



Evaluation and Field Implementation of Directional Rumble Strips to Deter Wrong-way Freeway Entries

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Problem Statement

- Wrong-way driving (WWD) on freeways has been identified as a serious traffic safety problem. Drivers who make wrong-way entries onto freeways pose a serious risk to the safety of other motorists and themselves.
- The Directional Rumble Strips (DRS) is designed to generate elevated noises and vibrations to warn against WWD and to generate normal noises and vibrations to slow down the traffic for the right-way direction.

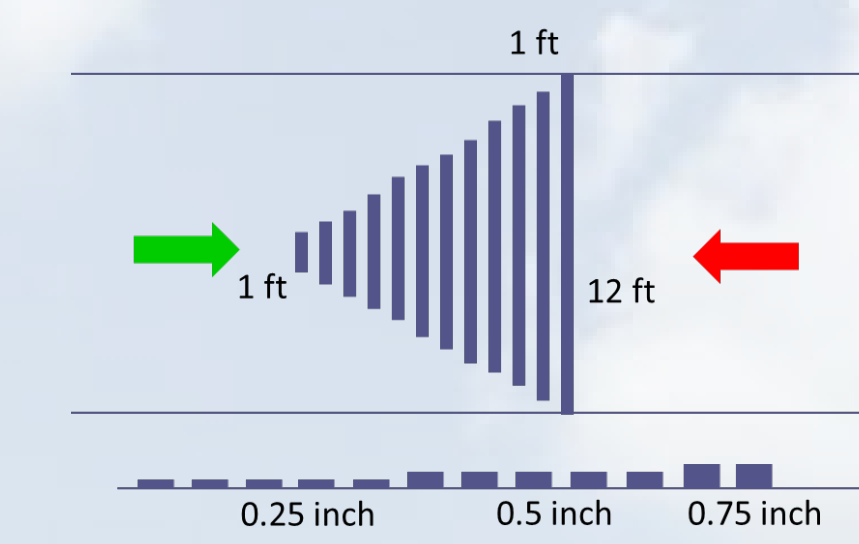
Objectives

- Data Collection
 - Full-size passenger car
 - Sound meter
 - Sampling rate: 10Hz
 - Accelerometer
 - Sampling rate: 100Hz
 - Tested speeds: 10, 15, 20, 25, 35, 45 mph
 - Each speed was tested 5 times for both directions

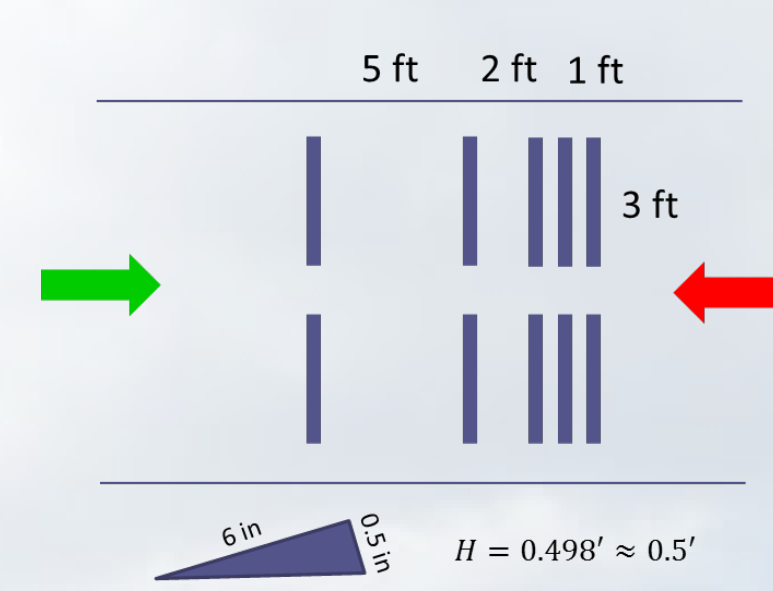


Methodology

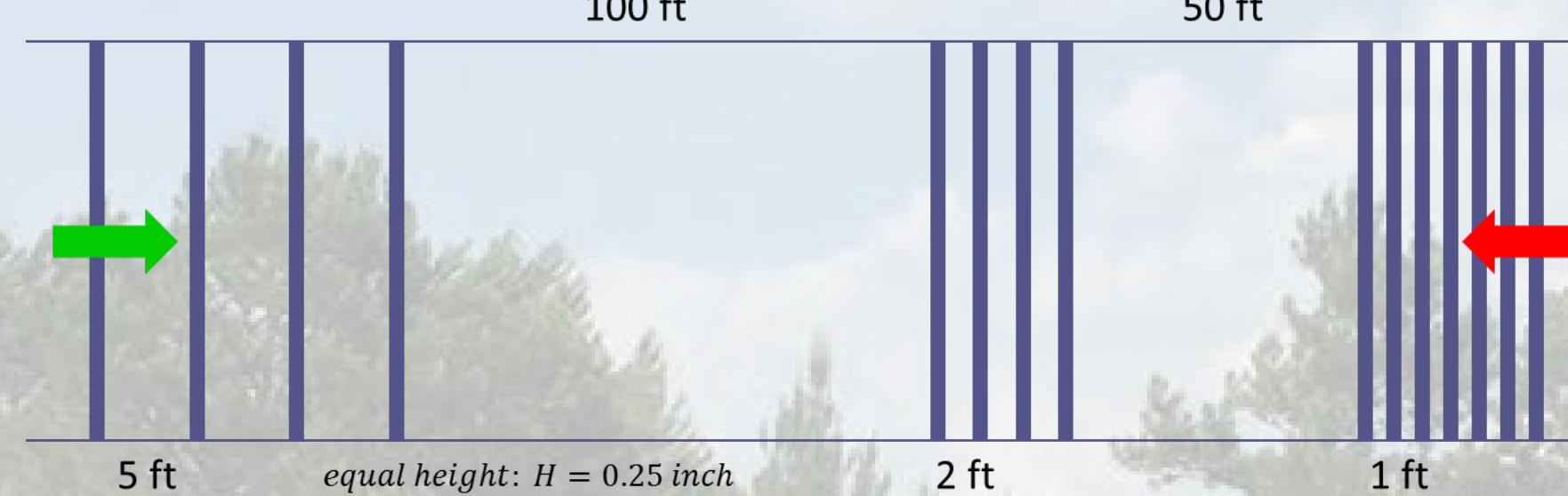
Pattern D3



Pattern E



Pattern C



Results: Statistical Results Comparison

Sound (95% confidence level)

Pattern	Test	10 mph	15 mph	20 mph	25 mph	35 mph	45 mph
D3	t-test	0.6049	0.513	0.6291	0.2666	0.1839	0.1174
E	t-test	0.2582	0.1072	0.3895	0.5236	0.4343	0.4116
C	t-test	0.01455	0.00001	0.03724	0.00069	0.085	0.5478

Vibration (95% confidence level)

Pattern	Test	10 mph	15 mph	20 mph	25 mph	35 mph	45 mph
D3	t-test	0.08487	0.1272	0.08246	0.1026	0.1971	0.07437
E	t-test	0.173	0.2787	0.09524	0.5943	0.1764	0.00112
C	t-test	0.00005	0.00003	0.00004	0.00101	0.6523	0.6473

Acknowledgments

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D3

Recommended Location for Implementation

Exit-ramp Terminal

Features

- Visually warn potential wrong-way drivers;
- High visible reflective painting - highest strip as the stop bar.

E

Recommended Location for Implementation

Exit-ramp Curves

Features

- Wrong-way driver would receive more noise and vibration;
- Visual warning of curves;

C

Recommended Location for Implementation

Straight long exit-ramp

Features

- Transverse Rumble Strips;
- Easy implementation

