Investigating Public Knowledge and Perceptions Toward Railroad Trespassing in the United States and the Impact of Terminology on Social Perceptions of People Struck by Trains

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STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

RESEARCH & DEVELOPMENT

Investigating Public Knowledge and Perceptions Toward Railroad Trespassing in the United States and the Impact of Terminology on Social Perceptions of People Struck by Trains

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16. Abstract

Railroad trespassing remains a persistent and growing public safety challenge in the United States. Trespasser-related injuries and fatalities have increased over the past decade, highlighting critical gaps in public knowledge, risk perception, and everyday decision-making near railroad infrastructure. This study examines public understanding of railroad property ownership, trespassing legality, safety risks, and behavioral motivations, with particular attention to how terminology framing shapes moral judgment and responsibility attribution in railroad incident scenarios. An anonymous national online survey was administered in October 2025 to over 1,000 U.S. adults using a representative sampling approach. The survey included two components: (1) baseline measures assessing demographics, rail safety education, perceptions of train noise and audibility, trespassing behaviors, and risk perceptions; and (2) a randomized terminology framing experiment in which participants evaluated four railroad accident narratives using either legally charged language ("trespasser") or neutral descriptors ("pedestrian" or "person crossing the tracks"). Open-ended responses were analyzed using a hybrid qualitative approach combining thematic coding with natural language processing assisted support. Results reveal substantial gaps in exposure to rail safety education, widespread normalization of track crossings for routine activities, and frequent overreliance on auditory cues despite acknowledged limitations. Terminology framing significantly influenced moral judgment: legalistic language increased rule-based reasoning and criminal attribution, while neutral language fostered greater empathy and contextual reasoning. Across scenarios, respondents frequently expressed moral ambivalence, resisting binary victim–criminal classifications. These findings highlight the importance of education, infrastructure design, and careful language choice in railroad safety communication and policy development.

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EXECUTIVE SUMMARY

Railroad trespassing remains a persistent and growing public safety challenge in the United States. Trespasser fatalities and injuries have continued to rise over the past decade, despite substantial progress in improving safety for passengers and railroad employees. This underscores the need to better understand public knowledge, perceptions, behaviors, and moral judgments related to railroad trespassing. This study explores existing research by examining both baseline public perceptions and the impact of terminology framing on how individuals interpret and evaluate railroad crossing incidents.

An anonymous, national online survey was administered to 1,006 U.S. adults in October 2025. The survey was conducted on Qualtrics and distributed via Prolific using a representative sampling approach. The survey consisted of two parts: (1) baseline measures capturing demographics, rail safety knowledge, rail noise perceptions, trespassing behaviors, risk perceptions, and safety concerns; and (2) a terminology framing experiment in which participants were randomly assigned to read accident narratives using either biased legal language ("trespasser") or neutral language ("pedestrian" or "person crossing the tracks"). Open-ended responses were analyzed using a hybrid qualitative approach combining thematic coding and natural language processing (NLP) assisted support.

Results from Part One reveal substantial gaps in public knowledge and safety awareness. Fewer than 8% of respondents reported receiving any rail safety education, and over one-quarter believed railroad trespassing is legal, while one-third believed railroad property is public. More than half of the respondents reported having crossed railroad tracks for shortcuts, which are most common to shorten travel distance, access recreational spaces, or reach school, work, or nearby destinations. Risk perceptions among those who crossed often reflected confidence in auditory cues or personal vigilance, despite widespread acknowledgment that trains are quieter than in the past and that auditory warnings are not always reliable.

Results from Part Two demonstrate that terminology meaningfully shapes public judgment. Across all four accident scenarios, the use of legalistic language increased reliance on rule-based reasoning (Legal Formalism) and reinforced criminal attribution, even when respondents expressed compassion or acknowledged vulnerability. Neutral language consistently increased victim labeling, reduced legalistic justification, and elevated reasoning related to intent, awareness, age, and situational context. Across conditions, respondents frequently selected a "Victim and Criminal" label, revealing discomfort with binary moral categorizations and highlighting moral ambivalence in public judgment.

These findings suggest that railroad trespassing is widely normalized in daily mobility, that public understanding of legal and safety risks remains incomplete, and that language choice plays a critical role in shaping empathy, blame, and perceived responsibility. These results have important implications for rail safety communication, education strategies, and policy framing.

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Chapter 1. Introduction

According to the Federal Railroad Administration (FRA, 2016), individuals who enter or remain on railroad property without permission—commonly referred to as trespassers—are at significant risk of injury or fatality. Nationally, trespasser casualties (excluding highway-rail incidents) increased by 41% from 765 in 2011 to 1082 in 2020 (FRA, 2021). Similarly, in North Carolina, these numbers rose by 20% from 20 in 2011 to 24 in 2020 (FRA, 2021). This rising trend not only highlights the urgent need for a deeper understanding of public attitudes, awareness, and behaviors related to railroad trespassing but also underscores a critical conflict: while these areas are considered private property by law, the increasing fatalities elevate this to a public safety concern, demanding broader societal attention and intervention.

U.S.-based research on public perceptions of railroad trespassing remains limited. While international studies, such as those conducted in Finland (Silla & Luoma, 2012) and the Czech Republic (Skládaná et al., 2019), have examined related themes, a focused investigation within the U.S. context is notably lacking. The terminology used to describe individuals on the tracks further complicates the issue. Labeling individuals, particularly vulnerable groups such as very young children, as “trespassers” may reduce public empathy and influence how responsibility and prevention are framed. However, the appropriateness of terminology depends on context. In cases involving deliberate and informed violations, the legal term “trespasser” may be accurate and necessary. In other situations, such as accidental exposure, impaired judgment, or limited awareness, more neutral terms (e.g., “pedestrian” or “person crossing the rail track”) may facilitate broader public engagement and more balanced policy discussions aimed at enhancing safety and prevention.

Chapter 2. Research Goal and Objectives

2.1 Research Goal

The goal of this study is to examine why people engage in railroad trespassing in the United States by investigating public knowledge, risk perceptions, behaviors, and moral judgments related to trespassing. The study places particular emphasis on how warning awareness, railroad safety education, terminology framing, and information sources shape public understanding of risk, responsibility, and legality. In addition, the study seeks to identify implications for more effective railroad safety communication, education, infrastructure improvement, and institutional intervention strategies involving both government agencies and railroad companies.

2.2 Research Objectives

To achieve the goal, the following specific objectives are proposed:

- To assess public awareness and understanding of railroad property ownership, trespassing legality, and safety risks, and examine how these factors relate to self-reported crossing and trespassing behaviors.
- To examine how warning cues, auditory awareness, proximity to rail infrastructure, and everyday contextual factors influence risk perception and behavioral decision-making near railroad tracks.
- To investigate how language and terminology framing, specifically legally charged versus neutral descriptors, affects public labeling judgments, moral reasoning, and responsibility attribution in railroad incident scenarios.
- To characterize the justificatory reasoning mechanisms used by the public when evaluating railroad trespassing incidents, including legal formalism, personal responsibility, compassion, infrastructure conditions, and discomfort with criminal labeling.
- To identify implications for railroad safety education, communication strategies, enforcement practices, and infrastructure improvements by linking public perceptions and reasoning patterns to observed behavioral and safety concerns.

Chapter 3. Literature Review

Railroad trespassing and train–pedestrian collisions remain a major safety concern in many countries, which often results in severe injuries, fatalities, and operational disruptions to rail systems. Understanding the causes and characteristics of these incidents is essential for developing effective prevention strategies. Existing research on railroad trespassing spans multiple disciplines and perspectives, including behavioral studies, crash severity analysis, spatial risk modeling, and evaluations of safety interventions. To provide a structured overview of the current state of knowledge, this literature review synthesizes prior research into four major themes: (1) behavioral motivations and perceptions, (2) crash severity factors, (3) spatial and contextual risk factors, and (4) countermeasures and interventions. These themes collectively capture the key factors influencing railroad trespassing behavior and safety outcomes.

3.1 Behavioral Motivations and Perceptions

Studies across different countries have highlighted the importance of behavioral motivations and risk perceptions in railroad trespassing. Silla and Luoma (2009) investigated trespassing in Finland by identifying high-risk locations and examining trespasser behavior through surveys of train drivers, field observations, and interviews with trespassers. Their findings showed that frequent trespassing occurred at numerous locations, typically involving adults and males, and that many individuals perceived trespassing as safe or even legal. Similarly, Skládaná et al. (2019) examined residents' attitudes toward railroad trespassing near illegal shortcut locations in the Czech Republic through 619 face-to-face interviews conducted at 26 sites. The study found that railroad trespassing was common, often motivated by a desire to shorten travel time or by habitual behavior, while many residents underestimated the risks of train–pedestrian collisions. Together, these studies indicate that railroad trespassing is strongly influenced by convenience-driven behavior and risk misperceptions, suggesting that both infrastructure improvements (e.g., fencing or underpasses) and awareness-raising measures may be necessary to reduce unsafe practices.

3.2 Crash Severity Factors

Several studies have examined factors influencing the severity of train–pedestrian collisions. Ghomi et al. (2016) found that train speed is a key determinant of injury severity in highway–rail grade crossing crashes involving vulnerable road users, with higher speeds associated with greater fatality risk. Their results also indicate that illumination does not significantly reduce accident severity when trains are traveling at high speeds, while demographic factors such as older age and female gender are associated with more severe injuries under nighttime conditions. Similarly, Zhang et al. (2018) showed that pre-crash behavior plays an important role in injury outcomes. Using U.S. FRA data, they found that most rail–pedestrian trespassing crashes occur at non-crossing locations and that lying or sleeping on the tracks significantly increases the probability of fatal injury. Regarding injury severity, Zhang et al. (2023) found that fatalities are more likely when victims are young men and when pedestrians engage in high-risk behaviors such as lying down on or crossing the tracks. Collision severity also increases with higher train speeds and when incidents occur on gentle downhill track segments. In addition, county-level contextual factors, including lower average education levels and a higher proportion of the labor force, are associated with a greater likelihood of fatal outcomes.

3.3 Spatial and Contextual Risk Factors

In the United States, trespassing fatalities have not declined in the same way as grade-crossing fatalities, highlighting the need for greater attention to trespassing prevention and detection strategies (daSilva, 2011). Previous research suggests that railroad trespassing occurs across different spatial contexts, such as stations, informal shortcuts, and open-track segments, and that incident characteristics may vary depending on whether events occur at highway–rail grade crossings or non-crossing track locations (Skládaná et al., 2016; Zhang et al., 2018). At broader spatial scales, Kang et al. (2019) examined rail trespass crash frequency at the county level in the United States using a mixed-effects negative binomial model and found that demographic and exposure-related factors, including population density, rail track length, median age, male population proportion, and train traffic, significantly influence the occurrence of trespassing crashes. Similarly, Oswald Beiler et al. (2019) analyzed Amtrak trespassing incidents using GIS-based spatial analysis and identified clear temporal and spatial patterns. Their results showed that incidents occur most frequently during the afternoon and evening and are more common on weekdays, particularly Fridays, with walking identified as the predominant pre-crash activity. The study also revealed that trespassing incidents are spatially concentrated in several megaregions, including Northern California, the Northeast, Southern California, and the Great Lakes.

3.4 Countermeasures and Interventions

Lobb et al. (2003) evaluated four interventions to reduce unsafe pedestrian crossings along a railway corridor near a high school in Auckland, New Zealand. The interventions included general safety communications, school-based rail safety education, continuous punishment for unsafe crossings, and intermittent punishment combined with rewards for safe behavior. Observations conducted before and after each intervention showed that education and both punishment strategies significantly reduced unsafe crossing behavior, while general safety communications alone did not produce a statistically significant effect. The largest reduction occurred when punishment for unsafe crossings was implemented, and intermittent punishment maintained the improvement achieved during continuous punishment. Survey results also indicated increased awareness of the illegality of unsafe crossings and improved safety attitudes after the interventions. These findings suggest that enforcement-based measures are more effective than awareness campaigns alone in reducing unsafe railroad crossing behavior, although infrastructure changes that eliminate convenient shortcuts may also help prevent unsafe crossings. Finally, a recent systematic review synthesizes decades of research, organizing known factors (location, time, profile/behavior, motivations) and prevention measures (education, engineering/technology, pilot studies), highlighting gaps and the need for integrated strategies (Grabušić & Barić, 2023).

Chapter 4. Methods

4.1 Survey Design

This study uses an anonymous, online survey instrument adapted and expanded from a previous U.S. survey of public perceptions toward railroad trespassing (Chen et al., 2024). The final survey contained two parts embedded within a single survey session: Part One (general knowledge/perceptions/behaviors) and Part Two (terminology framing using accident vignettes).

4.1.1 Survey Part One: Baseline Measures

Part One was identical for all participants (Q1–Q32), regardless of experimental condition. It included demographic characteristics, public knowledge of railroad safety and railroad trespassing, perceived impacts of rail noise, self-reported crossing/trespassing behaviors, and risk perceptions. Compared with the prior survey (Chen et al., 2024), Part one incorporated several additions and refinements to better support subgroup and contextual analyses:

- New location items for geospatial analysis: respondents reported town/city, state, and 5-digit ZIP code for their residence (Q7) and work/school location(s) (Q8; "N/A" permitted). These variables were added to support geospatial analyses linking perceptions/behaviors to geographic context while maintaining anonymity.
- Minor revision to residential context: the item on living environment added "suburban area" as a response category in addition to city and rural (Q10).
- New exposure/proximity measure: respondents who indicated living close to rail tracks (Q16) were asked to estimate distance to the nearest track using walking-time categories (Q17).
- New rail-noise and auditory-awareness measures: five items were added to assess experiences and beliefs relevant to auditory warning cues and potential distraction near tracks—noticed an approaching train without hearing it (Q20), perceived changes in train loudness over time (Q21), perceived reliability of train sounds as a warning (Q22), perceived train speed when it sounds quiet/distant (Q23), and headphone/earbud use near tracks (Q24).
- Expanded safety-concerns measure: the prior general "safety concerns" question was redesigned into a multi-select checklist with 11 predefined categories plus an "other" write-in option (Q32), enabling more specific identification of infrastructure, environment, and behavior-related concerns near tracks/crossings.

4.1.2 Survey Part Two: Terminology Framing Experiment

Only Part Two differed between survey versions. Participants were presented with four real-world news articles describing the events of a train-related incident resulting in a person's death or serious injury. Each article was analyzed to identify biased-language terminology versus neutral-language terminology describing the conditions of the event. Each of the four news articles was reframed, yielding two versions of each. One version of each news article used biased language (BL), such as "trespassing/trespasser" throughout the article, while the second version of the same article used neutral language (NL), such as "pedestrian/person crossing the tracks". Participants were randomly assigned to either a BL-adjusted version or an NL-adjusted version of the news article.

Each news story was followed by the same outcome questions, assessing labeling judgments (e.g., victim vs. criminal vs. both) and open-ended reasoning, along with additional perception and responsibility related measures. Attention checks were embedded to support data quality.

See Appendices 1 and 2 for the BL and NL versions of the surveys. Appendix 3 provides the original news article links for the four stories.

4.2 Survey Collection

The survey was implemented and hosted on Qualtrics, with two parallel versions—BL and NL—programmed. Randomization logic within Qualtrics was used to assign participants evenly to the two versions, ensuring comparable sample sizes across conditions. All participants completed the survey in a single session. After finalizing the survey in Qualtrics, participants were recruited via the Prolific online research platform. The Prolific study listing directed eligible participants to the Qualtrics survey link, where responses were collected. Institutional Review Board (IRB) approval for the study was obtained from The University of North Carolina at Charlotte. Eligibility criteria required participants to be 18 years or older and currently residing in the United States. A representative sampling approach was employed to approximate U.S. Census distributions based on age, sex, and region of residence. The survey was accessible on desktop, tablet, and mobile devices and required approximately 15 minutes to complete. Data collection occurred in October 2025, yielding 1,139 submitted survey responses. Upon successful completion, participants received USD 3.00.

4.3 Data Cleaning and Analysis

4.3.1 Data Cleaning and Descriptive Analysis

Following data collection, survey responses were screened for completeness and data quality. A total of 132 responses were removed due to incomplete survey status ("Finished" = false), and one additional response was excluded because of an unrealistically short completion time (less than three minutes). After data cleaning, 1,006 valid responses were retained for analysis. Descriptive statistics were used as the primary analytical approach. Frequency and percentage distributions were computed for categorical variables, while summary statistics were generated for continuous variables.

4.3.2 Qualitative Coding and Natural Language Processing Assisted Analysis

Open-ended responses were analyzed using a hybrid qualitative approach that combined human-led thematic analysis with natural language processing (NLP) assisted computational text analysis. NLP is a subfield of computer science and artificial intelligence (AI) that uses machine learning to enable computers to understand and communicate with human language (IBM, n.d.). In this study, NLP refers to the use of computational techniques to systematically identify patterns in language, such as recurring terms, semantic groupings, and co-occurring concepts, across a large volume of text responses. These techniques were used to support, rather than replace, human judgment by helping surface common reasoning structures and linguistic cues that informed respondents' labeling decisions.

The primary goal was to identify and systematically capture the justificatory reasoning mechanisms respondents used to support labeling individuals as victims, criminals, or both, rather than relying on outcome labels alone. An initial subset of responses was manually reviewed to identify recurring linguistic patterns, justificatory structures, and semantic markers (e.g., references to legality, personal responsibility, intent or awareness, age, injury severity, system conditions, or discomfort with criminal labeling). This exploratory qualitative review informed the development of a preliminary set of candidate codes grounded in observed reasoning patterns.

To support scalability, consistency, and transparency across the full dataset of over 4,000 responses (each survey has 4 stories), computational text analysis techniques were subsequently employed as decision-support tools. These techniques were:

- Keyword- and phrase-based pattern matching (e.g., “trespassing,” “criminal act,” “breaking the law,” “should have known,” “too young,” “no intent,” “I wouldn’t call her a criminal”),
- Rule-based text filtering to flag responses containing explicitly justificatory language,
- and pattern grouping of short or minimally elaborated responses that nonetheless contained clear reasoning markers.

These NLP-assisted procedures were used only to identify candidate responses for human coding and review, to reduce the risk of execution-level omissions, and to ensure consistent application of predefined coding rules across the dataset. All final coding decisions were governed by the qualitative codebook and execution rules; no codes were assigned solely based on automated text detection. Codes were applied conservatively and only when justificatory reasoning was explicitly articulated in the response. No inferential or interpretive coding was performed. Because respondents frequently employed multiple lines of reasoning within a single response, the coding framework allowed multi-label code assignment when multiple justificatory logics co-occurred.

Eleven codes were generated ultimately. Their definitions are listed below:

1. Code 1. Legal Formalism: Applied when respondents explicitly invoke laws, rules, or illegality (e.g., trespassing, criminal acts, breaking the law) as a primary justification for labeling decisions. Legal language must be used affirmatively as a reasoning framework rather than being questioned or dismissed.
2. Code 2. Outcome-Based Compassion: Applied when sympathy or mitigation is explicitly linked to the severity of injury or death and used to reduce blame or soften criminal judgment. Mere mention of injury or fatality without mitigating judgment does not trigger this code.
3. Code 3. Intent and Knowledge: Applied when respondents emphasize lack of intent, awareness, or understanding (e.g., “did not know,” “no criminal intent,” “unaware of the danger”) as a basis for judgment, even when legal terms are referenced.
4. Code 4. Personal Responsibility / Recklessness: Applied when respondents attribute the incident to avoidable personal choices or poor judgment (e.g., “should have known,” “bad decision,” “100% his fault”), regardless of outcome severity.
5. Code 5. System / Infrastructure Failure: Applied when respondents reference environmental, institutional, or infrastructural shortcomings (e.g., lack of fencing, signage, warnings, public education, or enforcement) as contributing factors, independent of personal responsibility.
6. Code 6. Rejection of Criminal Label: Applied when respondents explicitly or implicitly resist, critique, or express discomfort with labeling an individual as a criminal (e.g., “I wouldn’t call her a criminal,” “labeling him a criminal feels wrong”).
7. Code 7. Forced-Choice Discomfort: Applied when respondents explicitly reject or express discomfort with the victim/criminal classification framework itself rather than the specific case, representing meta-level critique of the labeling structure.
8. Code 8. Age / Minor Status: Applied when age or developmental capacity is used to justify mitigation or exemption from criminal responsibility, particularly in cases involving children or adolescents.
9. Code 9. Distraction / Impairment: Applied when respondents reference distraction or impairment (e.g., wearing headphones, inattention) as a factor influencing the individual’s behavior or awareness.
10. Code 10. Train Responsibility: Applied only when respondents explicitly attribute fault or causal responsibility to train operation or operators (e.g., failure to warn, excessive speed, operational negligence). This code is applied conservatively.
11. Code 11. Punishment Proportionality: Applied when respondents evaluate whether the consequences experienced by the individual constitute sufficient punishment or whether

additional criminal labeling is excessive or unwarranted (e.g., “he already paid the price,” “this punishment was too harsh”).

4.3.3 Inter-Coder Agreement and Calibration Timing

Prior to full-scale qualitative coding, an inter-coder agreement assessment was conducted to evaluate the clarity and reliability of the finalized codebook. The principal investigator and a trained graduate student independently coded 46 story-level responses using the same code definitions and execution rules. Inter-coder reliability was assessed using Cohen’s Kappa for each qualitative code (Table 1). This assessment was conducted before large-scale coding of Batch 1 and served as an additional quality-control step to verify that code definitions and execution criteria were sufficiently clear and consistently interpretable by multiple coders. Agreement levels ranged from fair to almost perfect across most codes, with higher reliability observed for codes capturing explicit and concrete reasoning (e.g., Legal Formalism, Age/Minor, Distraction). Lower kappa values for certain codes reflected their relative interpretive subtlety or low frequency in the reliability sample, a known limitation of kappa statistics in sparse data contexts. Codes exhibiting no variance in the reliability sample yielded undefined kappa values and were retained for conceptual completeness.

Table 1. Inter-Coder Agreement for Qualitative Codes (Cohen’s Kappa).

Code	Coder A (Yes)	Coder B (Yes)	Both Yes	Both No	Percent Agreement (%)	Cohen’s Kappa	Interpretation
Legal Formalism	22	23	21	22	93.48	0.87	Almost Perfect
Outcome-Based Compassion	6	11	4	33	80.43	0.36	Fair
Intent & Knowledge	10	1	1	36	80.43	0.15	Slight
Personal Responsibility	21	26	20	19	84.78	0.7	Substantial
System / Infrastructure Failure	4	4	3	41	95.65	0.73	Substantial
Rejection of Criminal Label	11	7	7	35	91.3	0.73	Substantial
Forced-Choice Discomfort	1	1	0	44	95.65	−0.02	Poor
Age / Minor Status	4	5	4	41	97.83	0.88	Almost Perfect
Distraction / Impairment	7	6	6	39	97.83	0.91	Almost Perfect
Train Responsibility	0	0	0	46	100	—	Undefined (no variance)
Punishment Proportionality	1	3	1	43	95.65	0.48	Moderate

Results of the inter-coder agreement assessment informed the initial calibration phase but did not result in changes to the theoretical code definitions.

Chapter 5. Results

5.1 Baseline Characteristics, Knowledge, and Behaviors

Table 2 presents the demographic characteristics of the 1,006 survey respondents. The gender distribution was nearly even, with 49.50% identifying as female and 48.41% as male.

Respondents represented a wide age range. The largest age group was 55–64 years (24.85%), followed by 25–34 years (17.50%) and 35–44 years (17.00%). Participants aged 18–24 years accounted for 12.03% of the sample, while 13.32% were aged 65 years or older.

Household income levels were broadly distributed. Approximately 34.89% of respondents reported annual household incomes below $50,000, 36.68% reported incomes between $50,000 and $99,999, and 26.74% reported incomes above $100,000.

Educational attainment was relatively high. Many respondents reported at least some college education, including 34.29% with some college or an associate's degree, 36.68% with a bachelor's degree, and 15.21% with a graduate or professional degree. Only 13.82% reported having a high school education or less.

In terms of residential context, more than half of respondents (52.78%) lived in suburban areas, followed by urban areas (28.93%) and rural areas (18.29%).

Table 2. Demographic Characteristics of Respondents.

Variable	Category	N	%
Gender	Male	487	48.41%
	Female	498	49.50%
Age (Years)	18–24	121	12.03%
	25–34	176	17.50%
	35–44	171	17.00%
	45–54	154	15.31%
	55–64	250	24.85%
	65+	134	13.32%
Household Income	Less than $50,000	351	34.89%
	$50,000-$99,999	369	36.68%
	More than $100,000	269	26.74%

Education	Less than high school graduate	4	0.40%
	High school graduate (includes equivalency)	135	13.42%
	Some college, or associate's degree	345	34.29%
	Bachelor's degree	369	36.68%
	Graduate or professional degree	153	15.21%
Urbanicity	City area	291	28.93%
	Suburban area	531	52.78%
	Rural area	184	18.29%

Figure 1 illustrates the geographic distribution of survey respondents across the United States. Respondents were geographically diverse, representing 48 states across the Northeast, Midwest, South, and West, indicating a broad national sample. The largest numbers of respondents were from California (n = 105) and Texas (n = 97). In contrast, South Dakota and Vermont were the least represented states, with one respondent each.

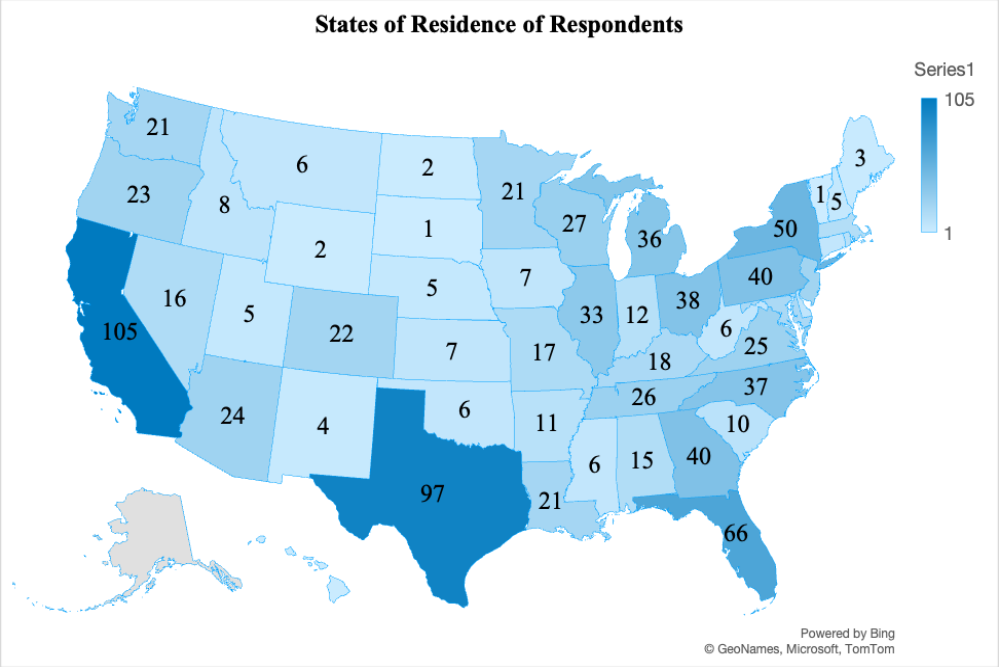

Figure 1. Geographic Distribution of Survey Respondents by State.

Figure 2 illustrates the distribution of respondents by residential proximity to railroad tracks. Most respondents (57.75%) reported that they live close to railroad tracks, while 42.25% reported that they do not live close to railroad tracks. This distribution indicates that more than half of the sample has direct residential exposure to railroad infrastructure, providing a relevant context for examining perceptions of rail noise, safety concerns, and crossing behaviors.

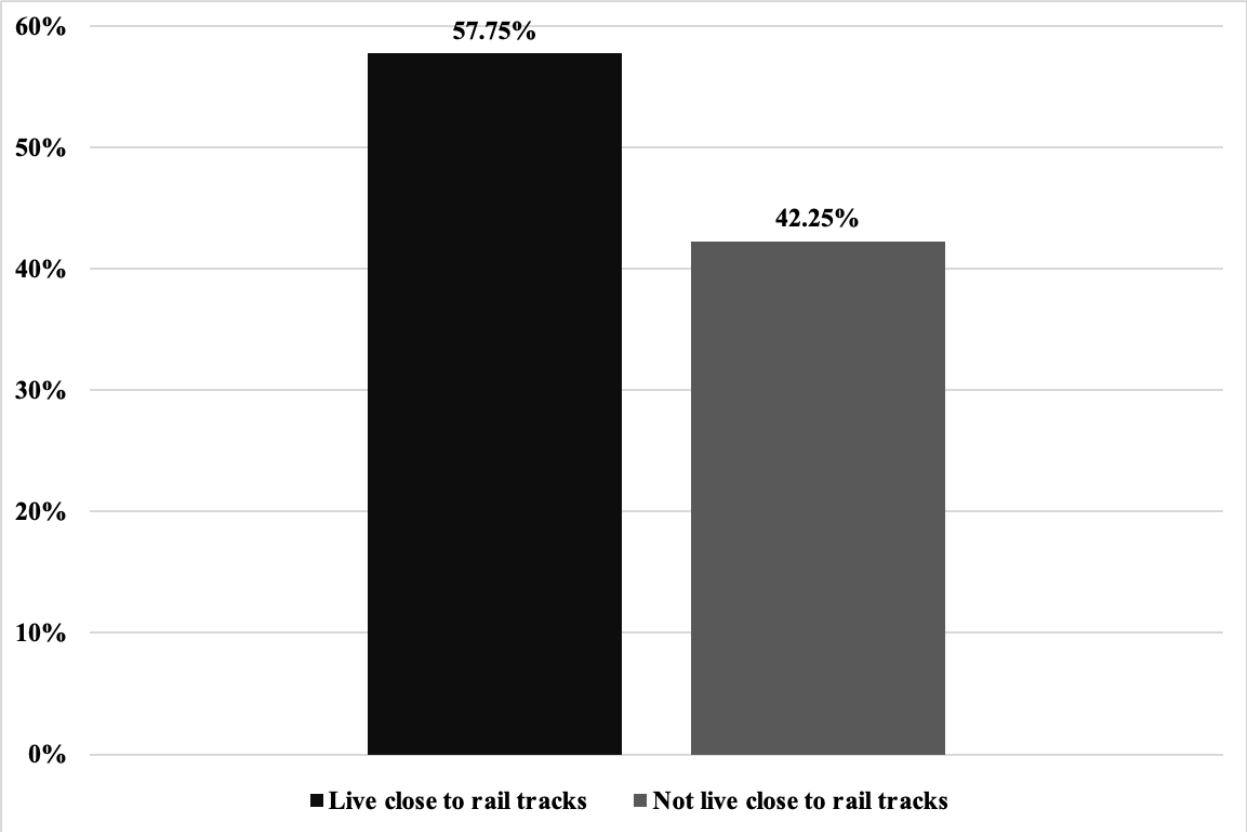

Figure 2. Distribution of Respondents by Residential Proximity to Railroad Tracks.

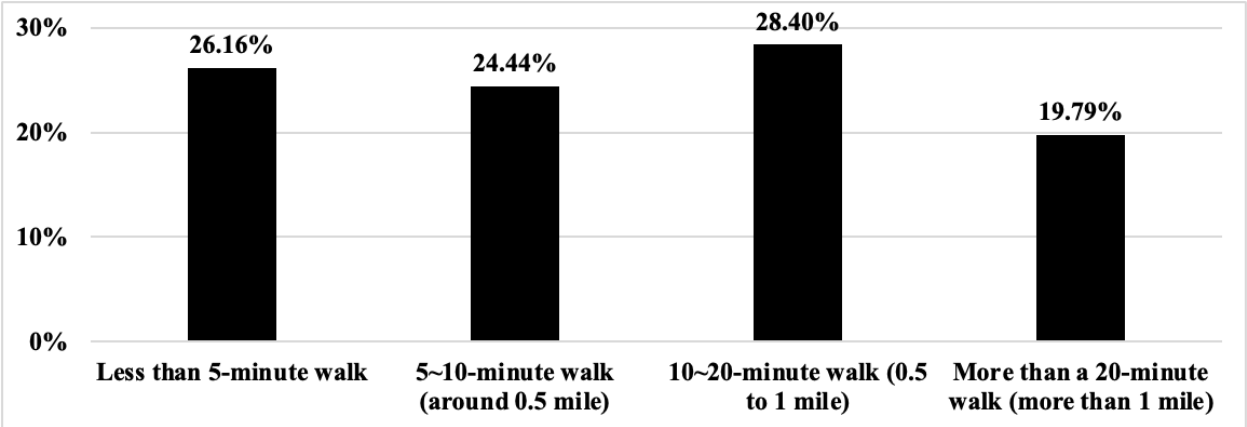

Figure 3. Walking Distance to the Nearest Railroad Track Among Respondents Living Close to Railroad Tracks.

Figure 3 presents the reported walking distance to the nearest railroad track among respondents who indicated that they live close to railroad tracks (N = 581). The most frequently reported distance was a 10~20-minute walk (0.5 to 1 mile), selected by 28.40% of respondents. This was followed by a less than 5-minute walk (26.16%) and a 5~10-minute walk (around 0.5 mile) (24.44%). Nearly one-fifth of

respondents (19.79%) reported that the nearest railroad track was more than a 20-minute walk (over 1 mile) away.

Table 3. Respondents' Rail Safety Education and Perceptions of Railroad Property and Trespassing behavior.

Variable	Category	N	%
Railroad Safety Training	Have Received Rail Safety Education	80	7.95%
	Have not Received Rail Safety Education	926	92.05%
Railroad Property Type	Think Railroad is Private	671	66.70%
	Think Railroad is Public	335	33.30%
Railroad Trespassing Legality Belief	Think Trespassing Railroad is Legal	265	26.34%
	Think Trespassing Railroad is Illegal	741	73.66%

Table 3 summarizes respondents' exposure to rail safety education and their perceptions of railroad property and the legality of railroad trespassing (N = 1,006). Only a small proportion of respondents (7.95%, n = 80) reported having received any form of rail safety education, whereas the vast majority (92.05%, n = 926) reported no prior rail safety training.

Regarding perceptions of railroad property, approximately two-thirds of respondents (66.70%, n = 671) believed that railroads are private property, while 33.30% (n = 335) perceived railroad property as public.

With respect to the legality of railroad trespassing, most respondents (73.66%, n = 741) believed that trespassing on railroad property is illegal. However, a substantial minority (26.34%, n = 265) believed that trespassing on railroad property is legal.

Overall, these findings indicate limited exposure to rail safety education and reveal notable gaps and inconsistencies in public understanding of railroad property rights and the legal status of railroad trespassing.

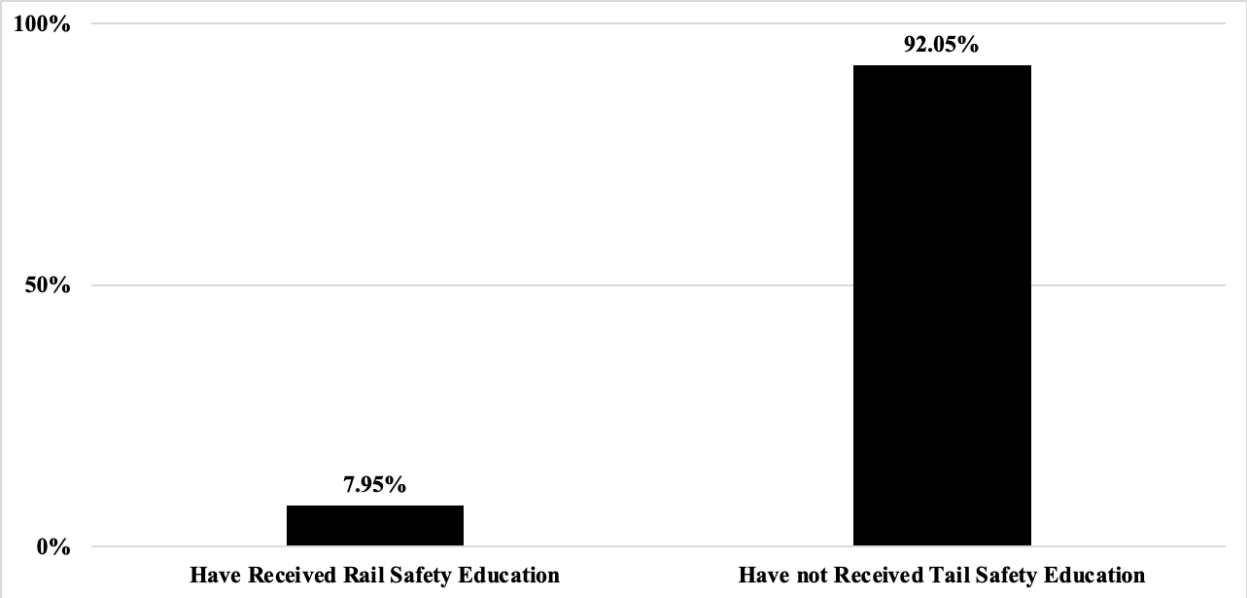

Figure 4. Rail Safety Education Experience Among Respondents.

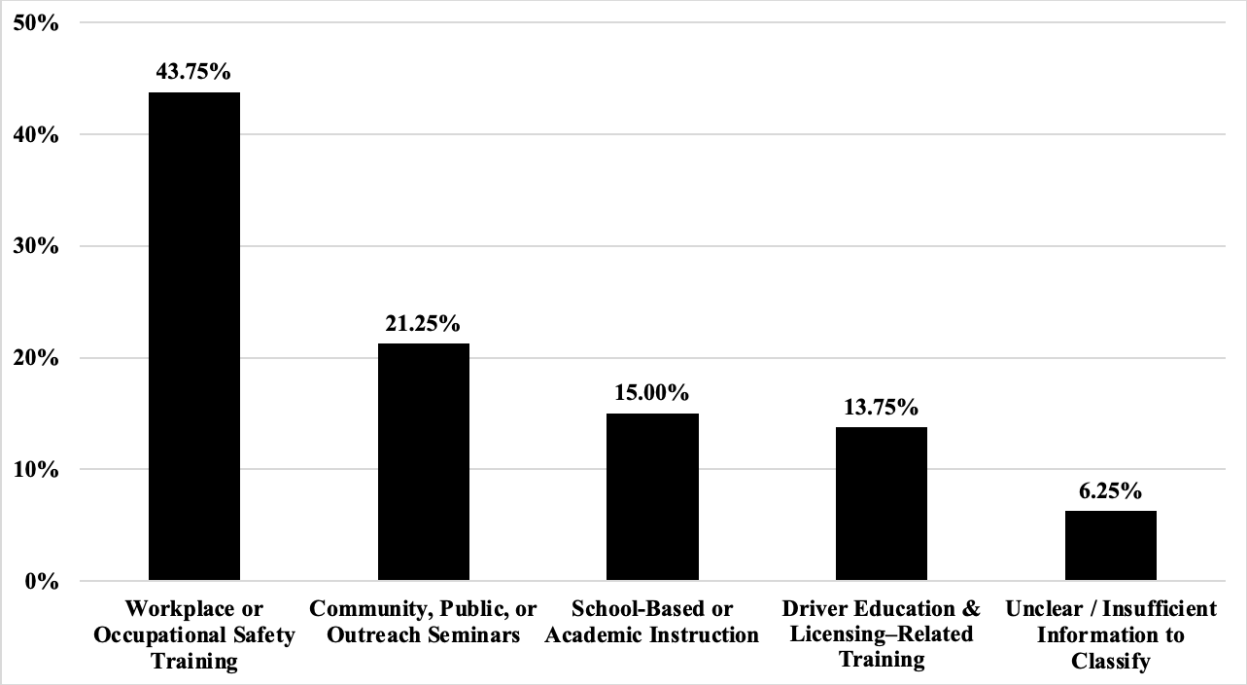

Figure 5. Categories of Rail Safety Education Respondents Received.

Figures 4 and 5 illustrate respondents' rail safety education experience and the types of training reported by those who had received education. Figure 4 shows the distribution of respondents by rail safety education status (N = 1,006). Only a small proportion of respondents (7.95%) reported having received rail safety education, whereas the vast majority (92.05%) reported no prior rail safety training.

Figure 5 presents the distribution of rail safety education categories among respondents who reported having received rail safety education (N = 80). These categories were derived from qualitative, open-

ended responses, which were systematically reviewed, grouped, and consolidated into five training categories to summarize the types of rail safety education experiences reported.

Among respondents with rail safety education, the most frequently reported form of training was workplace or occupational safety training (43.75%), followed by community, public, or outreach seminars (21.25%). School-based or academic instruction accounted for 15.00% of responses, while driver education or licensing–related training represented 13.75%. A smaller proportion of responses (6.25%) could not be clearly classified due to insufficient or unclear information.

Within the occupational safety training category (n = 35), respondents reported receiving rail safety education through employment with organizations such as Union Tank Car Company and Norfolk Southern Railroad Company. Two respondents also indicated receiving training from OSHA (Occupational Safety and Health Administration). Within the community, public, or outreach seminar category (n = 17), three respondents specifically reported receiving rail safety education through Operation Lifesaver, a nonprofit organization dedicated to rail safety education and awareness.

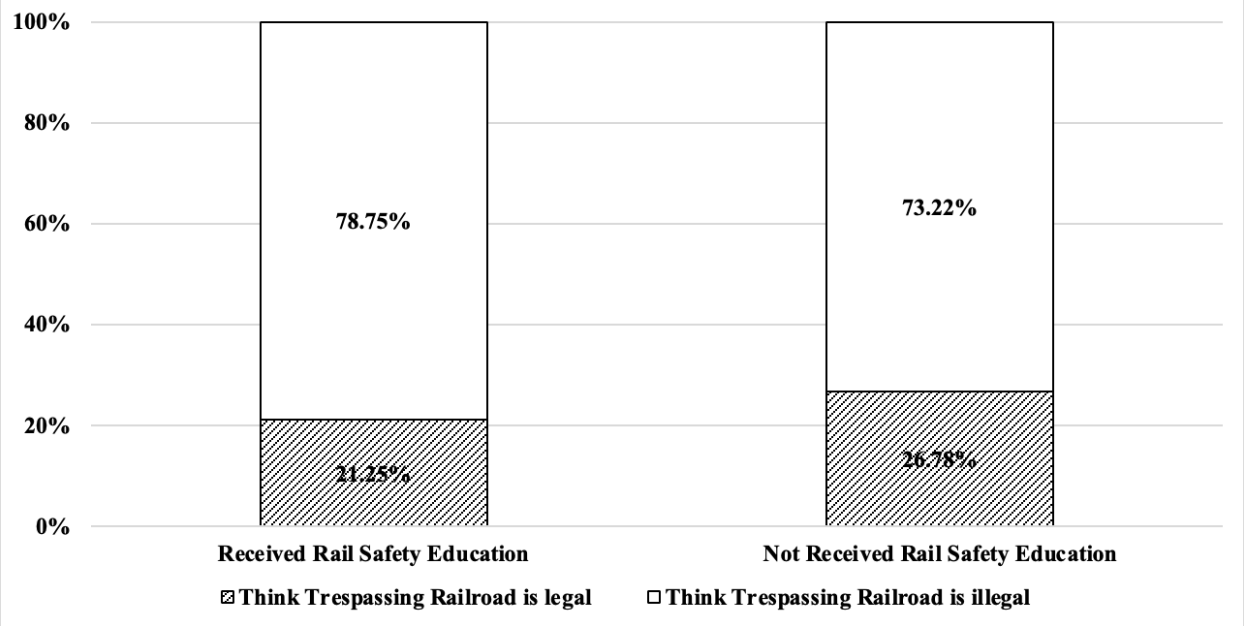

Figure 6. Rail Safety Training vs. Perception of Railroad Trespassing Legality Belief.

Figure 6 compares respondents' perceptions of the legality of railroad trespassing by rail safety education status (N = 1,006). Among respondents who reported having received rail safety education, 21.25% believed that trespassing on railroad property is legal, whereas 78.75% believed it is illegal. In contrast, among respondents who had not received rail safety education, 26.78% believed that railroad trespassing is legal, and 73.22% believed it is illegal.

Overall, respondents who reported having received rail safety education were less likely to perceive railroad trespassing as legal compared with those who had not received such education, suggesting a positive association between rail safety education exposure and awareness of trespassing illegality.

Table 4. Respondents' Perceptions of Train Noise and Auditory Warnings.

Variable	Category	N	%

Train Noisy	Think Noisy	899	89.36%
	Think Not Noisy	86	8.55%
	Not Sure	21	2.09%
Train Audible Distance	100 feet or less away	54	5.37%
	About 300 feet away	269	26.74%
	At least ½ mile away	410	40.76%
	A mile or more away	188	18.69%
	Not sure / It depends	85	8.45%
Auditory Warning Reliability	Very reliable – I can always hear it in time	373	37.08%
	Somewhat reliable – I usually hear it	471	46.82%
	Not very reliable – sometimes I don't hear it	95	9.44%
	Not at all reliable – trains can be silent or hard to hear	51	5.07%
	Not sure	16	1.59%

Table 4 summarizes respondents' perceptions of train noise, perceived audible distance of approaching trains, and the reliability of train sound as a pedestrian warning (N = 1,006). An overwhelming majority of respondents (89.36%, n = 899) perceived trains as noisy, while 8.55% (n = 86) believed trains are not noisy and 2.09% (n = 21) were unsure.

Respondents reported varied perceptions of how far away an approaching train can typically be heard. The largest proportion (40.76%, n = 410) indicated that trains can be heard from at least half a mile away, followed by 26.74% (n = 269) who reported hearing trains from approximately 300 feet away. Smaller proportions believed trains could be heard from a mile or more away (18.69%, n = 188) or only when they were 100 feet or less away (5.37%, n = 54), while 8.45% (n = 85) reported uncertainty.

Regarding the reliability of train sound as a pedestrian warning, nearly half of the respondents (46.82%, n = 471) reported that train sound is somewhat reliable, and 37.08% (n = 373) indicated it is very reliable and can always be heard in time. In contrast, 9.44% (n = 95) reported that train sound is not very reliable, and 5.07% (n = 51) indicated it is not at all reliable, noting that trains can be silent or difficult to hear. Only 1.59% (n = 16) reported being unsure.

Overall, the table shows that while most respondents perceive trains as noisy and believe they can often be heard from a distance, perceptions of the reliability of auditory warnings vary substantially.

Table 5. Respondents' Perceptions of Train Audibility and Speed.

Variable	Category	N	%
Train Unheard Experience	Had Not Heard	305	30.32%
	Heard	592	58.85%
	Not Sure	109	10.83%
Trains Quieter Now	Quieter	548	54.47%
	Not Quieter	169	16.80%
	Not Sure	289	28.73%
Perceived Train Speed	Very slow	72	7.16%
	Moderate speed	441	43.84%
	Fast	379	37.67%
	Not sure	114	11.33%

Table 5 presents descriptive statistics summarizing respondents' perceptions of train audibility and speed (N = 1,006). Regarding prior auditory experience, more than half of respondents (58.85%, n = 592) reported that they had heard an approaching train in advance, whereas nearly one-third (30.32%, n = 305) indicated that they had experienced situations in which they did not hear a train before it approached. The remaining 10.83% (n = 109) reported uncertainty.

When asked whether modern trains are quieter than in the past, most respondents (54.47%, n = 548) believed that trains are quieter now. In contrast, 16.80% (n = 169) perceived trains as not quieter, and 28.73% (n = 289) were unsure.

Respondents' perceptions of train speed varied. The largest proportion (43.84%, n = 441) described trains as traveling at a moderate speed, followed by 37.67% (n = 379) who perceived trains as fast. A smaller proportion (7.16%, n = 72) perceived trains as very slow, while 11.33% (n = 114) reported uncertainty.

Overall, the table indicates substantial variability in respondents' perceptions of train audibility and operational characteristics. While most respondents reported hearing trains in advance and perceived modern trains as quieter, a notable minority reported unheard train experiences and uncertainty regarding train noise and speed, highlighting potential perceptual gaps relevant to pedestrian safety in rail environments.

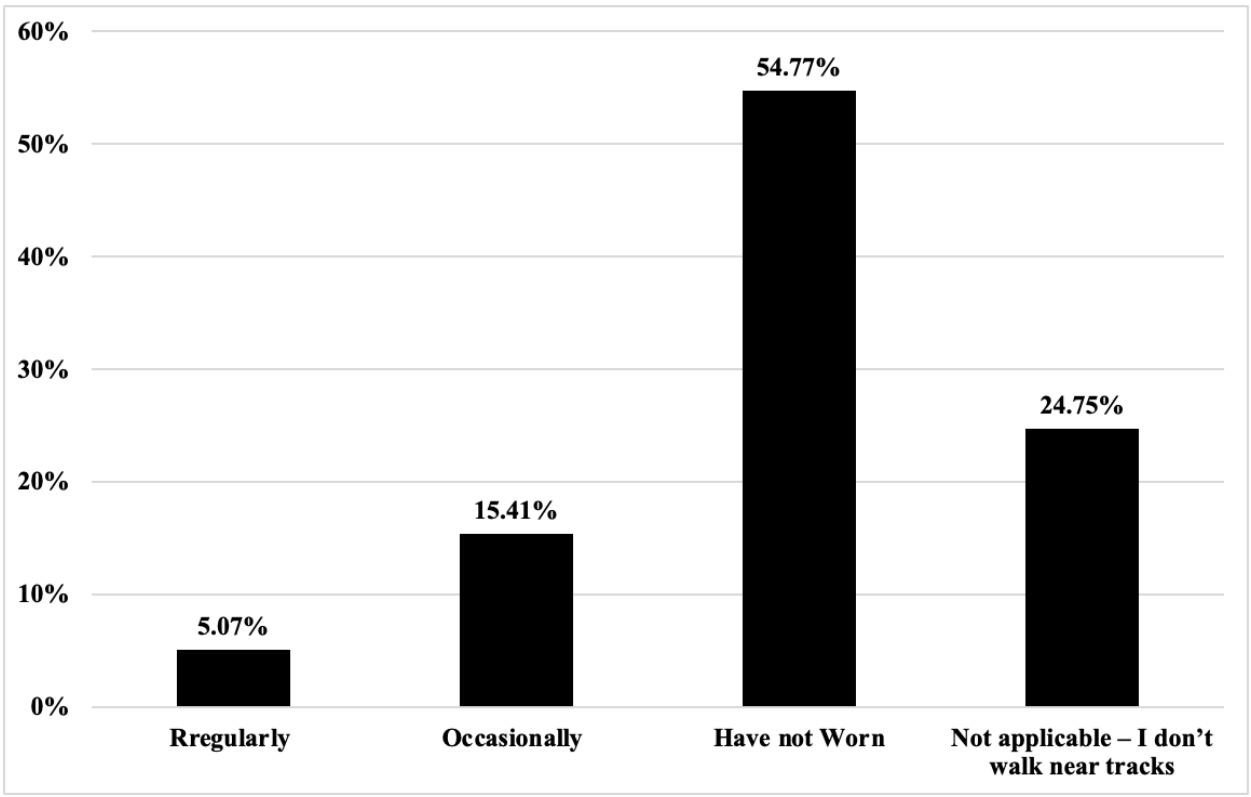

Figure 7. Respondents' Use of Headphones or Earbuds Near Railroad Tracks.

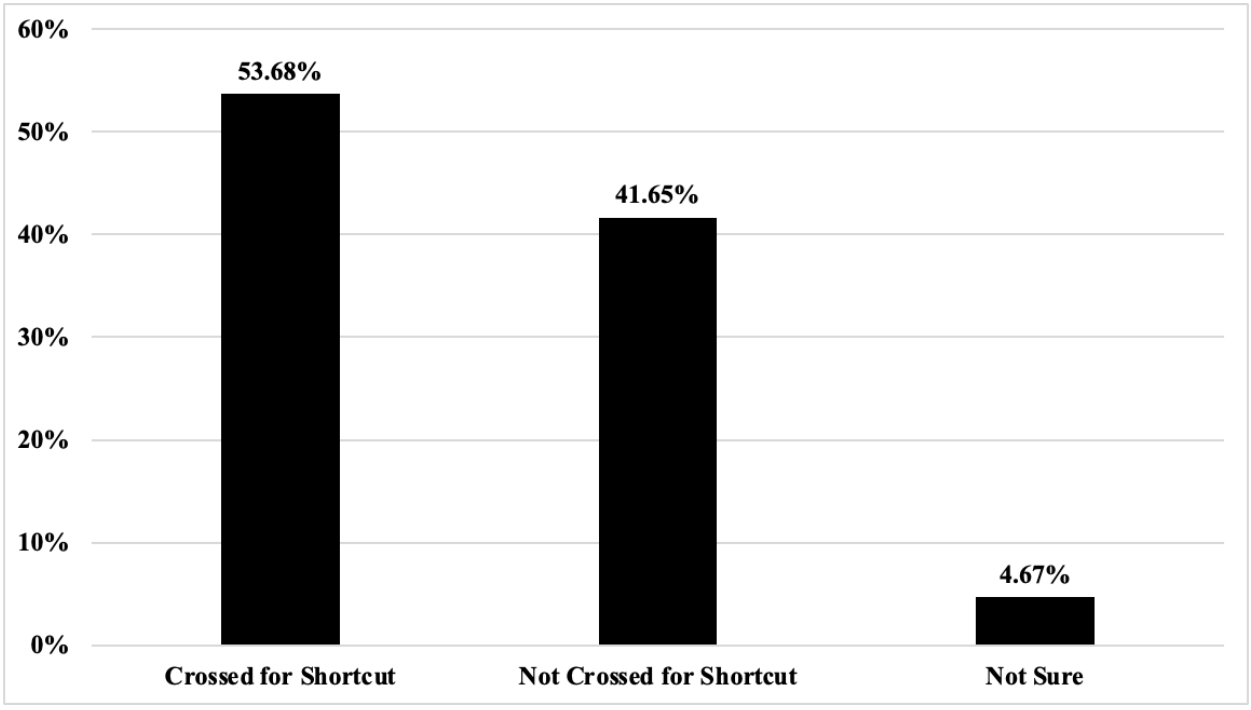

Figure 8. Railroad Track Crossing for Shortcut.

Figure 7 presents respondents' self-reported use of headphones or earbuds while walking near railroad tracks (N = 1,006). Overall, 54.77% of respondents reported that they have not worn headphones or earbuds when walking near railroad tracks, while 24.75% indicated that the question was not applicable, reflecting that they do not typically walk near railroad tracks. Among respondents who do walk near railroad tracks, 20.08% reported occasional or regular use of headphones or earbuds, including 15.41% who reported occasional use and 5.07% who reported regular use. Taken together, these results indicate that although most respondents either do not use headphones or do not walk near railroad tracks, a nontrivial minority of those exposed to rail environments report using personal audio devices, which may have implications for situational awareness and pedestrian safety.

Figure 8 illustrates respondents' self-reported behavior regarding crossing railroad tracks for shortcuts (N = 1,006). More than half of respondents (53.68%, n = 540) reported having crossed railroad tracks for shortcuts, while 41.65% (n = 419) indicated that they had not crossed tracks. A small proportion of respondents (4.67%, n = 47) reported being unsure. Overall, the figure indicates that crossing railroad tracks for shortcuts is a relatively common behavior among respondents, suggesting a notable level of exposure to potential risk associated with informal or unauthorized rail crossings.

Table 6. Respondents' Destination of Crossing Rail Tracks.

Shortcut Destination	**N**	**%**
Walking for exercise or walking a pet	289	49.23%
Accessing recreational or green spaces (e.g., gardens, hiking areas)	182	31.01%
Going to or from school	134	22.83%
Visiting family, friends, or neighbors	133	22.66%
I live near the railroad tracks	121	20.61%
Going to restaurants, entertainment, or social activities	117	19.93%
Accessing public transportation (e.g., train, bus)	114	19.42%
Shopping or running errands	109	18.57%
Going to or from work	104	17.72%
Traveling to town or city center	99	16.87%
Other	39	6.64%
Visiting a cemetery	16	2.73%
Visiting a hospital or health clinic	11	1.87%
I stay or sleep near the railroad tracks (e.g., unsheltered or in temporary encampments)	2	0.34%

* Percentages may exceed 100% because respondents could select multiple options.

Table 6 summarizes respondents' reported destinations when crossing railroad tracks for shortcuts (N = 587). The most reported destination was walking for exercise or walking a pet, selected by 49.23% (n = 289) of respondents. This was followed by accessing recreational or green spaces, such as gardens or hiking areas (31.01%, n = 182). Other frequently reported destinations included going to or from school (22.83%, n = 134), visiting family, friends, or neighbors (22.66%, n = 133), and living near the railroad tracks (20.61%, n = 121). Additional destinations reported by approximately one-fifth of respondents included going to restaurants, entertainment, or social activities (19.93%, n = 117), accessing public transportation (19.42%, n = 114), shopping or running errands (18.57%, n = 109), going to or from work (17.72%, n = 104), and traveling to a town or city center (16.87%, n = 99). Less frequently reported destinations included other unspecified reasons (6.64%, n = 39), visiting a cemetery (2.73%, n = 16), and visiting a hospital or health clinic (1.87%, n = 11). A very small number of respondents (0.34%, n = 2) reported staying or sleeping near railroad tracks, such as in unsheltered or temporary encampments.

Overall, the table indicates that crossings for shortcuts are primarily associated with routine daily activities, recreation, and nearby residential access, rather than isolated or exceptional circumstances, highlighting the integration of rail corridors into everyday pedestrian movement. Note: Because respondents could select multiple destination options, the reported percentages exceed 100%.

Table 7. Respondents' Reasons for Crossing Railroad Tracks.

Shortcut Reasons	**N**	**%**
To shorten travel time or distance	492	83.82%
The nearest official crossing was too far or hard to access	190	32.37%
It became a habit over time	122	20.78%
I saw others doing it regularly	95	16.18%
The nearest official crossing was at a busy or dangerous road	75	12.78%
Other	32	5.45%

***** Percentages may exceed 100% because respondents could select multiple options.

Table 7 summarizes respondents' reported reasons for crossing railroad tracks (N = 587). The most cited reason was shortening travel time or distance, selected by 83.82% (n = 492) of respondents. In addition, 32.37% (n = 190) reported crossing railroad tracks because the nearest official crossing was too far or difficult to access. Behavioral and social factors were also evident. 20.78% (n = 122) of respondents indicated that crossing railroad tracks had become a habit over time, while 16.18% (n = 95) reported that they crossed tracks because they observed others doing so regularly. A smaller proportion of respondents (12.78%, n = 75) reported crossing tracks because the nearest official crossing was located at a busy or dangerous roadway. Finally, 5.45% (n = 32) selected other reasons. Overall, the table suggests that convenience, accessibility limitations, and habitual or social influences play a central role in motivating railroad track crossings, underscoring the importance of addressing both infrastructure design and pedestrian behavior in rail safety interventions. Note: Because respondents could select multiple destination options, the reported percentages exceed 100%.

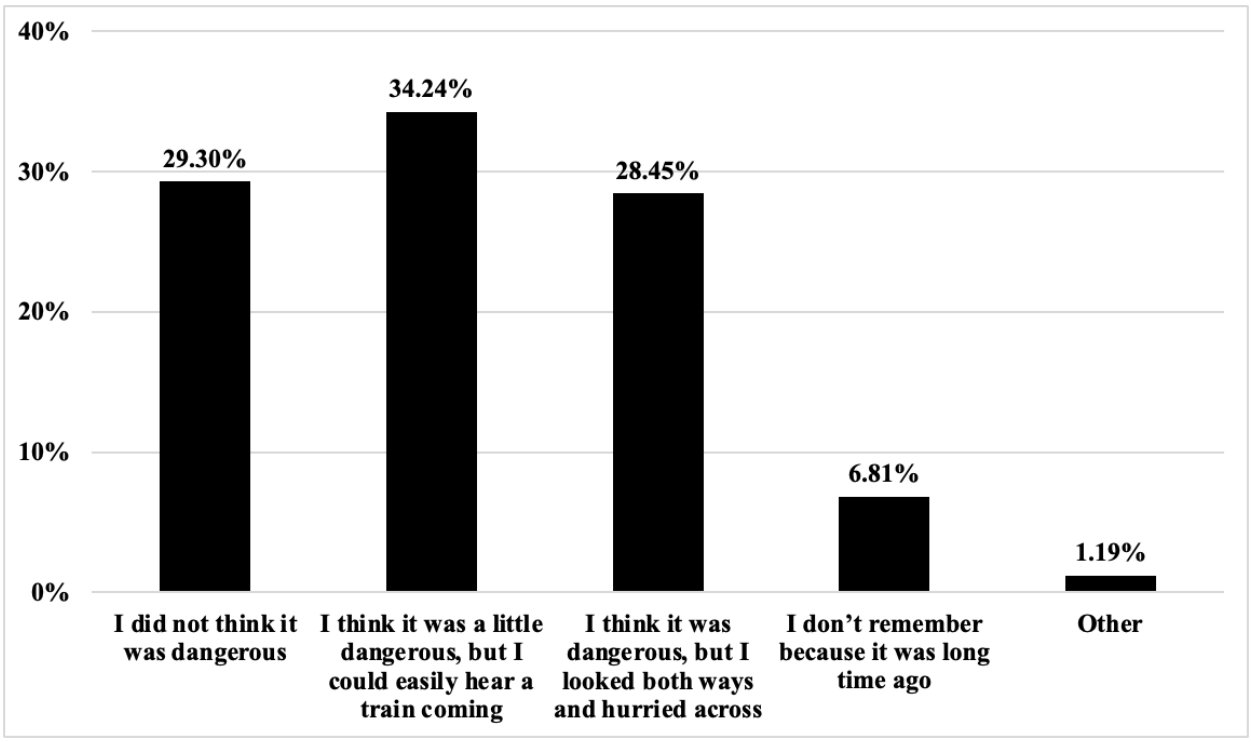

Figure 9. Risk Perception of Rail Track Crossing Among Respondents Who Crossed.

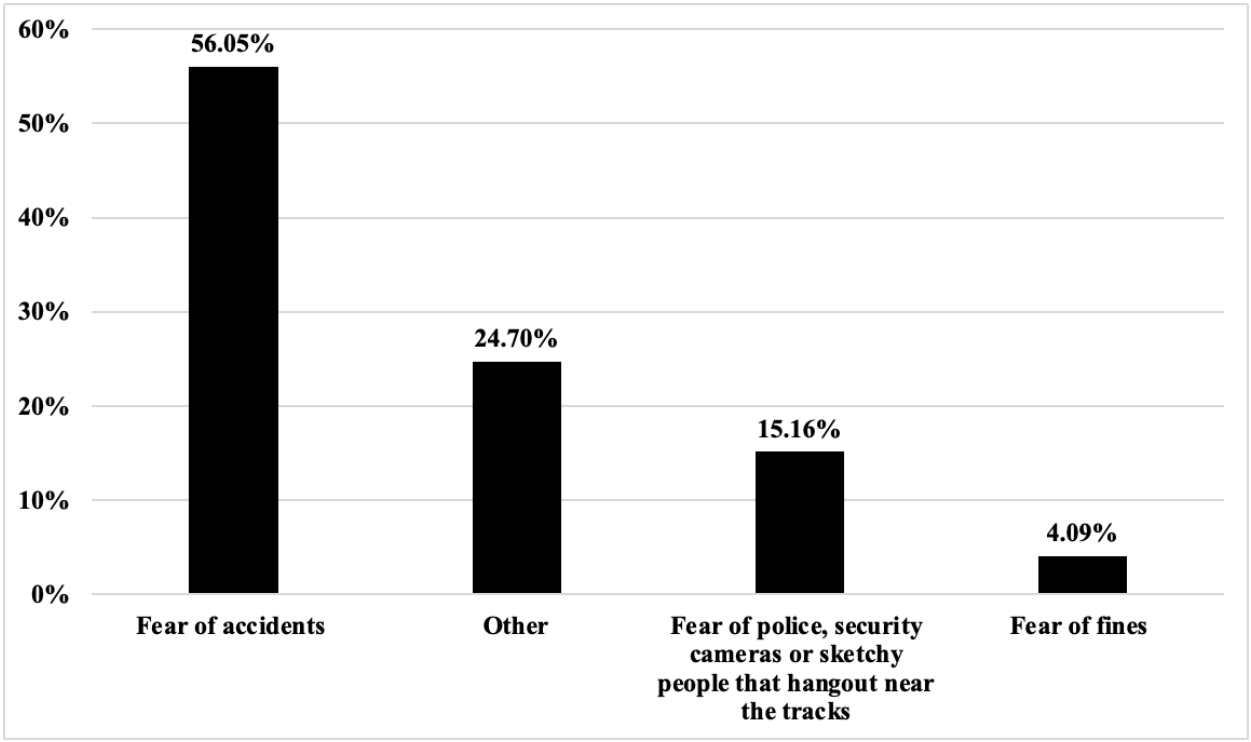

Figure 10. Reasons for Fear of Crossing Rail Track.

Figure 9 illustrates respondents' perceived level of risk when crossing railroad tracks among those who reported having crossed tracks (N = 587). The largest proportion of respondents (34.24%) indicated that they believed crossing was a little dangerous but felt confident because they could easily hear an approaching train. Nearly one-third of respondents (29.30%) reported that they did not think crossing railroad tracks was dangerous. Another 28.45% acknowledged that crossing was dangerous but reported mitigating the risk by looking both ways and hurrying across. Smaller proportions of respondents reported that they did not remember their risk perception because the event occurred a long time ago (6.81%) or selected other reasons (1.19%). Overall, the figure indicates that many respondents perceived the risk of crossing as low or manageable at the time of the behavior, often relying on auditory cues or personal vigilance rather than formal safety controls.

Figure 10 presents respondents' reported reasons for fearing crossing railroad tracks. The most frequently cited reason was fear of accidents, selected by 56.05% of respondents, indicating that concerns related to potential train collisions or injuries were the primary deterrent. A notable proportion of respondents (24.70%) selected other reasons, suggesting the presence of additional, less common factors influencing fear. Concerns related to law enforcement, security cameras, or the presence of suspicious individuals near railroad tracks were reported by 15.16% of respondents, reflecting apprehension associated with enforcement or personal security. In contrast, fear of fines was reported by a relatively small proportion of respondents (4.09%). Overall, the figure indicates that perceived physical danger, rather than fear of enforcement or punishment, was the dominant factor discouraging respondents from crossing railroad tracks.

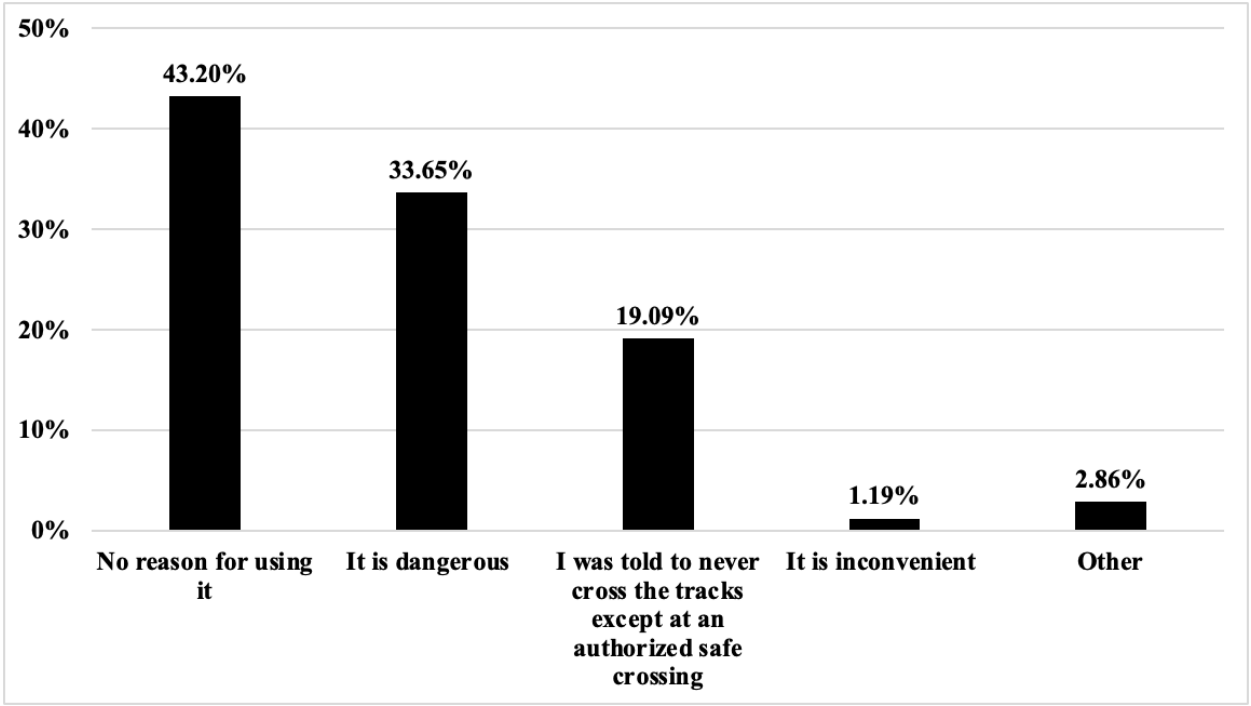

Figure 11. Reasons Have Not Crossed Rail Track.

In Figure 11, respondents reported reasons for not crossing railroad tracks among those who indicated they had never crossed tracks (N = 419). The most frequently selected reason was having no reason for using it, reported by 43.20% of respondents, indicating that many did not perceive a need or opportunity to cross railroad tracks.

Safety concerns were also prominent, with 33.65% of respondents indicating that they avoided crossing because it is dangerous. In addition, 19.09% reported that they had been told to never cross railroad tracks except at authorized crossings, reflecting the influence of safety instruction or social norms. Only small proportions of respondents cited inconvenience (1.19%) or other reasons (2.86%) for not crossing.

Overall, Figure 11 suggests that the absence of necessity and safety-related considerations was the primary factor discouraging respondents from crossing railroad tracks.

Table 8. Safety Concerns Near Rail Tracks or Crossings That Require Attention.

Safety Concerns Near Rail Tracks or Crossings That Require Attention	N	%
Vehicles or pedestrians ignoring warning signals	373	37.08%
Poor visibility of trains (e.g., curves, vegetation, obstacles)	344	34.19%
Lack of fencing to prevent trespassing	330	32.80%
Inadequate lighting at night	313	31.11%
Trains blocking roadways for long periods (delays/emergency access issues)	281	27.93%
Broken or uneven surfaces on/near the tracks (trip hazards)	256	25.45%
Damaged or missing crossing gates/barriers	235	23.36%
Malfunctioning or absent warning lights/bells	215	21.37%
People frequently crossing tracks at undesignated locations	205	20.38%
Noise concerns (e.g., excessive horn use, vibration)	190	18.89%
Faded or missing pavement markings or signage	179	17.79%
Other	85	8.45%

* Percentages may exceed 100% because respondents could select multiple options.

Table 8 summarizes respondents' reported safety concerns near railroad tracks or crossings that they believe require attention. Because respondents were allowed to select multiple concerns, percentages may exceed 100%.

The most frequently reported safety concern was vehicles or pedestrians ignoring warning signals, identified by 37.08% (n = 373) of respondents. This was followed by concerns related to poor visibility of trains, such as curves, vegetation, or other obstacles (34.19%, n = 344), and lack of fencing to prevent trespassing (32.80%, n = 330). Inadequate lighting at night was also commonly reported (31.11%, n = 313), highlighting visibility-related safety issues.

Additional concerns included trains blocking roadways for extended periods, resulting in traffic delays or emergency access issues (27.93%, n = 281), and broken or uneven surfaces on or near the tracks, posing trip hazards (25.45%, n = 256). Infrastructure and equipment-related issues were further reflected in reports of damaged or missing crossing gates or barriers (23.36%, n = 235) and malfunctioning or absent warning lights or bells (21.37%, n = 215).

Behavioral concerns were also evident, with 20.38% (n = 205) of respondents reporting that people frequently cross tracks at undesignated locations. Noise-related concerns, such as excessive horn use or

vibration, were reported by 18.89% (n = 190), while faded or missing pavement markings or signage were identified by 17.79% (n = 179). A smaller proportion of respondents (8.45%, n = 85) reported other concerns not captured by the predefined categories.

Overall, Table 8 indicates that respondents perceive a combination of behavioral, visibility-related, and infrastructure-related issues as key safety concerns near railroad tracks and crossings, underscoring the multifaceted nature of rail safety challenges.

54.2 Thematic Analysis of Narrative Responses

Table 9. Label Distribution by Condition for Story 1.

Condition	Victim	Criminal	Victim and Criminal	Total
BL	112	93	295	500
NL	194	84	228	506

Table 9 presents the distribution of label choices by experimental condition (BL vs. NL) for Story 1. Across both conditions, the *Victim and Criminal* label was the most frequently selected response. Under the BL condition, most respondents selected the *Victim and Criminal* label (n = 295), followed by *Victim* (n = 112) and *Criminal* (n = 93). A similar pattern was observed under the NL condition, where *Victim and Criminal* responses remained most prevalent (n = 228), although the number of *Victim* selections increased relative to the BL condition (n = 194).

The distribution of *Criminal* labels was relatively stable across conditions (BL: n = 93; NL: n = 84), whereas differences between conditions were primarily driven by shifts between *Victim* and *Victim and Criminal* responses. Overall, these results indicate that respondents frequently adopted dual-label judgment when evaluating responsibility in Story 1, regardless of experimental condition.

Table 10. Justification Codes by Label Choice and Condition for Story 1.

Condition	Code	Victim	Criminal	Victim and Criminal	Total
BL	Legal_Formalism	32	63	173	268
	Personal_Responsibility	12	21	46	79
	Outcome_Compassion	3	2	57	62
	Age_Minor	3	1	8	12
	Punishment_Proportionality	3	0	6	9
	Rejection_Criminal_Label	2	0	3	5
	Intent_Knowledge	3	0	3	6
	System_Infrastructure	0	0	1	1
	Forced_Choice_Discomfort	0	0	0	0
	Distraction	0	0	0	0
	Train_Responsibility	0	0	0	0
NL	Legal_Formalism	37	34	89	160

Personal_Responsibility	27	17	61	105
Outcome_Compassion	11	5	31	47
Age_Minor	12	1	6	19
Punishment_Proportionality	2	0	5	7
Rejection_Criminal_Label	3	0	3	6
Intent_Knowledge	1	0	0	1
System_Infrastructure	1	0	2	3
Forced_Choice_Discomfort	0	0	0	0
Distraction	0	0	0	0
Train_Responsibility	0	0	0	0

Table 10 summarizes the frequency of justification codes used by respondents when labeling the individual in Story 1 as a *Victim*, *Criminal*, or *Victim and Criminal*, stratified by experimental condition (BL vs. NL). Across both conditions, Legal Formalism was the most frequently cited justification, particularly among respondents selecting the *Victim and Criminal* label. This pattern was especially pronounced in the BL condition (n = 173), suggesting that explicit legal framing encouraged respondents to rely on rule-based reasoning even when assigning dual responsibility. In contrast, while Legal Formalism remained dominant in the NL condition, its overall frequency was substantially lower (BL: 268 vs. NL: 160), indicating reduced reliance on legalistic reasoning when legal language was absent.

Personal Responsibility emerged as the second most common justification in both conditions. However, it appeared more evenly distributed across label choices in the NL condition, particularly among respondents selecting *Victim* (n = 27), compared to the BL condition (n = 12). This shift suggests that removing legal framing may encourage respondents to attribute responsibility in a more individualized and less categorical manner.

Justifications reflecting Outcome Compassion and Age (Minor) were used more frequently when respondents selected *Victim and Criminal*, especially under the BL condition. These codes indicate moral ambivalence—acknowledging wrongdoing while simultaneously emphasizing vulnerability or harmful outcomes. Notably, Age (Minor) was cited more often in the NL condition among *Victim* responses (n = 12), suggesting heightened sensitivity to developmental considerations when legal cues were absent.

Codes related to Punishment Proportionality and Rejection of the Criminal Label were relatively rare but appeared almost exclusively in *Victim and Criminal* responses across both conditions, reinforcing the interpretation that dual labeling reflects discomfort with binary moral judgments.

Finally, system-level explanations (e.g., System Infrastructure) and meta-response codes (e.g., Forced Choice Discomfort, Distraction, Train Responsibility) were infrequently used, indicating that respondents primarily grounded their judgments in individual-level reasoning rather than structural or procedural factors for Story 1.

Table 11. Label Distribution by Condition for Story 2.

Condition	Victim	Criminal	Victim and Criminal	Total
BL	157	80	263	500
NL	301	61	144	506

Table 11 shows the distribution of label choices by condition for Story 2. Under the BL condition, the *Victim and Criminal* label was again the most common response (n = 263), followed by *Victim* (n = 157) and *Criminal* (n = 80). In contrast, under the NL condition, respondents most frequently selected the *Victim* label (n = 301), with substantially fewer *Victim and Criminal* responses (n = 144).

The number of *Criminal* labels decreased slightly from the BL to the NL condition (80 vs. 61), while the most pronounced difference between conditions was observed in the distribution of *Victim* and *Victim and Criminal* responses. Compared to Story 1, label choices in Story 2 exhibited greater sensitivity to experimental conditions, suggesting that the presence or absence of legal framing more strongly influenced how responsibility was categorized in this scenario.

Table 12. Justification Codes by Label Choice and Condition for Story 2.

Condition	Code	Victim	Criminal	Victim and Criminal	Total
BL	Legal_Formalism	34	57	177	268
BL	Personal_Responsibility	9	8	29	46
BL	Outcome_Compassion	3	1	37	41
BL	Intent_Knowledge	2	0	0	2
BL	Rejection_Criminal_Label	1	0	3	4
BL	System_Infrastructure	0	1	2	3
BL	Age_Minor	0	1	4	5
BL	Distraction	0	0	1	1
BL	Punishment_Proportionality	1	0	3	4
BL	Forced_Choice_Discomfort	0	0	0	0
BL	Train_Responsibility	0	0	0	0
NL	Legal_Formalism	38	17	56	111
NL	Personal_Responsibility	15	16	31	62
NL	Outcome_Compassion	19	4	18	41
NL	Intent_Knowledge	6	0	1	7
NL	Rejection_Criminal_Label	2	0	0	2

NL	System_Infrastructure	0	0	2	2
NL	Age_Minor	0	0	0	0
NL	Distraction	1	0	3	4
NL	Punishment_Proportionality	1	0	0	1
NL	Forced_Choice_Discomfort	0	0	0	0
NL	Train_Responsibility	0	0	0	0

As shown in Table 12, Legal Formalism was the most frequently cited justification across both conditions. Under the BL condition, references to Legal Formalism were especially concentrated among respondents selecting the *Victim and Criminal* label (n = 177), resulting in a substantially higher overall frequency than in the NL condition (BL: 268 vs. NL: 111). This pattern indicates that legal framing reinforced rule-based reasoning when respondents evaluated shared responsibility in Story 2.

Personal Responsibility and Outcome Compassion were the next most cited justifications (as shown in Table 12), though their distributions varied by condition and label choice. In the BL condition, both codes were predominantly associated with *Victim and Criminal* responses, reflecting moral ambivalence that acknowledged wrongdoing while emphasizing harm outcomes. In contrast, under the NL condition, Outcome Compassion was more evenly distributed across *Victim* (n = 19) and *Victim and Criminal* (n = 18) responses, suggesting greater empathic reasoning in the absence of explicit legal cues.

Justifications related to Intent Knowledge were relatively infrequent overall but appeared more often in the NL condition than in the BL condition (as shown in Table 12). These references were primarily associated with *Victim* responses, indicating that respondents were more likely to consider the individual's awareness or understanding when legal framing was removed.

Codes reflecting Rejection of the Criminal Label, Punishment Proportionality, and System Infrastructure were rare across both conditions and were mainly observed in *Victim and Criminal* responses (as shown in Table 12), reinforcing the interpretation that dual labeling reflects discomfort with binary moral categorization rather than clear attribution of sole blame.

Finally, references to Age (Minor), Forced Choice Discomfort, and Train Responsibility were minimal or absent (as shown in Table 12), indicating that these considerations played a negligible role in respondents' reasoning for Story 2.

Table 13. Label Distribution by Condition for Story 3.

Condition	Victim	Criminal	Victim and Criminal	Total
BL	264	54	182	500
NL	316	63	127	506

Table 13 presents the distribution of label choices by experimental condition (BL vs. NL) for Story 3. Under both conditions, the *Victim* label was the most frequently selected response. In the BL condition, many respondents labeled the individual as a *Victim* (n = 264), followed by *Victim and Criminal* (n = 182) and *Criminal* (n = 54). A similar pattern was observed in the NL condition, where *Victim* responses further increased (n = 316), while selections of *Victim and Criminal* decreased (n = 127).

The number of *Criminal* labels remained relatively low (BL: n = 54; NL: n = 63). However, compared to Stories 1 and 2, Story 3 elicited a stronger tendency toward exclusive victim attribution, particularly under the NL condition, indicating that respondents were more inclined to assign primary victim status in this scenario.

Table 14. Justification Codes by Label Choice and Condition for Story 3.

Condition	Code	Victim	Criminal	Victim and Criminal	Total
BL	Legal_Formalism	90	36	112	238
	Age_Minor	117	5	35	157
	Distraction	30	10	21	61
	Personal_Responsibility	18	6	18	42
	Intent_Knowledge	21	1	6	28
	Outcome_Compassion	4	3	16	23
	System_Infrastructure	17	0	6	23
	Rejection_Criminal_Label	1	0	2	3
	Punishment_Proportionality	0	0	2	2
	Forced_Choice_Discomfort	0	0	0	0
	Train_Responsibility	0	0	0	0
NL	Legal_Formalism	24	15	42	81
	Age_Minor	127	10	15	152
	Distraction	55	10	21	86
	Personal_Responsibility	22	20	27	69
	Intent_Knowledge	37	1	2	40

Outcome_Compassion	17	1	12	30
System_Infrastructure	0	0	1	1
Rejection_Criminal_Label	2	0	1	3
Punishment_Proportionality	0	0	0	0
Forced_Choice_Discomfort	0	0	0	0
Train_Responsibility	0	0	0	0

Table 14 summarizes the distribution of justification codes by label choice and condition for Story 3. As shown in Table 14, Legal Formalism and Age (Minor) were the most frequently cited justifications across both conditions. In the BL condition, Legal Formalism was commonly referenced across all label choices (total n = 238), whereas Age (Minor) was primarily associated with *Victim* responses (n = 117), highlighting the salience of vulnerability-related reasoning in this story.

In the NL condition, references to Age (Minor) increased further (total n = 152), remaining strongly concentrated among *Victim* responses (n = 127). Similarly, justifications related to Distraction and Intent Knowledge were more prevalent in the NL condition than in the BL condition, particularly among *Victim* responses, suggesting that the absence of legal framing encouraged greater attention to situational factors and the individual's cognitive state.

Personal Responsibility was cited with moderate frequency in both conditions and appeared across all three label choices, including *Victim and Criminal* responses, indicating that responsibility attribution coexisted with victim recognition in Story 3. In contrast, codes reflecting Punishment Proportionality, Rejection of the Criminal Label, and System Infrastructure were relatively rare, and were primarily associated with *Victim and Criminal* responses.

Overall, the justification patterns in Story 3 were characterized by a strong emphasis on vulnerability- and context-based reasoning, with reduced reliance on purely legal or punitive considerations, particularly under the NL condition.

Table 15. Label Distribution by Condition for Story 4.

Condition	Victim	Criminal	Victim and Criminal	Total
BL	158	78	264	500
NL	244	72	190	506

Table 15 presents the distribution of label choices by experimental condition (BL vs. NL) for Story 4. Under the BL condition, the most frequently selected label was *Victim and Criminal* (n = 264), followed by *Victim* (n = 158) and *Criminal* (n = 78). A similar pattern was observed under the NL condition, where *Victim and Criminal* responses remained the most common (n = 190), although the number of *Victim* selections increased substantially (n = 244).

Across conditions, the number of *Criminal* labels remained relatively stable (BL: n = 78; NL: n = 72). Differences between conditions were primarily driven by shifts between *Victim* and *Victim and Criminal* responses, indicating that the presence or absence of legal framing influenced how responsibility was distributed rather than increasing exclusive criminal attribution.

Table 16. Justification Codes by Label Choice and Condition for Story 4.

Condition	Code	Victim	Criminal	Victim and Criminal	Total
BL	Legal_Formalism	47	53	157	257
	Personal_Responsibility	6	9	30	45
	Outcome_Compassion	7	1	35	43
	Intent_Knowledge	4	0	4	8
	System_Infrastructure	8	1	4	13
	Age_Minor	0	1	6	7
	Punishment_Proportionality	1	0	4	5
	Rejection_Criminal_Label	0	0	1	1
	Distraction	0	0	0	0
	Forced_Choice_Discomfort	0	0	0	0
	Train_Responsibility	0	0	0	0
NL	Legal_Formalism	21	26	64	111
	Personal_Responsibility	21	14	55	90
	Outcome_Compassion	13	3	17	33
	Intent_Knowledge	7	0	0	7
	System_Infrastructure	0	0	1	1
	Age_Minor	1	0	0	1
	Punishment_Proportionality	1	0	1	2
	Rejection_Criminal_Label	2	0	1	3

Distraction	1	0	0	1
Forced_Choice_Discomfort	0	0	0	0
Train_Responsibility	0	0	0	0

Table 16 summarizes the distribution of justification codes by label choice and condition for Story 4. As shown in Table 16, Legal Formalism was the most frequently cited justification across both conditions, particularly among respondents selecting the *Victim and Criminal* label. Under the BL condition, references to Legal Formalism were substantially higher (total n = 257) than under the NL condition (n = 111), indicating that legal framing strongly reinforced rule-based reasoning in this scenario.

Personal Responsibility and Outcome Compassion were also commonly cited justifications (as shown in Table 16). In both conditions, these codes were most frequently associated with *Victim and Criminal* responses, reflecting moral ambivalence in which acknowledgment of rule violation coexisted with concern for harm outcomes.

Justifications related to Intent Knowledge and Age (Minor) were relatively infrequent overall and appeared primarily in *Victim* and *Victim and Criminal* responses. In contrast, references to System Infrastructure, Punishment Proportionality, and Rejection of the Criminal Label were rare and accounted for a small proportion of responses across both conditions.

Finally, Distraction, Forced Choice Discomfort, and Train Responsibility were minimally referenced or absent (as shown in Table 16), suggesting that respondents' reasoning in Story 4 was largely grounded in individual-level legal and moral considerations rather than structural or procedural factors.

Overall, the results for Story 4 further reinforce the pattern observed across previous stories, in which legal framing amplifies rule-based reasoning while respondents continue to favor shared responsibility over exclusive criminal attribution.

Chapter 6. Discussion

6.1 Gaps in Public Knowledge and Normalization of Trespassing

The baseline results reveal a concerning disconnect between the legal status of railroad property and public understanding. Despite federal classification of railroad property as private, a substantial proportion of respondents perceived it as public or were unaware of the illegality of trespassing. This knowledge gap coexists with a high prevalence of self-reported trespassing behaviors, indicating that trespassing has become normalized as part of everyday travel, recreation, and access to nearby destinations.

Importantly, trespassing decisions were rarely framed by respondents as reckless or malicious. Instead, they were often justified by convenience, accessibility constraints, habitual behavior, or perceived safety based on personal vigilance. This suggests that traditional deterrence-based approaches relying solely on enforcement or punitive messaging may be insufficient, particularly when trespassing is embedded in routine mobility patterns.

6.2 Rail Noise, Perception, and Overconfidence in Auditory Cues

Findings related to rail noise and audibility highlight a critical perceptual mismatch. While most respondents perceive trains as noisy and audible from a distance, a notable minority reported having experienced approaching trains without hearing them in advance. At the same time, many respondents expressed confidence in their ability to detect trains through sound alone, even as they acknowledged that modern trains are quieter.

This combination of auditory overconfidence and inconsistent detection may contribute to underestimation of risk during crossings. Reliance on sound as a primary safety cue is particularly problematic given train stopping distances, environmental noise, and the use of personal audio devices. These findings underscore the importance of shifting public messaging away from individual vigilance alone and toward more reliable, system-level safety measures.

6.3 Terminology Framing and Moral Judgment

The thematic analysis provides strong evidence that terminology framing shapes how the public assigns blame, responsibility, and empathy. Legalistic language amplified rule-based reasoning and encouraged respondents to invoke illegality even when outcomes were severe or when individuals were clearly vulnerable. Neutral language, by contrast, facilitated more nuanced reasoning that incorporated intent, age, distraction, and situational context.

Across all scenarios, respondents frequently resisted exclusive criminal labeling, instead opting for shared responsibility or expressing discomfort with forced binary choices. This pattern suggests that public moral reasoning about railroad trespassing is context-sensitive rather than categorical, and that rigid legal framing may oversimplify how people interpret these events.

From a policy perspective, these findings raise important questions about how terminology influences public support for prevention strategies. Language that foregrounds criminality may reduce empathy and obscure systemic contributors, whereas neutral language may foster broader concern and openness to infrastructure-based interventions.

6.4 Implications for Rail Safety Policy and Communication

Collectively, the results suggest that effective trespass prevention requires an integrated approach that combines education, infrastructure design, and communication strategy. Educational efforts should address not only legality, but also perceptual limitations related to rail noise and stopping distance. Infrastructure improvements—such as fencing, lighting, and improved visibility—align closely with the safety concerns identified by respondents.

Equally important, communication strategies should be carefully designed to avoid unintended framing effects. While legal clarity is necessary, over-reliance on criminalizing language may hinder public engagement and empathy, particularly in cases involving youth, distraction, or environmental constraints.

Chapter 7. Conclusions and Future Work

7.1 Conclusions

This study provides one of the most comprehensive examinations to date of the U.S. public perceptions, behaviors, and moral judgments related to railroad trespassing. By combining a large-scale national survey with an embedded terminology framing experiment and qualitative thematic analysis, the study offers new insights into how individuals understand risk, responsibility, and legality in rail environments.

Key conclusions include:

1. Public knowledge of railroad trespassing laws and safety risks remains limited, despite widespread exposure to rail infrastructure.
2. Trespassing is commonly integrated into routine daily activities, driven by convenience, accessibility, and habit rather than intentional risk-taking.
3. Auditory cues are widely trusted but inconsistently reliable, creating potential for risk underestimation.
4. Terminology framing significantly influences moral judgment, with legalistic language increasing criminal attribution and neutral language fostering empathy and contextual reasoning.
5. Public reasoning often reflects moral ambivalence, resisting binary classifications and highlighting the need for more nuanced policy and communication approaches.

Together, these findings suggest that reducing railroad trespassing injuries and fatalities requires not only enforcement, but also rethinking how risk is communicated, how environments are designed, and how responsibility is framed.

7.2 Future Work

Future research should build on this work in several directions. First, longitudinal studies are needed to examine how changes in education, infrastructure, or communication strategies influence trespassing behavior over time. Second, integrating geospatial analysis with observed trespassing hotspots can help identify context-specific intervention opportunities. Third, experimental testing of alternative messaging strategies—beyond binary legal vs. neutral framing—may further inform effective public communication.

Finally, future studies should incorporate the perspectives of rail operators, planners, and community stakeholders to better align public perception research with operational realities and implementation constraints. By bridging behavioral insights with system-level solutions, future work can contribute to more effective, humane, and sustainable approaches to railroad trespass prevention.

Chapter 8. Implementation and Technology Transfer Plan

This research provides evidence-based insights into public knowledge gaps, risk perception, behavioral normalization, and terminology framing related to railroad trespassing. While the project does not produce a deployable software tool or physical prototype, its findings are directly applicable to NCDOT's rail safety education, communication, planning, and coordination activities. The following plan outlines how the results of this study can be implemented and transferred into practice.

8.1 Intended Users and Use Cases

The primary intended users of this research include:

1. NCDOT Rail Division and Rail Safety Staff, who are responsible for rail safety coordination, outreach, and policy development.
2. NCDOT Communications Office, which develops safety messaging, educational materials, and public-facing content.
3. Local governments and planning agencies working with NCDOT on rail corridor safety, pedestrian access, and land-use planning near rail infrastructure.
4. External partners, such as Operation Lifesaver, rail operators, and community organizations involved in rail safety education and awareness.

These users can apply the findings to improve how rail safety risks are communicated and how educational efforts are designed.

8.2 Implementation Pathways

The findings of this study can be implemented through multiple complementary pathways within NCDOT's rail safety, communication, and planning activities. First, results documenting limited exposure to rail safety education and widespread overreliance on auditory cues can inform the development or refinement of rail safety education and outreach efforts, with messaging that emphasizes the limitations of relying on sound alone and addresses the everyday, routine contexts in which trespassing occurs. Second, findings from the terminology framing experiment provide evidence-based guidance for safety communication and public messaging, suggesting that careful language selection—balancing legal clarity with neutral or context-sensitive terminology—may improve public engagement, empathy, and support for prevention strategies. These insights can be applied to educational materials, outreach campaigns, and coordination with media or partner organizations. Third, the study's results related to public safety concerns and behavioral motivations can support infrastructure and planning coordination by providing empirical justification for improvements such as fencing, lighting, visibility enhancements, and pedestrian access considerations near rail corridors. Finally, the findings can inform policy and program development by supporting internal discussions, interagency coordination, and evaluation of existing rail safety initiatives, particularly where public perceptions of responsibility, risk, and legality influence the effectiveness of prevention efforts.

8.3 Training, Benefits, and Knowledge Transfer

Formal training is not required to implement the findings of this study; however, effective knowledge transfer can be supported through targeted, low-burden activities. These may include brief internal presentations or summary memos for NCDOT staff involved in rail safety, communications, and planning, as well as incorporation of key findings into meetings or workshops with external partners such as Operation Lifesaver, local governments, and other rail safety stakeholders. The development of concise

briefing materials, including one-page summaries or slide decks highlighting actionable insights, can further facilitate internal and external dissemination.

The expected benefits of implementing the study findings include more effective and credible rail safety messaging aligned with how the public perceives risk, responsibility, and legality, improved public engagement through communication strategies that avoid counterproductive framing effects, and better alignment between safety education efforts, infrastructure investments, and observed behavioral patterns near rail corridors. While these benefits are primarily qualitative, even modest improvements in public understanding, compliance, or support for safety initiatives have the potential to contribute to long-term reductions in trespassing-related incidents and associated social and economic costs.

Knowledge and technology transfer from this project may also occur through dissemination to the broader transportation safety community. This includes submission of peer-reviewed journal articles and conference papers, presentations at professional venues such as the NCDOT Research and Innovation Summit, TRB meetings, and rail safety workshops, and sharing of the final report and executive summary with relevant stakeholders and partner organizations. Together, these activities extend the impact of the project beyond NCDOT while reinforcing evidence-based approaches to railroad trespass prevention.

REFERENCES

Chen, Y., Dou, W., Yi, X., & Huda, K. T. (2024). Investigation of public knowledge and perceptions toward railroad trespassing in the United States. In *International Conference on Transportation and Development 2024*. American Society of Civil Engineers.

daSilva, M. P. (2011). Railroad infrastructure trespass detection performance guidelines (DOT/FRA/ORD-11/01). U.S. Department of Transportation, Federal Railroad Administration.

Federal Railroad Administration. (2016). *Highway-rail crossing and trespassing fact sheet*. https://railroads.dot.gov/sites/fra.dot.gov/files/2019-10/rrx-fact-sheet-final12716.pdf

Federal Railroad Administration. (2021). *Trespasser casualties*. https://safetydata.fra.dot.gov

Ghomi, H., Bagheri, M., Fu, L., & Miranda-Moreno, L. F. (2016). Analyzing injury severity factors at highway–rail grade crossing accidents involving vulnerable road users: A comparative study. Traffic Injury Prevention, 17(8), 833–841.

Grabušić, S., & Barić, D. (2023). A systematic review of railway trespassing: Problems and prevention measures. Sustainability, 15(18), 13878.

IBM. (n.d.). *Natural language processing (NLP).* https://www.ibm.com/think/topics/natural-language-processing

Kang, Y., Iranitalab, A., & Khattak, A. J. (2019). Modeling railroad trespassing crash frequency using a mixed-effects negative binomial model. International Journal of Rail Transportation, 7(3), 208–218.

Lobb, B., Harré, N., & Terry, N. (2003). An evaluation of four types of railway pedestrian crossing safety intervention. Accident Analysis & Prevention, 35(4), 487–494.

Oswald Beiler, M. R., Miller, G., & Varley, D. (2019). Railway trespass prevention: Spatial analysis of incidents to connect to countermeasures. Journal of Transportation Engineering, Part A: Systems, 145(2), 04018086.

Silla, A., & Luoma, J. (2009). Trespassing on Finnish railways: Identification of problem sites and characteristics of trespassing behaviour. European Transport Research Review, 1, 47-53.

Silla, A., & Luoma, J. (2012). Opinions on railway trespassing of people living close to a railway line. Safety Science, 50(1), 62–67

Skládaná, P., Skládaný, P., Tučka, P., Bidovský, M., & Sulíková, B. (2016). Trespassing railway property – Typology of risk localities. Transportation Research Procedia, 14, 2091–2100.

Skládaná, P., Skládaný, P., & Tučka, P. (2019). Attitudes of inhabitants living in the vicinity of railroads on the matter of trespassing on the railway. Transactions on Transport Sciences, 10(1), 31–40.

Zhang, M., Khattak, A. J., Liu, J., & Clarke, D. (2018). A comparative study of rail–pedestrian trespassing crash injury severity between highway–rail grade crossings and non-crossings. Accident Analysis & Prevention, 117, 427–438.

Zhang, J., Liu, F., Chen, Z., Yu, Z., Xiao, X., Shi, L., & Guo, Z. (2023). A multi-level analysis on the causes of train–pedestrian collisions in Southwest China, 2011–2020. Accident Analysis & Prevention, 193, 107332.

Appendix 1. Survey: Biased Language Version

This survey seeks to understand how people think and feel about railroad safety and incidents involving individuals who cross or walk near train tracks. The goal is to better understand public opinions on safety, responsibility, and how people respond to different types of rail-related incidents. The results will help researchers develop more effective communication strategies and improve safety efforts.

The survey will take approximately 15–20 minutes to complete. It includes questions about your opinions and a few short news stories about real-life rail-related accidents, which may involve serious injuries or fatalities. Please take a moment to consider whether this content might be emotionally distressing, especially if you or someone close to you has experienced a train-related accident—before deciding whether to continue.

Your participation is voluntary, and you may stop the survey at any time if you feel uncomfortable. However, please note that all questions are mandatory in this survey. If you choose to continue, you are agreeing to answer every question. This survey also includes a few attention-check questions to ensure data quality. Responses from participants who fail attention checks or do not complete all required questions will be excluded from the study and will not be eligible for compensation.

You will be paid approximately $3 for completing the survey.

No personally identifiable information will be collected. The data collected from the survey will be stored in UNC Charlotte owned Google Drive and will only be accessible to the research team of the study. In the future, the research team will use the data for future research studies and might share the non-identifiable data with other researchers for future research studies without additional consent from you.

To participate, you must be at least 18 years old and currently live in the United States.

If you have any questions or concerns about your rights as a participant, you may contact the UNC Charlotte Office of Research Protections and Integrity at (704) 687-1871 or uncc-irb@charlotte.edu. For any questions about the research itself, please contact Dr. Yuting (Tina) Chen at ychen106@charlotte.edu.

Thank you for your consideration.

Sincerely,
Yuting (Tina) Chen, PhD
Assistant Professor, Engineering Technology and Construction Management
Williams States Lee College of Engineering
The University of North Carolina at Charlotte

If you agree to participate in the survey, please click the “agree” button.

- Agree
- Disagree

Note: to participate in the survey, you must be 18 years or older.

PART 1

1. Gender: _____
   A: Female
   B: Male

2. Age: _____(Years)

3. What is your race/ethnicity?
   A. American Indian or Alaska Native
   B. Asian
   C. Black or African American
   D. Hispanic or Latino
   E. Native Hawaiian or Other Pacific Islander
   F. White
   G. Other (please specify): _____
   H. Prefer not to answer

4. Which of the following best describes your status in US?
   A. US citizen
   B. Permanent resident with a green card
   C. Non-immigrants, business
   D. Non-immigrants, study
   E. Non-immigrants, tourism
   F. Non-immigrants, temporary work
   G. Other

5. What was your total household income before taxes during the past 12 months?
   A. Less than $25,000
   B. $25,000- $49,999
   C. $50,000-$74,999
   D. $75,000-$99,999
   E. $100,000-$149,999
   F. $150,000 or more
   G. Prefer not to say

6. How many years have you lived in US? _____(Years)

7. Town/city, state, and the zip code (5-digit only) of your residence.
   A. Town/City_____
   B. State _____
   C. Zip Code (5-digit only) _____

8. Town/city, state, and the zip code (5-digit only) of your work/school. If you work and go to school simultaneously, provide the zip code for both.

	Work (1)	School (2)	Prefer not to say (3)
Town/City			
State			
Zip Code (5-digit only)			

9. What is your education level?
   A: less than high school graduate
   B: high school graduate (includes equivalency)
   C: Some college, or associate's degree
   E: Bachelor's degree
   F: Graduate or professional degree

10. Do you live in a city or a rural area?
   A: City area
   B. Suburban area
   C: Rural area

11. Have you ever taken any railroad safety related lecture, workshop, seminar, training, etc.?
   A: Yes
   B: No

12. If you answered Yes in the previous question, can you please specify what lecture, workshop, seminar, training on railroad safety, etc. you have taken? And when did you take that?

13. To show that you are paying attention, please select "Rural area" as your answer.
   A. City area
   B. Rural area
   C. Suburban area

14. Do you think railroad property is private property or public property?
   A: Private
   B: Public

15. Do you think walking around train cars when a train is stopped, crossing rail tracks for recreational purposes (e.g., taking photos on rail tracks), or crossing rail tracks for shortcuts (e.g., for shopping or hiking), is legal or illegal?
   A: legal
   B: illegal

16. Do you live close to rail tracks? (Yes No)

17. If you Choose "Yes" in Question 16, how far is the nearest railroad track from your home? (Please estimate the distance based on walking time.)
   A. Less than a 2-minute walk (less than 500 feet)
   B. 2~5-minute walk (500–1,000 feet)
   C. 5~10-minute walk (around 0.5 mile)

D. 10~20-minute walk (0.5 to 1 mile)
E. More than a 20-minute walk (more than 1 mile)
F. Not sure

18. Do you think trains are generally noisy when they pass by?
A: Yes
B: No
C: Not sure about that

19. In your experience, how far away can you typically hear a train approaching?
(Assume no headphones and a quiet environment)
A. 100 feet or less away
B. About 300 feet away (the length of a football field)
C. At least ½ mile away
D. A mile or more away
E. Not sure / It depends

20. Have you ever noticed a train approaching without hearing it in advance?
A. Yes
B. No
C. Not Sure

21. Do you think modern trains are quieter than they used to be?
A. Yes
B. No
C. Not Sure

22. How reliable do you think train sound (e.g., engine noise or horn) is as a warning for pedestrians?
A. Very reliable – I can always hear it in time
B. Somewhat reliable – I usually hear it
C. Not very reliable – sometimes I don't hear it
D. Not at all reliable – trains can be silent or hard to hear
E. Not sure

23. How fast do you think a train is moving when it sounds very quiet or distant?
A. Very slow
B. Moderate speed
C. Fast
D. Not sure

24. Have you ever worn headphones or earbuds while walking near railroad tracks?
A. Yes, regularly
B. Occasionally
C. No
D. Not applicable – I don't walk near tracks

25. Which of the following is a type of fruit?
A. Car

B. House
C. Apple
D. Train

26. Have you ever crossed rail tracks for shortcuts?
    A. Yes
    B. No
    C. Not Sure

27. If you have ever crossed rail tracks for shortcuts, what are your purposes? (Please select all apply)
    A. Going to or from work
    B. Going to or from school
    C. Accessing public transportation (e.g., train, bus)
    D. Walking for exercise or walking a pet
    E. Shopping or running errands
    F. Going to restaurants, entertainment, or social activities
    G. Traveling to town or city center
    H. Visiting family, friends, or neighbors
    I. Accessing recreational or green spaces (e.g., gardens, hiking areas)
    J. Visiting a hospital or health clinic
    K. Visiting a cemetery
    L. I live near the railroad tracks
    M. I stay or sleep near the railroad tracks (e.g., unsheltered or in temporary encampments)
    N. Other: _____

28. If you have ever crossed rail tracks for shortcuts, what were your main reasons for doing so? (Please select all apply)
    A. To shorten my travel time or distance
    B. It became a habit over time
    C. I saw others doing it regularly
    D. The nearest official crossing was too far or hard to access
    E. The nearest official crossing was at a busy or dangerous road
    F. Other_____

29. If you have ever crossed rail tracks for shortcuts, did you think or feel it was a dangerous act?
    A: I did not think it was dangerous
    B: I think it was a little dangerous, but I could easily hear a train coming
    C. I think it was dangerous, but I looked both ways and hurried across
    D: I don't remember because it was long time ago

30. Following question 29, if you experienced fear when crossing a rail track, what were the reasons for your fear?
    A: Fear of accidents
    B: Fear of fines
    C: Fear of police, security cameras or sketchy people that hangout near the tracks
    D: Other_____

31. If you have never crossed a rail track, what were the reasons you didn't do that?

A: No reason for using it
B: It is dangerous
C: It is inconvenient
D: I was told to never cross the tracks except at an authorized safe crossing
E: Other_____

32. Have you observed any safety concerns close to rail track/crossing which you believe railroad companies, local Department of Transportation, or other stakeholders need to pay attention to?
_____

PART 2 ACCIDENT STORIES

There are four accident stories described in Part 2. Please read through the stories and answer questions.

Story 1: Train runs over Elon student's foot
Student taken to hospital with non-life-threatening injuries
By Elon News Network| 12/11/16 11:15pm

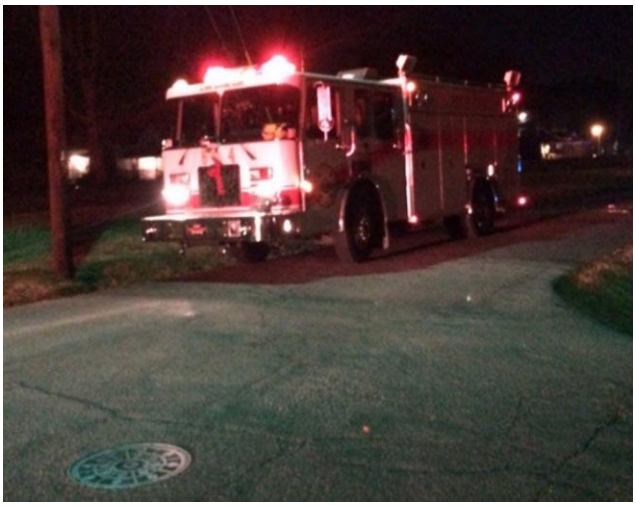

Photo by Bryan Anderson | Elon News Network

Emergency personnel response to report of a student's foot being run over by a train.

Updated: 11:15 a.m. Monday, Dec. 12

An Elon University student's foot was struck by a train Saturday morning, according to the Town of Elon Police Department.

Assistant Chief James Perry told the Burlington Times-News that the student, senior Ryan Lowe, approached the railroad tracks at Lee and Lebanon avenues and a 160-car train rolled over his left foot after it had previously come to a stop.

Elon Police Department officers were not immediately available for comment shortly after the incident. Efforts to contact the department were unsuccessful.

The Town of Elon police report said, "Lowe was **trespassing** on Norfolk Southern Railroad property at West Lebanon Street near Lee Street, a short-cut commonly used by students" and "was injured by a Norfolk Southern Train as a result of his actions."

The Times-News reports that "police believe Lowe attempted to cross the railroad tracks between two train cars and slipped and fell while trying to climb between the two, his foot landing on the tracks as it happened."

Immediately after the incident, Lowe was rushed to Moses Cone Hospital in Greensboro where he will undergo amputation. His injuries are believed to be non-life-threatening, according to the police report. Police are using this incident to remind citizens that crossing tracks anywhere other than a highway-grade crossing and permission of the railroad is trespassing and dangerous.

Questions:

- Is the person who suffered amputation a victim or criminal?
- Regarding your answer, briefly describe how you feel about your answer and why.

Story 2: Pedestrian hit by Amtrak train, killed in Elon
WXII 12
Updated: 5:23 PM EDT May 20, 2014

SOURCE: Chris Petersen/WXII

ELON, N.C. —

A 22-year-old male pedestrian died after being hit by an Amtrak train in Elon Tuesday afternoon. Malcolm Carnelius Sims was hit at 1:49 p.m. just west of the intersection of Trollinger and Church streets. He died at the scene.

Sims was going east on the railroad tracks and trespassing when he was hit by the eastbound train, Elon police said. Amtrak Piedmont train #74 was going from Charlotte to Raleigh.

The investigation continues, but police believe the crash was accidental. Sims was not an Elon University student.

The train remained stopped as of 4:30 p.m., even though emergency crews had cleared the scene by then. Amtrak officials said the train's engineer requested relief.

Questions:

- Is the person who died a victim or criminal?
- Regarding your answer, briefly describe how you feel about your answer and why.

To check your attention, please select "This is an attention check" from the list below.

A. The train was too fast
B. It was raining during the incident
C. This is an attention check
D. The crossing lights were broken

Story 3: 11-year-old girl hit, killed by train in Haines City
Ledger staff
3 January 2018

HAINES CITY — The Polk County Sheriff's Office is conducting a death investigation of 11-year-old Yazmin White after the girl was hit by a passenger train on Wednesday afternoon in Haines City. The incident occurred at approximately 4:45 p.m. at the intersection of U.S. 17/92 and Bates Road in unincorporated Haines City.

PCSO's preliminary investigation has concluded that White was leaving Carmelita's Restaurant at 2670 US 17/92 in Haines City and was walking through nearby woods. White attempted to cross directly over the railroad tracks, which is a trespassing offense, when she was struck by the southbound Amtrak passenger train heading toward Winter Haven.

The train, which was transporting 12 passenger cars and two engines, was going approximately 68 mph. The conductor observed White trying to cross the tracks and repeatedly sounded the train's horn and applied the brakes.

The conductor said White made no indication that she was aware that the train was coming and was looking down at her phone as she walked. Evidence collected at the scene indicated White was wearing headphones at the time of the accident and was declared dead at the scene.

Police and railroad officials stated that although there are no trespass warning signs posted, anyone walking on railroad property is a trespasser.

No charges are pending.

Questions:

- Is the person who died a victim or criminal?
- Regarding your answer, briefly describe how you feel about your answer and why.

Story 4: Man who lost legs warns of train dangers
Staff Writer
The Columbus Dispatch

On a cool October night in 2012, time stopped for Mark Kalina Jr. as he found himself underneath a train. "It felt like hours till the train passed over, and I rolled over and saw my left leg was cut off," he said. Kalina, then a junior studying civil engineering at Ohio State University, lost both of his legs that night. While walking home to his apartment near 19th Avenue and Summit Street, he decided to save five minutes by cutting across a railroad track just west of campus. The railroad posted No Trespassing along the tracks, but Kalina said he did not see the warnings on route he walked. Kalina, said there was a train stopped on the track, so he had to walk along and then around it to cross. But he stumbled on the gravel and fell. As he was trying to grab onto anything to help him get back up, his sleeve caught on a train car just as the train started moving. The train "was slow at first, but I was panicked," he said. "I was trying to get a good footing, get my sleeve unhooked, but I just couldn't. It wouldn't even tear."

After the train passed over him, Kalina pulled his cellphone from a pocket and called 911. That's about when he looked down and saw that he was covered in blood, and that he'd lost at least his left leg. It had been severed completely; he would later lose his right leg below the knee.

Kalina spent 12 days in intensive care at Ohio State's Wexner Medical Center, then time in rehabilitation. After rehabilitation Kalina plans to return to school to finish his engineering studies.

Questions:

- Is the person who suffered amputation a victim or criminal?
- Regarding your answer, briefly describe how you feel about your answer and why.

Please select “Strongly agree” to confirm you are reading the questions carefully.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Appendix 2. Survey: Neutral Language Version

This survey seeks to understand how people think and feel about railroad safety and incidents involving individuals who cross or walk near train tracks. The goal is to better understand public opinions on safety, responsibility, and how people respond to different types of rail-related incidents. The results will help researchers develop more effective communication strategies and improve safety efforts.

The survey will take approximately 15–20 minutes to complete. It includes questions about your opinions and a few short news stories about real-life rail-related accidents, which may involve serious injuries or fatalities. Please take a moment to consider whether this content might be emotionally distressing, especially if you or someone close to you has experienced a train-related accident—before deciding whether to continue.

Your participation is voluntary, and you may stop the survey at any time if you feel uncomfortable. However, please note that all questions are mandatory in this survey. If you choose to continue, you are agreeing to answer every question. This survey also includes a few attention-check questions to ensure data quality. Responses from participants who fail attention checks or do not complete all required questions will be excluded from the study and will not be eligible for compensation.

You will be paid approximately $3 for completing the survey.

No personally identifiable information will be collected. The data collected from the survey will be stored in UNC Charlotte owned Google Drive and will only be accessible to the research team of the study. In the future, the research team will use the data for future research studies and might share the non-identifiable data with other researchers for future research studies without additional consent from you.

To participate, you must be at least 18 years old and currently live in the United States.

If you have any questions or concerns about your rights as a participant, you may contact the UNC Charlotte Office of Research Protections and Integrity at (704) 687-1871 or uncc-irb@charlotte.edu. For any questions about the research itself, please contact Dr. Yuting (Tina) Chen at ychen106@charlotte.edu.

Thank you for your consideration.

Sincerely,
Yuting (Tina) Chen, PhD
Assistant Professor, Engineering Technology and Construction Management
Williams States Lee College of Engineering
The University of North Carolina at Charlotte

If you agree to participate in the survey, please click the “agree” button.

- Agree
- Disagree

Note: to participate in the survey, you must be 18 years or older.

PART 1
The questions for Part 1 in the neutral language version are identical to those in the BL version. Due to page limitations, they are not reproduced here.

PART 2 ACCIDENT STORIES

There are four accident stories described in Part 2. Please read through the stories and answer questions.

Story 1: Train runs over Elon student's foot
Student taken to hospital with non-life-threatening injuries
By Elon News Network|12/11/16 11:15pm

Photo by Bryan Anderson| Elon News Network

Emergency personnel response to report of a student's foot being run over by a train.

Updated: 11:15 a.m. Monday, Dec. 12

An Elon University student's foot was struck by a train Saturday morning, according to the Town of Elon Police Department.

Assistant Chief James Perry told the Burlington Times-News that the student, senior Ryan Lowe, approached the railroad tracks at Lee and Lebanon avenues and a 160-car train rolled over his left foot after it had previously come to a stop.

Elon Police Department officers were not immediately available for comment shortly after the incident.

Efforts to contact the department were unsuccessful.

The Town of Elon police report said, "Lowe was using a short-cut near West Lebanon Street commonly used by students to cross the railroad" and "was injured by a Norfolk Southern Train as a result of his actions."

The Times-News reports that "police believe Lowe attempted to cross the railroad tracks between two train cars and slipped and fell while trying to climb between the two, his foot landing on the tracks as it happened."

Immediately after the incident, Lowe was rushed to Moses Cone Hospital in Greensboro where he will undergo amputation. His injuries are believed to be non-life-threatening, according to the police report.

Questions:

- Is the person who suffered amputation a victim or criminal?
- Regarding your answer, briefly describe how you feel about your answer and why.

Story 2: Pedestrian hit by Amtrak train, killed in Elon
WXII 12
Updated: 5:23 PM EDT May 20, 2014

SOURCE: Chris Petersen/WXII
ELON, N.C.

A 22-year-old male pedestrian died after being hit by an Amtrak train in Elon Tuesday afternoon. Malcolm Carnelius Sims was hit at 1:49 p.m. just west of the intersection of Trollinger and Church streets. He died at the scene.

Sims was going east on the railroad tracks when he was hit by the eastbound train, Elon police said. Amtrak Piedmont train #74 was going from Charlotte to Raleigh.

The investigation continues, but police believe the crash was accidental. Sims was not an Elon University student.

The train remained stopped as of 4:30 p.m., even though emergency crews had cleared the scene by then. Amtrak officials said the train's engineer requested relief.

Questions:

- Is the person who died a victim or criminal?
- Regarding your answer, briefly describe how you feel about your answer and why.

To check your attention, please select “This is an attention check” from the list below.

A. The train was too fast
B. It was raining during the incident
C. This is an attention check

D. The crossing lights were broken

Story 3: 11-year-old girl hit, killed by train in Haines City
Ledger staff
3 January 2018

HAINES CITY — The Polk County Sheriff's Office is conducting a death investigation of 11-year-old Yazmin White after the girl was hit by a passenger train on Wednesday afternoon in Haines City.

The incident occurred at approximately 4:45 p.m. at the intersection of U.S. 17/92 and Bates Road in unincorporated Haines City.

PCSO's preliminary investigation has concluded that White was leaving Carmelita's Restaurant at 2670 US 17/92 in Haines City and was walking through nearby woods. White attempted to cross directly over the railroad tracks when she was struck by the southbound Amtrak passenger train heading toward Winter Haven.

The train, which was transporting 12 passenger cars and two engines, was going approximately 68 mph. The conductor observed White trying to cross the tracks and repeatedly sounded the train's horn and applied the brakes.

The conductor said White made no indication that she was aware that the train was coming and was looking down at her phone as she walked. Evidence collected at the scene indicated White was wearing headphones at the time of the accident and was declared dead at the scene.
No charges are pending.

Questions:
- Is the person who died a victim or criminal?
- Regarding your answer, briefly describe how you feel about your answer and why

Story 4: Man who lost legs warns of train dangers
Staff Writer
The Columbus Dispatch

On a cool October night in 2012, time stopped for Mark Kalina Jr. as he found himself underneath a train. "It felt like hours till the train passed over, and I rolled over and saw my left leg was cut off," he said. Kalina, then a junior studying civil engineering at Ohio State University, lost both of his legs that night. While walking home to his apartment near 19th Avenue and Summit Street, he decided to save five minutes by cutting across a railroad track just west of campus. Kalina, said there was a train stopped on the track, so he had to walk along and then around it to cross. But he stumbled on the gravel and fell. As he was trying to grab onto anything to help him get back up, his sleeve caught on a train car just as the train started moving.

The train "was slow at first, but I was panicked," he said. "I was trying to get a good footing, get my sleeve unhooked, but I just couldn't. It wouldn't even tear."

After the train passed over him, Kalina pulled his cellphone from a pocket and called 911. That's about when he looked down and saw that he was covered in blood, and that he'd lost at least his left leg. It had been severed completely; he would later lose his right leg below the knee.

Kalina spent 12 days in intensive care at Ohio State's Wexner Medical Center, then time in rehabilitation. After rehabilitation Kalina plans to return to school to finish his engineering studies.

Questions:

- Is the person who suffered amputation a victim or criminal?
- Regarding your answer, briefly describe how you feel about your answer and why.

Please select “Strongly agree” to confirm you are reading the questions carefully.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Appendix 3. Original News Articles for the Four Stories

1. https://www.elonnewsnetwork.com/article/2016/12/train-rolls-over-elon-students-foot

2. https://www.wxii12.com/article/pedestrian-hit-by-amtrak-train-killed-in-elon/2055048

3. https://www.theledger.com/story/news/local/2018/01/03/11-year-old-girl-hit-killed-by-train-in-haines-city/16351575007/

4. https://www.dispatch.com/story/news/crime/2015/08/05/man-who-lost-legs-warns/23654646007/