

ROADWAY SYSTEMS & DRIVERS
TECHNICAL REPORT



Developing a Near-Miss Reporting System for Roadside Responders

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Title

Developing a Near-Miss Reporting System for Roadside Responders

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Foreword

Towing and service technicians and other responders working at roadside are at near-constant risk while performing their jobs. Unfortunately, far too many workers are struck by passing vehicles each year. However, with current data systems we have very limited insight into the circumstances surrounding safety critical events as many non-fatal incidents go unreported. Knowledge about these less severe, but equally important, incidents is critical in guiding countermeasure deployment and other initiatives to better protect these vulnerable workers.

This report describes the results of research that seeks to explore and identify the elements required for a successful near-miss reporting system as well as some of the inherent challenges. This report should be of interest to roadside assistance professionals as well as first responders, road authorities with responsibility for traffic incident management, policymakers, and all motorists.

C. Y. David Yang, Ph.D.
President and Executive Director
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List of Acronyms

AAAFTS	AAA Foundation for Traffic Safety
ASRS	Aviation Safety Reporting System
ATI	Alabama Transportation Institute
C ³ RS	Confidential Close Call Reporting System
DOT	Department of Transportation
EMS	Emergency Medical Service
ERSI	Emergency Responder Safety Institute
FRA	Federal Railroad Administration
GPS	Global Positioning System
IAFC	International Association of Fire Chiefs
IRB	Institutional Review Board
LEO	Law Enforcement Officer
NASA	National Aeronautics and Space Administration
NHTA	New Hampshire Towing Association
NM	Near Miss
OR	Odds Ratio
PII	Personally Identifiable Information
SB	Struck By
TIM	Traffic Incident Management
TRAA	Towing and Recovery Association of America, Inc.
TRAO	Towing & Recovery Association of Ohio
TTIRS	Towing Traffic Incident Reporting System

EXECUTIVE SUMMARY

The safety of roadside responders is often placed in jeopardy by the potential dangers posed by passing vehicles. To develop and implement effective protection measures for roadside responders, comprehensive safety data is essential. Traditional methods relying on crash data to identify incidents involving roadside responders, such as struck-by or secondary crashes, provide some information about the risks, but fail to capture information regarding near-miss incidents that occur far too often. These near misses, in which roadside technicians narrowly avoid crashes or harm, often go unreported and undocumented, creating a significant data gap. The lack of reliable information on the frequency and characteristics of near-miss incidents hinders efforts to understand the working environment of roadside responders and protect them while they assist other road users. Near-miss reporting systems are therefore invaluable tools for collecting this crucial data. Despite the existence of several reporting systems tailored for roadside responders and workers in other domains, these platforms exhibit notable deficiencies in both the quality and quantity of reports submitted. These shortcomings highlight the necessity for a more robust and effective system. To address this critical issue, the current project aims to identify elements required for a successful near-miss reporting system specifically designed for roadside responders. The project focused on understanding the opinions and concerns of a variety of stakeholders regarding near-miss reporting, as well as their expectations for the design and deployment of an incident reporting system. This project involved four major tasks, each with key takeaways:

- **Review of Existing Reporting Systems.** The team reviewed 13 near-miss or incident reporting systems, including six web-based and seven app-based systems. While most systems use a combination of open-ended and multiple-choice questions to gather incident details, the length of reporting (time required) and requirements for contact information vary among systems. Based on the review of existing systems, the team recommends exploring implementing a near-miss reporting system with multiple forms for different roadside responders to ensure data relevance and tailored reporting. To ensure the data collected from the systems can be used to support further exploration and the development of countermeasures and policies, it is recommended that data about the responder's demographics, training/work background, and incident characteristics (location, time, etc.) are gathered.
- **Interviews with Stakeholders.** Ten interviews with stakeholders were conducted, including developers/managers of current reporting systems and representatives from traffic incident response agencies. The primary goal of these interviews was to gain agency-level insights regarding the challenges, barriers, and opportunities of developing a near-miss incident reporting

system for roadside responders. The key takeaways from these interviews include the following:

- All interviewees echoed that having tools to analyze near-miss data will significantly benefit their respective organizations, allowing them to translate insights from data into actionable items via training materials.
 - Collecting personally identifiable information (PII) is not recommended by the interviewees, in order to reduce fear among the responders of possible repercussions.
 - Making systems easily accessible and viable to use with smartphones could increase the responses as many responders do not have access to computers.
 - Early training and education and continuing education are necessary to embed the culture of reporting near misses within a respective organization.
 - Publicity is crucial in getting the word out regarding near-miss systems.
 - Reporting systems all have associated expenses, and none of the existing systems have the level of funding to go beyond what they are currently doing.
 - Defining near misses is essential because everyone has a different risk tolerance. Further, responders tend to understand the risks associated with their jobs and often do not attribute much importance to close calls.
 - Supervisors must be receptive to responders talking about near misses, which helps to foster a positive learning atmosphere for the responders.
 - While the concept of near-miss reporting systems was appreciated by the majority of interviewees, getting people to actually use the systems was seen as a major barrier.
- **Focus Groups.** The team conducted six focus group meetings involving 28 participants from 19 states. These participants represented various agencies, including towing and recovery, fire, law enforcement, emergency medical services (EMS) or paramedics, and the Department of Transportation (DOT)/safety patrol. The findings shed light on the various aspects influencing near-miss reporting practices. Some of the key takeaways included the following:
 - The definitions of a “near miss” varied significantly across focus group participants. To allow standardized data collection of near misses, it is recommended that the near-miss systems should clearly define “near misses.”
 - Focus group participants echoed that they do not give enough attention to the near-miss incidents, often viewing them as part of their job.
 - Concerns were raised about motorists’ compliance with Move-Over laws, and participants expressed frustration at the lack of enforcement.

- Some participants said it would not matter if the near-miss system collects PII information. In contrast, some said not collecting PII would help encourage people to use the near-miss system more freely without fearing repercussions.
- Most participants encouraged a positive safety culture within their organizations, emphasizing the need for open discussions about near-miss incidents.
- Many participants feared that the near-miss data could be used against them. Other concerns include insurance costs, legal implications, and the perception of reporting as burdensome.
- Participants discussed the potential use of advanced technologies, such as camera-based and LiDAR sensing systems, to streamline or complement near-miss reporting. While acknowledging the benefits, they raised concerns about costs, regulations, and implementation challenges.
- The majority of participants were unaware of existing near-miss reporting systems. They suggested leveraging associations, social media, events, magazines, training, and public awareness campaigns to enhance awareness.
- Participants recognized the value of near-miss data for learning from mistakes, supporting legislation, and improving safety. They emphasized the need to educate responders about the tangible benefits of collecting near-miss data; these benefits should be explored and substantiated through the use of clear and compelling demonstrations.
- **National Survey.** A national survey was designed and implemented to understand roadside responders' experiences, perspectives, and suggestions regarding near-miss incident reporting systems. Over 1,300 respondents completed the online survey. Key takeaways from the survey include the following:
 - Overall, nearly 20% of respondents reported experiencing near-miss incidents at least every week, approximately 22% reported experiencing near-miss incidents a few times a month, and approximately 38% reported several times a year. Only 21% reported only experiencing near misses once a year or never.
 - Nearly 30% of towing industry respondents reported encountering near-miss incidents daily, a rate that is significantly higher than other agency types.
 - Participants from fire (31%) and towing organizations (approximately 27%) were more likely to report every near-miss incident compared to other organizations.
 - A significant portion of participants (approximately 70%) stated that they are either unsure or that their workplace, department, or agency does not have policies or guidelines requiring the reporting of near-miss incidents.

- While 85% of respondents believe reporting near-miss incidents can improve safety practices, over 40% of towing responders reported not receiving any incident reporting training, the largest percentage among all agencies.
- Towing and law enforcement respondents (over 40%) are more likely to perceive near-miss incidents as a routine part of their job rather than an exception that merits reporting.
- Over 40% of participants from towing agencies cite “too many incidents to report” as a reason for not reporting near-miss incidents; this belief is much stronger for towing than for other agencies.
- Participants from towing agencies have significant concerns about reporting, including potential insurance impacts (over 50% of towing respondents) and legal consequences (nearly 40% of towing respondents); these concerns were much stronger for towing than for respondents from other agencies.
- Access on a mobile device is desired by nearly 75% of respondents, with over 41% preferring immediate reporting after encountering a near-miss incident.
- Most respondents (78%) stated that they support using devices that could be mounted on vehicles to automatically detect near-miss incidents based on tracking passing vehicles and the position of roadside responders on the road or roadside.
- More than 60% of participants were concerned about the cost of adopting advanced technologies, such as LiDAR, for automatic detection for near-miss reporting. Around half of the participants were concerned about the regulatory challenges of adopting advanced technologies.

Drawing from insights gleaned from the preceding tasks, the team developed initial recommendations for developing and deploying a near-miss incident reporting system for roadside responders. A two-hour virtual expert meeting with roadside response stakeholders and responder safety experts was then held to discuss these findings. The meeting included two panel discussions: one focused on system design and the other on system deployment. Meeting participants helped to further inform and to corroborate the recommendations, stating that the findings validate what they have been observing in their respective fields, confirming the need for an effective near-miss incident reporting system. The meeting concluded with discussions to confirm and finalize the recommendations for the near-miss incident reporting system’s development and deployment, as shown in Table 1.

Table 1. Recommendations for developing and deploying a near-miss reporting system.

Item	Recommendation
1 User-Friendly Interface	<ul style="list-style-type: none"> • Simplicity: Ensure the system is intuitive and straightforward, with a clean and simple reporting process. Provide predefined answer options for responders to select from. • Mobile Compatibility: Ensure the system functions seamlessly on smartphones and tablets. Develop a mobile app with quick questions for easy on-scene reporting, and a reminder for the rest at the end of the shift.
2 Multiple Reporting Forms	<ul style="list-style-type: none"> • Customized Forms: Develop forms tailored to different types of roadside responders (e.g., tow truck operators, police, firefighters) to ensure data relevance and accurate reporting. • Multiple Ways to Report: Allow for self-reports as well as reports submitted on someone else’s behalf. • Flexible Design: Balance standardization with flexibility to address the unique requirements of different response agencies.
3 Comprehensive Data Fields and Confidentiality	<ul style="list-style-type: none"> • Comprehensive Data Fields: Gather data on the responder’s demographics, experience, and job role, along with contextual information regarding the near-miss incident. • Confidentiality: Allow anonymous submissions to encourage more responders to report incidents without fear of repercussions.
4 Standardized Definitions and Reporting Criteria	<ul style="list-style-type: none"> • Clear Definitions: Establish standardized definitions of what constitutes a “near miss” to ensure consistency in reporting. • Risk Tolerance: Acknowledge the varying risk tolerances/perceptions among responders and address these in the reporting criteria.
5 Advanced Data Acquisition Technologies	<ul style="list-style-type: none"> • Automated Detection: Whenever possible, integrate technologies such as camera-based sensing systems to automatically detect incidents. • Cost and Regulation Management: Address concerns about advanced technologies’ cost and regulatory challenges.
6 Analysis Tools and Feedback Mechanisms	<ul style="list-style-type: none"> • Quality Control: Involve humans to review and standardize the reported data. Use AI to filter and ensure consistency and quality of data. • Data Analysis: Develop tools to analyze the collected data and convert insights into actionable items, such as training materials and safety protocols. • Feedback Loop: Provide timely feedback to responders on the outcomes and benefits derived from reported near-miss incidents.
7 Training and Education	<ul style="list-style-type: none"> • Initial and Ongoing Training: Provide early and continuing education for responders on the importance/benefits of near-miss reporting and how to use the system. • Positive Safety Culture: Foster an environment where supervisors and responders are encouraged and motivated to regularly discuss and report near-miss incidents.
8 Publicity and Awareness	<ul style="list-style-type: none"> • Outreach Programs: Use associations, social media, events, and public awareness campaigns to promote the near-miss reporting system. • Stakeholder Engagement: Collaborate with various agencies and stakeholders (organizations/associations) to ensure widespread adoption and consistent system use.

9	Policies and Legal Protections	<ul style="list-style-type: none"> • Non-Punitive Reporting Policies: Develop and enforce policies that ensure near-miss reporting is non-punitive. Responders should not face disciplinary actions or negative evaluations due to reporting near-miss incidents. • Confidential Reporting Agreements: Establish agreements with responders and agencies that emphasize the confidentiality and protection of reported data. • Legislative Support: Lobby with legislatures to implement policies requiring near-miss reporting, protect reported data, and adapt policies according to different state requirements.
<hr/>		
10	Deployment Considerations	<ul style="list-style-type: none"> • Budget Planning: Plan for the costs associated with developing, deploying, and maintaining the near-miss reporting system. Consider initial setup costs, ongoing maintenance, and future upgrades. • Funding Sources: Explore funding opportunities and grants to support the implementation and sustainability of the system. Seek partnerships with government agencies, industry organizations, and other stakeholders.

INTRODUCTION

Roadside responders are often at risk due to the potential danger posed by passing vehicles (AAA Exchange, n.d.; Lane, 2019; National Traffic Incident Management Coalition, n.d.; United States Government Accountability Office, 2024). Traditional methods that rely on crash data to identify incidents, such as struck-by or secondary crashes (ERSI, n.d.[a]; Pecheux et al., 2024), provide some useful information about these incidents and related risk factors, but fail to capture the numerous near-miss incidents that narrowly avoid accidents or harm. These near misses often go unreported and undocumented, resulting in a lack of comprehensive and reliable data regarding their frequency and characteristics (Ljung et al., 2004; Hayward, 1972; Yamamoto et al., 2020; Horrey et al., 2021). This data gap hinders the implementation of effective protection measures for roadside responders.

A near-miss incident refers to a situation in which potential harm or damage is narrowly avoided, with no property damage or personal injury occurring (Ljung et al., 2004; Hayward, 1972; OSHA, 2022). Near-miss incidents sometimes hinge on a minor shift in time or position that, had the situation been different, could have resulted in an adverse outcome. Access to near-miss incident data and understanding their underlying causes would be helpful in informing the development and implementation of targeted countermeasures to diminish these risks (Brown, 1991; Lytx, 2023; Park, Kim, and Kim, 2023; Wilson, 2020). This proactive approach could significantly reduce the likelihood of struck-by incidents among roadside responders, mitigating the potential for severe injuries and fatalities.

Currently, several reporting systems tailored for roadside responders exist, such as the Law Enforcement Officer (LEO) Near-Miss (LEO Near Miss, n.d.), Firefighter Near-Miss (Fire Near Miss, n.d.), Towing Traffic Incident Reporting System (TTIRS) (New Hampshire Towing Association, n.d.), and the Emergency Responder Safety Institute (ERSI)'s Struck-by Incident Reporting System (ERSI, n.d.[b]). However, observations of these systems and discussions with the managers of some of these systems have been suggestive of significant deficiencies in both the quality and quantity of reports submitted through these platforms.

Objectives

To better understand the role and key elements of near miss reporting, as well as potential barriers and challenges, a multi-pronged project was undertaken. This project aims to identify the elements required for a successful near-miss reporting system

specifically designed for roadside responders. To address these aims, the specific tasks included the following:

1. **Review of existing reporting systems:** This task aimed to identify, review, and document existing and relevant reporting systems. The team reviewed in total 13 near-miss reporting systems, including 6 web-based and 7 app-based systems. This review extracted useful information from existing near-miss reporting systems, identified the key attributes of these systems, and provided suggestions for striking a balance between standardization and flexibility in addressing the unique requirements of different response agencies.
2. **Interviews with stakeholders:** Stakeholder interviews with both developers and managers of existing reporting systems aimed to gain agency-level insights regarding the challenges, barriers, and opportunities of developing a near-miss incident reporting system for roadside responders. Ten of these one-on-one interviews with traffic response agencies were conducted by the team.
3. **Focus Groups:** Roadside responders who personally experience or witness various incidents at work are the primary providers of near-miss incident data. Collaborating with the Towing and Recovery Association of America (TRAA) and the Emergency Responder Safety Institute (ERSI), the team invited roadside responders from across the country to participate in the focus groups to understand how individual roadside responders perceive and participate in the near-miss reporting process. The findings shed light on the various aspects influencing near-miss reporting practices.
4. **National Survey:** Focus groups enabled participants to provide in-depth insights regarding near-miss incident reporting, though only a limited number of responders could participate. To offer a platform for more responders to voice their opinions about near-miss incident reporting, a national survey was administered to gather insights from roadside responders across the country. Building on outcomes from the preceding tasks, the survey covered respondents' working experience, training background, incident reporting experience, attitudes toward near-miss reporting, perspective about reporting system design, and other general information.

Following the completion of these four technical tasks, initial recommendations for developing and deploying a near-miss incident reporting system for roadside responders were identified. A virtual expert meeting with roadside response stakeholders and responder safety experts was then held to discuss the project findings and refine the recommendations.

The following sections correspond with the tasks of the project, which include providing technical details, significant findings, and discussion. Following these sections, recommendations are provided regarding the development and implementation of a near-miss reporting system.

REVIEW OF EXISTING REPORTING SYSTEMS

This task aimed to identify, review, and document existing and relevant reporting systems to characterize key attributes as well as potential barriers or challenges. The team reviewed both web-based and app-based reporting systems.

Method

A search for web-based near-miss reporting systems specifically within or related to the transportation industry was conducted first. Terms such as ‘near-miss,’ ‘struck by,’ ‘reporting system,’ ‘roadside responders,’ ‘first responders,’ ‘police,’ ‘fire,’ ‘tow,’ etc. were used individually and in combination to identify existing systems. Several near-miss systems were identified during the search; these included the following:

- Towing Traffic Incident Reporting System ([TTIRS](#))
- [LEO Near Miss](#)
- [Fire Near Miss](#)
- Federal Railroad Administration’s (FRA) Confidential Close Call Reporting System ([C³RS](#))
- [Aviation Safety Reporting System](#)
- [Emergency Responder Safety Institute’s \(ERSI\) incident reporting system](#)

It is worth noting that ERSI is designed to report struck-by incidents; however, the owner of the system indicated that this system can be used to report near-miss events as well.

In addition to these web-based interfaces that allow near-miss reporting, mobile applications have also been developed for this purpose. Similar search terms, such as ‘near-miss,’ ‘reporting system,’ and ‘responders,’ were used to search for relevant applications in the Apple App Store. The team identified and reviewed the following systems (and developers):

- LEO Near Miss (*The Police Foundation*)
- SDNM (*Sempra Energy San Diego Gas & Electric*)
- CIS Near Miss (*Core Insight Systems, Inc.*)
- EHS NearMiss Report (*Kah Chin Lee*)
- Safety Incident (*Safety-Reports.com, Inc.*)
- Near Miss (*Dynes Transport Tapanui Limited*)
- NearMiss (*Observis Oy*)

Each system is reviewed below, including the target domain, system features, and related practices. This is followed by some system comparatives.

Web-Based Reporting Systems

Towing Traffic Incident Reporting System (TTIRS)

The TTIRS was established in 2015 by the Statewide Towing Association of Massachusetts. It is the first national online incident reporting system for the towing industry, providing a free and voluntary platform for reporting both Struck-By and Near-Miss events involving tow operator safety. The primary objective of TTIRS is to collect and analyze data, which member associations can then utilize to advocate for Move Over enforcement and education. Additionally, these data help in the development of safety protocols and training specific to the towing industry. PII such as name, phone number, and email are collected mandatorily under this system. Charter Members of TTIRS include the Towing & Recovery Association of America (TRAA), the Towing & Recovery Association of Ohio (TRAO), and the New Hampshire Towing Association (NHTA), all of which supported the initial stages of TTIRS implementation.

TTIRS
Towing Traffic Incident Reporting System

Founding Member
STATEWIDE TOWING ASSOCIATION OF MASSACHUSETTS

Charter Members
TOWING & RECOVERY ASSOCIATION OF OHIO (TRAO)
NEW HAMPSHIRE TOWING ASSOCIATION (NHTA)
TOWING & RECOVERY ASSOCIATION OF AMERICA (TRAA)

Towing Traffic Incident Reporting System (TTIRS)

For TRAA Affiliate Members to request data reports:

1. TRAA Affiliate Member must register [HERE](#)
2. Once registered, a TRAA Affiliate Member can request a report [HERE](#)

Anyone can report an incident. To submit a TTIRS Incident Report:
Instructions

1. Incidents can be reported by a Tow Company representative or by a Tow Operator or surviving family member.
2. Past incidents should be reported. Historical data is an important part of the database.
3. In order to maintain the integrity of the data and avoid duplicate entries, a contact name, email address and phone number must be supplied. Identities will remain confidential and are for verification only and will not be shared.
4. All field displaying * are mandatory. Please take the time to fill out the form accurately and completely including optional information and photos. The integrity of the data is vital to the project.

Name of Person Reporting Incident *

First Last

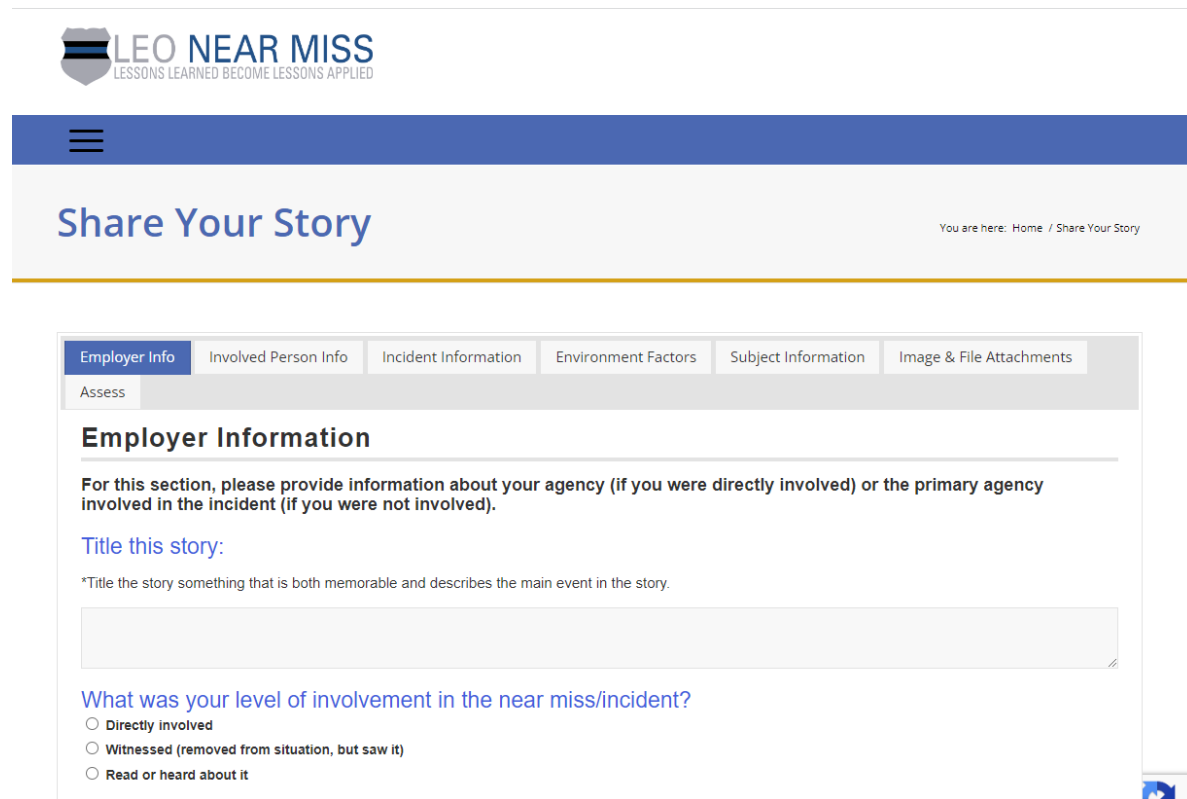
Company *

City *

Figure 1. Towing Traffic Incident Reporting System (TTIRS) (<http://www.ttirs.com/>)

LEO Near Miss (LEO)

LEO Near Miss is a voluntary initiative focused on officer safety (LEO Near Miss, n.d.). It provides a platform for law enforcement personnel to anonymously share stories of near misses or close calls they have experienced. These stories serve as valuable lessons learned and reminders that can be incorporated into training and policy development to enhance officer safety. LEO Near Miss is supported by the National Policing Institute, formerly known as the Police Foundation, through federal funding awarded by the U.S. Department of Justice's Office of Community Oriented Policing Services. The initiative aims to improve officer safety by promoting the sharing of experiences and facilitating the integration of lessons learned into law enforcement practices. The person who is completing the report can share their PII details if interested, however it is not mandatory to report incidents.



The screenshot shows the LEO Near Miss reporting interface. At the top left is the logo with the text 'LEO NEAR MISS' and the tagline 'LESSONS LEARNED BECOME LESSONS APPLIED'. Below the logo is a blue navigation bar with a hamburger menu icon. The main heading is 'Share Your Story' in blue, with a breadcrumb trail 'You are here: Home / Share Your Story' on the right. Below this is a horizontal tabbed interface with six tabs: 'Employer Info', 'Involved Person Info', 'Incident Information', 'Environment Factors', 'Subject Information', and 'Image & File Attachments'. The 'Employer Info' tab is active. Underneath, there is a sub-tab 'Assess'. The main content area is titled 'Employer Information' and contains the following text: 'For this section, please provide information about your agency (if you were directly involved) or the primary agency involved in the incident (if you were not involved)'. Below this is a blue link 'Title this story:' followed by a note: '*Title the story something that is both memorable and describes the main event in the story.' There is a large text input field for the title. Below the input field is another blue link: 'What was your level of involvement in the near miss/incident?'. Underneath this link are three radio button options: 'Directly involved', 'Witnessed (removed from situation, but saw it)', and 'Read or heard about it'. A small social media icon is visible in the bottom right corner of the form area.

Figure 2. LEO Near Miss (<https://www.leonearmiss.org/report/>)

Fire Near Miss (Fire)

The Fire Near Miss reporting system was launched on August 12, 2005, by the International Association of Fire Chiefs (IAFC) (Russ, 2019). It was announced at a press conference in Denver, Colorado, after having completed a pilot program involving 38 fire departments across the country. The system aims to prevent injuries and save lives of other firefighters by collecting, sharing, and analyzing near-miss experiences. The near-

miss experiences are collected by firefighters who voluntarily submit them; the reports are confidential, non-punitive, and secure. After the reports are compiled, they are posted to the website where firefighters can access them and learn from each other's real-life experiences. The program is based on the Aviation Safety Reporting System (ASRS), which is described below. PII is mandatory while reporting incidents.

The screenshot shows the 'Submit a Report' page. At the top, there is a navigation bar with 'HOME', 'SUBMIT A REPORT', 'TRAINING', 'BROWSE REPORTS', and 'ABOUT'. A 'Log in' link is on the right. The main heading is 'Submit a Report'. On the left is a sidebar with menu items: 'Tell us your story' (highlighted), 'Lessons learned', 'Contributing Factors', 'Outcomes', 'Supporting Files', 'Your Information', and 'Your Department'. The main content area contains several form fields:

- Description***: A text area with the placeholder 'Describe the event and how the near-miss occurred.' and a red asterisk icon indicating it is a required field. Below it is the text 'The Description field is required.'
- Date**: A date input field with the placeholder 'mm/dd/yyyy' and a calendar icon.
- Time**: A time input field with the placeholder '--:-- --' and a clock icon.
- Event Type**: A dropdown menu with the text 'Select the Event Type' and a downward arrow.
- Locations**: A dropdown menu with options: 'Single Family Home', 'Multi Family Structure', 'Commercial or Business Occupancy', 'Highrise Structure Fire (5 or more stories above gro', and 'Industrial Building'.
- Country where event occurred**: A dropdown menu with options: 'United States', 'Canada', and 'Other'.

 At the bottom, there is a note: '* denotes mandatory fields'. Navigation arrows and a 'required fields' icon are also visible at the bottom of the form area.

Figure 3. Fire Near Miss (<https://iafcnearmiss.azurewebsites.net/Report/Submit>)

Confidential Close Call Reporting System (C³RS)

The C³RS is a partnership between the National Aeronautics and Space Administration (NASA) and the Federal Railroad Administration (FRA), in conjunction with participating railroad carriers and labor organizations (FRA, n.d.). It is designed to improve railroad safety by collecting and analyzing reports that describe unsafe conditions or events in the railroad industry. Employees can report safety issues or “close calls” voluntarily and confidentially. By analyzing these events, potential life-saving information can be obtained to help prevent more serious incidents in the future. PII information is necessary to report incidents; however, the system explicitly states the PII information will be later removed to protect identities.



Figure 4. Confidential Close Call Reporting System (C³RS) (<https://c3rs.arc.nasa.gov/index.html>)

Aviation Safety Reporting System (ASRS)

The ASRS is a voluntary, confidential reporting system for the aviation industry (NASA, n.d.). It is administered by NASA and aims to enhance aviation safety by collecting and analyzing information on incidents, near misses, and potential hazards. The ASRS allows pilots, air traffic controllers, maintenance personnel, and other aviation professionals to report safety-related incidents or concerns. These reports can include near misses, operational errors, equipment malfunctions, communication issues, or any other safety-related events. The system encourages individuals to report without fear of regulatory or disciplinary actions, fostering a culture of open and honest reporting. Confidentiality is a key feature of the ASRS. The system ensures the anonymity of reporters by removing personally identifiable information from the reports. This promotes a safe environment for individuals to share their experiences and allows for the collection of more accurate and unbiased data. Reports can be submitted through various channels, including a web-based reporting form, telephone hotline, mail, or fax, which ensures convenience and accessibility for aviation professionals to report incidents.

The ASRS collects and analyzes the reported data to identify trends, safety concerns, and areas for improvement. The analysis results in the production of reports, publications, and safety recommendations that are shared with stakeholders in the aviation industry. This data analysis plays a crucial role in identifying potential risks and taking proactive measures to enhance aviation safety. Additionally, the ASRS issues Safety Alerts to quickly disseminate information on critical safety issues identified through the reporting process. These alerts serve as timely warnings and provide recommended actions to mitigate risks. The ASRS also contributes to safety education and training by sharing de-identified case studies and reports with the aviation community, which helps to promote a learning culture and raise awareness of potential safety hazards and best practices.

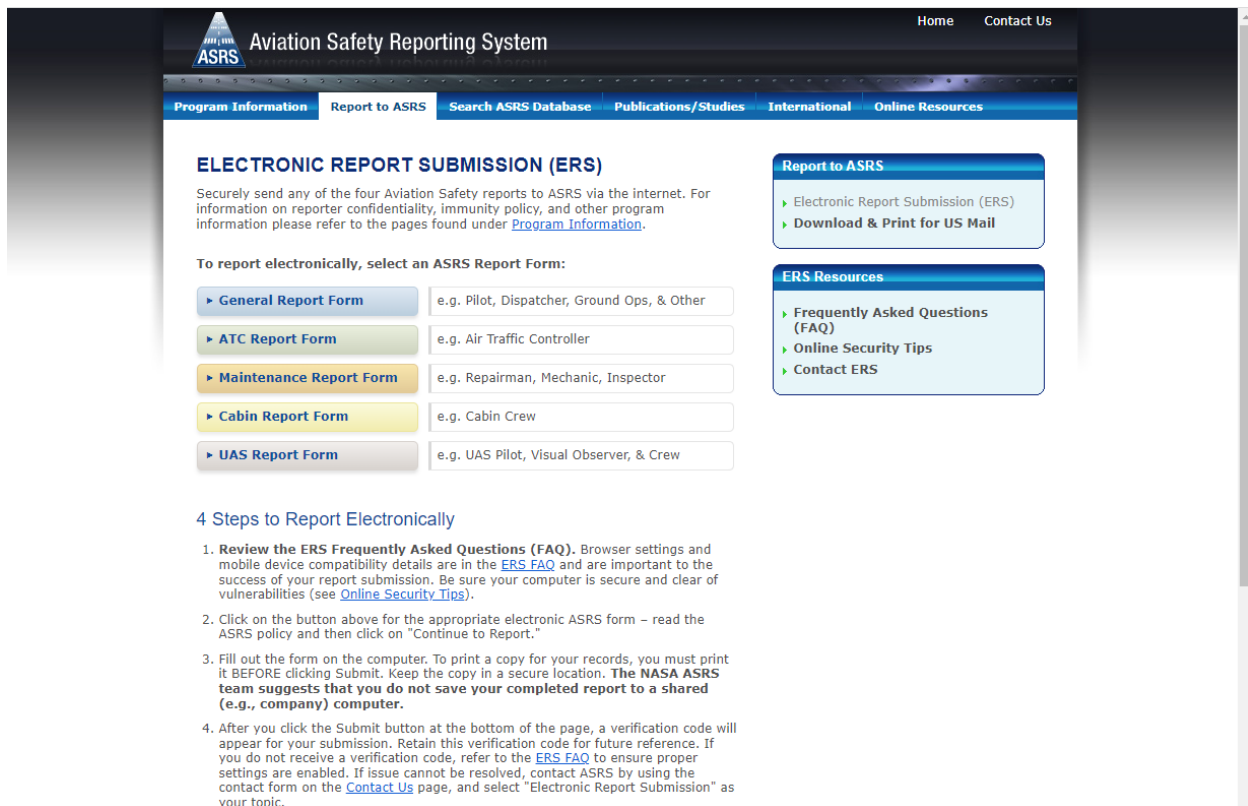


Figure 5. ASRS (<https://asrs.arc.nasa.gov/report/electronic.html>)

Emergency Responder Safety Institute Struck-By Incident Reporting (ERSI)

ERSI has recently introduced a nationwide database aimed at collecting comprehensive information about incidents on the roadway where emergency responders or their equipment have been struck by vehicles while operating at a scene (ERSI, n.d.[d][e]). This initiative is facilitated through the platform ResponderSafety.com. The form welcomes reports from all roadway responders, including fire departments, law enforcement agencies, EMS, special traffic units, safety and freeway service patrols,

departments of transportation and public works, and towing and recovery services. The primary objective is to enhance the voluntary reporting, tracking, and analysis of struck-by incident data with the ultimate goal of preventing future incidents. As noted, while ERSI is designed to report struck-by incidents, this system can also be used to report near-miss events. ERSI's reporting form allows any roadway responder to report a struck-by incident, regardless of whether it resulted in death, injury, or property damage. The reporting process ensures anonymity, although responders have the option to provide contact information for further communication with ResponderSafety.com if desired. The reporting form is designed to take approximately 3 to 4 minutes to complete. All fields within the form are optional, enabling responders to report as much information as they have.

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Report a Struck By Incident

The Emergency Responder Safety Institute (ERSI), a committee of the Cumberland Valley Volunteer Firemen's Association (CVVFA), has worked for years to improve the safety of those who respond to incidents on America's roadways. Continuing to be proactive in this effort, CVVFA/ERSI has again worked to develop a better document and analyze how and where our country's first responders are being struck, injured, and killed. This will be accomplished through this enhanced platform and capability to solicit and collect struck by incident information from voluntary reporters and significantly upgrading its data collection functionality and depth.

It typically takes 3-4 minutes to complete this reporting form. There are twelve very brief sections. All questions are optional. Please provide as much information as you can. If you do not know the answer to a question, skip it. If you have a problem with or a question about the form, please [contact us](#).

[Click here to download](#) a paper copy of this form for internal use by dispatchers to record information for later data entry into the online form.

1. Incident Time & Date (Please estimate if exact time not known)

A. Hour

B. Minute

C. AM/PM

Figure 6. ERSI's Struck By-Incident Form (<https://www.respondersafety.com/struck-by-near-miss/report-a-struck-by-incident>)

Comparison of Web-based Systems

Table 2 shows the comparison of personal information collected among the web-based near-miss systems. Across the systems, there is variability in the amount of demographic and historical data that is gathered. Nearly all the near-miss systems ask about reporters' experience; in contrast, the Fire Near Miss reporting system is the only

one that asks about reporters' education. Almost all the web-based near-miss systems request mandatory contact details such as name, email address, address, phone number, etc.; however, they expressly state that the information will not be shared is only used to contact the reporter to get more information if needed. Only TTIRS and ASRS near-miss systems ask about certifications and training information of reporters. TTIRS specifically asks for Traffic Incident Management (TIM) training certifications information in the system.

Table 2. Personal information collected in the web-based near-miss systems

Near-miss system	Personal information							Contact details	Training
	Role at incident	Education	Ethnicity	Experience	Age	Sex			
LEO	Yes	No	No	Yes	Yes	Yes	Optional	No	
TTIRS	Yes	No	No	Yes	Yes	No	Mandatory	Yes	
Fire	No	Yes	Yes	Yes	Yes	Yes	Mandatory	No	
C ³ RS	Yes ^a	No	No	Yes	No	No	Mandatory	No	
ASRS	Yes ^a	No	No	Yes	No	No	Mandatory	Yes	
ERSI	No	No	No	No	No	No	Optional	No	

^a The C³RS and ASRS systems have different forms for different roles.

Table 3 presents the agency-level information collected in the near-miss systems. Some systems allow near-miss reporting for self only (i.e., the person involved in the incident), while others allow reporting for someone else. For example, a supervisor or safety manager might enter the report based on information gleaned from the person who experienced the incident. Some of the questions asked in these sections are appropriate depending on the type of responder. For example, law enforcement officers can work for either state, federal, city, or county agencies, so they have a question on type of agency, whereas towing operators do not have these same considerations. The C³RS has different near-miss system forms for different roles, but still has a question on person type.

Table 3. Agency-level information collected in the web-based near-miss systems

Near-miss system	Agency-Level information				
	Who Reports	Type of agency	Agency size	Serving population size	Region of country
LEO	Anyone	Local/state/federal, etc.	Yes	Yes	Yes
TTIRS	Anyone	No	No (asks company name)	No	State and city
Fire	Not reported	Yes	How many units/how many miles covered	Yes	No
C ³ RS	Self-report only	Not agency but job type (e.g., engineer, dispatcher, etc.)	No	No	No
ASRS	Self-report only	Not agency but job type (e.g., captain, controller, etc.)	No	No	State and city
ERSI	Anyone	Yes (e.g., DOT, EMS, Police, Fire, etc.)	No	No	State and city

Table 4 lists the incident-related information collected in each near-miss system. Though LEO, TTIRS, and Fire record near misses, they have a question on the result of the incident, which includes options such as injury, level of injury, as well as near miss. Only LEO has a question on how the call was initiated, which is appropriate considering law enforcement duties. No system other than ERSI asks for details about the striking vehicle involved in the incident. This distinction is understandable as ERSI's focus is struck-by incidents. C³RS and the ASRS capture shift hours and hours into shift of the reporters, which can help explore the role of fatigue in the frequency of near-miss incidents. All the near-miss systems include an open-ended question asking reporters to describe the incident. Some give specific instructions on what to include about the incident and some ask for a general description of the incident.

Table 4. Incident information collected in the web-based near-miss systems

Near-miss system	Incident										
	Type of call or activity	How was the call initiated	Result of the incident	Date & Time	Initial assessment of the situation	Number of people at the scene	Striking Vehicle	Use of countermeasures	Shift during incident	Hours into shift	Narrative
LEO	Yes	Yes	Almost resulted injury or not	Yes	Yes	Yes	No	No	No	No	Yes
TTIRS	No	No	Same as LEO (also asks for level of injury)	Yes	No	No	No	No	No	No	Yes
Fire	No	No	Asks if resulted in an injury to responder, civilian, etc.	Yes	No	No	No	No	No	No	Yes
C³RS	No	N/A	No	Yes	No	Yes (crew size)	No	No	Yes	Yes	Yes
ASRS	Yes	N/A	No	Yes	No	No	No	No	No	Yes, flying time	Yes
ERSI	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes

Environment-related information collected in the near-miss systems are presented in Table 5. Visibility at the incident site is only collected in three of the six systems. Location of the incident site is asked in all systems; however, the provided options vary. For example, location in TTIRS asks about type of roadways, whereas in LEO, roadway is just an option among others. Only LEO asks if the reporter was aware of any hazards at or near the incident location.

Table 5. Environmental factors

Near-miss system	Environment			
	Location	Weather	Visibility	Aware of the hazards?
LEO	School, hospital, road, etc.	No	No	Yes
TTIRS	City & State, another question on type of roadway (interstate, state route, etc.)	Yes	No	No
Fire	Drop down selection with roadway, parking lot options	No	No	No
C³RS	Subdivision, facility, milepost, nearest station. Also, the location of the reporter (in locomotive, adjacent to track, train car, etc.)	Yes	Yes	No
ASRS	Airport, altitude, intersection	Yes	Yes	No
ERSI	State/City/Road/on-road location	Yes	Yes	No

As shown in Table 6, LEO includes an exhaustive list of risk factors that led to the incident, from which reporters can select. TTIRS asks reporters to provide risk factors in an open-ended question. LEO and Fire are the only two that ask what type(s) of countermeasures were used by the responders during the near-miss incident. A “lessons learned” section is another component of LEO and Fire, where respondents are asked: “Could you describe the lessons learned from this near miss/incident?” By asking this question, the responders might process or contemplate the experience more deeply, reflecting on what worked and what did not, and possibly grow from those insights. This reflection is beneficial for personal development and the avoidance of repeated mistakes. Further, these two systems ask reporters to state what changes they plan to implement because of the event.

Table 6. Information collected on incident assessment

Near-miss system	Incident assessment					
	Type of accident/incident averted	Risk factors that led to the incident	Protective factors that helped prevent injury or death	Lessons learned	Led to Changes?	Situational awareness
LEO	Narrative	Many options listed	15–19 options (select all that apply)	Yes	Policy, training, tactics, etc.	No
TTIRS	No	Open ended	No	No	No	No
Fire	No	Multiple choices	Yes	Yes	Yes	Yes
C ³ RS	Yes	No	No	No	No	No
ASRS	Yes	Narrative	No	Yes	No	No
ERSI	No	Several options listed	No	No	No	No

Table 7 provides a general comparison of these near-miss systems. All reporting systems included a combination of open-ended and multiple-choice questions. It takes approximately 5 to 15 minutes to report a near-miss incident in one of these systems, but times are variable depending on individual responses and the specific circumstances surrounding each incident.

Table 7. General comparison

Near-miss system	General			
	Length of survey (mins)	Number of choice-based questions	Number of open-ended/short-answer questions	Allows attachments of images?
LEO	10–15	23	4	Yes
TTIRS	5–8	10	14 (includes time, state, city)	Yes
Fire	8–10	12	16	Yes
C ³ RS	8–10	13	32 (one open-ended question)	No
ASRS	10–15	Many (varies based on job duty)	Many (includes aircraft type)	No
ERSI	5–6	30	4 (one open-ended question)	No

Comparison of App-based Systems

Seven near-miss reporting systems that are available in the Apple App Store were identified and reviewed by the team. Figure 7 shows the icons for these apps and Table 8 summarizes the key features of these systems. Some of these apps are not publicly

accessible; therefore, their features could not be translated into the table. Most of the identified near-miss reporting systems are designed for workplace or business environments, and these systems are specifically tailored to facilitate incident reporting and analysis within these contexts. They provide a platform for employees, workers, or relevant stakeholders to document and report near-miss incidents that occur within their respective workplaces.

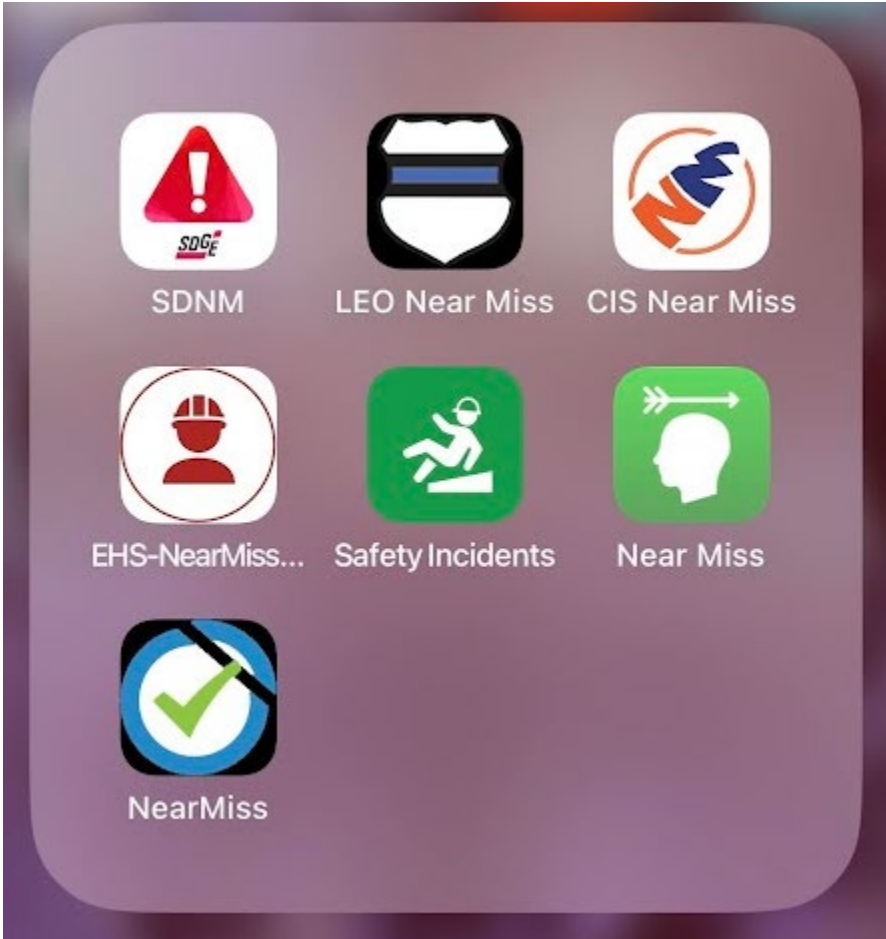


Figure 7. Selected near-miss reporting system apps

Table 8. Key features of selected app-based near-miss reporting systems

App	Public access	Registration	Purpose	Time/date	Location	Audio-to-text	Photo	Contact Info
LEO Near Miss	Yes	No	Same as web-based LEO system	No auto time or date	Manual entry	Yes	Upload	
SDNM	Yes	No	For utility work	Automatic time and date	No	Yes	Take or upload photo	Ask for contact info (optional)
CIS Near Miss	No	N/A	For business to document near misses	N/A	N/A	N/A	N/A	N/A
EHS-NearMiss Report	No	Yes	For workplace	N/A	Automatic	N/A	N/A	N/A
Safety Incidents	Yes	Yes	For workplace	Auto time and date	Automatic	Yes	Take or upload photo	Contact info provided at registration
Near Miss	Yes	No	For truck drivers to report near-misses	Auto time and date	Automatic	Yes	Take or upload photo	Contact info can be given in settings
NearMiss	No	Yes	N/A	N/A	N/A	N/A	N/A	N/A

Note: N/A means information not available since the system is not publicly accessible.

Two of the apps were transportation related. The LEO Near Miss App offers the same information as its corresponding web system, as shown in Figure 8. However, its unique advantage lies in its support for audio-to-text inputs, a feature that is also found in other apps. The inclusion of audio-to-text functionality in near-miss reporting systems could potentially present significant benefits for incident reporting, enabling users to easily convert spoken information into written text with a more efficient and user-friendly approach. The availability of audio-to-text functionality across various apps underscores its importance in facilitating incident reporting systems and ultimately promoting enhanced safety measures and the effective management of potential risks.

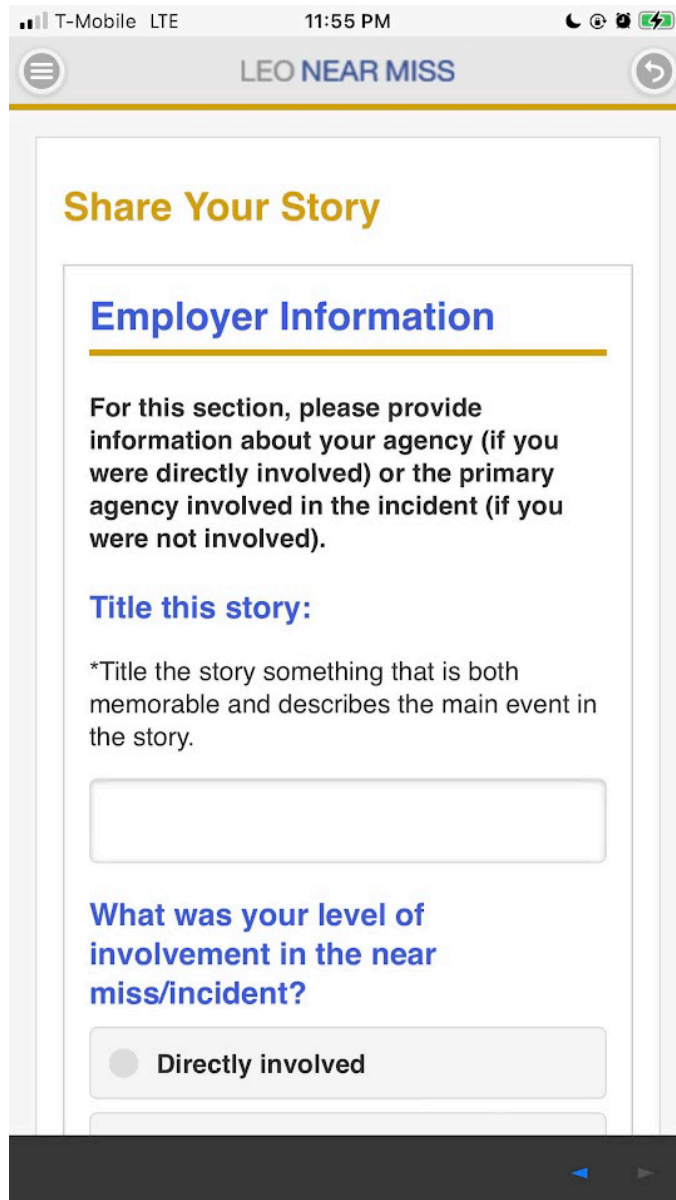


Figure 8. LEO Near Miss App

Figure 9 shows another transportation-related app called “Near Miss.” This app was developed by Dynes Transport Tapanui Limited, a prominent transport company in New Zealand. The app offers a user-friendly approach to reporting near-miss incidents without the need for complex forms. Users can conveniently record near-miss incidents by capturing photos and recording voice messages directly within the app. The Near Miss app simplifies the reporting process by automatically generating an email containing all the necessary information, including the photos, voice messages, date and time of the incident, GPS location, and contact details. If needed, the app allows emails to be sent to multiple recipients. Notably, this system distinguishes itself through its straightforward

setup, as it does not require logins or user accounts, providing a seamless and hassle-free experience for users.

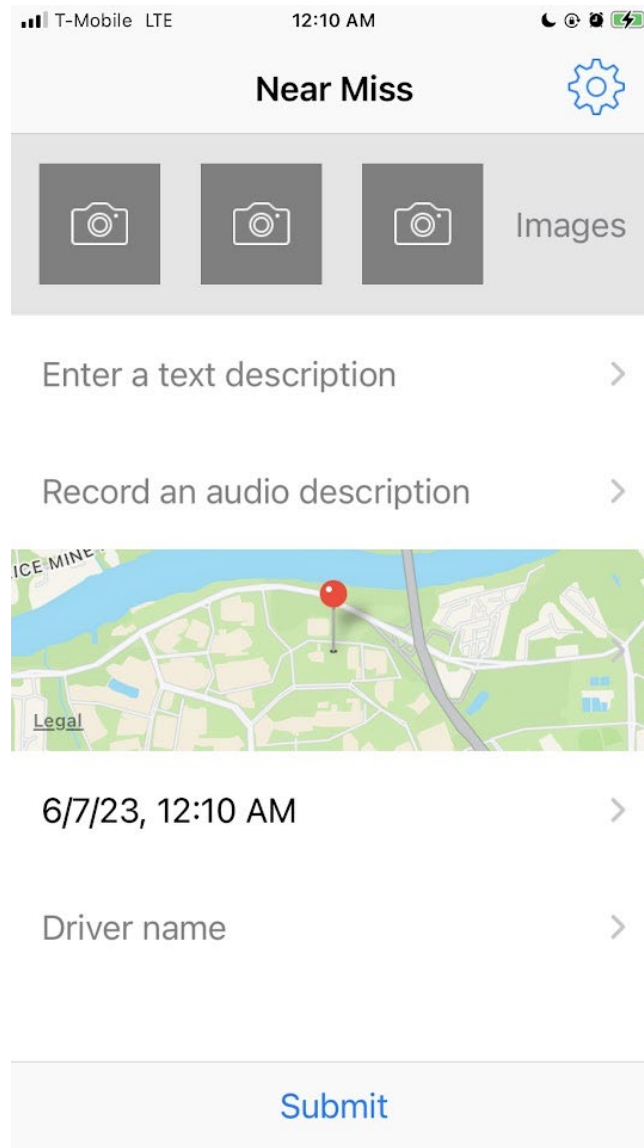


Figure 9. Near Miss App by Dynes Transport Tapanui Limited

Summary

In total, 13 near-miss reporting systems were reviewed, including 6 web-based and 7 app-based systems. Traffic incident or roadside responders include individuals from different agencies such as fire, police, and towing and recovery that play distinct roles at traffic incident scenes. It is possible that responders are more likely to utilize a near-miss reporting system that is tailored to their specific job duties. For instance, tow truck operators may employ TTIRS, police personnel may use LEO, and fire fighters and EMS personnel may utilize Fire. Similarly ERSI, although primarily designed to collect

information on struck-by incidents, can also be utilized by any roadside responder to report near-miss events.

The reporting systems employ a combination of open-ended and multiple-choice style questions to gather information about responders and incidents. The reporting duration for these systems can range from 5 to 15 minutes, depending on the complexity of the incident being reported. Additionally, most of these systems allow reporters to attach images along with their reports, facilitating visual documentation. It is important to note that, with the exception of the LEO and ERSI, systems typically mandate the inclusion of contact information, including name, address, and email, when submitting a report. C³RS and ASRS request reporters to read through some standard information before submitting a report. These two systems specifically state that the personal information will be stripped from the key report information so no backtracking can be done. Other systems say that contact information is necessary should the system operators would like to reach out to them to get more information; however, the information collected will not be distributed/shared. None of the systems state the key benefit of reporting near-miss incidents on their reporting form itself; however, they have information on the system web page.

C³RS and ASRS are transportation-related systems that focus the railroad and aviation industry, respectively. While they may not directly address traffic incidents or roadside assistance, they still provide valuable insights as they offer different reporting forms tailored to individuals with different work roles, allowing for comprehensive and specialized reporting. Implementing a near-miss reporting system with multiple forms for different roadside responders could allow for customized reporting based on each responder's role and responsibilities. This approach could ensure that the collected data is relevant and tailored to the specific needs of different roadside responder agencies. Further analysis and discussions with stakeholders from the various response agencies is necessary to determine the most effective approach for developing a near-miss reporting system that addresses the unique requirements of different agencies while fostering collaboration and data sharing. The aim would be to strike a balance between standardization for data consistency and flexibility to accommodate agency-specific reporting needs.

INTERVIEWS WITH STAKEHOLDERS

This task involved interviews with developers/managers of current reporting systems and representatives from traffic incident response agencies. These stakeholders have firsthand knowledge and insights regarding the challenges, barriers, and opportunities of developing a near-miss incident reporting system for roadside responders. This section presents key findings from the analysis of the interview transcripts.

Method

To facilitate the interview conversations, guiding questions were prepared and shared with the interviewees when scheduling to ensure they were adequately prepared. Two sets of questions were prepared: one for owners or managers of reporting systems and one for representatives of emergency response agencies.

1. *Questions for owners or managers of existing near-miss systems:*

Role/background

- Have you been with the near-miss system since its inception?
- How long have you been working with and running day-to-day operations of the near-miss system?
- What are your daily activities in operating the near-miss system?
- How many people work with you to maintain and operate the near-miss system? Type of people (statistician, software engineer or equivalent, administrative associate, etc.) and their key responsibilities?
- Were you involved during the development of the near-miss system? What's your role?

Information about the near-miss reporting system

- When was the near-miss system developed?
- Who developed the questions and prompts for the near-miss system? What was the process?
- What was the motivation behind creating the near-miss system?
- Is there a process to add, modify, or delete questions and prompts? Have the questions or prompts changed in the near-miss system since it was developed? What were the changes? Why were they made, and what is the basis for these changes?
- Was this system tested before rolling out to a broader audience?
- How many reports do you receive in a year? Are these reports nationwide or localized? Can you share a few insights about the data being collected?

- Do you get feedback from the near-miss system users to modify or improve the system? If yes, can you provide some high-level comments? If no, is there a method to collect feedback? And if so, why is feedback not collected?
- What level of funding do you need to run a near-miss system? Is the funding sufficient to maintain current operations?
- What percent of the _____ (*police, fire/EMS, tow truck driver*) population do you feel are aware of the _____ (*system name*) near-miss system?
- Have you taken any measures to publicize the near-miss system? If so, how?
- What partnerships did the near-miss system need in its development and deployment? Were those partnerships fruitful, or did they hinder developing the near-miss system?
- What could be done to improve the near-miss system?
- According to you, what are the critical challenges in developing and operating a near-miss system?
- Could anything be done differently to develop and operate a near-miss system?
- What are your agency's short-term/long-term goals regarding the near-miss system?
- How do you use the data collected? Do you publish reports summarizing the data collected? Is the data available to your users in reports or summarized and included in newsletters or journal articles?
- What kind of measures do you take to protect the data? Is personally identifiable information removed from the submittals? Is the data collected kept encrypted? Etc.
- You collect some personal data for the sake of reaching out to the submitter to get more information. Have you or anyone else contacted the submitter for more details about the near-miss incident?
- What do you perceive as some of the near-miss system barriers, and how do you think your team can overcome them over the years?

2. *Questions for representatives of emergency response agencies:*

Role/background

- How long have you been working/volunteering at ___?
- What are your day-to-day activities?
- How many people work with you?
- Are you aware of _____ (*police, fire/EMS, tow truck driver*) near-miss systems? How long have you known about this near-miss system?

Perspectives on near-miss reporting systems and corresponding reporting behaviors:

- Do you have any internal near-miss or incident reporting systems in place?

- Have you or anyone you know ever used ____ (*police, fire/EMS, tow truck driver*) near-miss reporting system? If not, why?
 - There was nothing to report
 - Don't know of the system
 - Didn't see a need to report
- Do you encourage your fellow responders and subordinates to use the near-miss reporting system? If not, why?
- Do you have formal incident management training for your responders?
- Have you or any of your responders had formal training on reporting a near-miss incident? If yes, what type of training is it?
- Does your agency have any policies or procedures for reporting a near-miss incident?
- Do you have any concerns about near-miss reporting systems?
- Do you think having tools that analyze near-miss incident data would help your team improve your safety? How do you think having access to these tools and data would help your team?
- What do you think could be done to improve near-miss incident reporting?
- What do you perceive as some of the near-miss system barriers, and how can the system overcome them over the years?

Ten interviews were conducted via conference calls; three with owners/managers of existing near-miss or incident reporting systems, and the remaining seven with representatives of emergency response agencies. These agencies included two towing agencies, one police department, one EMS agency, one fire department, one traffic management center, and one state department of transportation. Participants from the private sector were offered gift cards as a gesture of appreciation for their involvement in the interviews.

All interviews were conducted through Zoom conference meetings, with each interview session lasting between 45 and 90 minutes. During each interview, one team member took the lead in asking questions, while two other team members also participated help seek clarifications or inquire about additional insights from the interview participants. Following the approved University of Alabama Institutional Review Board (IRB) protocol, verbal consent was obtained to record the interview at the beginning of each interview session. Interview transcripts were then analyzed and synthesized to generate insights on the development and deployment of a successful near-miss reporting system. To ensure the confidentiality of the participants in these interviews, neither their names nor their agency names (except agency type) are disclosed in this report.

Results

Perspectives shared by interview participants were synthesized and organized below according to different themes. For certain themes, direct quotes from the interviews are included to provide additional context. All participants had at least 20 years of experience in their respective industries. The diversity of perspectives among interview participants is due in part to the array of roles they hold within their respective organizations. These roles included owner/developer of near-miss and struck-by reporting systems, trainer within a traffic incident management agency or towing/road assistance agency, leader/manager of an emergency response agency, owner of a towing agency, as well as founder of a non-profit organization dedicated to advocating for responder safety.

Owners/Managers of Existing Reporting Systems

All of the owners/managers of reporting systems who were interviewed were heavily involved in developing and operating their respective near-miss and struck-by reporting systems.

Self-Reporting. All the near-miss and struck-by reporting systems request responders to voluntarily report if they experience any incident. However, the system managers stated that it is very uncommon to receive voluntary self-reported responses. The people who manage these systems often rely on their connections or news media articles to identify struck-by incidents. The system managers then gather adequate information on these incidents to fill in the reporting form themselves. One of the significant challenges with self-reporting of near-miss or struck-by incidents is differences across reporting groups as well as data quality concerns:

“The tow operator business is independent, unlike the fire and police departments. Tow operator business owners are extremely concerned with worker’s compensation insurance. So, they are very, very, very reluctant to report near misses, especially because the insurance industry looks at those as potential exposure and the rates climb accordingly.”

“Near misses aren’t typically reported in any kind of a national database. It’s gonna take a long time to gather the kind of information and quality of information that we’re looking for in a near-miss type of atmosphere. It just doesn’t exist yet out there.”

Some interviewees believed that federal agencies should make the reporting of struck-by incidents mandatory so all the incidents get recorded in the database.

“There are some of us in the organization that would like to see it made mandatory that any incident involving an emergency responder struck by a vehicle or an emergency vehicle struck at an incident scene to be reported.”

Type of Incident. System managers stated that the majority of the time, struck-by incidents are reported in these near-miss systems, which they believe are also useful to improve the safety of responders. A few system managers mentioned that they will also search for injuries or fatalities involving the incident responders on the internet and report those incidents by collecting information from the news articles.

Personally Identifiable Information. Some interviewees favored the collection of PII as it helps to eliminate redundancies in the reports. However, in their specific cases, the PII collected is only accessible by the system manager and is not shared with others. Other systems do not collect any PII of the reporter, which they believe is important to ensure the anonymity of the reporter. Making the reporting of PII voluntary could create comfort for responders in reporting the near miss.

“Not collecting PII is good because people don’t want it known that they’ve had that close call, or that they were involved, or their particular agency is involved in a situation or whatever.”

Reporting Form Development. All system managers stated that they carefully reviewed several existing near-miss systems prior to creating their own reporting form, and that the systems were tested before rolling them out. One system had expert panel discussions and surveys to inform the creation of the reporting form, while another system had a trial run to gather inputs and then revised as needed. One system manager noted that most of the responders access their training materials on cell phones, so they ensured the reporting form is optimized for smartphones and tablets to provide a better experience for the incident reporters.

Funding. Interviewees stated that they are running their systems on minimal funds. Other systems are not funded, which means there are no dedicated personnel to manage the system, ensure data completeness and accuracy, and generate reports. These systems are currently operated by volunteers, which represents a challenge going forward; it gets more difficult to find volunteers to support the data collection process. These systems need adequate funding to collect and analyze data. One system is operated and maintained by just one person, who does all the work to maintain the system.

Awareness. One interviewee believes that many towing associations are aware of the existence of their near-miss system; however, they do not put a lot of effort into pushing it to their members. Also, the interviewees stated that not many individual operators or workers are aware of these systems and suggested that a lot of funding is needed to publicize the systems and their potential benefits. They promote the system at events they attend. Another system is actively working with some federal agencies to get

the word out and they feel marketing the system is key to the success of a reporting system.

“We’re still in negotiations with Federal Highway [Administration] to go to the next level, which would include better and more marketing of it to let more people know about it.”

Measures to Improve the System. Participants expressed that reliance on self-reporting of near misses makes it very challenging to collect a sufficient number of responses to support statistical analysis. One of the system managers stated that educating responders seems like an obvious answer for driving people to the near-miss system; however, it did not work for them. They expressed that some monetary benefit might attract responders to report near misses.

“We tried talking about the safety and how the data will help us develop better programs to keep the drivers safe. That doesn’t seem to drive participation.”

“I think the only way you’re gonna drive it is if there’s a monetary component to it in some way, shape, or form. Some financial incentive for the owners to be willing to report the information or allow their employees to report these incidences.”

Further, system managers felt that many roadside workers believe near misses to be part of their job and therefore do not give them enough attention. Changing the attitude about near misses could create a positive culture among the responders.

Data Collected. Some organizations use the data being collected to develop and publish reports. All the interviewees stated that the data is being stored on secure servers to ensure its confidentiality. Regarding the question of how many reports they generally receive, one participant said they receive 50 to 60 reports per year that involve fire and EMS people. Other participants mentioned that they may collect 40 to 60 reports each year nationwide.

Representatives from Traffic Incident Response Agencies

Traffic incident response agency interviewees included two towing agencies, one police department, one EMS agency, one fire department, one traffic management center, and one state department of transportation. The participants had a minimum of 10 years of working experience, while most had over 20 years of experience working in their respective agencies.

Most participants (5 out of 7) were not aware of the existing near-miss systems, and were therefore unable to provide insight into existing concerns. Moreover, none of the participants indicated that they had used any near-miss systems to report close calls.

“Yeah, I think for the most part it’s not widely known. It’s not publicized to us in the fire service that there’s a system out there for recording that kind of information.”

Internal Reporting. All the interviewees stated that they do not have any internal reporting systems in place to collect any data on near-miss or struck-by incidents. However, it is common for people to discuss among themselves or with their supervisors when such incidents happen.

“It’s usually just through kind of conversations where they had shared it with their supervisors that they were in a situation like that.”

“If we did have a near miss, we would probably talk internally as a crew. How can we avoid that from happening?”

Stigma Surrounding Reporting. Some interviewees in the supervisor roles stated that there could be a stigma associated with talking about near misses (e.g., “you did something wrong, that’s why it happened”). One interviewee said that responders might be afraid of the repercussions, and so they do not report even if the reports do not collect any PII.

“They hadn’t followed procedures exactly well. They would probably be less likely to report something like that as compared to if they had followed procedures by the book.”

“I think they fear repercussions that they don’t report, even [for a reporting form] that doesn’t record a name. Also, a lot of times we don’t want to admit when we screw up or we do something wrong.”

Suggestions for Implementation. One of the interviewees suggested that defining “near miss” is important for gathering factual and standardized information. To encourage more reporting, another interviewee suggested that data concerning near misses could inform the appropriate mapping of responder salary to the relative risks. It was further recommended that these systems do not collect any PII information to encourage people to report without any fear or concerns.

There was some discussion in the interviews regarding the possibility of a supervisor reporting on behalf of the responder about the near-miss incident; however, it might not be a practical solution considering other factors, such as fear of reporting to supervisor. The level of comfort responders have with their supervisors will be an integral factor in whether they discuss near misses with their supervisor.

“Is he gonna chew me out? Am I gonna get suspended? Am I gonna get written up? Is there any type of repercussions that can come from me telling my supervisor about this?”

Further, one interviewee mentioned that having a mobile application can make it easier for the responders to report these near-miss incidents.

“An app is easier. More easily accessed and timelier, and because a lot of times what happens is we’re out on this long, prolonged scene could be up to several hours, and then you get back to the station, and there’s always a lot of work to do. ... The writing of the run reports [is] gonna be something that’s just gonna fall to the wayside if it’s so hard to access.”

Many agencies and responders (police, fire, EMS, etc.) fill out some paperwork or reports as part of their normal duties. One suggestion from interviewees was to incorporate a question in those forms: Have you or your team member experienced a near-miss incident during this event? If selected yes, a series of follow-up questions could capture information on the near miss.

“If there is one check box that says that a near miss occurred on that [shift], and then that prompts a follow up, we go back and get the details later.”

It was noted that tow truck operators use dispatch systems, and these systems could have an additional question asking about a near miss with potential follow ups. Another interviewee suggested that if a regulation was passed requiring that near misses were reported, then responders would be more likely to report.

“No one’s gonna do it unless they are regulated to do it.”

Some advised that collecting near-miss data on the side of the road immediately after the incident is not a safe way of collecting the data. However, participants also stated that responders could easily forget about the near-miss incident they experienced as they continued their work shift. Thus, gathering near-miss data should be strategic: it should not be too late such that operators could forget, and it should not be collected while still parked on the side of the road, where other risks are present.

Training. All interviewees said they have training in place to educate responders on proper incident management safety protocols. However, currently none of those training materials include information on near-miss systems, how to use these systems, or advantages of using the systems. Introducing near misses in the early phases of someone’s career through training may significantly impact their attitude towards incident reporting compared to those who might learn about a system at later stages in their career.

“A lot of responders have the fear of the unknown. If they don’t know about something there, it’s automatically bad. It’s automatically terrible. It’s the worst thing they’ve ever heard until they’re exposed to it and they understand it.”

“You’re gotta change the old mindset, which I think is doable through continuing education training that each responder group has to go through at some point. And the other way is embedding it in that initial training. Whether it’s firefighters, whether it’s police, whether it’s whoever. I wasn’t always as mindful, because when you get stressed out, when you get into that environment where you’re stressed, you revert back to your initial training because that’s what was ingrained in [you]. So, I think if you can put that in the initial training it would be more useful.”

“Using this data would provide us the ability to be able to structure courses, build new courses and everything that that would help curb these issues.”

Ease of Access. One of the traffic incident managers stated that even if safety patrol folks know about the near-miss system, they might not put the effort into reporting them. Creating systems that are easily accessible and understood by the responders will play a role in attracting users.

“They are not comfortable enough [with] getting on a computer.”

One of the participants from the fire department stated that there could be some resistance from firefighters regarding reporting the near misses, as they are already burdened with a lot of paperwork.

“Any additional paperwork that you’re gonna add on top of us is gonna be met with resistance in most cases. So that’s probably a large part of why we don’t do any kind of near missing things, because we’ve got enough paperwork. As it is, we already do a bunch of it.”

Normalization of Risk. Echoing input from the near-miss system administrators, some agency interviewees agreed that responders often feel near misses to be part of their job.

“Most people... when a near miss happens they just go on about their business, you know, and they don’t think about reporting it. That could be the biggest obstacle in getting people to report.”

“A lot of times they just see it as part of doing their job. They don’t see it as a near miss.”

“There are people out there that are looking for near-miss kind of information! You don’t even know that, we just don’t. We go out, we do our job. And unfortunately, it’s just something that we have accepted as another risk of our jobs.”

Legal Issues. A few interviewees highlighted that there could be liability issues for reporting the data and therefore there could be a push from both agencies and

responders in reporting and recommending near-miss systems. Protecting near-miss data from legal discovery and use could greatly influence people's use of these systems.

*“Attorneys at these ****, would stop them and say, ‘No! We’re not sharing near-miss information.’ Information being leaked out could harm them legally.”*

Technology. One of the interviewees suggested looking at alternative mechanisms through which near-miss data could be collected rather than relying on responders to report it.

“I think the easiest and the best way for us to get accurate reporting on near misses is not relying on the individual rather relying on cameras that are on these trucks.”

Summary

Ten interviews with stakeholders were conducted with the primary goal of gaining agency-level insights regarding the challenges, barriers, and opportunities of developing a near-miss incident reporting system for roadside responders. Three interviews were held with owners or managers of existing near-miss or incident reporting systems, and the remaining six interviews were conducted with representatives of emergency response agencies. The key takeaways from these interviews are summarized in the following points:

- All interviewees echoed that having tools to analyze near-miss data will significantly benefit their respective organizations, allowing them to translate insights from data into actionable items via training materials.
- Collecting PII is not recommended by many interviewees, in order to reduce fear among the responders of possible repercussions.
- Making systems easily accessible and viable to use with smartphones could increase the responses as many responders do not have access to computers.
- Early training and education and continuing education are necessary to embed the culture of reporting near misses within a respective organization.
- Publicity is crucial in getting the word out regarding near-miss systems.
- Defining near miss is essential because everyone has a different risk tolerance. Further, responders tend to understand the risks associated with their jobs and often do not attribute much importance to close calls.
- Supervisors must be receptive to responders talking about near misses, which helps to foster a positive learning atmosphere for the responders.

While the concept of near-miss reporting systems was appreciated by the majority of interviewees, getting people to actually use the systems was seen as a major barrier.

FOCUS GROUPS

Previous tasks provided insights from an agency-level perspective, mainly through discussions with emergency response agency managers. However, a substantial gap remains regarding the perceptions and attitudes of individual roadside responders toward near-miss reporting. To gain a more comprehensive understanding of how these front-line professionals perceive and engage with the near-miss reporting process, a series of focus group meetings were conducted to provide a platform for individual roadside responders to share their experiences, perspectives, and feedback regarding near-miss reporting.

In total, six focus group meetings were organized, which involved direct interaction with 28 roadside responders. These participants represented various agencies, including towing and recovery, fire, law enforcement, EMS, and state DOTs. By actively engaging with these front-line professionals, the aim was to uncover the nuances of their attitudes, motivations, and concerns related to reporting near-miss incidents. This section presents key findings from the analysis of the transcripts from these focus group meetings.

Method

Figure 10 provides an overview of the methodology. First, procedures and questions were developed to guide the focus group meetings (Webb, 2002). The protocols for the focus group sessions were then submitted to the University of Alabama IRB for review, ensuring strict compliance with ethical standards. Both the Towing and Recovery Association of America (TRAA) and the Emergency Responder Safety Institute (ERSI) played a critical role in inviting roadside responders from across the country to participate in the focus groups. In particular, TRAA assisted in reaching out to participants from towing and recovery agencies, while ERSI invited roadside responders from fire departments, law enforcement agencies, EMS agencies, and the state DOTs. By engaging with a diverse array of roadside responders, there was an additional aim of cultivating awareness in these roadside responder communities regarding the objectives of this project and its potential to elevate safety practices. TRAA has a membership base with over 700 companies and state towing associations nationwide, and its social media account has over 11,000 followers within the towing industry. Similarly, ERSI has an extensive mailing list comprising nearly 60,000 individuals from various emergency response agencies, including DOT, fire and emergency management services, law enforcement agencies, and towing companies. Email invitations to participate in this study were distributed through this network of roadside responders.

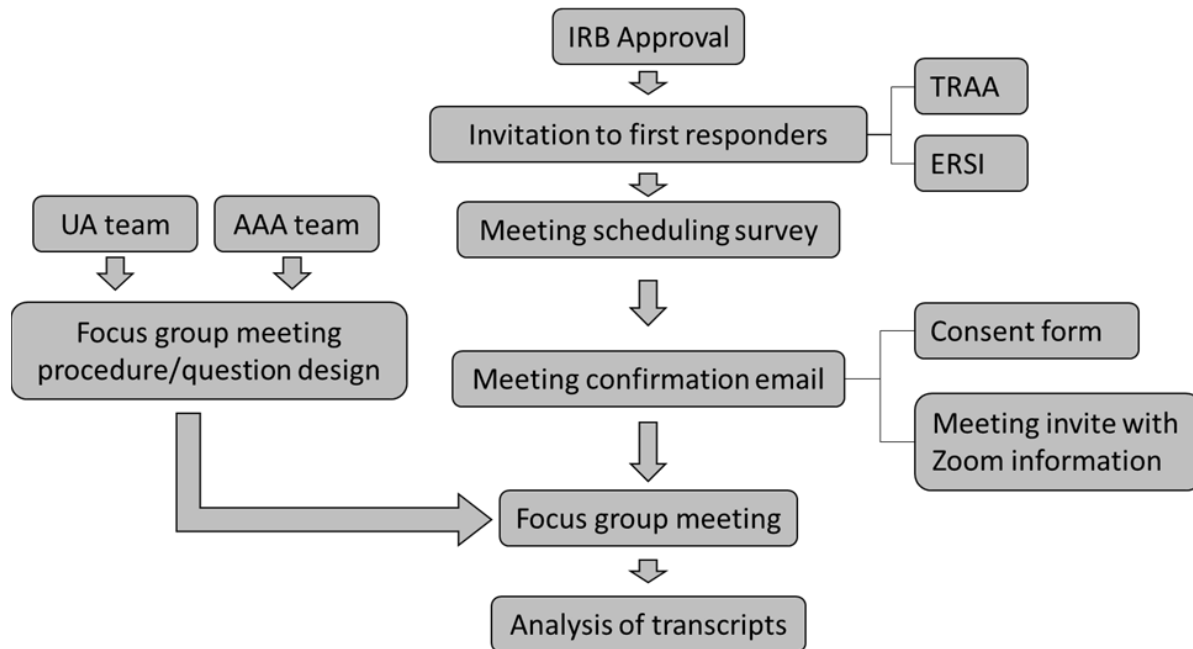


Figure 10. Overview of the methodology for focus groups

Individuals interested in participating were asked to complete a quick survey included in the initial invitation email. In the survey, participants were asked to indicate their agency type (fire, law enforcement, towing and roadside services, EMS/paramedics, DOT/safety patrol, and others) and their availability for meeting scheduling. They were also requested to provide their work email address for the verification of their agency type, and to receive confirmation of the meeting, meeting consent form, and the Zoom session information.

Many of those contacted showed significant interest in participating. More than 100 roadside responders responded to the initial invitation email and completed the meeting scheduling survey. However, due to the challenging scheduling constraints, which are particularly pronounced among roadside responders due to the demands of their professions, only a limited subset of participants could be scheduled. In total, six focus group meetings involving 28 roadside responders from the following agencies were organized:

- 10 participants from towing and roadside services (across two separate focus groups)
- 5 participants from fire
- 4 participants from law enforcement
- 3 participants from EMS/ paramedics (with one participant having to leave part way through the meeting)
- 6 participants from DOT/safety patrol

The questions asked in the focus group meetings are shown in Table 9.

Table 9. Guiding questions asked during focus group meetings

Topic	Questions
Work environment	<ul style="list-style-type: none"> • How do you define a near-miss incident, and what are some examples you've encountered or witnessed? • How often do you experience a near-miss incident? • Do you perceive near-miss incidents as routine in your line of work, not warranting significant attention? If so, why?
Near-miss system	<ul style="list-style-type: none"> • Were you aware of near-miss reporting systems before this discussion, and have you ever utilized them? • Would you feel more comfortable reporting near-miss incidents if these systems didn't collect PII? • What was the motivation behind creating the near-miss system?
Safety culture	<ul style="list-style-type: none"> • Does your organization foster a safety culture encouraging workers to report near-miss incidents without fear of blame or punishment? • What, in your opinion, could motivate responders to utilize near-miss incident reporting systems?
Challenges/obstacles	<ul style="list-style-type: none"> • Do you perceive reporting near-miss incidents as an additional administrative burden on top of your regular duties? • How would you feel if your supervisor mandated near-miss reporting? • How could near-miss reporting systems be made less burdensome for responders? • Would you be more comfortable reporting if the system ensures near-miss data is "protected from legal discovery" and can't be used against you? • Any other challenges for responders to use near-miss system?
Benefits	<ul style="list-style-type: none"> • What benefits do you believe exist in reporting near-miss incidents? • What methods do you think are most effective for educating responders about the benefits of near-miss reporting? • What platforms or approaches could be used to raise awareness about the existence of near-miss reporting systems?

Participants were offered gift cards in appreciation of their involvement in the focus groups. All focus groups were conducted through Zoom conference meetings, with each session lasting around 60 minutes.

Before participating in the focus group meetings, participants were asked to complete a consent form and a brief survey regarding their basic socio-demographic information. All participants willingly provided their consent to participate in the meetings and agreed to the recording of these sessions. Meeting transcripts were then analyzed and synthesized to generate insights on developing and deploying a successful near-miss reporting system. To ensure the confidentiality of the participants in these discussions, neither their names nor agency names (except agency type) are disclosed in this report.

Participants

Table 10 presents an overview of the sociodemographic characteristics of the participants who participated in six focus group meetings (N = 28). The participants ranged from 18 to 84 years old, with the majority being between 35 and 54. Participants were predominantly male and Caucasian, and having completed some college or held an associate degree. Agency-wise, participants represented various sectors, including DOT, EMS/paramedics, fire, law enforcement, and towing and roadside service. The representation extended across 19 different states. Participants also varied in terms of department size and professional experience.

Table 10. Sociodemographic characteristics of meeting participants (N = 28)

Term	Level	Count	Percentage
Age	18–24	1	3.6%
	25–34	4	14.3%
	35–44	7	25.0%
	45–54	9	32.1%
	55–64	5	17.9%
	65–74	1	3.6%
	75–84	1	3.6%
Gender	Female	7	25.0%
	Male	21	75.0%
Race	African American	1	3.6%
	Caucasian	27	96.4%
Education	Less than a High School Graduate	1	3.6%
	High School Graduate or equivalent	4	14.3%
	Some college or associate degree	15	53.6%
	Bachelor’s Degree	6	21.4%
	Master’s Degree or higher	2	7.1%
Agency Type	Department of Transportation	6	25.0%
	EMS/Paramedics	3	10.7%
	Fire	5	10.7%
	Law Enforcement	4	14.3%
	Towing and Roadside Service	10	35.7%

Term	Level	Count	Percentage
State	Alabama	2	7.4%
	Arizona	1	3.7%
	Colorado	3	11.1%
	Connecticut	1	3.7%
	Georgia	1	3.7%
	Louisiana	1	3.7%
	Maryland	1	3.7%
	Massachusetts	2	7.4%
	Minnesota	1	3.7%
	New Hampshire	1	3.7%
	New Jersey	2	7.4%
	New York	2	7.4%
	North Carolina	1	3.7%
	Oklahoma	2	7.4%
	Oregon	1	3.7%
	Pennsylvania	1	3.7%
	South Carolina	1	3.7%
	Texas	2	7.4%
	Wisconsin	1	3.7%
Department Size	1–50 employees	12	42.9%
	51–200 employees	7	25.0%
	More than 200 employees	9	32.1%
Years of Experience	Less than 1 year	2	7.1%
	1–5 years	3	10.7%
	6–10 years	2	7.1%
	11–20 years	7	25.0%
	More than 20 years	14	50.0%

Focus Group Outcomes and Themes

Table 11 provides the word count and participation levels across different focus group meetings and roles. Participants were actively engaged in discussions across all meetings, albeit at different levels. In meetings with towing professionals and DOT/safety patrol, participants collectively exhibited particularly robust participation, with higher total word counts. On the other hand, the EMS/paramedics meeting, while having a lower total word count, featured participants who contributed more extensively on average.

The firefighters’ meeting demonstrated a more balanced distribution of word counts between moderators/team members and participants. Lastly, the police officers meeting showed moderate engagement for participants.

Table 11. Overview of the transcripts from each focus group meeting

Meeting	Role	Number of Entries				Word Count			
		Total	Mean	Min	Max	Total	Mean	Min	Max
Towing professionals	Moderators	169				4558			
	Participants	338	56	11	152	6469	1078	137	2288
Towing professionals	Moderators	165				5357			
	Participants	219	73	62	81	5958	1986	1291	1780
DOT/safety patrol	Moderators	136				3216			
	Participants	313	78	70	92	5784	1446	1471	2078
EMS/paramedics	Moderators	153				3281			
	Participants	204	102	66	138	3596	1798	1227	2369
Firefighters	Moderators	156				3986			
	Participants	205	51	36	75	4238	1060	865	1158
Police officers	Moderators	134				4350			
	Participants	193	48	18	90	5029	1257	699	2428

In the categorized synthesis below, direct quotes from participants (italicized in sections below) illuminate and emphasize key points and insights derived from the focus group meetings.

Definition of Near-Miss Incidents

The definition of the term “near miss” differed among individuals, and this variance in definition can significantly influence roadside responders’ perception and understanding of their working environment and the hazards they encounter while operating on the road or roadside. During the focus group meetings, responses varied when participants were asked to define a near-miss incident. For example:

“We consider a near miss when any vehicle [is] passing beside us within 3 feet.”

“A near miss is whenever it’s very minor damage.”

“Advance warning signs, traffic cones, etc. getting struck and hard hat[s] blowing away are considered [a] near miss.”

One police officer highlighted that the definition of a near-miss incident could evolve with experience, suggesting that seasoned roadside responders might have a

more refined understanding of what qualifies as such. Other definitions provided by meeting participants included the following:

- A near miss should have some minor property damage
- A near miss could be anything when a motorist's vehicle travels within 1 to 3 feet of the responder
- Anything that causes the pucker factor to the responder
- Any motorist entering the "safe zone" (area setup at incident sites)
- If you can feel the vehicle pass by, if you feel the breeze when they pass by, that's a near miss

To promote near-miss reporting, roadside responders must have a good understanding of what constitutes a near-miss incident (OSHA, 2022). This understanding encourages reporting and ensures that potential hazards are identified and addressed proactively. Education and training initiatives may contribute to achieving this goal. Roadside responders can develop a more acute awareness of these situations by providing clear definitions and real-world examples of near-miss incidents.

Perception and Frequency of Near-Miss Incidents

As learned from the interviews, responders echoed that they often do not give enough attention to near-miss incidents. Responders often move on to their respective duties immediately, even after experiencing near-miss incidents. This could be because responders consider near misses to be part of their job or because they do not have a lot of downtime to sit and analyze these near misses. That is, they must attend to duties immediately after finishing their ongoing call. Further, responders stated that near misses occur daily (much worse during days with bad weather), making it difficult to pay attention. A few participants said that almost 75 to 90 percent of calls on highways have near misses. A few participants said they would end up with a lot of near-miss incidents data at the end of the year, if every near miss was reported.

"There's a chance that you could be struck because your office is the roadside. That's where your desk is—literally the shoulder of the road. So that's an inherent danger that you gotta automatically know up front that it could happen to you."

"Near misses are an everyday occurrence. They have no attention value other than debriefing with the employees or during drivers' interaction."

"Near-miss incidents, or just about every time you go on the highway on the freeway. It's just an everyday thing to be hitting cones and stuff like that."

"Nobody cares about near misses."

Most participants stated that it is better to rely on technology to gather near-miss incident data rather than burden responders with additional paperwork. Further, one of

the participants stated that the data collected from self-reporting forms could be erroneous because of the perceptions and emotions involved. To overcome this, a few responders stated that they are already using cameras on incident responder vehicles to track near-miss incidents rather than relying on responders to report the incidents. However, the question arises: who is going to bear the costs associated with the installation of the technologies to record near-miss incidents?

One of the participants recommended using social media platforms to collect near-miss incidents. A participant from the towing industry recommended incorporating a push button to report near-miss incidents in dispatch platforms. A few of the responder agencies reported that they were already using tools to notify motorists (via Waze, Google Maps, etc.) of the presence of a responder vehicle to increase compliance with Slow Down/Move Over laws.

“There is no way to track other than relying on camera footage. If you have camera footage that works a little bit into your favor for near-miss reporting.”

“I could see that the data collected could be erroneous and emotionally driven. Based on what perception is, and not necessarily what actually happens.”

“The only way that we’re going to get the tow operators to tell us is if we gather a lot of information through RAMS, which is the computer system that documents all the tows that we do within the city, including photos and GPS and everything, is if they have a button that they could push, that they’ve had a near miss.”

“Link them to Snapchat, Instagram, Facebook, you’ll get all the data you want. You’ll get more data than you know what to do it.”

Move Over Law Violation and Enforcement

Many participants expressed concerns about motorists’ compliance with Move Over laws. Similarly, the participants expressed frustration that Move Over laws are not enforced enough to change the motorists’ perceptions and behavior. At the same time, the law enforcement officers stated that legislation is often written vaguely, which makes it difficult to enforce. Further, another participant said that they usually do not have multiple parties at the incident/traffic-stop site to enforce the Move Over laws (i.e., they would have to stop everything and chase the violator to enforce the law, which is impractical).

“Our motorists are really bad at the Move Over law. They just don’t take [it] into consideration. We’ll have 3 or 4 troopers behind us and they still come right into our lane, and don’t even slow down so, or even try to move over.”

“The downfall to Move Over laws is, [they are] not being enforced. It’s all around the United States. It’s not being enforced by law enforcement.”

“The way the laws are written. It’s very tough to get somebody to get a conviction on that, because part of the law is written that the vehicle only has to slow down.”

The challenges and concerns raised by participants regarding motorists’ compliance with Move Over laws and the difficulties in enforcement might help explain why near-miss incidents are prevalent among roadside responders. When drivers fail to adhere to Move Over statutes and engage in risky behavior around emergency vehicles and personnel, the likelihood of near-miss incidents increases. These near-miss incidents serve as a warning sign of the dangers roadside responders face on the road and underscore the importance of addressing compliance and enforcement issues to ensure their safety.

Personally Identifiable Information

The viewpoints regarding anonymity in reporting near-miss incidents varied among the participants in the focus group meetings. While some emphasized the importance of remaining anonymous when reporting such incidents, others expressed the belief that anonymity may not be as crucial.

“As far as personal information, I don’t see a problem with reporting it.”

The contrasting perspectives on anonymity in reporting near-miss incidents suggest the need to offer flexibility regarding PII in near-miss reporting. Some individuals prioritize confidentiality due to concerns about potential repercussions or privacy breaches, while others may not find anonymity essential. Making the inclusion of PII an optional feature in reporting might be a viable solution, allowing individuals to choose whether to remain anonymous or provide personal information based on their comfort levels and the specific circumstances surrounding the incident.

Safety Culture

Most participants said they would encourage their peers and subordinates to talk about near-miss incidents.

“We encourage reporting to us. They are not blamed because we need to keep them safe.”

“I guess you kind of call it water cooler talk.”

“We encourage our drivers definitely to report everything.”

The conversations regarding near-miss incidents were often reported as being more casual than formal. One of the participants stated that their agency still looks at the incidents as punitive measures, a perspective they are trying to change. Notably, a participant shared the success of an educational campaign that shifted employees' perceptions regarding near-miss reporting. This change in perspective was further reinforced by the use of reported data to generate monthly reports, which garnered high regard among responders. The recognition and value placed on their contributions played a pivotal role in motivating them to report near-miss incidents. This demonstrates that creating a supportive and informative environment can significantly encourage near-miss reporting, contributing to improved safety practices within the responder community.

Challenges of Near-Miss Reporting

Some tow truck responders raised concerns about reporting near misses as the information could be used against them; specifically, there were concerns about increased worker compensation insurance costs. Protecting data from legal discovery could encourage participants to report near-miss incidents, as the near-miss data could not be used in lawsuits. One supervisor stated that many of their employees are not tech-savvy, and reporting near-miss incidents is a burden for such responders: having user-friendly reporting systems is vital in making responders report near-miss incidents.

“The major issue is, once they report [anything] we document it. There is no place for it to go. And the fear is with the insurance companies. If we gather information for them, it’s gonna show that we’re on a higher risk area, with fears for higher insurance premiums, which is the last thing we need already.”

“The problem with reporting that information is that the United States is a very litigious society today, and a lot of people will look to lawyers to win the lottery so that they can get mega lawsuits and mega windfalls.”

“I would definitely like it not to be used against the towing companies or the drivers for insurance reasons.”

“My guys are not tech friendly at all. They barely can check their email. So, for them to do that is more work than they really want to do.”

Responders from fire/EMS stated that they volunteer for their respective duties, and any additional paperwork in the form of a near-miss system will have a lot of resistance.

“I do feel for a hundred percent volunteer organization like mine, I think it would probably be like a little bit of a hindrance to getting people to join once they realize that there’s more paperwork involved than you anticipated.”

Further, almost all participants stated that reporting near misses is an additional burden to the responders. In addition, some participants stated that they do not have the liberty to spend time reporting near misses as they continue to respond to calls. However, with proper education, training, and the use of technology, this perception could be changed.

“We just don’t have the staffing for it, where you can take that time to sit there and fill out a 5 min[ute] form.”

One of the participants recommended that standardization is critical to the success of a near-miss system: defining and standardizing what a near miss is, making sure that responders understand the benefits of reporting near misses, and finally, collecting the data the same way everywhere. The rest of the participants from that meeting agreed with these recommendations. Further, another participant stated that integrating near-miss systems into an existing work-related system would get more buy-in from the responders than creating a new system altogether.

Technologies to Facilitate Near-Miss Reporting

Given comments concerning the additional burden of reporting, the focus group discussions also considered the exploration of advanced technologies to streamline near-miss reporting. Specifically, participants discussed technologies such as camera-based and LiDAR sensing systems to facilitate near-miss reporting. The majority of participants agreed that these technological solutions held substantial promise and could bring about considerable benefits in enhancing the efficiency and effectiveness of near-miss reporting.

“I think the technology would be more beneficial. Give the driver a reminder that they’re coming upon something that they’re going to be too close to.”

“... the technology that they put on cars, and it does that by LiDAR. It indicates the speed and the distance, and so on. And they were trying to implement it down here for civil violations.”

“My company has got to the point, because we’ve had several very close calls within the past 2 years. All of our trucks now are equipped with 9 cameras. We have multiple cameras pointing out front multiple cameras pointing out back. But our newest addition is we have cameras on the sides of the truck.”

Participants also shared insights about the challenges associated with deploying these technologies. Some towing or small agencies expressed concerns about the costs of implementing camera-based or Lidar sensing systems in their vehicles, particularly how it might impact their insurance rates and overall expenses. The financial burden of adopting such technology, especially for smaller departments with constrained budgets,

was a recurring theme, as competing priorities and economic constraints could deter their widespread adoption. Legislative restrictions, such as limitations on installing cameras in their vehicles, posed additional hurdles. Moreover, participants raised questions about how these technologies would function, be installed, and integrated effectively into their operations.

“But it’s gonna be a very big challenge. And to figure out how it can be used in order to track, to record, and to identify a near-miss incident.”

“Our legislators will not allow us to have cameras in our vehicles.”

“People talk about while you put cameras in your truck. It’ll blow your insurance rates, though. They went up \$60,000 with no claims. Who’s gonna afford that? I mean, tow truck costs [are] going up exponentially in the past 5 years, and there’s no end in sight. Manufacturers are reporting record profits. We can get into a whole economic conversation. But again, who would afford something like that. How would it work? How would it be installed on the vehicles? etc.?”

“Unless it’s mandated, you’re gonna have a really hard time with that adoption of that technology in the smaller departments.”

While advanced technologies hold great promise in capturing near misses, participants highlighted the financial and regulatory obstacles that must be overcome to achieve widespread adoption. These challenges underscore the need for comprehensive solutions that address the specific concerns of different agencies and promote the successful integration of technology into near-miss reporting.

Benefits of Near-Miss Reporting

Almost all participants agreed that near-miss data is needed to learn from mistakes, to back any legislation bills, and other initiatives. One participant cited an example of how near-miss data could bolster legislation related to Slow Down/Move Over laws, emphasizing the need for data-driven arguments to effect change.

“We have a Slow Down/Move Over law and it’s broken every single day. We went to our legislative people this year to [state] that you had to slow down at least 20 miles an hour, and they said that [this change] would be an undue hardship on the general public because we had no data to support that concerning near misses.”

“Hopefully, we can get the near-miss data to the legislators so they can make some changes at that level to protect us out on the road.”

Several participants also emphasized educating responders about the tangible benefits of collecting near-miss data. They stressed that conveying that this data serves a

purpose, particularly in safeguarding their own lives, could be a powerful motivator for increased participation.

“If you give that message to them that they’re doing it for a purpose, particularly saving their own lives. Then I think you’d have a lot of participation.”

Publicity of Reporting Systems

When participants were questioned about their awareness of existing near-miss reporting systems during the focus group meetings, the majority were unfamiliar with ones relevant to their fields, such as LEO Near Miss for law enforcement officers, Fire Near Miss for firefighters, and Towing Traffic Incident Reporting System for towing and roadside services. This raises a critical issue regarding better communication and education within the roadside responder community. To address this issue, participants were solicited for their recommendations on enhancing awareness and effectively promoting near-miss reporting systems. Their suggestions encompassed a range of tools and strategies:

- Leveraging the reach and influence of local or state associations
- Harnessing the power of social media platforms to disseminate information
- Engaging in special events like Tow Shows to reach tow truck operators and owners directly
- Utilizing magazines as a platform for publishing informative articles
- Integrating near-miss reporting into the curriculum and continued education programs
- Conducting specialized training sessions to equip responders with the necessary knowledge and tools
- Creating engaging and informative videos to convey the importance of near-miss reporting
- Active participation in conferences and industry events to raise awareness and foster discussions

Furthermore, it is worth noting that participants expressed a consensus regarding the need to extend this awareness beyond the roadside responder community to include motorists.

“I think public awareness needs to be there too.”

The emphasis on public awareness campaigns regarding the importance of moving over or slowing down when encountering emergency vehicles was a common theme, reflecting the participants’ perspective that road safety is shared among all road users.

Summary

Drawing upon insights acquired through interviews with administrators and managers of emergency response agencies, focusing on the agency-level perspective, focus group meetings were conducted to understand how individual roadside responders perceive and participate in the near-miss reporting process at the individual level. These meetings aimed to uncover individual roadside responders' challenges, perceptions, and attitudes toward near-miss reporting. The findings shed light on various aspects influencing near-miss reporting practices, including definitions of near-miss incidents, safety culture, concerns and challenges of near-miss reporting, technology adoption, and the awareness of reporting systems. The key takeaways from these meetings are summarized in the following points:

- The definitions of “near miss” among focus group participants varied significantly. To allow standardized data collection of near misses, it is recommended that the near-miss systems should clearly define the near misses early in the reporting system.
- As heard in the previous interviews, focus group meeting participants echoed that they do not give enough attention to the near-miss incidents, often viewing them as part of their job.
- Concerns were raised about motorists' compliance with Move Over laws, and participants expressed frustration at the lack of enforcement. Participants highlighted challenges in enforcing these laws, citing vague legislation and operational constraints.
- Some participants said it would not matter if the near-miss system collects PII, while others said that excluding it might help encourage people to use the near-miss system more freely without the fear of repercussions. Flexibility in PII collection was recommended to accommodate those who prioritize confidentiality.
- Most participants encouraged a positive safety culture within their organizations, emphasizing the need for open discussions about near-miss incidents. Some participants highlighted successful initiatives that shifted employees' perceptions regarding reporting.
- Participants shared their concerns about near-miss reporting. Many participants were afraid that the near-miss data could be used against them. Other concerns include insurance costs, legal implications, and the perception of reporting as burdensome.
- Participants discussed the potential use of advanced technologies, such as camera-based and LiDAR sensing systems, to streamline or complement near-miss reporting. While acknowledging the benefits, they raised concerns about costs, regulations, and implementation challenges.
- The majority of participants were unaware of existing near-miss reporting systems, highlighting the need for better communication and education within

the roadside responder community. They suggested leveraging associations, social media, events, magazines, training, and public awareness campaigns to enhance awareness.

- Participants recognized the value of near-miss data for learning from mistakes, supporting legislation, and improving safety. They emphasized the need to educate responders about the tangible benefits of collecting near-miss data; these benefits should be explored and substantiated through the use of clear and compelling demonstrations.

The focus groups provided valuable insights for enhancing near-miss reporting practices among roadside responders. Steps can be taken to encourage increased reporting by acknowledging the variations in perception and understanding of near-miss incidents, implementing clear and standardized definitions in reporting systems, and fostering a culture of openness and safety. Moreover, the potential integration of advanced technologies, while addressing associated concerns, may streamline the reporting process and ensure more comprehensive data collection. Finally, improving awareness and education within responder circles and among the general public can further contribute to a safer working environment for these dedicated professionals.

NATIONAL SURVEY

Based on insights from interviews and focus groups, a national survey was conducted to obtain a broader perspective from a wider sample of roadside responders across the country. This survey was conducted in collaboration with the Towing and Recovery Association of America (TRAA) (TRAA, n.d.) and the Emergency Responder Safety Institute (ERSI) (ERSI, n.d.[c]). In total, over 1,300 respondents completed the majority of questions.

Survey Design

The survey development process began with an initial draft set of survey questions, drawing from insights gained through interviews and focus groups conducted in earlier project phases. After an iterative process, the final survey contained five major sections:

1. **Working Experience.** Respondents were asked about their organization type (fire, towing and recovery, law enforcement, EMS, DOT or other), agency size, and their primary role/duty within their agency (manager/administrator, employee/technician, owner, other).
2. **Incident Reporting Experience.** This section focused on respondents' experience with incident reporting. Topics included near-miss incidents experience, training background, existing policies or guidelines related to near-miss incident reporting within their organizations, agencies' attitudes toward near-miss incidents, approach to near-miss reporting, and the frequency of reporting near-miss incidents.
3. **Attitudes Toward Near-Miss Reporting.** Respondents were asked about their motivations and concerns regarding near-miss reporting. They were also asked whether they perceive near-miss incidents as just a routine part of their job or something that requires reporting.
4. **Near-Miss System Design.** This section sought respondents' input and preferences about near-miss system design. Topics included preferences for mobile- or computer-based reporting systems, interest in automatic near-miss detection and other advanced technologies, and preferences regarding the timing of near-miss incident reporting.
5. **Demographic Information.** The final section collected demographic information of roadside responders, including age group, gender, race, education level, employment status, working experience, and state of residence.

Table 12 presents some example survey questions. The complete questionnaire is available in Appendix A.

Table 12. Selected survey questions.

Item	Questions	Scale or Response Options
Section 1: Work Experience		
Organization	In which type of organization are you employed? If you are retired, please select the organization type that applied before retirement.	<ul style="list-style-type: none"> • Law enforcement • Paramedics/Private EMS • Fire • Towing & Recovery • DOT, Highway Dept., or Public Works • Other, please specify:
Primary role	What is your primary role within your department or organization? If you are retired, please select the role that applied before retirement.	<ul style="list-style-type: none"> • Owner • Manager or Supervisor • Employee/Technician • Other, please specify
Section 2: Incident Reporting Experience		
Near-miss reporting policies	Are there any policies or guidelines within your workplace/department/agency that require you to report near-miss incidents?	<ul style="list-style-type: none"> • Yes • No • Not sure
Near-miss reporting frequency	If you report near-miss incidents, how frequently do you do so?	<ul style="list-style-type: none"> • I report every incident • I usually report incidents • I often report incidents • I sometimes report incidents • I rarely report incidents • I do not ever report incidents • Prefer not to say
Section 3: Near-Miss Reporting Attitude		
Near-miss reporting improves safety	Do you believe reporting near-miss incidents can improve safety practices?	<ul style="list-style-type: none"> • Yes • No • Not sure • Prefer not to say
Concern of reporting	<p>How concerned are you about reporting near-miss incidents in your work?</p> <p>(a) Potential misuse of near-miss data</p> <p>(b) Potential insurance impacts related to reporting</p> <p>(c) Potential legal consequences related to reporting</p> <p>(d) Other, please specify:</p>	Please rate each concern on a scale of 1 to 5, where 1 is "Not concerned at all," and 5 is "Extremely concerned."

Section 4: Reporting System Design

Reporting platform	Would you prefer a mobile-based or a computer-based platform for reporting near-miss incidents?	<ul style="list-style-type: none">• Mobile-based (e.g., phone app)• Computer-based (e.g., built-in form or a web-based platform)• Either, I am comfortable with both options• No preference
Timing of near-miss reporting	Regarding the timing of near-miss incident reporting, what is your favorite approach?	<ul style="list-style-type: none">• Immediate reporting after the incident• Delayed reporting at a more convenient time• A brief initial report followed by a detailed one later• No preference

Data Collection

The survey was conducted via Qualtrics. ERSI and TRAA assisted in distributing the survey links within their respective networks. ERSI reaches nearly 70,000 active emergency responder members nationwide and TRAA reaches over 700 companies and state towing associations. Participants were given the option to skip questions they were not comfortable answering, except for the required informed consent section. The survey was rolled out in early March 2024 and garnered a total of 3,011 responses by April 9, 2024. Measures were implemented to prevent multiple submissions from the same IP address prior to the survey's launch on the Qualtrics platform. Approval from the University of Alabama IRB was obtained.

Data Analysis Methods

To ensure the accuracy and reliability of the survey data, rigorous error-checking and data cleaning procedures were implemented before data analysis. The following steps were taken to clean the data:

- Participants who completed the survey in under three minutes were excluded from the dataset, as such short completion times may indicate rushed, incomplete responses, or suspected bots.
- Observations with zip codes that did not correspond with their identified working state were eliminated from the dataset to maintain geographical accuracy.
- Participants who either did not provide a zip code or provided a zip code that did not correspond with U.S. format, were identified and marked for exclusion from the final analysis.
- Participants who did not provide any location information were removed from the dataset, as their authenticity could not be verified.

- Only participants who completed at least 80% of the survey questions (excluding open-ended questions) were retained for analysis, ensuring data completeness and reliability.
- Observations with missing values for questions that did not offer the option of “Prefer not to say” were excluded from the dataset to minimize bias and maintain data integrity.
- For modeling purposes, participants who did not provide any useful information for the target questions were excluded from the analysis, ensuring the relevance and accuracy of the predictive model.

After data cleaning, 1,312 samples were kept for the descriptive analysis. For modeling purposes, further data cleaning steps were required, including keeping complete information for all variables involved in the modeling process. In total, 1,243 samples were used for statistical modeling. The binary logistic model was developed to explore the correlates of responses to the question: “*If you report near-miss incidents, how frequently do you do so?*” This Near-Miss Reporting Frequency Model aimed to identify the factors that influence the frequency with which individuals report near-miss incidents, thus providing insights into reporting behavior and potential areas for improvement in incident reporting systems.

For modeling purposes, some variables were re-coded. For example, each variable intended for use in building the model was re-coded as a categorical variable, based on the response options and their distribution. For example, due to the highly imbalanced distribution of responses to the race question, the variable for race was re-coded into a binary variable with two categories: Caucasian and non-Caucasian. Similarly, the near-miss reporting frequency variable was re-coded as a binary variable based on the question design and the distribution of responses. The categories were defined as “Frequently” (combining response options “I report every incident”, “I usually report incidents”, and “I often report incidents”) and “Not frequently” (including response options “I sometimes report incidents,” “I rarely report incidents,” and “I do not ever report incidents”).

Descriptive Analysis

Descriptive statistics were summarized for responses to key questions using distribution tables, simple graphics, and contingency tables. In addition, chi-square (χ^2) tests were conducted to assess similarities and differences in the distribution of variables related to incident reporting experience, near-miss reporting attitude, and reporting system design across different organizations and across different roles within the organization. It is important to note that the reliability of chi-square test results may be compromised if the value in the contingency table falls below five. To address this issue, categories were appropriately re-grouped to avoid occurrences where the value is lower than five. This processing step was implemented solely for statistical testing purposes,

ensuring the validity and reliability of the analysis conducted. The results from the chi-square analyses are included in Appendix B.

Sample Characteristics

Table 13 summarizes the demographics of the participants after data cleaning (number of observations = 1,312), including age, gender, race, education level, working experience, and employment status. More than half of the participants were between 45 and 64 years old (53.3%), and the majority of participants were male (85.6%) and Caucasian (84.3%). More than 46% of participants had some college education or held an associate degree, and 38% held a bachelor’s or higher degrees. The majority of the participants (54.6%) had over 20 years of working experience and 19.6% of participants had 11 to 20 years of experience.

Table 13. Descriptive statistics of responders’ basic information (N = 1,312)

Item	Category	Frequency	Percentage
Age (years old)	< 18	4	0.3%
	18–24	29	2.2%
	25–34	133	10.1%
	35–44	224	17.1%
	45–54	345	26.3%
	55–64	354	27.0%
	> 64	213	16.2%
	Prefer not to say	10	0.8%
Gender	Male	1123	85.6%
	Female	168	12.8%
	Other/Unknown	21	1.6%
Education level	Less than a High School Graduate	6	0.5%
	High School Graduate or equivalent	195	14.9%
	Some college or associate degree	611	46.6%
	Bachelor’s degree	341	26.0%
	Master’s degree or higher	150	11.4%
	Prefer not to say	9	0.7%

Item	Category	Frequency	Percentage
Race	African American	17	1.3%
	Asian	10	0.8%
	Caucasian	1106	84.3%
	Latino or Hispanic	37	2.8%
	Native American	17	1.3%
	Native Hawaiian or Pacific Islander	4	0.3%
	Multi-Race	57	4.3%
	Other/Unknown	16	1.2%
	Prefer not to say	48	3.7%
Working experience	Less than 1 year	21	1.6%
	1–5 years	154	11.7%
	6–10 years	151	11.5%
	11–20 years	257	19.6%
	More than 20 years	716	54.6%
	Prefer not to say	13	1.0%
Employment	Currently employed full-time	823	62.7%
	Currently employed part-time	89	6.8%
	Retired but employed full-time	60	4.6%
	Retired but employed part-time	132	10.1%
	Retired and not working	84	6.4%
	Others	124	9.5%

Figure 11 shows the distribution of the agencies from which the participants were drawn. The majority of participants (55.1%) worked for fire departments or related organizations. Around 10% of participants were from each of the following sectors: towing and recovery, EMS, and law enforcement. Roughly 9% of participants selected “Other” as their organization type, with most of them working for multiple agencies. About 90% of participants worked for organizations with at least ten employees, and of those, 40% worked for organizations with more than 50 employees. In terms of job titles or roles, 37.6% of participants were employees or technicians, and 38.6% were managers or supervisors. Less than 100 participants (7.1%) reported being the owner of their organization. Besides, over 15% of participants selected “Other” when asked about their primary role with many identifying themselves as volunteers.

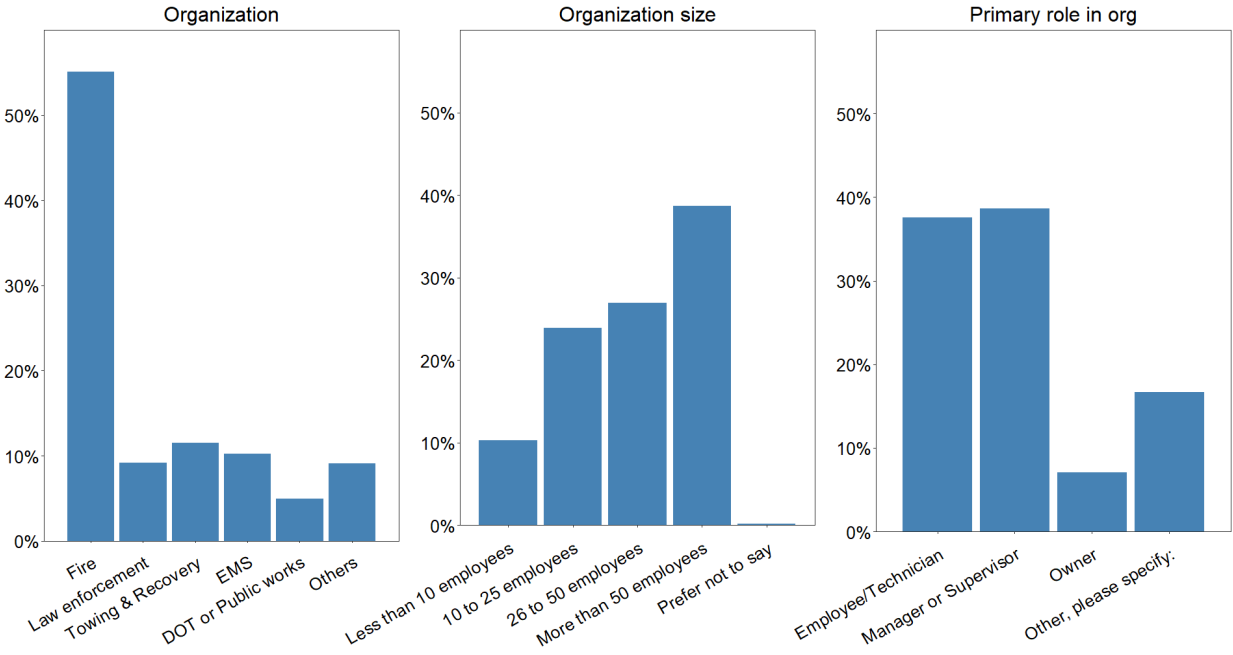
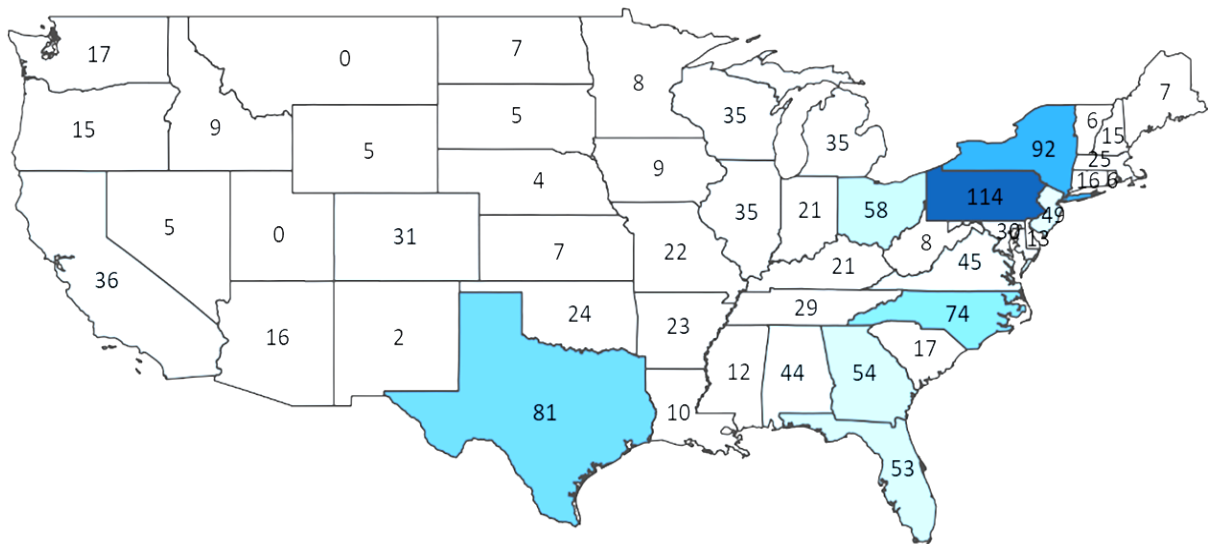


Figure 11. Distributions of organization type, size, and primary role.

Figure 12 visualizes the geographical distribution of survey participants by their state of residence. Except for Utah and Montana, all states and Washington D.C. were represented in the survey. More than half of the participants were from Pennsylvania, New York, Texas, North Carolina, Ohio, Georgia, Florida, New Jersey, and Alabama.



AK: 9, HI: 6, and DC: 2

Figure 12. Spatial distribution of survey samples.

Survey Outcomes

Frequency of Near Misses

Overall, 260 participants (19.8%) reported experiencing near-miss incidents at least every week, 284 participants (21.7%) reported experiencing near-miss incidents a few times a month, 496 participants (37.8%) reported experiencing near-miss incidents several times a year, and 272 (21%) reported only experiencing near misses once a year or never.

As shown in Figure 13, the distributions of near-miss experience frequency vary significantly depending on the type of organization. A significantly larger number of participants from towing and recovery organizations reported experiencing near-miss incidents every day (29.1%) or every week (26.5%) compared to participants from other agencies (Figure 13). About one-fifth of participants working for a DOT or public works organization also reported experiencing near-miss incidents every day. Many law enforcement participants indicated that they experience near-miss incidents several times a year (30.0%) or even a few times a month (21.8%). More than half of EMS and fire personnel reported experiencing near-miss incidents several times a year or less. The chi-square test results for all significant effects are shown in Appendix B.

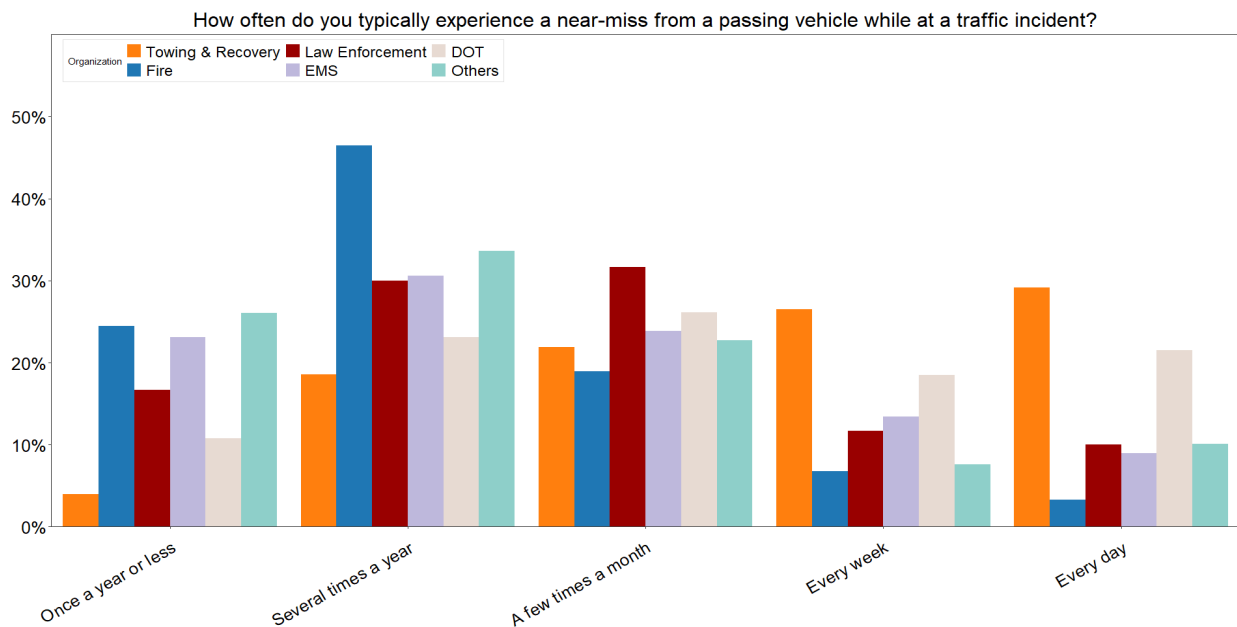


Figure 13. How often do you typically experience a near miss from a passing vehicle while at a traffic incident? Comparison by organizations.

Similarly, as shown in Figure 14, the near-miss experience frequency varied significantly across participants' primary roles. Notably, over half of the owners (52.7%) reported experiencing near-miss incidents at least every week, likely because the

majority (90.3%) are from towing and recovery organizations. In contrast, the near-miss experiences for participants in other roles was more aligned.

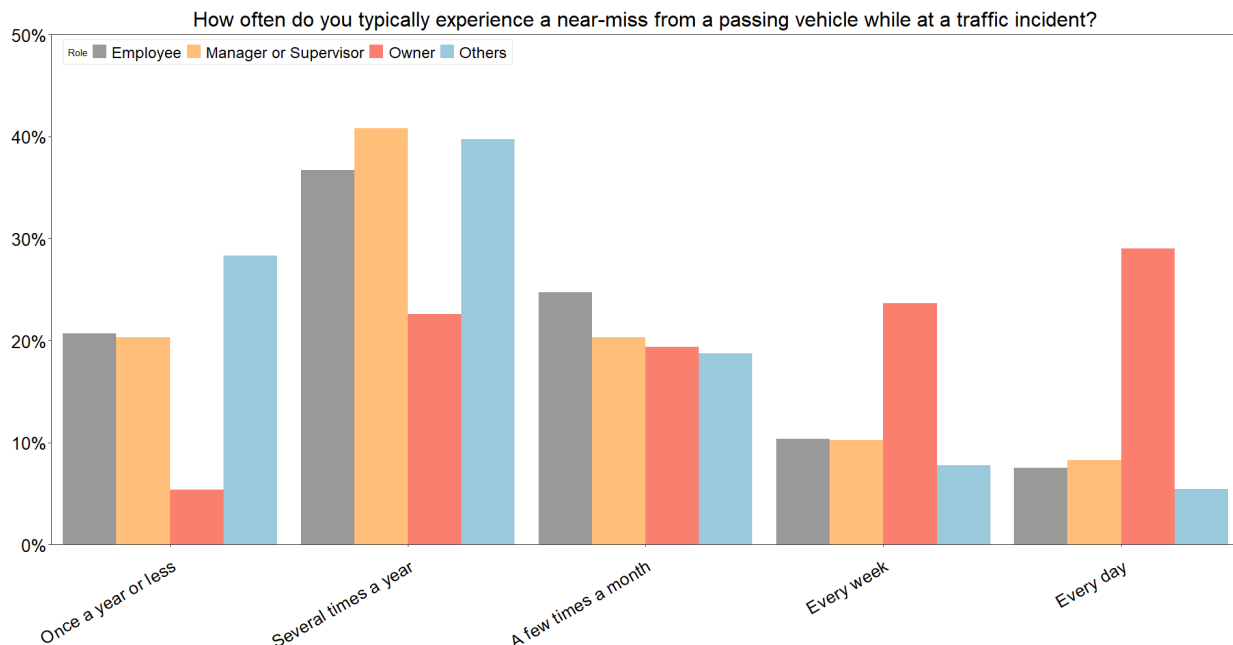


Figure 14. How often do you typically experience a near miss from a passing vehicle while at a traffic incident? Comparison by primary roles.

Near-Miss Incident Report Training

Responders were asked about their training experience. Overall, more than 40% of participants indicated that they had attended training that included information about near-miss or struck-by incident reporting. About 7% of participants reported receiving training on incident reporting, but it was unclear whether the training distinguished between struck-by and near-miss incident reporting. Moreover, 34.5% of participants stated that they had not attended any training related to near-miss or struck-by incident reporting, and around 13% could not recall if they had attended such training.

As shown in Figures 15, compared to other organizations, participants from towing and recovery had the highest percentage (42%) of individuals not receiving any training on incident reporting. On the other hand, DOT participants had the highest percentage, with nearly 60% receiving training specifically on near-miss or struck-by reporting. These findings suggest that towing and recovery organizations may need more targeted training on incident reporting.

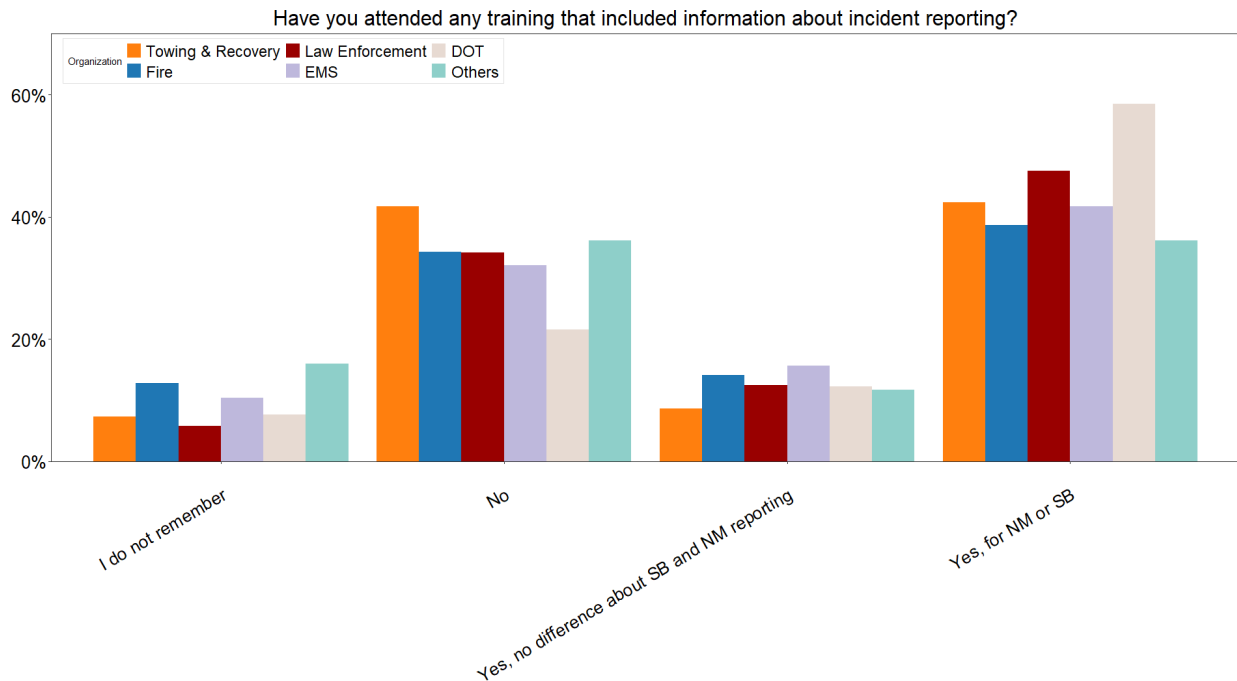


Figure 15. Have you attended any training that included information about incident reporting? Comparison by organizations. (NM = near miss; SB = struck by)

When comparing the responses by participants' primary roles (Figure 16), it appears that owners have the highest percentage (around 50%) of *not* receiving training on incident reporting. This finding aligns with the earlier observation that towing and recovery participants need more training, as many of these owners are likely from towing and recovery organizations. This suggests that targeted training programs should be developed to address the specific needs of owners, particularly in the towing and recovery sector, to improve incident reporting practices.

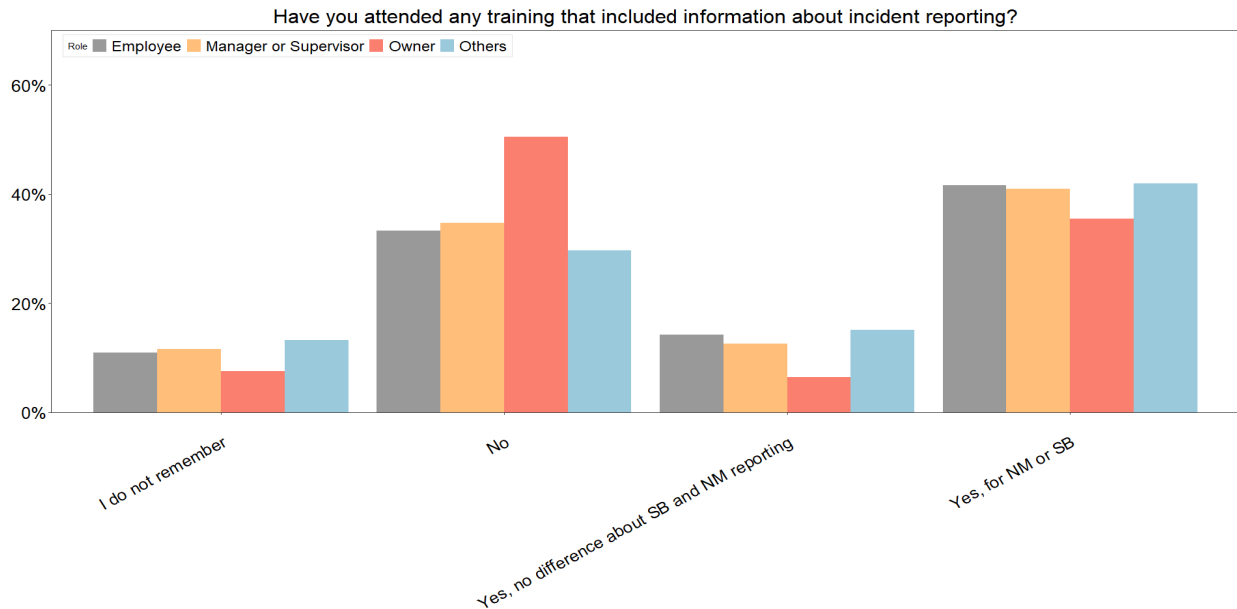


Figure 16. Have you attended any training that included information about incident reporting? Comparison by primary roles. (NM = near miss; SB = struck by)

Workplace Policies on Near-Miss Incident Reporting

Policies or guidelines within responders' workplaces related to near-miss incident reporting play a crucial role in determining whether responders choose to report such incidents. A significant portion of participants (70.3%) stated that they are either unsure or that their workplace, department, or agency does not have policies or guidelines requiring the reporting of near-miss incidents.

Figure 17 illustrates the distribution of responses concerning the presence of policies or guidelines for near-miss incident reporting in responders' workplaces. According to the chi-square test results, there were statistically significant differences across organizations regarding the presence of policies or guidelines that require responders to report near-miss incidents. Over 80% of law enforcement participants indicated that they were unsure or that no such policies or guidelines existed within their department. Similarly, nearly 78% of EMS participants reported the same. For fire, DOT, and towing organizations, less than 70% of participants were unsure or stated that no policies or guidelines were in place for near-miss incident reporting. No statistically significant differences were found when comparing participants by their primary roles.

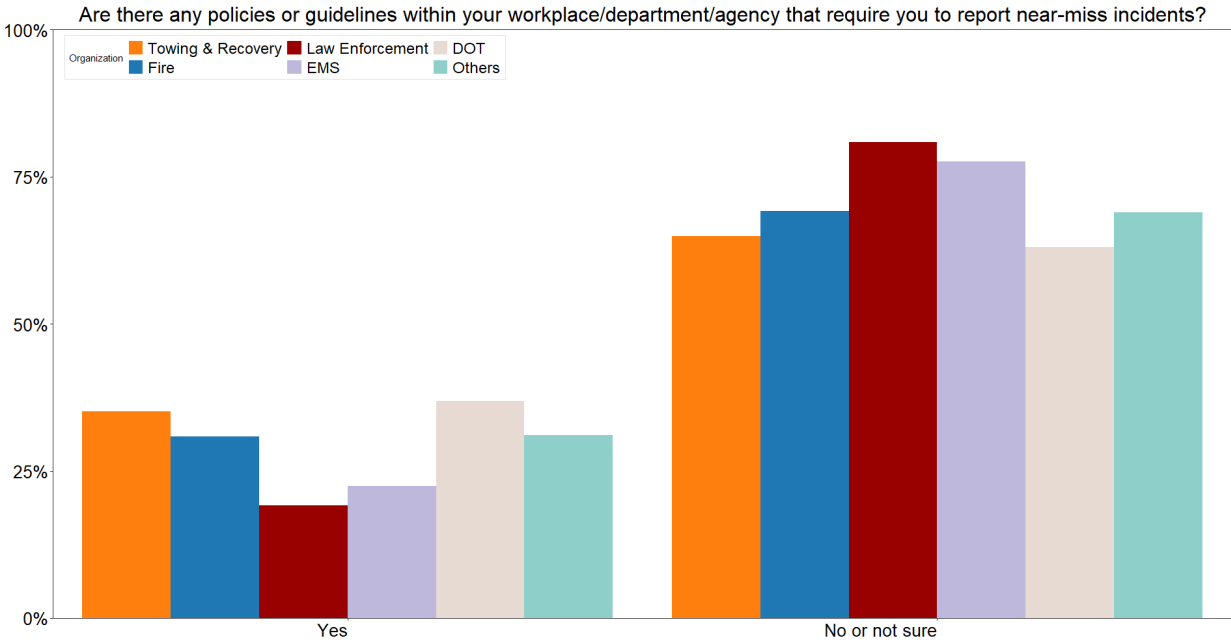


Figure 17. Are there any policies or guidelines within your workplace/department/agency that require you to report near-miss incidents? Comparison by organizations.

Workplace Encouragement of Near-Miss Reporting

Responders were asked whether their workplace/department/agency encouraged them to report near-miss incidents. In general, about half of the participants reported being encouraged to report near misses. Among those participants who were encouraged, the majority were encouraged to report incidents internally. Less than 2% of participants said that they were encouraged to report near-miss incidents externally.

Figures 18 and 19 show the distribution of responses by organization and by job role. More than 60% of towing participants reported being encouraged to report near-miss incidents, while only 26.9% of law enforcement participants said the same.

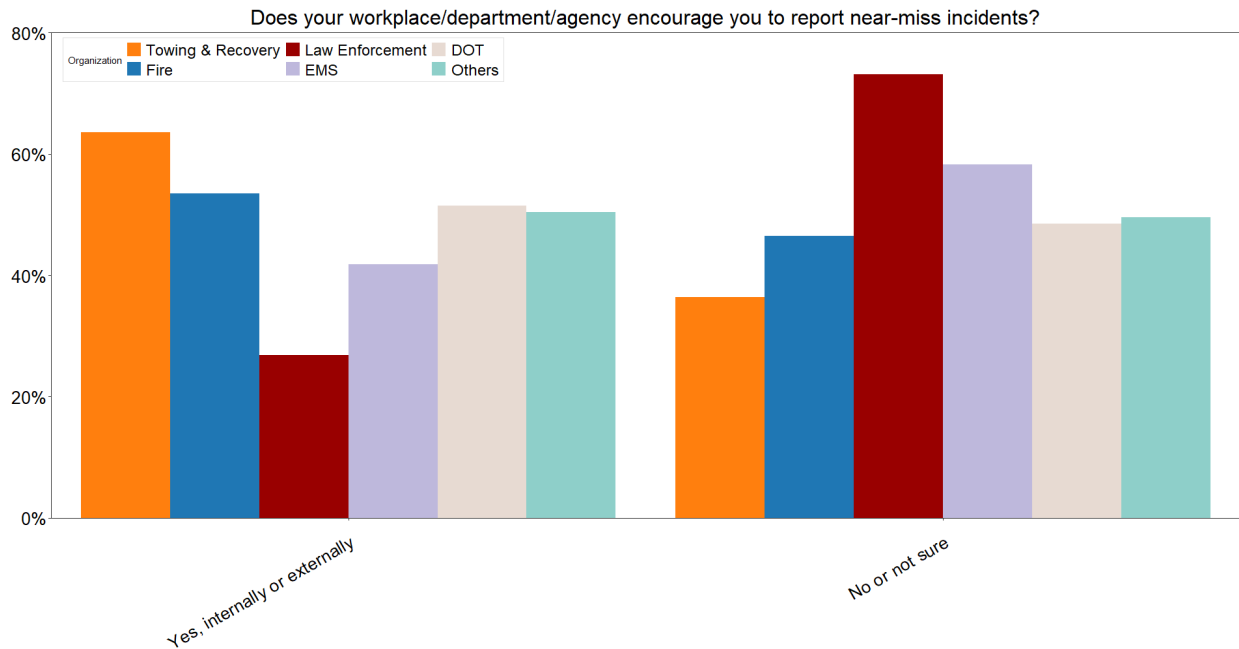


Figure 18. Does your workplace/department/agency encourage you to report near-miss incidents? Comparison by organizations.

Statistically significant differences were also found by primary roles (Figure 19). Nearly 69% of owners indicated that their workplace encourages near-miss reporting, compared to only 43.8% of employees or technicians who reported being instructed or encouraged to do so.

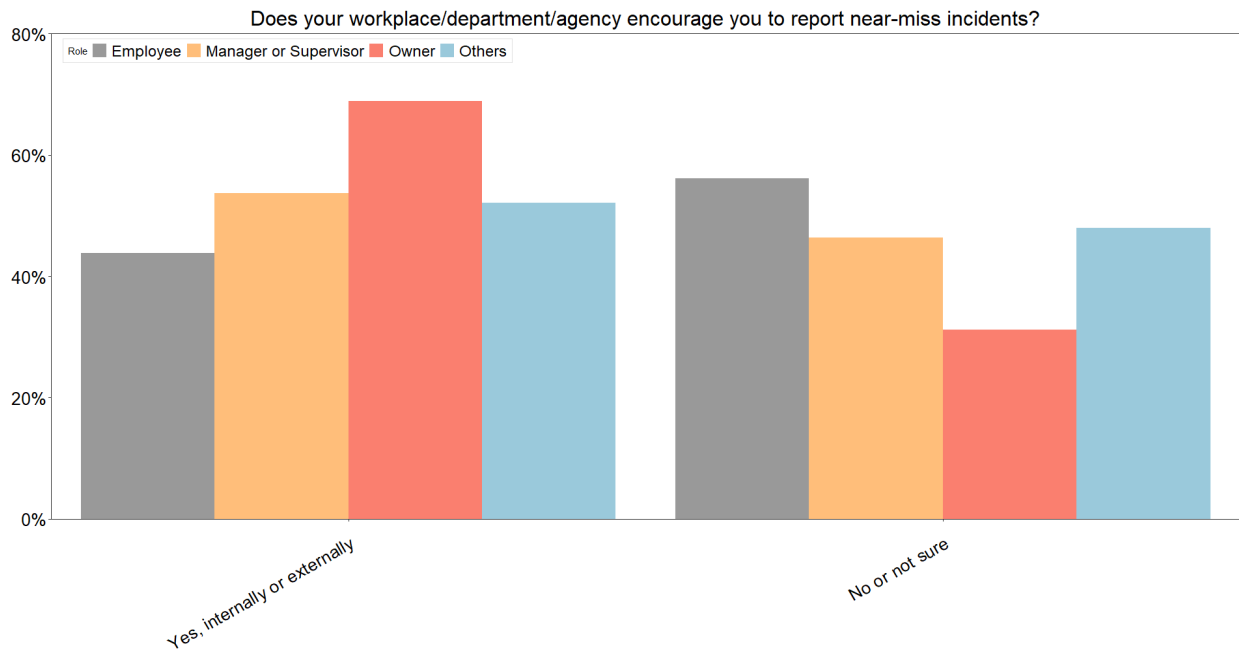


Figure 19. Does your workplace/department/agency encourage you to report near-miss incidents? Comparison by primary roles.

Approach to Near-Miss Reporting

There was variability in how respondents shared or reported information concerning near-miss experiences. The most frequently used approach is informally sharing near-miss incidents with co-workers or friends (29.5%). Other common methods include discussing near-miss incidents in formal settings, such as review or safety meetings (19.7%), and informing supervisors of the incident in passing (21.8%). These three approaches were more commonly used than reporting near-miss incidents through established written procedures, which was used by 15.0% of participants.

Figure 20 shows the differences among organizations in their preferred approaches to near-miss reporting. About 48% of law enforcement respondents and 37% of towing respondents reported sharing information informally with co-workers or friends.

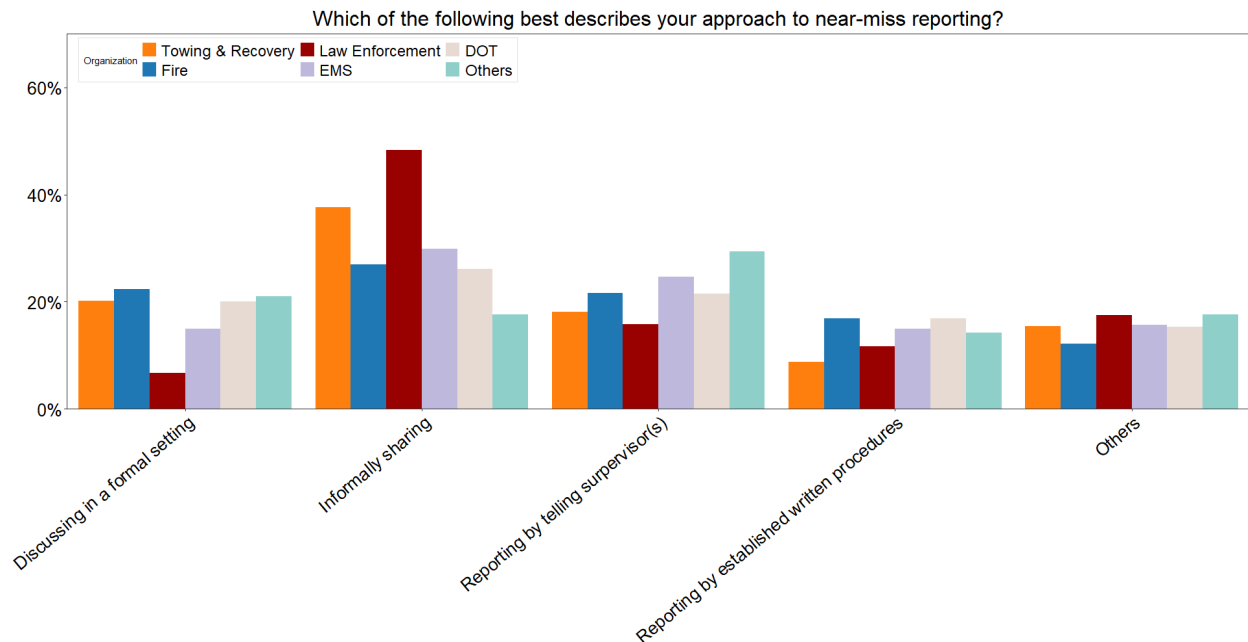


Figure 20. Which of the following best describes your approach to near-miss reporting? Comparison by organizations.

Managers and supervisors (35.3%) and owners (36.6%) are the most likely to share near-miss incident experiences informally with co-workers or friends. However, employees or technicians were less likely to share informally, with only 15.6% adopting this approach; they were more inclined to tell supervisors instead.

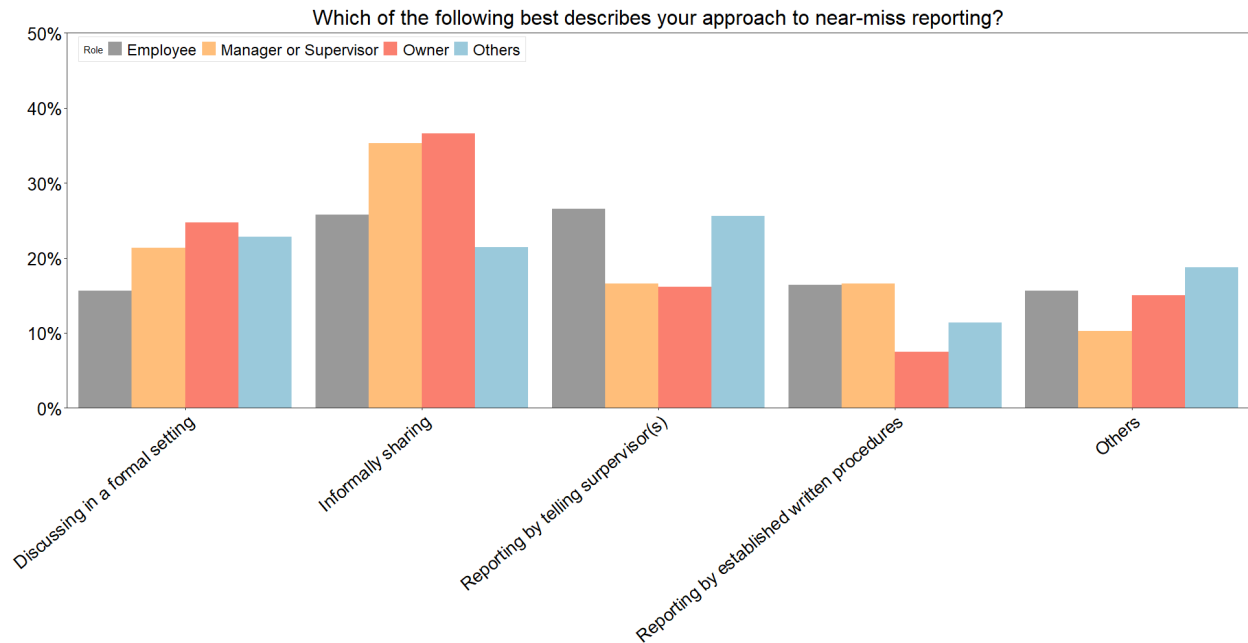


Figure 21. Which of the following best describes your approach to near-miss reporting? Comparison by primary roles.

Frequency of Reporting Near-Miss Incidents

Overall, about 28% of respondents indicated that they report every near-miss incident, 16.8% indicated that they usually report near-miss incidents, while 19.1% stated that they never report them.

As shown in Figure 22, participants from fire (31%) and towing (26.5%) organizations were more likely to report every near-miss incident compared to those from other organizations. Notably, 30.8% of law enforcement participants never reported any near-miss incidents. Respondents from EMS and DOT tended not to report near-miss incidents compared to those from fire and towing organizations.

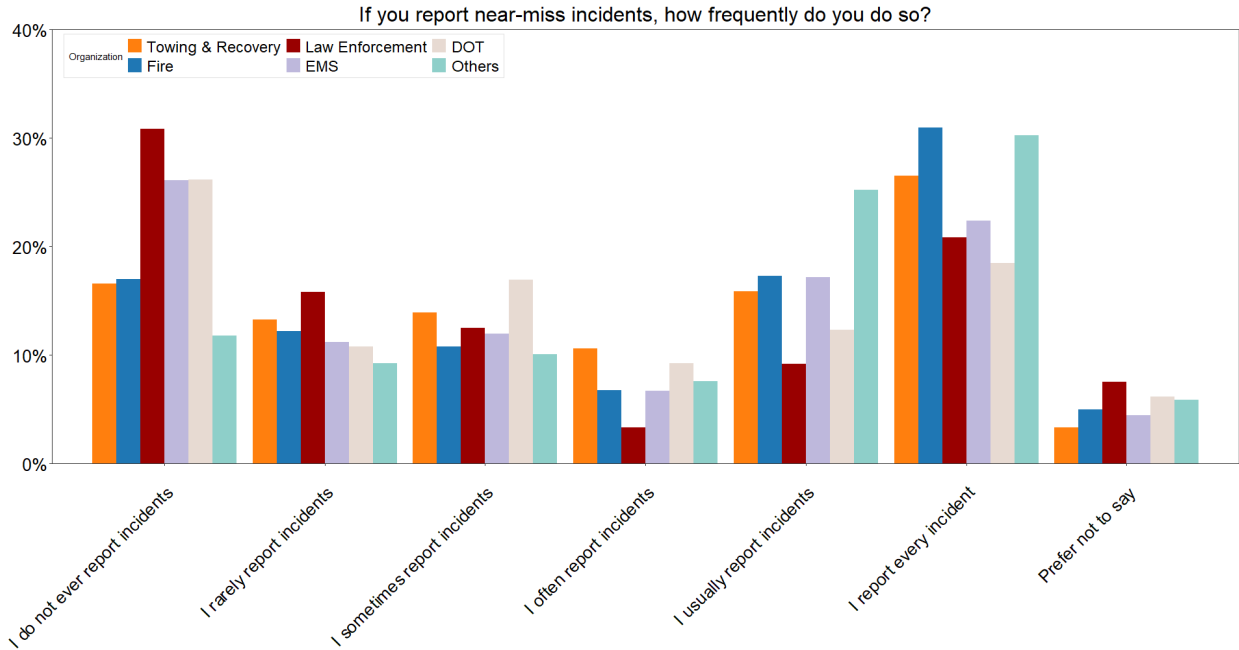


Figure 22. If you report near-miss incidents, how frequently do you do so? Comparison by organizations.

When comparing the responses across primary job roles, marginal differences were found, with owners more likely to report every near-miss incident. These results are shown in Figure 23.

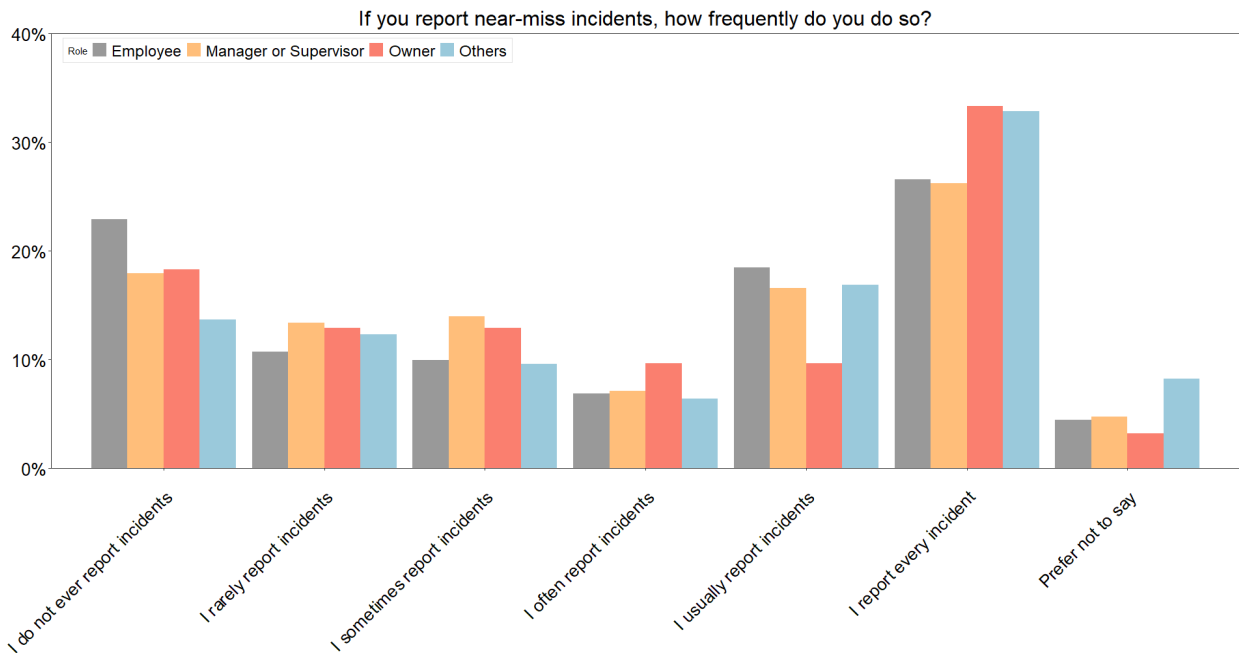


Figure 23. If you report near-miss incidents, how frequently do you do so? Comparison by primary roles.

Normalization of Risk

Responders were asked whether they perceive near-miss incidents as just a routine part of their job rather than something that should be reported. More than half of the participants (55.2%) disagreed with that point of view. About 15% of participants were not sure if near-miss incidents are a routine part of their job; however, there were still 28.5% of participants who considered near misses to be part of their work routine.

As shown in Figure 24, more than 40% of law enforcement and towing participants indicated that they perceive near-miss incidents as a routine part of their job. In contrast, this percentage dropped to around 30% for participants from DOT and EMS organizations. Only 20% of fire department participants agreed that they view near-miss incidents as a routine part of their work.

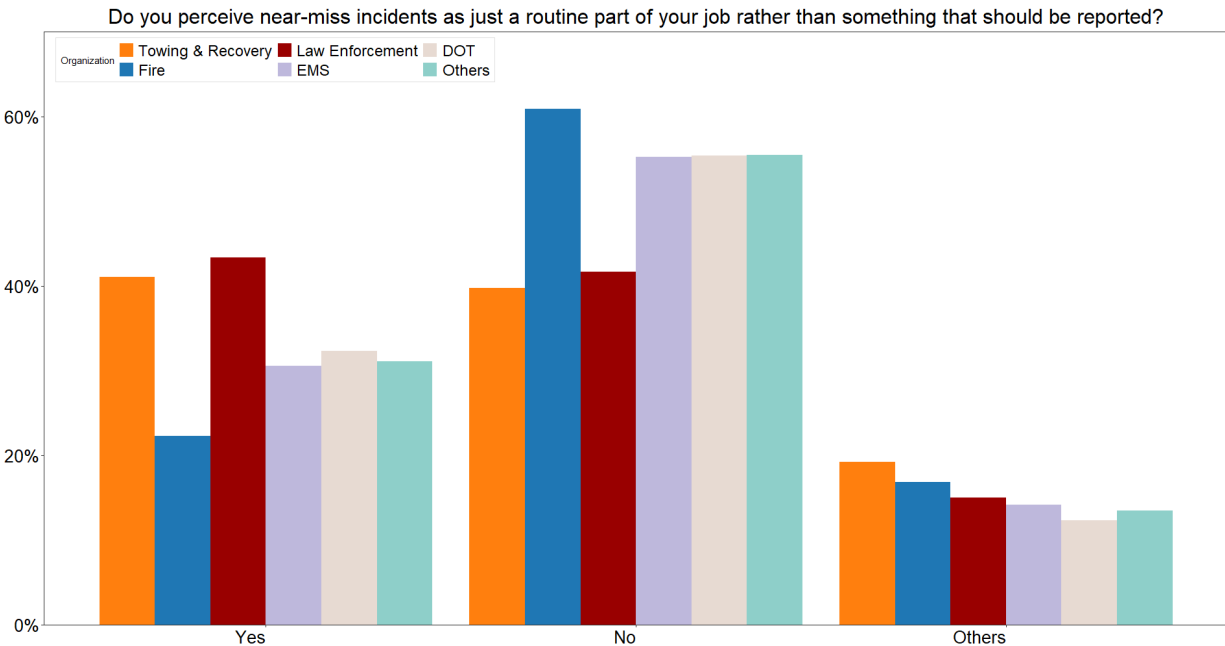


Figure 24. Do you perceive near-miss incidents as just a routine part of your job rather than something that should be reported? Comparison by organizations.

Additionally, 37.6% of owners, 31.8% of employees, and 25.0% of managers perceived near-miss incidents as routine rather than something that should be reported. These results are shown in Figure 25.

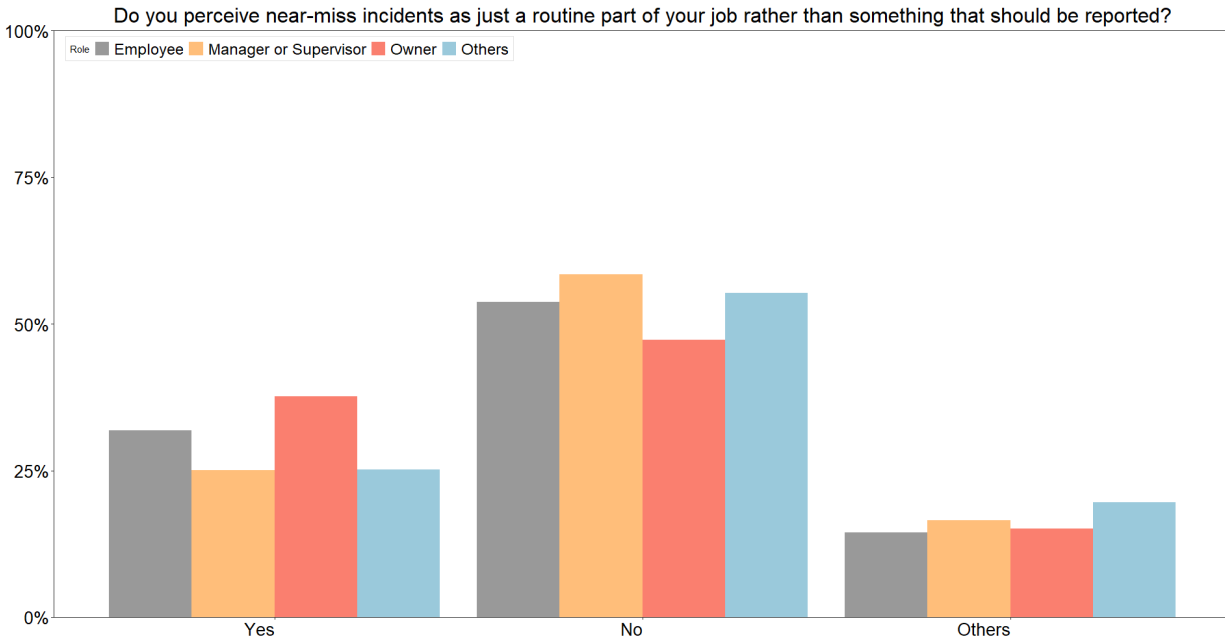


Figure 25. Do you perceive near-miss incidents as just a routine part of your job rather than something that should be reported? Comparison by primary roles.

Attitudes Towards Near-Miss Reporting

Responders were asked for their opinion on whether reporting near-miss incidents can improve safety practices. The majority of participants (85.1%) responded “yes,” while 12.0% were unsure. Figures 26 and 27 illustrate the distribution of opinions by organization. Participants from fire and EMS organizations were more likely to believe that reporting near-miss incidents can improve safety practices, with 88.1% expressing a positive attitude. In contrast, participants from towing and recovery organizations were less likely to agree, with only 68.9% showing a positive attitude.

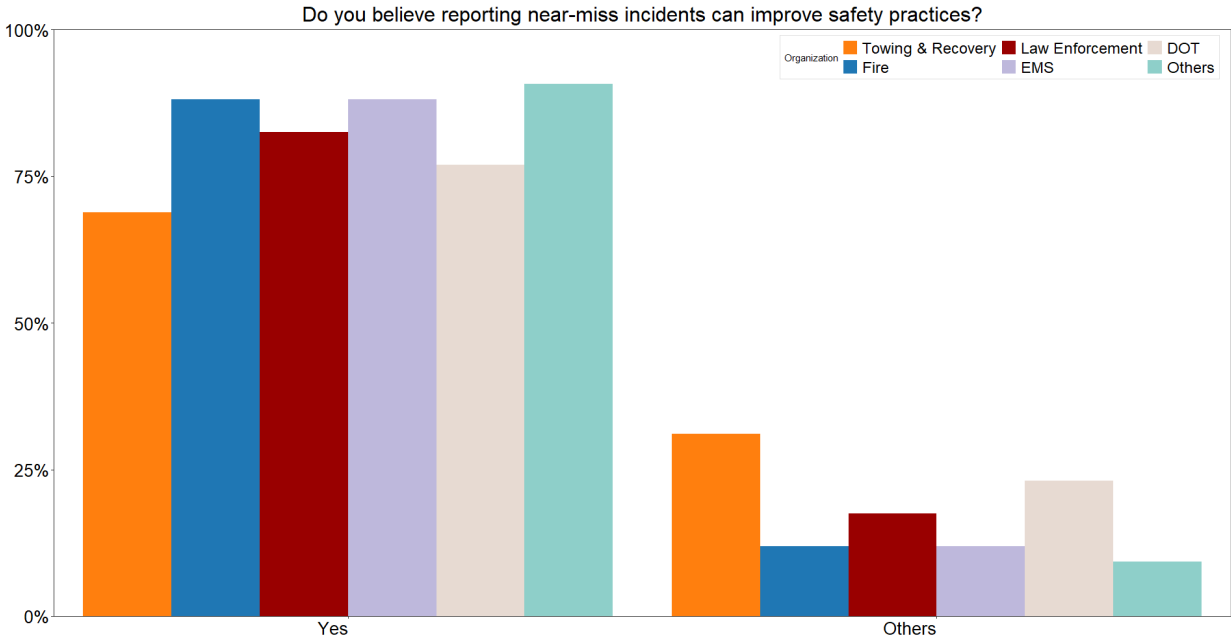


Figure 26. Do you believe reporting near-miss incidents can improve safety practices? Comparison by organizations.

Significant differences were also observed among different job roles (Figure 27). A higher percentage of employees and managers (around 85%) expressed positive attitudes, compared to only 72% of owners.

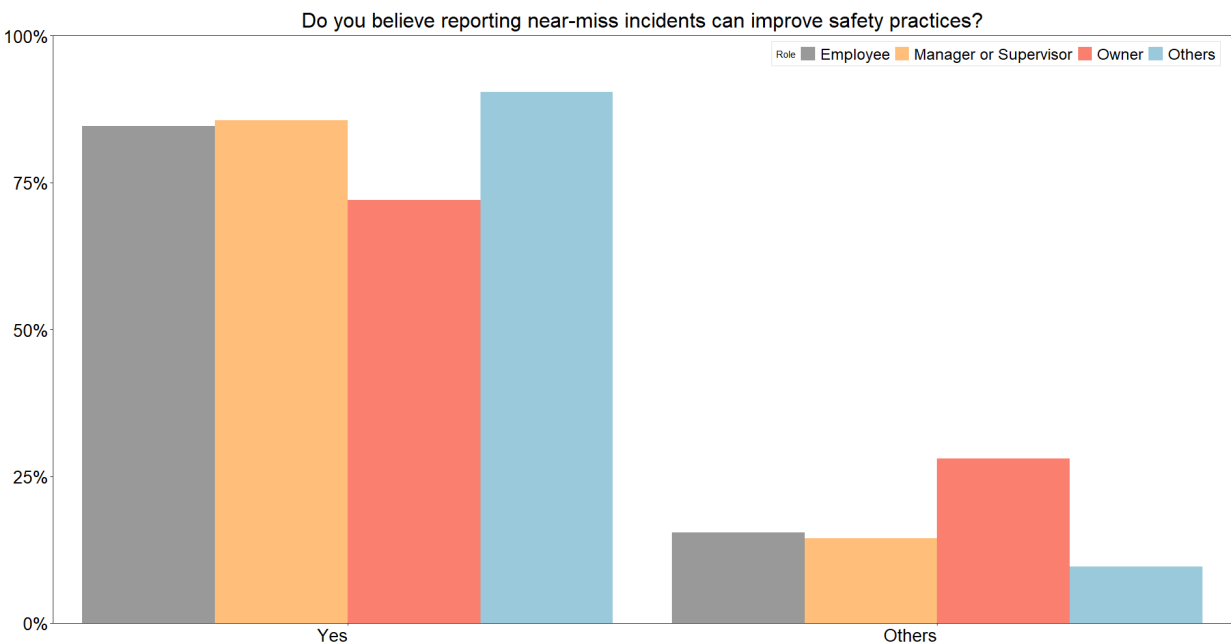


Figure 27. Do you believe reporting near-miss incidents can improve safety practices? Comparison by primary roles.

Factors that Influence the Decision to Report or Not Report

The survey explored a number of factors that might motivate responders to report near-miss incidents as well as those that might dissuade them from reporting. As shown in Table 14, most participants (79%) indicated that concern for their own safety is an extremely important reason for reporting near-miss incidents. Another critical motivation is concern for co-worker safety, with approximately 85% of participants rating it as extremely important. Over 70% of participants rated “belief in the importance of improving safety procedures” as extremely important, indicating a strong desire to enhance safety practices. Compliance with department or agency policies was considered less important, with fewer than half of the participants (48%) rating it as extremely important. Lastly, nearly 74% of participants rated their desire to contribute to a safer work environment as extremely important.

Table 14. Importance of factors in decision to report near misses.

Reason to Report Near Miss	Not important at all	Not important	Neutral	Important	Extremely important
Concern for personal safety	2.3%	1.4%	5.6%	11.7%	79.0%
Concern for co-worker’s safety	2.2%	0.6%	3.2%	9.2%	84.9%
Belief in the importance of improving safety procedures	1.8%	1.3%	6.4%	20.0%	70.6%
Compliance with department or agency policies	6.0%	5.6%	17.9%	22.6%	48.0%
Desire to contribute to a safer work environment	2.0%	0.8%	5.3%	18.2%	73.7%

The pattern of responses was similar for all safety-related factors (i.e., concern for personal or co-worker safety, improving safety procedures, safer working environment), regardless of organization or job type. However, there were some differences with regards to compliance with department or agency policies. As shown in Figure 28, over 75% of DOT participants indicated this reason was important, as did roughly 72% of fire and towing participants. Approximately 68% of EMS participants also felt that compliance with department or agency policy was an important reason to report, while only 58% of law enforcement participants indicated so.

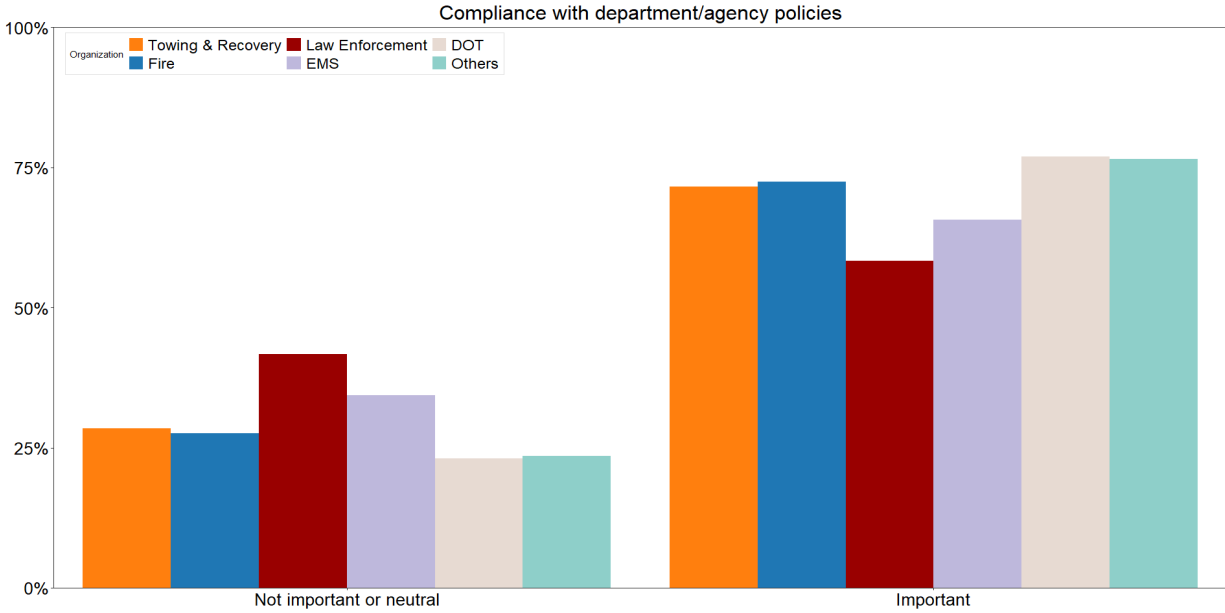


Figure 28. Importance of compliance with department/agency policies in decision to report near misses by organization. (Note: ratings of 1 to 3 on the 5-point scale are combined as “not important or neutral” and ratings of 4 and 5 are combined as “important”)

As shown in Figure 29, the comparison among primary roles, 74% of owners and 71% of employees (not manager or supervisor) thought that compliance with department or agency policies was an important motivation for reporting near-miss incidents compared to managers or supervisors (66.5%).

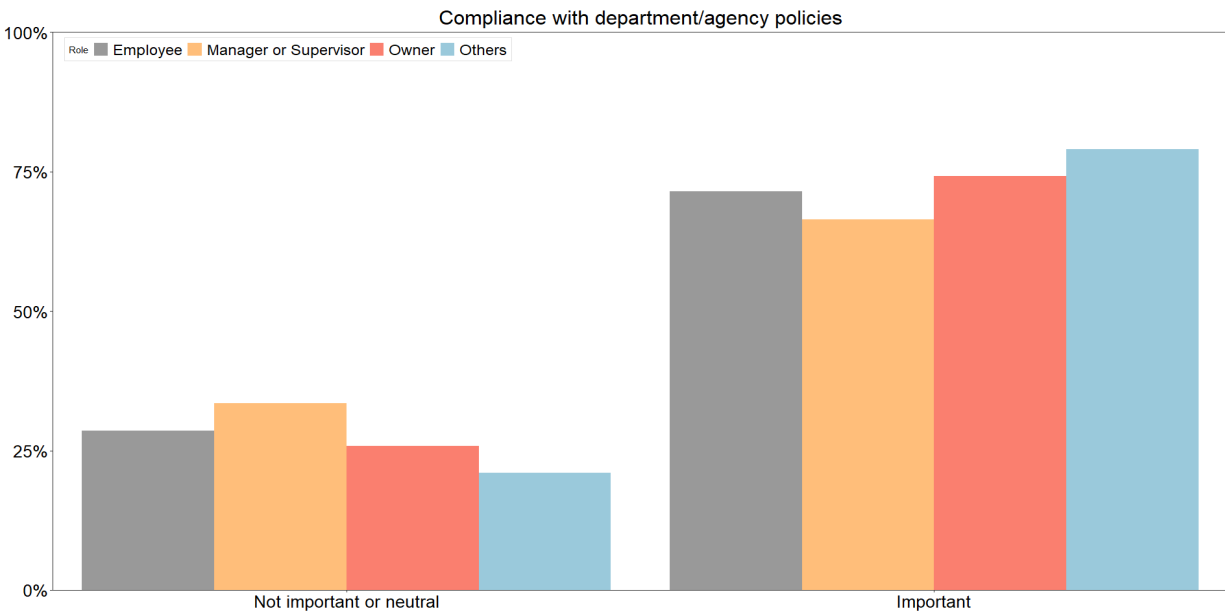


Figure 29. Importance of compliance with department/agency policies in decision to report near misses by primary roles. (Note: ratings of 1 to 3 on the 5-point scale are combined as “not important or neutral” and ratings of 4 and 5 are combined as “important”)

The survey also examined factors that might influence responders' decisions to refrain from reporting near-miss incidents. It is important to understand and address such concerns to improve near-miss reporting systems and procedures. As shown in Table 15, the most important barrier preventing most participants from reporting near-miss incidents is the lack of training about near-miss reporting. That is, more than half of participants (55%) identified "not enough training about reporting near misses" as being important or extremely important in their decision to not report. The second most common reason was the belief that near-miss incidents are insignificant and do not need to be reported. The remaining factors were approximately equivalent in their importance in decisions to not report near misses.

Table 15. Importance of factors in decision to not report near misses.

Reason to Not Report Near Miss	Not important at all	Not important	Neutral	Important	Extremely important
Fear of potential consequences or punishment	49.2%	10.9%	16.1%	10.9%	12.6%
View near-miss incidents as not significant	31.2%	13.6%	26.3%	13.4%	15.5%
Just too many near misses to report	38.7%	13.8%	22.2%	11.5%	13.8%
Too much paperwork	41.2%	13.9%	19.8%	12.8%	12.3%
Not enough training	15.8%	9.6%	19.8%	22.0%	32.8%
Belief that near-miss incidents are not relevant to safety	48.8%	12.6%	16.7%	8.5%	13.4%
Concerns about confidentiality	47.6%	13.7%	18.2%	9.2%	11.4%

When comparing by agencies, there were some differences in participants' viewpoints across the different factors, especially regarding the lack of training or awareness and confidentiality or privacy concerns (Table 16). Approximately 51% of towing participants and 54% of fire participants indicated that lack of training or awareness was an important factor. In contrast, over 66% of DOT and 64% of EMS respondents viewed it as a significant barrier preventing them from reporting near-miss incidents. About 15% of law enforcement, 21% of fire, and 21% of EMS reported that confidentiality or privacy concerns would be an important factor in deciding not to report an incident. However, nearly 37% of DOT and 27% of towing respondents reported that these concerns would be a factor.

Table 16. Ratings of “important” or “extremely important” in decision to not report near misses by organization.

Reason to Not Report Near Miss	Towing & Recovery	Fire	LEO	EMS	DOT	Other
Fear of potential consequences or punishment	23.8%	23.4%	18.3%	30.6%	35.4%	20.2%
View near-miss incidents as not significant	31.1%	28.9%	31.7%	26.1%	35.4%	27.7%
Just too many near misses to report	45.7%	18.0%	30.0%	25.4%	49.2%	26.1%
Too much paperwork	27.2%	23.0%	34.2%	25.4%	33.8%	22.7%
Not enough training*	51.0%	53.5%	58.3%	64.2%	66.2%	48.7%
Belief that near-miss incidents are not relevant to safety	23.4%	22.0%	22.5%	21.6%	20.0%	22.7%
Concerns about confidentiality*	26.5%	21.2%	15.0%	20.9%	36.9%	15.1%

* Comparison across organization significant at $p < .05$ level.

Comparing primary roles, as shown in Table 17, nearly 28% of employees indicated that fear of potential consequences or punishment is an important factor preventing them from reporting near-miss incidents, which is higher than the percentages of managers (20.1%) and owners (22.6%). The perception that near-miss incidents are not significant also factored in decisions: 32.3% of owners and 29.8% of employees agreed with this perspective, compared to only 25.0% of managers. In addition, a significantly higher percentage of owners (43.0%) reported that “too many near misses to report” is an important factor, about 20% higher than managers. Privacy concerns also varied; approximately 29.0% of owners, 24.1% of employees, and 17.2% of managers considered privacy a concern when deciding whether to report near-miss incidents.

Table 17. Ratings of “important” or “extremely important” in decision to not report near misses by job role.

Reason to Not Report Near Miss	Employee	Manager or Supervisor	Owner	Other
Fear of potential consequences or punishment*	27.6%	20.1%	22.6%	25.6%
View near-miss incidents as not significant*	29.8%	25.0%	32.3%	37.0%
Just too many near misses to report*	26.0%	23.3%	43.0%	21.0%
Too much paperwork	27.0%	22.9%	28.0%	25.6%
Not enough training	56.4%	55.0%	48.4%	54.3%
Belief that near-miss incidents are not relevant to safety	23.5%	18.5%	25.8%	26.0%
Concerns about confidentiality*	24.1%	17.2%	29.0%	21.5%

* Comparison across job role significant at $p < .05$ level.

Responders were also asked to rate their level of concern regarding a few potential issues related to near-miss reporting. They were asked about potential misuse of near-miss data, potential insurance impacts related to reporting, and potential legal consequences related to reporting.

Overall, the majority of participants were not concerned about these issues. However, as shown in Figure 30, the level of concern varied notably depending on their organizational affiliation. About 76% of law enforcement participants, 74% of fire participants, 69.5% of towing participants, and 67.9% of EMS participants were not concerned about the potential misuse of near-miss data. In contrast, 52.3% of DOT participants were concerned about the potential misuse of near-miss data. Participants from towing organizations were more concerned about the potential insurance impacts (53%) and potential legal consequences (41.1%) related to reporting than those from other organizations, which is much higher than in other organizations.

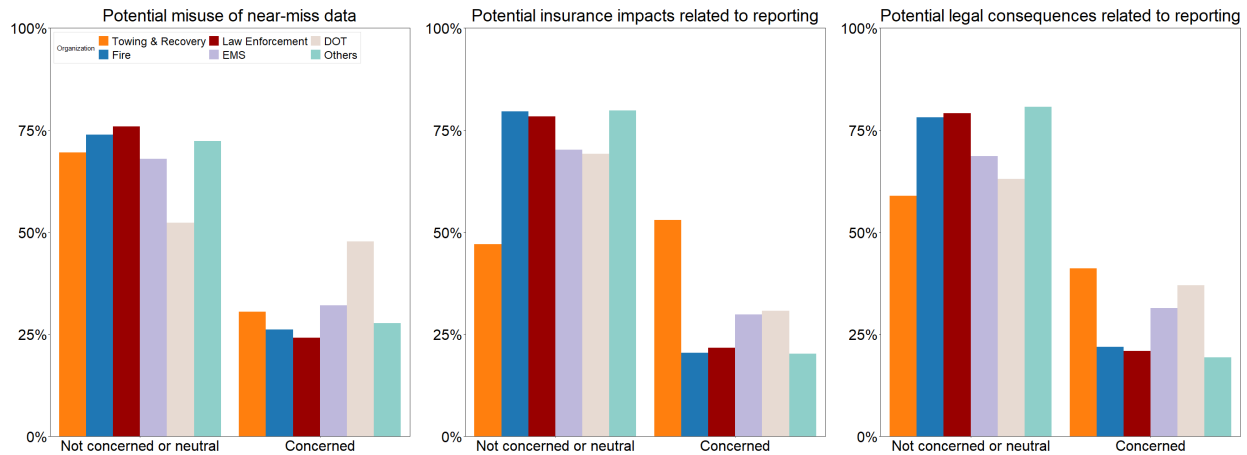


Figure 30. Concerns over reporting near-miss incidents by organization. (Note: ratings of 1 to 3 on the 5-point scale are combined as “not concerned or neutral” and ratings of 4 and 5 are combined as “concerned”)

With respect to job role, there were no significant differences in concerns about the potential misuse of near-miss data (Figure 31). There was, however, some variability regarding insurance and legal concerns. More than half of owners (50.5%) stated that they were concerned about the potential insurance impacts related to reporting, whereas only 27.6% of employees and 20.3% of managers shared concerns. Additionally, 36.6% of owners were concerned about the potential legal consequences related to reporting, which was approximately 14% higher than managers and 8% higher than employees.

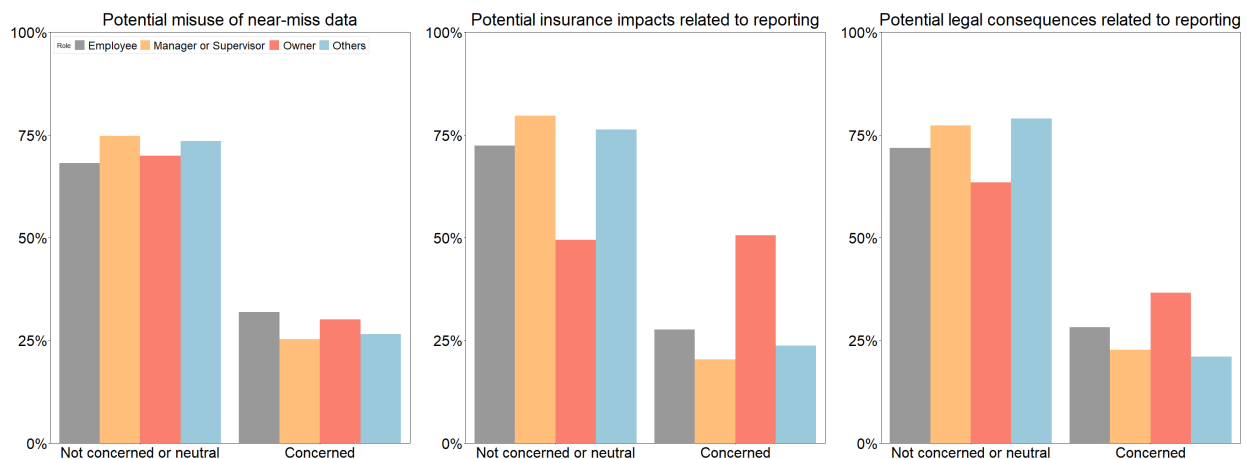


Figure 31. Concerns over reporting near-miss incidents by job role. (Note: ratings of 1 to 3 on the 5-point scale are combined as “not concerned or neutral” and ratings of 4 and 5 are combined as “concerned”)

Personally Identifiable Information

Respondents were asked if they would be willing to provide PII, such as an email or phone number while reporting near-miss incidents. Overall, 44.9% of participants

were willing to provide it and understood the importance of accurate reporting. Approximately 22% of participants said that it would depend on the specific circumstances or guarantees provided. About 27% of participants preferred not to share their personal information while reporting near-miss incidents.

Figure 32 and 33 show the distribution of responders' willingness to provide PII while reporting near-miss incidents. Statistically significant differences are found across organizations and roles regarding responders' willingness to share PII while reporting near-miss incidents. More than half of participants from DOT (55.4%) and towing organizations (54.3%) were willing to provide PII, which is at least 10% higher than those from other organizations (Figure 32).

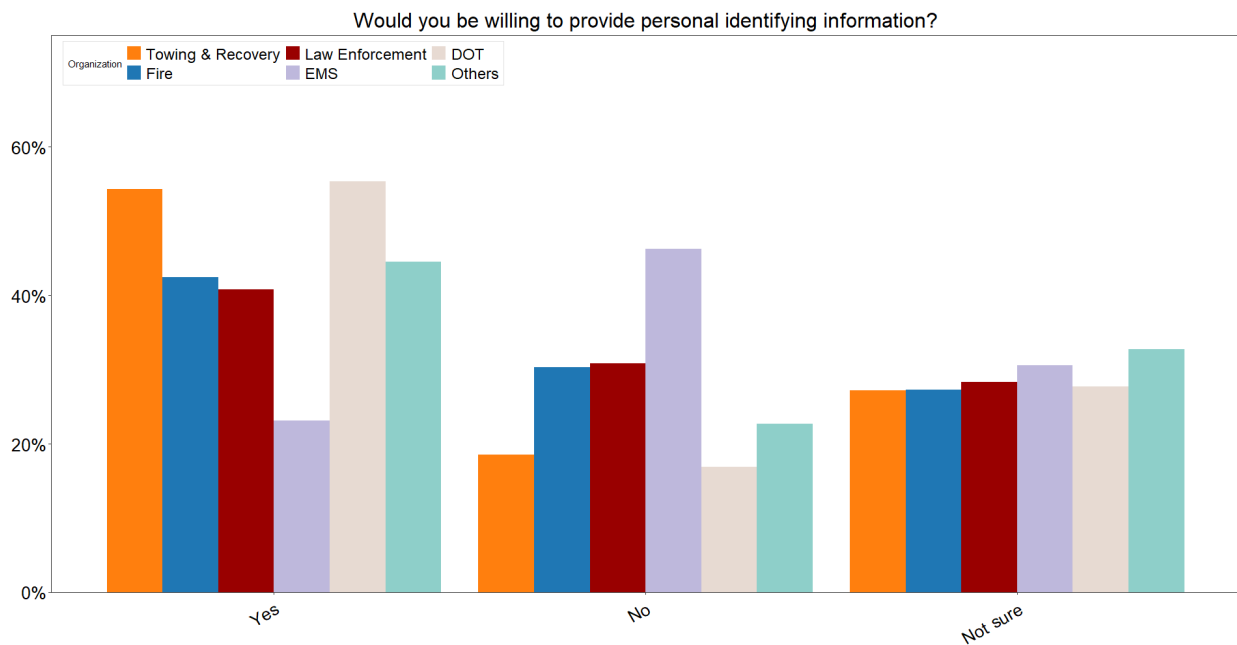


Figure 32. Would you be willing to provide personal identifying information, such as your email or phone number, so the near-miss reporting system managers could verify the information you report? Comparing by organizations.

As shown in Figure 33, over 60% of owners indicated that they would share PII while reporting near-miss incidents, which is about 22% higher than employees.

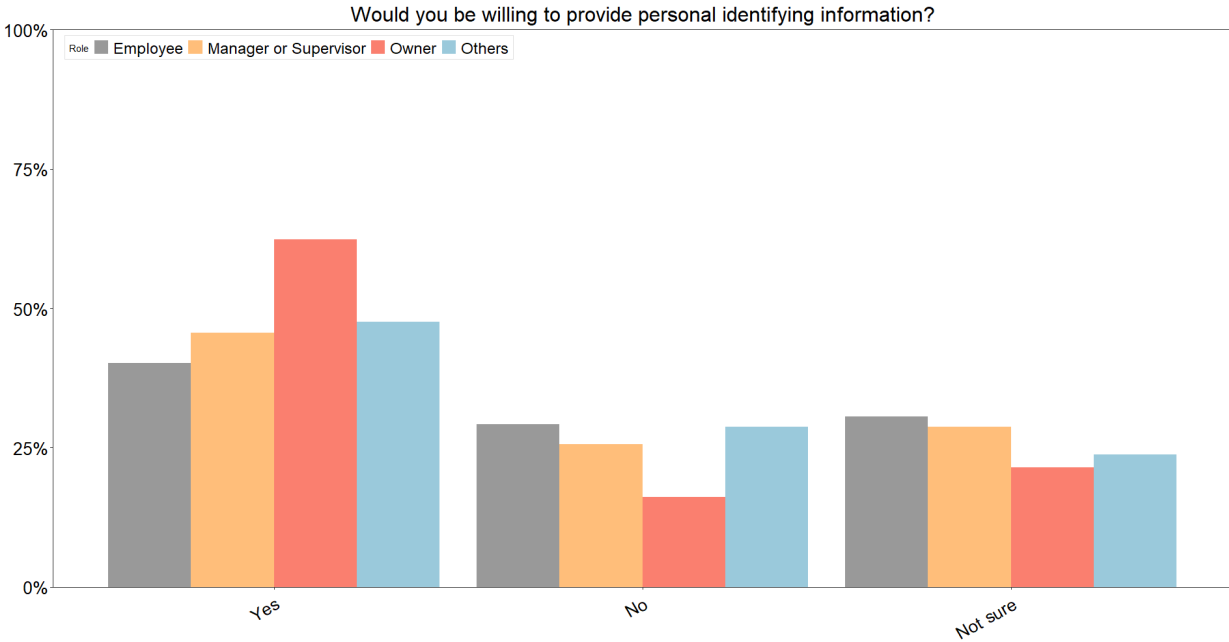


Figure 33. Would you be willing to provide personal identifying information, such as your email or phone number, so the near-miss reporting system managers could verify the information you report? Comparing by primary roles.

Reporting System Design

This section presents the survey results related to the design and implementation of a reporting system. Table 18 summarizes the responses to questions concerning the design and implementation of the reporting system. More than half of the participants had no preference between mobile- or computer-based platforms for near-miss incident reporting. One-quarter of participants preferred mobile-based platforms, while about 15% favored computer-based platforms. Regarding the timing of near-miss reporting, the most popular choice was reporting immediately after the incident (41.2%). The second and third most preferred options were submitting a brief initial report followed by a detailed one later (32.2%) and delayed reporting at a more convenient time (15.5%). Most participants (77.9%) supported the use of devices that could be mounted on vehicles to automatically detect near-miss incidents by tracking passing vehicles and the position of roadside responders. However, more than 60% of participants expressed concerns about the cost of adopting advanced technologies, such as LiDAR, for automatic near-miss detection. Additionally, around half of the participants were concerned about the regulatory challenges associated with implementing such technologies.

Table 18. Summary of key questions in the section of reporting system design.

Item	Category	Frequency	Percentage
Prefer mobile- or computer-based platform for reporting near-miss incidents	Mobile-based	330	25.2%
	Computer-based	203	15.5%
	Either	683	52.1%
	No preference	96	7.3%
Favorite approach of the timing of near-miss incident reporting	Immediate reporting after the incident	540	41.2%
	Delayed reporting at a more convenient time	204	15.5%
	A brief initial report followed by a detailed one later	422	32.2%
	No preference	146	11.1%
Would you support the using of automated near-miss detector	Yes	1022	77.9%
	No	195	14.9%
	No preference	95	7.2%
Concerned level about costs of the adoption of advanced technologies	Very concerned	410	31.3%
	Concerned	381	29.0%
	Neutral	387	29.5%
	Not concerned	84	6.4%
	Not concerned at all	50	3.8%
Concerned level about the regulatory challenges of adopting advanced technologies	Very concerned	215	16.4%
	Concerned	452	34.5%
	Neutral	491	37.4%
	Not concerned	118	9.0%
	Not concerned at all	36	2.7%

Responders were also asked to rate the importance of various features in a near-miss incident reporting system. As shown in Figure 34, mobile accessibility, photo or video attachments, and an anonymous reporting option were considered important by the majority of respondents. Additionally, nearly half of participants said that GPS location tracking was an important feature. Far fewer believed that audio-to-text functionality was important to a reporting system.

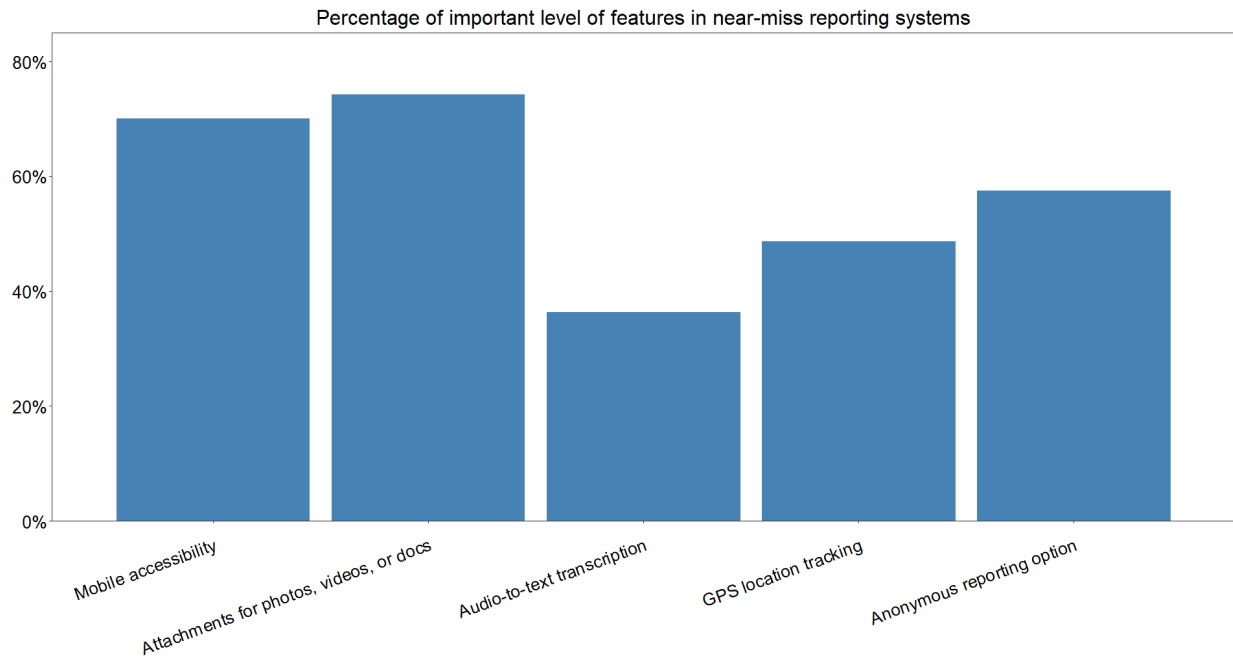


Figure 34. Percentage of ratings of “important” or “extremely important” for different features or functionalities of a near-miss incident reporting system.

As shown in Table 19, the majority of DOT respondents (81.5%) indicated that mobile accessibility is important for a near-miss reporting system. Similarly, more than 70% of participants from EMS, towing, and law enforcement organizations supported this view, while only 66% of fire respondents agreed. Approximately 48% of towing participants felt that audio-to-text transcription is an important feature, higher than other organizations. Approximately 58% of DOT, towing, and LEO respondents believed that GPS location tracking is important for a near-miss reporting system. Respondents from LEO and DOT were less likely to indicate that an anonymous reporting option was important, compared to other organizations.

Table 19. Ratings of “important” or “extremely important” of different system design features by organization.

Feature	Towing & Recovery	Fire	LEO	EMS	DOT	Other
Mobile accessibility*	74.2%	66.4%	71.7%	76.9%	81.5%	72.3%
Attachments for photos, videos, etc.	73.5%	74.4%	70.0%	74.6%	80.0%	75.6%
Audio-to-text transcription*	47.7%	31.5%	35.0%	41.8%	38.5%	45.4%
GPS location tracking*	58.3%	42.0%	57.5%	51.5%	58.5%	59.7%
Anonymous reporting option	59.6%	57.9%	49.2%	64.2%	47.7%	58.0%

* Comparison across organization significant at $p < .05$ level.

With respect to job role, differences were also found across ratings for audio-to-text transcription, GPS location tracking, and anonymous reporting options (Table 20). Compared to employees and managers, a higher percentage of owners (47.3%) indicated that audio-to-text transcription is important. Additionally, over half of owners (58.1%) and employees (54.4%) reported that GPS location tracking is important, while only 39.8% of managers agreed. Around 65% of employees supported the inclusion of an anonymous reporting option, higher than both owners and managers.

Table 20. Ratings of “important” or “extremely important” of different system design features by job role.

Feature	Employee	Manager or Supervisor	Owner	Other
Mobile accessibility	70.6%	71.0%	67.7%	68.0%
Attachments for photos, videos, etc.	72.8%	76.5%	72.0%	73.5%
Audio-to-text transcription*	38.3%	30.4%	47.3%	41.1%
GPS location tracking*	54.4%	39.8%	58.1%	52.5%
Anonymous reporting option*	64.7%	55.8%	58.1%	44.7%

* Comparison across job role significant at $p < .05$ level.

Modeling of Near-Miss Reporting

This section presents the results of a binary logit model examining the relationships between these influencing factors and the frequency of near-miss reporting, specifically aiming to identify the factors that influence responders’ behavior and understand what motivates or discourages reporting in their work environment. As previously stated, incident reporting frequency was recoded as a binary variable: “frequently” and “not frequently.” The analysis included numerous independent variables, such as demographic characteristics, organizational factors, and individual perceptions of safety and risk.

To fully utilize the survey data, all variables were initially included in the models. As the analysis progressed, variables were removed from the final models based on their correlations with independent variables and the significance of each factor. The selection of base categories for the model was determined by the natural order (e.g., response scale) or the major categories of the independent variables (e.g., based on volume of data). Table 21 shows the descriptive statistics of all variables used for modeling.

Table 21. Descriptive statistics of all variables used for modeling purposes (N = 1,243).

Variable	Category	Percentage
Near-miss reporting frequency (Dependent Variable)	Not frequent (Sometimes, Rarely, or Do not ever report)	45.3%
	Frequent (Every time, Usually, or Often report)	54.7%
Near-miss reporting to improve safety practices	No	14.7%
	Yes	85.3%
Near-miss incidents are a routine part of the job	No	71.4%
	Yes	28.6%
Organization type	Fire	55.3%
	EMS	10.3%
	Law enforcement	8.9%
	Towing & recovery	11.7%
	DOT	4.9%
	Other	8.9%
Organization size	Less than 10 employees	10.8%
	10–25 employees	24.0%
	26–50 employees	26.7%
	More than 50 employees	38.5%
Primary roles	Employee/Technician	37.8%
	Manager/Supervisor	38.9%
	Owner	7.2%
	Others	16.1%
Age	Under 25 years old	2.5%
	25–44 years old	26.7%
	45–54 years old	26.5%
	55–64 years old	27.3%
	65 years old or older	16.3%
	Unknown	0.8%
Gender	Male	85.4%
	Other	14.6%
Race	Caucasian	84.6%
	Other	15.4%
Education level	High school or less	15.4%
	Some college or associate degree	46.4%
	Bachelor's degree	26.3%
	Graduate degree	11.2%
	Prefer not to say	0.7%

Variable	Category	Percentage
Working experience	0–5 years	12.7%
	6–10 years	11.6%
	11–20 years	20.0%
	20 years or more	54.9%
	Prefer not to say	0.9%
Employment	Full-time	67.7%
	Part-time	16.8%
	Retired	6.2%
	Other	9.3%
Near-miss experience frequency	Never	3.0%
	Once a year or less	17.3%
	Several times a year	37.7%
	A few times a month	22.0%
	Every week	10.9%
	Every day	9.3%
Training experience	No	34.7%
	Yes, but did not talk about the difference between near miss and struck by	13.2%
	Yes	41.4%
	Do not remember	10.8%
Reporting policy	No	56.0%
	Yes	30.3%
	Not sure	13.8%
Encouraged reporting of near misses	No	37.3%
	Yes, externally	2.0%
	Yes, internally	39.1%
	Yes, both externally and internally	10.9%
	Not sure	10.6%
Reporting approach	Not report	9.1%
	Formal setting	19.9%
	Informally	29.3%
	Telling supervisors	22.2%
	Established written procedures	15.8%
	Others	3.8%

Variable	Category	Percentage
Concern for personal safety	1: Not important at all	2.3%
	2: Not important	1.4%
	3: Neutral	5.6%
	4: Important	11.7%
	5: Extremely important	79.0%
Concern for co-worker's safety	1: Not important at all	2.2%
	2: Not important	0.6%
	3: Neutral	3.2%
	4: Important	9.2%
	5: Extremely important	84.9%
Belief in the importance of improving safety procedures	1: Not important at all	1.8%
	2: Not important	1.3%
	3: Neutral	6.4%
	4: Important	20.0%
	5: Extremely important	70.6%
Compliance with department or agency policies	1: Not important at all	6.0%
	2: Not important	5.6%
	3: Neutral	17.9%
	4: Important	22.6%
	5: Extremely important	48.0%
Desire to contribute to a safer work environment	1: Not important at all	2.0%
	2: Not important	0.8%
	3: Neutral	5.3%
	4: Important	18.2%
	5: Extremely important	73.7%
Fear of potential consequences or punishment	1: Not important at all	49.2%
	2: Not important	10.9%
	3: Neutral	16.1%
	4: Important	10.9%
	5: Extremely important	12.6%
View near-miss incidents as not significant	1: Not important at all	31.2%
	2: Not important	13.6%
	3: Neutral	26.3%
	4: Important	13.4%
	5: Extremely important	15.5%

Variable	Category	Percentage
Just too many near misses to report	1: Not important at all	38.7%
	2: Not important	13.8%
	3: Neutral	22.2%
	4: Important	11.5%
	5: Extremely important	13.8%
Too much paperwork	1: Not important at all	41.2%
	2: Not important	13.9%
	3: Neutral	19.8%
	4: Important	12.8%
	5: Extremely important	12.3%
Not enough training	1: Not important at all	15.8%
	2: Not important	9.6%
	3: Neutral	19.8%
	4: Important	22.0%
	5: Extremely important	32.8%
Belief that near-miss incidents are not relevant to safety	1: Not important at all	48.8%
	2: Not important	12.6%
	3: Neutral	16.7%
	4: Important	8.5%
	5: Extremely important	13.4%
Concerns about confidentiality	1: Not important at all	47.6%
	2: Not important	13.7%
	3: Neutral	18.2%
	4: Important	9.2%
	5: Extremely important	11.4%
Potential misuse of near miss data	1: Not concerned at all	43.0%
	2: Not concerned	10.9%
	3: Neutral	18.3%
	4: Concerned	12.4%
	5: Extremely concerned	15.5%
Potential insurance impacts related to reporting	1: Not concerned at all	43.7%
	2: Not concerned	13.5%
	3: Neutral	17.5%
	4: Concerned	11.3%
	5: Extremely concerned	14.0%

Variable	Category	Percentage
Potential legal consequences related to reporting	1: Not concerned at all	43.6%
	2: Not concerned	13.5%
	3: Neutral	17.9%
	4: Concerned	11.0%
	5: Extremely concerned	14.0%
Willing to provide personal identification information	No	26.6%
	Yes	45.9%
	It depends	22.4%
	Not sure	5.2%

Table 22 shows the modeling results. As noted, the dependent variable was the frequency of reporting near miss incidents. Those that reported every incident or reported them often or usually were considered “frequent” incident reporters. Those that only sometimes or rarely reported or who did not ever report were considered “not frequent” incident reporters. Note that below “responders” refers to survey participants who are roadside responders and “reporters” refers to those who report a near-miss incident. Odds ratios (ORs) were estimated to show how independent variables affect the likelihood of frequent near-miss reporting (i.e., whether the responder was classified as a frequent or not frequent reporter). If the odds ratio is greater than 1, holding other factors constant, responders with a specific attribute are more likely to report near misses frequently compared to those in the base category. Conversely, an odds ratio lower than 1 indicates that responders with a specific attribute are less likely to report near misses frequently.

The model results showed that responders from LEO, EMS, and towing were as likely to be frequent incident reporters as responders from fire; however, DOTs were 0.49 times as likely to report near-miss incidents frequently compared to fire (Table 22). Responders with a graduate-level degree were 1.77 times more likely to be frequent near-miss reporters than those with a high school degree or less (base group). Responders who perceived near-miss incidents as a routine part of their job were also less likely to report near-miss incidents frequently than those who did not (OR = 0.67). When organizations had policies or guidelines for near-miss reporting, responders were 1.63 times more likely to report near-miss incidents frequently. Furthermore, if the organization encouraged near-miss reporting internally or both internally and externally, responders were 3.36 and 2.54 times more likely to report frequently, respectively. Not surprisingly, responders who reported employing different approaches to reporting were more likely to be frequent reporters of near misses than those who reported infrequently. However, those that discussed incidents in formal settings, reported them to supervisors, or following established written procedures were much more likely to report near misses frequently, compared to those that used informal

approaches (e.g., sharing with co-workers). Additionally, responders who were willing to provide PII were 1.47 times more likely to report near-miss incidents frequently than those who were not.

Further, responders’ perceptions of safety and their attitudes toward incident reporting were found to be significant factors influencing near-miss reporting behavior. As shown in Table 22, responders who believed that contributing to a safer work environment is extremely important were 3.05 times more likely to report near-miss incidents frequently compared to those who did not prioritize safety at all. Conversely, responders who viewed near-miss incidents as insignificant were less likely to report them frequently, though the difference for those who considered this factor “important” did not reach statistical significance. Responders who believed that the frequency of near-miss incidents was an important factor in their decision to report were also less likely to report near-miss incidents frequently. Responders with less concern about confidentiality and privacy issues, as well as those with neutral attitudes, were less likely to report near-miss incidents frequently compared to those who had no such concerns. On the other hand, responders who were concerned about potential legal consequences of reporting near-miss incidents were nevertheless 1.67 times more likely to report frequently than those who had no concerns.

Table 22. Binary logistic regression model for frequently reporting near-miss incidents (Reference level: Not frequently).

	Variable	Estimate	Pr (> z)	OR
	(Intercept)	-4.22	< 0.01	0.01
Organization (base: Fire)	EMS	-0.07	0.78	0.93
	Law enforcement	-0.11	0.72	0.90
	Towing & recovery	0.02	0.94	1.02
	DOT	-0.71	0.05	0.49
	Others	0.54	0.05	1.72
Education level (base: High school or less)	Some college or associate degree	-0.28	0.21	0.75
	Bachelor’s degree	-0.08	0.75	0.92
	Graduate degree	0.57	0.06	1.77
	Prefer not to say	0.87	0.43	2.38
Employment (base: Full-time)	Part-time	0.08	0.69	1.09
	Retired	0.45	0.17	1.57
	Others	0.50	0.07	1.65
Near-miss incident is a routine part of job (base: No)	Yes	-0.40	0.02	0.67

	Variable	Estimate	Pr (> z)	OR
Reporting policy (base: No)	Yes	0.49	0.03	1.63
	Not sure	0.14	0.56	1.16
Encouraging reporting near miss (base: No)	Yes, externally	0.46	0.36	1.59
	Yes, internally	1.21	< 0.01	3.36
	Yes, both externally and internally	0.93	< 0.01	2.54
	Not sure	-0.10	0.74	0.91
Reporting approach (base: Not report)	Formal setting	3.69	< 0.01	40.24
	Informally	2.00	< 0.01	7.39
	Telling supervisors	3.67	< 0.01	39.30
	Established written procedures	3.81	< 0.01	45.02
	Others	3.14	< 0.01	23.20
Willing to provide PII (base: No)	Yes	0.39	0.04	1.47
	It depends	0.12	0.57	1.13
	Not sure	-0.14	0.70	0.87
Desire to contribute to a safer work environment (base: 1: Not important at all)	2: Not important	1.49	0.14	4.45
	3: Neutral	0.69	0.21	2.00
	4: Important	0.89	0.11	2.44
	5: Extremely important	1.11	0.04	3.05
	2: Not important	-0.49	0.06	0.61
View near-miss incidents as not significant (base: 1: Not important at all)	3: Neutral	-0.74	< 0.01	0.48
	4: Important	-0.45	0.12	0.64
	5: Extremely important	-0.51	0.07	0.60
	2: Not important	-0.03	0.90	0.97
Just too many near misses to report (base: 1: Not important at all)	3: Neutral	0.12	0.59	1.13
	4: Important	-0.65	0.02	0.52
	5: Extremely important	-0.23	0.39	0.79
	2: Not important	0.28	0.30	1.33
Belief that near-miss incidents are not relevant to safety (base: 1: Not important at all)	3: Neutral	0.67	0.01	1.96
	4: Important	0.52	0.11	1.68
	5: Extremely important	0.25	0.39	1.28
	2: Not important	-0.66	0.01	0.52
Concerns about confidentiality (base: 1: Not important at all)	3: Neutral	-0.49	0.05	0.61
	4: Important	-0.21	0.51	0.81
	5: Extremely important	-0.01	0.96	0.99

	Variable	Estimate	Pr (> z)	OR
Potential legal consequences related to reporting (base: 1: Not concerned at all)	2: Not concerned	-0.05	0.85	0.95
	3: Neutral	0.20	0.37	1.22
	4: Concerned	0.52	0.06	1.67
	5: Extremely concerned	0.41	0.12	1.50
Number of observations	1,243			
Pseudo R-square	0.34			
Log-likelihood	-568.6			
AIC	1,241.2			

Note: **Bold** entries significant at $p < .05$ level.

Limitations

This survey-based study has several limitations that should be noted. First, it relies on a stated preference approach, meaning the responses may not fully reflect participants' real-world behavior. It follows that the quality of the analysis is dependent on the accuracy and honesty of participants' answers. While efforts were made to keep the survey to a manageable length, it is possible that survey fatigue led to inaccurate or incomplete responses, and participants might misunderstand the questions or options provided, further contributing to inaccuracies. Although strict data cleaning standards were applied to reduce the impact of low-quality responses, these issues cannot be entirely eliminated. Furthermore, a significant number of participants identified their organizations and primary roles as "other," which may indicate that they actually belong to the categories provided in the survey. This could lead to a loss of valuable information and potentially affect the analysis results. Lastly, data collection relied on organizations like ERSI and TRAA, and so the sample might not be completely representative of the populations of roadside responders.

Summary

A national survey of roadside responders was conducted to gather information about their experiences with near-miss incidents, their attitudes toward reporting such incidents, and their opinions and concerns regarding near-miss reporting systems. Over 3,000 roadside responders from across the country participated in the survey. After error-checking and data cleaning, slightly over 1,300 samples were retained for further analysis.

The results of descriptive analysis and statistical modeling provide valuable insights into roadside responders' experiences, attitudes, and needs related to near-miss incident reporting. One of the primary goals of the analysis was to determine whether there are significant differences based on agency type (fire, law enforcement, towing and recovery, DOT and public works, and EMS) or the specific roles or duties of responders

within their respective agencies (manager/supervisor, employee/technician, and owner). For many factors, there were significant differences across agency types and among primary roles. Some of the key findings include the following:

- **Near-miss incident frequency:** Overall, nearly 20% of respondents reported experiencing near-miss incidents at least every week, approximately 22% reported experiencing near-miss incidents a few times a month, and approximately 38% several times a year. Only 21% reported only experiencing near misses once a year or never. A significant portion of participants from towing and recovery organizations reported experiencing near-miss incidents daily (29%) or weekly (27%).
- **Near-miss reporting frequency:** Participants from fire (31%) and towing organizations (approximately 27%) were more likely to report every near-miss incident compared to other organizations.
- **Policies:** A significant portion of participants (approximately 70%) stated that they are either unsure or that their workplace, department, or agency does not have policies or guidelines requiring the reporting of near-miss incidents.
- **Encouragement to report near-miss incidents:** More than 60% of towing participants reported being encouraged to report near-miss incidents, compared to only 27% of law enforcement participants.
- **Normalization of risk.** More than 40% of law enforcement and towing participants indicated that they perceive near-miss incidents as a routine part of their job.
- **Training.** Overall, more than 40% of participants indicated that they had attended training that included information about near-miss or struck-by incident reporting. However, approximately 35% of participants stated that they had not attended any training related to near-miss or struck-by incident reporting, and around 13% could not recall if they had attended such training. Participants from towing and recovery had the highest percentage (42%) of individuals not receiving any training on incident reporting.
- **Belief that reporting near misses improves safety:** Participants from fire and EMS organizations overwhelmingly believe that reporting near-miss incidents can improve safety practices, with 88% expressing a positive attitude. In contrast, towing and recovery participants were less likely to agree, with only 69% holding this view.
- Most participants indicated that concern for their own safety (79%) or that of a co-worker (85%) is an extremely important reason for reporting near-miss incidents. Compliance with department or agency policies was considered less important, with fewer than half of the participants (48%) rating it as extremely important.
- The most important barrier preventing most participants from reporting near-miss incidents is the lack of training about near-miss reporting. The second

most common reason was the belief that near-miss incidents are insignificant and do not need to be reported.

- Regarding the timing of near-miss reporting, the most popular choice was reporting immediately after the incident (41%). Most participants (78%) supported the use of devices that could be mounted on vehicles to automatically detect near-miss incidents.

The near-miss reporting frequency model revealed several key factors influencing responders' reporting behavior. Responders with graduate-level degrees, those working in organizations with established policies or guidelines on near-miss reporting, and those in organizations who encouraged reporting were more likely to report incidents "frequently." Similarly, responders who believed that reporting incidents could benefit their own safety as well as the safety of others were more likely to be frequent reporters of near misses. Conversely, those who perceived near misses as a routine part of their work, perceived that they were insignificant, or believe that they occurred too frequently were less likely to report near misses frequently. These findings highlight the importance of creating a structured and supportive environment where clear policies, guidelines, and organizational encouragement play a critical role in fostering a culture of safety. Responders who feel guided and supported by their organizations are more likely to recognize the value of reporting near-miss incidents. Furthermore, cultivating a mindset that emphasizes personal safety and collective responsibility for a safer workplace may significantly increase the likelihood of frequent near-miss reporting, reinforcing the importance of safety practices in daily operations.

RECOMMENDATIONS

Following the completion of four technical tasks, initial recommendations were drafted based on the findings. To gather additional insights and gain consensus with roadside response stakeholders and responder safety experts, a virtual meeting was organized to discuss the project findings and recommendations. A total of eight external members, excluding the project team, participated in the meeting and the panel discussions.

The expert meeting began with introductions of all meeting participants, a brief background on the project, and an outline of the meeting objectives. Findings from the technical tasks were presented to the panel members, followed by a question-and-answer session, allowing participants to share their comments and additional insights (if any) on the results. Two panel discussions were then conducted. The first panel discussion focused on system design, exploring the key components of the reporting system and the technologies that can facilitate near-miss incident reporting. The second panel discussion centered on system implementation, discussing how agencies should prepare for implementing the reporting system. This included considerations for policy, training, and feedback mechanisms, as well as addressing challenges and barriers such as institutional, policy, cultural, and financial issues. The discussion also touched on cross-agency challenges in reporting near-miss events and improving roadside response practices.

Following these two panel discussions, a closing discussion was held to generate consensus among all meeting participants regarding the recommendations and actionable steps for reporting system developers/managers, roadside response agencies, and individual responders. Key outcomes included the following:

- **Validation of findings:** Meeting participants confirmed that the technical task findings aligned with their observations in the field (such as incident reporting experience, attitude towards near-miss reporting, the reasons for not reporting near misses, and concerns of near-miss reporting), underscoring the need for an effective near-miss incident reporting system.
- **Agreement on recommendations:** Participants agreed on the majority of initial recommendations. They also provided valuable insights to enhance the recommendations:
 - **Passive reporting and simplicity:** Incorporate passive questions into the reporting system. Offer multiple ways to report near misses. Simplify the reporting process and provide pre-defined answer options for responders to select from.
 - **Centralized reporting:** Assign a designated person (e.g., safety officer) to handle reporting via phone or text. This person can ask critical questions and report to the system, reducing the burden on individual responders.

- **Aggregate reporting:** Instead of reporting each near miss individually (especially in towing), allow responders to report the number of similar near-miss incidents within the same call.
- **Mobile app:** Develop a mobile app with a few quick questions for easy reporting. Design the app considering the age and background of responders.
- **Context information:** Ensure that contextual information (location, time, conditions) is included in the reporting.
- **Feedback:** Provide immediate feedback based on historical data to offer recommendations for the reported near miss.
- **Human review and AI:** Involve humans to review and standardize the reported data. Use AI to filter out spam and ensure data consistency and quality.
- **Leadership and training:** Promote reporting through peer-to-peer training and by highlighting benefits. Conduct annual or quarterly refresher courses. Share success stories of near-miss reporting. Collaborate with various agencies (e.g., TIM training efforts) to provide regular training. Offer training courses that can be taken between calls or while at the shop.
- **Education on benefits:** Educate responders on the long-term benefits of reporting near misses, such as reduced insurance rates.
- **Policy and requirements:** Implement policies that mandate near-miss reporting. Ensure data is collected, compiled, and protected in compliance with federal regulations. Adapt policies to meet different state requirements.
- **Legislative support:** Lobby legislatures to support near-miss reporting and protect the reported data.

Incorporating the valuable insights gained from the meeting led to the refinement of the initial recommendations. These enhanced recommendations, summarized in Table 23, outline the critical steps needed to establish a robust and effective near-miss reporting system. The table also provides links to specific modules, showing how these recommendations were informed by various activities throughout the project.

Table 23. Refined Recommendations for Developing and Deploying a Near-Miss Reporting System

Item	Recommendation	Informed by
1	<ul style="list-style-type: none"> • Simplicity: Ensure the system is intuitive and straightforward, with a clean and simple reporting process. Provide predefined answer options for responders to select from. 	Expert panel ¹
	<ul style="list-style-type: none"> • Mobile Compatibility: Ensure the system functions seamlessly on smartphones and tablets. Develop a mobile app with quick questions for easy on-scene reporting, and a reminder for the rest at the end of the shift. 	Focus groups, survey, expert panel
2	<ul style="list-style-type: none"> • Customized Forms: Develop forms tailored to different types of roadside responders (e.g., tow truck operators, police, firefighters) to ensure data relevance and accurate reporting. 	Review ²
	<ul style="list-style-type: none"> • Multiple Ways to Report: Allow for self-reports as well as reports submitted on someone else’s behalf. 	Expert panel
	<ul style="list-style-type: none"> • Flexible Design: Balance standardization with flexibility to address the unique requirements of different response agencies. 	Review
3	<ul style="list-style-type: none"> • Comprehensive Data Fields: Gather data on the responder’s demographics, experience and job role, along with contextual information regarding the near-miss incident. 	Reviews, expert panel
	<ul style="list-style-type: none"> • Confidentiality: Allow anonymous submissions to encourage more responders to report incidents without fear of repercussions. 	Review, interviews, focus groups, survey
4	<ul style="list-style-type: none"> • Clear Definitions: Establish standardized definitions of what constitutes a near miss to ensure consistency in reporting. 	Interviews, focus groups
	<ul style="list-style-type: none"> • Risk Tolerance: Acknowledge the varying risk tolerances/perceptions among responders and address these in the reporting criteria. 	Interviews
5	<ul style="list-style-type: none"> • Automated Detection: Whenever possible, integrate technologies such as camera-based sensing systems to automatically detect incidents. 	Focus groups, survey
	<ul style="list-style-type: none"> • Cost and Regulation Management: Address concerns about advanced technologies’ cost and regulatory challenges. 	Focus groups, survey

Item	Recommendation	Informed by
6	<ul style="list-style-type: none"> • Quality Control: Involve humans to review and standardize the reported data. Use AI to filter and ensure consistency and quality of data. 	Expert panel
	<ul style="list-style-type: none"> • Data Analysis: Develop tools to analyze the collected data and convert insights into actionable items, such as training materials and safety protocols. 	Interviews
	<ul style="list-style-type: none"> • Feedback Loop: Provide timely feedback to responders on the outcomes and benefits derived from reported near-miss incidents. 	Focus groups, expert panel
7	<ul style="list-style-type: none"> • Initial and Ongoing Training: Provide early and continuing education for responders on the importance/benefits of near-miss reporting and how to use the system. 	Interviews, focus groups
	<ul style="list-style-type: none"> • Positive Safety Culture: Foster an environment where supervisors and responders are encouraged and motivated to regularly discuss and report near-miss incidents. 	Focus groups
8	<ul style="list-style-type: none"> • Outreach Programs: Use associations, social media, events, and public awareness campaigns to promote the near-miss reporting system. 	Focus groups
	<ul style="list-style-type: none"> • Stakeholder Engagement: Collaborate with various agencies and stakeholders (organizations/associations) to ensure widespread adoption and consistent system use. 	Focus groups
9	<ul style="list-style-type: none"> • Non-Punitive Reporting Policies: Develop and enforce policies that ensure near-miss reporting is non-punitive. Responders should not face disciplinary actions or negative evaluations due to reporting near-miss incidents. 	Review, focus groups
	<ul style="list-style-type: none"> • Confidential Reporting Agreements: Establish agreements with responders and agencies that emphasize the confidentiality and protection of reported data. 	Interviews, survey, expert panel
	<ul style="list-style-type: none"> • Legislative Support: Lobby with legislatures to implement policies requiring near-miss reporting, protect reported data, and adapt policies according to different state requirements. 	Focus groups, expert panel
10	<ul style="list-style-type: none"> • Budget Planning: Plan for the costs associated with developing, deploying, and maintaining the near-miss reporting system. Consider initial setup costs, ongoing maintenance, and future upgrades. 	Interviews, focus groups, survey
	<ul style="list-style-type: none"> • Funding Sources: Explore funding opportunities and grants to support the implementation and sustainability of the system. Seek partnerships with government agencies, industry organizations, and other stakeholders. 	Interviews, focus groups

¹ Expert panel meeting held following the technical tasks.

² Review of existing reporting systems.

CONCLUSIONS

The primary objective of this project was to identify the necessary elements for a successful near-miss incident reporting system for roadside responders. To achieve this, the project included four technical tasks: (1) a review of existing near-miss reporting systems to document their features, (2) interviews with stakeholders to gain agency-level insights into the challenges and opportunities of developing a near-miss incident reporting system, (3) focus group meetings with roadside responders to gather their perspectives and attitudes towards near-miss reporting, and (4) a national survey to understand roadside responders' experiences and suggestions regarding near-miss incident reporting systems. The findings from these tasks were synthesized to inform recommendations for the design and deployment of an effective near-miss reporting system. These recommendations aim to address the identified challenges, leverage the opportunities, and incorporate the needs and expectations of roadside responders, ultimately enhancing their safety and operational efficiency.

The review of existing systems highlighted the importance of striking a balance between standardization and flexibility in addressing the unique requirements of different response agencies. To maximize the utility of the data for both reporting and strategic purposes—such as the development of countermeasures and policies—it is recommended that responder demographics, training, and work history, as well as incident specifics like location and time are gathered. Interviews with stakeholders emphasized the need for analysis tools to convert data insights into actionable training materials, considerations surrounding PII, and the necessity of early and continuous education to embed a culture of near-miss reporting. Focus group meetings revealed various definitions of near-miss incidents, concerns about motorists' compliance with Move Over laws, and the potential benefits and challenges of using advanced technologies for near-miss reporting. The national survey showed significant concerns among towing and law enforcement responders about reporting near-miss incidents, a strong preference for mobile accessibility, and support for using automatic detection technologies.

With findings from these technical tasks, the team developed initial recommendations for developing and deploying a near-miss reporting system. A virtual meeting with roadside response stakeholders and responder safety experts was then held to discuss project findings and recommendations. The meeting informed the further refinement of recommendations for a near-miss incident reporting system's development and deployment. This project underscores the need for a comprehensive, user-friendly, and confidential near-miss incident reporting system. Key recommendations include establishing standardized definitions of near-miss incidents, integrating advanced data acquisition technologies, fostering a positive safety culture, and ensuring widespread publicity and stakeholder engagement. Developing non-punitive reporting policies and securing funding for implementation are also essential

for the system's success. By addressing these elements, the expected near-miss reporting system can significantly enhance the safety of roadside responders, providing valuable data to develop targeted countermeasures and ultimately reducing the risks they face on the job.

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APPENDIX A: NATIONAL SURVEY

Introduction

Thank you for participating in the survey conducted by Alabama Transportation Institute at the University of Alabama, as part of a study funded by the AAA Foundation for Traffic Safety. The survey is supported by the Emergency Responder Safety Institute (ERSI) and the Towing and Recovery Association of America, Inc. (TRAA). This study aims to identify the necessary elements for a successful near-miss reporting system for roadside responders. This survey is designed to understand your experiences, perspectives, and suggestions regarding near-miss incident reporting systems for roadside responders.

Informed Consent

Please read this informed consent carefully before you decide to participate in the study.

Consent Form Key Information: You are invited to participate in an online survey as part of a research study being conducted by researchers at the University of Alabama. The survey will take approximately 15 minutes. This consent form will provide you with information about the study, as well as your rights as a participant. Please read this form carefully and ask any questions you may have before deciding whether to participate. Participate in an online survey about the near-miss reporting system for roadside responders. Participation in this study is voluntary. No information collected that will connect identity with responses.

Purpose of the research study: This survey is designed to understand your experiences, perspectives, and suggestions regarding near-miss incident reporting systems for roadside responders. This study aims to identify the necessary elements for a successful near-miss reporting system for roadside responders.

What you will do in the study: In the survey, you will be asked to answer questions related to near-miss incident reporting systems based on your working experiences. The survey data will be used in the analysis. The data will be kept confidential, and only the research team will have access to the data.

Time required: The survey will require about 15 minutes of your time.

Risks: There are no anticipated risks in this study.

Benefits: Your participation in this study will help the research team better understand the attributes and needs of near-miss incident reporting systems. By sharing your experiences and insights, you contribute valuable information that may help the project team assess the data needs associated with a near-miss reporting system and develop recommendations for a successful reporting system, from system design through to deployment.

Confidentiality: The information that you give in the study will be handled confidentially. Your name and other information that could be used to identify you will not be collected or linked to the data.

Voluntary participation: Your participation in the study is completely voluntary.

Right to withdraw from the study: You have the right to withdraw from the survey at any time without penalty. Your responses will not be recorded should you decide to withdraw.

How to withdraw from the study: To withdraw from the survey, simply close the web browser or tab. There is no penalty for withdrawing. If you would like to withdraw after your responses have been submitted, please contact Dr. Jun Liu, Assistant Professor, University of Alabama, jliu@eng.ua.edu. If you choose to withdraw, any data collected from you will not be used in the study.

Compensation/Reimbursement: At the end of the survey, you can participate in a raffle. There is a two in five chance of winning a \$25 gift card. The raffle will be drawn only among the first 200 participants, so hurry up! If you'd like to participate in the raffle, please leave your professional/work email. We will draw winners from the first 200 participants who leave an email, and the email will be used only for raffle drawing and winner notification.

If you have questions about the study or need to report a study-related issue please contact, contact: Dr. Jun Liu, Assistant Professor, jliu@eng.ua.edu.

If you have questions about your rights as a participant in a research study, would like to make suggestions or file complaints and concerns about the research study, please contact: The University of Alabama Office for Research Compliance (205)-348-8461 or toll-free at 1-877-820-3066. You may also ask questions, make suggestions, or file complaints and concerns through the IRB Outreach Website at <https://research.ua.edu/compliance/irb/>. You may email the Office for Research Compliance at rscompliance@ua.edu.

Agreement:

- I agree to participate in the research study described above.
- I do not agree to participate in the research study described above.

Work Experience and Training Background

In which type of organization are you employed? If you are retired, please select the organization type that applied before retirement.

- Law enforcement (police, sheriff, etc.)
- Paramedics/Private EMS
- Fire
- Towing & Recovery
- Dept. of Transportation, Highway Dept., or Public Works
- Other, please specify:

What is the size of your department or organization?

- Less than 10 employees
- 10 to 25 employees
- 26 to 50 employees
- More than 50 employees

What is your primary role within your department or organization? If you are retired, please select the role that applied before retirement.

- Owner
- Manager or Supervisor
- Employee/Technician
- Other, please specify:

Please enter the zip code of your department or organization:

Incident Reporting Experience

What, in your opinion, should be considered as a “near-miss” incident? Please select all that apply:

- A near-miss should involve some minor property damage, but no one gets hurt.
- A near-miss could be anything when a motorist’s vehicle travels within 1 to 3 feet of the responder.
- Anything that causes a big safety concern to the responder.
- Any motorist entering the “safe zone” (area set up at incident sites).
- None of above
- Other, please specify:

How often do you typically experience a near-miss from a passing vehicle while at a traffic incident?

- Every day
- Every week
- A few times a month
- Several times a year
- Once a year or less
- Never

Have you attended any training that included information about incident reporting?

- Yes, only for struck-by incident reporting
- Yes, only for near-miss incident reporting
- Yes, for both struck-by and near-miss incident reporting
- Yes, but they didn’t talk about the difference between struck-by and near-miss incident reporting
- No, they did not mention any incident reporting at all
- I do not remember

Are there any policies or guidelines within your workplace/department/agency that require you to report near-miss incidents?

- Yes
- No
- Not sure

Does your workplace/department/agency encourage you to report near-miss incidents?

- Yes, internally (reporting within my organization)
- Yes, externally (reporting to outside of my organization, e.g., Emergency Responder Safety Institute)
- Yes, both internally and externally
- No
- Not sure

Which of the following best describes your approach to near-miss reporting?

- I report near-miss incidents using established written procedures.
- I report near-miss incidents by telling my supervisor(s) of the incident in passing.
- I discuss near-miss incidents in a formal setting (e.g., review meetings or safety meetings).
- I informally share near-miss incidents with my co-workers or friends.
- I do not report near-miss incidents to anyone.
- None of the above.
- Other, please specify:
- Prefer not to say

If you report near-miss incidents, how frequently do you do so?

- I report every incident
- I usually report incidents
- I often report incidents
- I sometimes report incidents
- I rarely report incidents
- I do not ever report incidents
- Prefer not to say

Near-Miss Reporting Attitude

Do you believe reporting near-miss incidents can improve safety practices?

- Yes
- No
- Not sure
- Prefer not to say

How important are these factors in your decision to report near-misses in your work?
Rate each on a scale of 1 to 5, where 1 is “Not at all important” and 5 is “Extremely important.”

	1	2	3	4	5
Concern for your safety					
Concern for the safety of your co-workers					
Belief in the importance of improving safety procedures					
Compliance with department/agency policies					
Desire to contribute to a safer work environment					
Other, please specify:					
<input type="text"/>					

Do you perceive near-miss incidents as just a routine part of your job rather than something that should be reported?

- Yes
- No
- Not sure
- Prefer not to say

Many individuals refrain from reporting near-miss incidents. Please rate how important each of these factors is in a decision NOT to report a near-miss incident. Please rate each on a scale of 1 to 5, where 1 is “Not at all important” and 5 is “Extremely important.”

	1	2	3	4	5
Fear of potential consequences or punishment					
View near-miss incidents are not significant					
Just too many near-misses to report					
Too much paperwork					
Not enough training or awareness about reporting near-miss incidents					
Belief that near-miss incidents are not relevant to safety					
Concerns about confidentiality or privacy of the reporting process					
Other, please specify:					
<input type="text"/>					

How concerned are you about reporting near-miss incidents in your work? Please rate each concern on a scale of 1 to 5, where 1 is “Not concerned at all,” and 5 is “Extremely concerned.”

	1	2	3	4	5
Potential misuse of near-miss data					
Potential insurance impacts related to reporting					
Potential legal consequences related to reporting					
Other, please specify:					
<input type="text"/>					

Would you be willing to provide personal identifying information, such as your email or phone number, so the near-miss reporting system managers could verify the information you report?

- Yes, I understand the importance of accurate reporting.
- No, I prefer not to share personal information.
- It depends on the specific circumstances or guarantees provided.
- Not sure

Reporting System Design

Are you aware of the following near-miss incident reporting systems or tools? Please select all that apply:

- Towing Traffic Incident Reporting System (TTIRS)
- LEO Near Miss
- Fire Near Miss
- Emergency Responder Safety Institute’s (ERSI) incident reporting system
- Other, please specify:
- None of the above

Have you used the following near-miss incident reporting systems to report an incident?
Please select all that apply:

- Towing Traffic Incident Reporting System (TTIRS)
- LEO Near Miss
- Fire Near Miss
- Emergency Responder Safety Institute's (ERSI) incident reporting system
- Other, please specify:
- None of the above

Would you prefer a mobile-based or a computer-based platform for reporting near-miss incidents?

- Mobile-based (e.g., phone app)
- Computer-based (e.g., built-in form or a web-based platform)
- Either, I am comfortable with both options
- No preference

Regarding the timing of near-miss incident reporting, what is your favorite approach?

- Immediate reporting after the incident
- Delayed reporting at a more convenient time
- A brief initial report followed by a detailed one later
- No preference

What information should a near-miss reporting form include? Please select all that apply:

- Location of the incident
- Date and time of the incident
- Environment of the incident (e.g., weather, road type)
- Description of the incident
- Type of near-miss (e.g., traffic-related, equipment-related)
- Contributing factors
- Actions taken to prevent the incident
- Additional comments or descriptions about the incident
- Other, please specify:

What features or functionalities are essential in a near-miss incident reporting system?
Please rate each feature on a scale of importance from 1 to 5, with 1 being “Not important” and 5 being “Very important.”

	1	2	3	4	5
Mobile accessibility					
Attachments for photos, videos, or docs					
Audio-to-text transcription					
GPS location tracking					
Anonymous reporting option					
Other, please specify:					
<input type="text"/>					

If a device could be mounted on vehicles to automatically detect near-miss incidents based on tracking passing vehicles and the position of first responders on the road or roadside, would you support its use?

- Yes
- No
- Prefer not to say

Considering the potential adoption of advanced technologies (e.g., a LiDAR system for automatic near-miss detection) for near-miss reporting, how concerned are you about the associated costs?

- Very concerned
- Concerned
- Neutral
- Not concerned
- Not concerned at all

Considering the potential adoption of advanced technologies for near-miss reporting, how concerned are you about the regulatory challenges?

- Very concerned
- Concerned
- Neutral
- Not concerned
- Not concerned at all

How would you prefer to be informed about a new near-miss reporting system and its benefits? Please select all that apply:

- Professional associations and networks.
- Social media and online platforms.
- Awareness events and training sessions.
- Information in magazines or publications.
- Public awareness campaigns.
- Company leadership or direct supervisors.
- Not sure
- Other, please specify:
- Prefer not to say

Additional Information

What is your age?

- Under 18
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65 or over
- Prefer not to say

What is the best description of your gender?

- Male
- Female
- Non-binary
- Prefer not to say

What is your ethnicity? Please select all that apply:

- Caucasian
- African American
- Latino or Hispanic
- Asian
- Native American
- Native Hawaiian or Pacific Islander
- Other/Unknown
- Prefer not to say

What is your state of residence?

What is the highest degree or level of education you have completed?

- Less than a High School Graduate
- High School Graduate or equivalent
- Some college or associate degree
- Bachelor's Degree
- Master's Degree or higher
- Prefer not to say

How many years of experience do you have working as an emergency response personnel?

- Less than 1 year
- 1-5 years
- 6-10 years
- 11-20 years
- More than 20 years
- Prefer not to say

What is your current employment status?

- Retired and not working
- Retired but employed part-time
- Retired but employed full-time
- Currently employed full-time
- Currently employed part-time
- Other, please specify:

Additional Comments

Do you have additional comments or suggestions regarding near-miss incident reporting for roadside responders?

APPENDIX B: STATISTICAL (CHI-SQUARE) TESTS FROM THE NATIONAL SURVEY

Table 24. How often do you typically experience a near-miss from a passing vehicle while at a traffic incident? Comparison by organizations.

		Once a year or less	Several times a year	A few times a month	Every week	Every day	Total
Fire	Frequency	177	336	137	49	24	723
	Percentage	24.5%	46.5%	18.9%	6.8%	3.3%	
LEO	Frequency	20	36	38	14	12	120
	Percentage	16.7%	30.0%	31.7%	11.7%	10.0%	
EMS	Frequency	31	41	32	18	12	134
	Percentage	23.1%	30.6%	23.9%	13.4%	9.0%	
DOT or Public Works	Frequency	7	15	17	12	14	65
	Percentage	10.8%	23.1%	26.2%	18.5%	21.5%	
Towing & Recovery	Frequency	6	28	33	40	44	151
	Percentage	4.0%	18.5%	21.9%	26.5%	29.1%	
Others	Frequency	31	40	27	9	12	119
	Percentage	26.1%	33.6%	22.7%	7.6%	10.1%	
Chi-squared = 234.110, df = 20, p-value < 0.001							

Table 25. How often do you typically experience a near-miss from a passing vehicle while at a traffic incident? Comparison by primary roles.

		Once a year or less	Several times a year	A few times a month	Every week	Every day	Total
Employee	Frequency	83	181	122	51	37	474
	Percentage	17.5%	38.2%	25.7%	10.8%	7.8%	
Manager or Supervisor	Frequency	93	207	103	52	42	497
	Percentage	18.7%	41.6%	20.7%	10.5%	8.5%	
Owner	Frequency	5	21	18	22	27	93
	Percentage	5.4%	22.6%	19.4%	23.7%	29.0%	
Others	Frequency	62	87	41	17	12	208
	Percentage	28.3%	41.8%	19.7%	8.2%	5.8%	
Chi-squared = 90.006, df = 12, p-value < 0.001							

Table 26. Have you attended any training that included information about incident reporting?
Comparison by organizations.

		I do not remember	No	Yes, no difference about SB and NM reporting	Yes, for NM or SB	Total
Fire	Frequency	93	248	102	280	723
	Percentage	12.9%	34.3%	14.1%	38.7%	
Law Enforcement	Frequency	7	41	15	57	120
	Percentage	5.8%	34.2%	12.5%	47.5%	
EMS	Frequency	14	43	21	56	134
	Percentage	10.4%	32.1%	15.7%	41.8%	
DOT or Public Works	Frequency	5	14	8	38	65
	Percentage	7.7%	21.5%	12.3%	58.5%	
Towing & Recovery	Frequency	11	63	13	64	151
	Percentage	7.3%	41.7%	8.6%	42.4%	
Others	Frequency	19	43	14	43	119
	Percentage	16.0%	36.1%	11.8%	36.1%	

Chi-squared = 27.264, df = 15, p-value = 0.027

NM = near miss; SB = struck by

Table 27. Have you attended any training that included information about incident reporting?
Comparison by primary roles.

		I do not remember	No	Yes, no difference about SB and NM reporting	Yes, for NM or SB	Total
Employee	Frequency	54	164	70	205	493
	Percentage	11.0%	33.3%	14.2%	41.6%	
Manager or Supervisor	Frequency	59	176	64	208	507
	Percentage	11.6%	34.7%	12.6%	41.0%	
Owner	Frequency	7	47	6	33	93
	Percentage	7.5%	50.5%	6.5%	35.5%	
Others	Frequency	29	65	33	92	219
	Percentage	13.2%	29.7%	15.1%	42.0%	

Chi-squared = 15.714, df = 9, p-value = 0.073

NM = near miss; SB = struck by

Table 28. Are there any policies or guidelines within your workplace/department/agency that require you to report near-miss incidents? Comparison by organizations.

		Yes	No or not sure	Total
Fire	Frequency	223	500	723
	Percentage	30.8%	69.2%	
Law Enforcement	Frequency	23	97	120
	Percentage	19.2%	80.8%	
EMS	Frequency	30	104	134
	Percentage	22.4%	77.6%	
DOT or Public Works	Frequency	24	41	65
	Percentage	36.9%	63.1%	
Towing & Recovery	Frequency	53	98	151
	Percentage	35.1%	64.9%	
Others	Frequency	37	82	119
	Percentage	31.1%	68.9%	
Chi-squared = 14.097, df = 5, p-value = 0.015				

Table 29. Does your workplace/department/agency encourage you to report near-miss incidents? Comparison by organizations.

		Yes, externally or internally	No or not sure	Total
Fire	Frequency	387	336	723
	Percentage	53.5%	46.5%	
Law Enforcement	Frequency	32	87	119
	Percentage	26.9%	73.1%	
EMS	Frequency	56	78	134
	Percentage	41.8%	58.2%	
DOT or Public Works	Frequency	34	32	66
	Percentage	51.5%	48.5%	
Towing & Recovery	Frequency	96	55	151
	Percentage	63.6%	36.4%	
Others	Frequency	60	59	119
	Percentage	50.4%	49.6%	
Chi-squared = 43.592, df = 5, p-value < 0.001				

Table 30. Does your workplace/department/agency encourage you to report near-miss incidents? Comparison by primary roles.

		Yes, externally or internally	No or not sure	Total
Employee	Frequency	216	277	493
	Percentage	43.8%	56.2%	
Manager or Supervisor	Frequency	272	235	507
	Percentage	53.6%	46.4%	
Owner	Frequency	64	29	93
	Percentage	68.8%	31.2%	
Others	Frequency	114	105	219
	Percentage	52.1%	47.9%	
Chi-squared = 23.490, df = 3, p-value < 0.001				

Table 31. Which of the following best describes your approach to near-miss reporting? Comparison by organizations.

		Discussing in a formal setting	Informally sharing	Reporting by telling supervisor(s)	Reporting by established written procedures	Others	Total
Fire	Frequency	162	195	156	122	88	723
	Percentage	22.4%	27.0%	21.6%	16.9%	12.2%	
Law Enforcement	Frequency	8	58	19	14	21	120
	Percentage	6.7%	48.3%	15.8%	11.7%	17.5%	
EMS	Frequency	20	40	33	20	21	134
	Percentage	14.9%	29.9%	24.6%	14.9%	15.7%	
DOT or Public Works	Frequency	13	17	14	11	10	65
	Percentage	20.0%	26.2%	21.5%	16.9%	15.4%	
Towing & Recovery	Frequency	30	56	29	13	23	151
	Percentage	19.9%	37.1%	19.2%	8.6%	15.2%	
Others	Frequency	25	21	35	17	21	119
	Percentage	21.0%	17.6%	29.4%	14.3%	17.6%	
Chi-squared = 57.619, df = 20, p-value < 0.001							

Table 32. Which of the following best describes your approach to near-miss reporting? Comparison by primary role.

		Discussing in		Reporting by	Reporting by	Others	Total
		a formal setting	Informally sharing	telling supervisor(s)	established written procedures		
Employee	Frequency	77	127	131	81	77	493
	Percentage	15.6%	25.8%	26.6%	16.4%	15.6%	
Manager or Supervisor	Frequency	108	179	84	84	52	507
	Percentage	21.3%	35.3%	16.6%	16.6%	10.3%	
Owner	Frequency	23	34	15	7	14	93
	Percentage	24.7%	36.6%	16.1%	7.5%	15.1%	
Others	Frequency	50	47	56	25	41	219
	Percentage	22.8%	21.5%	25.6%	11.4%	18.7%	
Chi-squared = 52.318, df = 12, p-value < 0.001							

Table 33. If you report near-miss incidents, how frequently do you do so? Comparison by organizations.

		Never	Rarely	Some-times	Often	Usually	Every	Prefer not to say	Total
		Fire	Frequency	123	88	78	49	125	
	Percentage	17.0%	12.2%	10.8%	6.8%	17.3%	31.0%	5.0%	
Law Enforcement	Frequency	37	19	15	4	11	25	9	120
	Percentage	30.8%	15.8%	12.5%	3.3%	9.2%	20.8%	7.5%	
EMS	Frequency	35	15	16	9	23	30	6	134
	Percentage	26.1%	11.2%	11.9%	6.7%	17.2%	22.4%	4.5%	
DOT or Public Works	Frequency	17	7	11	6	8	12	4	65
	Percentage	26.2%	10.8%	16.9%	9.2%	12.3%	18.5%	6.2%	
Towing & Recovery	Frequency	25	20	21	16	24	40	5	151
	Percentage	16.6%	13.2%	13.9%	10.6%	15.9%	26.5%	3.3%	
Others	Frequency	14	11	12	9	30	36	7	119
	Percentage	11.8%	9.2%	10.1%	7.6%	25.2%	30.3%	5.9%	
Chi-squared = 51.665, df = 30, p-value = 0.008									

Table 34. If you report near-miss incidents, how frequently do you do so? Comparison by primary roles.

		Never	Rarely	Some- times	Often	Usually	Every	Prefer not to say	Total
Employee	Frequency	113	53	49	34	91	131	22	493
	Percentage	22.9%	10.8%	9.9%	6.9%	18.5%	26.6%	4.5%	
Manager or Supervisor	Frequency	91	68	71	36	84	133	24	507
	Percentage	17.9%	13.4%	14.0%	7.1%	16.6%	26.2%	4.7%	
Owner	Frequency	17	12	12	9	9	31	3	93
	Percentage	18.3%	12.9%	12.9%	9.7%	9.7%	33.3%	3.2%	
Others	Frequency	30	27	21	14	37	72	18	219
	Percentage	13.7%	12.3%	9.6%	6.4%	16.9%	32.9%	8.2%	
Chi-squared = 27.302, df = 18, p-value = 0.074									

Table 35. Do you believe reporting near-miss incidents can improve safety practices? Comparison by organizations.

		Yes	Others	Total
Fire	Frequency	637	86	723
	Percentage	88.1%	11.9%	
Law Enforcement	Frequency	99	21	120
	Percentage	82.5%	17.5%	
EMS	Frequency	118	16	134
	Percentage	88.1%	11.9%	
DOT or Public Works	Frequency	50	15	65
	Percentage	76.9%	23.1%	
Towing & Recovery	Frequency	104	47	151
	Percentage	68.9%	31.1%	
Others	Frequency	108	11	119
	Percentage	90.8%	9.2%	
Chi-squared = 44.400, df = 5, p-value < 0.001				

Table 36. Do you believe reporting near-miss incidents can improve safety practices? Comparison by primary roles.

		Yes	Others	Total
Employee	Frequency	417	76	493
	Percentage	84.6%	15.4%	
Manager or Supervisor	Frequency	434	73	507
	Percentage	85.6%	14.4%	
Owner	Frequency	67	26	93
	Percentage	72.0%	28.0%	
Others	Frequency	198	21	219
	Percentage	90.4%	9.6%	
Chi-squared = 17.540, df = 3, p-value < 0.001				

Table 37. How important are these factors in your decision to report near-misses in your work? Rate each on a scale of 1 to 5, where 1 is “Not at all important” and 5 is “Extremely important”: Compliance with department/agency policies. Comparison by organizations.

		Not important	Important	Total
Fire	Frequency	199	524	723
	Percentage	27.5%	72.5%	
Law Enforcement	Frequency	50	70	120
	Percentage	41.7%	58.3%	
EMS	Frequency	46	88	134
	Percentage	34.3%	65.7%	
DOT or Public Works	Frequency	15	50	65
	Percentage	23.1%	76.9%	
Towing & Recovery	Frequency	43	108	151
	Percentage	28.5%	71.5%	
Others	Frequency	28	91	119
	Percentage	23.5%	76.5%	
Chi-squared = 14.808, df = 5, p-value = 0.011				

Table 38. How important are these factors in your decision to report near-misses in your work? Rate each on a scale of 1 to 5, where 1 is “Not at all important” and 5 is “Extremely important”: Compliance with department/agency policies. Comparison by primary roles.

		Not important	Important	Total
Employee	Frequency	141	352	493
	Percentage	28.6%	71.4%	
Manager or Supervisor	Frequency	170	337	507
	Percentage	33.5%	66.5%	
Owner	Frequency	24	69	93
	Percentage	25.8%	74.2%	
Others	Frequency	46	173	219
	Percentage	21.0%	79.0%	
Chi-squared = 12.342, df = 3, p-value = 0.006				

Table 39. Do you perceive near-miss incidents as just a routine part of your job rather than something that should be reported? Comparison by organizations.

		Yes	No	Others	Total
Fire	Frequency	161	440	122	723
	Percentage	22.3%	60.9%	16.9%	
Law Enforcement	Frequency	52	50	18	120
	Percentage	43.3%	41.7%	15.0%	
EMS	Frequency	41	74	19	134
	Percentage	30.6%	55.2%	14.2%	
DOT or Public Works	Frequency	21	36	8	65
	Percentage	32.3%	55.4%	12.3%	
Towing & Recovery	Frequency	62	60	29	151
	Percentage	41.1%	39.7%	19.2%	
Others	Frequency	37	66	16	119
	Percentage	31.1%	55.5%	13.4%	
Chi-squared = 45.623, df = 10, p-value < 0.001					

Table 40. Do you perceive near-miss incidents as just a routine part of your job rather than something that should be reported? Comparison by primary roles.

		Yes	No	Not sure	Total
Employee	Frequency	157	265	71	493
	Percentage	31.8%	53.8%	14.4%	
Manager or Supervisor	Frequency	127	296	84	507
	Percentage	25.0%	58.4%	16.6%	
Owner	Frequency	35	44	14	93
	Percentage	37.6%	47.3%	15.1%	
Others	Frequency	55	121	43	219
	Percentage	25.1%	55.3%	19.6%	
Chi-squared = 12.515, df = 6, p-value = 0.051					

Table 41. Not enough training or awareness about reporting near-miss incidents and concerns about confidentiality or privacy of the reporting process. Comparing by organizations.

		Not important	Important	Total
Not enough training or awareness about reporting near-miss incidents				
Fire	Frequency	336	387	723
	Percentage	46.5%	53.5%	
Law Enforcement	Frequency	50	70	120
	Percentage	41.7%	58.3%	
EMS	Frequency	48	86	134
	Percentage	35.8%	64.2%	
DOT or Public Works	Frequency	22	43	65
	Percentage	33.8%	66.2%	
Towing & Recovery	Frequency	74	77	151
	Percentage	49.0%	51.0%	
Others	Frequency	61	58	119
	Percentage	51.3%	48.7%	
Chi-squared = 11.862, df = 5, p-value = 0.037				
Concerns about confidentiality or privacy of the reporting process				
Fire	Frequency	571	154	725
	Percentage	78.8%	21.2%	
Law Enforcement	Frequency	102	18	120
	Percentage	85.0%	15.0%	
EMS	Frequency	106	28	134
	Percentage	79.1%	20.9%	
DOT or Public Works	Frequency	41	24	65
	Percentage	63.1%	36.9%	
Towing & Recovery	Frequency	111	40	151
	Percentage	73.5%	26.5%	
Others	Frequency	101	18	119
	Percentage	84.9%	15.1%	
Chi-squared = 17.337, df = 5, p-value = 0.004				

Table 42. Fear of potential consequences or punishment, view near-miss incidents are not significant, just too many near-misses to report, and concerns about confidentiality or privacy of the reporting process. Comparing by primary roles.

		Not important	Important	Total
<i>Fear of potential consequences or punishment</i>				
Employee	Frequency	357	136	493
	Percentage	72.4%	27.6%	
Manager or Supervisor	Frequency	405	102	507
	Percentage	79.9%	20.1%	
Owner	Frequency	72	21	93
	Percentage	77.4%	22.6%	
Others	Frequency	163	56	219
	Percentage	74.4%	25.6%	
Chi-squared = 8.061, df = 3, p-value = 0.045				
<i>View near-miss incidents are not significant</i>				
Employee	Frequency	346	147	493
	Percentage	70.2%	29.8%	
Manager or Supervisor	Frequency	380	127	507
	Percentage	75.0%	25.0%	
Owner	Frequency	63	30	93
	Percentage	67.7%	32.3%	
Others	Frequency	138	81	219
	Percentage	63.0%	37.0%	
Chi-squared = 11.113, df = 3, p-value = 0.011				
<i>Just too many near-misses to report</i>				
Employee	Frequency	365	128	493
	Percentage	74.0%	26.0%	
Manager or Supervisor	Frequency	389	118	507
	Percentage	76.7%	23.3%	
Owner	Frequency	53	40	93
	Percentage	57.0%	43.0%	
Others	Frequency	173	46	219
	Percentage	79.0%	21.0%	
Chi-squared = 18.787, df = 3, p-value < 0.001				
<i>Concerns about confidentiality or privacy of the reporting process</i>				
Employee	Frequency	374	119	493
	Percentage	75.9%	24.1%	
Manager or Supervisor	Frequency	420	87	507
	Percentage	82.8%	17.2%	
Owner	Frequency	66	27	93
	Percentage	71.0%	29.0%	
Others	Frequency	172	47	219
	Percentage	78.5%	21.5%	
Chi-squared = 10.857, df = 3, p-value = 0.012				

Table 43. How concerned are you about reporting near-miss incidents in your work? Please rate each concern on a scale of 1 to 5, where 1 is “Not concerned at all,” and 5 is “Extremely concerned.” Comparing by organizations.

		Not Concerned	Concerned	Total
Potential misuse of near-miss data				
Fire	Frequency	534	189	723
	Percentage	73.9%	26.1%	
Law Enforcement	Frequency	91	29	120
	Percentage	75.8%	24.2%	
EMS	Frequency	91	43	134
	Percentage	67.9%	32.1%	
DOT or Public Works	Frequency	34	31	65
	Percentage	52.3%	47.7%	
Towing & Recovery	Frequency	105	46	151
	Percentage	69.5%	30.5%	
Others	Frequency	86	33	119
	Percentage	72.3%	27.7%	
Chi-squared = 16.041, df = 5, p-value = 0.007				
Potential insurance impacts related to reporting				
Fire	Frequency	575	148	723
	Percentage	79.5%	20.5%	
Law Enforcement	Frequency	94	26	120
	Percentage	78.3%	21.7%	
EMS	Frequency	94	40	134
	Percentage	70.1%	29.9%	
DOT or Public Works	Frequency	45	20	65
	Percentage	69.2%	30.8%	
Towing & Recovery	Frequency	71	80	151
	Percentage	47.0%	53.0%	
Others	Frequency	95	24	119
	Percentage	79.8%	20.2%	
Chi-squared = 74.099, df = 5, p-value < 0.001				
Potential legal consequences related to reporting				
Fire	Frequency	565	158	723
	Percentage	78.1%	21.9%	
Law Enforcement	Frequency	95	25	120
	Percentage	79.2%	20.8%	
EMS	Frequency	92	42	134
	Percentage	68.7%	31.3%	
DOT or Public Works	Frequency	41	24	65
	Percentage	63.1%	36.9%	
Towing & Recovery	Frequency	89	62	151
	Percentage	58.9%	41.1%	
Others	Frequency	96	23	119
	Percentage	80.7%	19.3%	
Chi-squared = 34.976, df = 5, p-value < 0.001				

Table 44. How concerned are you about reporting near-miss incidents in your work? Please rate each concern on a scale of 1 to 5, where 1 is “Not concerned at all,” and 5 is “Extremely concerned.” Comparing by primary roles.

		Not concerned	Concerned	Total
Potential misuse of near-miss data				
Employee	Frequency	336	157	493
	Percentage	68.2%	31.8%	
Manager or Supervisor	Frequency	379	128	507
	Percentage	74.8%	25.2%	
Owner	Frequency	65	28	93
	Percentage	69.9%	30.1%	
Others	Frequency	161	58	219
	Percentage	73.5%	26.5%	
Chi-squared = 5.893, df = 3, p-value = 0.117				
Potential insurance impacts related to reporting				
Employee	Frequency	357	136	493
	Percentage	72.4%	27.6%	
Manager or Supervisor	Frequency	404	103	507
	Percentage	79.7%	20.3%	
Owner	Frequency	46	47	93
	Percentage	49.5%	50.5%	
Others	Frequency	167	52	219
	Percentage	76.3%	23.7%	
Chi-squared = 39.036, df = 3, p-value < 0.001				
Potential legal consequences related to reporting				
Employee	Frequency	354	139	493
	Percentage	71.8%	28.2%	
Manager or Supervisor	Frequency	392	115	507
	Percentage	77.3%	22.7%	
Owner	Frequency	59	34	93
	Percentage	63.4%	36.6%	
Others	Frequency	173	46	219
	Percentage	79.0%	21.0%	
Chi-squared = 12.332, df = 3, p-value = 0.006				

Table 45. Would you be willing to provide personal identifying information, such as your email or phone number, so the near-miss reporting system managers could verify the information you report?

		Yes	No	Not sure	Total
Organizations					
Fire	Frequency	307	219	197	723
	Percentage	42.5%	30.3%	27.2%	
Law Enforcement	Frequency	49	37	34	120
	Percentage	40.8%	30.8%	28.3%	
EMS	Frequency	62	31	41	134
	Percentage	46.3%	23.1%	30.6%	
DOT or Public Works	Frequency	36	11	18	65
	Percentage	55.4%	16.9%	27.7%	
Towing & Recovery	Frequency	82	28	41	151
	Percentage	54.3%	18.5%	27.2%	
Others	Frequency	53	27	39	119
	Percentage	44.5%	22.7%	32.8%	
Chi-squared = 45.618, df = 10, p-value < 0.001					
Primary roles					
Employee	Frequency	198	144	151	493
	Percentage	40.2%	29.2%	30.6%	
Manager or Supervisor	Frequency	231	130	146	507
	Percentage	45.6%	25.6%	28.8%	
Owner	Frequency	58	15	20	93
	Percentage	62.4%	16.1%	21.5%	
Others	Frequency	102	64	53	219
	Percentage	46.6%	29.2%	24.2%	
Chi-squared = 18.841, df = 6, p-value = 0.004					

Table 46. Mobile accessibility, audio-to-text transcription, and anonymous reporting option. Comparing by organizations.

		Not important	Important	Total
Mobile accessibility				
Fire	Frequency	243	480	723
	Percentage	33.6%	66.4%	
Law Enforcement	Frequency	34	86	120
	Percentage	28.3%	71.7%	
EMS	Frequency	31	103	134
	Percentage	23.1%	76.9%	
DOT or Public Works	Frequency	12	53	65
	Percentage	18.5%	81.5%	
Towing & Recovery	Frequency	39	112	151
	Percentage	25.8%	74.2%	
Others	Frequency	33	86	119
	Percentage	27.7%	72.3%	
Chi-squared = 13.339, df = 5, p-value = 0.020				
Audio-to-text transcription				
Fire	Frequency	495	228	723
	Percentage	68.5%	31.5%	
Law Enforcement	Frequency	78	42	120
	Percentage	65.0%	35.0%	
EMS	Frequency	78	56	134
	Percentage	58.2%	41.8%	
DOT or Public Works	Frequency	40	25	65
	Percentage	61.5%	38.5%	
Towing & Recovery	Frequency	79	72	151
	Percentage	52.3%	47.7%	
Others	Frequency	65	54	119
	Percentage	54.6%	45.4%	
Chi-squared = 21.750, df = 5, p-value < 0.001				
GPS location tracking				
Fire	Frequency	419	304	723
	Percentage	58.0%	42.0%	
Law Enforcement	Frequency	51	69	120
	Percentage	42.5%	57.5%	
EMS	Frequency	65	69	134
	Percentage	48.5%	51.5%	
DOT or Public Works	Frequency	27	38	65
	Percentage	41.5%	58.5%	
Towing & Recovery	Frequency	63	88	151
	Percentage	41.7%	58.3%	
Others	Frequency	48	71	119
	Percentage	40.3%	59.7%	
Chi-squared = 30.697, df = 5, p-value < 0.001				

Table 47. Mobile accessibility, Audio-to-text transcription, and Anonymous reporting option. Comparing by primary roles.

		Not important	Important	Total
Audio-to-text transcription				
Employee	Frequency	304	189	493
	Percentage	61.7%	38.3%	
Manager or Supervisor	Frequency	353	154	507
	Percentage	69.6%	30.4%	
Owner	Frequency	49	44	93
	Percentage	52.7%	47.3%	
Others	Frequency	129	90	219
	Percentage	58.9%	41.1%	
Chi-squared = 15.625, df = 3, p-value = 0.001				
GPS location tracking				
Employee	Frequency	225	268	493
	Percentage	45.6%	54.4%	
Manager or Supervisor	Frequency	305	202	507
	Percentage	60.2%	39.8%	
Owner	Frequency	39	54	93
	Percentage	41.9%	58.1%	
Others	Frequency	104	115	219
	Percentage	47.5%	52.5%	
Chi-squared = 26.784, df = 3, p-value < 0.001				
Anonymous reporting option				
Employee	Frequency	174	319	493
	Percentage	35.3%	64.7%	
Manager or Supervisor	Frequency	224	283	507
	Percentage	44.2%	55.8%	
Owner	Frequency	39	54	93
	Percentage	41.9%	58.1%	
Others	Frequency	121	98	219
	Percentage	55.3%	44.7%	
Chi-squared = 25.640, df = 3, p-value < 0.001				