

Use of Freeway Shoulders for Travel

Part-time Shoulder Use Guide

FHWA Guide

AASHTO SCOTE, Savannah GA

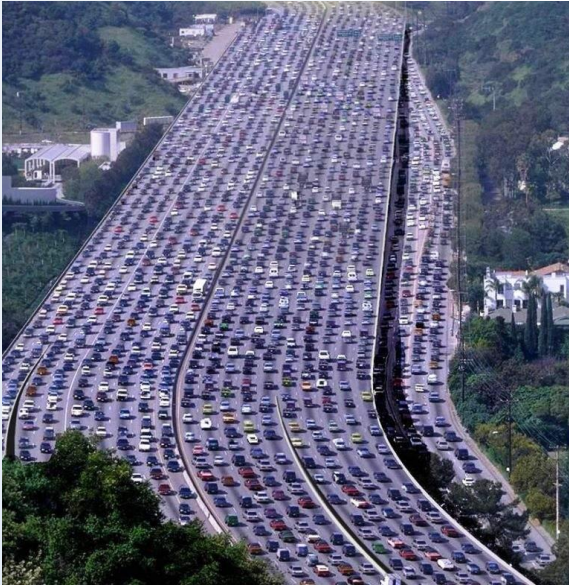


U.S. Department of Transportation
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DOTs Face Increasing Challenges



Performance Based Practical Design

*PBPD is a decision making approach that helps agencies better manage transportation investments and **serve system-level needs and performance priorities** with limited resources.*

Modifying the traditional “top down, standards first” approach to a “design up” approach

This does not mean one can compromise on certain standards or regulations!



Common Themes of PBPD:

- Project decisions are based on critical examination of **geometric** elements
 - Select/size elements that serve priority needs
 - Reduce or eliminate those that don't
- Utilizes relevant, objective data to inform decisions – engineering judgement
- Choices made to serve project priorities while trying to make cost effective decisions
- **Project savings Benefit System Needs**



Example Operations Strategies and Solutions

- Work Zone Management
- Traffic Incident Management
- Service Patrols
- Special Event Management
- Road Weather Management
- Transit Management
- Freight Management
- Traffic Signal Coordination
- Traveler Information
- Ramp Management
- Managed Lanes
- **Part-Time Shoulder Use**
- Active Traffic Management
 - Dynamic Speed Limits
 - Dynamic Lane Assignment
 - Queue Warning
 - **Dynamic Part-Time Shoulder Use**



Part-Time Shoulder Use

- Use of the safety shoulder as a travel lane during congested conditions – **Not a permanent conversion of a shoulder**
- Add capacity only when needed
- Keep shoulder intact for most hours of the day
- Do what is physically and financially possible
 - Support decisions with analysis



What is Part-Time Shoulder Use?

- Various names
 - Hard shoulder running (European)
 - Shoulder running
 - Temporary shoulder use
 - Part-time shoulder use
- Same meaning: use of the left or right shoulders of an existing roadway for travel during certain hours of the day.
 - TSM&O strategy for addressing congestion and reliability issues
 - Preserves shoulder as shoulder during most hours of day



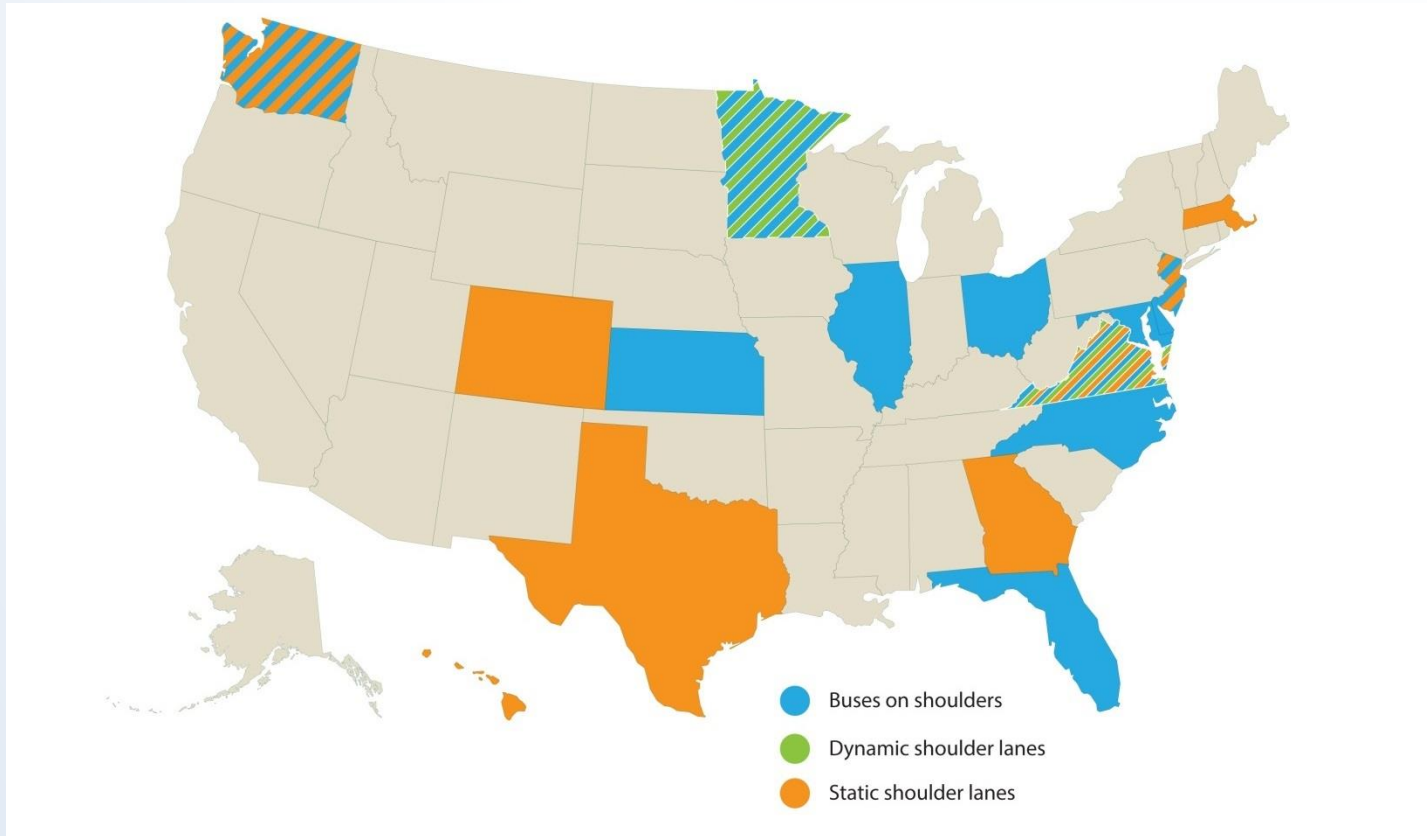
Types of Part-Time Shoulder Use

- Static shoulder use – open to passenger vehicles during predetermined hours of operation
- Dynamic shoulder use – open to passenger vehicles based on need and real-time conditions
- Bus-on-Shoulder (BOS) – open only to buses, usually at driver's discretion

Shoulder use typically implemented on freeways; but can be applied to arterials



Where is Part-Time Shoulder Use?



- Now 16 states
- Many international applications as well



Bus On Shoulder (BOS) in Minneapolis-St. Paul

10



Left-Shoulder Bus on Shoulder (BOS) in Chicago

11



Bus on Shoulder (BOS) on US 9 Arterial in New Jersey

12



Static Shoulder Use – US 2 in Washington State

13



Static Shoulder Use – I-66 in Virginia (Made Dynamic in 2015)

14



Dynamic signs over shoulder; but fixed hours of operation



Dynamic Shoulder Use – I-66 in Virginia

15



Dynamic Shoulder Use – I-35W in Minneapolis



- Part of Managed Lane (HOT) operation



Purpose of Shoulder Guide

Why did we need a Guide?

- No national guidelines
 - Existing research scattered in many sources
- Growing interest - Division Offices getting requests for projects
- Regulatory uncertainty/complexity
 - Air and noise analysis
 - NEPA
 - Design exceptions
 - Signing and pavement marking (MUTCD)
- The Guidebook is not a standard/directive/policy/etc.
 - Collection of referenced standards and applied best practices
- Consistent with other FHWA initiatives
 - PBPD
 - TSM&O and Active Traffic Management



Guide Chapters - Planning

Chapter 1 – What is Part-time Shoulder Use?

- Also contains summary of entire guide

Chapter 2 – Planning, Decision Making, and Preliminary Engineering

- Planning considerations
- NEPA requirements
- Preliminary Engineering
- Relationship to Planning for Operations and PBPD



Guide Chapters - Analysis

Chapter 3 – Mobility Analysis

- How to do it (HCM/FREEVAL, Simulation)
- Observed and simulated shoulder use capacities

Chapter 4 – Safety Analysis

- Before/after studies
- How to do analysis
- What Highway Safety Manual says

Chapter 5 – Environmental Analysis

- Air quality
- Greenhouse gas emissions
- Noise

Chapter 6 – Costs and Benefits Analysis

- Life cycle costs
- Benefit-cost ratio



Guide Chapters – Design / Implement / Operate

Chapter 7 – Design Considerations

- Geometry
- Pavement/Drainage
- Signing and pavement marking

Chapter 8 – Implementation Process

- Design exceptions
- MUTCD
- Stakeholder/public involvement

Chapter 9 – Day-to-Day Operations

- Maintenance
- Incident management
- Law enforcement
- Opening and closing the shoulder



Some Design and Operations Questions

Preliminary Engineering

- Is shoulder width adequate, or can it be widened?
- Are vertical clearances adequate?
- Is the shoulder pavement structural capacity adequate in terms of drainage and rideability?
- Is it feasible to provide supplemental emergency turn-out or refuge areas beyond the shoulder at reasonable intervals?
- Is a sufficiently long segment available, or is an acute bottleneck being relieved?

Operations Concepts

- Should the right or left shoulder be used?
- What vehicles will the shoulder be open to?
- If the shoulder is open to more than buses, should it be static (fixed hours of operation) use dynamic use
- Will there be speed restrictions?
- Use in conjunction with other operational strategies?

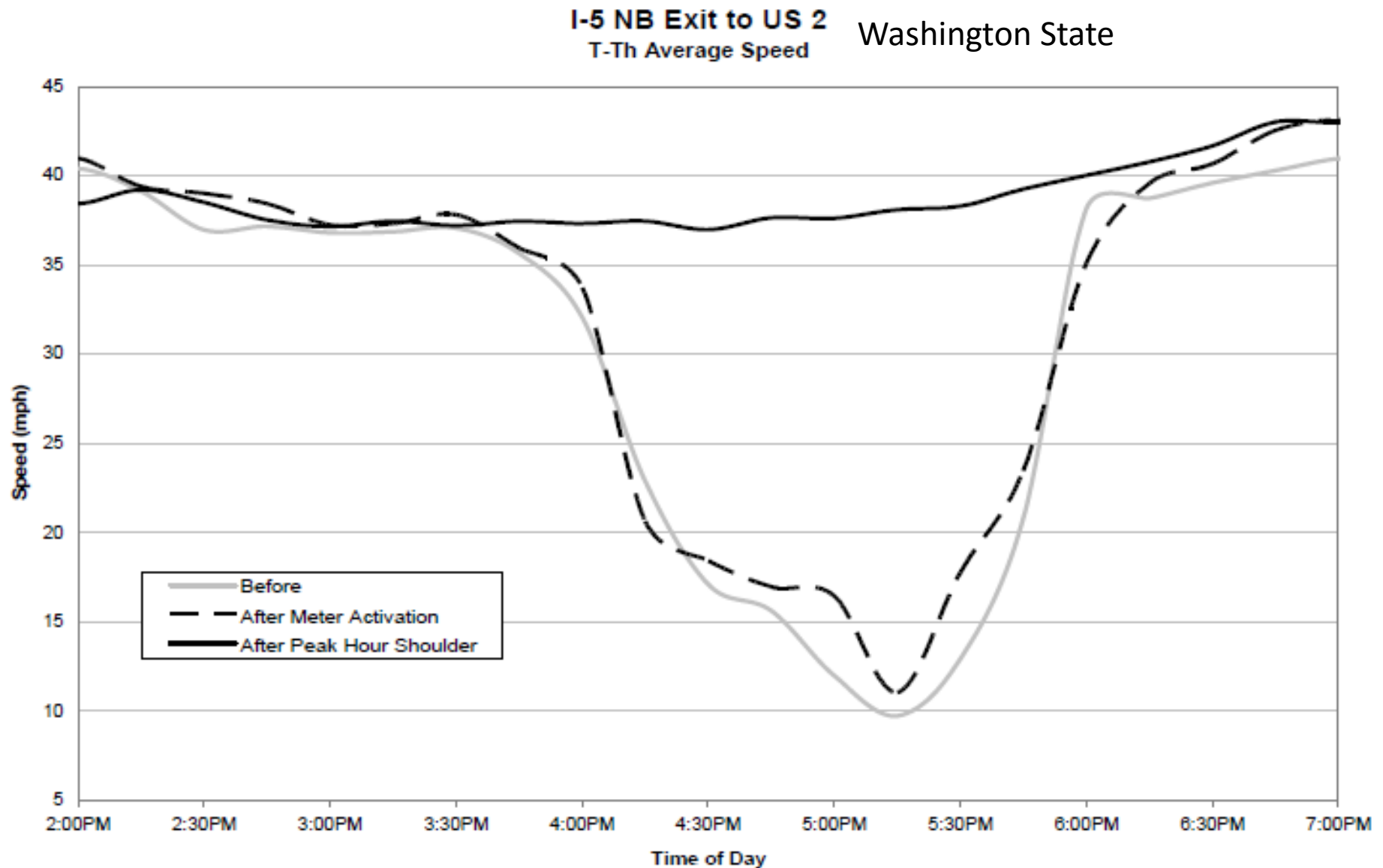


Shoulder Use Capacity Findings

- Shoulder lane utilization and effective capacity is highly dependent on geometric/design features
- Effective capacities of 1200 – 1800 VPH
- Left vs. Right shoulder use is quite different

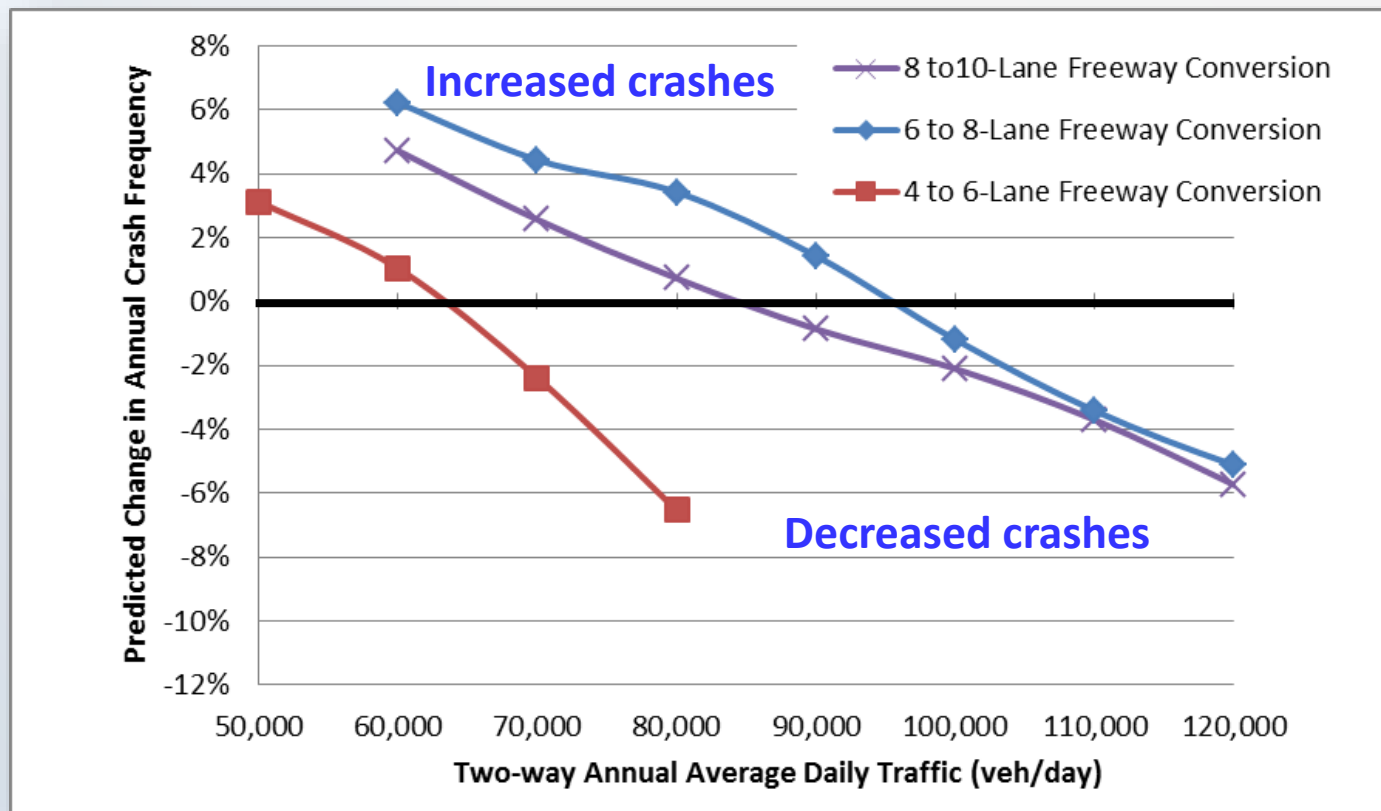


Before and after Implementation of Shoulder Use



Highway Safety Manual (HSM) Model Findings

- Narrowing shoulders and adding a lane reduces crashes if the volume is high enough



Environmental Effects of Part-Time Shoulder Use

- Changes in traffic volumes or speeds may effect:
 - Air quality
 - Greenhouse gas emissions
 - Noise
- Likely minimal changes in roadway footprint with minimal effect:
 - Water quality
 - Plants and animals
 - Cultural resources
- Cannot generalize air and noise effects
 - Reduced congestion -> generally good for air quality/noise
 - Increased volume -> generally bad for air quality/noise



Turnoffs

- Have refuge for disabled vehicles approximately every half mile
- Construct turnoffs where other refuge spaces (ramps, gores, etc.) don't exist
- If turnoffs cannot be constructed, part-time shoulder use still possible
- Not necessary for BOS, but still helpful



UK Turnoff



Signing and Pavement Marking

- Bus on shoulder
 - Minimal
 - Too much shoulder markings may make passenger car drivers think lane is open to them
- Static shoulder use
 - Static regulatory and warning signs
 - Can have dynamic lane control signs
- Dynamic shoulder use
 - Dynamic lane control signs



Regulatory Sign Examples (static shoulder use)

28



GA 400 Mainline

GA 400 Ramp



Regulatory Sign Examples (static shoulder use)

29



I-H-1 (Hawaii)

Massachusetts



Regulatory Sign Examples (static shoulder use)

30



New Jersey Turnpike Newark Bay Extension (I-78)



Day-to-Day Operation

- Maintenance
 - More similar to a general purpose lane than shoulder
 - Presence of traffic clears debris
 - Some major snowfall removal issues if roadside barriers present
- Incident Management
 - Plans often in place already on freeways where shoulder use being considered
 - Potential enhancements:
 - Turnouts
 - Service patrols
 - CCTV
 - Changeable lane control signs



Day-to-Day Operation

- Law Enforcement
 - Police must know when lanes are open/closed
 - Targeted enforcement where roadside space available
- Opening and closing
 - “Sweep” the lanes before opening
 - Driving the facility most common
 - CCTV also used
 - Unnecessary for BOS
 - Police and/or TMC have authority to order closure of shoulder for incidents or other reasons.

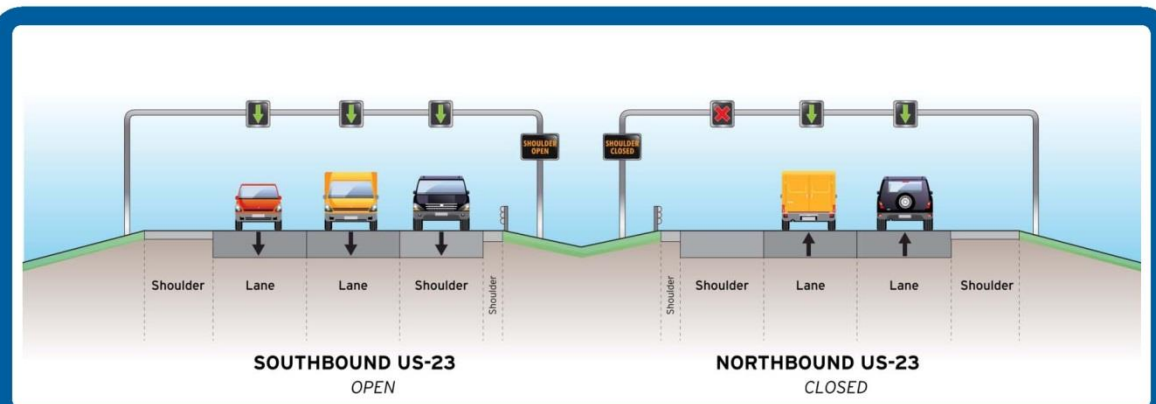


Public Outreach and Education

- Critical to success
- Use multiple formats and forums
- Ongoing after opening to traffic



Active Traffic Management



AM
OPERATION

www.michigan.gov/mdotstudies



FHWA Task Order Next Steps

- Webinars
 - This summer through National Operations Center of Excellence
 - One more TBD
- Conference Presentations
 - AASHTO Subcommittee on Design in Baltimore later this month
 - Two more TBD
- 5 one-day workshops for states



Questions and Comments

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USE OF FREEWAY SHOULDERS FOR TRAVEL

Guide for Planning, Evaluating, and Designing Part-Time Shoulder Use as a Traffic Management Strategy



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<http://www.ops.fhwa.dot.gov/publications/fhwahop15023/index.htm>

