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
Transportation Management Plan: Process

Transportation Management Plan Process

TMP Document

Process
**TMP Administrative Process**

- **Begin TMP**
  - Scoping
  - Regional WZ Coordinator
  - BPD
  - FHWA (If Fed Oversight)

- **Major Change?**
  - YES
  - Hand-Off to Field Office
  - LET
  - Implement TMP
    - Constr
  - Revise and Update
    - PS&E
  - Initial TMP Approval
    - DSR

- **NO**
  - Implement TMP
  - Constr
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

- Document
- Process
- Policy
- Responsible Parties
Transportation Management Plan: Guidelines

Wisconsin Department of Transportation

GUIDELINES FOR DEVELOPING

Work Zone
Transportation Management Plans
Transportation Management Plan: Typical TMP Types

- Traffic Control Plan
- TYPE 1 TMP
- Public Information and Outreach
Transportation Management Plan: Typical TMP Types

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

TMP TYPE 2,3,4
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

#### Life Cycles

<table>
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<tr>
<th>Stage</th>
<th>LC 00 Unprogrammed</th>
<th>LC 10 Authorized</th>
<th>LC 11 Program Level Scoping</th>
<th>LC 12 PMP Approved</th>
<th>LC 15 DSR</th>
<th>LC 20 PS&amp;E</th>
<th>LC 40 Award</th>
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#### PMP Development Phases

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<th>PMP Approval</th>
<th>Preliminary Plan Review</th>
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<th>PS&amp;E</th>
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#### Project Initiation Process

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<th>Task</th>
<th>Needs Identification</th>
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<th>Concept Definition Report</th>
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<th>PMP Approval</th>
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<td>Identify candidate projects</td>
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Project Coordination

- Projects along a corridor.
- Detours to other STH.
- Detours to county and local roads.
Transportation Management Plan Process

1. Develop and/or Update WisDOT Policies, Procedures and Practices

2. Program Level Scoping (SPO Program Level Engineer)
   - Perform work zone impacts assessment

3. What Kind of TMP is Required?
   - Type 1 & 2
   - Type 3
   - Type 4

4. Establish TMT (PDS and other Stakeholders)

5. Include TMP Components and Estimate in PVM for approval (PDS Project Manager)

6. Project Level Scope, Initial TMP (SPO Program Scope Engineer & PDS Project Manager, TMT for TMP Project, Type 4)

7. Refine TMP (Perform work zone impacts assessment at Preliminary Plan Review – FDM Guidance)

8. Work zone impacts exceed WisDOT Policies? [User Delay Analysis, Loss Count Policy, etc.]
   - YES
   - Project Exception Required?
     - YES
   - Update TMP Strategies, Cost (Document in DSR)
     - Review TMP during P & E (start early TMP elements)

   - NO
     - Modify TMP Strategies as needed
     - Monitor during construction


10. Modify TMP Strategies as needed

11. Implement TMP

12. Begin construction

**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
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
Guidance Material

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

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<th>SUBJECT</th>
<th>WORK ZONE TRAFFIC CONTROL PLAN PROCESS</th>
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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
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
Work Zone
Transportation Management
Plan Development Course

Work Zone Impact
Analysis
Transportation Management Plan Process

START

Develop and/or Update WisDOT Policies, Procedures and Practices

Program Level Scoping (SPO Program Level Engineer)

Perform work zone impacts assessment

Traffic/Safety/PDS (Data gathering, recommendations)

Document in DSR

Type 1 & 2

Prepare TCP (FDM 11-59-21)

Type 4

What Kind of TMP is Required?

Type 3

Establish TMT (PDS and other Stakeholders)

Include TMP Components and Estimate in PMP for approval (PDS Project Manager)

Project Level Scope, Initial TMP (SPO Program Scope Engineer & PDS Project Manager, TMT for TMP Project Type 1 & 2)

Refine TMP (Perform work zone impacts assessment at Preliminary Plan Review – FDM Guidance)

Work zone impacts exceed WisDOT Policies? (User Delay Analysis, Loss Count Policy, etc.)

YES

NO

Project Exception Required?

NO

YES

Update TMP Strategies, Cost (Document in DSR)

Review TMP during PS&E (start early TMP elements)

Prepare Post-Construction Evaluation Report

Modify TMP Strategies as needed

Monitor during construction

Implement TMP

Begin construction

END

TMP is Required on all WisDOT projects.
Transportation Management Plan: Work Zone Impacts Assessment

- Worker Safety
- Network Impacts
- Driver Safety
- Pedestrians Bikes Handicapped
- Work Zone Capacity

Work Zone Impacts
Transportation Management Plan: Work Zone Impacts Context

- Work Zone Impacts
  - Urban
  - Rural
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

DRAFT
Corridor Delay
2007

Legend
- Delay Node
- Point of Entry Node
- Delay Segments

15 min. delay between nodes and within each city node.
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
One Lane Two-Way With Temporary Signal
One Lane Two-Way With Temporary Signal
One Lane Two-Way With Temporary Signal
Pilot Car
Temporary Facilities
Simple Detour
Network Detour
Combinations: Fwy Crossover with Diversion
Mobile Operation on a Two-Lane Road Using Flaggers
(Traveling at less than 3 mph)

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<td>35-40</td>
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<td>45-55</td>
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Mobile Operation
Traffic Data: AADT

Elkhart Lake
Traffic Data: Stations

[Map Interface with various data layers and options]

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

Data Layer Selections:
Active Layer: Asbuilt/Asbuilt Plans

Buttons for Transportation Systems, Local Roads, Local Road Cartesianics, Project Related Data, TRIMAS Count Data, Court Sites, STI Inventory, Legislation Districts, Geographic Reference, Hydrography, Boundaries.
Traffic Data: Stations
### 48 Hour Counts

| Location:               | STH 57 0.5 MI SOUTH OF OZAUKEE-SHEBOYGAN CO LINE |

| Site Names:             | 450101, 2214, SE                          |
| County:                 | Ozaukee                                   |
| Function Class:         | R Principal Arterial - Other             |
| Growth Factor Type:     | 1                                         |
| Daily Factor Type:      | 4                                         |
| Axle Factor Type:       | 1                                         |
| Seasonal Factor Type:   | 4                                         |

#### Hourly Flow Rates

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### Average Hourly Flow Rates

*AM = 0700-0800; PM = 1600-1700; ADJ = Average(0800-0700, 0900-1600, 1800-1900); OFF = Average (1900-0600)*

Hourly Flow Rates Excludes 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

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| **09/06/2007** |               |               |
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| 52 | 30 | 22 | 39 | 21 | 18 |
| 66 | 46 | 20 | 66 | 46 | 20 |
| 182 | 153 | 29 | 164 | 127 | 37 |
| 416 | 341 | 75 | 348 | 283 | 65 |

| **09/07/2007** |               |               |
| Neg | Pos | Neg | Pos | Neg | Pos | Neg | Pos |
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| 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: Urban

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

Traffic Volume (Vehicles/Hr)

Time of Day

Neg DIR
Pos DIR
Hourly Profile: Weekend
I-43 AT WEST CAPITOL DRIVE (MILWAUKEE CO)
Saturdays - October 2007

Traffic Volume (Vehicles per Hour)

Time of Day

Neg DIR  Pos DIR
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

- “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

**During Design Hour**

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<tr>
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<tr>
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<td>K8(ADT) --</td>
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<td>T(A8HV) --</td>
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<th>Seg. 3</th>
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**← 580**

**→ 420**
Intersection Counts

**Osborne Blvd**
- GEH: N/A
- Tube Count: 6273
  - 3118
  - 197 2430 492 3154

**Kinzie Ave**
- Tube: 7275
- 3876 ←
- 204 ↑
- 2742 →
- 453 ↓
- 3399

**West Blvd**
- Tube Count: 10048
- GEH: 0.19

- Expansion Spreadsheet Available
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 pcph (70 mph)
  - 2,350 pcph (65 mph)
  - 2,300 pcph (60 mph)
  - 2,250 pcph (55 mph)

- **Multilane Suburban/Rural**
  - 2,200 pcph (60 mph)
  - 2,100 (55 mph)
  - 2,000 (50 mph)
  - 1,900 (45 mph)

- **2-lane rural** – 2,800 pcph
- **Signal** – 1,900 pcph
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**

<table>
<thead>
<tr>
<th>Site Conditions</th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term construction</td>
<td>Start at 1600 pcphpl</td>
<td>1600 pcphpl</td>
</tr>
<tr>
<td>Long-term construction</td>
<td>Start at 1550 w/ crossover (1750 w/o crossover)</td>
<td>1750 pcphpl</td>
</tr>
</tbody>
</table>

Choose one

Close, Intense Construction Activity Proximity (Large number of work vehicles, workers, noise/dust)

Subtract

<table>
<thead>
<tr>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 160</td>
<td>Up to 160</td>
</tr>
</tbody>
</table>

Construction Activity Less Intense than Average (Guardrail/barrier installation, pavement repairs at intermittent spot locations, work activity across median)

Add

<table>
<thead>
<tr>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 160</td>
<td>Up to 160</td>
</tr>
</tbody>
</table>

Choose any that apply

<table>
<thead>
<tr>
<th>Site Conditions</th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>11' lane width</td>
<td>Multiply 0.97</td>
<td>0.97</td>
</tr>
<tr>
<td>10.5' lane width</td>
<td>Multiply 0.95</td>
<td>0.95</td>
</tr>
<tr>
<td>Shoulder width &lt; 6'</td>
<td>Multiply 0.97</td>
<td>0.97</td>
</tr>
<tr>
<td>Heavy Vehicle/Truck Volume</td>
<td>Multiply (1-%Truck)</td>
<td>(1-%Truck)</td>
</tr>
<tr>
<td>Onramp within 1500' downstream of lane closure taper</td>
<td>Subtract Hourly ramp volume (600 max)</td>
<td>Hourly ramp volume (600 max)</td>
</tr>
</tbody>
</table>
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.

\[ C_a = (1600 + 80-80) \times (1-0.1) \times 1 \times (0.97) = 1397 \text{ vehicles/hour} \]
Transportation Management Plan: WZ Queueing

How does a queue form?
Transportation Management Plan: WZ Queueing

How to estimate queue?

- **Basic Theory**
  - HCM Guidance
  - \( \text{Queue}_L = f(\text{Demand-Capacity}) \)

- **Example**
  - 1 lane open (WZ capacity = 1600 pc/hr)

<table>
<thead>
<tr>
<th>Time</th>
<th>Demand</th>
<th>Capacity</th>
<th>Queued Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00</td>
<td>500</td>
<td>400</td>
<td>100</td>
</tr>
<tr>
<td>10:15</td>
<td>400</td>
<td>400</td>
<td>100</td>
</tr>
<tr>
<td>10:30</td>
<td>300</td>
<td>400</td>
<td>0</td>
</tr>
<tr>
<td>10:45</td>
<td>200</td>
<td>200</td>
<td>0</td>
</tr>
</tbody>
</table>
Defining 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...

\[ T_{FF} = \frac{20 \text{ miles}}{60 \text{ mph}} = 0.33 \text{ hr} = 20 \text{ min} \]
\[ T_A = \frac{20 \text{ miles}}{40 \text{ mph}} = 0.50 \text{ hr} = 30 \text{ min} \]
\[ D = 10 \text{ minutes (without construction)} \]
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...

\[ T_{FF} = \frac{20 \text{ miles}}{60 \text{ mph}} = 0.33 \text{ hr} = 20 \text{ min} \]
\[ T_A = \frac{20 \text{ miles}}{40 \text{ mph}} = 0.50 \text{ hr} = 30 \text{ min} \]
\[ D = 10 \text{ minutes (without construction)} \]
\[ T_{WZ} = \frac{20 \text{ miles}}{30 \text{ mph}} = 0.67 \text{ hr} = 40 \text{ min} \]
\[ D_{WZ} = 20 \text{ minutes (with construction)} \]
\[ \Delta D = 20 \text{ min} - 10 \text{ min} = 10 \text{ min} \]
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% x $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
- $D = 10 min

User Delay Cost:
\[
1500 \times 1.25 \times \frac{10}{60} \times 8.83 = 2760/\text{hr}
\]
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

## Lane Restrictions

**Queue Analysis for**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00:00 AM</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>0.2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>10:00:06 AM</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>0.3</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>10:00:12 AM</td>
<td>3</td>
<td>1</td>
<td>6</td>
<td>0.5</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>10:00:18 AM</td>
<td>3</td>
<td>1</td>
<td>8</td>
<td>0.6</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>10:00:24 AM</td>
<td>3</td>
<td>1</td>
<td>10</td>
<td>0.7</td>
<td>17</td>
<td>7</td>
</tr>
<tr>
<td>10:00:30 AM</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>0.9</td>
<td>20</td>
<td>8</td>
</tr>
<tr>
<td>10:00:36 AM</td>
<td>3</td>
<td>1</td>
<td>13</td>
<td>1.0</td>
<td>23</td>
<td>10</td>
</tr>
<tr>
<td>10:00:42 AM</td>
<td>3</td>
<td>1</td>
<td>15</td>
<td>1.2</td>
<td>27</td>
<td>11</td>
</tr>
<tr>
<td>10:00:48 AM</td>
<td>3</td>
<td>1</td>
<td>17</td>
<td>1.3</td>
<td>30</td>
<td>13</td>
</tr>
<tr>
<td>10:00:54 AM</td>
<td>3</td>
<td>1</td>
<td>19</td>
<td>1.4</td>
<td>33</td>
<td>14</td>
</tr>
<tr>
<td>10:01:00 AM</td>
<td>3</td>
<td>1</td>
<td>21</td>
<td>1.6</td>
<td>37</td>
<td>15</td>
</tr>
<tr>
<td>10:01:06 AM</td>
<td>3</td>
<td>1</td>
<td>23</td>
<td>1.7</td>
<td>40</td>
<td>17</td>
</tr>
<tr>
<td>10:01:12 AM</td>
<td>3</td>
<td>1</td>
<td>25</td>
<td>1.8</td>
<td>43</td>
<td>18</td>
</tr>
<tr>
<td>10:01:18 AM</td>
<td>3</td>
<td>1</td>
<td>27</td>
<td>2.0</td>
<td>46</td>
<td>20</td>
</tr>
<tr>
<td>10:01:24 AM</td>
<td>3</td>
<td>1</td>
<td>29</td>
<td>2.1</td>
<td>50</td>
<td>21</td>
</tr>
<tr>
<td>10:01:30 AM</td>
<td>3</td>
<td>1</td>
<td>31</td>
<td>2.3</td>
<td>53</td>
<td>22</td>
</tr>
<tr>
<td>10:01:36 AM</td>
<td>3</td>
<td>1</td>
<td>33</td>
<td>2.4</td>
<td>56</td>
<td>24</td>
</tr>
<tr>
<td>10:01:42 AM</td>
<td>3</td>
<td>1</td>
<td>35</td>
<td>2.5</td>
<td>60</td>
<td>25</td>
</tr>
<tr>
<td>10:01:48 AM</td>
<td>3</td>
<td>1</td>
<td>37</td>
<td>2.7</td>
<td>63</td>
<td>26</td>
</tr>
<tr>
<td>10:01:54 AM</td>
<td>3</td>
<td>1</td>
<td>39</td>
<td>2.8</td>
<td>66</td>
<td>28</td>
</tr>
<tr>
<td>10:02:00 AM</td>
<td>3</td>
<td>1</td>
<td>40</td>
<td>3.0</td>
<td>70</td>
<td>29</td>
</tr>
<tr>
<td>10:02:06 AM</td>
<td>3</td>
<td>1</td>
<td>42</td>
<td>3.1</td>
<td>73</td>
<td>31</td>
</tr>
<tr>
<td>10:02:12 AM</td>
<td>3</td>
<td>1</td>
<td>44</td>
<td>3.2</td>
<td>76</td>
<td>32</td>
</tr>
<tr>
<td>10:02:18 AM</td>
<td>3</td>
<td>1</td>
<td>46</td>
<td>3.4</td>
<td>80</td>
<td>33</td>
</tr>
<tr>
<td>10:02:24 AM</td>
<td>3</td>
<td>1</td>
<td>48</td>
<td>3.5</td>
<td>83</td>
<td>35</td>
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<td>10:02:30 AM</td>
<td>3</td>
<td>1</td>
<td>50</td>
<td>3.6</td>
<td>86</td>
<td>36</td>
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<td>3</td>
<td>1</td>
<td>52</td>
<td>3.8</td>
<td>90</td>
<td>38</td>
</tr>
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<td>10:02:42 AM</td>
<td>3</td>
<td>1</td>
<td>54</td>
<td>3.9</td>
<td>93</td>
<td>39</td>
</tr>
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<td>10:02:48 AM</td>
<td>3</td>
<td>1</td>
<td>56</td>
<td>4.1</td>
<td>96</td>
<td>40</td>
</tr>
<tr>
<td>10:03:00 AM</td>
<td>3</td>
<td>1</td>
<td>58</td>
<td>4.2</td>
<td>100</td>
<td>42</td>
</tr>
<tr>
<td>10:03:06 AM</td>
<td>3</td>
<td>1</td>
<td>60</td>
<td>4.3</td>
<td>103</td>
<td>43</td>
</tr>
<tr>
<td>10:03:12 AM</td>
<td>3</td>
<td>1</td>
<td>62</td>
<td>4.5</td>
<td>106</td>
<td>45</td>
</tr>
</tbody>
</table>

**Total Delay (vehicle-hours)**: 100.326067

**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

Queue and Delay

Demand

Capacity
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
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

- Worker Safety
- Network Impacts
- Driver Safety
- Pedestrians
- Bikes
- Handicapped
- Work Zone Capacity
- Work Zone Impacts

Note: Use only if there is no need for pedestrian access to businesses, neighborhood, etc. within the sidewalk closure.
YOU CAN'T GET THERE FROM HERE
Bikes, Peds & Transit
Convenient?
Constructable?
Safe?
Compliant?
It Can Be Done!
Stakeholder Co-ordination

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
Transportation Management Plan: Worker Safety

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

Source: FHWA
Transportation Management Plan: Driver Safety

Source: FHWA
## Transportation Management Plan: Safety Experience

<table>
<thead>
<tr>
<th></th>
<th>21 Months of Construction</th>
<th>Previous 21 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Construction Related</td>
<td>Non-construction Related</td>
</tr>
<tr>
<td>Angle</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Head-on</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>No Collision With Moving Vehicle</td>
<td>9</td>
<td>36</td>
</tr>
<tr>
<td>Rear-end</td>
<td>26</td>
<td>121</td>
</tr>
<tr>
<td>Same Direction Side Swipe</td>
<td>15</td>
<td>42</td>
</tr>
</tbody>
</table>
Transportation Management Plan Process

START

Develop and/or Update WisDOT Policies, Procedures and Practices

Program Level Scoping (SPO Program Level Engineer)

Perform work zone impacts assessment

Document in DSR

Type 1 & 2

Type 3

Prepare TCP (FDM 11-59-21)

Include TMP Components and Estimate in PMP for approval (PDS Project Manager)

Project Level Scope, Initial TMP (SPO-Program Scope Engineer & PDS Project Manager, TMT for TMP Project Type 4)

What Kind of TMP is Required?

Type 4

Establish TMT (PDS and other Stakeholders)

NO

Refine TMP (Perform work zone impacts assessment at Preliminary Plan Review – FDM Guidance)

Work zone impacts exceed WisDOT Policies? (User Delay Analysis, Lost Count Policy, etc.)

NO

YES

YES

Project Exception Required?

Update TMP Strategies, Cost (Document in DSR)

Review TMP during P&SE (start early TMP elements)

Prepare Post Construction Evaluation Report

Modify TMP Strategies as needed

Monitor during construction

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