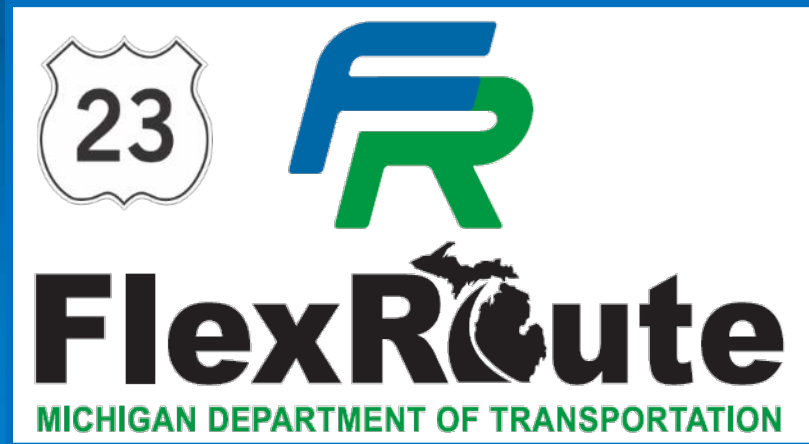


US-23 Flex Route



Jennifer Foley
University Region Traffic & Operations Engineer
Michigan Department of Transportation
October 22nd, 2018
National Rural ITS Conference

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Background



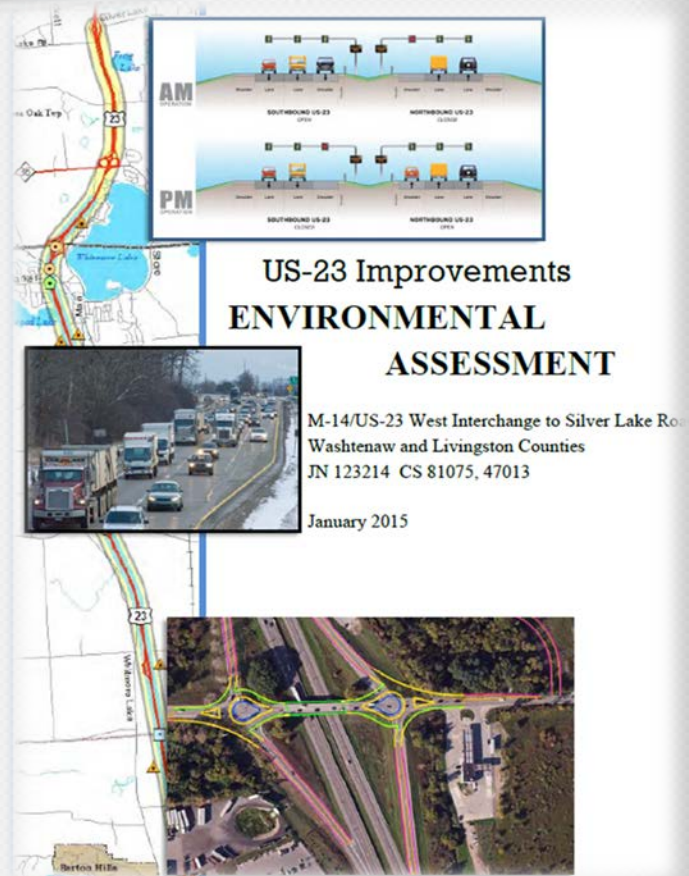
- Located North of Ann Arbor
- Recurring Directional Peak Hour Congestion
- Non-Recurring Congestion
 - Incidents
 - Special events
- Interchange and Mainline Operational Issues
- Road and bridge improvements already planned



23

Planning for the Flex Route

- First ATM in Michigan
- Started early outreach in 2013
- Dynamic Shoulder Use was controversial issue
- Performed an Environmental Assessment
- ATM with dynamic shoulder use was the preferred alternative
- Construction began in Nov. 2016





Gantry Design

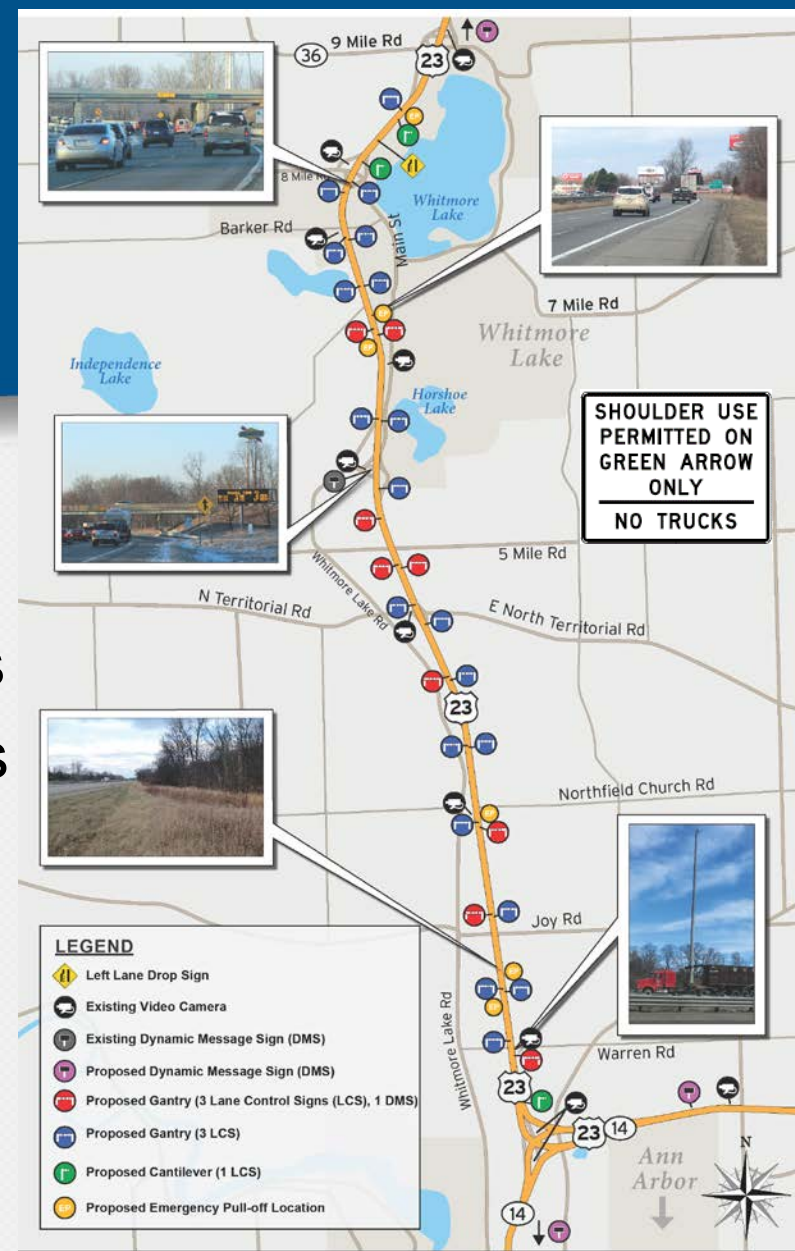
- ATM Strategies:
 - Dynamic Shoulder Use
 - Dynamic Lane Use
 - Variable Speed Advisories
 - Queue Warning
- System Details:
 - 8.5 Miles long
 - Truss style gantry system spaced at ½ mile
 - 5' x 5.5' Lane Control Signs
 - 9 Small DMS
 - Cameras and detection





US-23 ATM “Flex Route”

- 33 Gantries
- 93 Lane Control Signs
- 9 Small Dynamic Message Signs
- 3 Large Dynamic Message Signs
- 11 Microwave Vehicle Detection
- 21 Low-light cameras
- 11 miles of fiber/conduit





- # When traffic was



Operation of the Flex Route

- System was fully operational in January of 2018
- ATM Strategies:
 - Dynamic Shoulder Use
 - Dynamic Lane Use
 - Variable Speeds
 - Queue Warning



Dynamic Shoulder

- Using the median shoulder for directional peaks
- Scheduled to open during weekday peaks:
 - Southbound from 6:00 to 9:30 AM
 - Northbound from 3:00 to 7:00 PM
- Operator confirms that the shoulder is clear
 - By Freeway Courtesy Patrol
 - By Cameras
- Also an alert when congestion thresholds are met





Dynamic Shoulder





Dynamic Shoulder Lane Drop

- Lane Drop at northbound end of Flex Route
 - Signing sequence:
 - Cantilever with Merge
 - Then disappearing legend sign with merge right symbol
 - Then cantilever with Red X





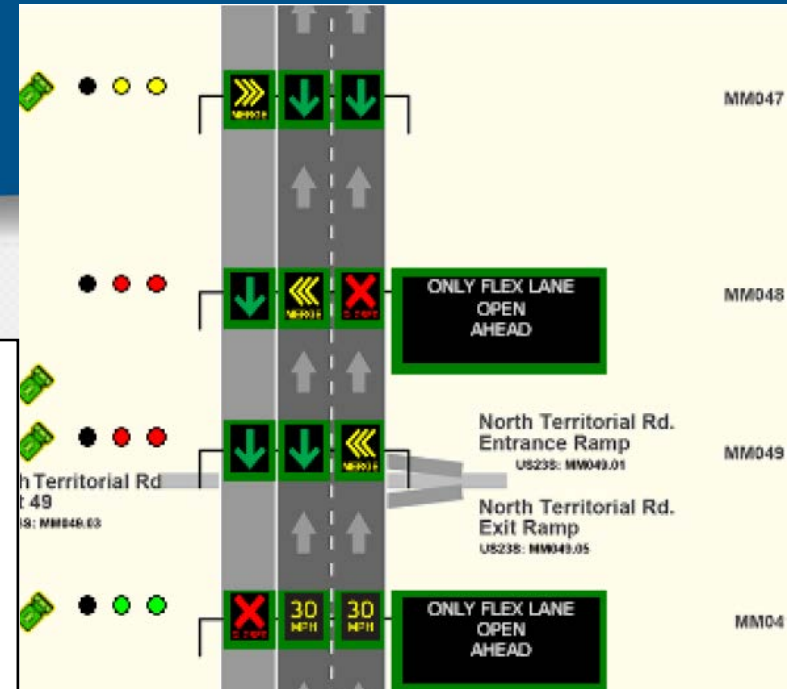
Dynamic Lane Use

- Used to manage incidents and construction activities
- Anticipated that it would be used more often for incidents
- Most incidents are occurring outside the limits of the Flex Route





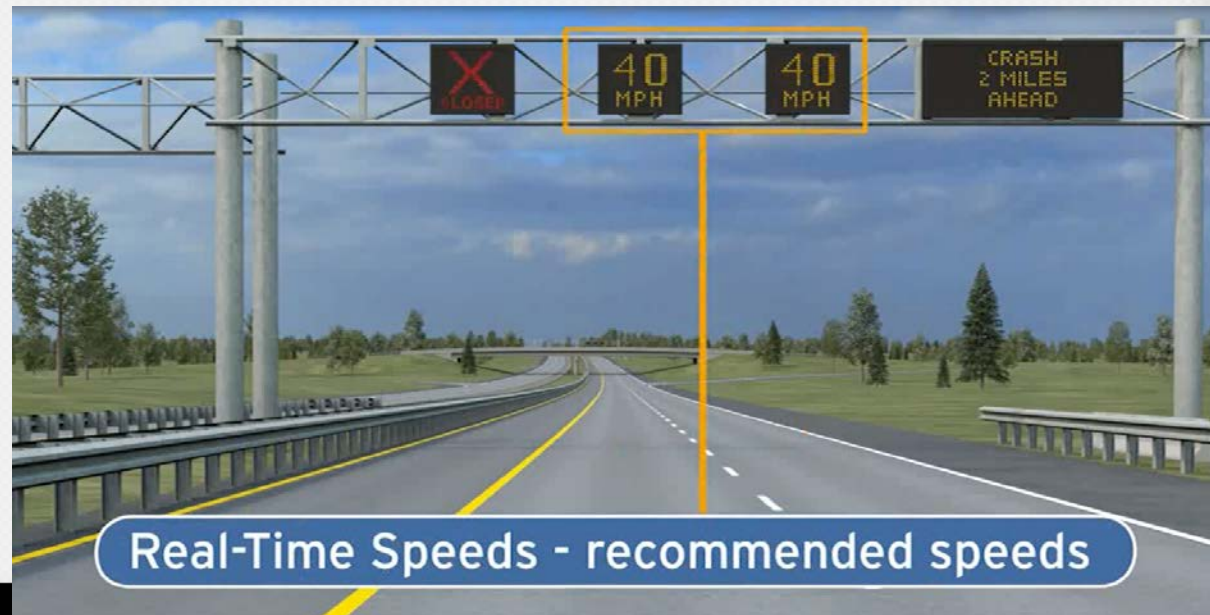
Dynamic Lane Use





Variable Speeds

- Based on real-time speed data collected from MVDS
- Calculated in 30 second intervals
- Displayed in 60 second intervals
- When speeds drop, VSL will drop by increments of 10 mph





Variable Speeds

- When dynamic shoulder is opened, VSL automatically runs and is posted at 60 mph
 - narrow dynamic shoulder width (11 feet)
 - 2 foot shy distance to barrier or guardrail
 - horizontal curvature
 - required a design exception
- VSL will change back to faster speeds in larger increments
- When VSL drops below 30 mph, we post SLOW





Variable Speeds





Variable Speeds in Winter Weather

- During winter operations (snow storms) developed procedures with Michigan State Police:
 - Mild Storms- allow the VSL to run normally
 - Moderate Storms- manually set the max. VSL speed to 40 mph
 - Severe Storms- override the VSL with “SLOW”



Flex Route QRG 11 – ATM SYSTEM USE DURING WINTER MAINTENANCE



When to Use

- Using the ATM system during winter maintenance events.

Winter Maintenance Event Categories

1. Winter maintenance events are defined by the following three categories:
 - Mild – light snow, winter maintenance is monitoring and potentially plowing
 - Moderate – snowing, winter maintenance plowing and using salt
 - Severe – heavy snow / white out conditions, winter maintenance plowing and using salt plus chemicals

Using VSL Advisory Speed

2. The VSL Advisory Speed System can be used during winter maintenance based on the following three event categories:
 - Mild – Allow the VSL Advisory Speed System to run as ATMS software recommends.
 - Moderate – Manually set maximum advisory speed due to weather at the direction of MDOT or MSP.
 - Severe – Override the VSL Advisory Speed message with “SLOW”.

Note: See QRG 02 – Variable Speed Advisory for instruction on operating and overriding the VSL Advisory Speed.

3. Priority for Small DMS messaging:
 - 1) Queue Warning messages (automated response).
 - 2) Winter Weather Message (manual override).
 - 3) Shoulder Open/Closed to Traffic (automated response).
4. TOC Operator to maintain contact with winter maintenance personnel to determine when winter maintenance event is over and remove VSL Advisory Speed overrides.

Contacts

5. If median shoulder roadway conditions appear to be snow/ice covered, contact the Brighton Maintenance Garage or Washtenaw County Road Commission to inquire if they plan to plow again. If conditions warrant, the median shoulder may be closed at the direction of MDOT, MSP, or Washtenaw County Road Commission.



Variables Speed in Winter Storm





Queue Warning

- When VSL activated, queue warning system is on
- Message on the small DMS states slow or stopped traffic, X.X miles ahead
- Queue Warning has highest priority on small DMS
- 9 small DMSs used for queue warning
 - strategically placed
 - complicated logic for software configuration



Queue Warning System

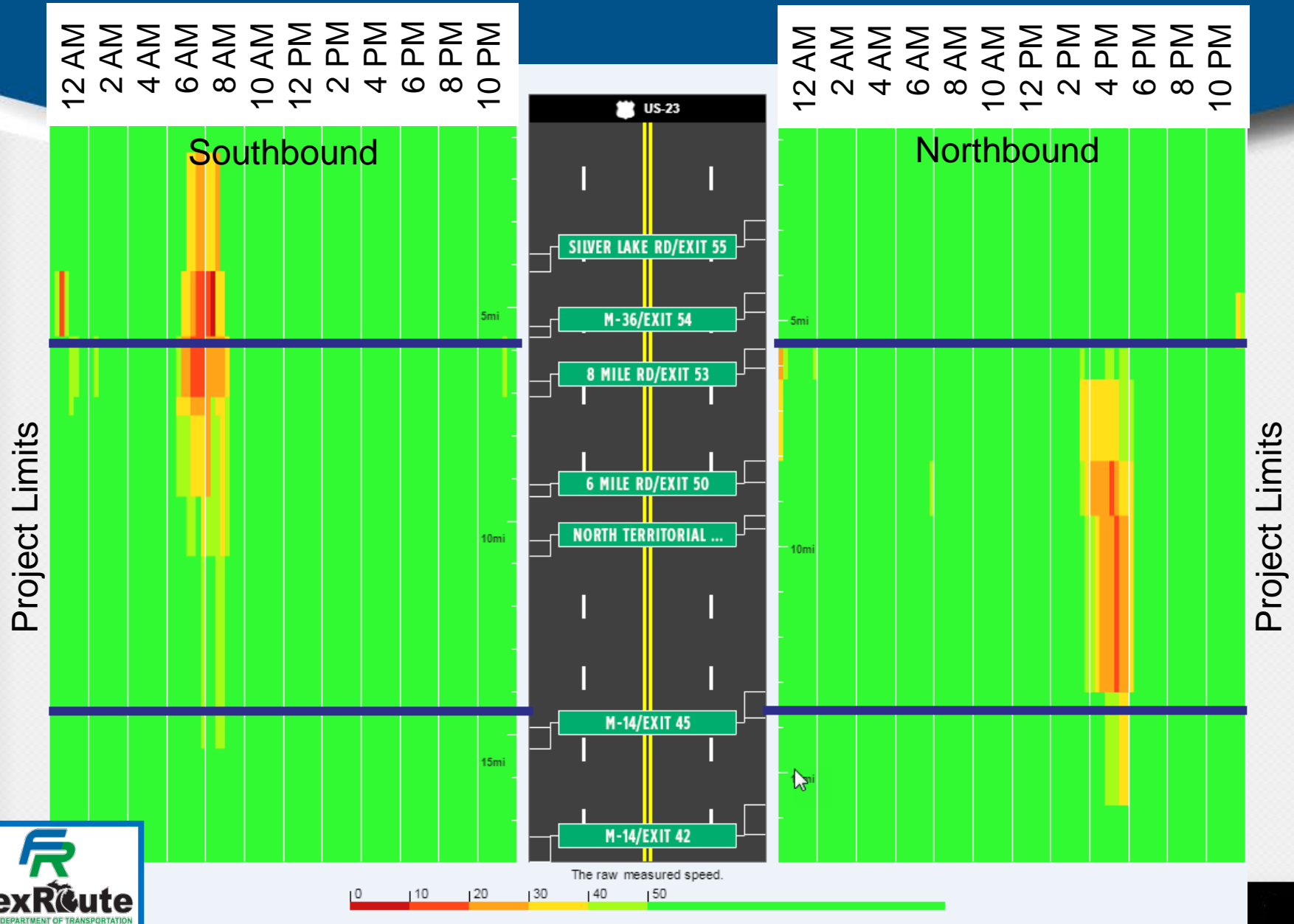




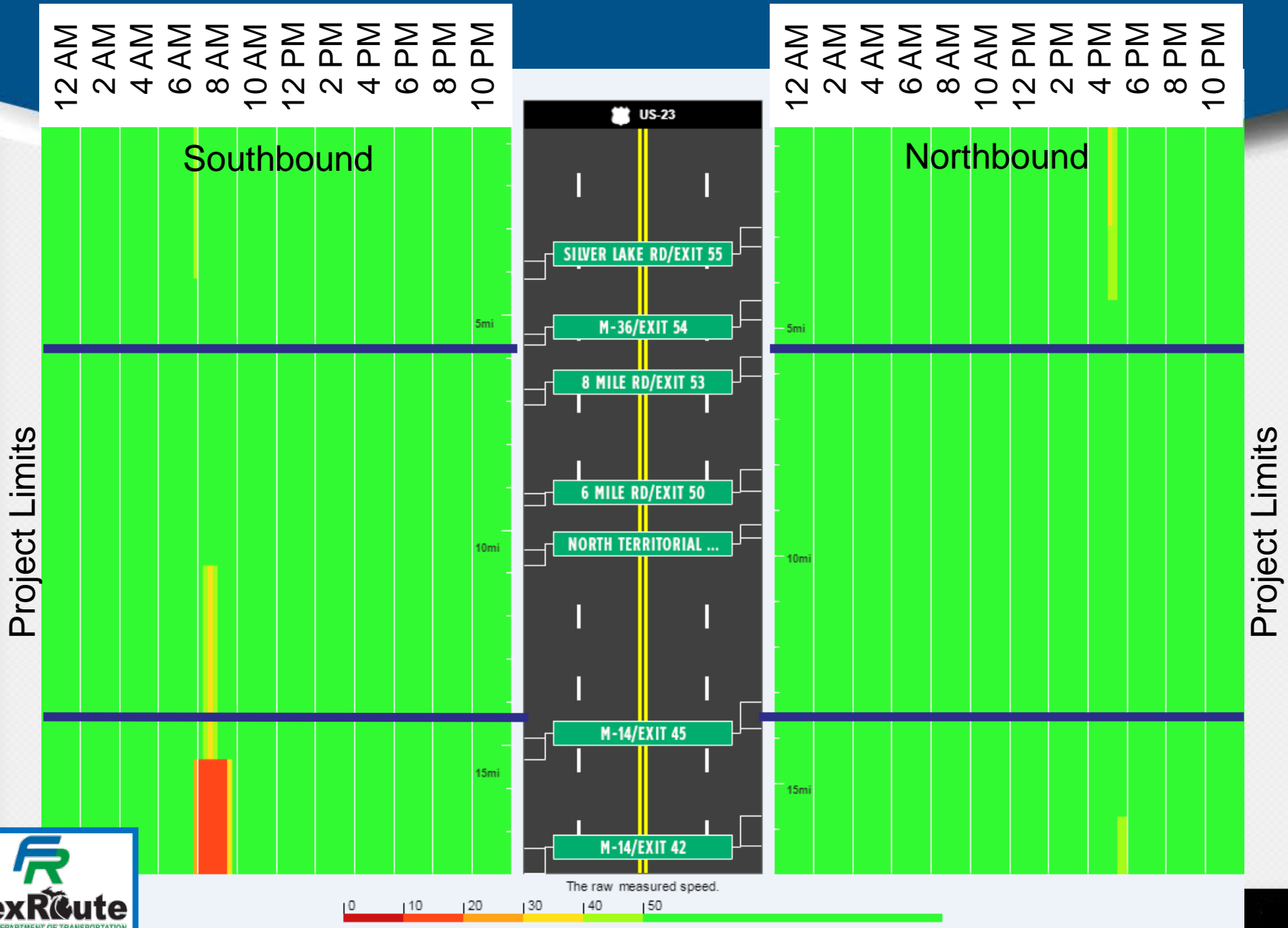
Flex Route Performance

- MDOT tracking monthly performance measures (started Jan 2018)
 - Travel times, speeds, planning time, and crash data
 - Operation and Maintenance costs
 - Feedback from agency partners, the public, and emergency responders
- Early Results- improvements in travel time and reliability- especially for southbound US-23
 - SB US-23 planning time improvement over 50% (from 22 mins to 10 mins)
 - SB US-23 average travel time savings of about 5 minutes (for 8.5 miles)
 - SB US-23 speed increases of 19 mph (from 43 mph to 62 mph)
 - NB US-23 also showing improvements
- Research project in 2019 will further investigate performance

Speed Performance Before



Speed Performance After





Operational Lessons Learned

- Need for additional small DMS in corridor
- Need to integrate the detection downstream of the Flex Route
- Remote access to reboot system after power outages is critical
- Poor compliance with 60 mph advisory speed when shoulder is open
- Treating the lane in the winter- when to start snow plowing/treating procedures
- Utilizing the system when there is a failure in the middle of the corridor
- Construction coordination and limited staffing

Questions?



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