

Rumble Strips

What's All the Rumbling About?

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What Are Rumble Strips?

- Shoulder rumble strips are variations in the shoulder or pavement edge designed to alert drivers that they are leaving the traveled way
- Studies estimate that shoulder rumble strips can reduce run-off-road crash rates by 15% to 70%, depending on location

Shoulder Rumble Strip Types

- Rolled-in
- Ground-In
- Raised Materials

Rolled-In



FHWA

- Used in many states from 1970s-1990s
- Placed in fresh AC pavement with roller
- Low cost, but had drawbacks
 - Couldn't be retrofitted
 - Quality control problems
 - Width (24-36") took up much of usable shoulder

Ground-In



FHWA

- New design popular in late 1990s
- Uses a cutting wheel to grind indentations into the shoulder pavement

Advantages of Ground-In Rumble Strips

- Can be ground into most pavement types
- Can be installed at any time
- Low cost
 - Typical cost = \$0.12 - \$0.15 per linear foot
 - Slightly more expensive than rolled-in
- Eligible for HES (Hazard Elimination and Safety) funding

Problems with Ground-In Rumble Strips

- May not be effective in some locations
 - Too-narrow shoulders - no recovery room
 - Sharp curves
- Ineffective against some run-off-road crashes
 - Equipment failure
 - Departing the road at too-steep angle

Problems with Ground-In Rumble Strips

- Can be hazardous to bicyclists and motorcyclists
 - FHWA recommends a minimum of 4 ft clear shoulder width after rumble strip installation
 - not including guardrail, barrier, obstructions, etc.
 - also helps to ensure that drivers can recover while still on a paved surface

Effects of Rumble Strips on Bicyclists

- Bicycle wheel drops completely into grooves
 - 1/2" or more up & down for every foot of travel
- Can cause loss of control and crashes
 - Reports of serious injuries from several states

Balancing of Interests

- Agencies have a responsibility to operate and maintain roadways that are reasonably safe for users
- Drivers cannot always operate perfectly, and roadways should not hurt or kill unwary drivers
- However, safety features (such as rumble strips) cannot be a substitute for personal responsibility

Balancing of Interests

- Large numbers of motorists running off the road
- VS.
- Smaller numbers of bicyclists and motorcyclists who are doing nothing wrong, yet may be at risk

What Can Be Done?

- Periodic Gaps
- Reducing Depth
- Raised Materials
- Signs & Markings

Periodic Gaps

- Bicyclists need to cross rumble strips
 - To avoid debris & obstructions
 - To avoid parked vehicles and equipment
 - To make left turns, or to merge over in advance of right turn lanes
- Gaps can be installed periodically in a rumble strip pattern
 - 12 ft gap every 40 to 60 ft is recommended
 - This still provides 70-80% coverage
 - Gap lengths below 10 ft are not recommended

Periodic Gaps

- Gaps allow bicyclists to cross rumble pattern without hitting grooves, even at higher speeds
- However, gaps will not solve the problem of insufficient shoulder width remaining after rumble strips are installed

Reducing Depth

- First generation of ground-in rumble strips used 1/2" - 5/8" milling depth
- Research has been conducted recently by Penn State, Caltrans, and CDOT to determine optimum depth
- Results indicate that 1/4" - 3/8" depths still provide adequate rumble to larger motor vehicles while being less jarring to bicyclists

Raised Materials

- Raised materials can be used in areas that are not subject to snow plows
- Typically much less jarring to bicyclists
- Still effective in providing tactile warning
- Two types in widespread use:
 - Profile thermoplastic
 - Raised pavement marker patterns

Signs & Markings

- Some states have installed signs for rumble strip warning
- Sample sign from Vermont:
- However, there is insufficient evidence that signs or markings will improve safety



ADOT Rumble Strip Policy

- Rumble strips are placed on rural highways with shoulder widths of 4 ft or greater
- Rumble strips may be placed on shoulders of less than 4 ft width only if a written study indicates there are a high number of run-off-road crashes in that area
 - Wider shoulders are desirable in these areas, but additional width cannot always be justified or funded due to low AADT and other constraints

ADOT Rumble Strip Policy

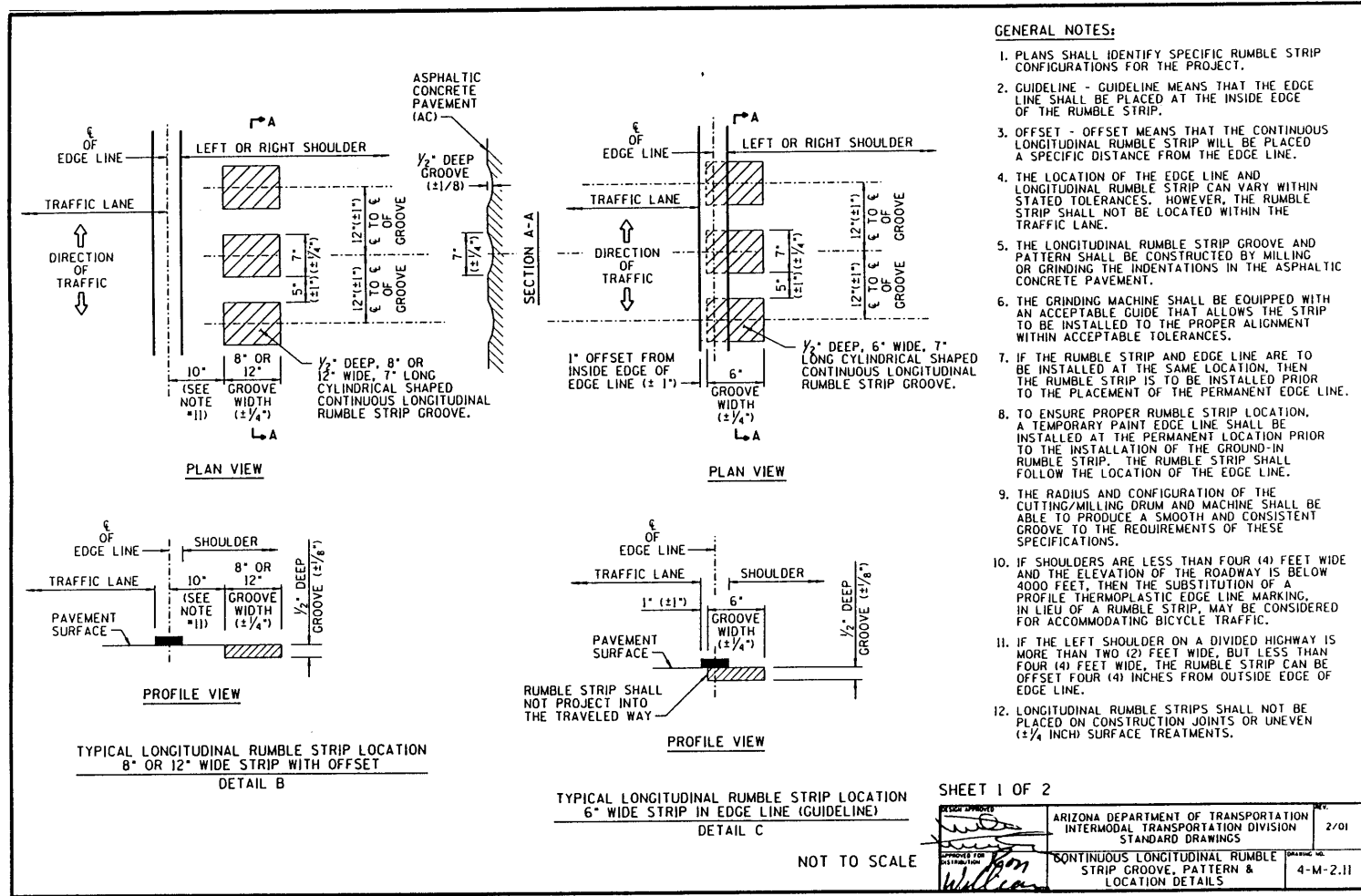
- Freeways:
 - 12” wide continuous ground-in rumble strip, 12” off edge line (both sides)
- Other Highways:
 - Shoulders greater than 5 ft in width: 8” rumble strip (gapped or continuous) 12” off edge line
 - Shoulders 5 ft or less: 6” rumble strip (gapped or continuous) under the edge line, or 6” profile thermoplastic edge line in non-snowplow areas

ADOT Rumble Strip Policy

- Rumble strip discontinued at:
 - Ramps
 - Crossroads and turnouts
 - Turn lanes
 - Guardrail or barrier that does not allow 2 ft clearance between rumble strip and face of barrier
- Rumble strip is typically not used in suburban or urban areas
 - Noise concerns
 - Fewer run-off-road crashes

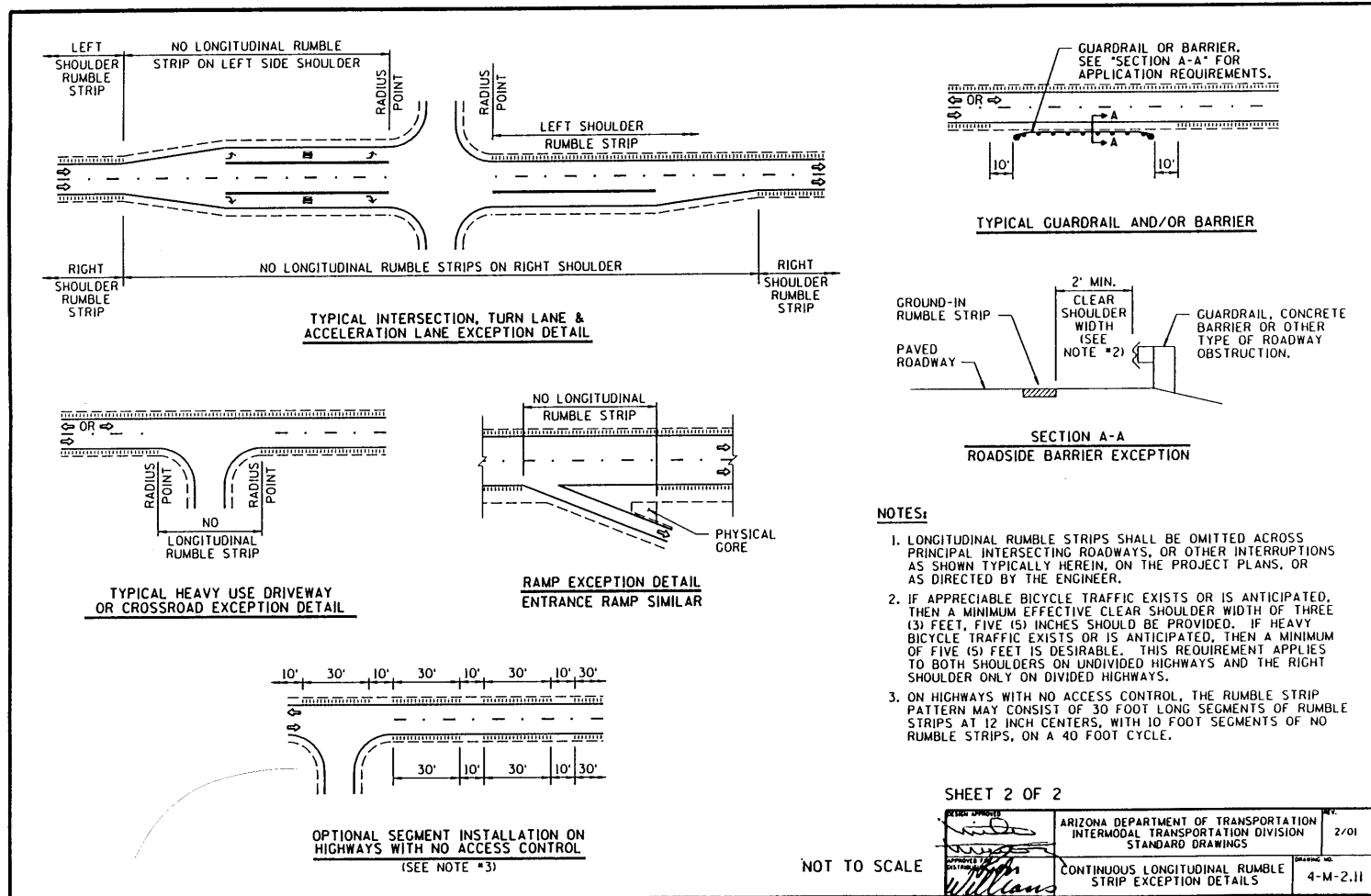
ADOT Rumble Strip Standards

New ADOT Standard Drawing 4-M-2.11 - Sheet 1



ADOT Rumble Strip Standards

New ADOT Standard Drawing 4-M-2.11 - Sheet 2



What's in the Future?

- Possible future modifications to ADOT rumble strip policies and standards:
 - Gaps may become standard on non-freeways
 - Rumble strip depth may be reduced
 - Use of centerline rumble strips on selected roadways with high head-on crash rates

Conclusions

- Rumble strips can reduce run-off-road crashes at low cost
- Rumble strips can negatively affect some road users
- Competing interests must be balanced
- Agency policies should encourage installation of rumble strips where appropriate, but use design features (gaps, depth) to reduce negative impacts