

Need Statement 717: Literature Search

Title: Safety comparison of sidewalk and roadside feature placement

Date: June 21, 2023

Prepared for: Dave Glycer, MnDOT Research and Innovation

Prepared by: Maddie Kuncio, MnDOT Library

Resources searched: TRID, Transport, Web

Summary:

Results are compiled from the databases named above. Links are provided for fulltext, if applicable, or to the full record citation. I completed my searches using the following terminology: roadside feature placement AND Sidewalks, clear zones AND crash rates, Roadside hazards and sidewalks, roadside hazards AND pedestrians, high risk locations AND pedestrians. Results are organized by more and less relevant below.

This topic was difficult to research. I could not find anything specifically about how roadside signs affect crash rates. In the ideascale, it was mentioned that “there is also some evidence that suggests that smaller clear zones may reduce (or have no impact on) crash rates or severity in certain contexts such as where roadside features create a “narrow feel” on a roadway.” I could not find this research, but if someone could point me towards it, I could expand my search.

More Relevant Results

Title: Influence of Built Environment on Pedestrian Crashes: A Case Study of Miami-Dade County

Authors: Fabio Soto, Angela E. Kitali, Md Asif Raihan, Priyanka Alluri

Source: Transportation Research Record, 2022

Link: <https://doi.org/10.1177/03611981221088196>

Abstract: The objective of this study was to identify pedestrian crash hotspots and assess the built environment to identify factors that increase the probability of a roadway corridor becoming a hotspot. Therefore, this research attempted to identify the pedestrian hotspots and then answer the question, do locations with a “specific built environment” have a higher probability of becoming a pedestrian crash hotspot? The study used 4 years of pedestrian crash data (2011 to 2014) from Miami-Dade County, one of the top three leading counties in the United States with the highest pedestrian fatalities. Pedestrian crash hotspots were first identified in the ArcGIS environment, integrating spatial analysis. The Bayesian complementary log-log (cloglog) model was then used to develop a hotspot risk prediction model, in which the likelihood of a corridor becoming a hotspot was linked to the built environment, and to demographic and socioeconomic factors. The density of bus stops, shopping centers, healthcare facilities, hotels, alcohol sales establishments, households without vehicles, traffic volume, presence of sidewalks, and presence of medians were found to significantly increase the likelihood of a corridor becoming a pedestrian crash hotspot. The methodological framework and findings of this study could be used while developing site-specific proactive measures to improve pedestrian safety.

Title: Missouri Systemic Countermeasures to Improve Pedestrian Safety

Authors: Priscilla A. Tobias; Timothy Szwedo, Brady Nye

Source: Missouri Department of Transportation, 2022

Link: <https://spexternal.modot.mo.gov/sites/cm/CORDT/cmr22-013.pdf>

Abstract: Missouri Department of Transportation (MoDOT) has successfully implemented systemic safety countermeasures in the past to reduce fatal and serious injury crashes related to roadway departure. MoDOT initiated this research project to address the increasing trend in pedestrian fatalities and serious injuries in Missouri. The focus of the project is to develop a Missouri Pedestrian Safety Countermeasure Tool based on analysis of pedestrian-involved crash data and identification of situational trends. This matrix-based tool identifies those peer groups (segments and intersections) that have the highest risk of pedestrian crashes and the countermeasures based on a particular set of roadway criteria (traffic volume, speed limit, and number of lanes) that can be applied across various jurisdictions. The Pedestrian Safety Countermeasure Tool includes multiple peer groups for road segments, signalized intersections, and unsignalized intersections. Overall, the study found that the following priority peer groups provide the greatest impact for reducing pedestrian crashes through implementation of the Pedestrian Safety Countermeasure Tool.

1. Urbanized 4-Leg Signalized (Z4S) Intersection on Undivided Roads (Priority 1).
2. Urbanized 2-Lane Undivided (Z2U) Road Segments (Priority 1).
3. Rural 2-Lane Undivided (R2U) Road Segments (Priority 1).
4. Urbanized 3-Leg Signalized (Z3S) Intersections on Divided Roads (Priority 2).

Specific traffic volume and speed limit ranges have higher occurrences of pedestrian crashes. GIS maps were developed for each Metropolitan Planning Organization (MPO) area to facilitate implementation. Modifications to policies can further enhance pedestrian safety in Missouri

Title: Impact of Roadside Design Compliance and Hazard Offset on the Risk of Single-Vehicle, Run-Off-Road Crash Fatalities

Authors: Dina Mustafa Awadalla & Francisco Daniel Benicio Albuquerque

Source: International Journal of Injury Control and Safety Promotion (2021)

Link: <https://doi.org/10.1080/17457300.2021.1942923>

Abstract: Single-vehicle, run-off-road (SVROR) crashes account for a significant portion of all road-related injuries and fatalities worldwide. However, no previous study has examined to what extent roadside design guidelines have been applied, nor (and most importantly) whether having a compliant roadside design reduces the likelihood of fatal injury occurrence in SVROR crashes. Thus, the objectives of this research are i) to examine the level of roadside design compliance within the studied area based on the selected benchmark and ii) to investigate whether roadside design compliance reduces the likelihood of fatal injury occurrence in SVROR crashes. Findings from this study are based on extensive crash and field data collected from 1,070 SVROR injury collisions and locations, respectively. The study shows that i) only 32 percent of the studied locations contained compliant design, and ii) barrier and discrete-obstacle lateral offsets larger than 6 and 12 meters, respectively, tended to lower fatality risk. The 12-meter clear-zone (CZ) width is larger than that recommended by previous research, which has based CZ width recommendations also on cost-benefit procedures and not just on fatality risk reduction.

Title: Unclear territory: Clear zones, roadside trees, and collaboration in state highway agencies

Author: Ellen Oettinger White

Source: Transportation Research Part D: Transport and the Environment, 2023

Link: <https://doi.org/10.1016/j.trd.2023.103650>

Abstract: The American Association of State Highway and Transportation Officials (AASHTO) issues guidance for highway agencies to maintain clear zones adjacent to the roadbed, free of trees, to reduce the severity of run-off-the-road crashes. Some departments of transportation (DOTs) are clearing trees beyond the standard clear zone for road safety, creating friction between units of different disciplines.

Following an analysis of roadside tree literature, I use semi-structured interviews with agency staff to illuminate how perceptions of trees—either as safety hazards or as beneficial environmental assets—are considered by practitioners at state highway agencies.

Results indicate that engineering leadership understands roadside tree management as a nuanced issue. The benefits of trees are understood by most staff though are rarely a sufficient counterweight for perceived safety issues. Maintenance staff are motivated more by budgets or contracts than by research or federal guidance. An interdisciplinary staff structure, robust communication practices, and stronger environmental policy can improve DOT collaboration.

Title: United States fatal pedestrian crash hot spot locations and characteristics

Authors: Robert J. Schneider, Rebecca L. Sanders, Frank R. Proulx, Hamideh Moayyed

Source: Journal of Transport and Land Use, 2021

Link: <https://doi.org/10.5198/jtlu.2021.1825>

Abstract: US pedestrian fatalities are at their highest level in nearly three decades and account for an increasing share of total traffic fatalities (16%). To achieve the vision of a future transportation system that produces zero deaths, pedestrian safety must be improved. In this study, we screened the entire US roadway network to identify fatal pedestrian crash “hot spot” corridors: 1,000-meter-long sections of roadway where six or more fatal pedestrian crashes occurred during an eight-year period. We identified 34 hot spot corridors during 2001-2008 and 31 during 2009-2016. While only five corridors were hot spots during both analysis periods, the 60 unique hot spots had remarkably consistent characteristics. Nearly all (97%) were multilane roadways, with 70% requiring pedestrians to cross five or more lanes. More than three-quarters had speed limits of 30 mph or higher, and 62% had traffic volumes exceeding 25,000 vehicles per day. All had adjacent commercial retail and service land uses, 72% had billboards, and three-quarters were bordered by low-income neighborhoods. Corridors with these characteristics clearly have the potential to produce high numbers of pedestrian fatalities. We also used hierarchical clustering to classify the hot spots based on their roadway and surrounding land use characteristics into three types: regional highways, urban primary arterial roadways, and New York City thoroughfares. Each context may require different safety strategies. Our results support a systemic approach to improve pedestrian safety: Agencies should identify other roadway corridors with similar characteristics throughout the US and take actions to reduce the risk of future pedestrian fatalities.

Title: The effects of roadway and built environment characteristics on pedestrian fatality risk: A national assessment at the neighborhood scale

Authors: Theodore J. Mansfield, Dana Peck, Daniel Morgan, Barbara McCann, and Paul Teicher

Source: Accident Analysis and Prevention, 2018

Link: <https://doi.org/10.1016/j.aap.2018.06.018>

Summary: Characteristics of the transportation system and built environment contribute to pedestrian fatality risks, including vehicular traffic and land-use characteristics associated with higher pedestrian activity. We combined data from FHWA, NHTSA, EPA, and the Census Bureau and performed regression modeling to explore associations between transportation system and built environment characteristics and pedestrian fatalities between 2012 and 2016 at the Census tract scale across the United States. In urban tracts, we found especially strong associations between traffic on non-access-controlled principal arterial and minor arterial roadways and pedestrian fatalities (0.91 and 0.68 additional annual pedestrian fatalities per 100,000 persons per 10,000 VMT/mi² increase in traffic density, respectively). In both urban and rural tracts, we also found strong associations between employment density in the retail sector and pedestrian fatalities. Finally, we compared our model to the High Injury Network in Los Angeles, CA. Nearly half (43%) of observed fatalities were identified by both methods, while some fatalities were identified by only one (19% by our model and 23% by the High Injury Network). This work shows that traffic on certain roadway facility types and employment in certain sectors have especially strong associations with pedestrian fatality risk. More broadly, we

illustrate how leveraging cross-disciplinary data in novel ways can support prospective, risk-based assessments of pedestrian fatality risks and support integrated and systemic approaches to transportation safety.

Less Relevant Results

[FHWA – Clear Zones](#)

This page collects several resources on roadside design. Most of them are probably familiar to you, but I included the page in case there is anything new.

Title: A Design Method for the Roadside Clear Zone Based on Accident Simulation Analysis

Authors: Cheng, Rui; Pan, Ye; Wang, Tao

Source: Mathematical Problems in Engineering, 2021

Link: <https://doi.org/10.1155/2021/2605095>

Abstract: In order to improve the safety design of roadside areas and reduce the loss of roadside accidents, this paper uses PC-Crash software to perform an accident simulation analysis. By recording the track of the vehicle after entering the roadside, the recommended widths of the roadside clear zone for different operating speeds and horizontal curve radii in straight and curved sections are given. According to our previous research data, the conditions for setting the roadside clear zone are proposed. Finally, based on a cost-benefit ratio analysis, a comprehensive risk index method is adopted to evaluate the social stability risk of the project and conduct research on the design method of the roadside clear zone. The results show that the width of the roadside clear zone has an exponential relation with the departure speed and a power relation with the horizontal curve radius. The research results realize the accurate calculation of the roadside clear zone width and fill in the gaps of the relevant specifications and guidelines in the setting conditions of the roadside clear zone.