



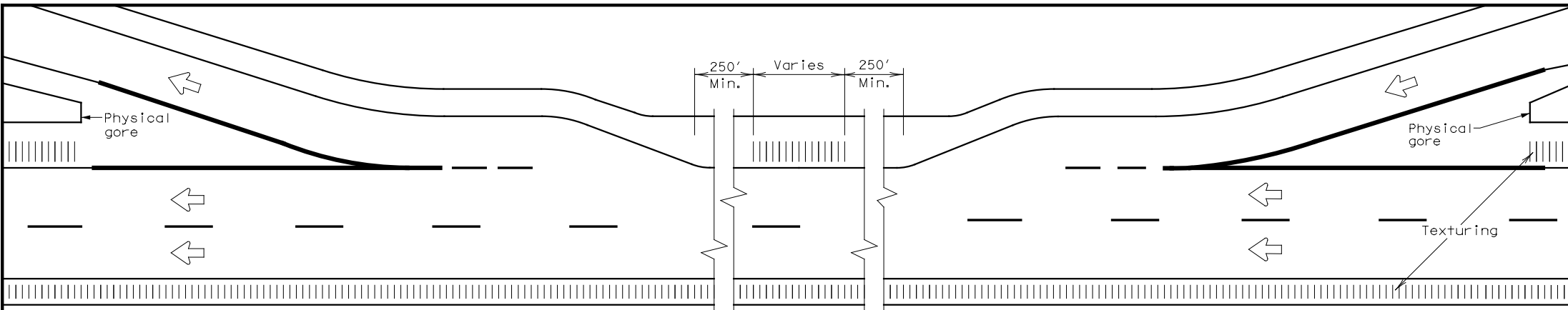
**Highway Factors Attachment – Rumble strip detail on I-35W in the vicinity of the crash**

**Fort Worth, TX**

**HWY21FH005**

(6 pages)

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TYPICAL RUMBLE STRIP PLACEMENT AT EXIT AND ENTRANCE RAMPS

**GENERAL NOTES**

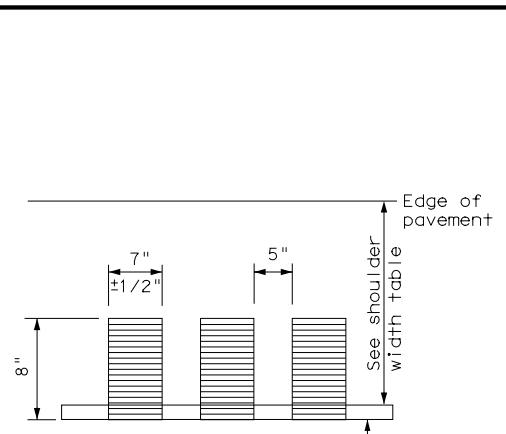
1. Rumble strips and profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.
2. Milled rumble strips are preferred when adequate pavement depth is available. If pavement thickness is less than 2 inches, milled rumble strips shall not be used. Rumble strips shall not be milled or depressed into bridge decks.
3. Use Standard Sheet PM(2) for positioning, dimensioning, and spacing of all reflective raised pavement markers, pavement markings, and profile markings.
4. See the table below for determining what options may be used for edgeline rumble strips.

**WHEN INSTALLING MILLED DEPRESSION EDGELINE RUMBLE STRIPS:**

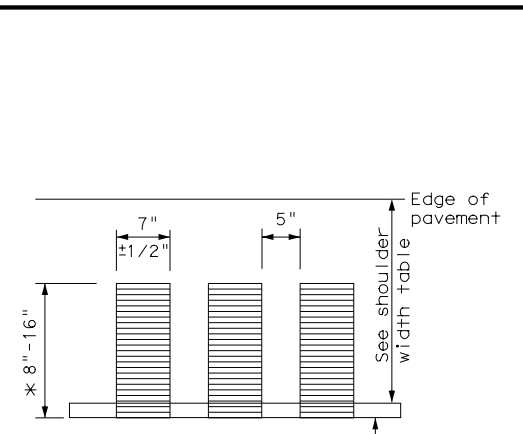
5. See dimensions for milled rumble strips. Other shapes and dimensions may be used if approved by the Traffic Operations Division.
6. Pavement markings can be applied over milled shoulder rumble strips to create an edgeline rumble stripe.
7. Breaks in edgeline rumble strips shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossings, intersections and driveways with high usage of large trucks when installed on conventional highways.
8. Rumble strips shall not be placed across exit or entrance ramps, acceleration and deceleration lanes, crossovers, gore areas or intersections with other roadways.
9. Consideration should be given to noise levels when edgeline rumble strips are installed near residential areas, schools, churches, etc. A minimum of 3/8 inches depth of milled rumble strip may be considered in these areas.
10. On roadways with high bicycle activity, consideration should be given before the installation of edgeline rumble strips. Things to consider include size of rumble strips, rumble strip material and location of rumble strips on the shoulder. If the designer determines that gaps are needed in the rumble strips due to bicycle use of the road, then follow the requirement shown in FHWA Technical Advisory T5040.39, or latest version. A detail of the spacing shall be included in the plans.

**WHEN INSTALLING RAISED OR PROFILE EDGELINE RUMBLE STRIPS:**

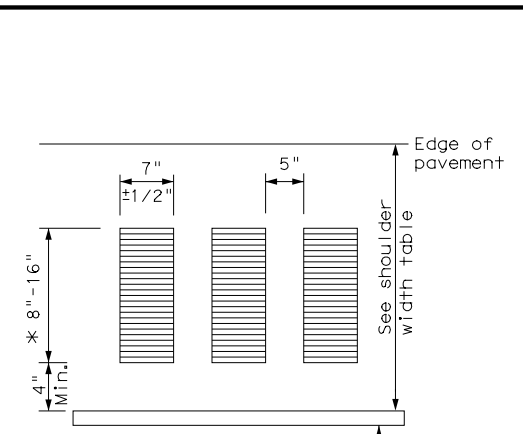
11. Raised rumble strips consisting of non-reflective raised traffic buttons may be used. Non-reflective raised traffic buttons can be affixed to asphalt or concrete with bitumen or adhesives, as per the manufacturer's recommendations.
12. Non-reflective traffic buttons shall be placed adjacent to the pavement marking delineating the edgeline when used as a rumble strip. The color of the button should match the color of the adjacent edgeline marking (white or yellow). The buttons will be paid for under item 672, "Raised Pavement Markers." Non-reflective traffic buttons must meet the requirements of DMS-4300.
13. Non-reflective traffic buttons shall not be placed across exit or entrance ramps, acceleration and deceleration lanes, crossovers, gore areas or intersections with other roadways.
14. Breaks in edgeline rumble strips using raised traffic buttons shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossing, intersections and driveways with high usage of large trucks when installed on conventional highways.
15. The minimum distance between the edgeline and the buttons should be used if the shoulder is less than 8 feet in width.
16. Raised profile thermoplastic markings used as edgelines may substitute for buttons.



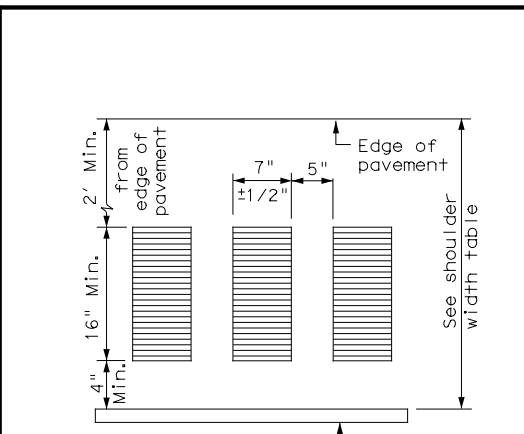
PLAN VIEW



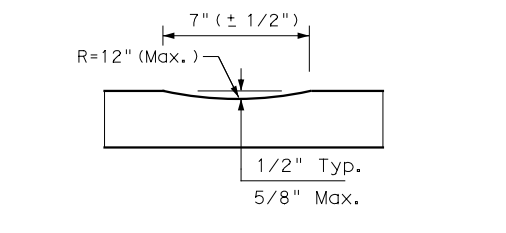
PLAN VIEW



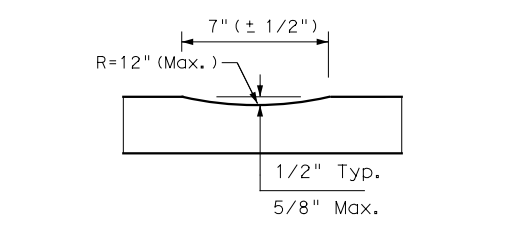
PLAN VIEW



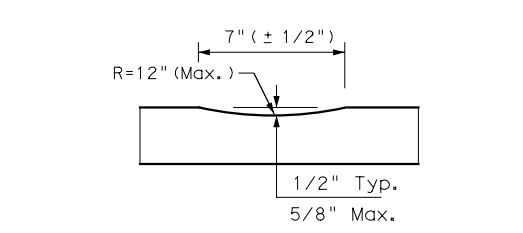
PLAN VIEW



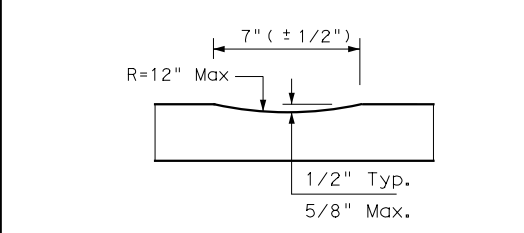
PROFILE VIEW  
OPTION 1



PROFILE VIEW  
OPTION 2



PROFILE VIEW  
OPTION 3



PROFILE VIEW  
OPTION 4

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)

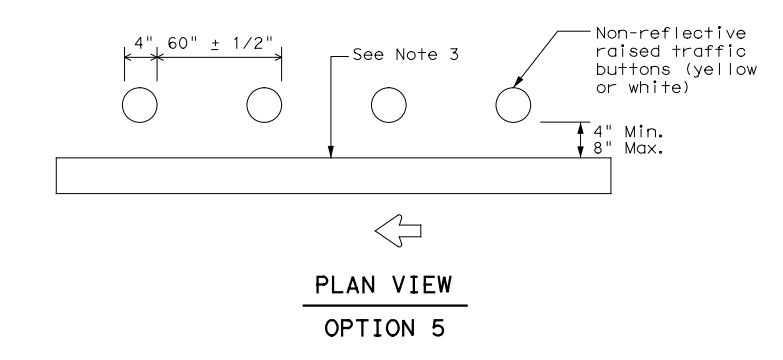
CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)

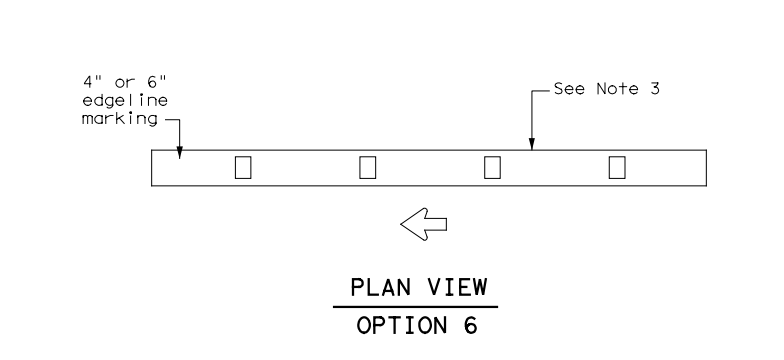
\* This distance may vary based on width of shoulder

\* This distance may vary based on width of shoulder



PLAN VIEW  
OPTION 5

RAISED EDGELINE RUMBLE STRIPS



PLAN VIEW  
OPTION 6

PROFILE EDGELINE MARKINGS

SHOULDER WIDTH TABLE		
EQUAL TO OR LESS THAN 2 FEET	GREATER THAN 2 FEET LESS THAN 4 FEET	EQUAL TO OR GREATER THAN 4 FEET
Option 1, 5 OR 6	Option 1, 2, 3, 5 or 6	Option 2, 4, 5 OR 6

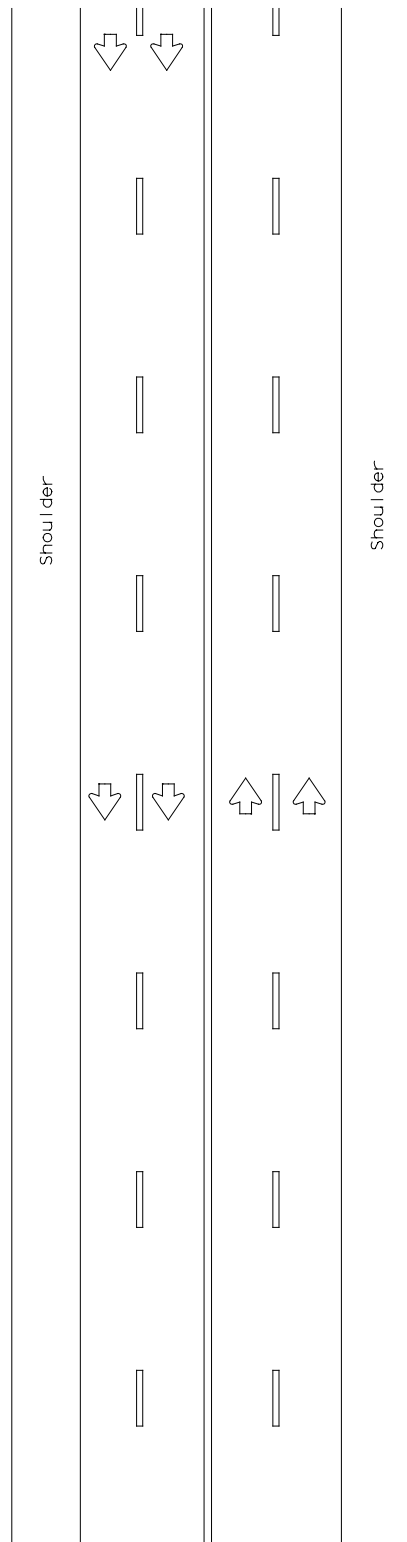


**EDGELINE RUMBLE STRIPS ON FREEWAYS AND DIVIDED HIGHWAYS RS(1)-13**

FILE: rs(1)-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT April 2006	CONT	SECT	JOB	HIGHWAY
2-10	0014	16	179	IH35W
10-13	DIST	COUNTY	SHEET NO.	
	FTW	TARRANT	TRA-189	

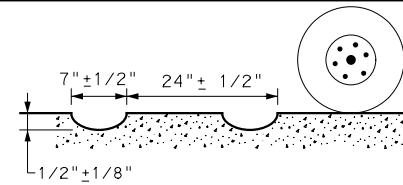
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DATE:  
FILE:

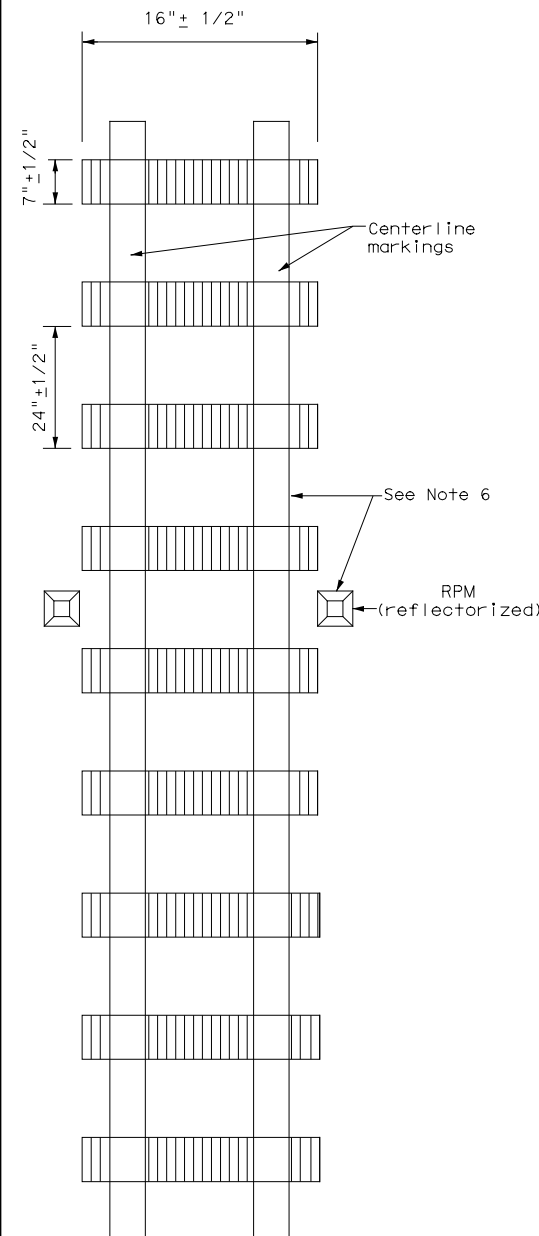


MULTILANE UNDIVIDED HIGHWAY WITH SHOULDER

CENTERLINE RUMBLE STRIPS

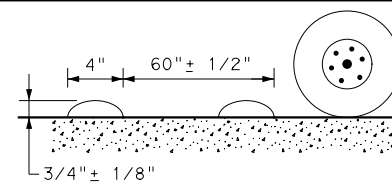


PROFILE VIEW

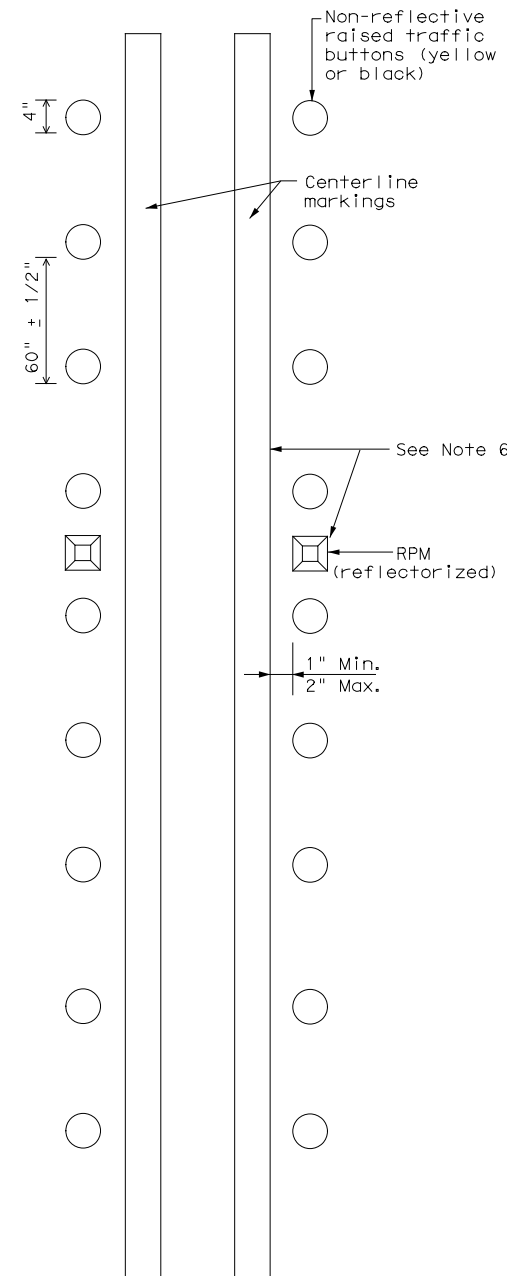


PLAN VIEW  
OPTION 1

MILLED CENTERLINE RUMBLE STRIPS

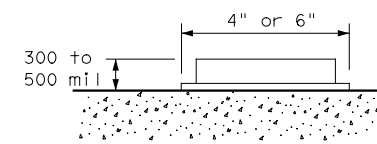


PROFILE VIEW

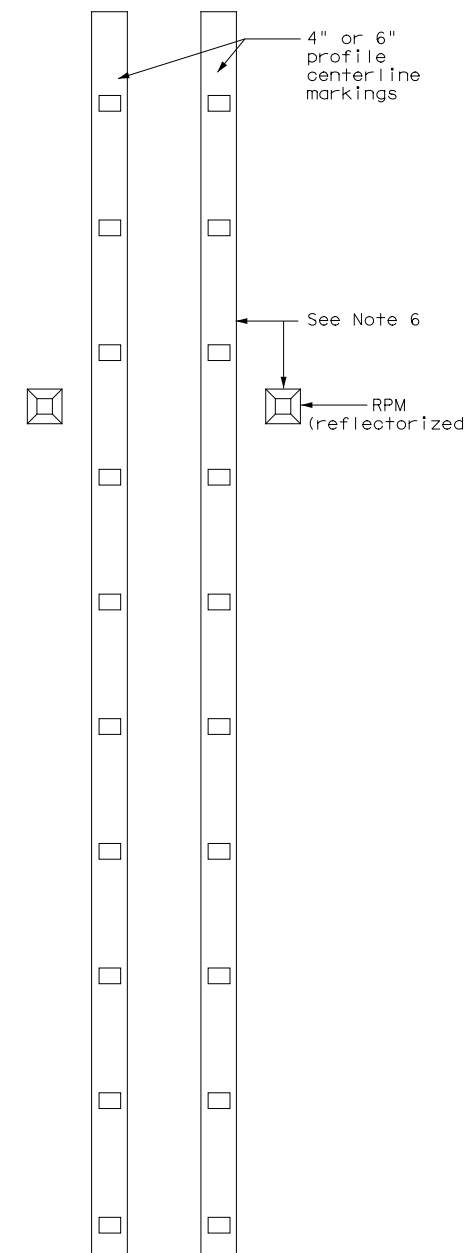


PLAN VIEW  
OPTION 2

RAISED CENTERLINE RUMBLE STRIPS



PROFILE VIEW



PLAN VIEW  
OPTION 3

PROFILE CENTERLINE MARKINGS

GENERAL NOTES

1. This standard sheet provides guidelines for installing centerline rumble strips on multilane undivided highways.
2. Centerline and edgeline rumble strips or profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.
3. Milled rumble strips are preferred when adequate pavement depth is available. If pavement thickness is less than 2 inches, milled rumble strips shall not be used. Rumble strips shall not be milled or depressed into bridge decks.
4. See dimensions for milled rumble strips. Other shapes and dimensions may be used if approved by the Traffic Operations Division.
5. Breaks in milled centerline rumble strips shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossing, intersections and driveways with high usage of large trucks.
6. Use Standard Sheet PM(2) for positioning, dimensioning, and spacing of all reflective raised pavement markers, pavement markings and profile markings.
7. Consideration should be given to noise levels when centerline rumble strips are installed near residential areas, schools, churches, etc. A minimum of 3/8 inch depth of milled rumble strip may be considered in these areas.
8. Pavement markings must be applied over milled centerline rumble strips for normal centerline spacing. For wider medians, specify in the plans the exact placement of the rumble strips. Place the rumble strips under each centerline marking or centered in the middle of the median.

WHEN INSTALLING CENTERLINE RUMBLE STRIPS:

9. Raised rumble strips consisting of non-reflective raised traffic buttons may be used. Non-reflective raised traffic buttons can be affixed to asphalt or concrete with bitumen or adhesives, as per manufacturer's recommendations.
10. When using non-reflective raised traffic buttons as a centerline rumble strip, the button shall be placed adjacent to the pavement marking delineating the centerline. The color of the button should be yellow for a continuous no passing roadway. The button will be paid for under Item 672, "Raised Pavement Markers." Non-reflective traffic buttons must meet the requirements of DMS-4300.

WHEN INSTALLING EDGELINE RUMBLE STRIPS WITH OR WITHOUT CENTERLINE RUMBLE STRIPS ON UNDIVIDED HIGHWAYS:

11. See standard sheet RS(4).



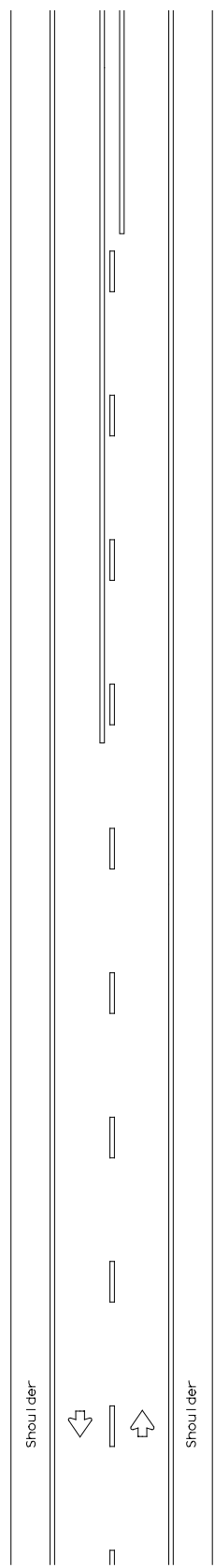
CENTERLINE RUMBLE STRIPS ON MULTILANE UNDIVIDED HIGHWAYS

RS (2) - 13

FILE:	rs(2)-13.dgn	DN: TxDOT	CK: TxDOT	DN: TxDOT	CK: TxDOT
© TxDOT	October 2013	CONT	SECT	JOB	HIGHWAY
REVISIONS		0014	16	179	IH35W
		DIST	COUNTY		SHEET NO.
		FTW	TARRANT		TRA-190

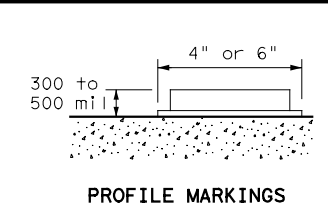
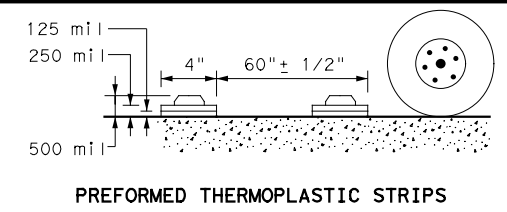
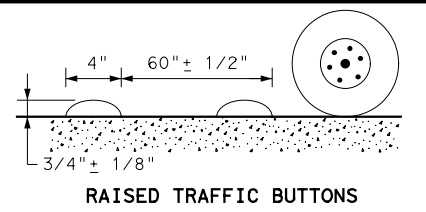
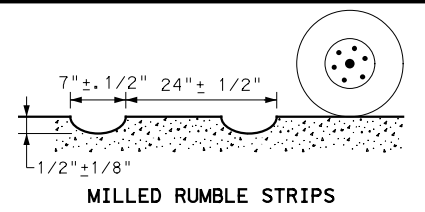
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DATE: FILE:

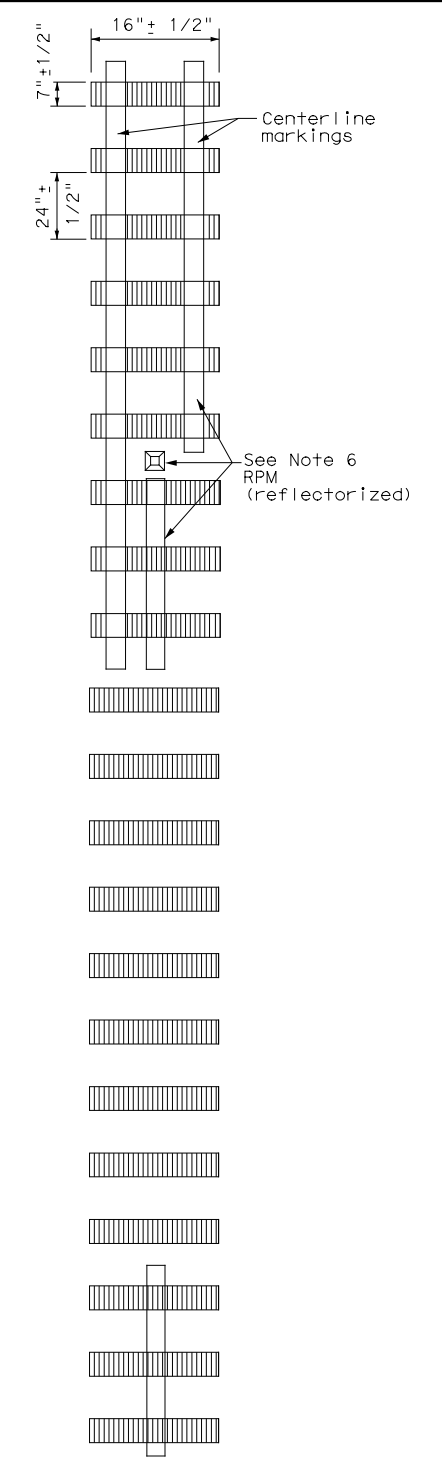


TWO LANE TWO-WAY ROADWAYS

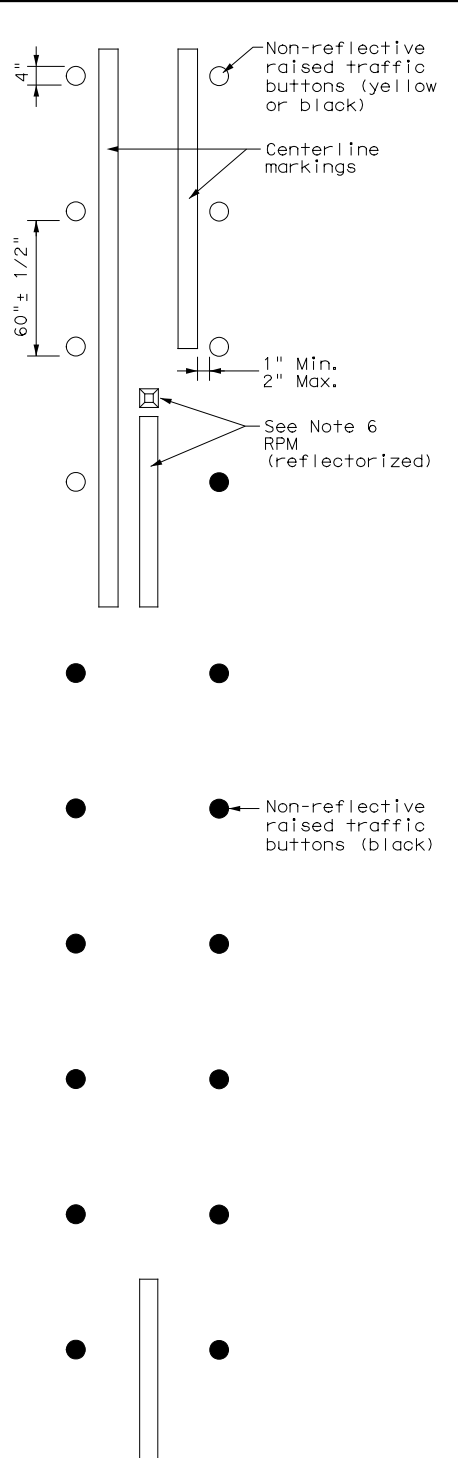
CENTERLINE RUMBLE STRIPS



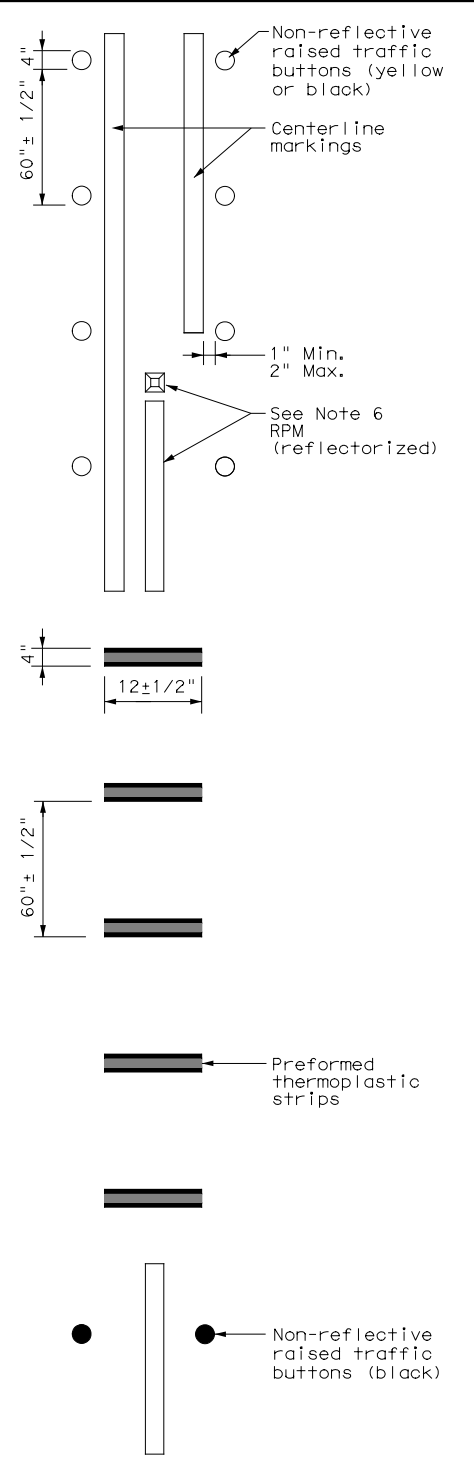
PROFILE VIEW



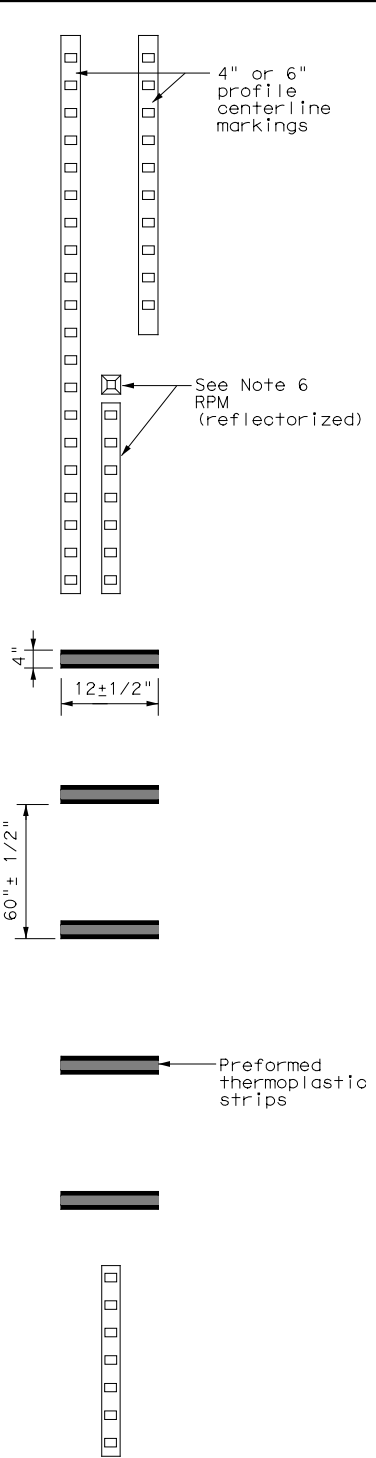
PLAN VIEW OPTION 1



PLAN VIEW OPTION 2



PLAN VIEW OPTION 3



PLAN VIEW OPTION 4

GENERAL NOTES

- This standard sheet provides guidelines for installing centerline rumble strips on two-lane highways with or without shoulders.
  - Centerline and edgeline rumble strips or profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.
  - Milled rumble strips are preferred when adequate pavement depth is available. If pavement thickness is less than 2 inches, milled rumble strips shall not be used. Rumble strips shall not be milled or depressed into bridge decks.
  - See dimensions for milled rumble strips. Other shapes and dimensions may be used if approved by the Traffic Operations Division.
  - Breaks in milled centerline rumble strips shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossings, intersections and driveways with high usage of large trucks.
  - Use Standard Sheet PM(2) for positioning, dimensioning, and spacing of all reflective raised pavement markers, and dimensions pavement markings and profile markings.
  - Consideration should be given to noise levels when centerline rumble strips are installed near residential areas, schools, churches, etc. A minimum of 3/8 inch depth of milled rumble strip may be considered in these areas.
  - Pavement markings must be applied over milled centerline rumble strips.
- WHEN INSTALLING CENTERLINE RUMBLE STRIPS:**
- Raised rumble strips consisting of non-reflective raised traffic buttons may be used. Non-reflective raised traffic buttons can be affixed to asphalt or concrete with bitumen or adhesives, as per manufacturer's recommendations.
  - When using non-reflective raised traffic buttons as a centerline rumble strip, the button shall be placed adjacent to the pavement marking delineating the centerline. The buttons will be paid for under Item 672, "Raised Pavement Markers." Non-reflective traffic buttons must meet the requirements of DMS-4300.
  - The color of the button should be yellow for a continuous no passing roadway. Black buttons should be used in areas where passing is allowed.
- WHEN INSTALLING EDGELINE STRIPS WITH OR WITHOUT CENTERLINE RUMBLE STRIPS ON UNDIVIDED HIGHWAYS:**
- See standard sheet RS(4).

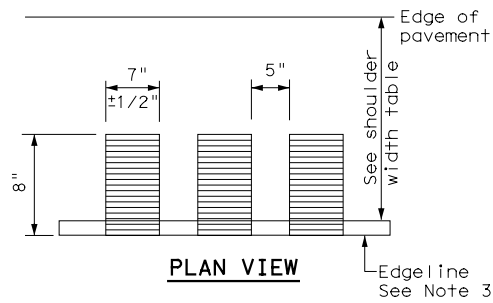
**Texas Department of Transportation**  
 Traffic Operations Division Standard

**CENTERLINE RUMBLE STRIPS ON TWO LANE TWO-WAY HIGHWAYS**  
**RS(3)-13**

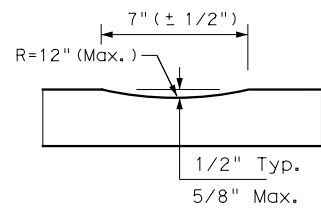
FILE: rs(3)-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
© TxDOT October 2013	CONT	SECT	JOB	HIGHWAY
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	DIST	COUNTY		SHEET NO.
	FTW	TARRANT		TRA-191

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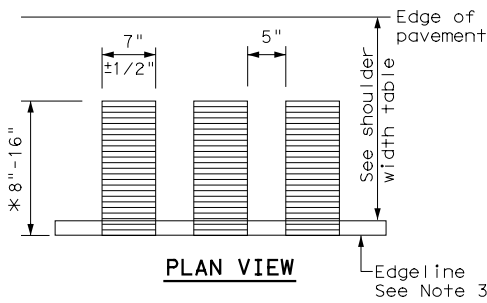


PLAN VIEW

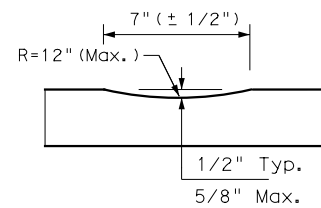


PROFILE VIEW  
OPTION 1

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)

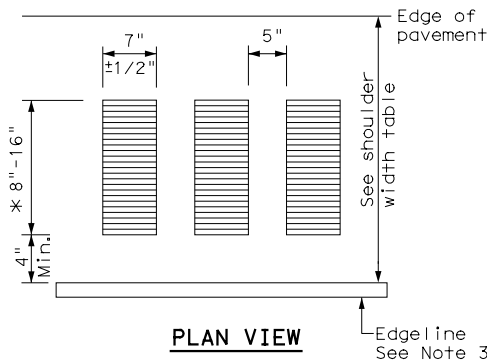


PLAN VIEW



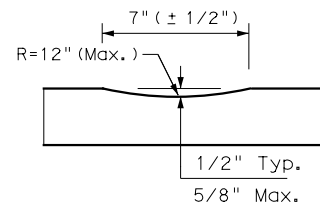
PROFILE VIEW  
OPTION 2

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)



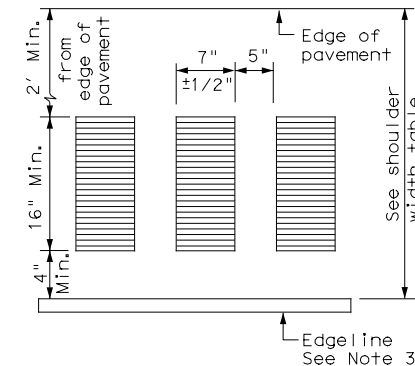
PLAN VIEW

\* This distance may vary based on width of shoulder

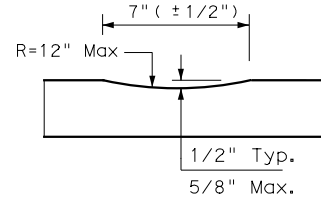


PROFILE VIEW  
OPTION 3

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)



PLAN VIEW



PROFILE VIEW  
OPTION 4

CONTINUOUS MILLED DEPRESSIONS (Rumble Strips)

GENERAL NOTES

- Rumble strips and profile markings shall not be placed on roadways with a posted speed limit of 45 MPH or less.
- Milled rumble strips are preferred when adequate pavement depth is available. If pavement thickness is less than 2 inches, milled rumble strips shall not be used. Rumble strips shall not be milled or depressed into bridge decks.
- Use Standard Sheet PM(2) for positioning, dimensioning, and spacing of all reflective raised pavement markers, pavement markings, and profile markings.
- See the table below for determining what options may be used for edgeline rumble strips.

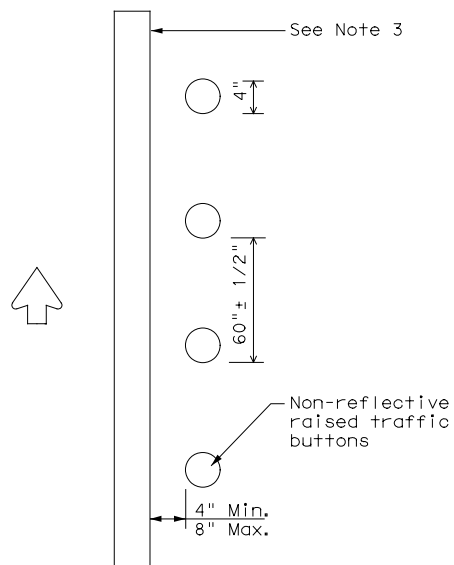
WHEN INSTALLING MILLED DEPRESSION EDGELINE RUMBLE STRIPS:

- See dimensions for milled rumble strips. Other shapes and dimensions may be used if approved by the Traffic Operations Division.
- Pavement markings can be applied over milled shoulder rumble strips to create an edgeline rumble stripe.
- Breaks in edgeline rumble strips shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossings, intersections and driveways with high usage of large trucks when installed on conventional highways.
- Rumble strips shall not be placed across exit or entrance ramps, acceleration and deceleration lanes, crossovers, gore areas or intersections with other roadways.
- Consideration should be given to noise levels when edgeline rumble strips are installed near residential areas, schools, churches, etc. A minimum of 3/8 inches depth of milled rumble strip may be considered in these areas.
- On roadways with high bicycle activity, consideration should be given before the installation of edgeline rumble strips. Things to consider include size of rumble strips, rumble strip material and location of rumble strips on the shoulder. If the designer determines that gaps are needed in the rumble strips due to bicycle use of the road, then follow the requirement shown in FHWA Technical Advisory T5040.39, or latest version. A detail of the spacing shall be included in the plans.

WHEN INSTALLING RAISED OR PROFILE EDGELINE RUMBLE STRIPS:

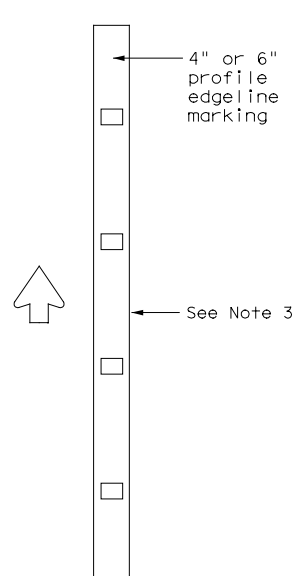
- Raised rumble strips consisting of non-reflective raised traffic buttons may be used. Non-reflective raised traffic buttons can be affixed to asphalt or concrete with bitumen or adhesives, as per the manufacturer's recommendations.
- Non-reflective traffic buttons shall be placed adjacent to the pavement marking delineating the edgeline when used as a rumble strip. The color of the button should match the color of the adjacent edgeline marking (white or yellow). The buttons will be paid for under Item 672, "Raised Pavement Markers." Non-reflective traffic buttons must meet the requirements of DMS-4300.
- Non-reflective traffic buttons shall not be placed across exit or entrance ramps, acceleration and deceleration lanes, crossovers, gore areas or intersections with other roadways.
- Breaks in edgeline rumble strips using raised traffic buttons shall occur at least 50 feet and no more than 150 feet in advance of bridges, railroad crossing, intersections and driveways with high usage of large trucks when installed on conventional highways.
- The minimum distance between the edgeline and the buttons should be used if the shoulder is less than 8 feet in width.
- Raised profile thermoplastic markings used as edgelines may substitute for buttons.

SHOULDER WIDTH TABLE		
EQUAL TO OR LESS THAN 2 FEET	GREATER THAN 2 FEET LESS THAN 4 FEET	EQUAL TO OR GREATER THAN 4 FEET
Option 1, 5 OR 6	Option 1, 2, 3 5 OR 6	Option 2, 4, 5 OR 6



PLAN VIEW  
OPTION 5

RAISED EDGELINE RUMBLE STRIPS



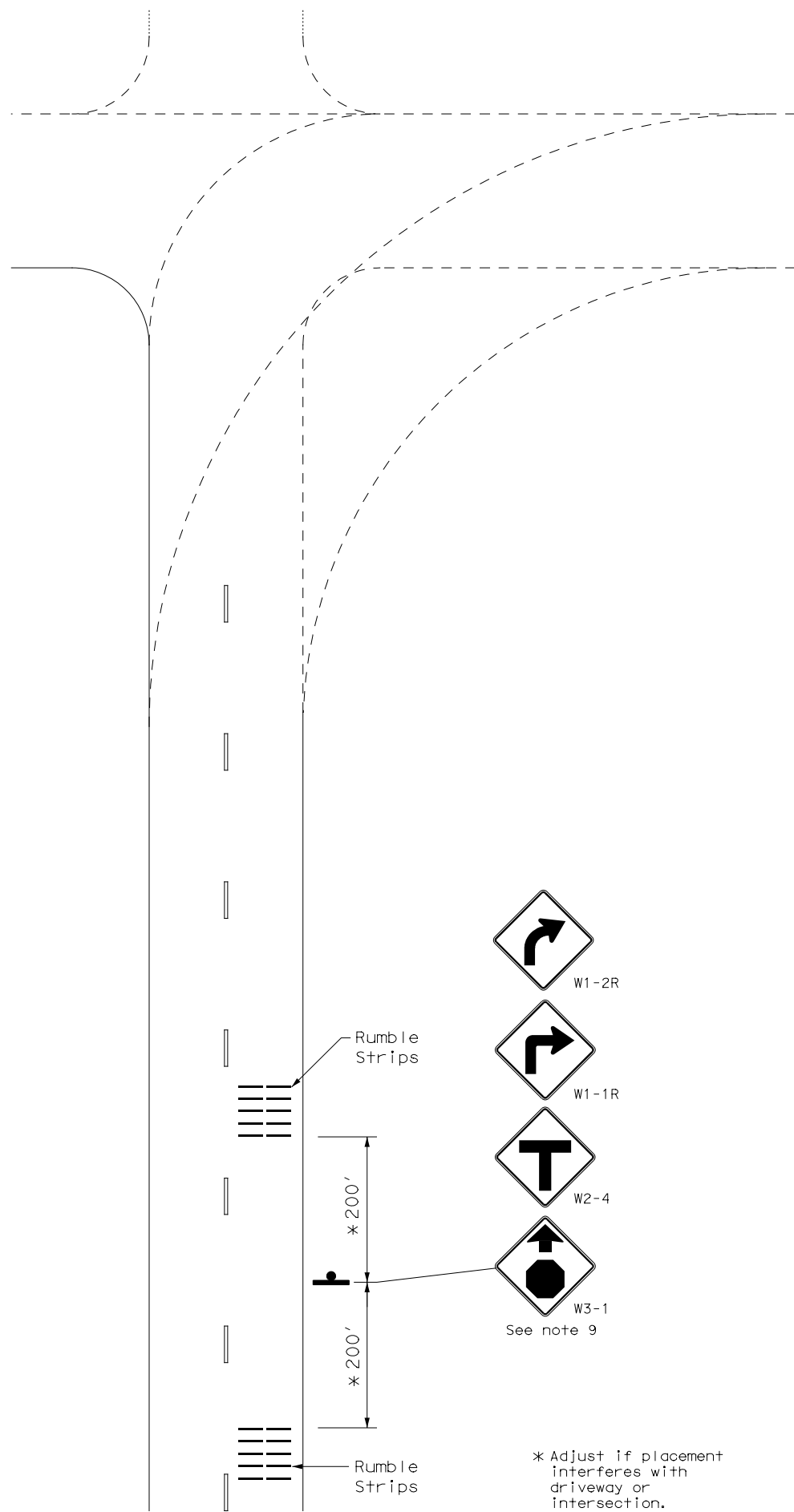
PLAN VIEW  
OPTION 6

PROFILE EDGELINE MARKINGS

		<b>Texas Department of Transportation</b>		<b>Traffic Operations Division Standard</b>	
<h2>EDGELINE RUMBLE STRIPS ON UNDIVIDED OR TWO LANE HIGHWAYS RS(4)-13</h2>					
FILE:	rs(4)-13.dgn	DN:	TxDOT	CK:	TxDOT
©TxDOT	October 2013	CON:	SECT	JOB	HIGHWAY
REVISIONS		0014	16	179	IH35W
		DIST:	COUNTY		SHEET NO.
		FTW	TARRANT		TRA-192

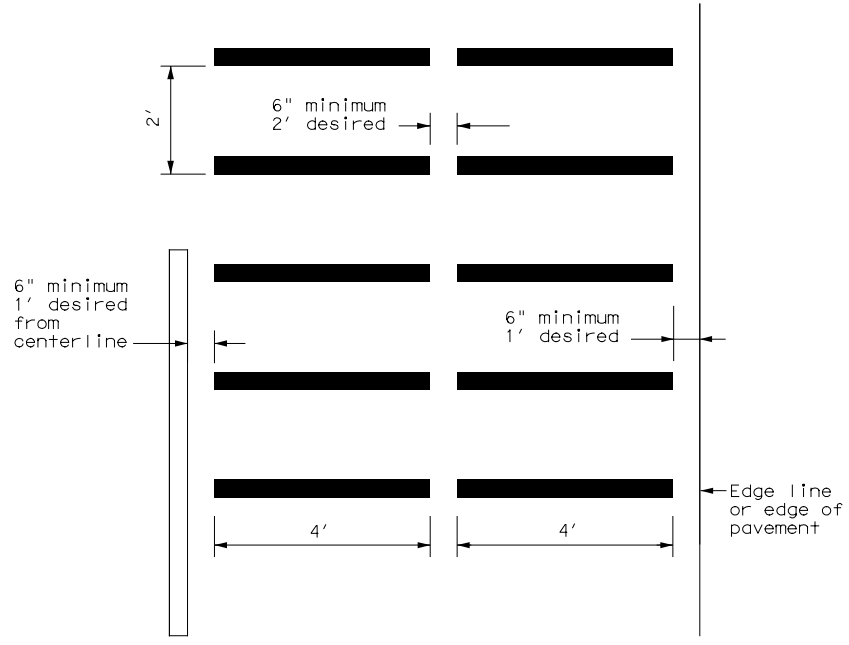
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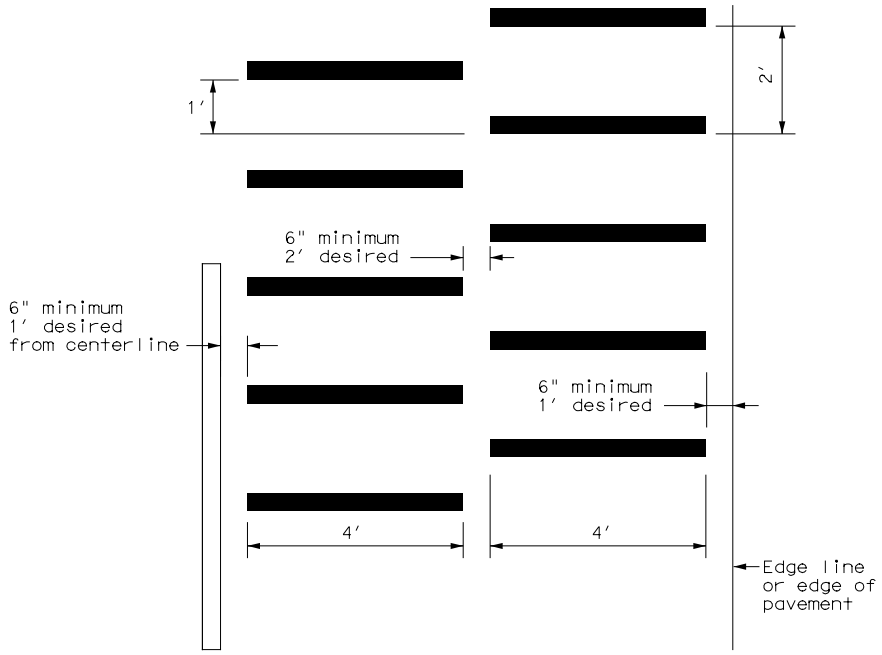


\* Adjust if placement interferes with driveway or intersection.

### STANDARD PATTERN



### ALTERNATIVE PATTERN



### GENERAL NOTES

1. Transverse or in-lane rumble strips should only be used at high incident and special geometric locations. These special geometric locations may include: approaches to rural, high speed signalized or Stop -controlled intersections with sight restrictions and/or high crash rates, approaches to unexpected urban intersections, approaches to newly installed Stop or signalized controlled intersections, approaches to toll plazas, approaches to hazardous horizontal curves, and approaches to railroad grade crossings.
2. When used, the rumble strips shall be placed 200 feet prior to and after the placement of the warning device.
3. The use of rumble strips should not be widespread or used indiscriminately.
4. Preformed black raised rumble strips should be used. They should be installed in accordance with the manufacturer's recommendations.
5. A list of approved, preformed raised rumble strips can be obtained from the Traffic Operations Division.
6. Consideration should be given to noise levels when in -lane or transverse rumble strips are installed near residential areas, schools, churches, etc.
7. The use of the "Rumble Strips Ahead" sign may be used in advance of in -lane or transverse rumble strips, based on engineering judgement. This sign is typically not necessary for rumble strip installations built to the guidelines on this standard sheet. When used, this sign should be spaced in advance of the rumble strips based on the guidelines for advance placement of warning sign included in the "Texas Manual on Uniform Traffic Control Devices".



8. Consideration should be given to bicyclists. A 12 inch gap from the edge line may be used to accommodate bicyclists when a usable shoulder is not available. Additional gaps in the in -lane or transverse rumble strips are not recommended since they could cause motorists to swerve to avoid the rumble strips.
9. Other signs can be used as conditions warrant.

		<b>Texas Department of Transportation</b>		<b>Traffic Operations Division Standard</b>	
<h2>TRANSVERSE OR IN-LANE RUMBLE STRIPS</h2> <h3>RS (5) - 13</h3>					
FILE:	rs (5) - 13, dgn	DN:	TxDOT	CK:	TxDOT
© TxDOT	April 2006	CONT:	SECT:	JOB:	HIGHWAY:
REVISIONS		0014	16	179	IH35W
2-10		DIST:	COUNTY:	SHEET NO.	
10-13		FTW	TARRANT	TRA-193	