480 LONGITUDINAL RUMBLE STRIPS

480.1 GENERAL OVERVIEW AND CONSIDERATIONS

The purpose of this guidance is to define when and where longitudinal rumble strips are applied on the state highway system.

The purpose of longitudinal rumble strips is to reduce run-off-road (ROR) and crossover crashes due to driver inattention and/or overcorrection. Rumble strips are intended to alert drivers by creating an audible (noise) and tactile (rumble or vibratory) warning sensation that their vehicle is leaving the traveled way (traffic lane) or entering an opposing lane and that a steering correction is required. These are proven low-cost safety countermeasures. Before and after crash studies have indicated that run-off-road, head-on, or sideswipe type crashes may be reduced significantly by the use of longitudinal rumble strips.

Longitudinal ground-in rumble strips should be applied to the mainline roadway on projects per Traffic Safety recommendations and per requirements of this document. Exceptions to this guidance require approval of the State Traffic Engineer.

Longitudinal rumble strips can be constructed through several different techniques and patterns (e.g. ground-in rumble strips, raised pavement markers, sinusoidal or profile pavement markings). This guidance is not intended to restrict or prohibit the use of any alternatives. If an alternative technique is shown to offer an advantage over the ground-in rumble strip, then its use may be considered. Raised treatments may not be suitable for locations subject to snowplow activity, or in other areas subject to frequent use of blade-on-pavement activities such as debris or rock clearance.

In urban, suburban and developing areas, sinusoidal rumble strips should be used in areas within 2,000 feet (0.4 miles) of an inhabited residential structure. Sinusoidal rumble strips shall be installed per Standard Drawing M-22.

Ground-in rumble strips can be installed in Portland cement concrete pavement (PCCP) or asphaltic concrete pavement (ACP). Installing ground-in rumble strips in PCCP may require a different operation and payment structure. Ground-in rumble strips should not be installed on bridge decks, approach slabs, or concrete weight-in-motion slabs.

The composition of the new pavement or the thickness, condition, and type of existing pavement should be determined prior to the application of ground-in rumble strips. The installation of ground-in rumble strips should be evaluated to ensure placement is possible without adversely impacting pavement condition or rumble strip performance. Factors contributing to such an adverse condition can include pavement thickness, pavement width, pavement condition, or pavement structural section (e.g., ACP over PCCP).

Where possible, rumble strip treatments should be installed on all State Highway System routes. Consultation with ADOT Pavement Design staff should be considered before installing ground-in rumble strips on existing pavement.

This guidance does not account for all possible applications (e.g. rural gore areas). Therefore, it may be necessary for the designer to develop special application plans or details for the application of ground-in or alternative longitudinal rumble strip treatments. All such plans and details shall be submitted to the Traffic Engineering Group for review and approval prior to their use on a project.

Details for rumble strip configuration and placement shall be shown on the project plans. Typically, the details will be included in conjunction with project pavement marking plans. In addition, the limits of the various types of rumble strip patterns and offsets shall be indicated on the plans.

480.2 SHOULDER RUMBLE STRIPS

The following table should be used as a guideline in determining the groove width of the rumble strips to be installed on roadway shoulders:

Type of Roadway	Right Shoulder Width	Groove Width (right shoulder)	Groove Width (left shoulder)
Undivided	less than 5' 6"	6"*	N/A
Undivided	greater than or equal to 5' 6"	8"	N/A
Divided	less than 6'	8"	8"
Divided	greater than or equal to 6'	12"	12"

* Typically placed under the edge line in accordance with Standard Drawing M-22.

On undivided two-lane highways in rural areas with paved shoulders with an effective clear width of five (5) feet and greater, longitudinal rumble strips should be applied. The use of longitudinal rumble strips on shoulders less than five (5) feet in effective width may be considered on a case-by-case basis when supported by a written traffic evaluation.

On divided highways, longitudinal rumble strips should be applied on the right (outside) shoulders with a width of six (6) feet or greater and on left (median) shoulders which have a width of two (2) feet or greater. The use of longitudinal rumble strips on divided highways with narrower shoulders than those noted may be considered on a case-by-case basis when supported by a written traffic evaluation.

The use of rumble strips may be considered on shoulders with a width of one (1) foot or less if constructability permits, since a shoulder of such width may not be usable by bicycle traffic.

The use of longitudinal rumble strips on all roadway shoulders with an effective clear width of less than six (6) feet wide with sections of guardrail, barrier, or other features or obstructions shall be evaluated. The effective clear width of the shoulder in these areas if a longitudinal rumble strip is installed shall be determined. The effective clear shoulder width is defined as the distance between the outside edge of the proposed rumble strip and the front face of the guardrail, barrier, or other obstruction.

The effective clear shoulder width is important for the following reasons:

(a) Constructability - To allow for installation equipment, i.e. grinding, a minimum effective clear shoulder width of two (2) feet is needed from the outside edge of the rumble strip groove to the front face of the barrier or guardrail. If the barrier is on a higher-degree horizontal curve, additional width may be needed. This constructability issue applies to all shoulders and all types of highways.

(b) Bicycle Traffic - A minimum effective clear shoulder width of four (4) feet should be provided from the outside edge of the rumble strip pattern to the edge of pavement or front face of the barrier or guardrail. If this clear area cannot be maintained, then a change of configuration and/or deletion of the rumble strip should be considered.

If these minimum clear shoulder width dimension criteria cannot be maintained, then there are four possible solutions that may be considered. These possible solutions should be considered in the order that they are presented here.

1. Use a narrower strip width (6 inch) installed under the edge line (see Standard Drawing M-22).
2. Re-evaluate lane widths; if the lanes are wider than 12 feet it may be permissible to reduce their width.
3. If on a roadway not subject to routine snowplow activity, consider using an alternative rumble strip treatment such as profile pavement markings and/or raised pavement markers. Note that neither a ground-in rumble strip nor a raised pavement marker pattern should be considered "bicycle-friendly", as these have negative impacts on bicyclists by causing significant vertical oscillations that can be very uncomfortable or potentially affect stability.
4. Omit the use of the longitudinal rumble strip.

Rumble strips on the right shoulder should use a pattern incorporating periodic gaps as shown on Standard Drawing M-22.

At the discretion of the Engineer, the shoulder rumble strip may be omitted on the approach to an intersection.

If a pavement surface discontinuity (such as the outside edge of a surface course) exists at the typical lateral location of the rumble strip, the rumble strip may be offset to avoid the discontinuity. The rumble strip may be shifted outward (away from the travel lanes) if a minimum of four (4) feet of clear paved shoulder remains after the shift.

The use of longitudinal shoulder rumble strips on roadways with shoulders less than five (5) feet shall require a written traffic evaluation approved by the Manager of the Traffic Safety Section. At a minimum, the traffic evaluation should analyze run-off-road crashes in the specific areas where shoulder widths are less than five (5) feet, the effectiveness of shoulder rumble strips or other proposed treatments to mitigate these crashes, and the specific predicted impacts on bicycle travel due to the installation of shoulder rumble strips. The checklist in Exhibit 480-A can be used to collect relevant information for an evaluation; however, the checklist itself is not a substitute for an evaluation.

480.3 CENTERLINE RUMBLE STRIPS

Centerline rumble strips (CLRS) should be installed on undivided roadways in rural areas in both passing and no-passing zone areas. The allowable CLRS pattern, width and spacing is detailed on Standard Drawing M-22. The CLRS should be centered on the roadway centerline marking pattern as depicted in Standard Drawing M-22.

CLRS should be discontinued to a minimum of 25 feet in advance of roadway intersections. In locations with left turn lanes, CLRS should be discontinued in advance of the left turn lane opening.

CLRS should not be installed under the following conditions unless approved by the State Traffic Engineer and supported with a written traffic evaluation:

- On roadways with travel lanes less than eleven (11) feet in width.
- On roadways with non-raised or marked medians.
- Bordering two-way left turn lanes, driveways or other high volume turning areas (approximately 500 or more vehicles per day).
- On urban roadways.
- On roadways with a posted speed limit of 40 mph or less.
- Where there is a likelihood of significant noise generation from vehicle travel over centerline rumble strips, such as passing or turning maneuvers in the vicinity of occupied residences. The use of sinusoidal CLRS rumble strips should be considered if there are no other reasonable alternatives and/or it is to mitigate a specific area. Sinusoidal rumble strips shall be installed per Standard Drawing M-22
- Where it is determined that centerline rumble strips are likely to have a detrimental effect on snowplow operations.

If the pavement is a condition such that the ground-in rumble strips cannot be installed, and it is determined that some type of additional treatment is appropriate, alternative techniques such as a pattern of raised pavement markers or profile pavement markings should be installed.

Exhibit 480-A. Shoulder Rumble Strip Evaluation Checklist

Project Name: _____

Project Number: _____

Route: _____

Milepost Limits: _____ to _____

Project Scope: _____

1. Has this highway segment been identified by the State Bicycle Coordinator or District as:
    a. being used by bicyclists, or
    b. does it comprise the only practical route between two destinations, or
    c. has it been identified as part of a current or prospective bicycle route such as a US Bicycle Route, state or local bike route, or route mapped by a national bicycling organization?

2. Are there inhabited residential structures within 2000 feet of the highway? If so, list by location (station or MP) and direction.

3. Are there shoulders with clear widths of less than 5 feet from edge line to edge of pavement or face of barrier or other obstruction? If so, list by limits (station or MP) and direction.

4. Has a run-off-road crash analysis been performed for the specific locations listed in #2? Yes No
5. Do the run-off-road crashes in the specific locations listed in #2 involve behavioral factors (DUI, speed) or inattention? Yes No
6. If the run-off-road crashes involve inattention, are they susceptible to mitigation by shoulder rumble strips? Yes No
7. Does the highway see winter snowfall, icing, or plow activity? Yes No

Note: This checklist is intended to be used to collect information relevant for an evaluation; however, this checklist is not a substitute for a required written traffic evaluation.