



MINNESOTA DEPARTMENT OF TRANSPORTATION  
Engineering Services Division  
Technical Memorandum No. XX-XX-XX-XX  
January XX, 201X

To: Distribution 57, 612, 618, 650

From: Susan Mulvihill  
Division Director  
Engineering Services

Subject: Centerline rumble stripEs on Rural Trunk Highways  
Rumble strips on Shoulders of Rural Trunk Highways  
Edgeline rumble stripEs on Rural Trunk Highways

#### Expiration

This Technical Memorandum supersedes both No. 07-09-T-03 and No. 08-04-TS-02, which were the Technical Memoranda titled *Edgeline Rumble StripEs Guidance for Rural Trunk Highways* and *Rumble Strips on Shoulders of Rural Trunk Highways*. It will expire XXXX XX, 201X unless superseded prior to this date or incorporated into the Mn/DOT Standard Plans, the Road Design Manual, and/or Traffic Engineering Manual.

#### Implementation

This policy shall be in effect for all construction and maintenance pavement projects with a scheduled letting date after January 1, 2011. District personnel should make every effort to implement this policy for projects which have been let prior to January 1, 2011 and on which rumble strip and rumble stripE construction have not yet begun.

This policy applies to all projects on rural Trunk Highways where the posted speed limit is 50 mph or higher. For the purpose of this technical memorandum a *Rural Trunk Highway* will be defined as a roadway segment with minimal residential or commercial development and little or no further development is anticipated in the near future. Officially, the definition of a *Rural Trunk Highway* will match the guidance given in the MnDOT Access Management Manual. Districts may implement this policy on urban high-speed Trunk Highways.

The guidelines contained in this Technical Memorandum apply to all Rural Trunk Highways. However, other road authorities are encouraged to evaluate their needs accordingly.

#### Purpose

To provide centerline rumble stripEs and shoulder rumble strips on all rural undivided Trunk Highways to reduce lane departure crashes, to provide increased centerline visibility during rainy conditions, and to guide motorists during snowy conditions when striping visibility is poor. This document will also provide guidance on cases where edgeline rumble stripEs can be substituted for either of the above requirements.

#### Definitions

##### ***Shoulder rumble strips***

These are defined as rumble strips outside of the edgeline. They are usually 12" in width. A 16" rumble strip is required on freeway segments. An 8" wide rumble strip (previously called a "profile strip") can be used when paved roadway width is limited.

##### ***Rumble stripEs***

Rumble stripEs are defined as a rumble strip that contains a pavement marking stripe. These will be referred to as either **edgeline rumble stripEs** or **centerline rumble stripEs**

##### ***Rural Trunk Highway***

This is defined as a roadway segment that has minimal residential or commercial development, with little or no further development anticipated in the future. Officially, rural segments will be defined by the MnDOT Access Management Guide.

##### ***Profile Strips/StripEs***

This term will be removed from this Technical Memorandum. Rumble strips will be referred to by their width. For example, what was formerly known as a profile strip will now be known as an 8" rumble strip.

## Background

Detailed crash analysis has shown that lane departure crashes, such as run off the road, sideswipe and head-on crashes, on rural two-lane two-way highways in Minnesota result in an over represented number of fatalities and serious injuries.

Both traditional pavement markings and rumble strips are used to decrease the number of lane departure crashes. Following the lead of other states, MnDOT experimented with combining traditional pavement markings and rumble strips into a “rumble stripE,” where the pavement marking is installed on the rumble strip. MnDOT issued guidance for the use of edgeline rumble stripEs as part of Technical Memorandum No. 07-09-T-03.

The NCHRP Report 641 shows that the use of rumble strips both on the shoulder and beneath the centerline result in a significant reduction of targeted crashes. This report can be found at the following URL:

[http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_rpt\\_641.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_641.pdf).

Additionally, numerous states in the region have enacted systematic policies to require rumble strips and rumble stripEs on their trunkline roadways. Michigan, Missouri, and North Dakota have policies requiring centerline rumble stripEs, plus edgeline rumble stripEs or shoulder rumble strips, on most of their high-speed rural trunkline roadways. Iowa has a current statewide policy requiring the use of shoulder rumble strips that will likely be replaced with one requiring edgeline rumble stripEs on most of its primary trunkline network. Wisconsin has no policy on rumble stripEs, but has shoulder rumble strips extensively on its trunkline roadway network.

This Technical Memorandum strengthens the provisions of both Technical Memoranda that are being combined. All of the requirements of the Technical Memorandum No. 08-04-TS-02, titled *Rumble Strips on Shoulders of Rural Trunk Highways*, still are in place. The difference is that the requirement now extends to all high-speed rural roads where the paved shoulder is 4' or greater, instead of 6' or greater in the previous Memo.

Also, the intention of this Technical Memorandum is to emphasize the use of centerline rumble stripEs, and also provide stronger language and guidance than currently exists in Technical Memorandum No. 07-09-T-03, titled *Edgeline Rumble StripEs Guidance for Rural Trunk Highways*.

## Requirements

### Shoulder Rumble Strips

Shoulder rumble strips shall be placed on all rural highway projects where shoulders are constructed, reconstructed, or overlaid and where the posted speed limit is 50 mph (80 kph) or greater. This applies to both multi-lane and two-lane highways with paved shoulders 4 feet or greater in width. (This is a change from the previous standard, where shoulder rumble strips were required on highway paved shoulders of at least 6 feet in width.) They shall also be placed on the left shoulder of multi-lane divided roads.

### Centerline Rumble StripEs

Centerline rumble stripEs shall be placed on all rural highway construction and maintenance pavement projects where the posted speed limit is 50 mph or greater. This applies to both multi-lane and two-lane undivided highways.

### Exceptions

On rural highways where the paved shoulder width is 2 feet or less, edgeline rumble stripEs may be placed on both edgelines in lieu of a centerline rumble stripE. This may be preferred on roadway segments where run-off-the-road (ROR) right crashes are more prevalent.

In all cases, edgeline rumble stripEs may be substituted for shoulder rumble strips and still meet the standards within this Technical Memorandum. In cases where both centerline and edgeline rumble stripEs are used on the same highway segment, a 12' effective width free of rumbles should be maintained.

Shoulder rumble strips are not required in areas where there is a bus shoulder. However, it is assumed that bus shoulders will usually be installed in areas that are NOT defined as rural trunk highways in the Access Management Guide.

Even in cases where shoulder rumble strips are not required due to a narrow paved shoulder width, their installation, or the installation of an edgeline rumble stripE, is encouraged for proactive safety reasons. A rumble width as small as 8" may be used instead of the standard 12" rumble width.

Districts shall consider placing centerline rumble stripEs and shoulder rumble strips on in-place shoulders at locations on which no reconstruction is scheduled in the near future as a systematic proactive safety measure using safety funds. The District Materials Engineer should make recommendations regarding the structural adequacy of the in-place roadway and/or shoulder to receive rumble strips.

### **Shoulder rumble strips on concrete pavement**

On concrete paved roadway surfaces, there are two options for how to install shoulder rumble strips. They include:

- Installing 3' long structural rumble strips on alternating panels, and also shoulder rumble strips on the adjacent paved bituminous shoulder. (Refer to Figure 6.)
- Milling in either continuous or intermitted shoulder rumble strips outside the edgeline, but on the concrete surface. (Refer to Figure 7.)

### **Width of rumble strips**

The standard width of rumble strips on the shoulder and for edgeline rumble stripEs is 12". In cases of narrow shoulders, rumble strips as narrow as 8" may be used.

The standard width of rumble strips for centerline rumble stripEs is 16". Any reduction from this shall be approved by OTST.

All rumble strips shall meet any and all specifications for Milled Rumble Strips in the MnDOT Standard Specifications for Construction or Special Provisions. This includes a requirement that rumble strips be milled, and not rolled.

The placement of shoulder rumble strips and edgeline rumble stripEs with respect to the traveled lane shown in Figures can be deviated from at the discretion of the District.

### **Bicycle concerns**

In order to meet the concerns of bicyclists, flexibility has been built in to this Tech Memo. As stated above, rumble strips as narrow as 8" may be used at the discretion of the District. Also, while the dimensions in Figures 1 and 4 indicate the typical lateral placement of the shoulder rumble strip, the District has the discretion to deviate from this.

The longitudinal rumble strip pattern for shoulder rumble strips and edgeline rumble stripEs on non-freeway segments is to include a 12' gap in each 60' cycle. Refer to Figures 5B and 9B. This remains a standard from the previous two Technical Memoranda that are being combined.

### **Questions**

For information on the technical contents of this memorandum, please contact Mitch Bartelt, OTST Pavement Marking Engineer, at 651-234-7373.

Any questions regarding the publication and distribution of this Technical Memorandum should be referred to **Sophia Wicklund**, Design Standards Unit at 651-366-4701, or **Michael Elle**, Design Standards Engineer 651-366-4622. A link to all active Technical Memoranda and a list of historical Technical Memoranda can be found at <http://techmemos.dot.state.mn.us/>

### Attachments:

Table 1: Types and Applications of Edgeline Rumble StripEs

Figure 1: Undivided Rural Roadways – Section View

Figure 2: Undivided Rural Roadways: Option for Paved Shoulders 2' to Less Than 4' in Width – Section View

Figure 3: Undivided Rural Roadways: Option for Paved Shoulders 2' or Less in Width – Section View

Figure 4: Shoulder Rumble Strip on Divided Roadways – Section View

Figure 5: Shoulder Rumble Strip – Plan View

Figure 6: Concrete Pavement Option A: Modified Structural Rumble Strip

Figure 7: Concrete Pavement Option B: Modified Concrete Rumble Strip

Figure 8: Shoulder Rumble Strip – Appropriate Breaks

Figure 9: Bituminous Edgeline Rumble StripE

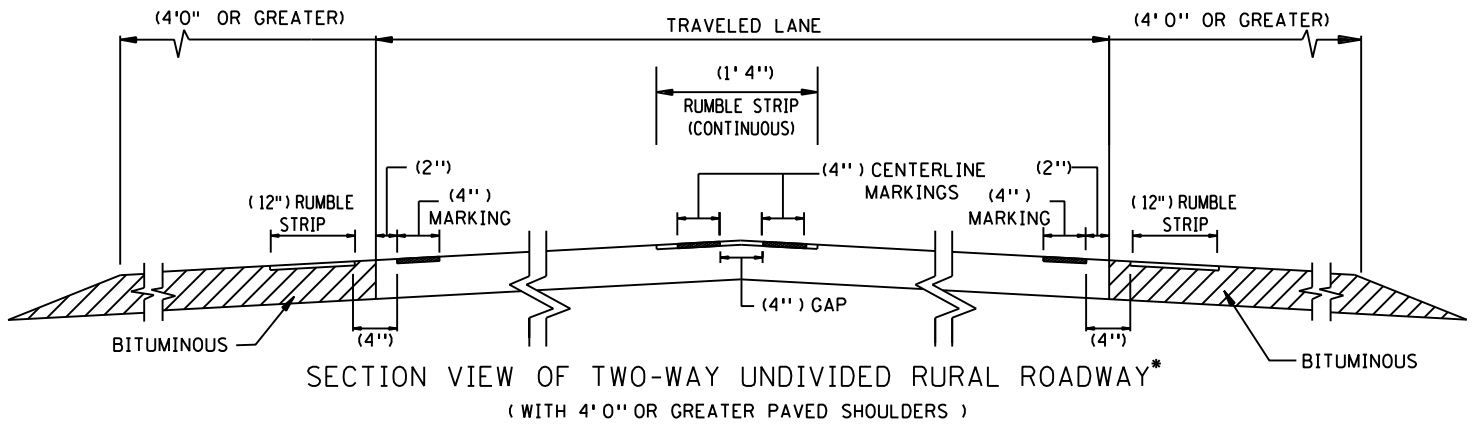
Figure 10: Centerline Rumble StripE – Plan View

**TABLE 1 – Types and Applications of Edgeline Rumble StripEs**

APPLICATIONS	RUMBLE STRIPE TYPES
Two-lane two way Roadway shoulders <b>4 ft.</b> or greater	<p><b><i>Intermittent Rumble StripE (see Figure 9B).</i></b></p> <ul style="list-style-type: none"> <li>• Intermittent milled rumble strips are <b>1 ft.</b> wide.</li> <li>• Intermittent rumble strips shall be milled in a <b>60 ft.</b> cycle; <b>48 ft.</b> of rumble strip followed by a <b>12 ft.</b> gap (also shown in Figure 5B).</li> <li>• The pavement marking shall be <b>4 in.</b> minimum width.</li> <li>• On intermittent rumble strips, the pavement marking shall continue through the <b>12 ft.</b> gap.</li> </ul>
Multi-lane roadway Right shoulders <b>4 ft.</b> or greater	
Multi-lane roadway Left shoulders <b>4 ft.</b> or greater	<p><b><i>Continuous Rumble StripE (see Figure 9A).</i></b></p> <ul style="list-style-type: none"> <li>• Continuous milled rumble strips are <b>1 ft.</b> wide (also shown in Figure 5A).</li> <li>• The pavement marking shall be <b>4 in.</b> minimum width.</li> </ul>
Freeway roadway	<p><b><i>Consult OTST Pavement Marking Engineer for proper design.</i></b></p>
Multi-lane and two-lane Highways with shoulders less than <b>4 ft.</b> wide	<p><b><i>Intermittent Rumble StripE (see Figure 9B).</i></b></p> <ul style="list-style-type: none"> <li>• Intermittent milled rumble strips are <b>1 ft.</b> wide.</li> <li>• Intermittent rumble strips shall be milled in a <b>60 ft.</b> cycle; <b>48 ft.</b> of rumble strip followed by a <b>12 ft.</b> gap (also shown in Figure 5B).</li> <li>• The pavement marking shall be <b>4 in.</b> minimum width.</li> <li>• On intermittent rumble strips the pavement marking shall continue through the <b>12 ft.</b> gap.</li> </ul>
	<p><b><i>Narrow Intermittent Rumble StripE (see Figure 9B).</i></b></p> <ul style="list-style-type: none"> <li>• In cases of narrow shoulders, the width of the rumble strips may be reduced to as little as 8".</li> <li>• Intermittent rumble strips shall be milled in a <b>60 ft.</b> cycle; <b>48 ft.</b> of rumble strip followed by a <b>12 ft.</b> gap (also shown in Figure 5B).</li> <li>• The pavement marking shall be <b>4 in.</b> minimum width.</li> <li>• On intermittent rumble strips the pavement marking shall continue through the <b>12 ft.</b> gap.</li> </ul>

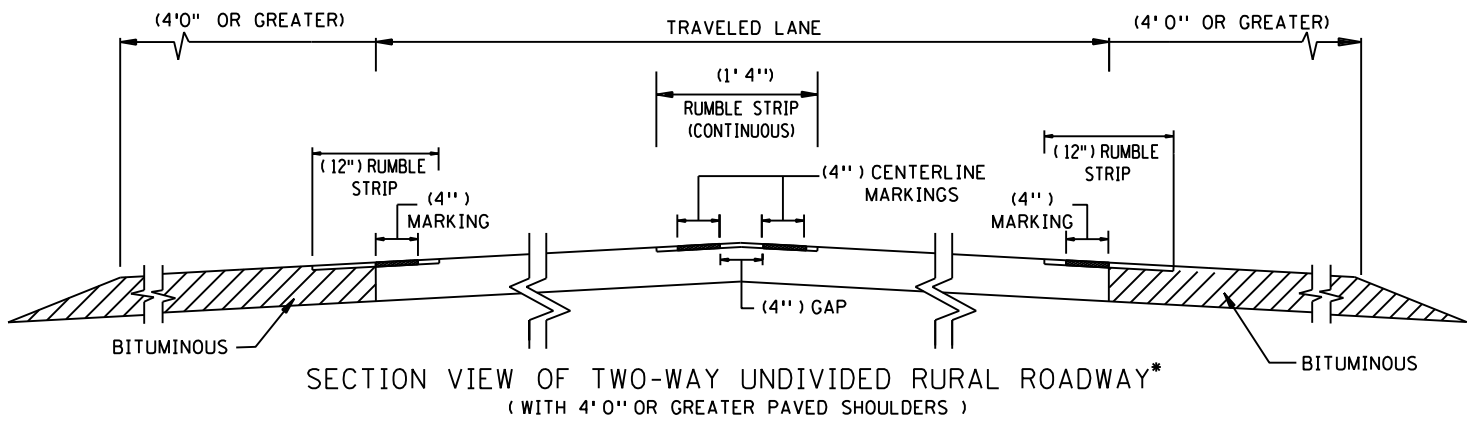
FIGURE 1 - SHOULDER RUMBLE STRIP AND CENTERLINE RUMBLE STRIP - SECTION VIEW

FIGURE 1A



OR

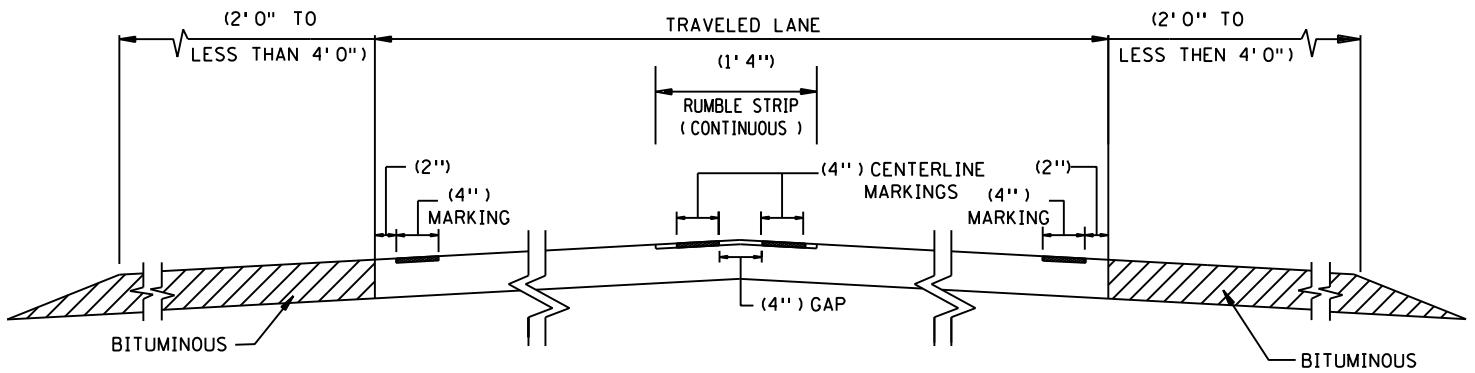
FIGURE 1B



\* A 12' EFFECTIVE LANE WIDTH FREE OF RUMBLES SHOULD BE MAINTAINED IN BOTH DIRECTIONS

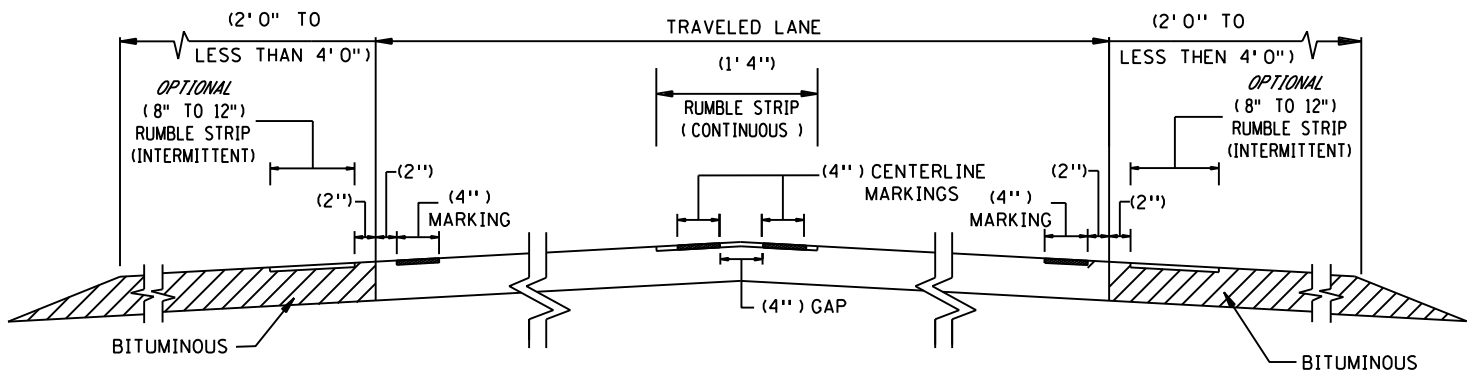
FIGURE 2 - OPTION FOR PAVED SHOULDERS 2' 0" TO LESS THAN 4' 0" IN WIDTH

FIGURE 2A



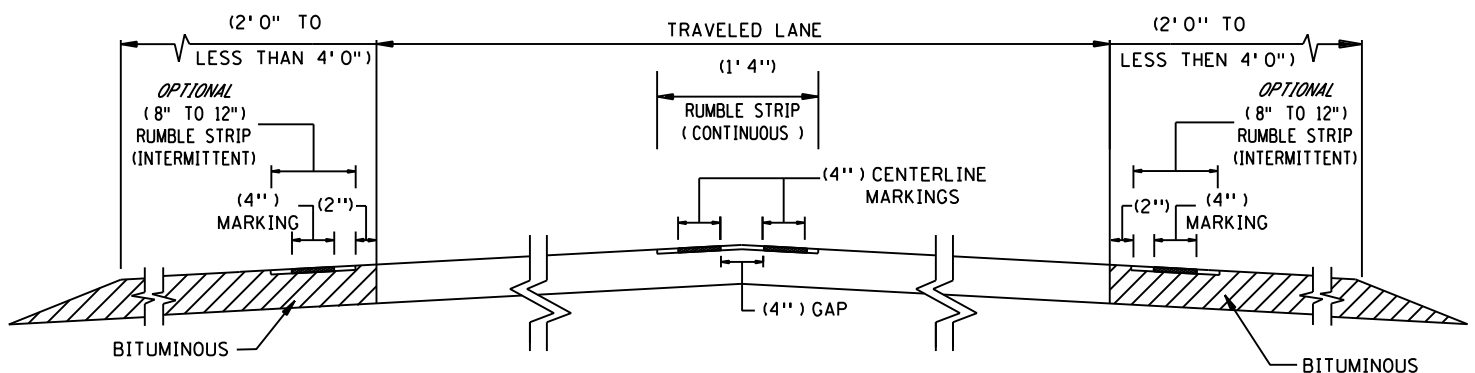
OR

FIGURE 2B



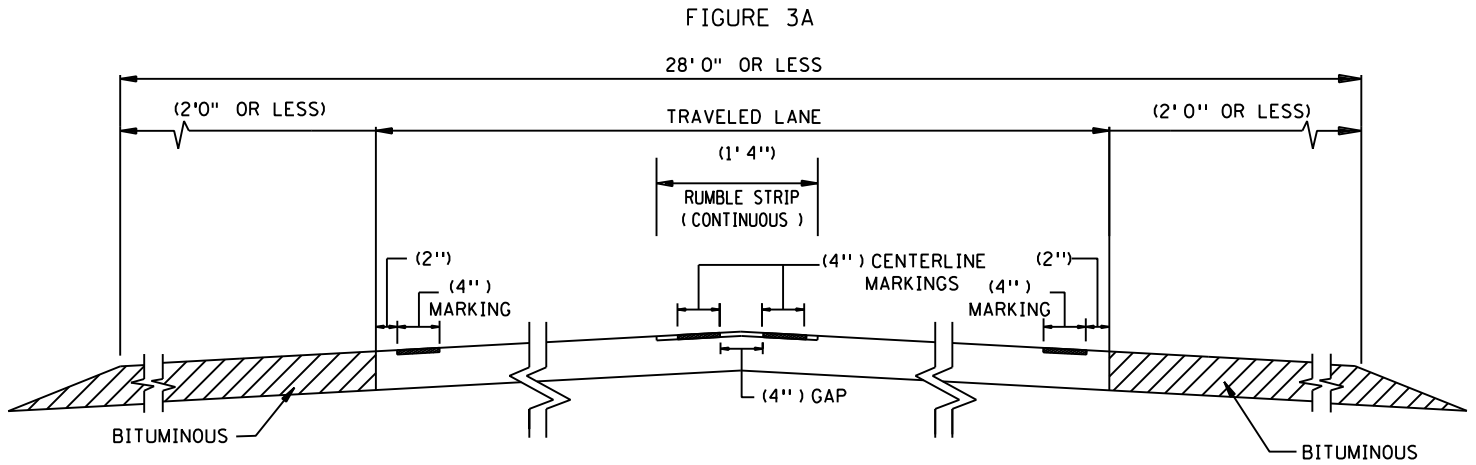
OR

FIGURE 2C



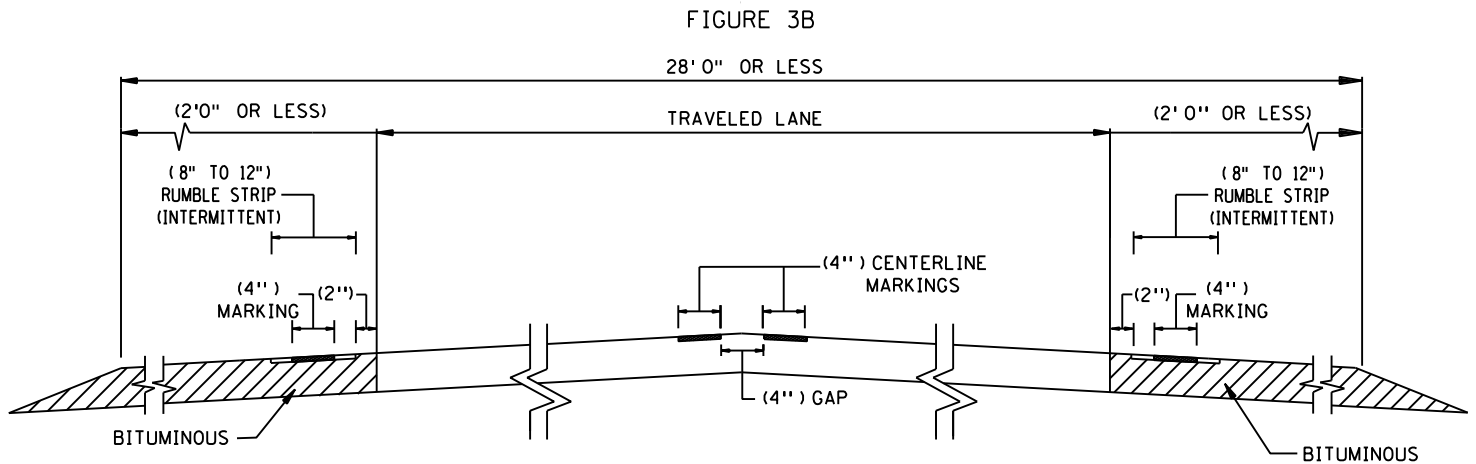
\* A 12' EFFECTIVE LANE WIDTH FREE OF RUMBLES SHOULD BE MAINTAINED IN BOTH DIRECTIONS

FIGURE 3 - OPTION FOR NARROW PAVED SHOULDERS (2' 0" OR LESS PAVED SHOULDER)



SECTION VIEW OF TWO-LANE TWO-WAY UNDIVIDED RURAL ROADWAY\*  
( WITH 2' 0" OR LESS PAVED SHOULDERS )

OR



SECTION VIEW OF TWO-LANE TWO-WAY UNDIVIDED RURAL ROADWAY\*  
( WITH 2' 0" OR LESS PAVED SHOULDERS )

\* A 12' EFFECTIVE LANE WIDTH FREE OF RUMBLES SHOULD BE MAINTAINED IN BOTH DIRECTIONS

FIGURE 4 - SHOULDER RUMBLE STRIP ON DIVIDED ROADWAYS - SECTION VIEW

FIGURE 4A

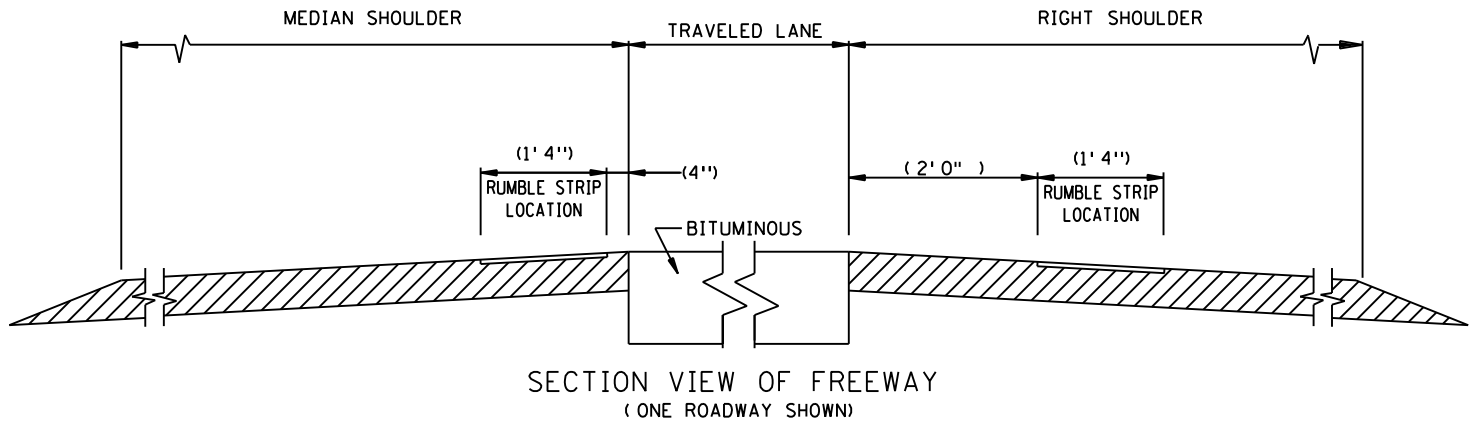


FIGURE 4B

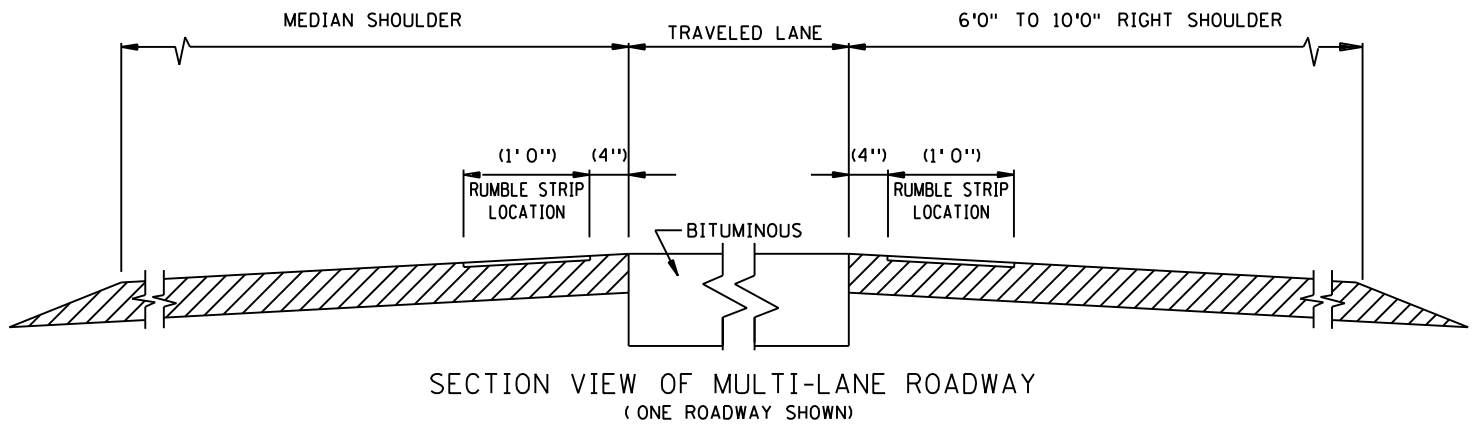


FIGURE 5 - SHOULDER RUMBLE STRIP - PLAN VIEW

FIGURE 5A - PLAN VIEW  
CONTINUOUS

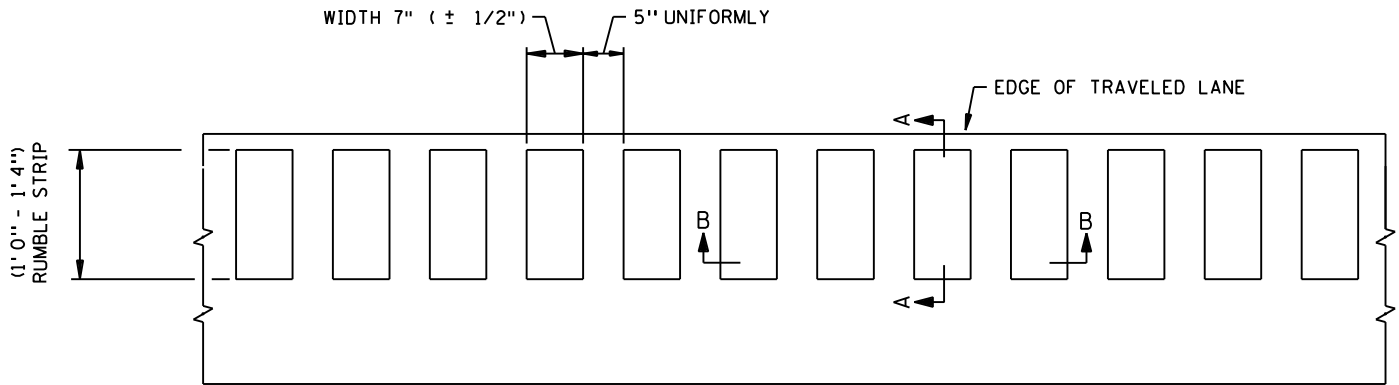
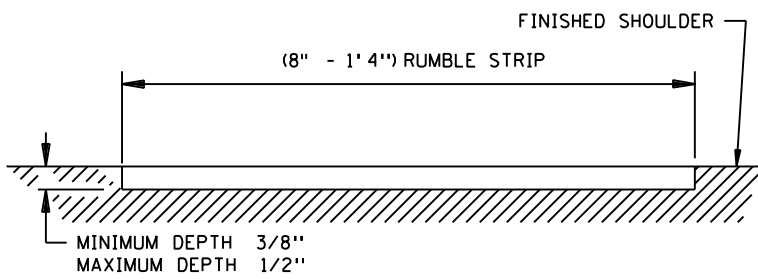
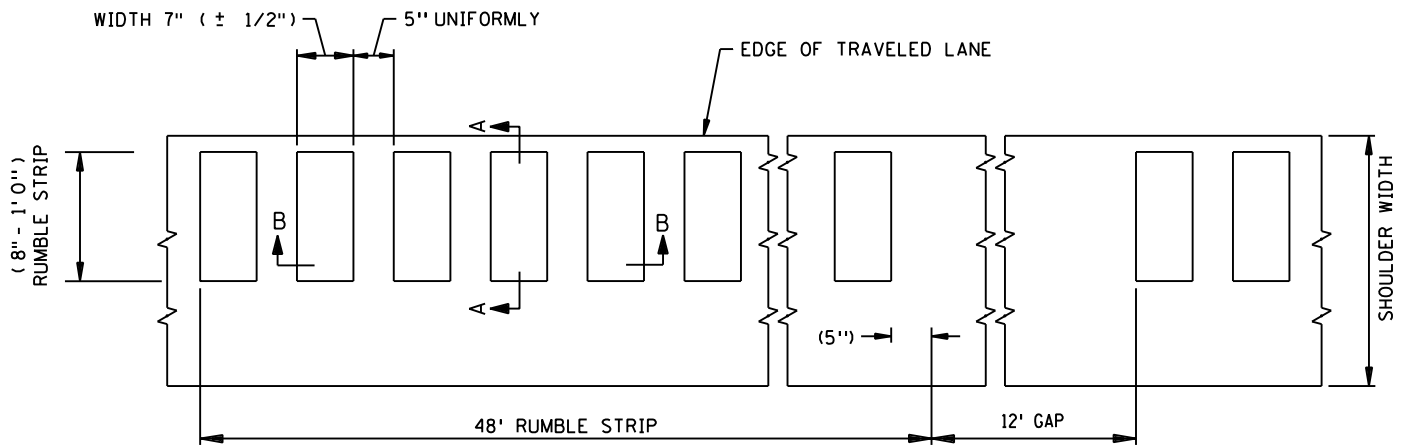
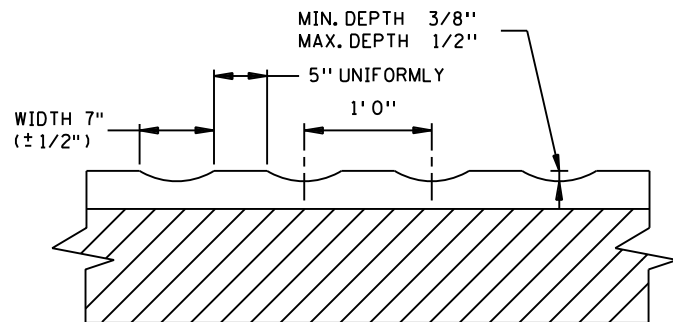


FIGURE 5B - PLAN VIEW  
INTERMITTENT PATTERN

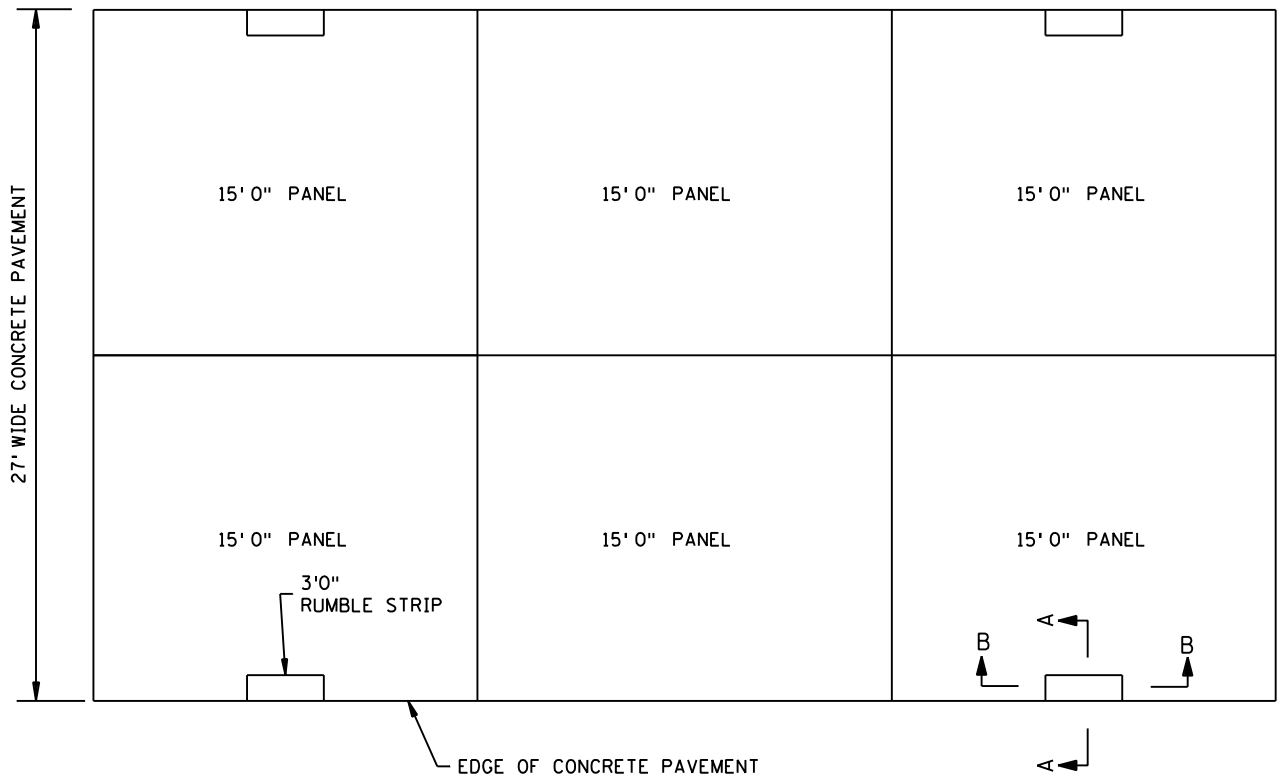


SECTION A-A

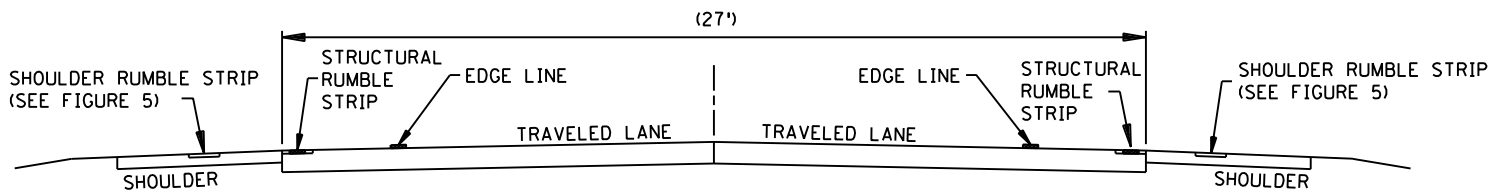


SECTION B-B

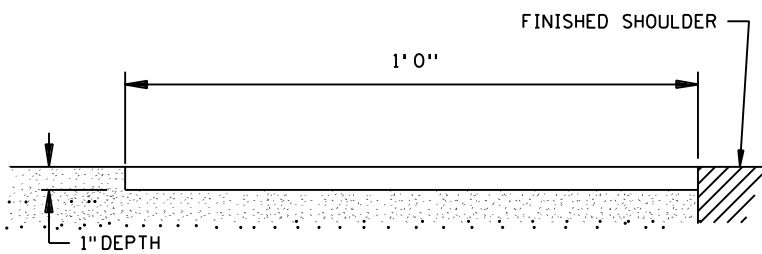
FIGURE 6 - CONCRETE PAVEMENT OPTION A - MODIFIED STRUCTURAL RUMBLE STRIP



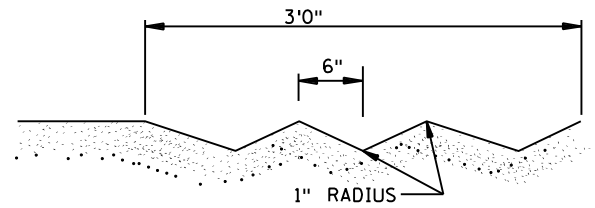
PLAN VIEW - TYPE 4



SECTION VIEW OF ROADWAY

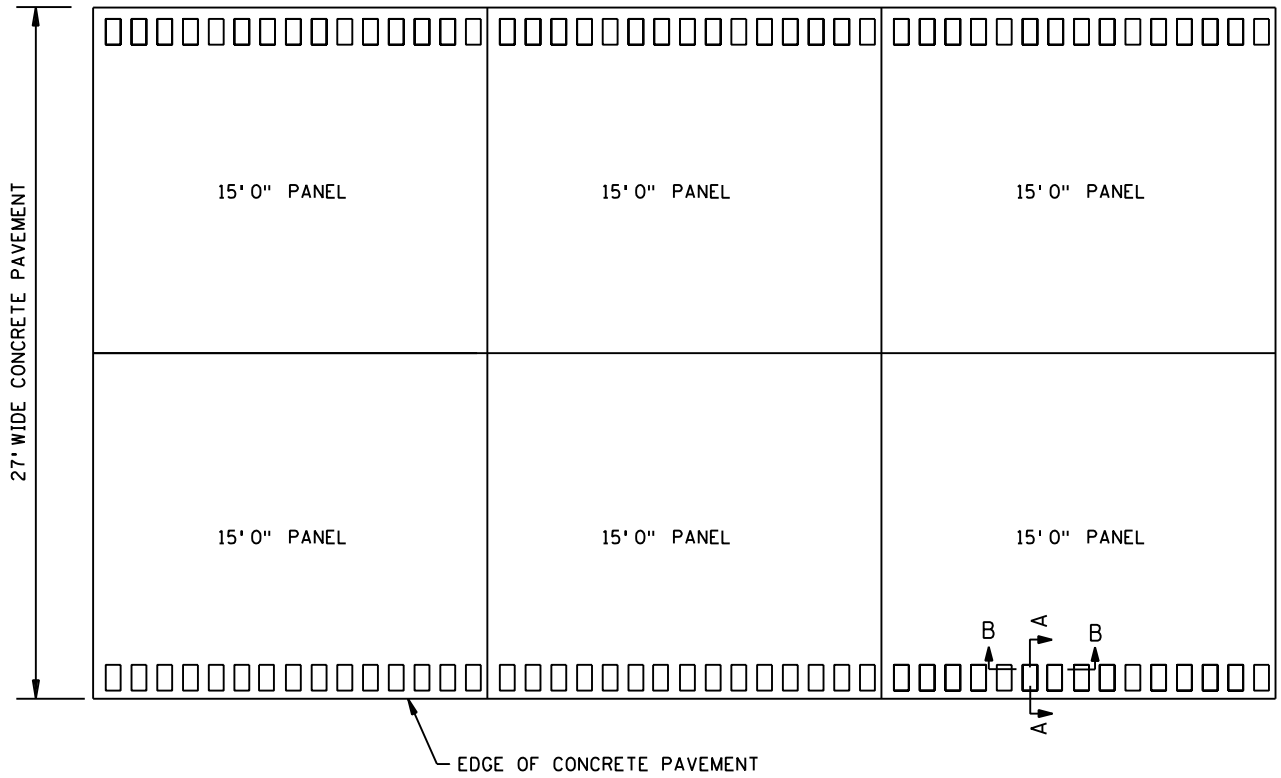


SECTION A-A

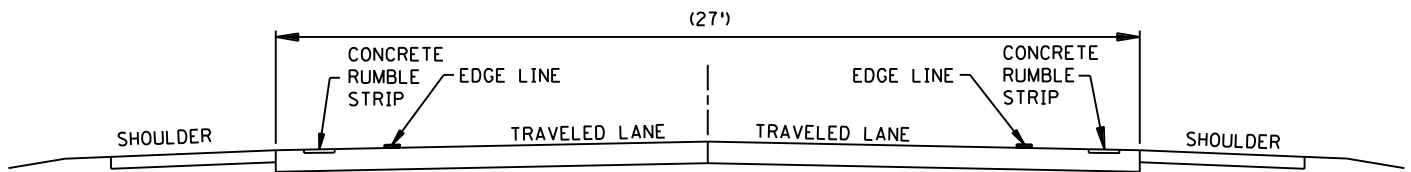


SECTION B-B

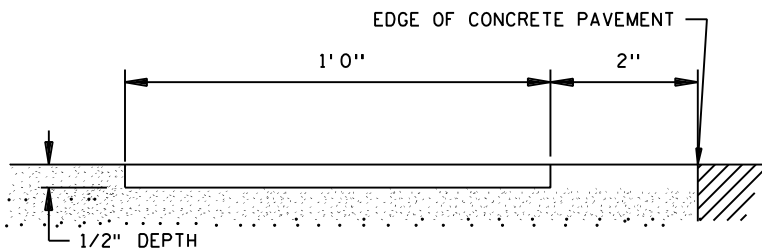
FIGURE 7 - CONCRETE PAVEMENT OPTION B - MODIFIED CONCRETE RUMBLE STRIP



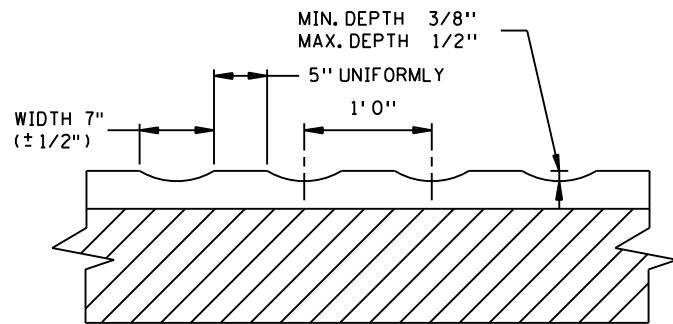
PLAN VIEW - TYPE 4



SECTION VIEW OF ROADWAY



SECTION A-A



SECTION B-B

FIGURE 8 - SHOULDER RUMBLE STRIP - APPROPRIATE BREAKS

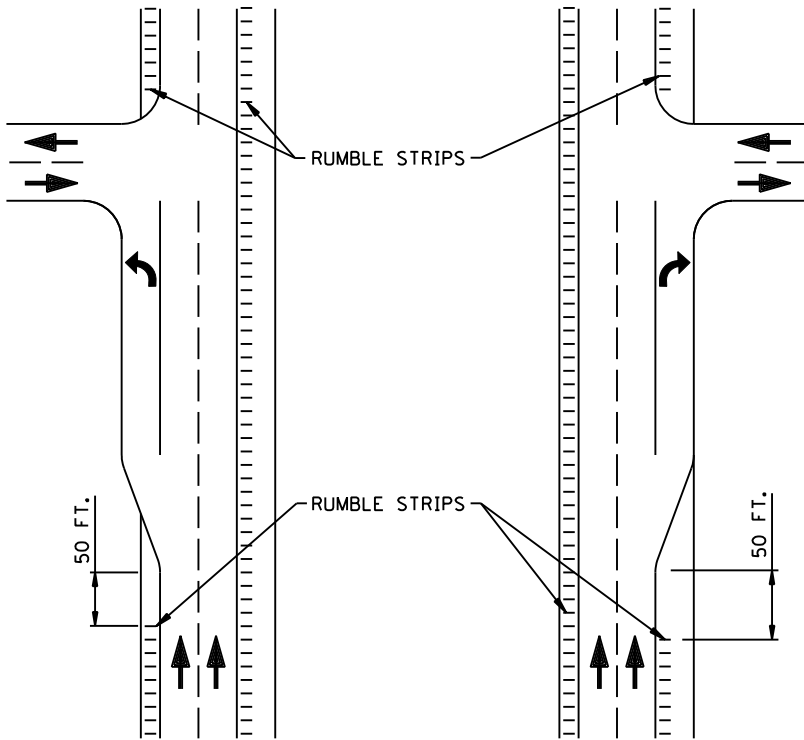


FIGURE 8A  
LEFT TURN LANE

FIGURE 8B  
RIGHT TURN LANE

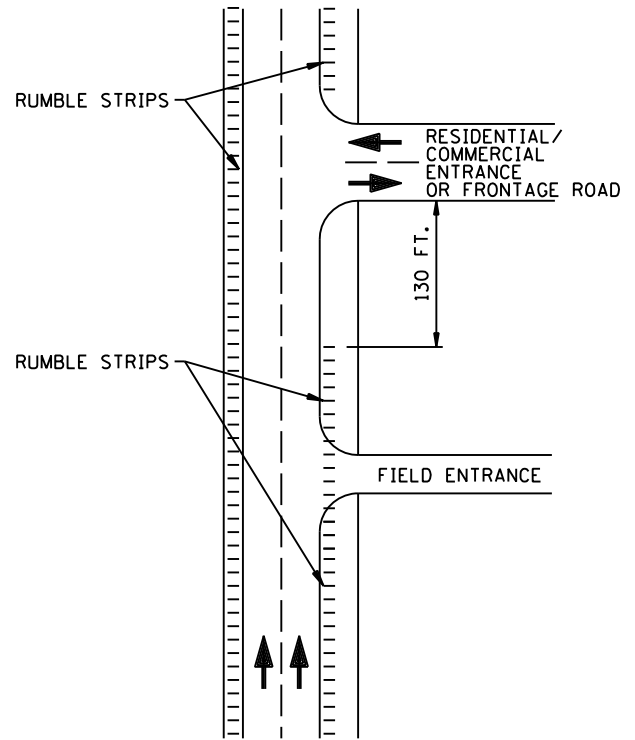


FIGURE 8C  
ENTRANCE ROADS

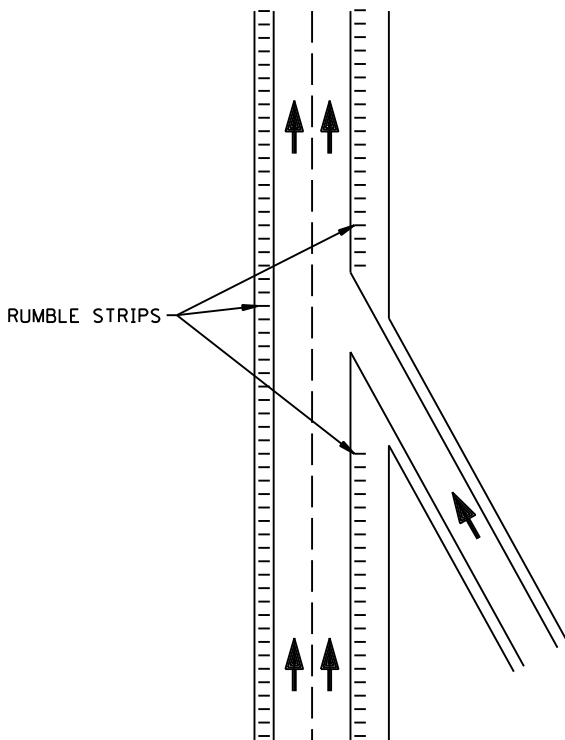


FIGURE 8D  
ACCELERATION LANE

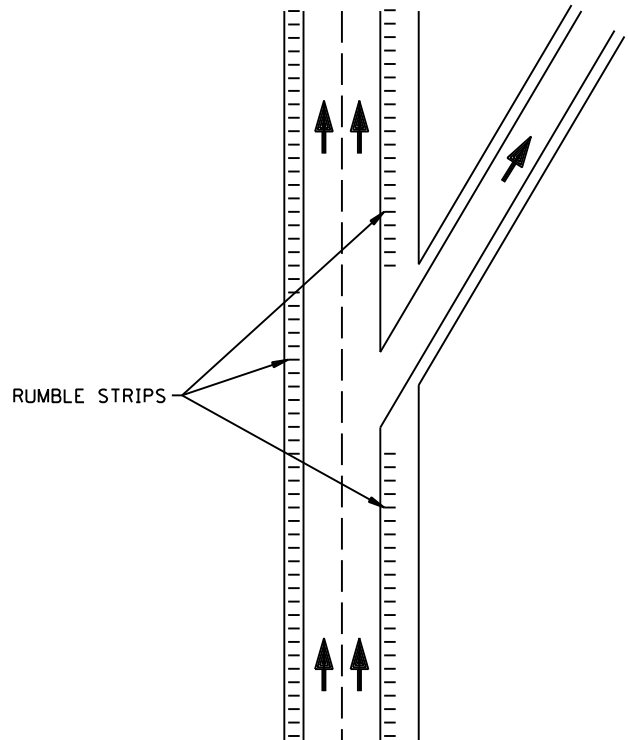


FIGURE 8E  
DECELERATION LANE

FIGURE 9 - BITUMINOUS EDGELINE RUMBLE STRIPE

FIGURE 9A - PLAN VIEW  
CONTINUOUS PATTERN

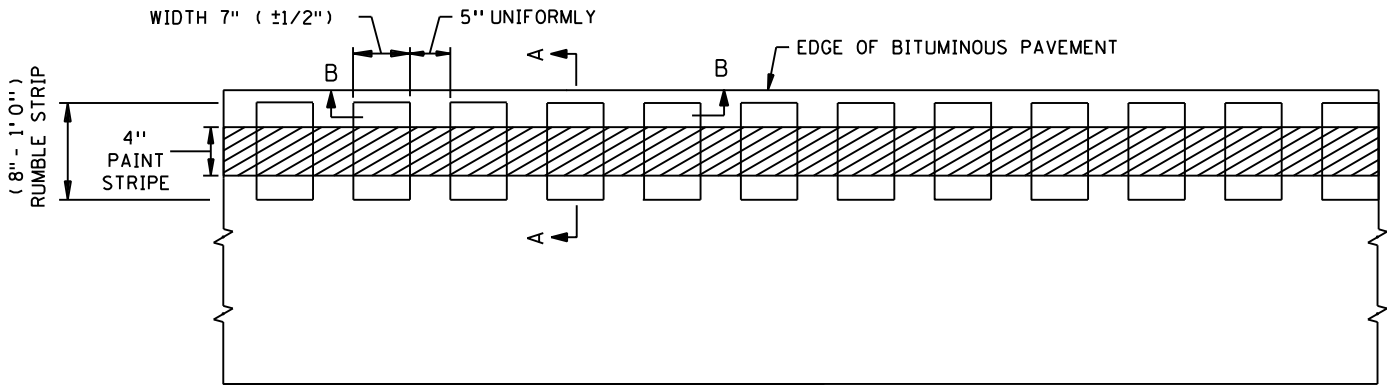
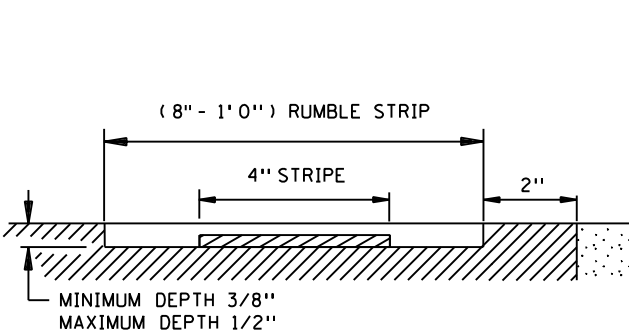
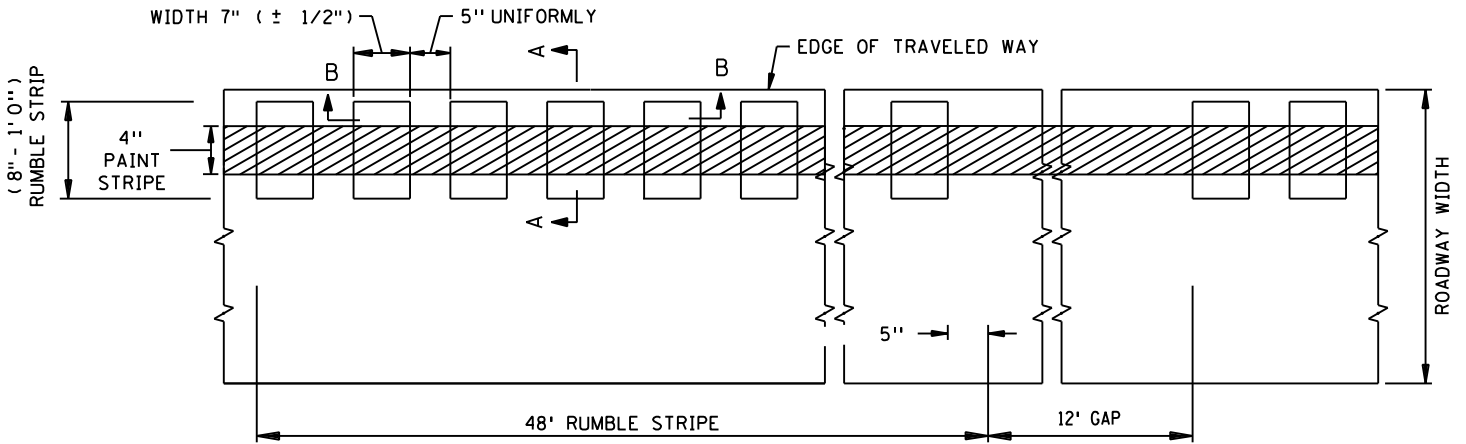
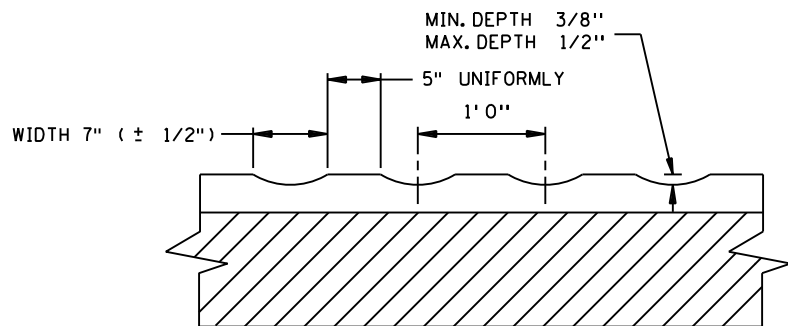


FIGURE 9B - PLAN VIEW  
INTERMITTENT PATTERN



SECTION A-A



SECTION B-B

FIGURE 10 - CENTERLINE RUMBLE STRIPE - PLAN VIEW

FIGURE 10A - PLAN AND PROFILE VIEW

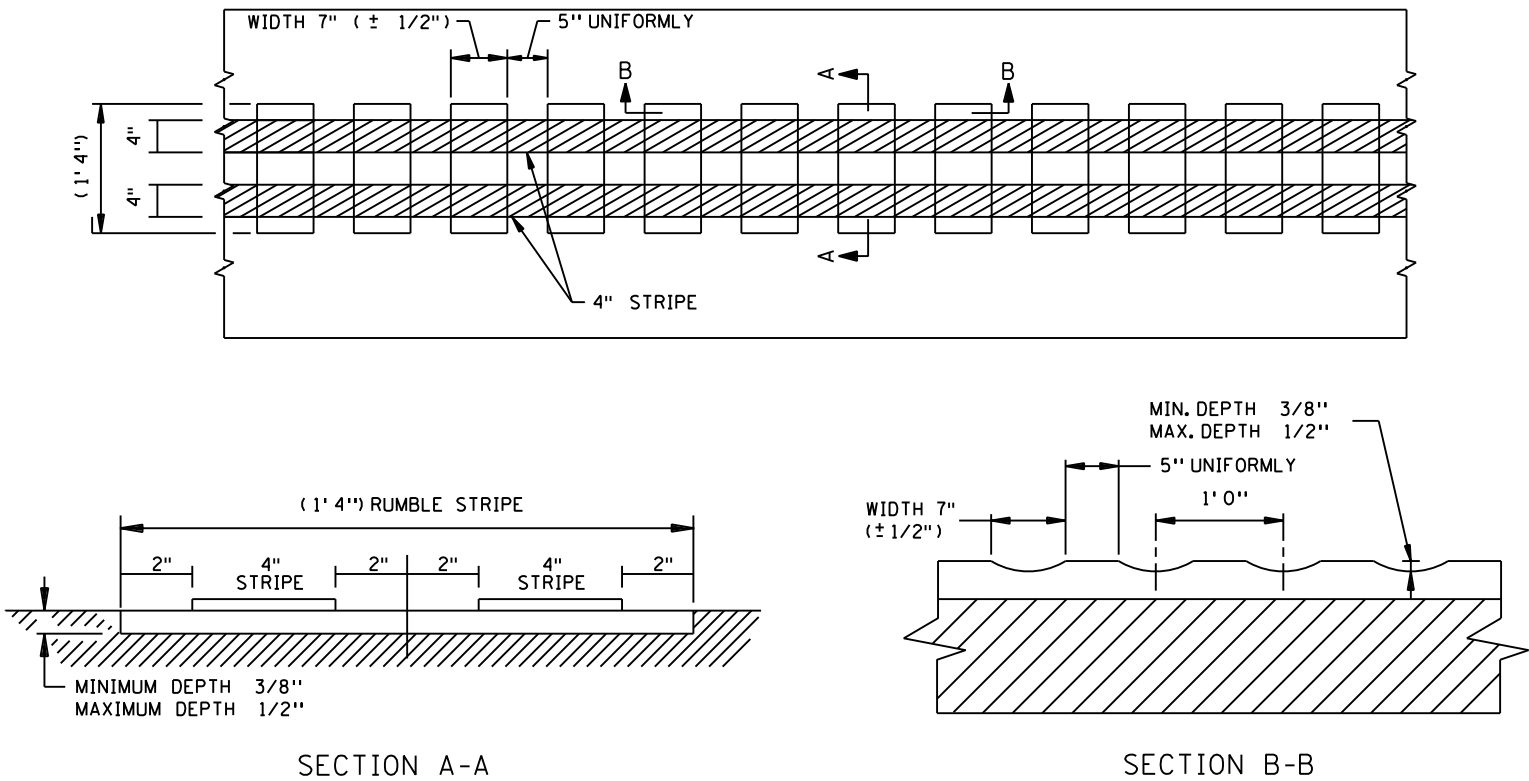
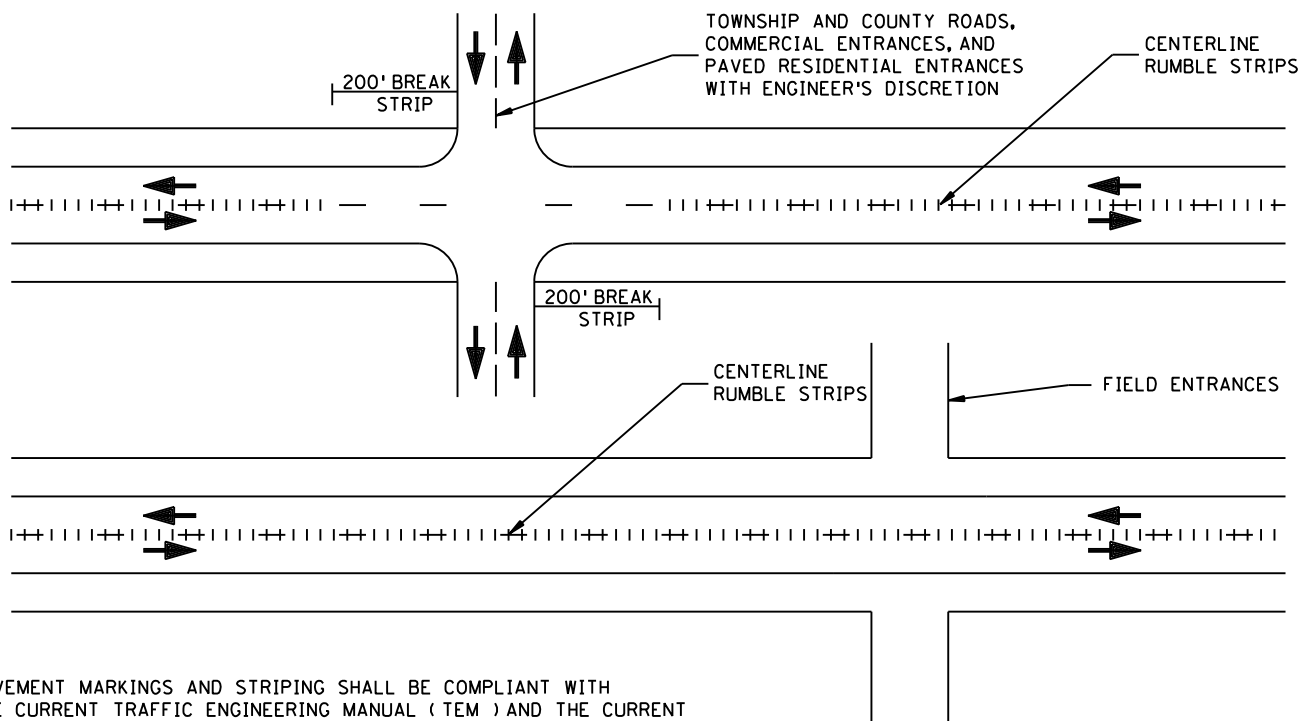


FIGURE 10B - PLAN VIEW FOR APPROPRIATE BREAKS\*



\* PAVEMENT MARKINGS AND STRIPING SHALL BE COMPLIANT WITH THE CURRENT TRAFFIC ENGINEERING MANUAL (TEM) AND THE CURRENT MINNESOTA MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MN/MUTCD)