Traffic Management Systems (TMSs) Supporting Part-Time Shoulder Use (PTSU)

Transportation Management Center (TMC)

Pooled-Fund Study(1)

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Presentation Outline

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How TMSs Manage and Operate Part-Time Use of Shoulders

- Agencies have implemented PTSU, or the part-time use of shoulders, on freeways and other roadways to support actively managing traffic.
- Agencies can use PTSU to actively manage traffic to address the following:
  - Increase peak roadway capacity (e.g., use of shoulder) when needed (e.g., crash restricting flow in another lane, increased demand).
  - Allow transit vehicles to use shoulders to bypass congested traffic.
  - Improve safety and reliability.
  - Provide access for emergency responders.
- Agencies implement PTSU based on time of day and day of week or traffic conditions.
- Some agencies implement PTSU along with variable speed limits and other TMS strategies.
- TMS assets may include:
  - Closed-circuit television cameras (CCTVs).
  - Changeable message signs (CMSs).
  - Overhead lane control signs.

PTSU Benefits

- Adds roadway capacity only when necessary, allowing the shoulder to remain a refuge for most hours of the day.
- Reduces severity and number of crashes and improves reliability of travel during the times PTSU is in operation.
- Helps agencies address political, physical, and financial constraints.
- Enables a flexible and cost-effective solution to managing traffic and improving overall transportation efficiency.
- Reduces travel time from 22 min to 10 min on average, according to the Michigan Department of Transportation (DOT).[1]

Issues Faced by TMSs Supporting PTSU

- TMSs face challenges with operating and managing part-time shoulders for the following reasons:
  - Traffic conditions may change often or sporadically (e.g., incidents, planned special events).
  - Traffic demand may exceed vehicle-carrying capacity of travel lanes during these events.
  - Traffic demand does not support adding a traffic lane, which can be expensive.
  - Procedures may differ from other traffic management operations, such as variable speed and lane control.
- Agency challenges may include:
  - Operational strategies, agency policies, and operating procedures may need to be altered.
  - Legislation and policies may need to be developed to implement and manage the use of PTSU.
  - Additional TMS resources, capabilities (e.g., surveillance, monitoring), staff with special skills, or training may be needed.
- Careful planning is required to integrate PTSU into TMSs.

Desired Outcomes of Using PTSU

- Manage TMSs actively based on changing conditions and circumstances.
- Improve safety by reducing the number and severity of crashes.
- Alleviate congestion and increase system reliability by adding capacity at the times when capacity is most needed.
- Provide emergency responders with access to crashes and incidents.
- Understand the information operators need to actively manage and operate PTSU.

Key Considerations

- What policies, procedures, and staff resources are needed to support the active management and operations of PTSU?
- What operations staffing and scheduling are needed to enable and operate PTSU?
- What operator position is needed, in terms of knowledge, skills, and abilities, to manage PTSU operations?
- Are changes needed to operator position job descriptions?
- What methods are best for enforcing PTSU?
- What legislation, policies, and procedures are needed to actively manage and operate PTSU?

Challenges With Implementing PTSU

- PTSU benefits may vary from site to site because of the following:
  - Driver awareness of reasons to use shoulder.
  - Driver behavior.
  - Road geometry.
- PTSU compliance may be low if restricted use is not enforceable.
- PTSU requires significant investment in intelligent transportation system (ITS) field devices, TMS capabilities, staff, and support resources.
- PTSU implementation may involve the following:
  - Agency policy changes.
  - Agency operating procedural changes.
  - Additional staffing.
  - Additional training for operators.

TMS Support for Using and Managing PTSU

- TMSs need the capabilities and resources to support actively managing and operating the use of PTSU.
- TMSs need to perform the following functions:
  - Collect and process data.
  - Disseminate information to travelers, emergency responders, and service providers.
  - Ensure the shoulder is clear of obstructions prior to opening.
  - Monitor the shoulder in realtime.

Issues To Consider When Incorporating PTSU Into TMSs

- Agencies may implement PTSU based on times of day and days of week or traffic conditions.
- Agencies may implement PTSU with other TMS strategies (e.g., variable speed limits, dynamic lane management, display of queue warning messages).
- Agencies may need to integrate ITS devices to support TMSs in managing and operating PTSU.
- Agencies may need to change legislation, policies, or operating procedures for PTSU.
- Agencies may need to automate TMS operation of PTSU to achieve desired safety and operational results.
- Agencies may need to increase TMC operator staffing and training.
- Agencies may need to communicate PTSU status to vehicles upstream of the shoulder.
- Agencies have indicated the need for TMSs to have the capability to communicate with emergency responders and other agencies.

Considerations When Planning for TMS Support of PTSU

- Evaluate staffing resources and capabilities to manage and operate PTSU.
- Identify training needs to effectively operate PTSU.
- Integrate PTSU operational strategy into TMSs.
- Assess TMSs' capabilities to allow operators to monitor, evaluate, and report on travel conditions.
- Consider PTSU to mitigate adverse impacts of changing traffic and roadway conditions.
- Explore operational considerations when implementing or extending the use of PTSU along a roadway section or corridor or an entire region.
- Review policies and processes to actively manage and operate PTSU.
- Review legislation, policies, and procedures to operate PTSU.

PTSU—Scenario for TMSs Opening and Managing PTSU During Changing Traffic Condition

- TMS senses reduced speed and increased traffic along a section of freeway.
- TMS analyzes current and projected conditions to recommend opening the shoulder to accommodate traffic and improve travel reliability.
- TMS operator accepts the recommendation to implement PTSU.
- TMS operator uses CCTV cameras to verify no obstructions are on the shoulder where PTSU will be implemented.
- TMS operator dispatches service patrol or maintenance vehicle to confirm opening the shoulder to traffic is safe.
- TMS operator issues command to open the shoulder to traffic after receiving safety confirmation.
- TMS places a message on a CMS to inform approaching motorists of the opening.
- TMS changes the overhead lane control signs over the shoulder from red x's to green arrows.
- TMS operator monitors traffic flow on the shoulder using CCTV cameras.
- TMS operator initiates procedure to restrict traffic from using the shoulder by changing the green arrow to a red x when traffic conditions return to acceptable levels.

Examples of Agencies Using PTSU

State DOTs that currently use PTSU include the following:

- New Jersey.(2)
- Michigan.(1)
- Virginia.(3)
- Georgia.(4)
- Washington State.(5)

New Jersey DOT Example[2]

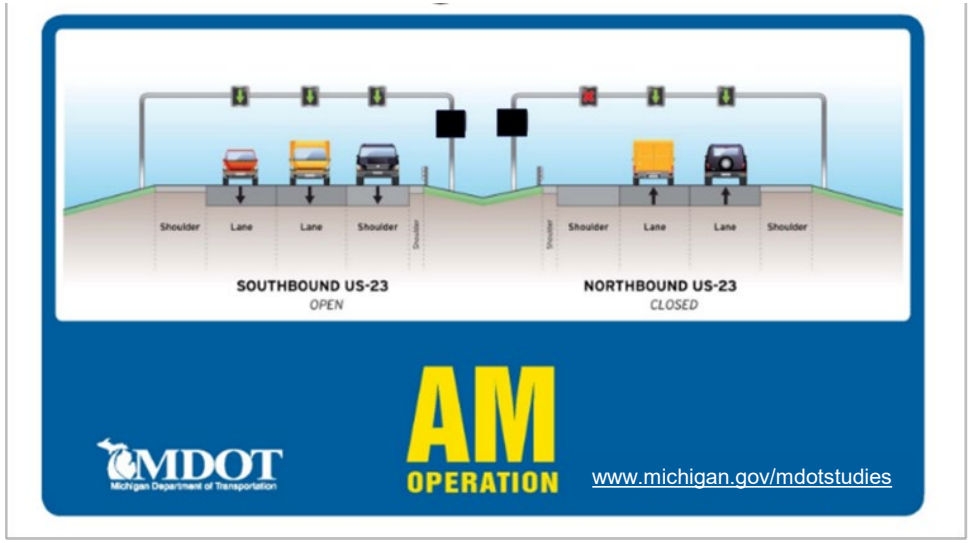
PTSU:

- Implemented on a 4-mi arterial section of U.S. 1.
- Stemmed from congestion at a lane-reduction bottleneck.
- Operates based on time of day and day of week.
- Uses lane use control signals, CMSs, and CCTV cameras to allow for application of PTSU when conditions warrant, offering more flexibility during changing conditions.
- Extended hours of operation implemented by New Jersey DOT.
- Managed initially by dedicated TMC operators, but all operators now support.
- Leveraged extensive stakeholder and public outreach for initial implementation.

Michigan DOT Example[1]

PTSU:

- Implemented on U.S. 23 in the Ann Arbor area when needed to provide additional capacity during peak hours and special events.
- Required no policy or staffing changes within the TMS to actively manage and operate.
- Uses reallocation of on-road maintenance personnel to sweep and verify that obstacles are not present to restrict the use of shoulders for traffic lanes.
- Presents a possible challenge in terms of timing deicer application in PTSU lanes during snow events.
- Improved travel time substantially.



Virginia DOT Example[3]

- Virginia DOT has operated PTSU for several years:
  - On I–66 in Northern Virginia: No longer in operation after implementation of managed lanes.
  - On I–264 in Hampton Roads: Shoulder is open for 2 h in each direction on weekdays and may be opened based on predicted or current conditions. Commercial vehicles are restricted from using the shoulder when opened to traffic.
- TMS operators can manage PTSU as part of routine duties.
- TMS operators must develop the needed capabilities before assignment to manage and operate PTSU.
- TMSs did not need additional staff to support PTSU management and operation.

Georgia DOT Example[4]

PTSU:

- Located along State Route (SR)-400 and I–85 northbound.
- Operates on a peak period schedule; however, the TMS may also activate, manage, or remain open as needed.
- Restricts buses from using the SR-400 shoulder; trucks are restricted from using the part-time shoulders on both SR-400 and I–85.
- Managed by senior TMS operators (TMC specialists).
- Activated after other TMS operators perform sweeps of shoulders for obstacles and then recommend activation to TMC specialists.
- Reviewed annually for standard operating procedures for activation and management.

Washington State DOT (WSDOT) Example[5]

- WSDOT has successfully implemented PTSU on various corridors:
  - I–405.
  - Highway 2.
  - Highway 14.
- WSDOT TMSs manage and operate PTSU.
- WSDOT designated transportation engineer positions to operate PTSU because of the capabilities required.

Lessons Learned in Incorporating PTSU in TMS

- Agencies that implemented PTSU based on changing conditions instead of by time of day required more TMS operator staff.
- Agencies that initially used TMS operators to manage and operate PTSU exclusively transitioned to training all operators to manage and operate PTSU.
- Agencies benefited from training TMS operators responsible for operating PTSU in traffic operations and traffic flow theory.
- Agencies found that PTSU operating procedures and plans should be reviewed and updated regularly.
- Agencies benefited from investigating the need for policy and legislative changes early in the planning process.

Additional Resources

- FHWA. 2024. “Part-Time Shoulder Use” (web page). http://ops.fhwa.dot.gov/atdm/approaches/ptshoulderuse.htm, last accessed August 26, 2024.
- Conference of European Directors of Roads, Traffic, and Network Management Working Group. 2022. “Hard Shoulder Running Fact Sheet v2.0.” https://www.cedr.eu/docs/view/629f3cd6e8920-en, last accessed September 19, 2024.
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2. New Jersey DOT. 2017. "Route 1 Congestion Relief Project Will Use Shoulder as Travel Lane During Peak Commuting Times in South Brunswick." News Release on June 16, 2017. https://www.nj.gov/transportation/about/press/2017/061617.shtm, last accessed July 22, 2024.

3. Virginia Transportation Research Council. 2016. *Evaluation of the Impact of the I–66 Active Traffic Management System*. Report No. VTRC 17-R5. Richmond, VA: Virginia Department of Transportation. https://vtrc.virginia.gov/media/vtrc/vtrc-pdf/vtrc-pdf/17-R5.pdf, last accessed July 25, 2024.

4. Georgia DOT. 2014. *Welcome Packet for the Public Information Open House for the Proposed I–85 Express Lanes Extension Project*. Atlanta, GA: Georgia Department of Transportation. http://mydocs.dot.ga.gov/PublicOutreach/110600-/PDF/110600_PIOH_Welcome%20Packet.pdf, last accessed September 18, 2024.

5. Washington State DOT. N.d. "Part-Time Shoulders" (web page). https://wsdot.wa.gov/travel/roads-bridges/part-time-shoulders, last accessed July 21, 2024.

6. Jenior, P., R. Dowling, B. Nevers, and L. Neudorff. *Use of Freeway Shoulders for Travel—Guide for Planning, Evaluating, and Designing Part-Time Shoulder Use as a Traffic Management Strategy*. Report No. FHWA-HOP-15-023. Washington, DC: Federal Highway Administration. https://ops.fhwa.dot.gov/publications/fhwahop15023/fhwahop15023.pdf, last accessed September 20, 2024.

7. Michigan DOT. 2024. "Studies" (web page). https://www.michigan.gov/mdot/projects-studies/studies, last accessed September 20, 2024.

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