Active Traffic Management in Michigan

Patrick Johnson, P.E.
HNTB Michigan Inc.
Active Traffic Management Strategies:
- Dynamic Lane Use
- Dynamic Shoulder Use
- Queue Warning
- Dynamic Speeds
- Adaptive Ramp Metering
- Adaptive Signal Control
- Dynamic Junction Control
- Dynamic Merge
- Dynamic Lane Reversal
- Transit Signal Priority
Michigan’s ATM Projects

- US-23 Ann Arbor
  *In Operation*

- I-96 Oakland County
  *Design Phase*

- I-496/US-127 Lansing
  *Planning Phase*
US-23 Corridor

- Recurring *Directional* Peak Hour Congestion
- Non-Recurring Congestion due to incidents and special events
- Interchange and Mainline Operational Issues
- Aging Pavement
- Aging Bridges with Substandard Underclearance
Planning for US-23 ATM

- OVER 75 PUBLIC, LOCAL AGENCY AND STAKEHOLDER MEETINGS
- Early outreach resulted in some public and agency controversy
- Concerns expressed about secondary traffic impacts
  - Will there be induced traffic?
  - What are the downstream impacts?
  - Will the ATM project discourage transit alternatives?
- Resulted in an Environmental Assessment (EA) being initiated and completed
Environmental Assessment
Alternatives Studied

- No Build
- Traffic System Management (TSM)
- Ramp Metering
- Active Traffic Management (ATM) with Dynamic Shoulder and Lane Use
- ATM – High Occupancy Vehicles (HOV) with Dynamic Shoulder and Lane Use
Some of the Factors Addressed in the EA

- Traffic Impacts
- Pedestrian and Non-Motorized
- Parks and Recreation Areas
- Air Quality
- Highway Noise
- Environmental Contamination
- Water Quality
- Threatened and Endangered Species
- Construction Impacts
- Public Input
Dynamic Shoulder Use
Traffic Analysis

- Used regional travel demand models and historical counts to project future traffic
- Traffic Projections for ATM with Dynamic Shoulder (compared to No-Build)
  - SB US-23 increases approx. 18% in AM
  - NB US-23 increases approx. 9% in PM
- Used VISSIM traffic simulation to compare all alternatives
US-23 Overall Project

- **Capital Preventive Maintenance (CPM) Jobs**
  - From Silver Lake Road to M-14

- **Bridge Replacement/Widen**
  - 8 Mile Road Replacement
  - Railroad Bridge Widening
  - Barker Road Bridge Widening
  - 6 Mile Road Replacement
  - N. Territorial Bridge Replacement

- **Bridge Repair**
  - Joy Road over US-23
  - Warren Road over US-23

- **Flex Route and ITS Projects**
  - From 9 Mile Road/M-36 to M-14

- **Ramps**
  - Upgrade the Ramps at N. Territorial Road, Barker Road, 6 Mile Road, 8 Mile Road, and M-36

For More Information:
Contact the Brighton TSC, 810-227-4681
www.flexroute23.com
Dynamic Shoulder Use (in median)
Dynamic Lane Use
Queue Warning
Variable Speed Advisories
US-23 ATM
“Flex Route”

- ATM Components:
  - Dynamic Lane and Shoulder Use
  - Queue Warning
  - Variable Speeds

- ITS Equipment:
  - 33 Gantries
  - 93 Lane Control Signs
  - 9 Small Dynamic Message Signs
  - 3 Large Dynamic Message Signs
  - 11 Microwave Vehicle Detection
  - 21 Low-light cameras
Design Challenges

• Gantry Placement
• Gantry Design
• Availability of Power
• Backhaul Communications
• Signing and Pavement Marking
• Rural freeway with “Dark Sky’s” Ordinance
Gantry Placement

- ½ Mile preferred spacing
- Horizontal curves
- Crest vertical curves
- Entrance and exit ramps
- Bridges
- Availability of Power
- Road Designer
Gantry Design

- Truss style gantry system – MDOT Type E
- 7’ x 5’ Lane Control Signs
- Added Conduit for Power and Comms
- Low Light Camera on Median Side
- MVDS on outside of gantry
- 3 LCS on each Truss
- 9 Small DMS placed strategically
Power

- Rural Area with limited power available at MDOT ROW
- Developed Distribution System
  - 7 or 8 service points
  - Installed distribution panel to feed multiple gantries from 1 service point
  - Installed step-up and step-down transformers to address voltage drop on long runs
  - Developed several new ITS detail
Communications

- Fiber Optic Distribution Network
- Evaluated several options
  - Licensed Wireless
  - Extension of Fiber
  - Verizon and AT&T Fiber
- Needed redundant backhaul
- Utilizing Ethernet Private Line Service with two points of presence
• During design, limited guidance available for median shoulder
• Used solid yellow line on both sides of dynamic shoulder
• Regulatory sign for shoulder usage
• Supplemented the NB lane drop with a disappearing legend sign
Clearing the Dynamic Shoulder

- No freeway lighting for most of corridor
- Must verify that the shoulder is free from obstructions before opening
  - Freeway Courtesy Patrol
  - Low Light Cameras
- Developed procedures for removing an obstruction from the shoulder
Construction of US-23

- Letting on October 7, 2016
- Construction started early November 2016
- Construction ended in November of 2017
- ATM/Flex Route is currently operational
Installed Gantry
• Displayed different graphics to avoid driver confusion
• Displayed actual graphics in closed section of roadway
• Final System Testing
  – performed with night-time full closures
  – Tested several ATM scenarios
Lessons Learned from Construction

• Modifications made to LCS
  – Controllers removed from sign and placed in cabinet
  – Increased cabinet size to accommodate additional controllers

• Maintenance Efficiencies
  – Installed Iboot bars in each cabinet in order to remotely re-boot equipment to decrease maintenance response times
  – Installed environmentally controlled laptops at the two nodes to reduce response time for maintenance
Every day, 60,000 to 65,000 vehicles on average travel US-23 between the US-23/M-14 interchange and Silver Lake Road. Congestion and delays are common, especially in the southbound direction during the morning peak hours and in the northbound direction during the evening peak hours. To lessen the impacts of heavy directional commuter travel patterns and to promote safety, MDOT is making several improvements to the corridor.

In 2017-18, MDOT will make improvements on the busy US-23 corridor from the US-23/M-14 west interchange north to Silver Lake Road. The project, which underwent an Environmental Assessment (EA) study in 2014-15, includes:

- Replacing the bridges at 8 Mile Road, 6 Mile Road and N. Territorial Road.
- Replacing the bridges at Joy Road and Warren Road.
- Upgrading acceleration and deceleration ramps at 8 Mile Road, 6 Mile Road, N. Territorial Road, and M-36.
- Replacing pavement including upgrading the median shoulder, along US-23 between US-23/M-14 and Silver Lake Road to improve traffic flow and promote safety.
- Installing a Flex Route system to manage peak-hour traffic congestion.

New Flex Route system promotes traffic flow and safety.

The new Flex Route system is a lane control system that uses cameras and electronic message boards to let drivers know when an additional lane is available for use during morning and afternoon peak travel periods.

There will be six crash investigation sites built along the corridor that will allow traffic to continue uninterrupted when incidents occur on the freeway.

The Flex Route system is monitored by MDOT’s Statewide Transportation Operations Center, through the use of expanded Intelligent Transportation System technology.

Contact
Brighton Transportation Service Center
810-227-4801
US-23 Kickoff Event
Software Development
Peak Hour Operations

• Show video of ATMS software operations
Congestion Management
Performance Monitoring

• Region and TSC are monitoring the performance
• Providing monthly performance measures
  – Travel times, speeds, and planning time index
  – Operation and Maintenance costs
  – Feedback from agency partners, the public, and emergency responders
Speed Performance Before

Southbound

Northbound

Project Limits

The raw measured speed.
Speed Performance After

<table>
<thead>
<tr>
<th>Time</th>
<th>Southbound</th>
<th>Northbound</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 AM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 AM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 AM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 AM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 AM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 AM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 PM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 PM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 PM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 PM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 PM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 PM</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Project Limits

- Southbound: 12 AM, 2 AM, 4 AM, 6 AM, 8 AM, 10 AM, 12 PM, 2 PM, 4 PM, 6 PM, 8 PM, 10 PM
- Northbound: 12 AM, 2 AM, 4 AM, 6 AM, 8 AM, 10 AM, 12 PM, 2 PM, 4 PM, 6 PM, 8 PM, 10 PM

- US-23
- SILVER LAKE RD/EXIT 55
- M-36/EXIT 54
- 8 MILE RD/EXIT 53
- 6 MILE RD/EXIT 50
- NORTH TERRITORIAL...
- M-14/EXIT 45
- M-14/EXIT 42

The raw measured speed.
US-23 Flex Route Enforcement

- State police patrolled 12 hours a day for first 3 weeks when ATM opened
- 22 citations written for “improper lane use” of Flex Lane
- Overall, MSP is seeing good compliance
Feedback Received

• Overall, receiving positive feedback regarding the Flex Route operation from public and media

• FAQs or concerns:
  – Why didn’t you just widen to 3 lanes?
  – Why isn’t the shoulder open more often?
  – What do the speeds over the lane mean?
MDOT Part-Time Shoulder Use

- US-23 Ann Arbor
  Construction Phase
- I-96 Oakland County
  Design Phase
- I-496/US-127 Lansing
  Planning Phase
I-96 ATM Project
Existing Corridor Conditions

- Recurring directional congestion
  - Eastbound in the morning
  - Westbound in the afternoon
- Frequent incidents
  - Extensive travel times
  - Inconsistent travel time reliability
  - Existing wide median shoulders
Next Steps

- Stakeholder Meeting: February 2018
- Complete EPE Phase: April 2018
- Begin PE Phase & Submit 30% Design Plans: August 2018