

VIRGINIA DEPARTMENT OF TRANSPORTATION

LOCATION AND DESIGN DIVISION

INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: RUMBLE STRIPS	NUMBER: IIM-LD-212.5 TED-365.1
SPECIFIC SUBJECT: <u>CONTINUOUS PATTERN:</u> SHOULDER RUMBLE STRIP CENTERLINE RUMBLE STRIP <u>INTERMITTENT PATTERN:</u> SHOULDER RUMBLE STRIP	DATE: AUGUST 12, 2013 SUPERSEDES: IIM-LD-212.4
LOCATION AND DESIGN DIVISION APPROVAL: B. A. Thrasher, P.E. State Location and Design Engineer Approved August 12, 2013	TRAFFIC ENGINEERING DIVISION APPROVAL: Raymond J. Khoury, P.E. State Traffic Engineer Approved August 2, 2013

Changes are **Shaded**.

CURRENT REVISION

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- This memorandum has been revised to require rumble strips in asphalt concrete pavement to be sealed with Liquid Asphalt Coating upon installation. Currently, rumble strips are sealed after the asphalt concrete pavement has been in place for a minimum of one year.

EFFECTIVE DATE

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- This memorandum is effective upon receipt.

BACKGROUND

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- Rumble Strips are cylindrical groove patterns milled into roadway or shoulder pavement which alert drivers, through detectable noise and vibration, when a vehicle's wheels leave the travel lane.
 - Rumble Strip grooves are known to effectively reduce roadway departure crashes on freeways and arterials. For reference documents on roadway departure treatments, see http://safety.fhwa.dot.gov/roadway_dept/index.htm.

POLICY FOR USE OF RUMBLE STRIP

- Rumble Strips are to be provided on new and appropriate existing roadways in accordance with this memorandum and as recommended by the Regional Traffic Engineer.
- Rumble Strips may be either “Continuous” or “Intermittent” and are applicable as shown in the table below.

Rumble Strip Patterns and Applications:

Pattern	Application		Standard
	Location	Roadway	
Continuous	Left or Right Shoulder	Fully-Controlled Access – Divided (with median)	RS-1
	Left Shoulder	Partially and Non-Controlled Access	
	Centerline	Partially and Non-Controlled Access - Undivided (no median)	RS-3
Intermittent (reviewed by VDOT District Bicycle-Pedestrian Coordinator)	Right Shoulder	Partially and Non-Controlled Access –Divided / Undivided (with median / no median)	RS-5

Note: VDOT roadway inventory classifies a roadway segment with two-way center left lanes as “divided roadway with flush median”.

For Intermittent Shoulder Rumble Strip, Standard RS-5, pavement marking shall be placed as directed by the Engineer. When designated as a Rumble “Stripe” the pavement marking shall be placed in accordance with Standard RS-4.

For information on “Fully-Controlled Access”, “Partially-Controlled Access” and “Non-Controlled Access”, see the AASHTO Green Book, Chapter 2.

- CSRS are not appropriate for bridge decks, acceleration / deceleration lanes, gore areas, surface drainage structures, or other areas identified by the Regional Traffic Engineer.
- Environmental Division is to be consulted to determine if a Programmatic Categorical Exclusion (PCE) will be required.

CRITERIA FOR DETERMINING USE OF RUMBLE STRIPS ON EXISTING ROADWAYS

- Rumble Strips are applicable for rural arterials and freeways being resurfaced or reconstructed where appropriate.
- Rumble Strips may be appropriate for other roadway classifications where studies indicate a high occurrence of roadway departure crashes.
- The Regional Traffic Engineer will verify that Rumble Strips are an appropriate measure through study, field review and consultation with the Residency Administrator, District Maintenance Engineer and District Materials Engineer. The following factors will be considered:
 - Roadway Functional Classification / Type of Facility (Multi-lane Arterials should be considered first)
 - Roadway Departure (RD) Crash Density for the past 3-5 years
 - Design / Posted Speed
 - Traffic Volumes (AADT)
 - Roadway Geometry (horizontal alignment, lane width, roadway access, roadside design)
 - Pavement Conditions (depth and existing quality)
 - Adjacent Land Use
 - Traffic Control Devices
 - Benefit-Cost Analysis for expected crash reduction greater than 1.0
- Instructions for conducting a cost-benefit analysis for rumble strip treatments are available on the Highway Safety Improvement Program (HSIP) website at: http://www.vdot.virginia.gov/business/ted_app_pro.asp.

POLICY FOR EVALUATING EXISTING SHOULDERS FOR RUMBLE STRIP APPLICATIONS

- When evaluating existing shoulders for the application of Shoulder Rumble Strips, the following items are to be considered:
 - Minimum of 2 inch shoulder pavement depth and sufficient condition determined by the District Materials Engineer to effectively accept the milling process without raveling or deteriorating. Otherwise, the shoulder pavement should be upgraded prior to milling.
 - Minimum of 4 feet of paved shoulder outside of the travel lane (right and left shoulder applications).

- Left paved shoulder widths between 2 feet and 4 feet outside of the travel lane may be considered for continuous rumble strips if adequate “total shoulder” recovery area is provided. This decision will be made at the joint discretion of the Regional Traffic Engineer, District Materials Engineer and the Project Manager.
 - Minimum of 4 feet outside of the milled rumble strip groove when providing for bicycles. If large bicycle volumes are present or expected, a minimum of 5 foot paved shoulder outside of the groove is desirable, particularly if there are obstructions such as guardrail. Additional shoulder width may be necessary if horse and buggy traffic is present or expected.
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CONTINUOUS SHOULDER RUMBLE STRIP, STANDARD RS-1

- For Rural Roadways with Fully-Controlled Access, Continuous Shoulder Rumble Strip (CSRS) Standard RS-1 is to be specified for Right and Left Paved Shoulders.
 - For Divided Roadways with Partially-Controlled / Non-Controlled Access, Continuous Shoulder Rumble Strip (CSRS) Standard RS-1 may be specified for left (median) shoulders with Design Speeds ≥ 50 mph / Posted Speeds ≥ 45 mph.
 - Continuous Shoulder Rumble Strip grooves shall be milled as follows:
 - 7 inches by 16 inches across by $\frac{1}{2}$ inch deep.
 - 6 inch positive offset from the outside edge of pavement edge-line.
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CONTINUOUS CENTERLINE RUMBLE STRIP, STANDARD RS-3

- For No-Passing Zones on New and Existing Undivided Non-Access Controlled roadways, Continuous Centerline Rumble Strip (CCLRS), Standard RS-3, is to be provided as recommended by the Regional Traffic Engineer based on the following:
 - Design Speeds ≥ 50 mph / Posted Speeds ≥ 45 mph
 - Through Travel Lane Widths ≥ 11 feet
 - Minimum 4” asphalt pavement and sufficient condition determined by the District Materials Engineer to effectively accept the milling process without raveling or deteriorating. Otherwise, the pavement should be upgraded prior to milling.
- For existing roadways, first consideration for CCLRS should be given to those with multiple lanes, posted speeds ≥ 45 mph and with traffic volumes > 5000 AADT.

- CCLRS groove dimensions shall be 7 inches by 14 inches across by ½ inch deep, spaced in accordance with Standard RS-3 (12 inches apart, leading edge to leading edge).
- CCLRS shall be installed in Passing Zones only when directed by the Regional Traffic Engineer based on evaluation of traffic crash types and patterns.
- When CCLRS are installed in Passing Zones, the depth shall be reduced to 3/8 inch and the groove spacing may be increased to 24 inches.

CCLRS shall not be installed:

- within limits of bridges
- on subdivision streets
- on unmarked roadway pavement segments
- within the limits of two-way turn lanes (designated as divided roadway with flush median)

SHOULDER RUMBLE STRIPE – STANDARD RS-4

- As an alternative to placing the pavement line marking on the outer edge of the travel lane, the Regional Traffic Engineer may recommend that the pavement marking be applied over the grooved area to enhance edge-line visibility. When recommended by the Regional Traffic Engineer, Shoulder (Edge-line) Rumble Stripe, Standard RS-4 shall be utilized.
- To avoid pavement raveling or deterioration, the surface course pavement joint shall be located a minimum of 6 inches **outside** of the outer edge of the milled groove or as directed by the Engineer.
- Edge-line Rumble Stripes are applicable to travel lanes ≥ 11 feet and are not applicable to concrete pavements.

INTERMITTENT SHOULDER RUMBLE STRIP, STANDARD RS-5

- Roadways without controlled access may include driveways, crossovers, intersections, and turn lanes, creating an environment of multiple entrances and exits. To provide accessibility to potential cyclists on these type roadways, rumble strip applications should use an “intermittent” pattern to provide gaps between the milled grooves.
- Intermittent Shoulder Rumble Strip (ISRS), Standard RS-5 is applicable to paved shoulders on appropriate Partially-Controlled and Non-Controlled Access roadways with design speed ≥ 50 mph / posted speed ≥ 45 mph and lane widths ≥ 11 feet.

- The District Bicycle-Pedestrian Coordinator shall be consulted on the use of Intermittent Shoulder Rumble Strip (ISRS), Standard RS-5.
 - A minimum of 4 feet of paved shoulder shall be provided outside of the milled rumble strip groove. If large bicycle volumes are present or expected, a minimum of 5 foot paved shoulder outside of the groove is desirable, particularly if there are obstructions such as guardrail. Additional shoulder width may be necessary if horse and buggy traffic is present or expected.
 - Intermittent Shoulder Rumble Strip (ISRS) shall be milled as follows:
 - 7 inches by 12 inches across by ½ inch deep
 - 12 foot gap provided between each 48 foot section of rumble strip
 - On downgrades $\geq 6\%$, a 16 foot gap should be provided between each 52 foot section of rumble strip
 - In addition to the gaps provided above, gaps are also provided by skipping driveways and intersections
 - Placement of the Pavement Marking (Strip or Stripe) shall be as directed by the Engineer.
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METHOD OF SHOWING RUMBLE STRIPS IN THE PLAN ASSEMBLY

- The Project Typical Section is to show station to station locations where Rumble Strips are to be placed and the type of application, (Continuous Shoulder Rumble Strip, Standard RS-1, Intermittent Shoulder Rumble Strip, Standard RS-5 or Centerline Rumble Strip, Standard RS-3).
 - When recommended by the Regional Traffic Engineer, the pavement marking shall be applied over the grooved area as an edge-line “stripe”. In these situations, the project typical section shall specify station to station locations where “Pavement marking is to be applied in accordance with Shoulder Rumble Stripe, Standard RS-4.
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SUMMARIZATION AND PAYMENT

- Quantities for “Rumble Strips” are to be shown in the Pavement Summary.
- Quantities will be shown as linear feet of “Rumble Strip” regardless of type of application (continuous/intermittent/centerline) or method of pavement marking (strip or stripe). Measurement is to include the length of application, measured longitudinally along the edge of pavement.
- Deductions are to be taken for bridge decks, acceleration/deceleration lanes, gore areas, intersections, driveways, crossovers, surface drainage structures and other sections where the Rumble Strips are not to be installed.

- For Intermittent Shoulder Rumble Strips (ISRS), there is to be no deduction in measurement for the 12 foot gap between the 48 foot sections (16 foot gaps in rolling terrain).
- When Rumble Strip(e)s are installed in asphalt concrete pavement, the entire Rumble Strip area shall be coated with Liquid Asphalt Coating. This coating shall be measured and paid for in square yards, estimated as follows:
 - For 16 inch groove - Pay area shall be 20 inches (0.556 yd.) times the length of rumble strip application, measured longitudinally along the edge of pavement.
 - For 14 inch groove - Pay area shall be 18 inches (0.5 yd.) times the length of rumble strip application, measured longitudinally along the edge of pavement.
 - For 12 inch groove - Pay area shall be 16 inches (0.444 yd.) times the length of rumble strip application, measured longitudinally along the edge of pavement.
- Overspray shall not extend more than 2 inches beyond the width of cut and/or shall not come in contact with pavement markings.
- For Shoulder (Edge-line) Rumble Stripes – Liquid Asphalt Coating shall be applied prior to placing the pavement markings over the groove.
- Rumble Strips will be measured in the field and paid for in linear feet of shoulder where actually placed and accepted (excluding test site).
- The following pay items have been established (applicable to Continuous Shoulder, Intermittent Shoulder and Centerline applications):

<u>Pay Item</u>	<u>Pay Unit</u>	<u>Item Code</u>
Rumble Strip (Asphalt)	Lin. Ft.	10700
Rumble Strip (Concrete)	Lin. Ft.	10702
Liquid Asphalt Coating (for asphalt)	S.Y.	10701

INSERTABLE SHEETS

- The following insertable sheets are available on Falcon DMS, under eng-ser, 2008 insertable sheets for applicable plan assemblies:
 - IIS03_03 Continuous Shoulder Rumble Strips RS-1
 - IIS03_04 Centerline Rumble Strips RS-3
 - IIS03_05 Shoulder Rumble Stripes RS-4
 - IIS03_06 Intermittent Shoulder Rumble Strip RS-5

SPECIAL PROVISION

- Special Provisions are available for applicable projects, available at:

<http://www.virginiadot.org/business/manuals-default.asp>