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Main Street Highways: Fatal Crashes on State and U.S. Highways Through Small-Town Centers in the United States, 2015–2024

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Main Street Highways: Fatal Crashes on State and U.S. Highways Through Small-Town Centers in the United States, 2015–2024

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Abstract

Across much of the United States, state and U.S. highways serve as main streets in small towns. Drivers enter these communities at rural highway speeds, passing storefronts, schools, and post offices where people cross on foot. Yet conventional crash statistics classify roads as urban or rural, leaving these short, busy stretches without separate reporting. This paper presents an open national dataset that identifies them. For every incorporated town with fewer than 10,000 residents in the contiguous 48 states, as well as small New England towns, the town center was located at the densest quarter-mile cluster of everyday destinations, and each state and U.S. highway was divided into three zones: the town center, the rest of town, and the same route for 5 miles beyond town limits. A state or U.S. highway passes through the center in 8,995 of the 10,659 towns with an identifiable center (84%). Fatal crashes from the Fatality Analysis Reporting System for 2015–2024 were matched to these zones within 50 m using route number and road ownership. The resulting dataset contains 72,301 town–route–zone segments and 39,300 fatal crashes. Per 100 million vehicle miles traveled, the fatal crash rate was lower in town centers (0.97) than outside town (1.27), while the pedestrian death rate was three times higher (0.276 versus 0.093). Pedestrians accounted for 26% of people killed in town centers. The higher pedestrian death rate in centers was found in every Census region and town-size class, and on both U.S. and state routes. These findings indicate that small-town centers on state highways warrant separate attention in highway safety programs.

Keywords: main street highways; small towns; pedestrian safety; rural highways; speed transitions; Fatality Analysis Reporting System; Highway Performance Monitoring System; open data

1. Introduction

State and U.S. highways connect communities across the country, but in many small towns these same roads also serve as main streets. They carry regional traffic while meeting local needs, from parking and accessing businesses to crossing the road and walking children to school. This mix of functions presents a particular safety challenge where drivers move from rural highway conditions into a town center. In this dataset, posted speed limits average 56 mph on approaches to small towns and 37 mph in town centers, with the change occurring within a few hundred feet.

Despite their distinct setting, these stretches of highway are not identified separately in conventional crash reporting. Fatal crashes are classified as urban or rural, although small-town centers do not fit neatly into either category. The rural/urban label in the national fatal crash census also differs from Census urban-area boundaries for a substantial share of deaths, particularly near urban edges [1]. These classifications make it difficult to assess how safety conditions change as a highway enters a small town, passes through its center, and continues beyond its limits.

Previous work has examined road safety along highways in different settings and at broader geographic scales. A study of informal economic activity along a national highway corridor in an urbanizing Ghanaian

city linked that activity to road accidents, congestion, and poor sanitation; informal economic actors were involved in 21.8% of reported accident cases [2]. A county-level panel of U.S. rural road deaths offers another perspective [3]. These studies provide useful context, but neither isolates the short highway stretches passing through small-town centers.

This paper addresses that gap with an open national dataset of highway segments in and around small towns. It examines how often a state or U.S. highway passes through the town center and compares fatal crash rates and pedestrian death rates on the approaches, in the rest of town, and within the center. The analysis also considers whether these differences persist across Census regions, town sizes, and route types. Distinguishing these short highway environments makes it possible to study their safety outcomes without folding them into broader urban or rural categories.

2. Background

A road's surroundings shape the safety risks associated with its design and use. Features intended to make high-speed travel more forgiving may create conflicts where motorists encounter pedestrians, turning vehicles, and parked cars [4]. Studies have also linked commercial strips along arterial roads to more crashes than compact street networks [5]. For pedestrians, the consequences of these conflicts depend strongly on speed: the risk of death increases steeply with impact speed [6].

Much of the engineering guidance relevant to small towns addresses the point where a high-speed rural highway enters a developed area. NCHRP Synthesis 412 reviews techniques for reducing speeds during rural high-to-low speed transitions [7], while NCHRP Report 737 provides design guidance for transition zones approaching small towns [8]. National research on pedestrian fatalities has tended to focus on large metropolitan areas, high-poverty counties, and urban arterials [9,10]. The streets beyond the transition zone, particularly those running through the center of a small town, have received less attention. One obstacle has been the lack of a national inventory identifying these centers.

3. Data and Methods

3.1 Towns

Outside New England, the study defines small towns as incorporated places in the 2024 TIGER/Line files [11] with a 2024 population estimate below 10,000 [12]. New England towns are general-purpose local governments but are recorded as county subdivisions in Census data. Towns and small cities with fewer than 10,000 people were therefore selected from that layer. Because some New England towns extend across 30 square miles or more of farmland and forest, their study limits were restricted to incorporated villages and Census Designated Places within them. The 732 towns without either type of area were assigned a center zone only. Places with more than half their land inside a 2020 Census urban area of at least 50,000 people were excluded as suburbs [13]. Alaska and Hawaii were also excluded. The final study area contains 15,195 small towns, with all geometry processed in the Albers equal-area projection (EPSG:5070).

3.2 Locating town centers

Legal town boundaries often extend well beyond the area residents recognize as downtown, sometimes including highway frontage and undeveloped land. Each center was therefore located where everyday destinations were most concentrated. These destinations included shops, restaurants, offices and services, government buildings, schools, health care facilities, lodging, and cultural sites from Overture Maps places

release 2026-10-21.0 [14]. Records marked as closed or assigned a confidence score below 0.5 were excluded. Fuel stations and automotive services were also omitted to avoid treating a commercial strip at the highway edge as a town center. Parks and sports fields were excluded because they often lie near town boundaries.

For each town, a k-d tree identified the destination with the most neighboring destinations within a quarter mile (402 m). The candidate point was then shifted once toward the mean location of that cluster, and whichever of the two points held more destinations was retained. A center was identified when at least 10 destinations fell within a quarter mile of the selected point. Its zone was defined as a quarter-mile circle clipped to town limits. This method identified centers in 10,659 of the 15,195 towns. The median center contained 34 destinations (interquartile range: 18–70). Towns without an identifiable center were generally small; 63% of those with fewer than 500 residents had none. Figure 1 illustrates the method in Stockton, Missouri (2024 population: 1,841), where the densest cluster contained 61 destinations near the intersection of Missouri Routes 32 and 39, 187 m from the Cedar County Courthouse.

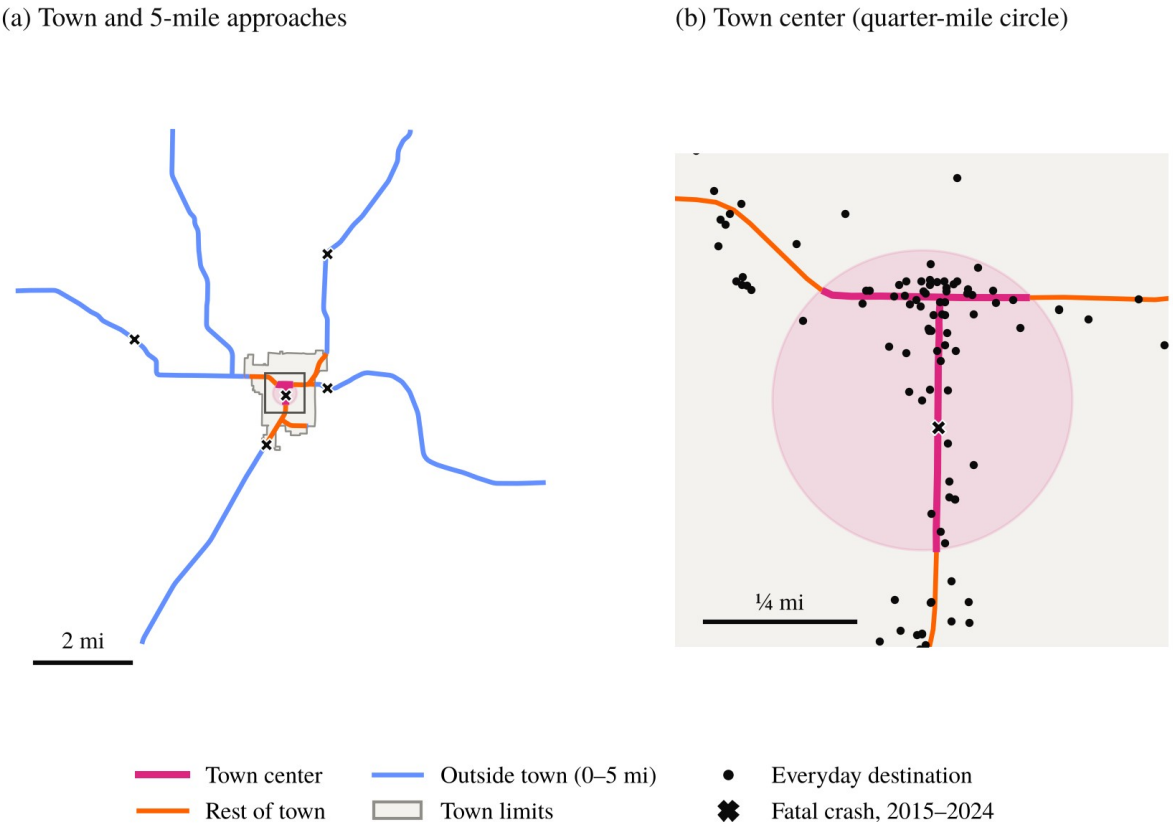


Figure 1. Highway zones in Stockton, Missouri. (a) State routes through town and up to 5 miles beyond town limits. (b) Town center: the quarter-mile circle around the densest cluster of everyday destinations. Fatal crashes 2015–2024 from FARS; town limits from TIGER/Line 2024; roads from HPMS 2024; destinations from Overture Maps.

3.3 Checking the centers

A random sample of 45 towns, 30 in Missouri and 15 in New England, was used to check whether the calculated locations corresponded to places residents would likely recognize as town centers. Post offices, town or city halls, and county courthouses were identified through the U.S. Geological Survey's Geographic

Names Information System [15]. Distances were measured from each calculated center to the nearest of these civic anchors; when a village post office or town office was absent from the names database, the nearest civic site in the destinations data was used. All 45 centers were within a quarter mile of a civic anchor. The median distance was 187 m, and the maximum was 371 m. A review of aerial imagery showed that 3 of the 45 centers were civic or commercial strips along a highway rather than traditional downtowns. In one New England town, the method identified the present-day civic center, approximately 3 km from the historic town common.

3.4 Highway zones

Highway geometry and attributes came from the 2024 Highway Performance Monitoring System (HPMS) [16]. The study network included roads signed as U.S. or state routes and roads owned by a state highway agency that were classified as principal arterials, minor arterials, or collectors. Interstates, ramps, local roads, and the second carriageway of divided highways were excluded. Each road was divided into 50 m pieces and assigned to a zone according to the midpoint of each piece. The town-center zone was the quarter-mile circle, and the rest-of-town zone covered the area within town limits but outside that circle. The outside-town zone followed the same route for up to 5 miles beyond incorporated places, excluding other incorporated areas; each piece was assigned to the nearest town entered by that route. Pieces were combined into a single segment for each town, route, and zone, retaining length, annual average daily traffic (AADT), posted speed limit where available, and lane count. This produced 72,301 town–route–zone segments.

3.5 Crash matching and rates

Fatal crash and victim records were drawn from the Fatality Analysis Reporting System (FARS) for 2015–2024 [17]. A crash was matched to a study segment if it occurred within 50 m of a study road and FARS classified the road as a U.S. or state highway, identified it as state-highway-agency owned, or recorded a route number matching the study route. Interstate crashes were excluded in all cases. Where several study roads were within 50 m, a matching route number took precedence, followed by proximity. Of the 357,175 fatal crashes recorded in the lower 48 states and the District of Columbia, 39,300 (11%) matched a study segment. The FARS route number agreed with the assigned route for 91% of matched crashes.

Traffic exposure was measured in vehicle miles traveled (VMT), calculated as 2024 AADT multiplied by segment length and 3,652.5 days. Rates are reported per 100 million VMT, with exact Poisson 95% confidence intervals. The rate calculations use only principal arterials, minor arterials, and major collectors for which traffic counts cover at least 90% of segment length. Those segments account for 97% of matched crashes. Nighttime was defined as 6:00 p.m. through 5:59 a.m.

4. Results

4.1 How common main street highways are

A state or U.S. highway passes through the center of 8,995 small towns, representing 84% of the 10,659 towns with identifiable centers and 59% of all 15,195 towns in the study (Figure 2). The proportion varies by region, from 95% in the South and 92% in the Northeast to 85% in the West and 74% in the Midwest. The Midwest's denser county-road network allows more town centers to lie outside the state highway system. Main street highways are also more common in larger towns: they pass through the centers of 88% of towns with 2,500–9,999 residents, compared with 78% of towns with fewer than 500 residents. Across the study

area, these highways extend for 6,144 miles through town centers, 34,260 miles through the rest of town, and 174,674 miles along the approaches within 5 miles of town limits.

Between 2015 and 2024, 1,131 fatal crashes occurred on these highways within town centers, compared with 7,059 in the rest of town and 31,110 outside town. At least one fatal crash occurred in the center of 954 towns. Pedestrian fatalities were recorded in the centers of 293 towns, with 318 pedestrian deaths in all. These towns are distributed across the country.

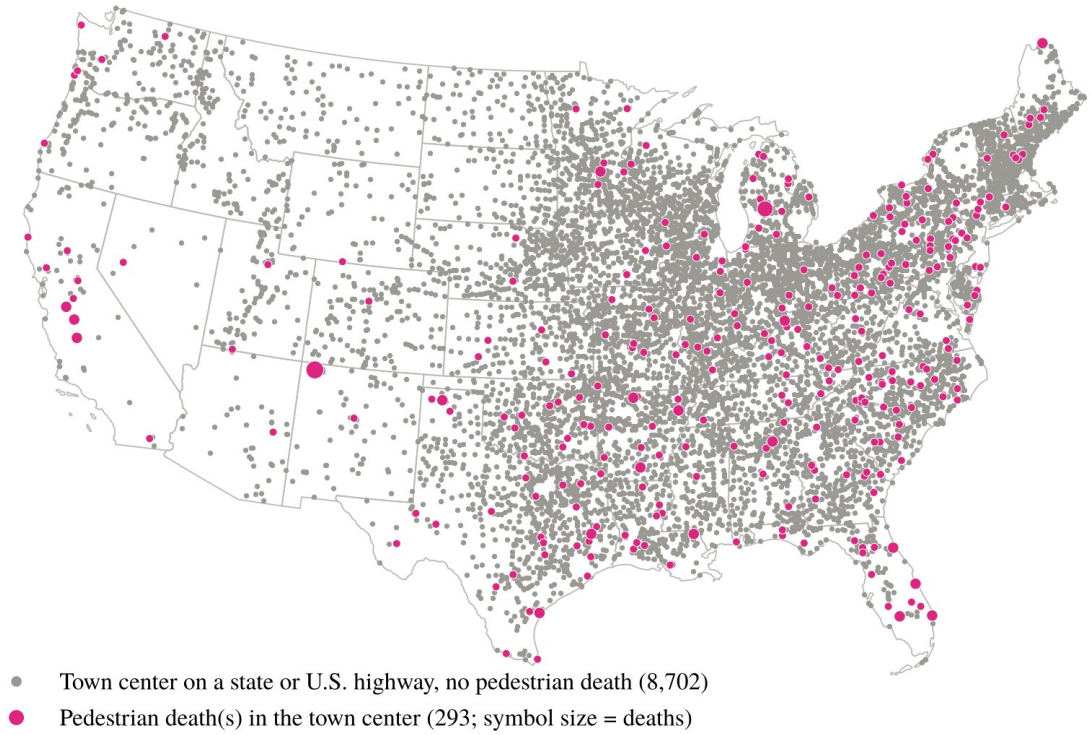


Figure 2. Small-town centers on state and U.S. highways, lower 48 states (n = 8,995). Magenta points mark the 293 towns where at least one pedestrian was killed in the town center, 2015–2024; symbol size is proportional to deaths. State outlines from Census cartographic boundary files.

4.2 Rates by zone

Fatal crash rates and pedestrian death rates followed different patterns across the three zones (Table 1). Per 100 million VMT, fatal crashes were less frequent in town centers (0.97) and the rest of town (0.96) than on the approaches (1.27). The pedestrian death rate, however, was highest in town centers at 0.276, compared with 0.146 in the rest of town and 0.093 on the approaches. The center rate was 3.0 times the approach rate and 1.9 times the rest-of-town rate; the confidence intervals did not overlap (Figure 3). Pedestrians accounted for 26% of all people killed in town centers, 14% in the rest of town, and 6% on the approaches. Over the same sequence of zones, average posted speed limits declined from 56 mph to 48 mph and then to 37 mph. Thus, the lower overall fatal crash rate within towns coincided with a higher pedestrian death rate.

Table 1. Fatal crashes and rates by zone on small-town state and U.S. highways, 2015–2024 (rate base). Rates per 100 million VMT using 2024 AADT; exact Poisson 95% confidence intervals in parentheses.

Zone	Miles	100M VMT	Fatal crashes	Deaths	Ped. deaths	Fatal crash rate (95% CI)	Ped. death rate (95% CI)
Town center	5,782	1,149	1,120	1,198	317	0.97 (0.92–1.03)	0.276 (0.246–0.308)
Rest of town	32,123	7,163	6,915	7,533	1,043	0.96 (0.94–0.99)	0.146 (0.137–0.155)
Outside town	160,857	23,580	30,059	33,833	2,194	1.27 (1.26–1.29)	0.093 (0.089–0.097)

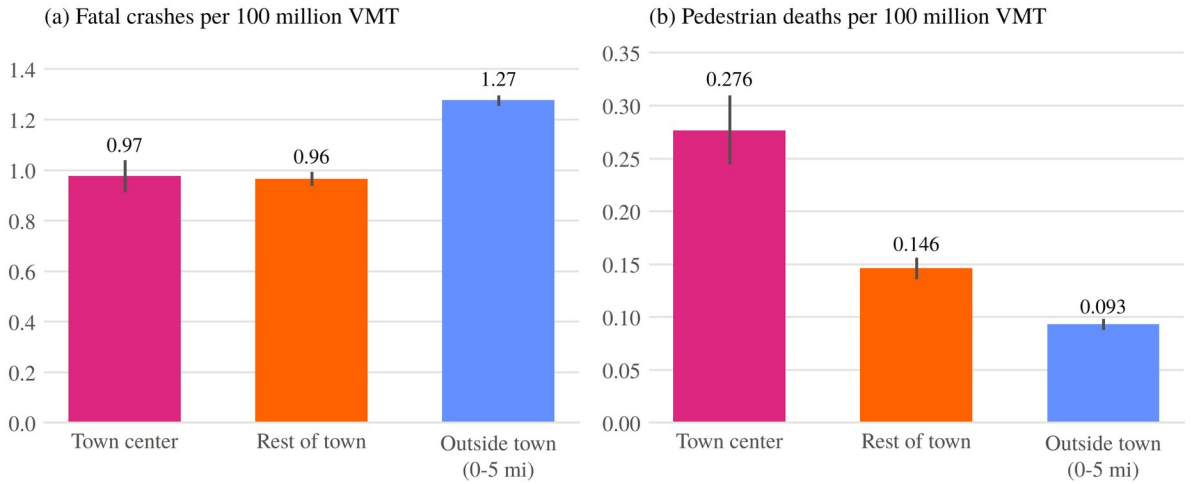


Figure 3. (a) Fatal crash rate and (b) pedestrian death rate by zone on state and U.S. highways in and near U.S. towns under 10,000 people, 2015–2024. Whiskers are exact Poisson 95% confidence intervals.

4.3 Town size, region, and route type

Town-center pedestrian death rates exceeded approach rates in every subgroup (Table 2 and Figure 4). In towns of 2,500–9,999 people, rates were 0.318 versus 0.106 per 100 million VMT; for towns under 500, they were 0.199 versus 0.077, with a wider confidence interval. The center-to-approach ratio was highest in the Midwest (4.2). Pedestrians accounted for 38% of town-center deaths in the West and 33% in the Northeast, the highest regional shares. The pattern also held on U.S. and state routes and with New England excluded (0.285 versus 0.095).

Table 2. Pedestrian death rates by subgroup (per 100 million VMT; rate base); center/outside ratio.

Subgroup	Town center	Rest of town	Outside town	Ratio	Center ped. deaths
Towns under 500	0.199	0.128	0.077	2.6	22
Towns 500–2,499	0.247	0.133	0.085	2.9	123
Towns 2,500–9,999	0.318	0.154	0.106	3.0	172
Northeast	0.290	0.156	0.081	3.6	55
Midwest	0.219	0.098	0.052	4.2	68
South	0.302	0.161	0.123	2.5	164
West	0.282	0.155	0.086	3.3	30
U.S. routes	0.303	0.149	0.096	3.2	122
State routes	0.261	0.144	0.091	2.9	195
Excluding New England	0.285	0.147	0.095	3.0	303
New England only	0.162	0.108	0.058	2.8	14

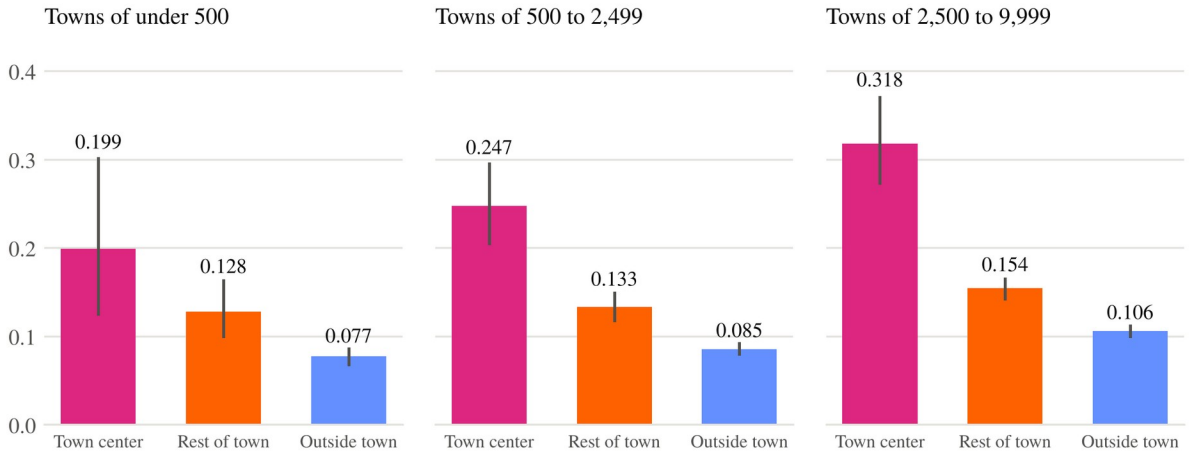


Figure 4. Pedestrian death rate by zone and town size. Whiskers are exact Poisson 95% confidence intervals.

4.4 Time of day

About 42% of fatal crashes occurred at night in each zone, but pedestrian crashes had a different distribution. Nighttime accounted for 76% of pedestrian crashes on the approaches and 75% in the rest of town, compared with 62% in town centers. A larger share of pedestrian crashes in town centers therefore occurred during daylight hours.

5. Discussion

State and U.S. highways are a common feature of small-town main streets: 84% of towns with an identifiable center have one passing through it. The findings show that the safety profile of these roads changes over a relatively short distance. As highways move from open country toward the center of town, the fatal crash rate per vehicle mile falls, while the pedestrian death rate rises to roughly three times its level on the approaches. This contrast is consistent with the different demands placed on a road that serves both through traffic and people walking to shops, schools, and services. It also resonates with findings from Ghana linking activity along a national highway corridor to road accidents [2].

Current guidance on speed transitions largely addresses the approach to a town [7,8], but the pedestrian deaths documented here occurred within the center itself. This suggests that speed management and safe crossing provisions should extend beyond the town entrance. The area identified by the method is relatively compact, extending about a quarter mile around the densest cluster of destinations, and could be mapped and screened statewide alongside other priority locations. Road management also crosses jurisdictional boundaries: states design and operate the highway, while local land-use decisions shape the destinations that bring pedestrians to it. Coordinating state corridor improvements with downtown planning is therefore important, particularly where revitalization may bring more people on foot. The time-of-day findings add another consideration. Because a substantial share of town-center pedestrian crashes occurs during daylight hours, nighttime visibility measures alone would not address the full pattern observed here.

These locations are difficult to recognize as a single road safety issue within the conventional urban–rural reporting split, which distributes their crashes across rural and small-urban categories [1]. Defining town

centers through concentrations of everyday destinations makes it possible to examine these roads together and compare their safety outcomes with those of the surrounding highway network.

6. Limitations

Several limitations affect how the results should be interpreted. This is an observational study, and pedestrian volumes were not measured. Higher pedestrian death rates per vehicle mile in town centers may therefore reflect, in part, greater pedestrian exposure. FARS captures only crashes involving a death within 30 days. The analysis also applies 2024 traffic volumes to the full 2015–2024 period and uses a 2024 road network, which may not accurately represent earlier conditions in towns that gained bypasses. Town centers were identified from a 2026 snapshot of destinations; those records may not capture conditions in earlier years and may be less complete in the smallest towns. Although the 45-town validation supports the center-identification method, it does not establish its error rate nationally. Posted speed-limit data are incomplete outside the National Highway System, and some legal town boundaries encompass rural land.

7. Conclusions

This study identifies the centers of small towns across the contiguous United States and the state and U.S. highways that pass through them. Such highways serve as main streets in 8,995 towns, or 84% of those with an identifiable center. Although fatal crashes per vehicle mile were less frequent in town centers than on the approaches, pedestrian deaths per vehicle mile were approximately three times as frequent. The higher center rate was observed across Census regions and town-size classes, and on both U.S. and state routes. The openly available dataset of towns, centers, highway zones, and matched crashes offers state agencies, planners, and researchers a consistent basis for identifying these locations, examining their safety conditions, and monitoring change over time.

Declarations

Funding. None.

Competing interests. None.

Ethics. Analysis of public, de-identified federal data.

Use of AI tools. Claude (Anthropic) assisted with code and data assembly; the author designed and drafted the study, made the analytic decisions, verified the reported figures against the source files, and is responsible for the content.

Data Availability

The towns, town centers, highway segments, matched crashes, code, provenance log, quality report, and verification records are openly available on Zenodo [18] (https://doi.org/10.5281/zenodo.24030310) and GitHub (https://github.com/Emmanuel-Oti-Nani/main-street-highways) under CC BY 4.0 (data) and MIT (code) licenses.

References

[1] Nani, E. O. (2026). How rural is rural? Agreement between the FARS rural/urban label and 2020 Census urban areas for U.S. traffic deaths, 2015–2024. EarthArXiv preprint. https://doi.org/10.31223/X5RV4C

[2] Nani, E. O., Camynta-Baezie, G., Anbazu, J., Antwi, N. S., Blija, D., Adabor, E., & Asibey, M. O. (2025). A burgeon in informal economic activities along highways in urbanizing cities: Implications for sustainable development. Transportation in Developing Economies, 11, 5. https://doi.org/10.1007/s40890-024-00222-0

[3] Nani, E. O. (2026). U.S. Rural Road Fatality County Panel (Version 1.0.0) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.23547649

[4] Ewing, R., & Dumbaugh, E. (2009). The built environment and traffic safety: A review of empirical evidence. Journal of Planning Literature, 23(4), 347–367. https://doi.org/10.1177/0885412209335553

[5] Dumbaugh, E., & Rae, R. (2009). Safe urban form: Revisiting the relationship between community design and traffic safety. Journal of the American Planning Association, 75(3), 309–329. https://doi.org/10.1080/01944360902950349

[6] Tefft, B. C. (2013). Impact speed and a pedestrian's risk of severe injury or death. Accident Analysis & Prevention, 50, 871–878. https://doi.org/10.1016/j.aap.2012.07.022

[7] Forbes, G. J. (2011). NCHRP Synthesis 412: Speed reduction techniques for rural high-to-low speed transitions. Transportation Research Board. https://doi.org/10.17226/22890

[8] Torbic, D. J., Gilmore, D. K., Bauer, K. M., Bokenkroger, C. D., Harwood, D. W., Lucas, L. M., Frazier, R. J., Kinzel, C. S., Petree, D. L., & Forsberg, M. D. (2012). NCHRP Report 737: Design guidance for high-speed to low-speed transition zones for rural highways. Transportation Research Board. https://doi.org/10.17226/22670

[9] Governors Highway Safety Association. (2025). Pedestrian traffic fatalities by state: 2024 preliminary data (January–December). GHSA.

[10] Smart Growth America. (2024). Dangerous by design 2024. Smart Growth America.

[11] U.S. Census Bureau. (2024). TIGER/Line shapefiles, 2024: Places and county subdivisions.

[12] U.S. Census Bureau. (2025). Annual estimates of the resident population for incorporated places and minor civil divisions, Vintage 2024.

[13] U.S. Census Bureau. (2023). 2020 Census urban areas.

[14] Overture Maps Foundation. (2026). Overture Maps places, release 2026-10-21.0. https://overturemaps.org

[15] U.S. Geological Survey. (2021). Geographic Names Information System, domestic names archive (August 25, 2021). https://www.usgs.gov/tools/geographic-names-information-system-gnis

[16] Federal Highway Administration. (2025). Highway Performance Monitoring System, 2024 spatial data by state. https://geo.dot.gov

[17] National Highway Traffic Safety Administration. (2026). Fatality Analysis Reporting System (FARS) national data files, 2015–2024. https://www.nhtsa.gov/research-data/fatality-analysis-reporting-system-fars

[18] Nani, E. O. (2026). Main Street Highways: Fatal crashes on state and U.S. highways through small-town centers (Version 1.0.0) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.24030310