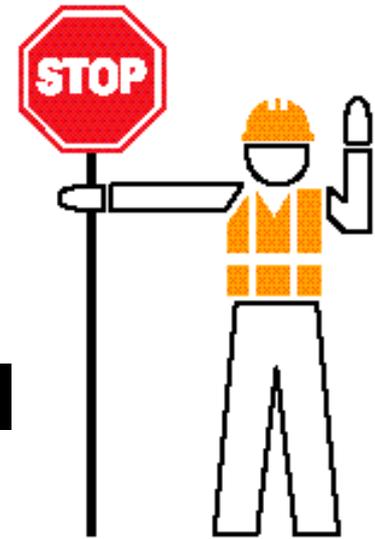


- Single Lane
- Multi-Lane

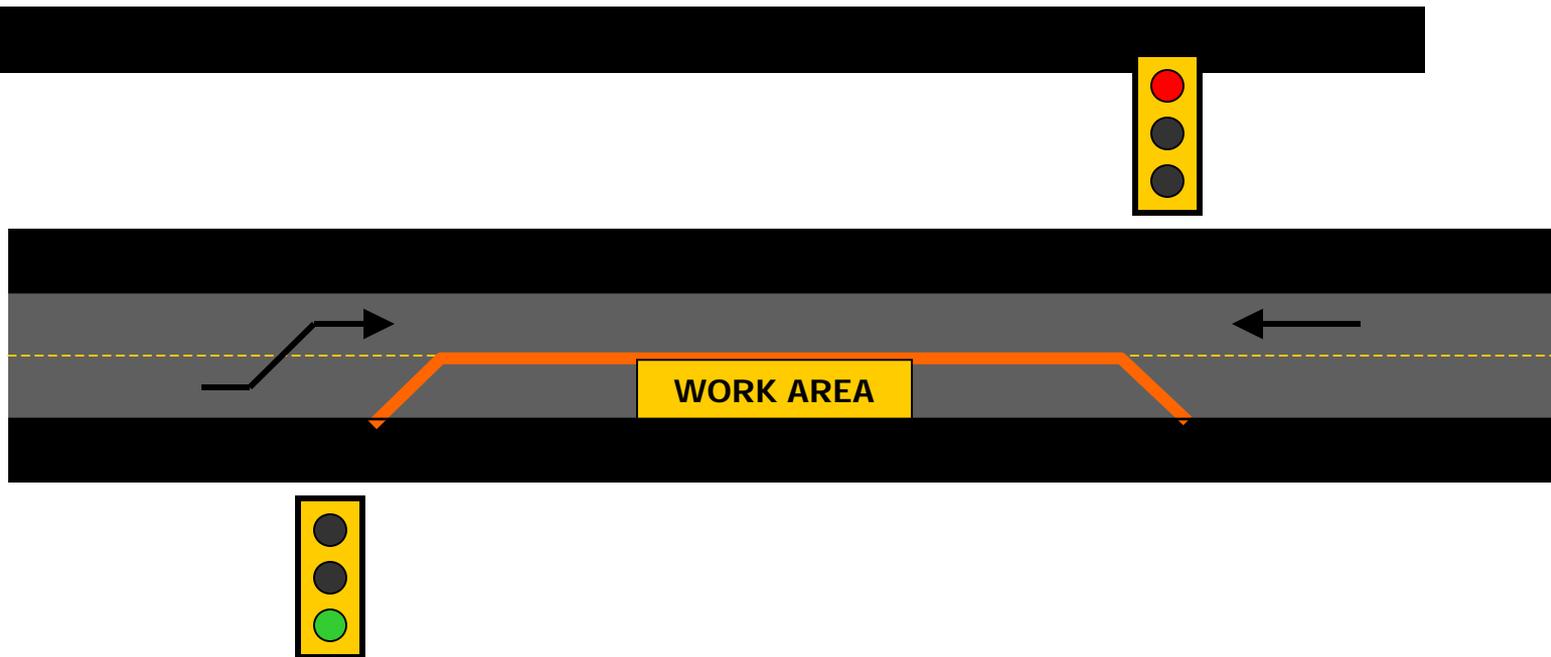
# Crossover



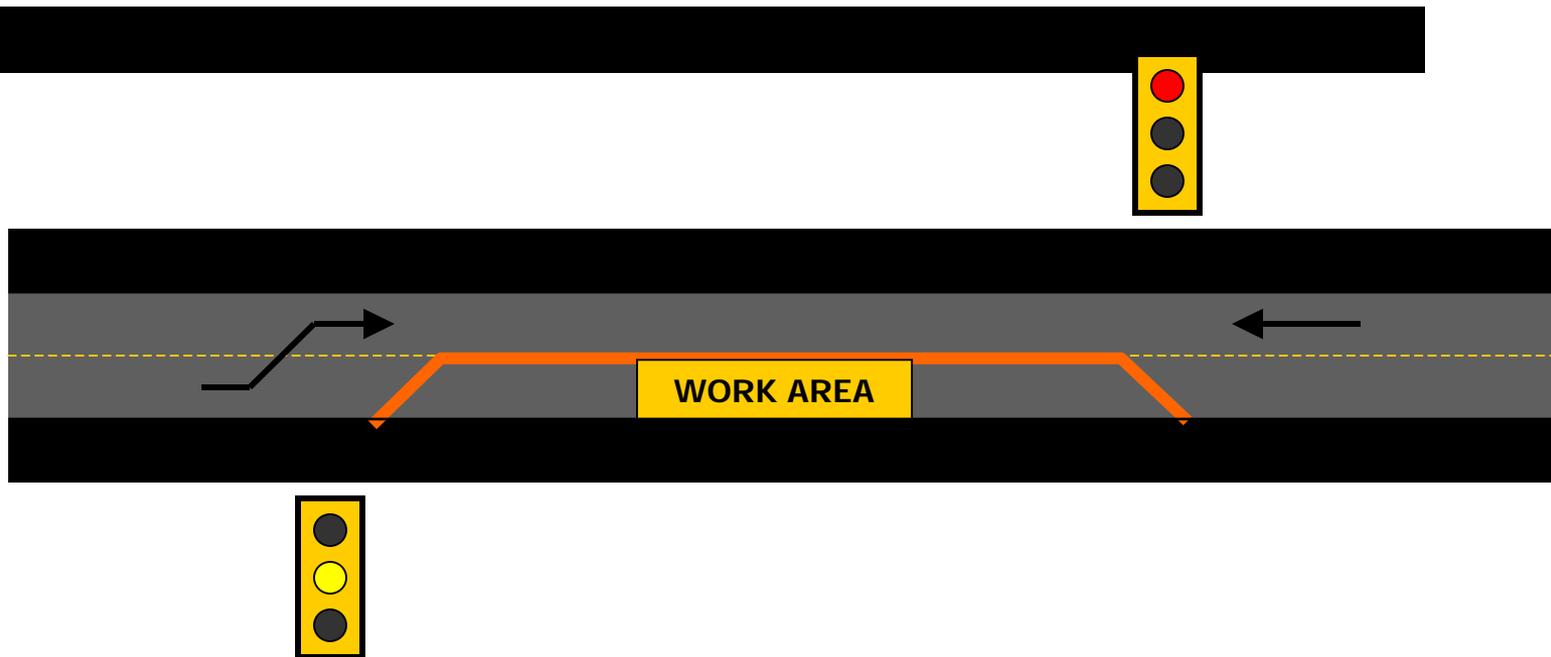
# Flagging Operation



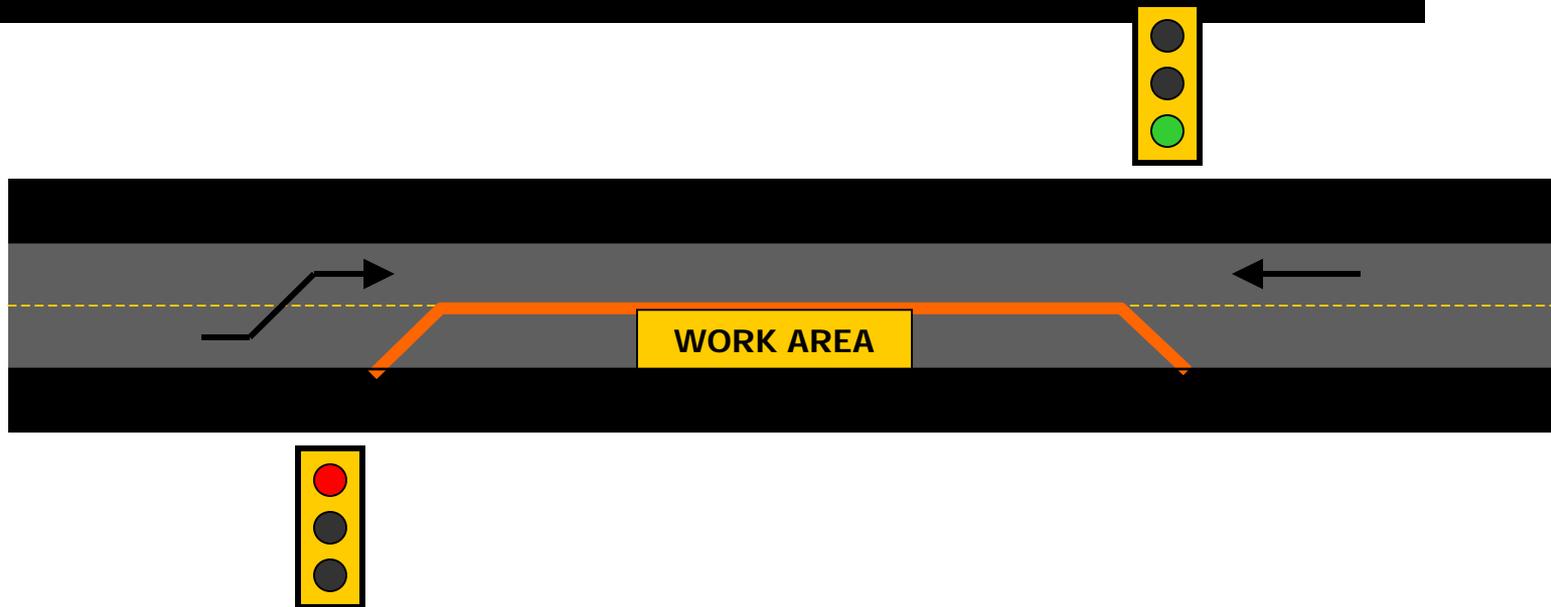
# One Lane Two-Way With Temporary Signal



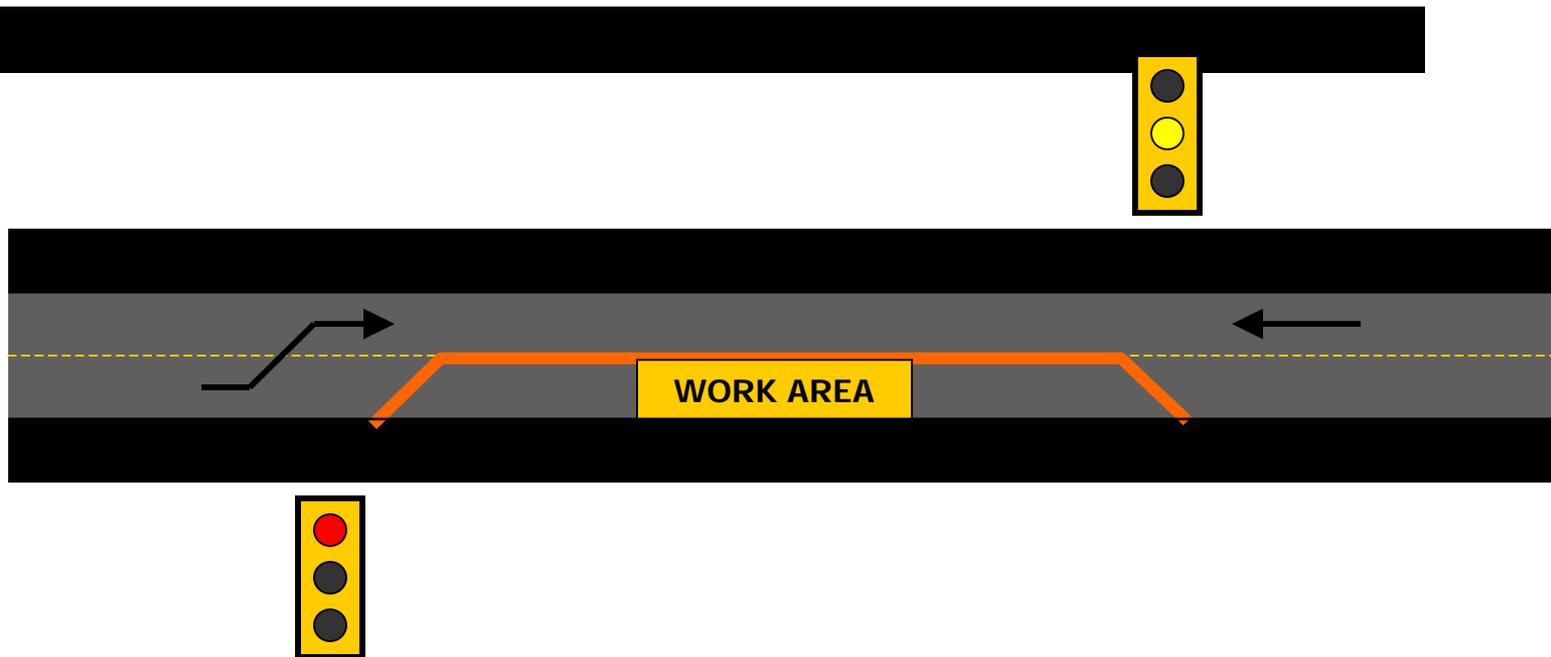
# One Lane Two-Way With Temporary Signal



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# One Lane Two-Way With Temporary Signal

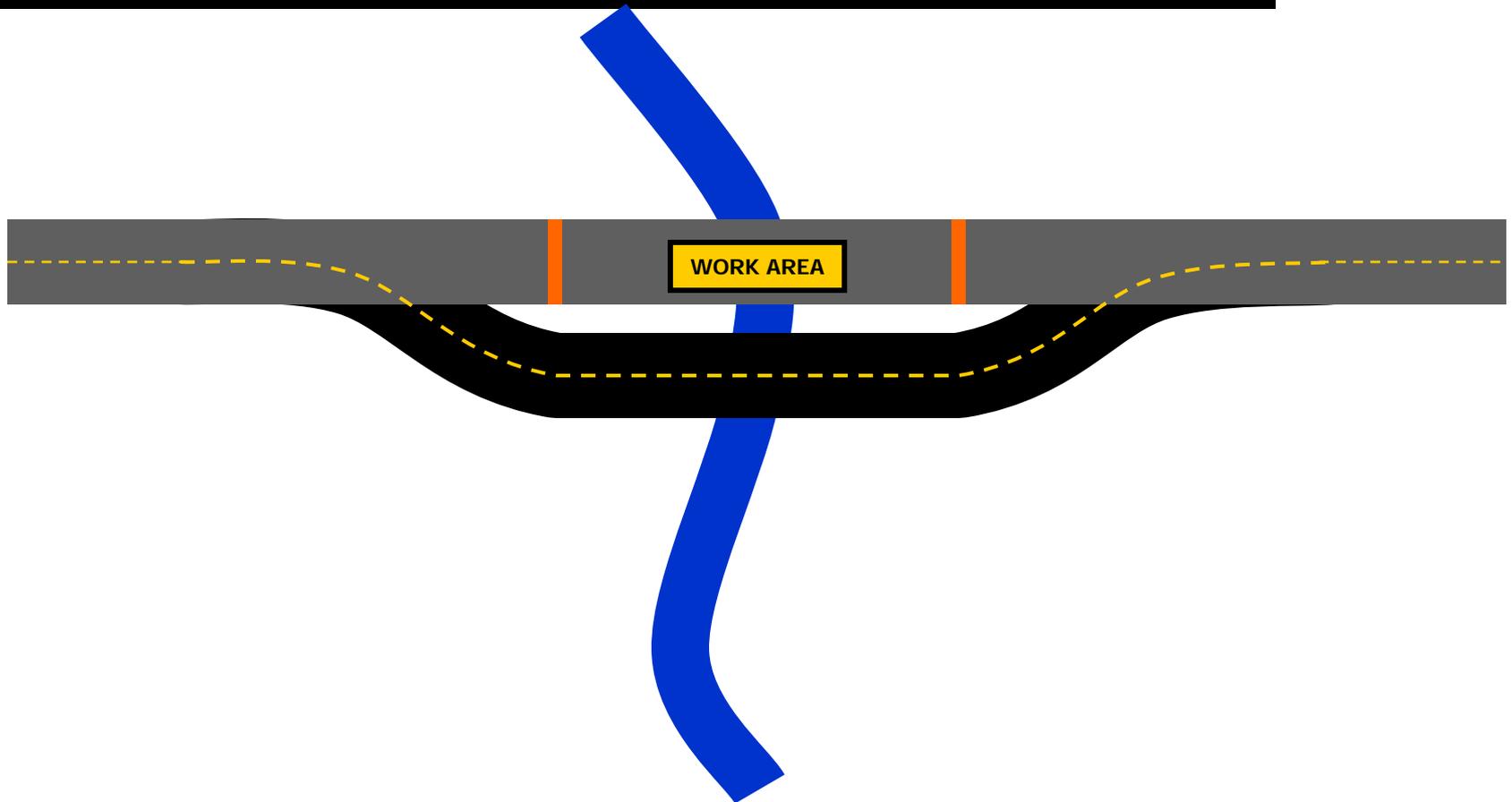




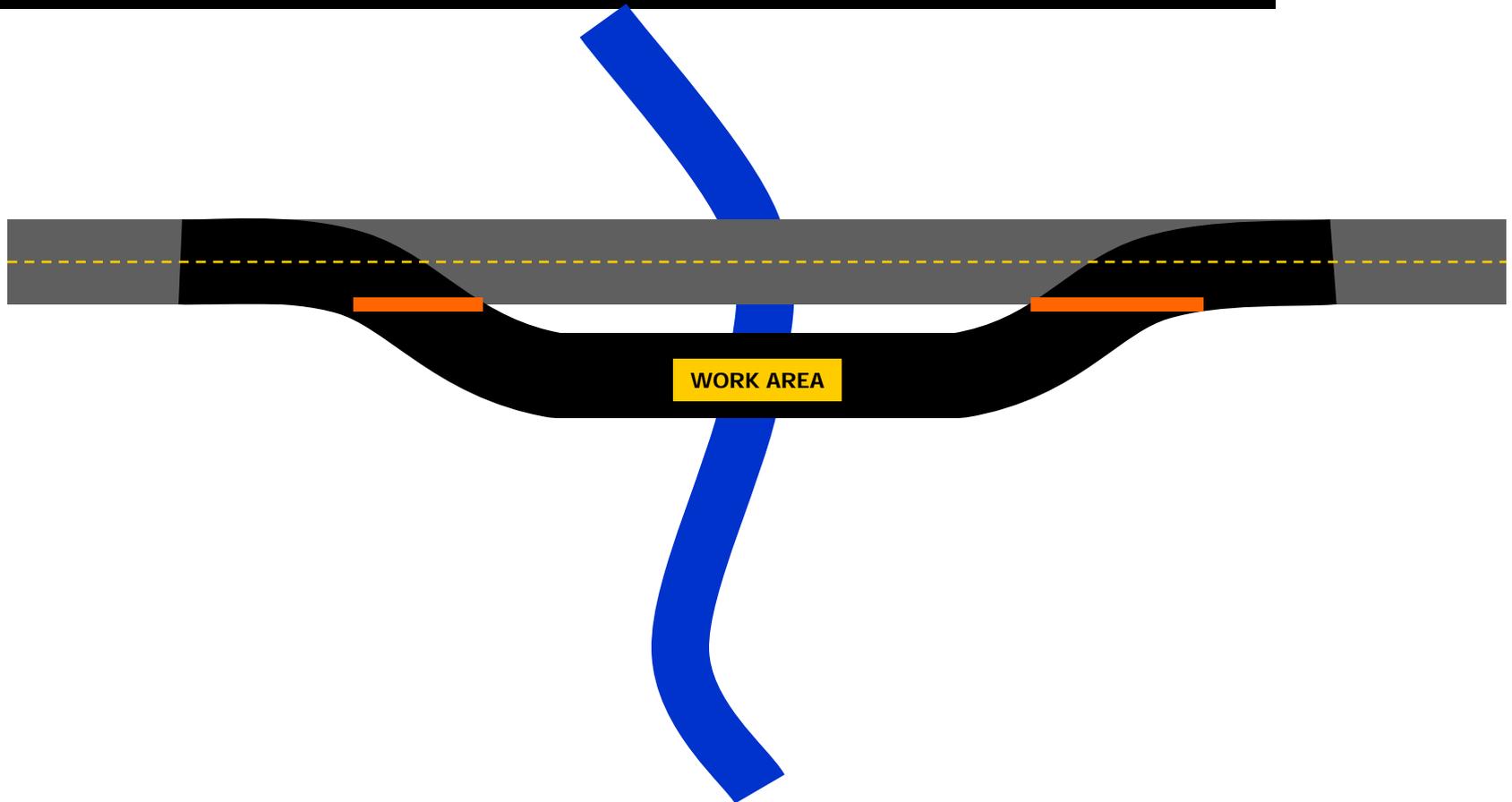
# Pilot Car



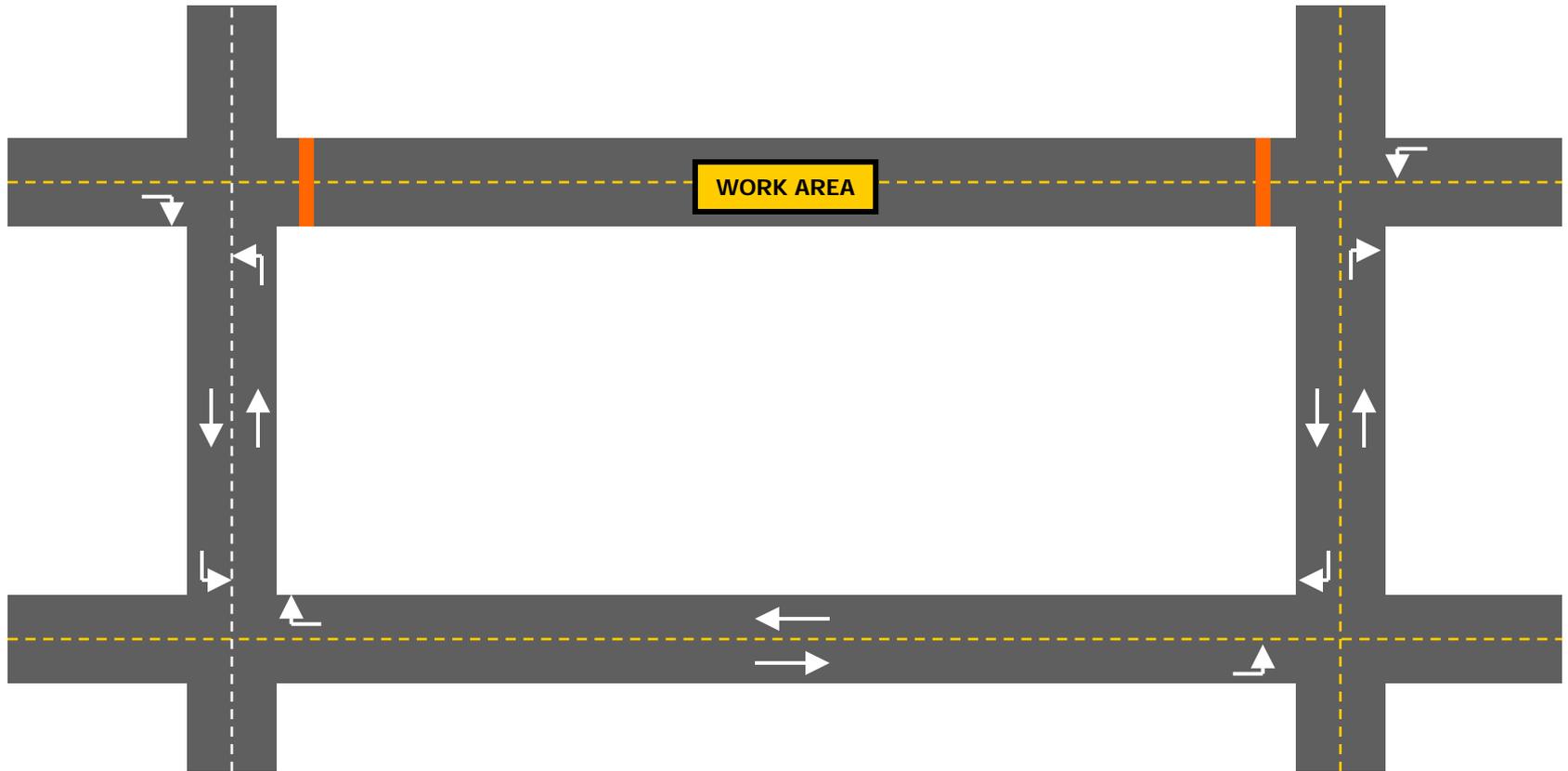
# Temporary Facilities



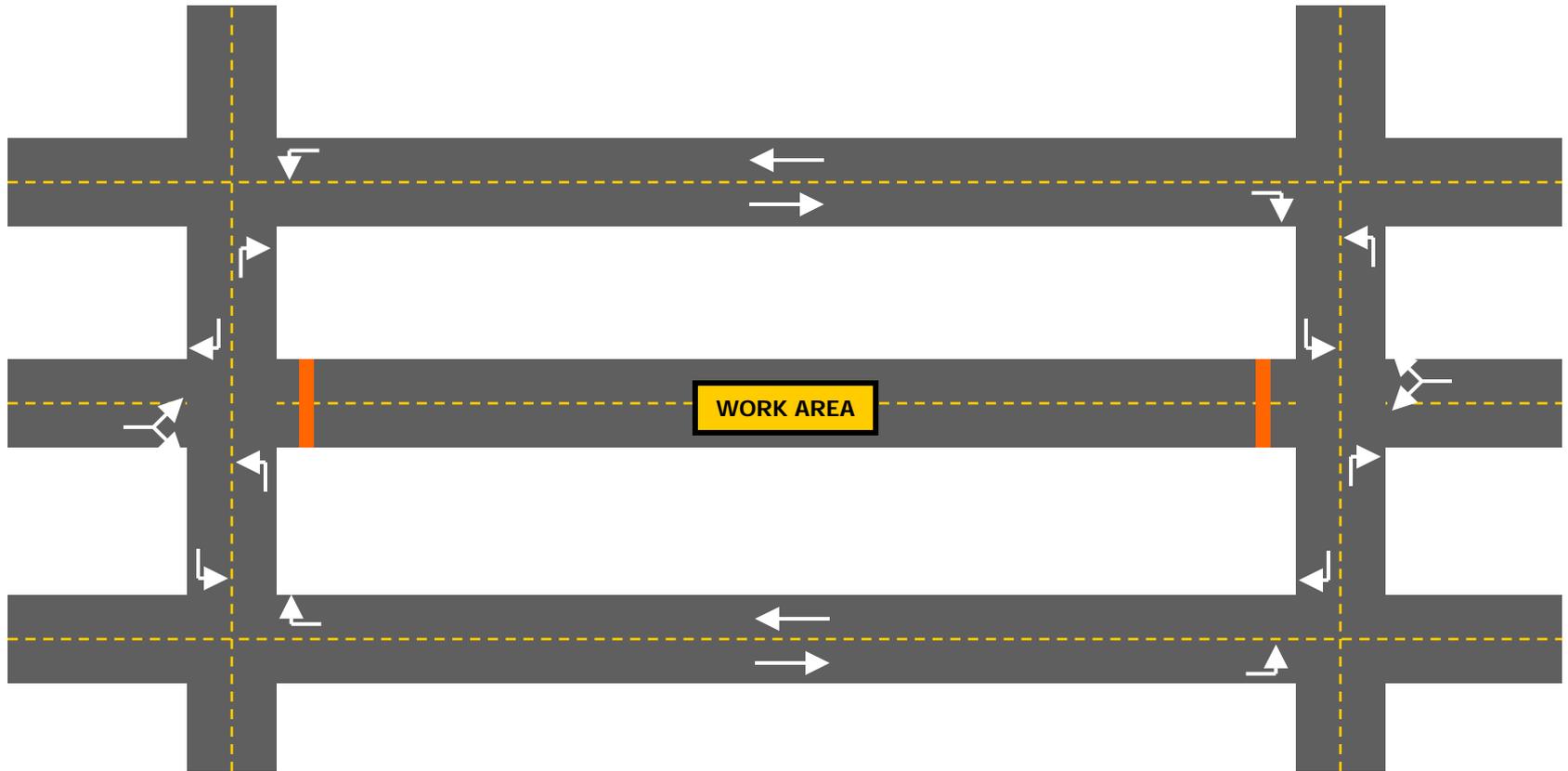
# Permanent Realignment



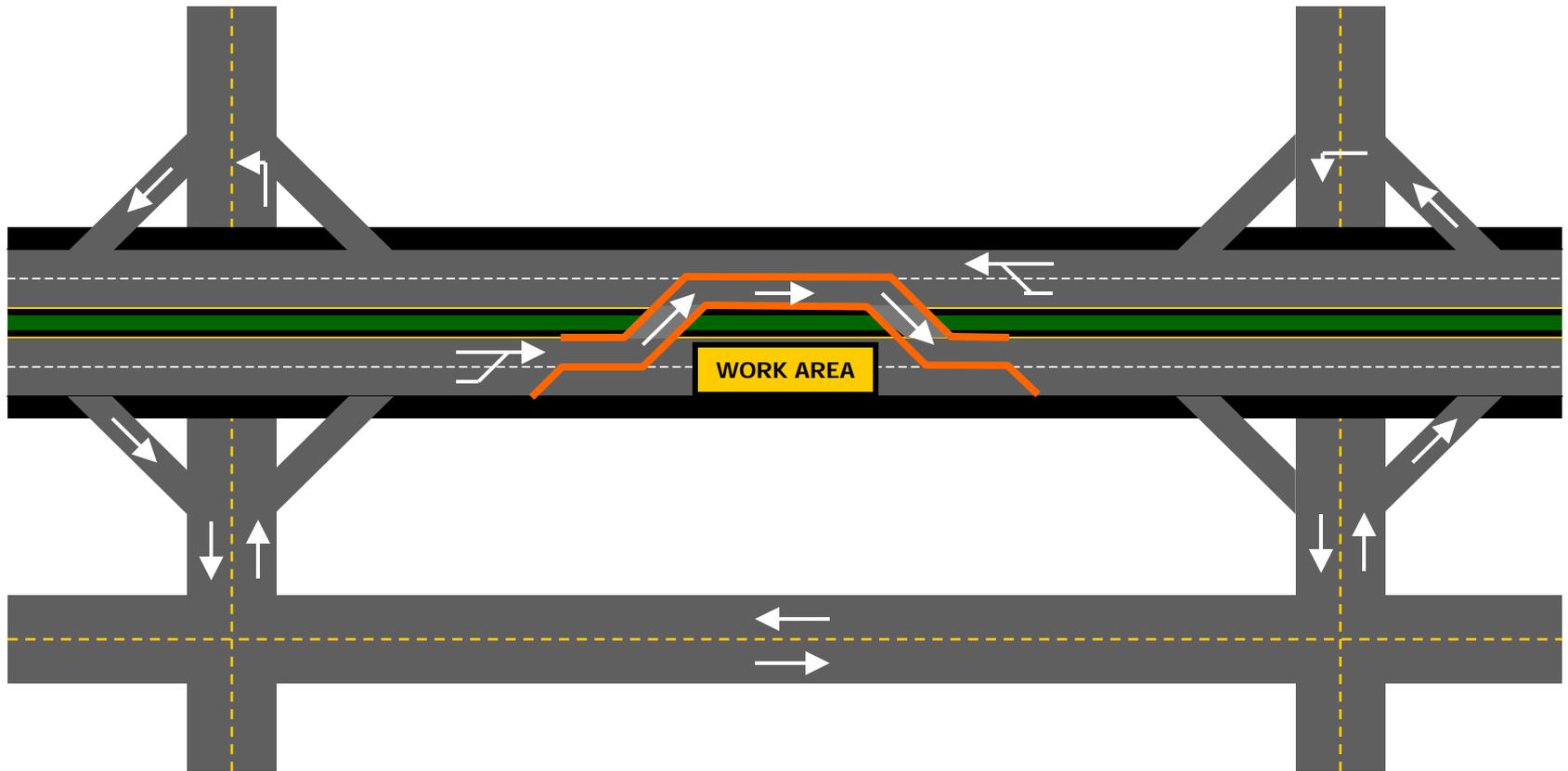
# Simple Detour



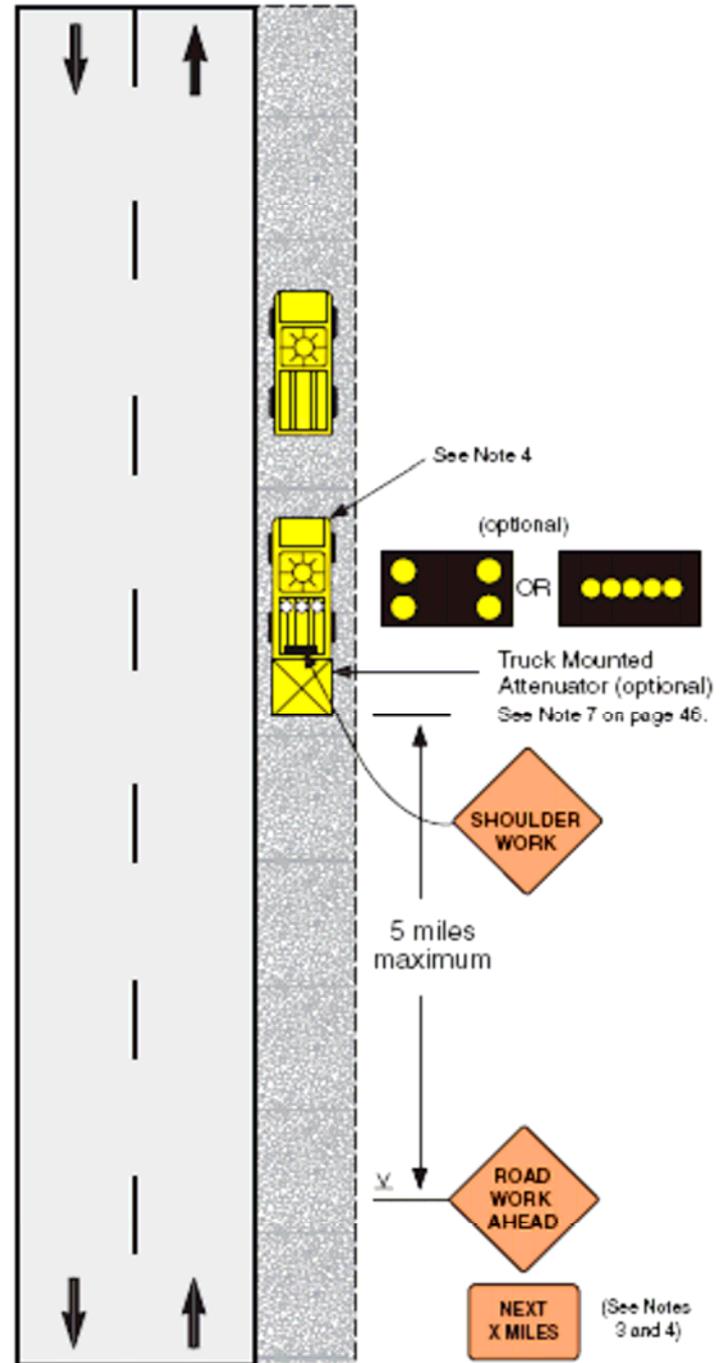
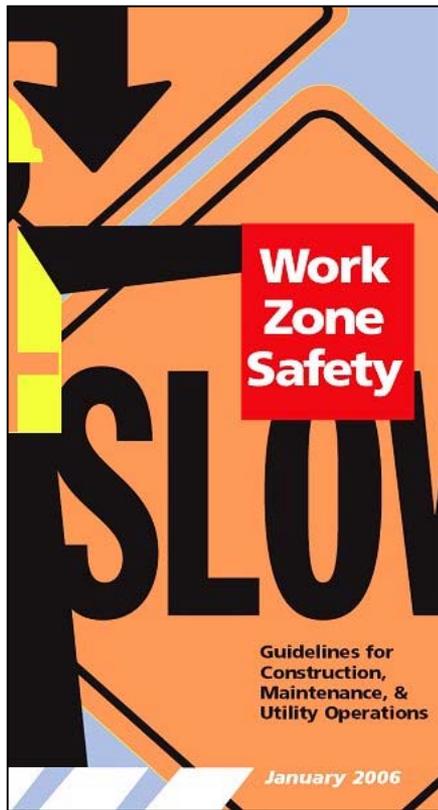
# Network Detour



# Combinations: Fwy Crossover with Diversion

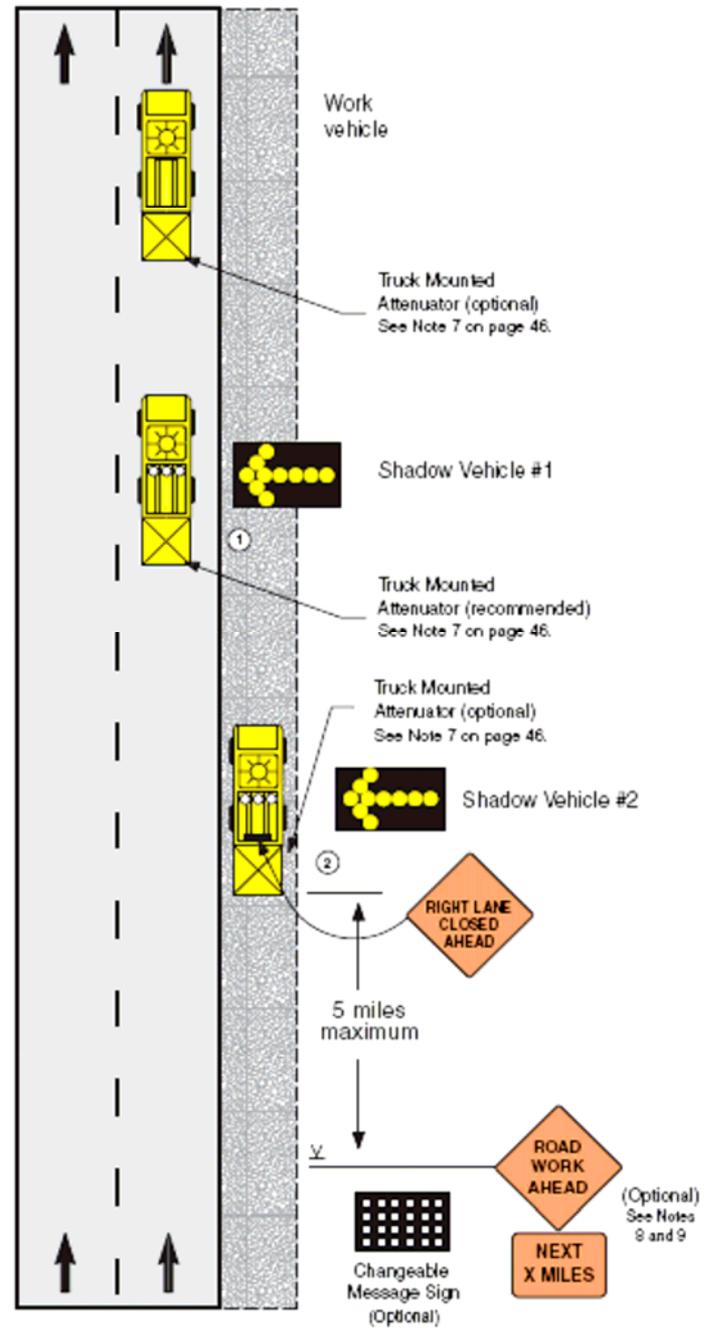
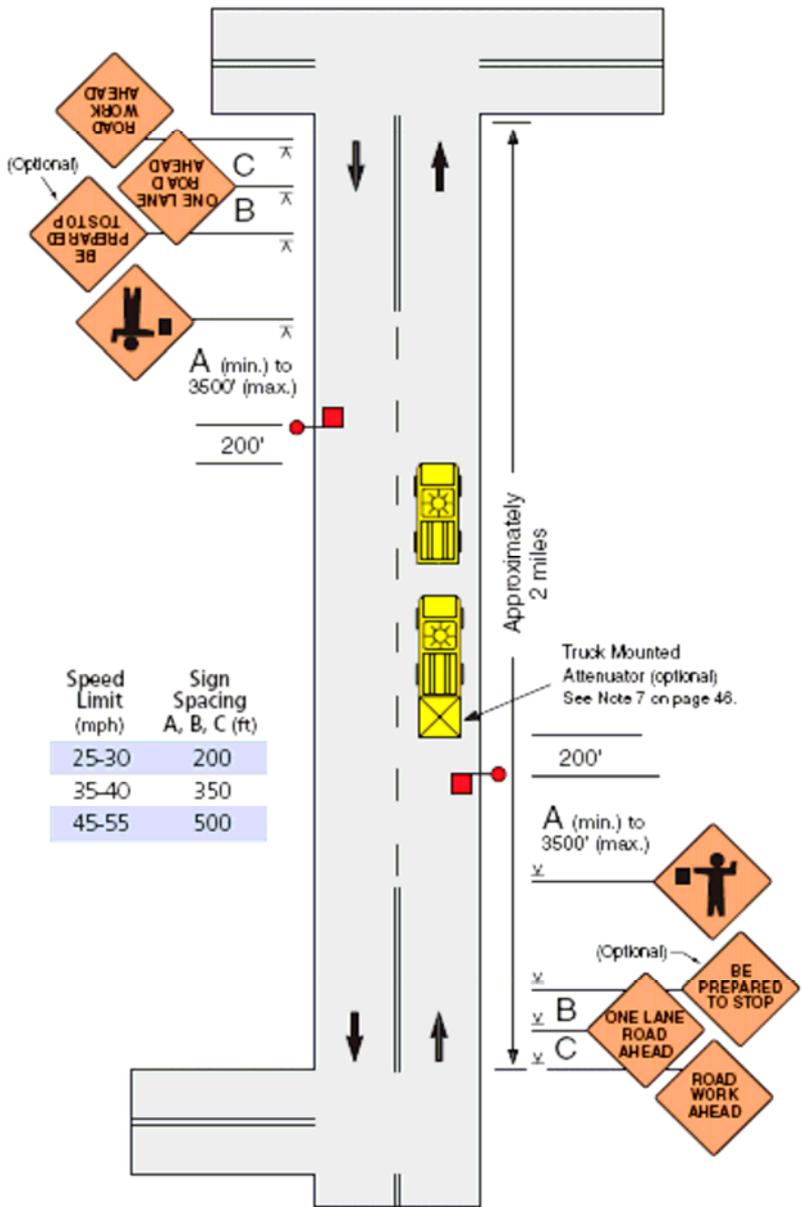


# Mobile Operations

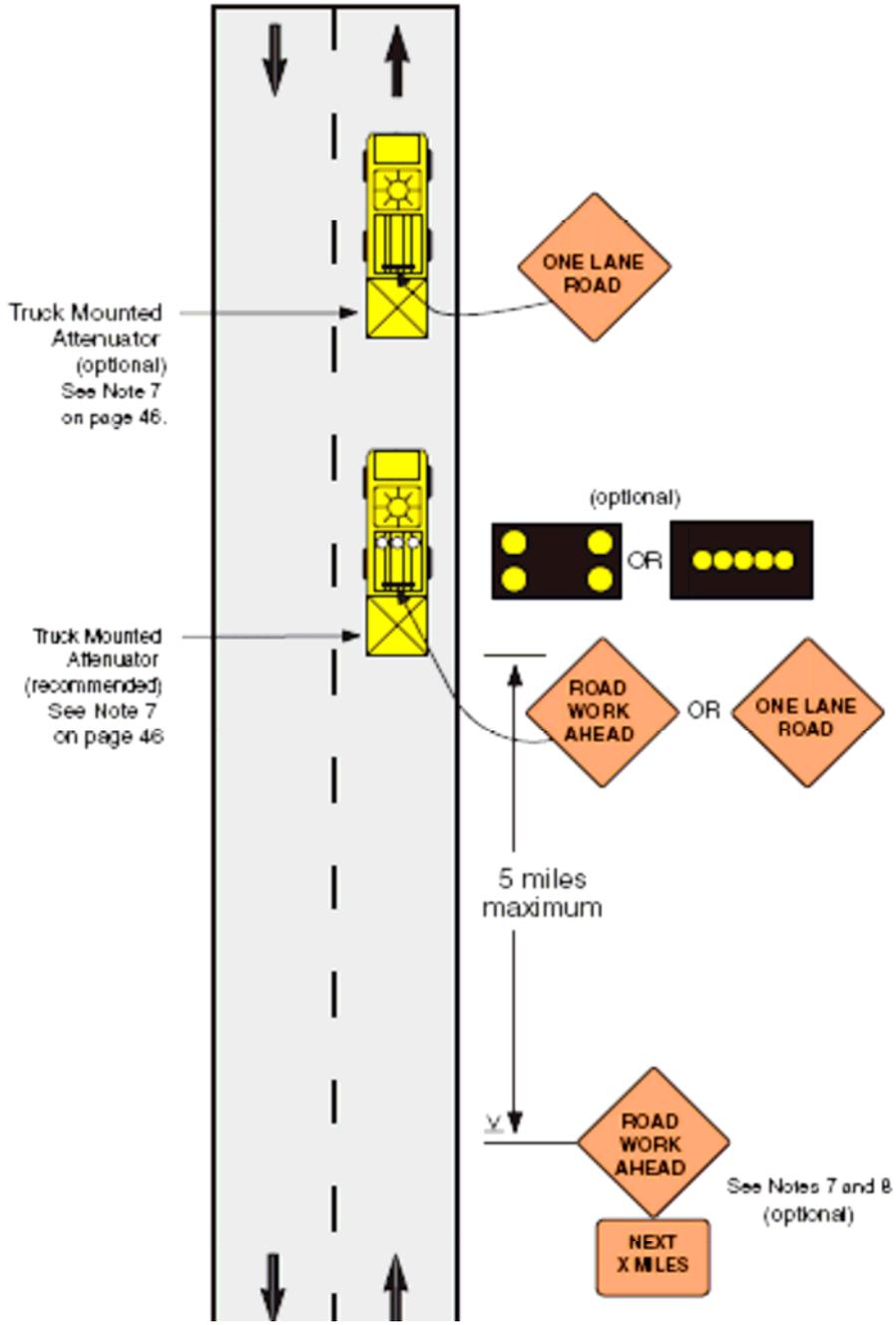


# Mobile Operation on a Two-Lane Road Using Flaggers

(Traveling at less than 3 mph)



# Mobile Operation





JUNCTION  
41 3

TO

10

95

EAST

WE

41

3

3

STOP

T

NO WITCH HUNTING

NO TRUCKS OVER 35 FEET

NEED WALK TENT

NEW

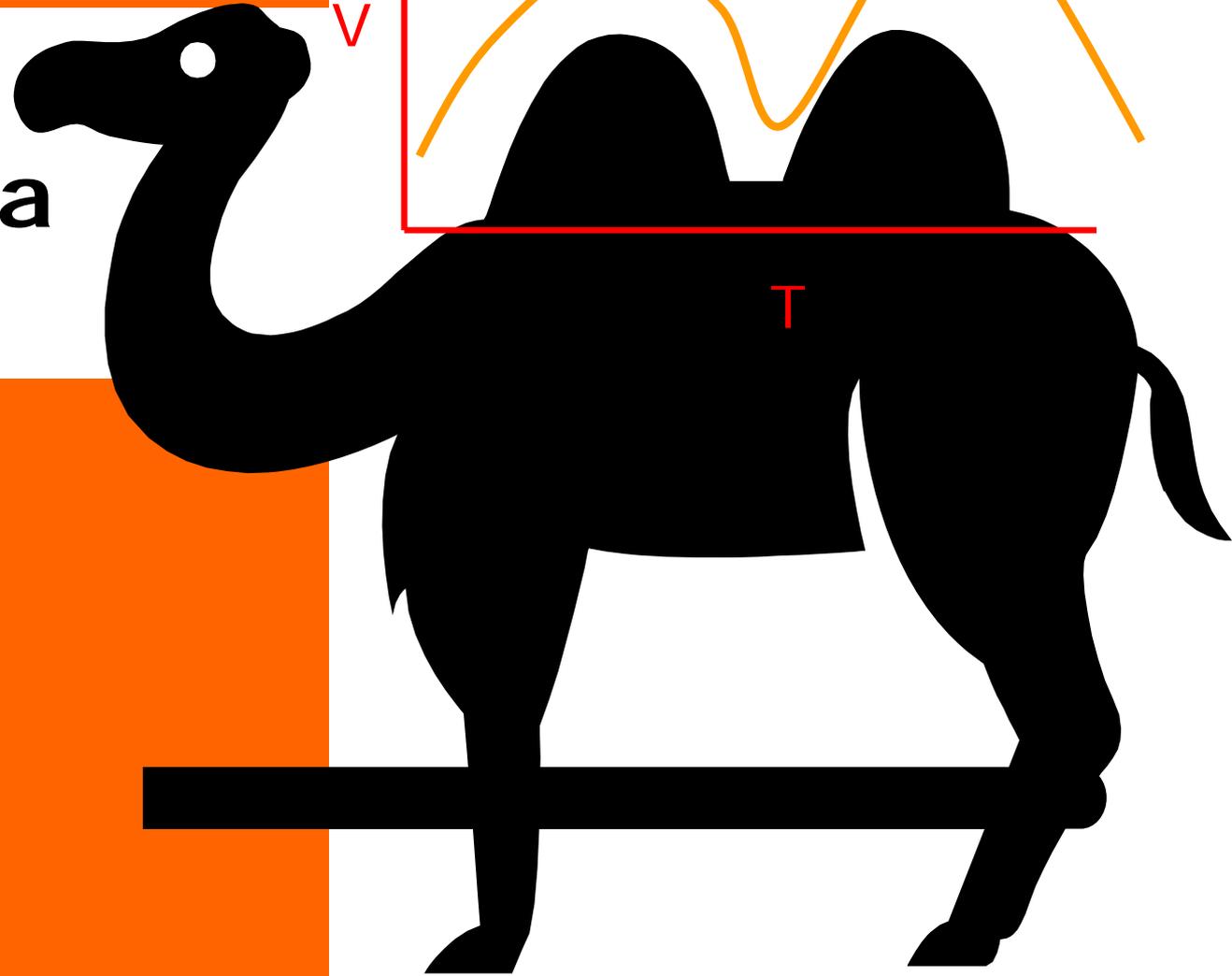
7 SHERMAN

FL 4

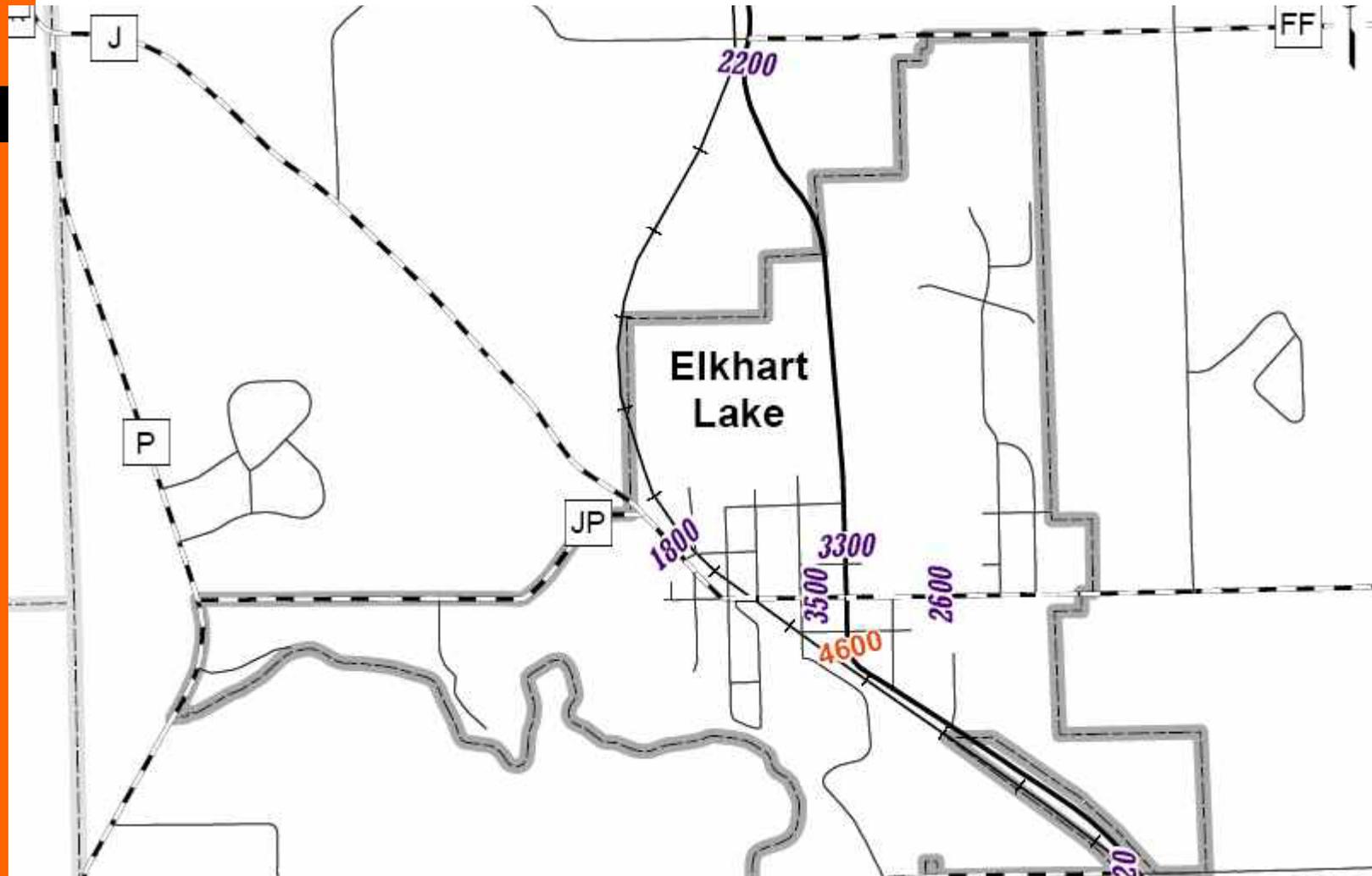
RY

ROAD AS  
LODGING

Data



# Traffic Data: AADT



# Traffic Data: Stations

DTDView - Microsoft Internet Explorer provided by WisDOT

Address <http://webapp1.dot.state.wi.us/dtdview/viewer.htm>

Google  Go

DTDView (DOT GIS Data Viewer) Map Width: 5.1

**Photolog**

**Zoom / Plan**

**Data Info Search & Select**

**Measure & Units**

**Output**

**Labeling**

**User Options**

**Map Area**

**Favorite**

**Extent**

**Units**

**Active Layer**

**Visible Layers**

**Legend**

- Count Sites
- STN Basic Routes
- State Highway
- US Highway
- Interstate Highway
- On/Off Ramps
- Private Roads
- Other Roads
- Forest Roads
- Rural Roads

**Data Layer Selections**

**Active Layer:** **Asbuilt/Aslet Plans**

- Transportation Systems
- Local Road Search
- Local Road Cartographics
- Project Related Data
- TRADAS Count Data
  - Count Sites
- STN Inventory
- Legislative Districts
- Geographic Reference
- Hydrography
- Boundaries

# Traffic Data: Stations



# 48 Hour Counts

Site Names: **450101, 2214, SE**  
 County: **Ozaukee**  
 Funct. Class: **R Principal Arterial - Other**  
 Location: **STH 57 0.5 MI SOUTH OF OZAUKEE-SHEBOYGAN CO LINE**

Seasonal Factor Type: **4**  
 Daily Factor Type: **4**  
 Axle Factor Type: **1**  
 Growth Factor Type: **1**

	09/02/2007			09/03/2007			09/04/2007			09/05/2007			09/06/2007			09/07/2007			09/08/2007			Average				
	Road	Neg	Pos	Road	Neg	Pos	Road	Neg	Pos	Road	Neg	Pos	Road	Neg	Pos											
00:00													57	14	43	98	25	73				78	20	58		
01:00													53	19	34	54	21	33				54	20	34		
02:00													52	30	22	39	21	18				46	26	20		
03:00													66	46	20	66	46	20				66	46	20		
04:00													182	153	29	164	127	37				173	140	33		
05:00													416	341	75	348	283	65				382	312	70		
06:00													783	562	221	709	502	207				746	532	214		
07:00													740	480	260	669	435	234				705	458	247		
08:00													518	326	192	513	289	224				516	308	208		
09:00													451	230	221	480	259	221				466	245	221		
10:00												521	255	266	469	222	247				495	239	257			
11:00												517	255	262	468	234	234				493	245	248			
12:00												542	284	258	492	258	234				517	271	246			
13:00												552	256	296	535	249	286				544	253	291			
14:00												663	321	342	675	295	380				669	308	361			
15:00												714	296	418	765	284	481				740	290	450			
16:00												858	310	548	878	325	553				868	318	551			
17:00												819	311	508	876	345	531				848	328	520			
18:00												552	216	336	600	246	354				576	231	345			
19:00												372	165	207	434	176	258				403	171	233			
20:00												289	118	171	333	124	209				311	121	190			
21:00												222	98	124	235	83	152				229	91	138			
22:00												231	84	147	185	89	96				208	87	122			
23:00												115	39	76	103	20	83				109	30	80			
Volume												<b>6,967</b>	<b>3,008</b>	<b>3,959</b>	<b>10,366</b>	<b>5,151</b>	<b>5,215</b>	<b>3,140</b>	<b>2,008</b>	<b>1,132</b>				<b>10,237</b>	<b>5,084</b>	<b>5,153</b>
AM Peak Vol												783	562	260												
AM Peak Fct												1.00	1.00	1.00												
AM Peak Hr												6.00	6.00	7.00												
PM Peak Vol												858	321	548	878	345	553									
PM Peak Fct												1.00	1.00	1.00	1.00	1.00	1.00									
PM Peak Hr												16.00	14.00	16.00	16.00	17.00	16.00									
Seasonal Fct												0.946	0.946	0.946	0.946	0.946	0.946	0.946	0.946	0.946	0.946					
Daily Fct												1.034	1.034	1.034	0.976	0.976	0.976	0.821	0.821	0.821						
Axle Fct												0.443	0.443	0.443	0.443	0.443	0.443	0.443	0.443	0.443						
Pulse Fct												2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000						

Created 09/10/2007 10:54:49 AM      ROAD AADT **8,339**      NEG AADT **4,101** POS AADT **4,238**      DV03: Page 1 of 1

	Road	Neg	Pos			
AM Peak	705	458	247	ROAD AADT	8,300	ROAD AWDY 10,200
ADJ Peak	583	290	292	NEG AADT	4,100	NEG AWDY 5,100
PM Peak	868	318	551	POS AADT	4,200	POS AWDY 5,200
OFF Peak	187	96	91			

AADT & Average Hourly Flow Rates for 4 time periods  
 AM = 0700-0800; PM = 1600-1700; ADJ = Average(0600-0700, 0900-1600, 1800-1900); OFF = Average (1900-0600)  
 Hourly Flow Rates Exclude 0800-0900 & 1700-1800; THESE HOURS ARE INCLUDED IN THE AADT ONLY

# Traffic Data: Hourly

Seasonal Factor Type: 4

Daily Factor Type: 4

Axle Factor Type: 1

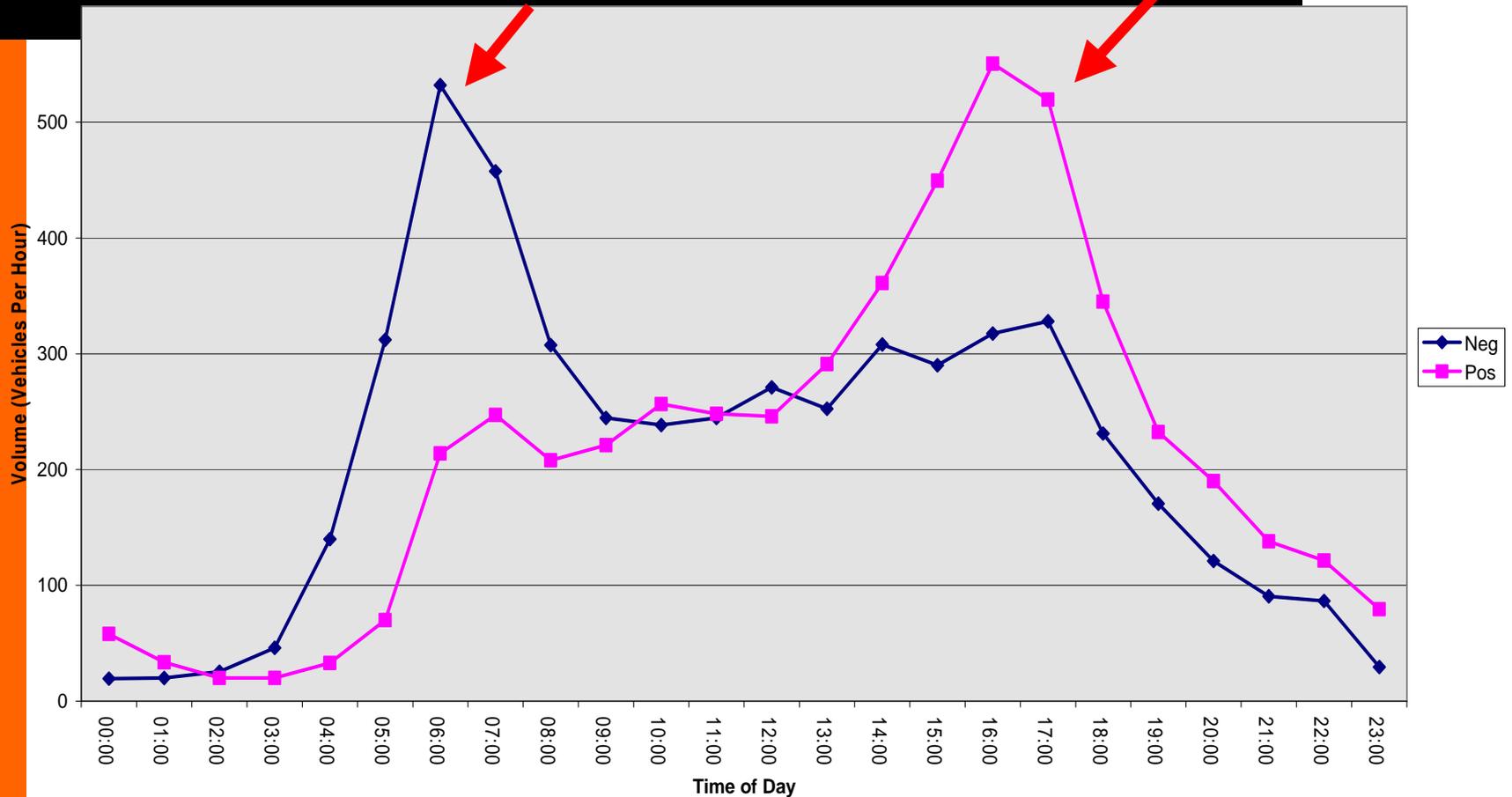
Growth Factor Type: 1

Pos: NB or EB  
Neg: SB or WB

09/05/2007		09/06/2007			09/07/2007		
Neg	Pos	Road	Neg	Pos	Road	Neg	Pos
		57	14	43	98	25	73
		53	19	34	54	21	33
		52	30	22	39	21	18
		66	46	20	66	46	20
		182	153	29	164	127	37
		416	341	75	348	283	65

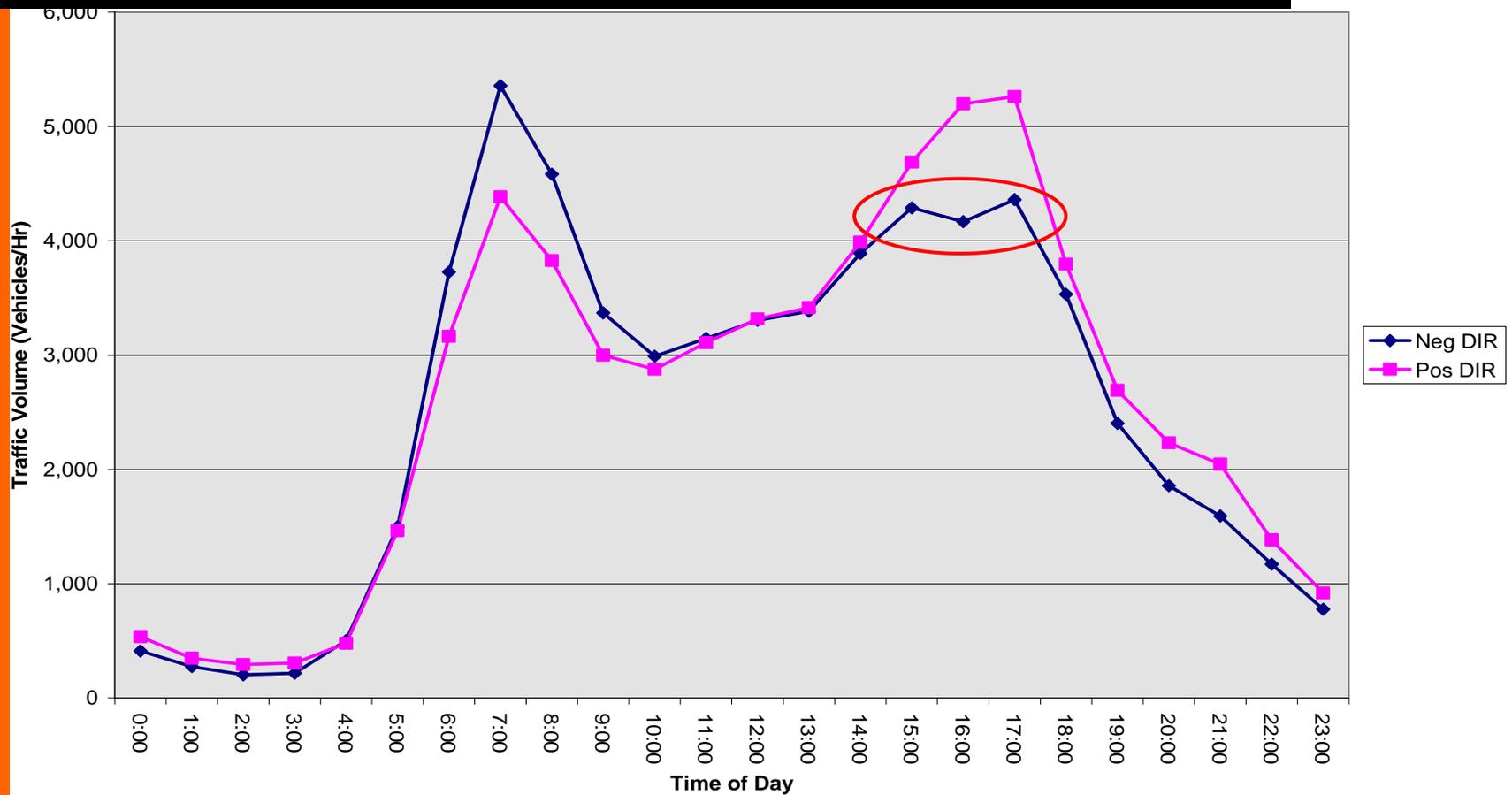
# Hourly Profile: Rural

STH 57 0.5 MI SOUTH OF OZAUKEE-SHEBOYGAN CO LINE  
Hourly Volume from 09/05/2007 through 09/07/2007



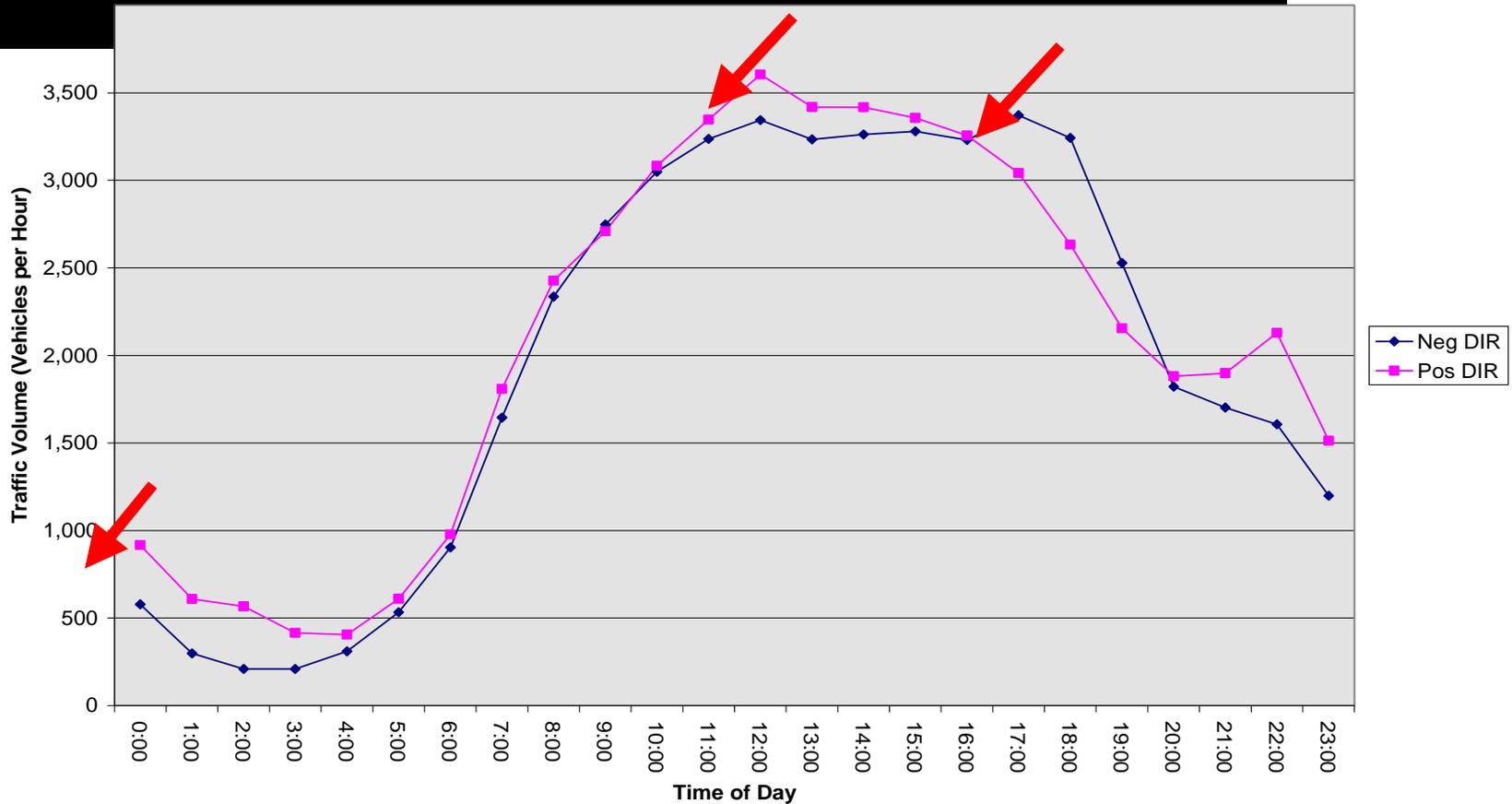
# Hourly Profile: Urban

I-43 AT WEST CAPITOL DRIVE (MILWAUKEE CO)  
Weekdays - October 2007



# Hourly Profile: Weekend

I-43 AT WEST CAPITOL DRIVE (MILWAUKEE CO)  
Saturdays - October 2007



# Operational Analysis Periods

- I. AM Peak
- II. PM Peak
- III. Adjacent-To-Peak
- IV. Off-Peak
- v. Special

# Operational Analysis Periods

- v. Special
  - Site-Specific
  - Tourists, Shoppers, Events
  - Typically less than 100 hours/yr

# Extreme Hours



- Usually Can't Build Road to Accommodate Extreme Traffic
  - Sports & Special Events
  - Peak Tourist Days
  - Christmas Shopping
  - Evacuations
- Consider Mitigation Options
  - Law Enforcement & Service Patrols
  - Alternate Routes & ITS



# T: Percent Trucks

Design Values (%'s)			
ROUTE(S):	Local Streets		
Design Volume(s):			
K250	10.0	--	--
K100	10.7	--	--
K30	11.3	--	--
P(PHV)	13.2	--	--
T(DHV)	2.6	--	--
T(PHV)	1.5	--	--
D (Dsgn hr)	58/42	--	--
K8(ADT)	--	--	--
T(A8HV)	--	--	--
Truck Class %'s			
Truck Class	Seg. 1	Seg 2.	Seg. 3
2D	1.3	--	--
3AX	0.9	--	--
2S1+2S2	0.4	--	--
3-S2	0.5	--	--
DBL-BTM	0.1	--	--
TOTAL	3.3%	--	--

- "Scheme F" Defines Types
- Length > 21 Feet
- Variables Affecting Percentage
  - Type of Road
  - Hour of Day
  - Day of Week
  - Month of Year

# D. Directional Split

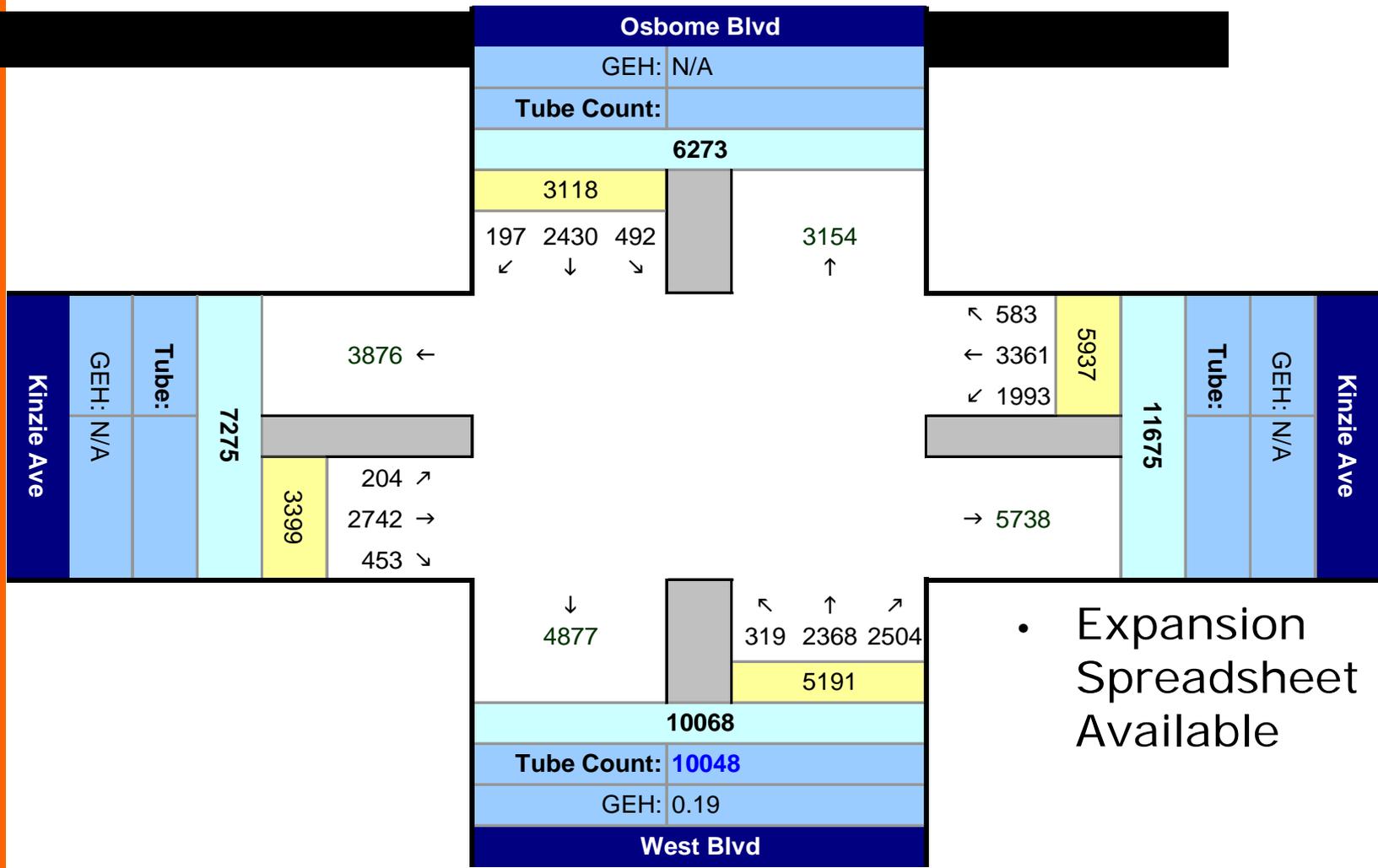
Design Values (%'s)			
ROUTE(S):	Local Streets		
Design Volume(s):			--
K250	10.0	--	--
K100	10.7	--	--
K30	11.3	--	--
P(PHV)	13.2	--	--
T(DHV)	2.6	--	--
T(PHV)	1.5	--	--
D (Dsgn hr)	58/42	--	--
K8(ADT)	--	--	--
T(A8HV)	--	--	--
Truck Class %'s			
Truck Class	Seg. 1	Seg 2.	Seg. 3
2D	1.3	--	--
3AX	0.9	--	--
2S1+2S2	0.4	--	--
3-S2	0.5	--	--
DBL-BTM	0.1	--	--
TOTAL	3.3%	--	--

- Directional Split During Design Hour

← 580

→ 420

# Intersection Counts



- Expansion Spreadsheet Available

# Transportation Management Plan: WZ Capacity

## Work Zone Capacity and Delay

- Maximum hourly rate of vehicles or persons that can reasonably be expected to pass a point, or traverse a uniform section of lane or roadway, during a specified time period under prevailing conditions
- e.g. 45 pc/mi/ln – LOS E
- Delay: How much longer does it take?



# Transportation Management Plan: WZ Capacity

## Ideal Capacity

- Freeways: Capacity (Free-Flow Speed)
  - 2,400 pcphpl (70 mph)
  - 2,350 pcphpl (65 mph)
  - 2,300 pcphpl (60 mph)
  - 2,250 pcphpl (55 mph)
- Multilane Suburban/Rural
  - 2,200 pcphpl (60 mph)
  - 2,100 (55 mph)
  - 2,000 (50 mph)
  - 1,900 (45 mph)
- 2-lane rural – 2,800 pcph
- Signal – 1,900 pcphgpl

# Transportation Management Plan: WZ Capacity



# Transportation Management Plan: WZ Capacity

Construction Date, Duration and Period



Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

# Transportation Management Plan: WZ Capacity

## Effect of Roadway on Capacity

- Lane and Shoulder Width
- Proximity to WZ Activities
- Visual Distractions
- Traffic Control Devices
- Vertical and Horizontal Geometry



# Transportation Management Plan: WZ Capacity

## FDM 11-50-23

	Site Conditions		Rural	Urban
Choose one	Short-term construction	Start at	1600 pcphpl	1600 pcphpl
	Long-term construction	Start at	1550 w/ crossover (1750 w/o crossover)	1750 pcphpl
Choose any that apply	Close, Intense Construction Activity Proximity (Large number of work vehicles, workers, noise/dust)	Subtract	Up to 160	Up to 160
	Construction Activity Less Intense than Average (Guardrail/barrier installation, pavement repairs at intermittent spot locations, work activity across median)	Add	Up to 160	Up to 160
	11' lane width	Multiply	0.97	0.97
	10.5' lane width	Multiply	0.95	0.95
	Shoulder width < 6'	Multiply	0.97	0.97
	Heavy Vehicle/Truck Volume	Multiply	(1-%Truck)	(1-%Truck)
	Onramp within 1500' downstream of lane closure taper	Subtract	Hourly ramp volume (600 max)	Hourly ramp volume (600 max)

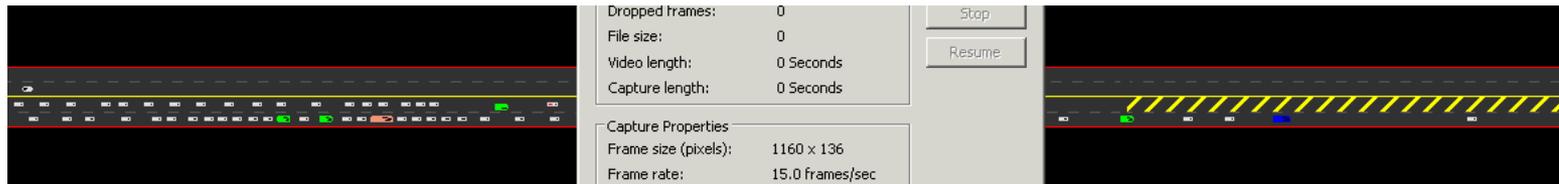
# Transportation Management Plan: WZ Capacity

Example: Rural, short-term construction, moderate intensity construction, close proximity to construction, 12-ft lane width, 4-ft shoulder width, on ramp within 1500 downstream of closure taper, 10% truck.

$$C_a = (1600 + 80 - 80) * (1 - 0.1) * 1 * (0.97) = 1397 \text{ vehicles/hour}$$

# Transportation Management Plan: WZ Queueing

How does a queue form?



# Transportation Management Plan: WZ Queueing

How to estimate queue?

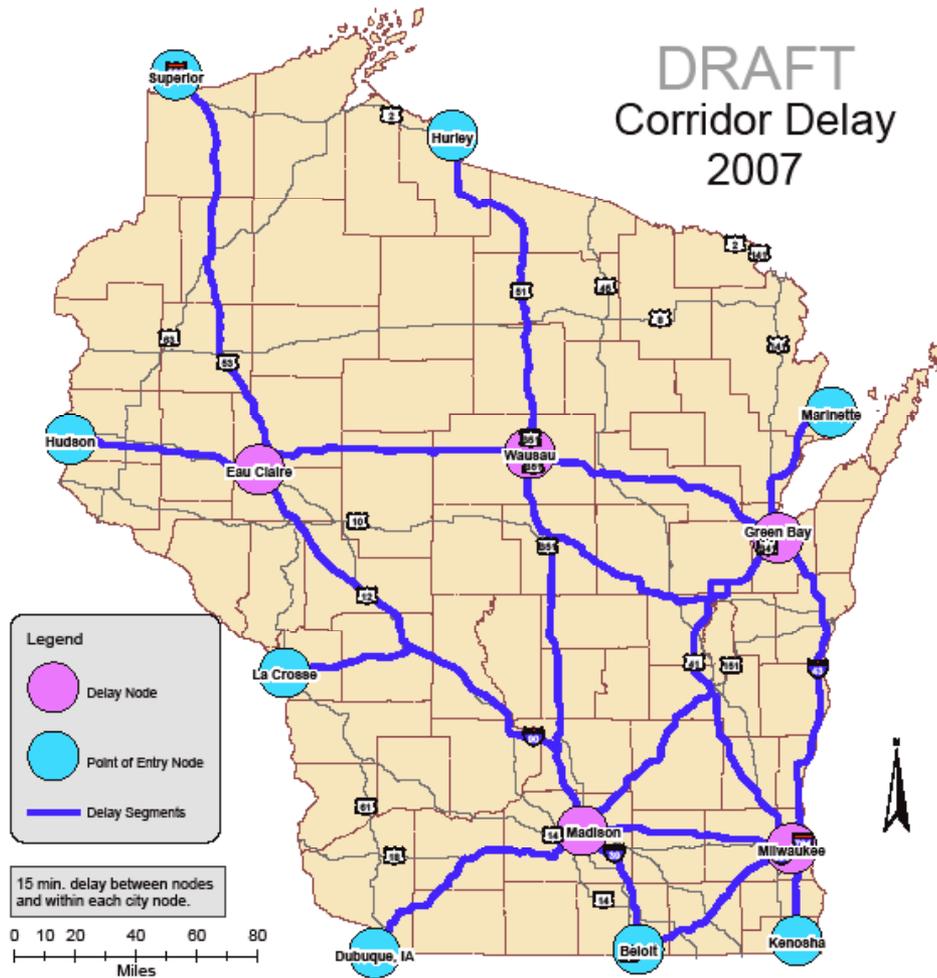
- Basic Theory
  - HCM Guidance
  - $Queue_L = f(\text{Demand-Capacity})$
- Example
  - 1 lane open (WZ capacity = 1600 pc/hr)

Time	Demand	Capacity	Queued Vehicles
10:00	500	400	100
10:15	400	400	100
10:30	300	400	0
10:45	200	200	0

# Defining Delay



# Transportation Management Plan: Delay



# What Causes Delay?

- Reduced Travel Speed
  - Construction Affects Capacity
  - Detours Increase Volumes on Some Routes
- Queues at Bottlenecks
- Detours Increase Travel Distance
- Detours Require Driving Through More Intersections

# Free Flow Speed



- The speed when there is no congestion.
- How fast would you go at 4:30 AM (if there were no cops around)?
- Based on driver perception of roadway.
- Usually equal to design speed.
- Usually 5 mph above posted speed limit.

# Calculating Delay



The difference between actual travel time and travel time at Free Flow Speed.

Calculate the Delay (without construction):

- 20 mile long rural STH segment.
- At 4:30 AM average speed 60 mph.
- At 7:30 AM average speed 40 mph.

# Calculations...



$$T_{FF} = 20 \text{ miles} \div 60 \text{ mph} = 0.33 \text{ hr} = 20 \text{ min}$$

$$T_A = 20 \text{ miles} \div 40 \text{ mph} = 0.50 \text{ hr} = 30 \text{ min}$$

$$D = 10 \text{ minutes (without construction)}$$



# Hey! Wait a Minute!

You said we're allowed 15 minutes of construction delay on an entire corridor?

But there's already 10 minutes of delay without any construction???



**No!**

The Wisconsin WZ policy goal relates to additional delay.

# Work Zone Delay



## Without Construction:

- 20 mile long rural STH segment.
- At 4:30 AM average speed 60 mph.
- At 7:30 AM average speed 40 mph.

## With Construction:

- At 7:30 AM average speed 30 mph.

# Calculations...



$$T_{FF} = 20 \text{ miles} \div 60 \text{ mph} = 0.33 \text{ hr} = 20 \text{ min}$$

$$T_A = 20 \text{ miles} \div 40 \text{ mph} = 0.50 \text{ hr} = 30 \text{ min}$$

$$D = 10 \text{ minutes (without construction)}$$

$$T_{WZ} = 20 \text{ miles} \div 30 \text{ mph} = 0.67 \text{ hr} = 40 \text{ min}$$

$$D_{WZ} = 20 \text{ minutes (with construction)}$$

$$\Delta D = 20 \text{ min} - 10 \text{ min} = 10 \text{ min}$$

# Putting A Dollar Value on Delay



- How much is your time worth?
- Studies show people usually value travel time at about 50% of what they're paid.
- Wisconsin Statewide Average wage \$17.66/h
- $50\% \times \$17.66 = \$8.83/h$

# Calculations...



Data:

- Traffic volume 1500 vehicles/hour
- Average occupancy 1.25 adults per vehicle
- 50% of Prevailing wage = \$8.83
- $\Delta D = 10$  min

User Delay Cost:

$$1500 \times 1.25 \times 10/60 \times \$8.83 = \$2760/\text{hr}$$

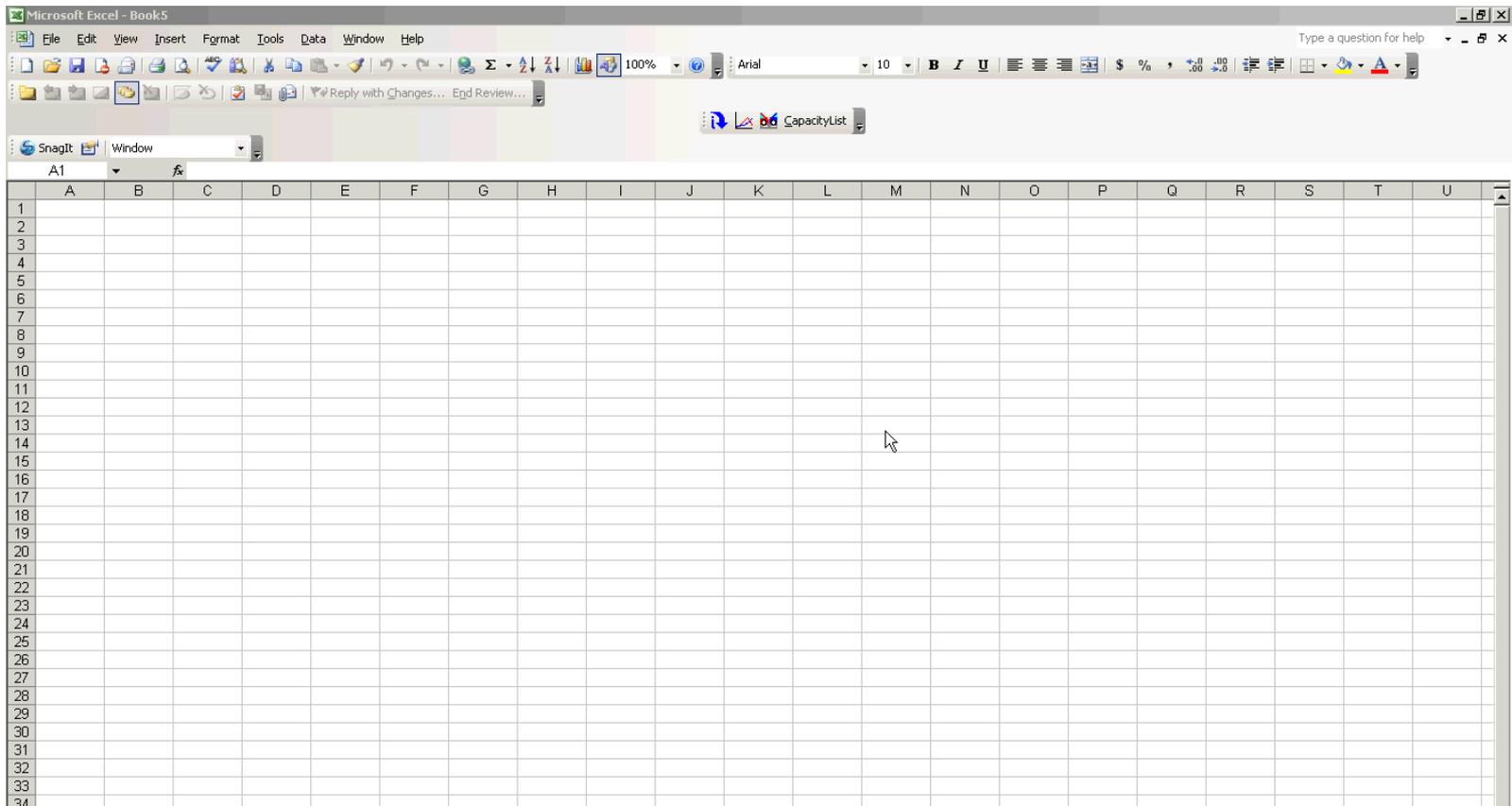
# How can we use this?

- Helping make WZ strategy decisions.
- Evaluating contractor incentive/disincentive.

# Transportation Management Plan: Delay

- Estimating delay due to queueing
  - Each vehicle is assumed to be delayed as long as waiting in a queue to be released into the vehicle stream.
  - Work zone is treated as a point bottleneck
  - The cumulative time passed at a queue is the delay

# Transportation Management Plan: WZCAT



# Transportation Management Plan: WZCAT

Time	Demand (vehicles)	Capacity (vehicles)	Cur.Queue(vehicles)	Delay(minutes)	Cum.Demand (vehicles)	Cum.Capacity(vehicles)
10:00:00 AM	3	3	1	0.2	3	1
10:00:06 AM	3	3	1	0.3	7	3
10:00:12 AM	3	3	1	0.5	10	4
10:00:18 AM	3	3	1	0.6	13	6
10:00:24 AM	3	3	1	0.7	17	7
10:00:30 AM	3	3	1	0.9	20	8
10:00:36 AM	3	3	1	1.0	23	10
10:00:42 AM	3	3	1	1.2	27	11
10:00:48 AM	3	3	1	1.3	30	13
10:00:54 AM	3	3	1	1.4	33	14
10:01:00 AM	3	3	1	1.6	37	15
10:01:06 AM	3	3	1	1.7	40	17
10:01:12 AM	3	3	1	1.8	43	18
10:01:18 AM	3	3	1	2.0	46	20
10:01:24 AM	3	3	1	2.1	50	21
10:01:30 AM	3	3	1	2.3	53	22
10:01:36 AM	3	3	1	2.4	56	24
10:01:42 AM	3	3	1	2.5	60	25
10:01:48 AM	3	3	1	2.7	63	26
10:01:54 AM	3	3	1	2.8	66	28
10:02:00 AM	3	3	1	3.0	70	29
10:02:06 AM	3	3	1	3.1	73	31
10:02:12 AM	3	3	1	3.2	76	32
10:02:18 AM	3	3	1	3.4	80	33
10:02:24 AM	3	3	1	3.5	83	35
10:02:30 AM	3	3	1	3.6	86	36
10:02:36 AM	3	3	1	3.8	90	38
10:02:42 AM	3	3	1	3.9	93	39
10:02:48 AM	3	3	1	4.1	96	40
10:02:54 AM	3	3	1	4.2	100	42
10:03:00 AM	3	3	1	4.3	103	43
10:03:06 AM	3	3	1	4.5	106	45

Queue Analysis for  
NB I-94 43 @ S 10th  
 Total Delay (vehicle-hours)  
 109.326067

Lane Restrictions  
 10:00:00 AM TO 10:00:00 AM

Maximum Delay/Vehicle (minutes)  
 8.8

Average Delay/Vehicle (minutes)  
 5.54282238

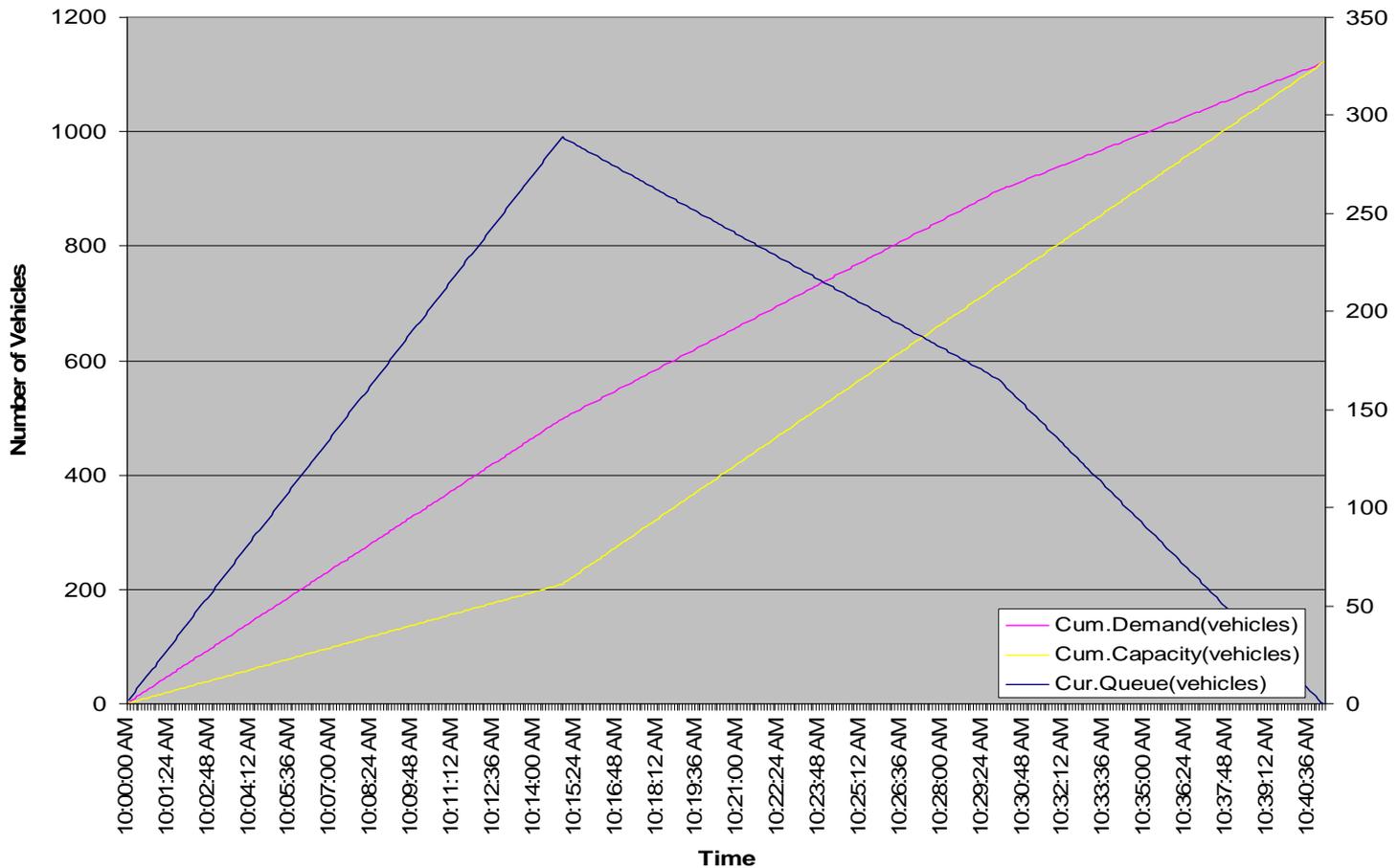
Maximum Queue (vehicles)  
 289 at 10:14 AM

Average Queue Length (miles)  
 2.18939394

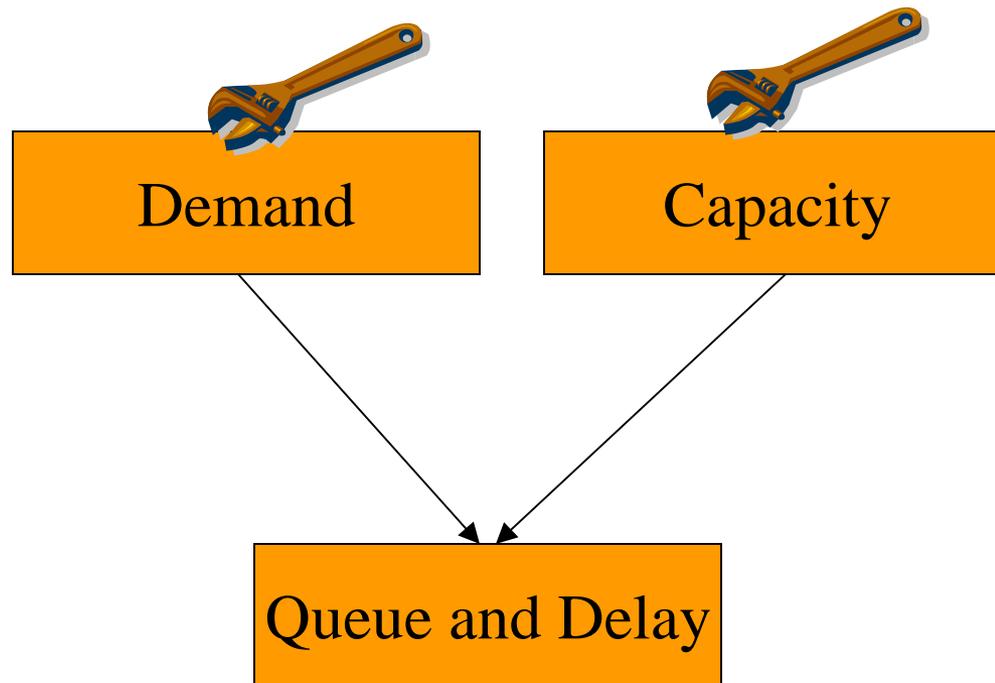
Total Vehicles Affected  
 1119

Delayed Periods  
 10:00:00 AM to 10:41:06 AM

# Transportation Management Plan: Delay

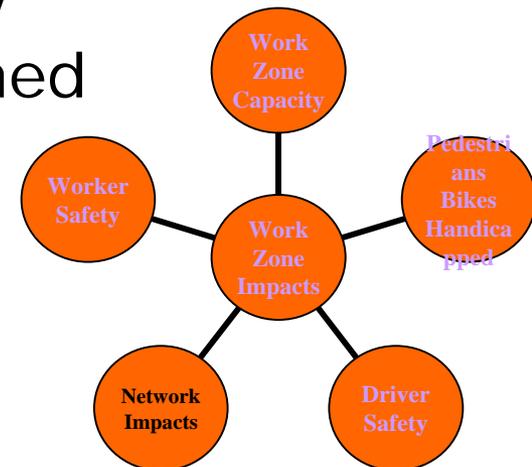


# Transportation Management Plan: Delay



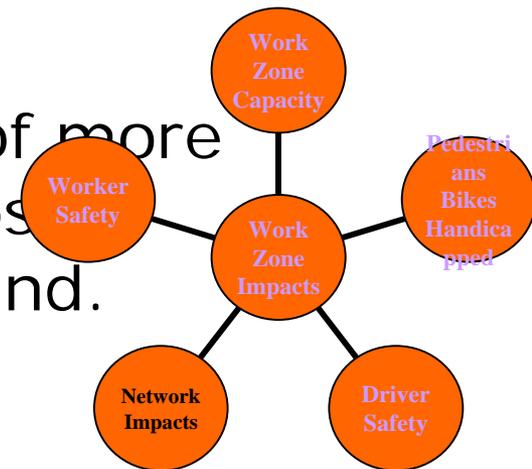
# Transportation Management Plan: Diversion (Urban)

- Diversion occurs naturally due to any excessive delays
- Inconvenient detours are ignored by familiar drivers
- The queues don't grow indefinitely
- Trips may be cancelled or postponed



# Transportation Management Plan: Diversion (Rural)

- Diversion occurs reasonably only when alternative routes are available and the public is informed.
- Queues can grow longer than urban environments since less detour routes are available
- The demand traffic can be made of more long distance trips than urban trips allowing less of reduction of demand.



# Transportation Management Plan: Lane Closure System

- Keeps Track of Lane Closures
- Administers the Approval Process
- Facilitates Access to Available Traffic Data



# Transportation Management Plan: Lane Closure System

- Managing activity according to demand
- Coordination with other closures and events
- Centralized administration

# System Use

## What closures should be tracked?

- All let projects (information formerly entered into Traffic Impediment Module)
- Any planned closures or restrictions on Corridors 2030 roadways
- All major special events

## When should closures be entered?

- 14 days - Project start or full roadway closure
- 7 days - System ramp closure
- 3 days - Lane and service ramp closure

# System Users

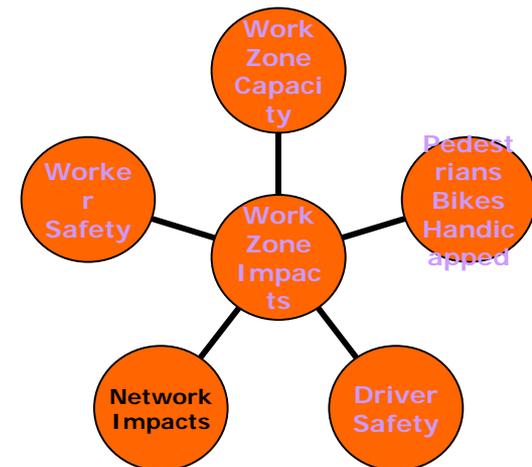
- LCS User Roles
  - Administrator
  - Supervisor
  - **Regional Traffic Engineer (RTE)** - Regional Coordinator
  - **Statewide Traffic Operations Center (STOC)**
  - *Project Manager (PM)*
  - *Permit Coordinator (PC)*
  - *Maintenance Coordinator (MC)*
  - *Project Leader (PL)*
  - Public Information (PUBLIC)
  - Inspector (INSP)
  - Requestor (REQ)
  - Viewer (VIEWER)
- System can be accessed via the Internet – therefore people outside of WisDOT can log on with a username and password

# Acceptance Process

- Closures that will typically be accepted automatically include:
  - Closures that meet requirements outlined in the TMP
- Closures that should follow the approval process include:
  - Maintenance work
  - Short-term project closures – i.e. overnight work

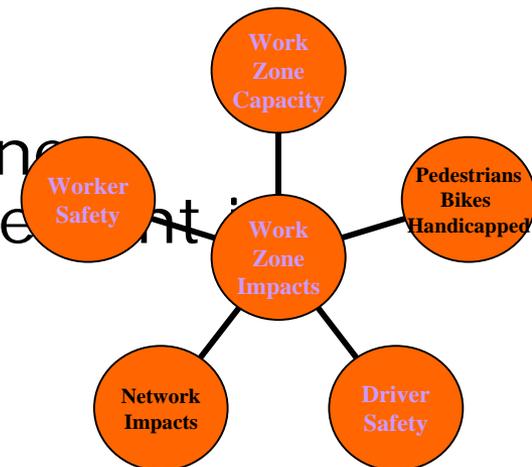
# Transportation Management Plan: Access Impacts

- Hospitals, Schools or Large Traffic Generators
- Emergency Vehicle Access
- Pedestrians, Handicapped
- Bicyclists
- Access to transit



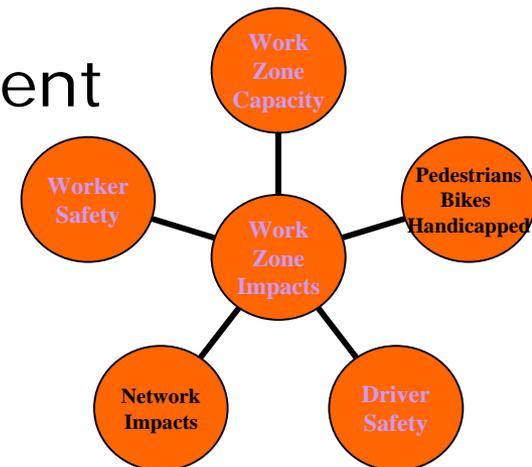
# Transportation Management Plan: Access Impacts

- Over the last decade more than 1200 pedestrians and bicyclists died in work zones.
- Over 10,000 pedestrians and bicyclists were injured in work zone crashes during that same period.
- Non-motorist fatalities (workers, pedestrians, bicyclists) in work zone crashes increased more than 60 percent in the last 5 years.

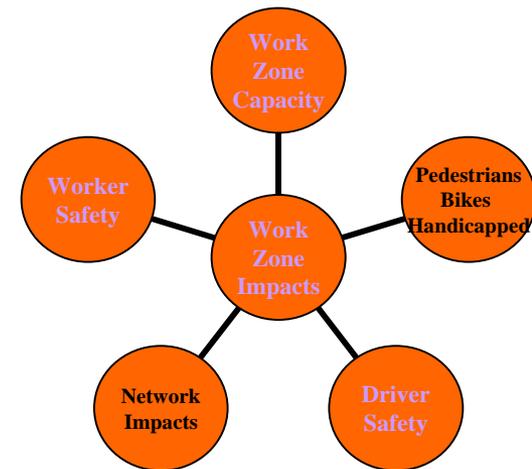
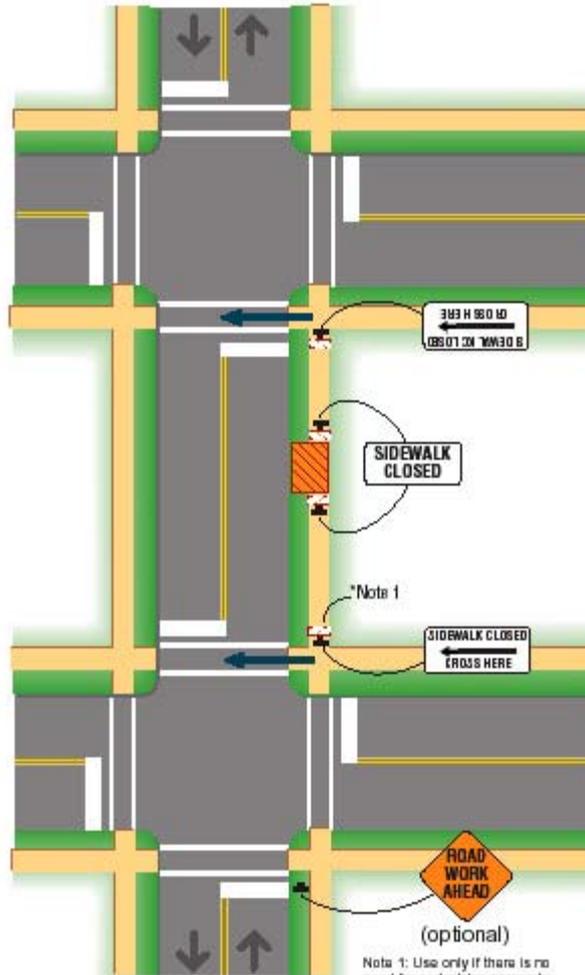
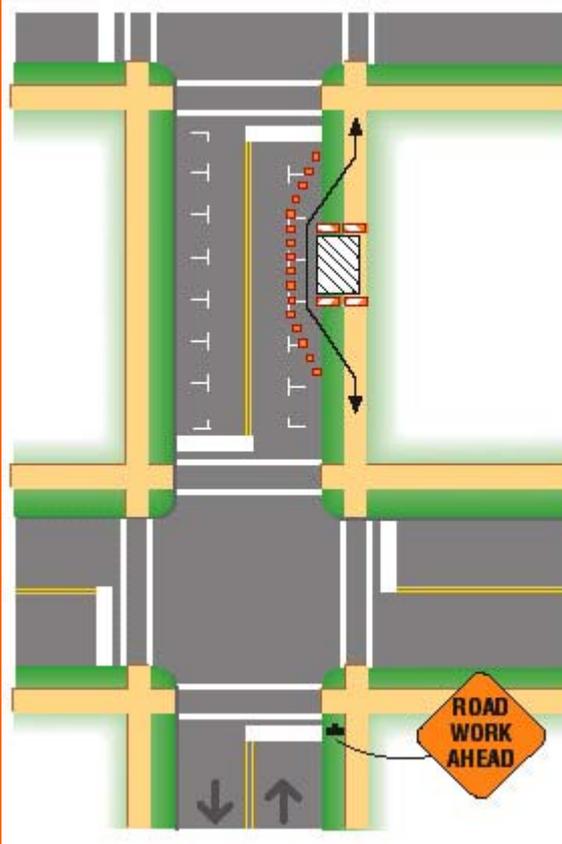


# Transportation Management Plan: Access Impacts

- Avoid direct conflicts between pedestrians and vehicles and work activities
- Provide safe accessible ped facilities that replicate the existing facility
- Provide covered walkways to prevent injury from falling objects
- Businesses need pedestrians



# Transportation Management Plan: Access Impacts



A yellow sign with black text is mounted on a wooden structure. The sign is rectangular and has a corrugated or ribbed texture. The text is arranged in three lines. The background shows a wooden roof and green foliage.

**YOU CAN'T  
GET THERE  
FROM HERE**

# Bikes, Peds & Transit



SESSION \_

# Convenient?



# Constructable?



**Safe?**



# Compliant?



# It Can Be Done!



# Stakeholder Co-ordination

The screenshot shows a web browser window with the address <http://www.megabus.com>. The page features the megabus.com logo and a promotional banner for \$1 fares with a \$0.50 reservation fee. A yellow banner at the top right contains the text "close window [x]".

The main content area is titled "Movement of Milwaukee Bus Stop" and includes a map of downtown Milwaukee. The map shows the intersection of W Clybourn St and W St Paul Ave, with N 6th St, N 5th St, and N 4th St running north-south. A yellow arrow points west along W Clybourn St, indicating the new bus stop location. A bus icon is shown at the intersection of W St Paul Ave and N 5th St. A red text box on the right contains the following message:

**Due to construction the downtown Milwaukee Bus Stops is moving from 4th and St Paul to 5th and St Paul, one block west.**

# Transportation Management Plan: Safety



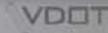
2007 National



Work Zone



Awareness Week

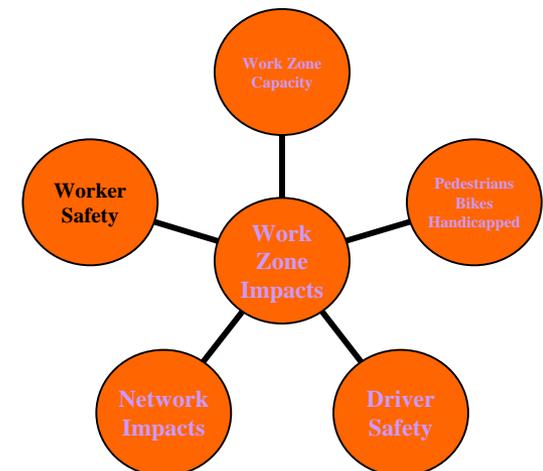


# Transportation Management Plan: Worker Safety

- Conducive work zone is safer
- Properly installed barriers
- Law enforcement presence

ORIGINATOR Director, Bureau of Highway Development	PROCEDURE 11-50-30
CHAPTER 11	Design
SECTION 50	Traffic Control
SUBJECT 30	Law Enforcement in Work Zones

ORIGINATOR Director, Bureau of Highway Operations	11-50-35
CHAPTER 11	Design
SECTION 50	Traffic Control
SUBJECT 35	Concrete Barrier Temporary Precast in Work Zone



# Transportation Management Plan: Driver Safety

- Promote safe behavior through media
- Clearly signed and delineated roadway
- Law enforcement presence
- Reduced delays → Reduced Frustration
- Consistent, timely and accurate signing

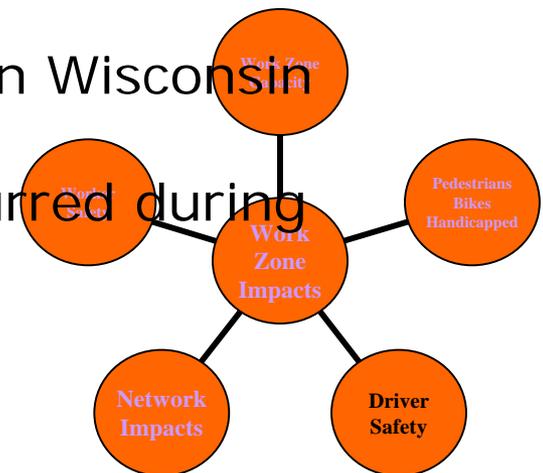
ORIGINATOR Director, Bureau of Highway Operations	11-50-35
CHAPTER 11	Design
SECTION 50	Traffic Control
SUBJECT 35	Concrete Barrier Temporary Precast in Work Zone

ORIGINATOR Director, Bureau of Highway Development	PROCEDURE 11-50-30
CHAPTER 11	Design
SECTION 50	Traffic Control
SUBJECT 30	Law Enforcement in Work Zones



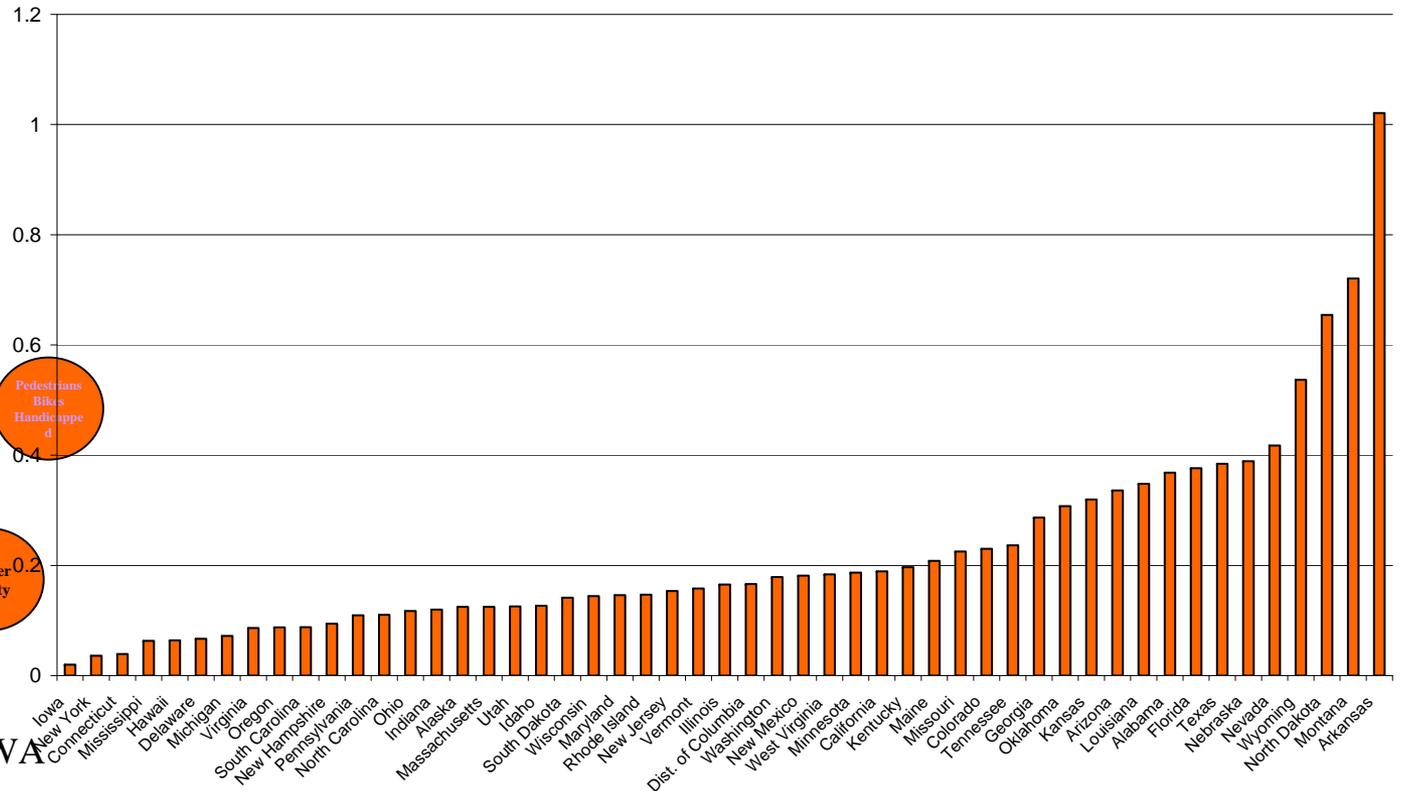
# Transportation Management Plan: Driver Safety

- 85% of those killed in a work zone are drivers or occupants
- More than 40,000 people are injured each year as a result of motor vehicle crashes in work zones.
- 1,010 work zone fatalities in 2006, 14 in Wisconsin
- 50% of all fatal work zone crashes occurred during the day

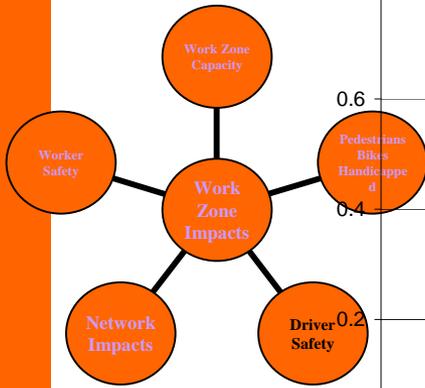


# Transportation Management Plan: Driver Safety

Relative Fatality Rate



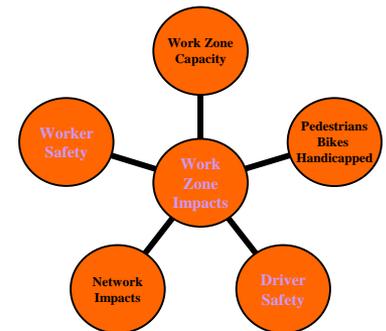
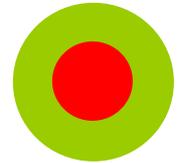
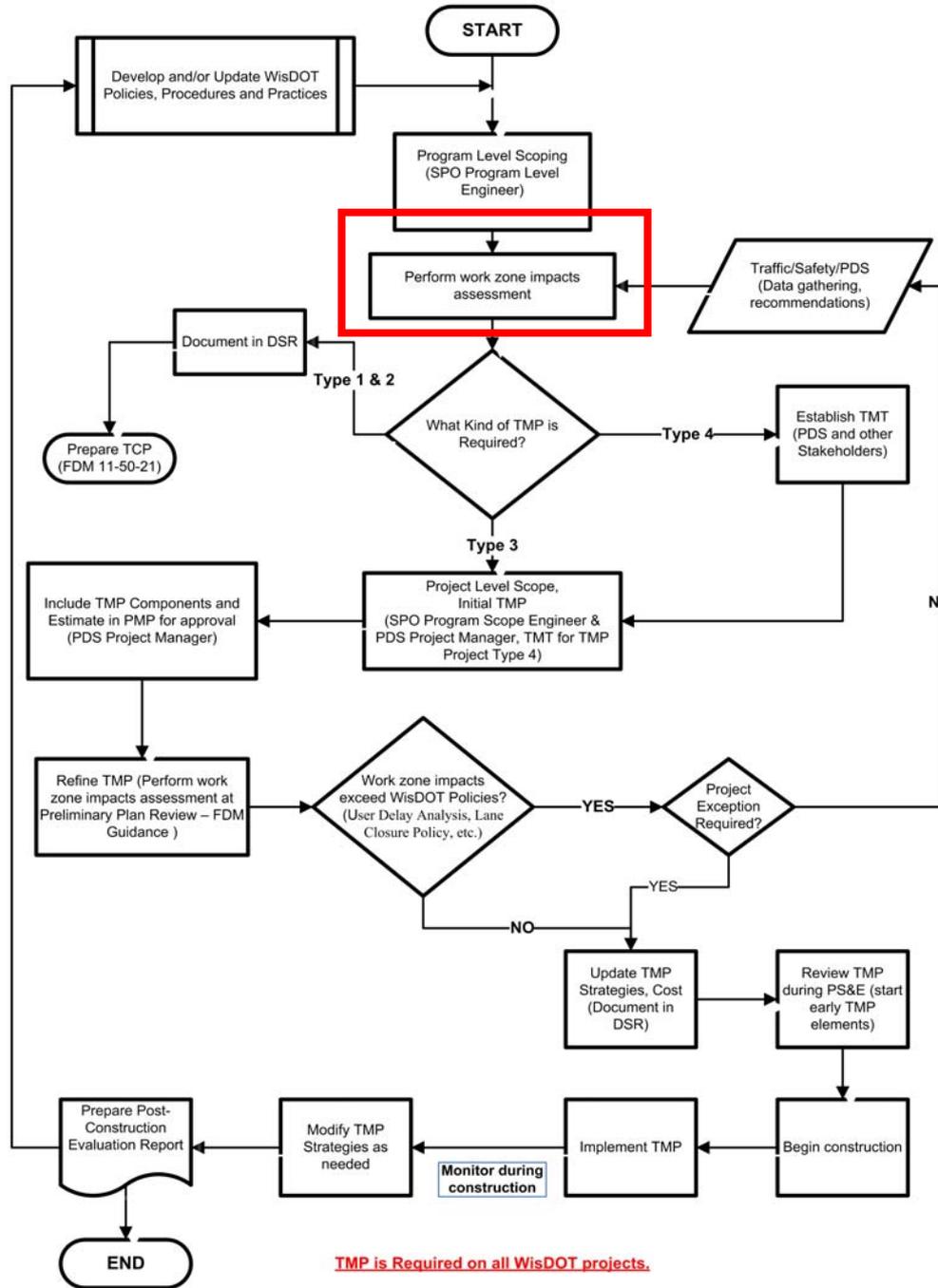
Source: FHWA



# Transportation Management Plan: Safety Experience

	21 Months of Construction		Previous 21 Months	
	Construction Related	Non-construction Related	Construction Related	Non-construction Related
Angle	1	3	0	9
Head-on	0	1	0	0
No Collision With Moving Vehicle	9	36	0	60
Rear-end	26	121	2	155
Same Direction Side Swipe	15	42	0	38

# Transportation Management Plan Process



**TMP is Required on all WisDOT projects.**

# Transportation Management Plan: Work Zone Impacts

- Early Work Zone Impacts Assessment
  - Work Zone Safety and Mobility Impacts
  - Impact of Alternative Project Options
  - Allocate Resources by Impact Magnitude
  - Identify Potential Management Strategies
  - Estimate Cost
  - Coordinate Multiple Projects
  - Productivity and User Impact
  - Obtain Data for Analysis