Mumble Strip and Stripe Research and Evaluation

ARKANSAS DEPARTMENT OF TRANSPORTATION

Background:

A **mumble strip** is variation of the rumble strip that has been modified to be quieter, but intended to maintain its safety aspects. Mumble strips are similar in width to rumble strips however, there is no distinct plateaued separation between scalloped depressions. Mumble strips are designed to still create a strong vibration and noticeable sound to the driver, but it is expected to create or disperse a less intrusive sound to the surrounding environment. The shape of the mumble strip differs from the rumble strip in profile view and takes on the shape of a sinusoidal wave. The sinusoidal wave in a mumble strip system is a continuous wave shape with no flat areas between divots. The depth of the mumble strip is 7/16 inch from the top of the sinusoidal wave. The continuous wave reduces the exterior noise distributed to the surrounding areas, while allowing enough internal noise and vibration to remain effective.

Sound Measurement Data Processing and Analysis

Figures 1 and 2 provide the example results of time history for the LAeq and LApk values during the test duration in a decibel unit obtained from Highway 65 mumble strip test site and Highway 10 rumble strip test site at 150 ft away from the highway shoulder edge, respectively. For data analysis purpose, loud noises such as loud truck or vehicle passing noises have been removed from the raw data of sound measurement results. The yellow line indicates the peak instantaneous value denoted as LApk in the figures. The LAeq results (blue line) shown in Figures 5 and 6 are the modified LAeq values after the filtering out all other loud sounds during the test duration. Therefore, the modified LAeq values can be considered as the constant sound over the test duration with the same sound energy as the actual unsteady sound that is similar concept to an average sound level.

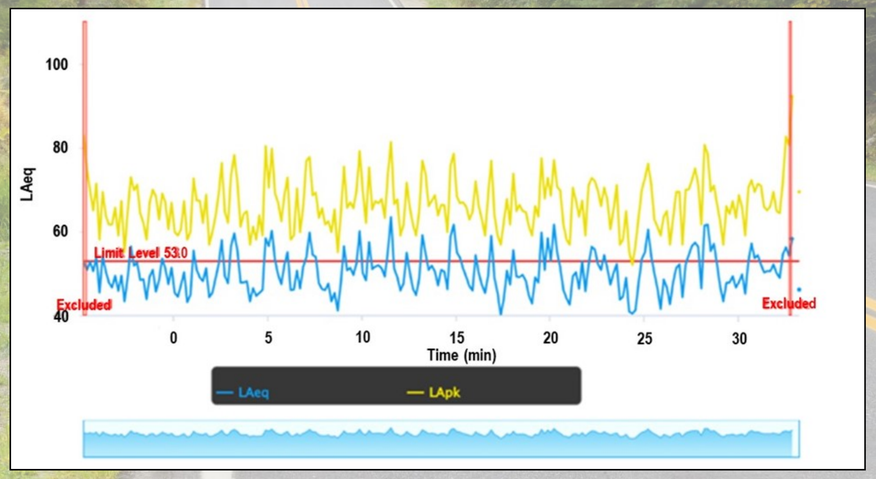

Figure 1 LAeq Time History Data for Highway 65 Mumble Strip Test Site

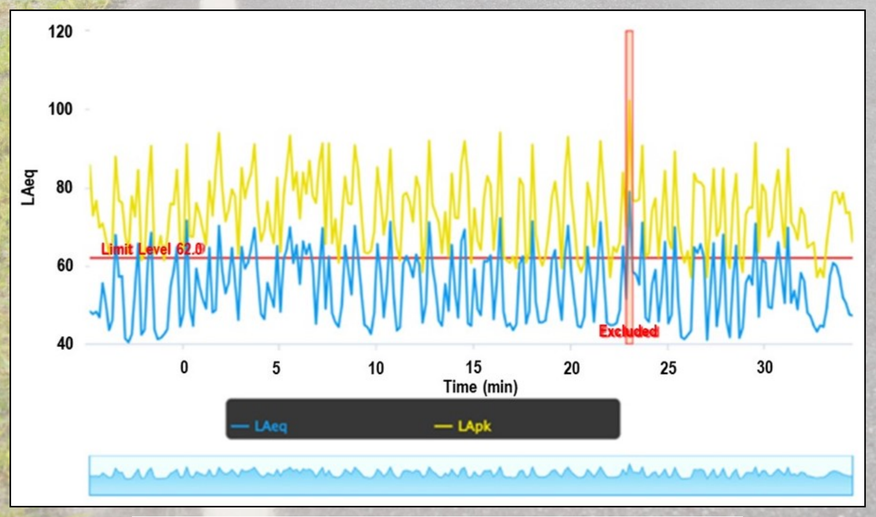

Figure 2 LAeq Time History Data for Highway 10 Mumble Strip Test Site

Sound Measurement Results and Discussions

Figure 3 summarizes the modified LAeq results obtained from different locations (i.e., 0, 75, and 150 ft) for all four rumble and mumble strip test sites. Results indicate that the modified LAeq values measured at the shoulder edge (at 0) for mumble strip test sites are similar to those obtained from the rumble strip test sites. This means the mumble strips provide comparable levels of noise and vibration to those produced by the rumble strips at the vehicle in order to alert the driver in the situation that they are leaving their lane.

The results at the 150 ft away from the shoulder edge that clearly indicate the LAeq values measured from the mumble strip test sites were significantly lower (approximately 7 dB level lower) than those observed from the rumble strip test sites. This observation is desired and implied that the mumble strips perform at the comparable level of effectiveness for drivers' safety aspects to those of standard rumble strips, and more importantly, the mumble strips are also capable of reducing a significant amount of noise pollution to the surrounding areas. Figure 8 represents the rate of reductions in modified LAeq (%) between 0 and 150 ft location for rumble and mumble strip test sites evaluated.

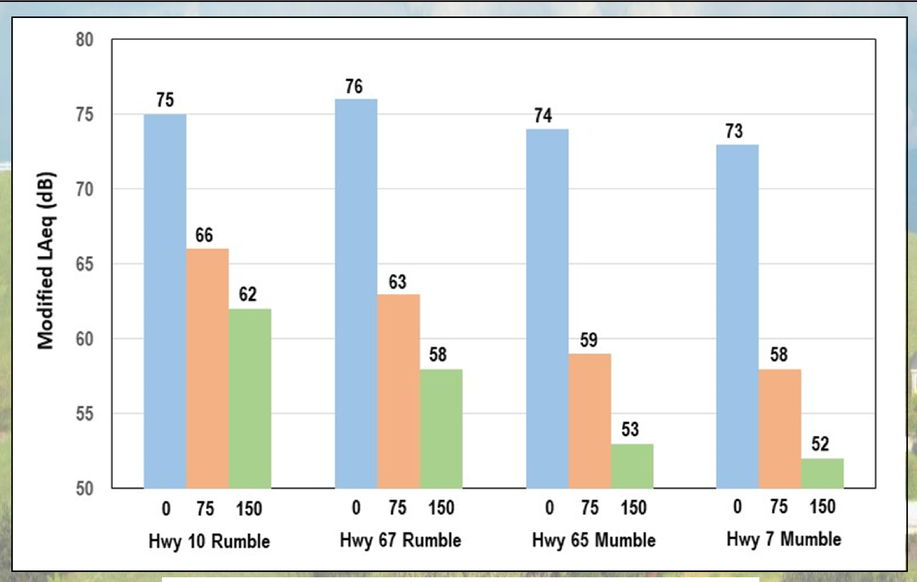

Figure 3 Modified LAeq Results for Rumble and Mumble Strip Test Sites

Crash Data Analysis

Before and after crash data was observed in this location to compare mumble strips/stripes to rumble strips/stripes in respect to safety. The data shows two years worth of before and after data. In an attempt to achieve accurate results, our locations shared similar ADT and rural functional classifications. The results for a two-year evaluation can be seen in the table below.

It can be observed that a similar KA crash reduction exists between rumbles and mumbles.

2-Year Before and After Analysis for Rumble Vs Mumble Strips/Stripes

	MUMBLE STRIPS/STRIPES				RUMBLE STRIPS/STRIPES	
Crashes	6" Mumble (ALL CRASHES)	6" Mumble (SINGLE VEHICLE CRASHES)	8" Mumble (ALL CRASHES)	8" Mumble (SINGLE VEHICLE CRASHES)	Rumble (ALL CRASHES)	Rumble (SINGLE VEHICLE CRASHES)
Total Before	119	35	19	10	181	60
KA Before	21	6	3	1	20	14
Total After	157	37	25	10	166	69
KA After	12	4	1	0	11	4
% Total Change	32%	6%	32%	0%	-8%	15%
% KA Change	-43%	-33%	-67%	-100%	-45%	-71%

Summary:

Mumble strips are designed to create a strong vibration and noticeable sound to the driver, but it is expected to create or disperse a less intrusive sound to the surrounding environment. The continuous wave reduces the exterior noise distributed to the surrounding areas, while allowing enough internal noise and vibration to remain effective. The results of this research and crash evaluation will enable ARDOT to include mumble strips and stripes in the updated Rumble and Mumble Strip(e) Policy, which will in turn prevent more roadway departure crashes.

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