

# **SAFETY PERFORMANCE OF CENTERLINE RAISED PAVEMENT MARKERS**

by

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## **ABSTRACT**

This thesis evaluates the safety effects of centerline raised pavement markers (RPMs) installed on two-lane rural roads in Indiana. The analysis focuses on changes in the occurrence of run-off-road (ROR) crashes and opposite-direction (head-on and sideswipe) collisions. The underlining objective is to assist the Indiana Department of Transportation (INDOT) by developing Crash Modification Factors (CMFs) that quantify the safety effects of RPMs on these crash types.

The presented analysis uses a comprehensive dataset of Indiana's rural two-lane state roadway network, including roadway characteristics, traffic exposure, and crash records from 2015 to 2023. The dataset contains 24,737 crashes across more than 5,000 roadway segments.

In addition to estimating the impact of RPMs, the study examines the combined safety effect of RPMs where present concurrently with rumble strips (RS), widened shoulders, and widened traffic lanes. The analysis also investigates RPM effectiveness under different lighting conditions.

This research employs a panel data analysis by integrating cross-sectional and before-and-after data structures. To account for unobserved heterogeneity and the inherent overdispersion of crash data, frequency was modeled using a negative binomial framework with random effects, while severity was evaluated through a logistic regression model. The models controlled for factors including traffic volume and roadway geometry, among others.

The results indicate statistically significant reductions in run-off-road (ROR) crashes associated with RPM installation, averaging 15% during daytime and 11% during nighttime. Nighttime opposite-direction crashes decreased by approximately 22%, while no statistically significant change was observed during daytime. When RPMs were installed together with RS, ROR crashes decreased by 20% during daytime and 22% during nighttime, and nighttime opposite-direction crashes were reduced by approximately 46%.