

# PAVED SHOULDERS



Paved shoulders provide a recovery area for errant motor vehicles, and lengthen the lifespan of the roadway by providing pavement structure support, reducing edge deterioration, and improving drainage. Paved shoulders significantly reduce maintenance costs and are proven to reduce crashes. Paved shoulders provide space for pedestrian and bicycle travel, which facilitates safer passing behaviors and improves comfort for all users.

Paved shoulders serve many purposes. All users should be considered to develop the most appropriate design given the intended use of the shoulder. Designers have flexibility in determining when to pave shoulders, as well as on factors such as shoulder width and rumble strip design and placement.

## KEY DESIGN FLEXIBILITY

The **AASHTO Green Book** states the advantages and varied uses of paved shoulders. It also provides ranges for paved shoulder widths:

*"Paved shoulders advantages include providing a space for pedestrian and bicycle use, for bus stops, for occasional encroachment of vehicles, for mail delivery vehicles, and for the detouring of traffic during construction."*

2011, p. 4-9

*"[Shoulders] vary in width from only 2 ft on minor rural roadways...to approximately 12 ft on major roads."*

2011, p. 4-8

## OTHER RESOURCES

*"Wide shoulders and bicycle lanes provide an additional clear area adjacent to the traveled way, so these features potentially could provide a secondary safety benefit for motorists and can be included as part of the clear zone... and also improve the resulting sight distance for motor vehicle drivers at intersecting driveways and streets."*

AASHTO Roadside Design Guide 2011, p. 10-11

*"Adding or improving paved shoulders can greatly improve bicyclist accommodation on roadways with higher speeds or traffic volumes, as well as benefit motorists...Creating shoulders or bike lanes on roadways can improve pedestrian conditions as well by providing a buffer between the sidewalk and the roadway."*

AASHTO Bike Guide 2012, p. 4-7

*"Paving part or all of the shoulder also helps reduce crash rates further and helps to facilitate use of the road by bicyclists. Shoulder paving also reduces maintenance requirements"*

AASHTO Flexibility Guide 2004, p. 66

# APPLYING DESIGN FLEXIBILITY

## SHOULDER WIDTH

Sufficiently wide shoulders can greatly improve bicyclist safety and comfort, particularly on higher-speed, higher-volume roadways. Shoulders are most often found on rural roadways and less often on urban roadways. To accommodate bicyclists, a 4-foot or greater paved shoulder width, continuous along the length of the roadway and through intersections, should be provided. (Use at least 5 feet where guardrails, curbs, or other roadside barriers are present.) Designers should consider wider shoulders if vehicle speeds are greater than 50 mi/h (AASHTO Bike Guide 2012, p. 4-7). Designers may use the Bicycle Level of Service model, which includes factors for vehicle speeds, traffic volumes, and lane widths to determine the appropriate shoulder width (AASHTO Bike Guide 2012, p. 4-7).

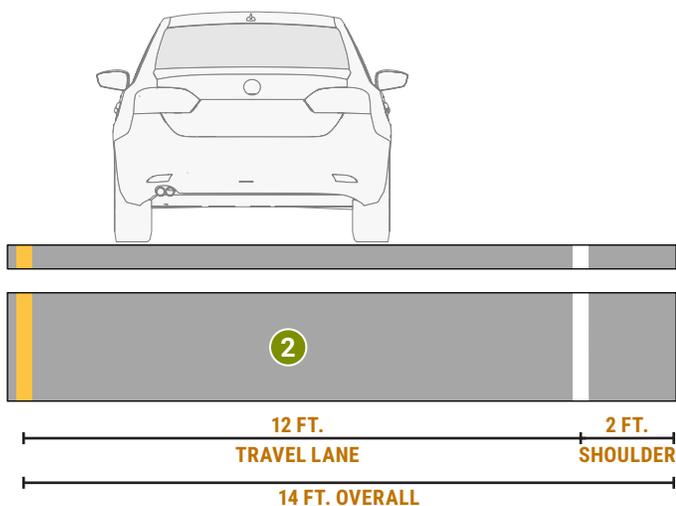
## WHEN TO PAVE SHOULDERS

Designers should consider paving shoulders in all project types, particularly in rural settings. The AASHTO Green Book presents policies concerning shoulder width for specific highway functional classes (e.g., local, collector, and arterial roads) and it recommends that “usable shoulders on arterials be paved” (2011, p. 7-5). Although the AASHTO Green Book 2011 doesn’t specify that shoulders be paved on local and collector streets, designers should consider paved shoulders to accommodate bicyclists, and possibly pedestrians, in rural areas.

## SHOULDERS AND DIFFERENT PROJECT TYPES

It is important to capture opportunities to include or upgrade paved shoulders during all types of roadway projects. Designers should weigh the trade-offs such as proven safety benefits for all users, construction costs, and cost savings over the lifespan of a roadway. Examples of how to capture opportunities to provide bicycle-friendly paved shoulders during different types of roadway projects include:

### EXISTING CONFIGURATION



## RESURFACING AND RESTORATION

Pavement resurfacing offers an opportunity to reallocate roadway space. In some cases, designers should consider reducing lane widths to provide more paved shoulder width suitable for bicycling. The AASHTO Flexibility Guide states that “for lower speed, lower volume rural roads and highways with little or no truck traffic, lane widths as low as 9 ft [2.7 m] may be acceptable” (2004, p. 65). For more information, refer to the design topic on Design Criteria and Lane Width. For example, in a retrofit situation, the AASHTO Bike Guide suggests that a 10- or 11-foot travel lane with a 3- or 4-foot shoulder would be preferable for bicyclists to a 12-foot travel lane and 2-foot shoulder (2012, 4-28).

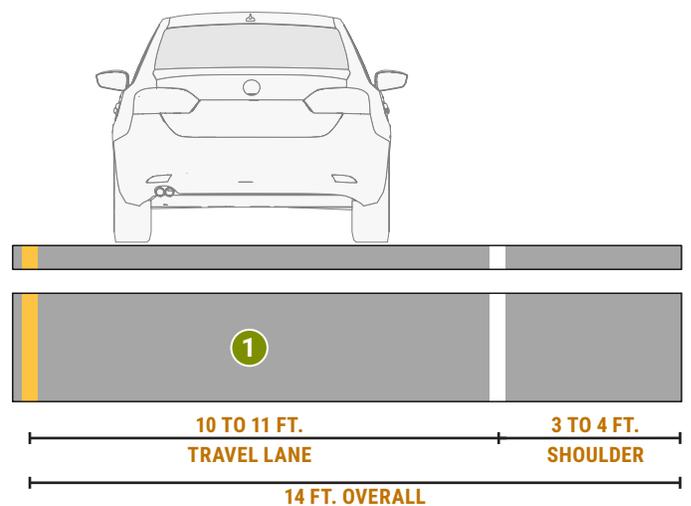
## REHABILITATION

Rehabilitating pavements offers an opportunity to add pavement width. This project type includes the complete replacement of pavements which opens opportunities to add paved shoulders as the mainline pavements are replaced. This can be an economical and cost-effective way to implement this type of enhancement. It is also an opportune time to widen narrower paved shoulders, especially if rumble strips are being added to the shoulders and additional width is desired to provide clear space for bicyclists.

## RECONSTRUCTION AND NEW CONSTRUCTION

Including paved shoulders when roadways are being newly constructed or reconstructed is cost effective and should be considered on rural and suburban arterial roadway projects. This affords the best opportunity to get a 4-foot or greater paved shoulder in place. This is also the time to consider other treatments such as separated bike lanes, shared use paths, and sidewalks. These treatments may be more desirable in urban and suburban locations with higher bicycle and pedestrian demand. For more information, refer to design topics on Separated Bike Lanes and Shared Use Paths.

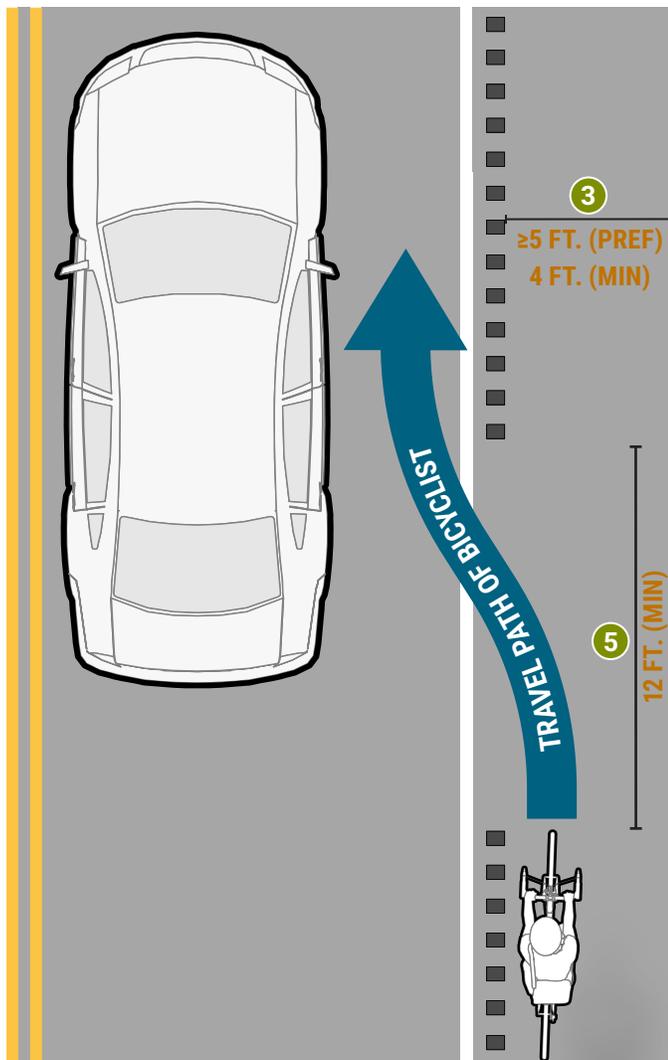
### BICYCLE-FRIENDLY CONFIGURATION



## RUMBLE STRIPS

Rumble strips are a Proven Safety Countermeasure. Designers have flexibility on the placement and configuration of roadway rumble strips. Therefore, it is important that rumble strips are designed with bicyclist safety in mind. The **AASHTO Bike Guide** recommends providing a 4-foot clear space **3** from the rumble strip to the outside edge of a paved shoulder, or 5 feet to an adjacent curb, guardrail, or other obstacle **(2012, p. 4-7)**. A reduced rumble strip length (measured perpendicular to the roadway) or edge line rumble strips, sometimes referred to as a rumble stripes **4**, can be considered to provide additional shoulder width for bicyclists. The **AASHTO Bike Guide** recommends providing 12-foot minimum gaps **5** in rumble strips spaced every 40–60 feet to allow bicyclists to enter or exit the shoulder as needed **(2012, p. 4-9)**. Designers should consider longer gaps in locations where bicyclists are traveling at relatively high speeds. Designers may also consider bicycle-tolerable rumble strips. Even though the strips can be made more tolerable, they are not considered to be rideable

### DESIRABLE (FOR BICYCLISTS) CROSS SECTION



by bicyclists. Additional information on rumble strip design can be found in the **AASHTO Bike Guide 2012** and the **FHWA Rumble Strips and Rumble Stripes Website** ([http://safety.fhwa.dot.gov/roadway\\_dept/pavement/rumble\\_strips/](http://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/)).

In constrained locations with a paved shoulder width less than 4 feet, designers should consider placing rumble strips at the far right edge of the pavement to give bicyclists additional space near the edge of the lane. **6** Results from **NCHRP Report 641: Guidance for the Design and Application of Shoulder and Centerline Rumble Strips 2009** indicate that there may not be a practical difference in the effectiveness of rumble strips placed on the edge line or 2 feet or more beyond the edge line on two-lane rural roads.

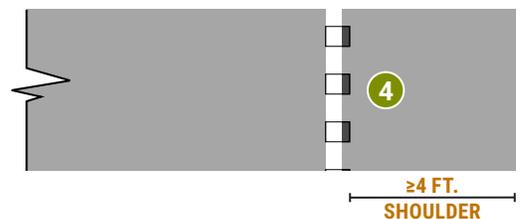
## PEDESTRIAN USE OF SHOULDERS

Except where expressly prohibited, pedestrians may legally walk on roadway shoulders. Most highway shoulders are not intended for use by pedestrians but can accommodate occasional pedestrian use. If a shoulder is intended for use as a pedestrian access route “it must meet ADA requirements for pedestrian walkways to the maximum extent possible” **(AASHTO Pedestrian Guide 2004, p. 55)**. For more information, refer to the design topic on **Accessibility**.

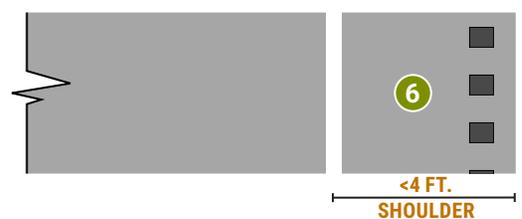
### UNDESIRABLE (FOR BICYCLISTS) CROSS SECTION



### ADEQUATE CROSS SECTION



### CONSTRAINED CROSS SECTION



## CASE STUDIES

### RUMBLE STRIP POLICY WASHINGTON

The Washington State Department of Transportation (WSDOT) policy for the application of rumble strips on shoulders seeks to strategically reduce run-off-the-road crashes while minimizing impacts to bicyclists. The policy allows rumble strips only if 4 feet of usable shoulder remains after application (5 feet if a guardrail or barrier is present). It also prohibits rumble strips on downhill grades exceeding 4 percent for more than 500 feet along common bike routes. WSDOT's policy allows rumble strips to be placed only along roadways that have above-average levels of run-off-the-road crashes, which can be mitigated by shoulder rumble strips.



Source: John Russell (Creative Commons)

### PAVED SHOULDERS AS BICYCLE ACCOMMODATIONS ARIZONA

State departments of transportation pave shoulders based on well-documented benefits they produce for all modes, including the accommodation of bicyclists. For example, the Arizona Department of Transportation (ADOT) typically adds wider paved shoulders (6 feet or greater) to State highways that are part of major reconstruction projects, which is consistent with their bicycle policy. Additionally, on pavement preservation projects, ADOT maintains existing paved shoulders and, in some cases, widens paved shoulders. Sometimes this requires a change in scope for the project and an additional source of funding. ADOT has also revised its **Traffic Engineering Guidelines and Processes on Continuous Longitudinal Rumble Strips** to include a clear shoulder width of 4 feet in order to make shoulders usable for bicyclists.



Source: Kevin Davidson, Hualapai Indian Tribe

### 11-FOOT LANE WIDTH STANDARD VERMONT

In 2015, the Vermont Agency of Transportation (VTrans) released an "Engineering Instruction" memorandum, specifying the Agency's standard practice of using 11-foot lanes. The memo states that 11 feet is the recommended maximum lane width because roadways with wider travel lanes often result in a "shoulder width that is less than ideal for bicycle traffic." This memorandum represents a major policy shift for a State department of transportation away from wider lanes by default and towards narrower lanes with shoulders that accommodate bicycling.



#### Highway Safety & Design Engineering Instructions (HSDEI)

**Distribution:** Highway Division, Director of Policy, Planning and Intermodal Development, Chief of Contract Administration, American Council of Engineering Companies of Vermont

**Approved:** *Michael J. Fowler* **Date:** 7/6/2015  
Michael J. Fowler, P.E.,  
Acting Highway Safety & Design Program Manager

**Subject:** 11 Foot Lane Width

**Administrative Information:**

**Effective Date:** HSDEI 15 – 103 shall be effective from the date of approval.

**Superseded HSDEI:** Not applicable.

**Exceptions:** Not applicable.

**Disposition of HSDEI Content:** The content of HSDEI 15–103 will be incorporated into a future revision of the Vermont State Standards.

Source: Vermont Agency of Transportation