



Report Title		Report Date: 2000
Removable Orange Rumble Strips		
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Supplemental Notes		
Abstract		

REMOVABLE ORANGE RUMBLE STRIPS

Introduction

Removable orange rumble strips, manufactured by Advance Traffic Markings (ATM), are designed for placement at construction sites to alert motorists of upcoming roadway conditions. As a vehicle crosses over the strips, the sound and tactile (vibrating) sensation of driving over the strips heighten the driver's attention.

The rumble strips are four inches wide and one-eighth of an inch thick. They come with polymeric tapes treated with pre-applied adhesive, which simplify application on both asphalt and concrete road surfaces. They can also easily be removed without the use of heat, solvent, or grinding at temperatures above 40 degrees Fahrenheit. Heat, solvent, and grinding used to remove other materials commonly has a deleterious impact on the pavement's service, and thus the strips tested have the added advantage of not negatively impacting the pavement when removed. Their orange color is similar to that of signs, barrels, and cones used at work zones.

As a part of the Midwest States Smart Work Zone Deployment Initiative (MwSWZDI), the orange removable rumble strips were applied at three different locations in and around the city of Ames, Iowa. The purpose of this field test was to examine the rumbling sensation, durability and removability of the strips applied on different pavement types.

Test Setup

The schematics of the sites are shown in Figures 2-25 through 2-27. Site A is a rural location at the intersection of two highways IA 210 and US 69. As can be seen in Figure 2-25, two sets of seven nine-foot strips (approximately 500 feet apart) were applied on the asphalt pavement of the eastbound approach of IA 210 roadway that leads to an all-way stop-controlled intersection. The first set of strips had a four-foot spacing. The second set (the one closer to the stop bar) had a two-foot spacing. The average daily traffic on the westbound approach of the IA 210 is 3,090 vehicles.

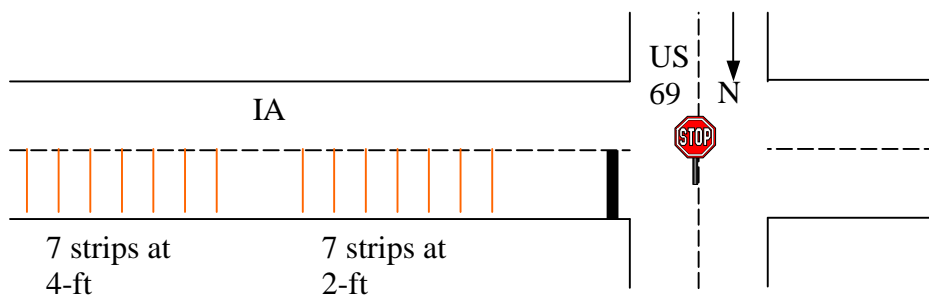


Figure 2-25 Rumble strips layouts – US 69 and IA 210 – Site A (asphalt pavement).

Site B is also a rural location at the intersection of E41 county road and IA 17 highway. Two sets of six nine-foot strips, approximately 500 feet apart, were applied on the concrete pavement of the eastbound of the E41 roadway. Similar to site A, the first set of strips had a four-foot spacing and the second set (the one closer to the stop bar) had a two-foot spacing. A third set of two double-thickness strips was also applied on the pavement under vehicles' wheel paths at about 500 feet upstream of the stop bar. The purpose of placing this last set of strips was to examine the rumbling sensation and durability of the strips when they are double layered. The average daily traffic on the eastbound approach of the E41 roadway is 3,220 vehicles.

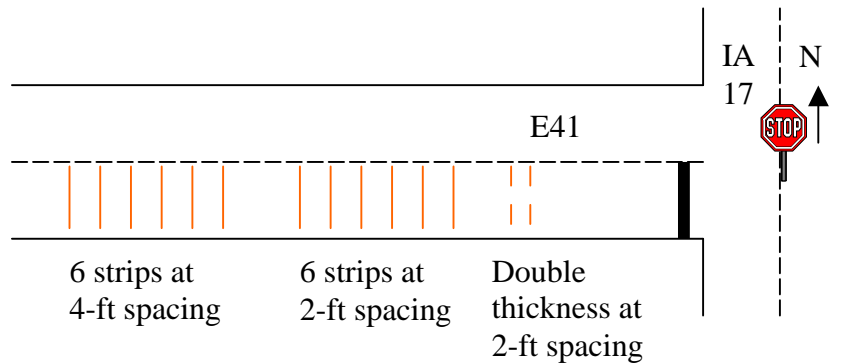


Figure 2-26 Rumble strips layouts – IA 17 and E41– Site B (concrete pavement).

Site C is an urban location at the eastbound approach of Airport Road in Ames, Iowa. To more extensively examine the durability and rumbling sensation of the double-thickness strips, a set of five nine-foot double-stacked strips at a two feet spacing were applied on the concrete pavement of the outer lane of the approach at about 500 feet upstream of the stop bar. According to the 1995 traffic count records, the average daily traffic on the eastbound approach of the Airport Road was 2,450 vehicles. However, due to recent development of the area, the average daily traffic should have increased significantly during past the two years (approximately 5,000 vehicles).

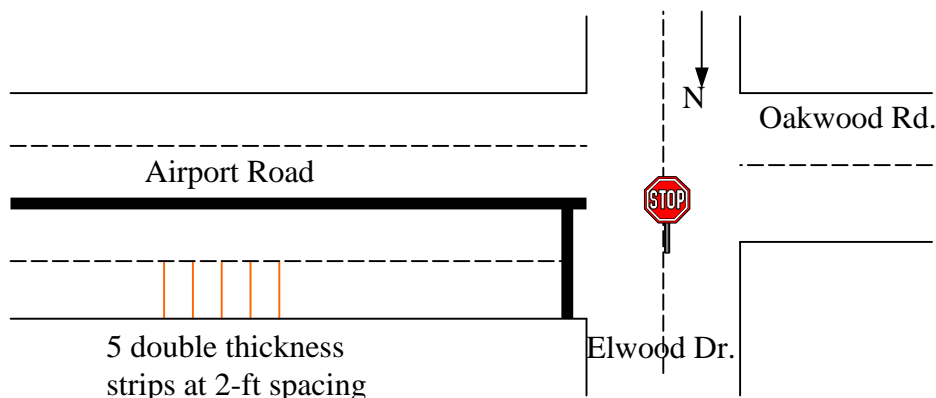


Figure 2-27 Rumble strips layouts – Airport Road – Site C (concrete pavement).

The rumble strips were applied at sites A and B on August 17, 1999. The strips at site C, however, were applied on October 5, 1999. They were easily applied in about 25 minutes at each site. Strips were tamped using a passenger car driving over them repeatedly at a very slow speed.

Upon approaching the strips, the strips were visible from approximately 500 feet. Their orange colors contrasted with the roadway and other pavement markings. They provided an insignificant rumbling sensation, especially the ones which were applied on the asphalt pavement at site A. It was, however, noted that the strips at the two-foot spacing provided a better rumbling sensation than those applied at the four-foot spacing. The two double stacked strips applied at sites B and C provided a noticeable rumbling sensation.

Test Operation

The rumbling sensation and durability of rumble strips were frequently evaluated by visiting the sites and driving over them with a passenger car, ¾ ton pickup truck, and once with an Iowa DOT maintenance truck. The site visits' observations are presented in the next section.

Site Visits

August 18, 1999 – In order to examine the ease of removing the strips, 24 hours after their initial installation, one strip from each set at site A and one of the sets at site B were removed (see Figures 2-27 and 2-28). Strips lifted up very easily from both pavement types. No residue remained on the pavements.

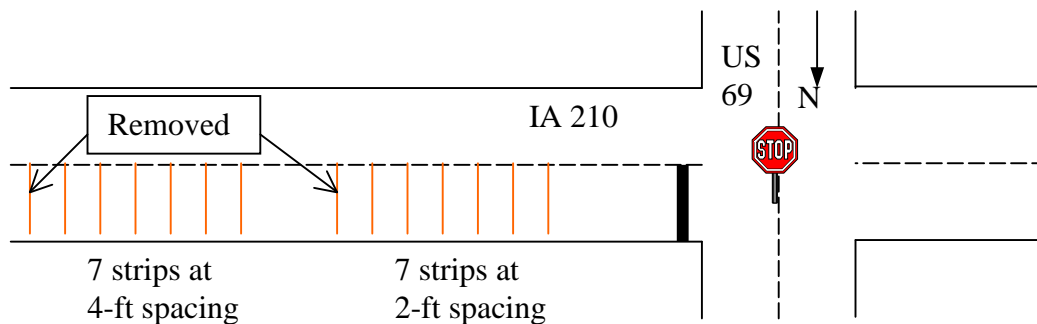


Figure 2-28 Rumble strips removals – August 18,1999 visit – Site A.

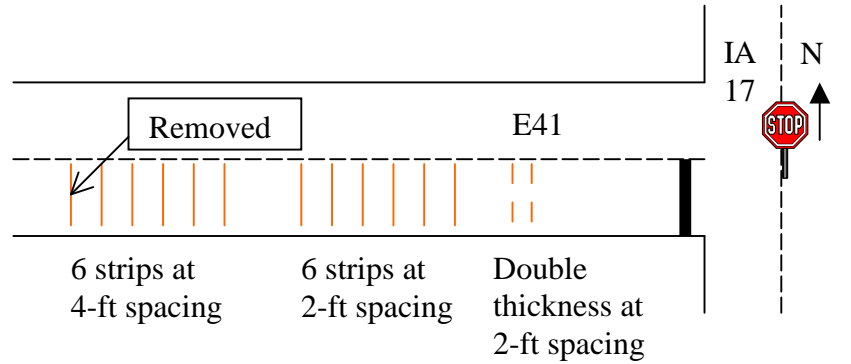


Figure 2-29 Rumble strips removals – August 18, 1999 visit – Site B.

August 28, 1999 – During this site visit another strip from each set at site A and one of the sets at site B were removed (see Figures 2-29 and 2-30). There were no signs of color fading and wear. Strips were perfectly stuck to the pavements, however, they peeled off relatively easy without using any tools. More than 90 percent of adhesive remained on the removed strip backings. It was, therefore, decided to reapply these strips on the concrete pavement at site B (see Figure 2-31) to evaluate their performance upon reapplication.

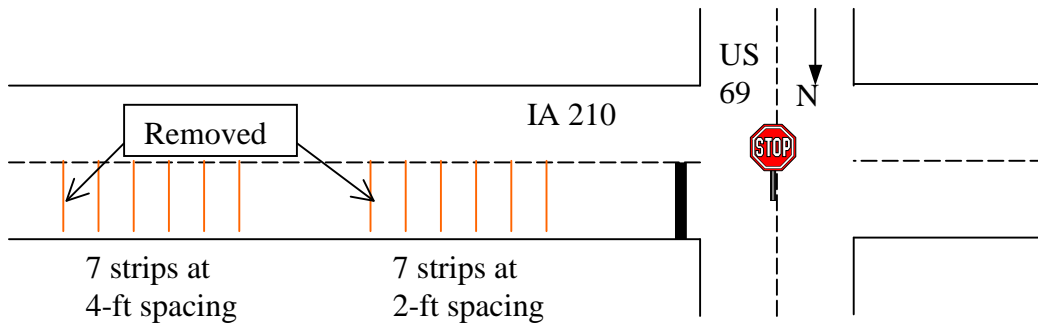


Figure 2-30 Rumble strips removals – August 28, 1999, Visit – Site A.

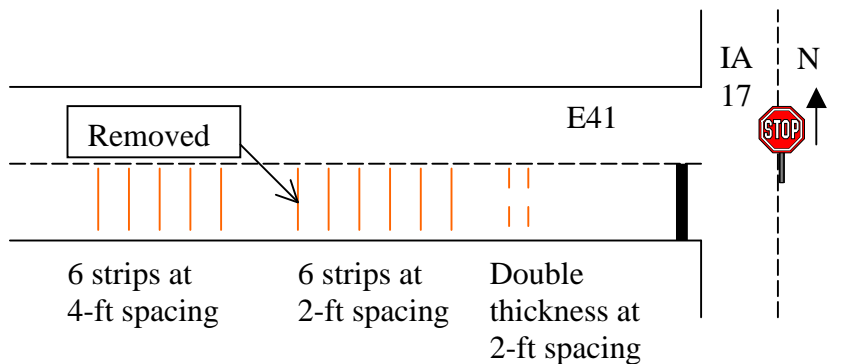


Figure 2-31 Rumble strips removals – August 28, 1999, Visit – Site B.

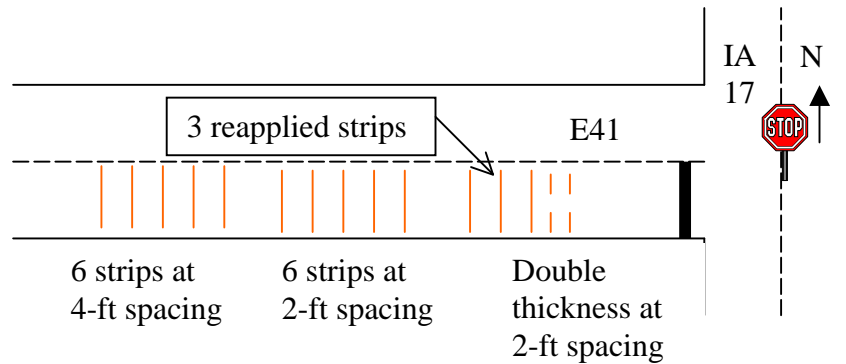


Figure 2-32 Rumble strips reapplication – August 28, 1999, Visit – Site B.

August 31, 1999 – To examine the rumbling sensation of the strips under heavy vehicles, an Iowa DOT maintenance vehicle traversed the strips at site A. No rumbling sensation was noticed.

September 8, 1999 – During this site visit, the rumble strips at sites A and B were driven over using a ¾ ton pickup truck. A rumbling sensation at both sites was barely noticeable. Strips were still completely affixed. There were no signs of color fading or wear.

October 5, 1999 – The rumble strips were removed from sites A and B on October 5, 1999. They were easily removed once their edges were loosened by inserting a screwdriver under a corner of each strip. All strips at site A were still in good shape. However, due to gravel shoulder scrapings, a few of the strips at site B were damaged. Damage to the two double-layered strips was more noticeable. Figures 2-33 and 2-34 show some of this damage. It should also be noted that two of the three reapplied strips at site B were still affixed with some minor damage.



FIGURE 2-33 Damaged rumble strips – Site B.



FIGURE 2-34 A damaged rumble strip – Site B.

October 5, 1999 – Five double-stacked rumble strips were applied at site C. This site is near the Center for Transportation Research and Education (CTRE), so these rumble strips were driven over by many CTRE staff and students on a daily basis. It was indicated that the strips were visible upon approach and provided adequate rumbling sensation to their cars and pickups.

December 2, 1999 – The double-stacked strips were removed from site C. They required extra removal efforts possibly due to the colder weather (50 degrees) and their double-layered thickness. A screwdriver was used to initiate the strips' removal. Having no snowfall during the testing period (October 5 through December 2), there were no signs of tear and wear due to snowplows.

Conclusion

The performance of the removable rumble strips was quite satisfactory. Being designed for use at work zones, these rumble strips are relatively easy to apply and remove. Although, they did not reflect in the dark, their orange color made them visible from a 500-foot distance during daylight hours.

It was concluded the strip's thickness of one-eighth of an inch does not provide an adequate rumbling sensation. However, the double layered strips were effective in providing adequate sound and rumbling sensation to passenger cars and pickup trucks. Having no effects on the Iowa DOT maintenance truck, it can be suggested the double-layered strips provide no rumbling sensation to commercial trucks.