Construction Industry Institute®

Using Near Miss Reporting to Enhance Safety Performance

Research Summary 301-1

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Prepared by
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Dedicated to the memory of Jimmie Hinze.

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Contents

Executive Summary

In the past decade, construction safety performance has stagnated to the point that only marginal improvements have been achieved. Past safety performance has been driven by lagging indicators, but any improvement in future safety performance will be realized through the effective use of leading indicators. One such metric for worker safety performance is a near miss reporting program. The identification and analysis of near misses helps construction organizations identify hazardous conditions and unsafe work practices before they result in construction accidents. The Construction Industry Institute (CII) established Research Team (RT) 301, Construction Safety, to identify best practices associated with near miss reporting programs.

To do this, the research team performed the following research actions: developed an actionable definition of near misses or non-injury events; investigated ways that near miss reporting can be a positive experience; developed an effective way to collect, analyze, and manage near miss reporting data; and created a tool to improve safety process with near miss data. At the outset, the team examined the many nuances of the various industry definitions of the near miss, considering references to it is as a free lesson, a wake-up call, a learning opportunity, a great catch, an unexpected occurrence, a close call, and so on. The team also assessed effective available means of systematically collecting and applying the information obtained from the near miss data to improve safety performance.

The RT 301 research objective answers the essential research question: "How can near miss reporting be used as a tool to help project teams identify gaps, learn from the events, and significantly improve safety performance?" While the research scope was confined to the construction industry, the research team also examined the successful use of near miss reporting in other work settings. This review focused on near miss programs from multiple U.S. industry sectors, including the chemical process industry, energy, firefighting, manufacturing, medical, military, and the airline industry. The expectation is that all sectors of the construction industry can benefit from the findings of this research.

The team interviewed a large number of personnel (i.e., safety managers, supervisors, and craft workers) on construction sites with active near miss reporting programs, and then analyzed these data, along with the results of its review of other industries' practices. Using this analysis, the team created a near miss reporting program for a construction company. Components of this program include a near miss definition, a reporting strategy, and a recommended flow of near miss information. It also offers near miss reporting guidelines, an implementation strategy, a near miss information flowchart, a near miss reporting database template, and a program evaluation tool for periodic assessment. To evaluate the program, the team asked several construction firms with active construction sites to implement it. Periodic interviews with personnel on these test sites provided useful suggestions for modifications and improvements to the program.

The research results indicate that near miss events and conditions can be reported, analyzed, and mitigated through a near miss reporting program. Near miss reporting was found to lower the OSHA TRIR, increase communication and trust about safety for construction site personnel, and further enable workers to identify hazardous conditions and unsafe worker behavior. For a majority of the participating construction sites, once the near miss reporting program was implemented, the ability to report near misses increased employee motivation to identify and report hazards on construction sites.

Construction companies—specifically construction site personnel—will benefit from this research by learning to identify hazards and reduce workplace risks through near miss reporting. Also, the RT 301 products can enhance a construction company's safety culture, improve worker morale, and increase worker productivity, all without significantly adding to a project or company budget.

1

Introduction

The number of work-related fatalities in the construction industry is consistently and significantly higher than that of other industries in the U.S. (BLS 2013a). Construction companies are required to document safety lagging indicators such as work-related accidents (BLS 2013b), but documentation of other safety leading indicators such as near misses are not mandatory. In 2011, the Bureau of Labor Statistics reported that, for every 10,000 workers, there were 117 recordable cases in which the injury or illness was nonfatal and required days away from work. These numbers were almost identical to those of the previous year for this metric. A direct function of severity of injury or illness is the number of days away from work due to the injury or illness. For 2011, the median number of days missed due to injury or illness was eight, the same value as in 2010 (BLS 2012). Figure 1 shows the OSHA Total Recordable Incident Rate (TRIR) for CII member companies compared to the construction industry at large. Since 2005, CII member companies have failed to make significant improvements in their OSHA TRIR.

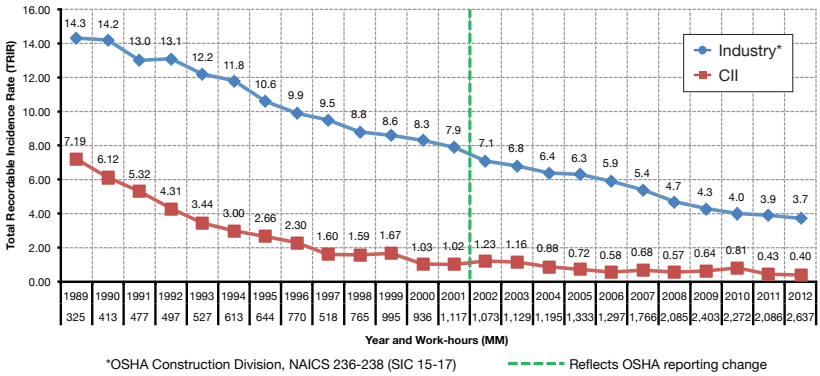

Figure 1. OSHA Total Recordable Incident Rate (TRIR) per Year for Construction Companies (CII 2012a)

Figure 2 presents Heinrich's Safety Pyramid, a conceptual illustration of the safety philosophy that argues that a multitude of near misses and minor incidents increases the probability of a more serious incident occurring (OSG 2009). Adopting the safety pyramid philosophy gives workers a motivation to reduce the number of actual accidents by identifying accidents with the potential to occur. Many safety theorists categorize related approaches as linear causation models. Examples include the Domino Theory and Loss Causation models (Toft et al. 2012).

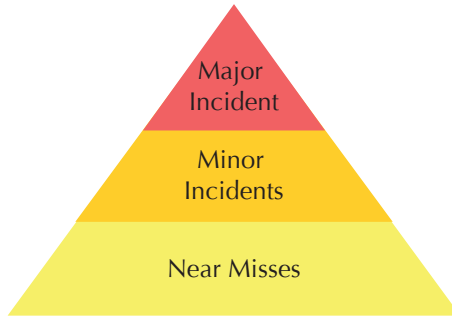

Figure 2. Heinrich's Safety Pyramid (OSG 2009)

These theories posit that accidents result from a sequence of events. Several modifications and augmentations have been applied to the original safety pyramid, including "incidents without damage or loss" and "unsafe hazards and conditions" (Phimister et al. 2003). These additions support previous CII research findings that show that all serious injury to workers can be successfully prevented through zero injury techniques (CII 2003, CII 2003a).

Problem Statement

The findings of CII Research Team (RT) 284, Driving to Zero with Safety Leading Indicators, established the safety performance benefits of measuring safety leading indicators on construction sites; near miss tracking was among the leading indicators studied by RT 284 (CII 2012). With a focus on this leading indicator, Research Team 301 aimed to answer the following question: How can near miss reporting help project teams identify gaps, learn from events, and improve safety by reducing worker exposure to pain and suffering? The research team found that construction organizations can use near miss reporting to identify and correct potentially hazardous conditions or poor worker safety practices before any illness, injury, or fatality occurs.

Research Objective

The research team's primary research objective was to identify best practices associated with near miss reporting programs. To meet this objective, the team developed an actionable definition of near misses or non-injury events, found a way to make near miss reporting a positive experience, developed an effective method of collecting analyzing, and managing near miss data, and established a near miss reporting program.

2

Research Methodology

The research team conducted a background and literature review of near miss reporting programs in the construction industry and other industries. Using the results of this review, the team developed a structured interview to obtain data from construction site personnel. Drawing on both the literature review and the interview data, the team identified and categorized best practices for near miss reporting, and incorporated them into the RT 301 Near Miss Reporting Program. Construction organizations can fully implement this program or incorporate individual components of it into existing programs

While the team's research scope was confined to the construction industry, it examined the use of near miss reporting in other work settings in other industries. The team only investigated non-injury, non-fatal events, and portions of safety programs addressing these kinds of near miss events. It specifically designed its near miss reporting program for implementation within construction companies.

The objective of the interviews conducted by the team was to identify the benefits and limitations of the near miss reporting programs currently utilized by construction companies. The literature review and the interviews provided the data needed to create near miss reporting program guidelines. These guidelines were implemented on active construction sites and monitored by the research team. The team's periodic reviews of projects that had implemented the near miss reporting guidelines revealed unexpected barriers to effective reporting. The team addressed these barriers in its final iteration of the program, and created program evaluation tools and a database template to supplement the program guidelines.

Construction Site Personnel Interviews

Using an interview instrument developed from its literature review findings, RT 301 initially interviewed personnel on a total of 47 construction sites. The team developed various interview questions for construction safety managers, field supervisors (foremen), and laborers. Participating project personnel were from companies and construction projects that claimed to have implemented a near miss reporting program. The interview questions asked for information regarding the following:

1. Company Information: Safety record (OSHA Recordable Injury Rate), annual revenue, number of employees, and services provided
2. Project Information: Total cost, percent complete, safety record, cumulative work hours, first aid incidents, number of safety personnel and first line supervisors
3. Near Miss Reporting Program: Initiating party, near miss definition, flow of near miss information, investigation strategy, number of reported near misses, overall perception of the program, and description of all aspects of the program

Table 1 lists the country and region of each project studied. The population was limited to active construction projects (with near miss reporting programs) affiliated with the organizations represented on the research team.

Table 1. Location of Interview Projects

U.S.		**International**	
Region	*Number*	*Country*	*Number*
Northeast	2	Canada	7
Northwest	6	Singapore	2
Southwest	12	Norway	1
Southeast	17		

In addition to being located in various parts of the world, these construction sites also had wide ranges of costs, types of construction, OSHA Total Recordable Incident Rates, and numbers of personnel, safety personnel, and cumulative work hours. Table 2 gives the range values for some of these metrics.

Table 2. Interview Project Metrics

Project Metric	Mean	Range
Cost	$1.5 billion	$5 million to $10 billion
Cumulative Work Hours	1.6 million	10,800 to 12 million
Number of Workers	408	26 to 2,600
Number of Safety Personnel	6	1 to 60
OSHA TRIR	0.82	0 to 4.30

The RT 301 Near Miss Reporting Program were deployed on nine unique construction sites for further evaluation. The research team conducted monthly interviews with the safety managers on each construction site over a four month period. The safety managers provided the following information:

- number of near misses reported
- OSHA total recordable events reported
- cumulative work hours
- project OSHA Total Recordable Incident Rate (TRIR)
- number of stop work authority events
- opinion concerning the effectiveness and value of the program
- experienced benefits and limitations
- changes made to the near miss reporting program
- effectiveness of each change implemented.

Of the construction sites selected for safety manager interviews, five were considered interventions, because the general contractor on each of the five sites fully implemented the RT 301 near miss reporting program guidelines. The other three construction sites selected for interviews were categorized as “monitoring” projects, because each general contractor had previously implemented a near miss reporting program. In these cases, the general contractor only adapted portions of the RT 301 guidelines. For four months, the team performed monthly reviews with a safety supervisor on each project. The team used the results of these interviews to modify the program. The interviews also provided a test and validation for the implemented program.

3

Near Miss Reporting Program Guidelines

The RT 301 guidelines for implementing and continuous monitoring of near miss programs will help construction organizations develop or enhance their programs. The guidelines are organized into the Near Miss Reporting Program Cycle shown in Figure 3. The program cycle consists of seven steps: 1) Define, 2) Roll Out, 3) Collect, 4) Analyze, 5) Take Corrective Action, 6) Communicate, and 7) Encourage. The program presents best practices for each step (e.g., a near miss is defined in the "Define" step as an unplanned event or unsafe condition that has potential for injury or illness to people, or that causes damage to property, or the environment).

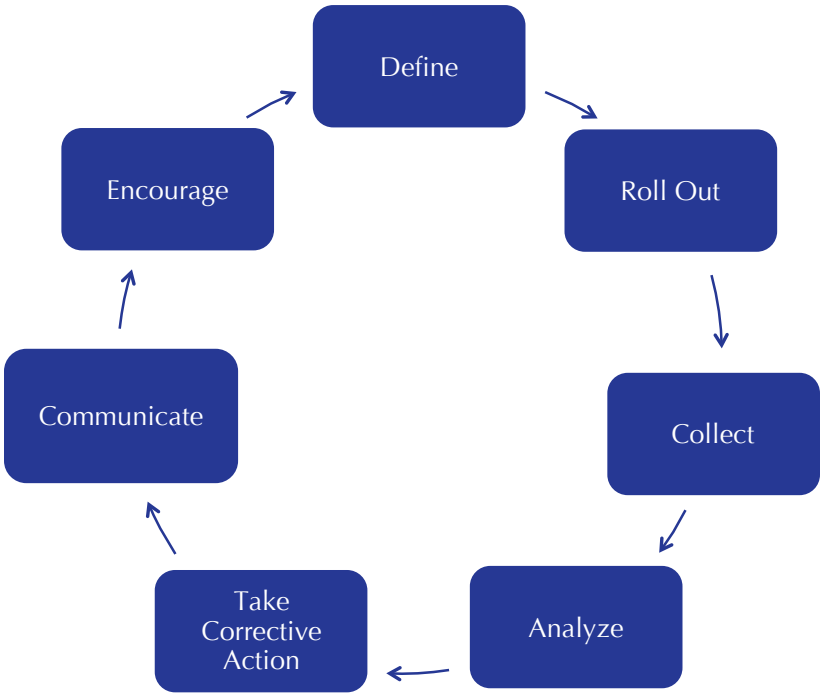

Figure 3. Near Miss Reporting Cycle

Near Miss Reporting Database

The team created a sample database template for implementation or integration into an existing company safety reporting database. To use the template, project safety managers should populate it with data from near miss reporting cards filled out by workers. (Appendix A presents the near miss reporting card form.) The database has the following elements: 1) a user-interface reporting form; 2) a table of near misses reported; and 3) reports based on specific near miss criteria. A unique near miss identification number is assigned to each near miss reported. The database provides for tracking of an individual near miss by allowing for review input and a description of the resolution of the event. The safety manager should complete as many fields as possible for each near miss reported. Figure 4 shows the database reporting form.

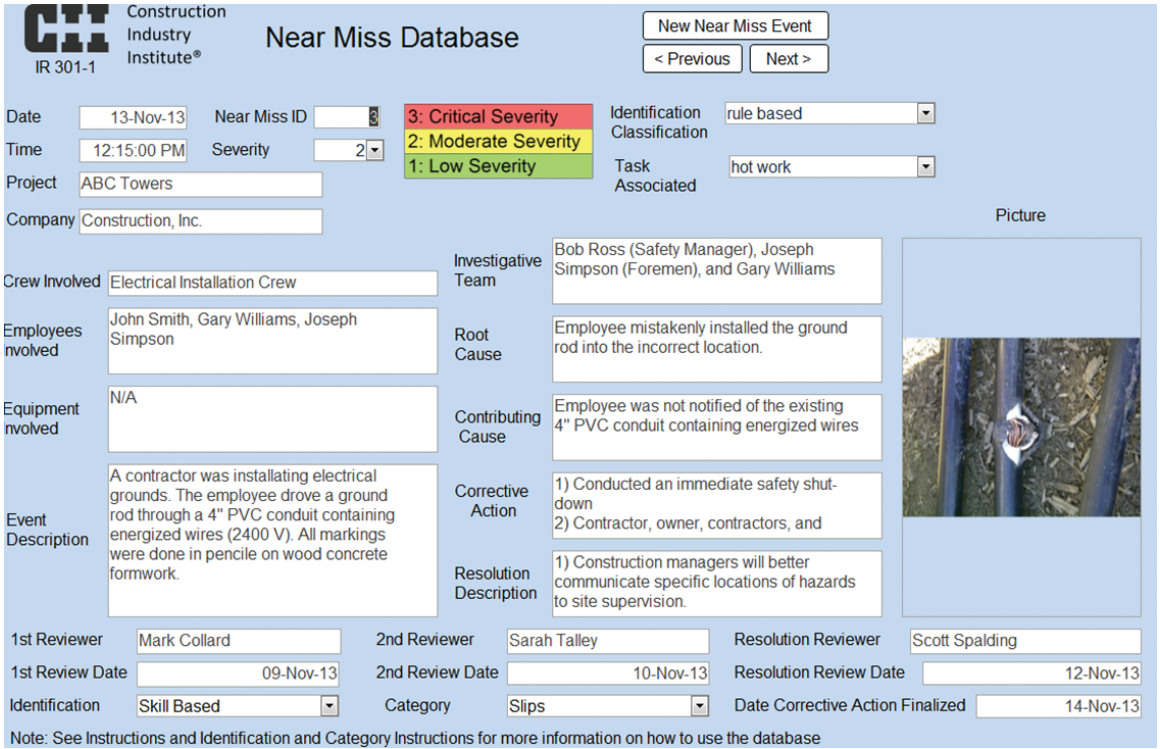

Figure 4. Near Miss Reporting Form for the Database Template

Near Miss Reporting Evaluation Tool

The team also produced a tool for evaluating existing near miss reporting programs. This evaluation tool generates performance scores for each guideline category. The tool asks safety managers and other management personnel questions about their organization's near miss reporting program. The goal is to generate ideas for modifications or additions to the program. The tool also gives users an overall metric and category-specific metrics, to inform users of areas in need of improvement. To help users address these gap areas, it also provides suggested practices and modifications based on the RT 301 Near Miss Reporting Program. Figure 5 presents a screen capture of an interface page of the tool's "Define" section.

This evaluation tool can be used throughout the life cycle of a project to monitor the progress or "health" of the near miss reporting program. Figure 6 shows the tool interface that provides the overall score and the scores for each category.

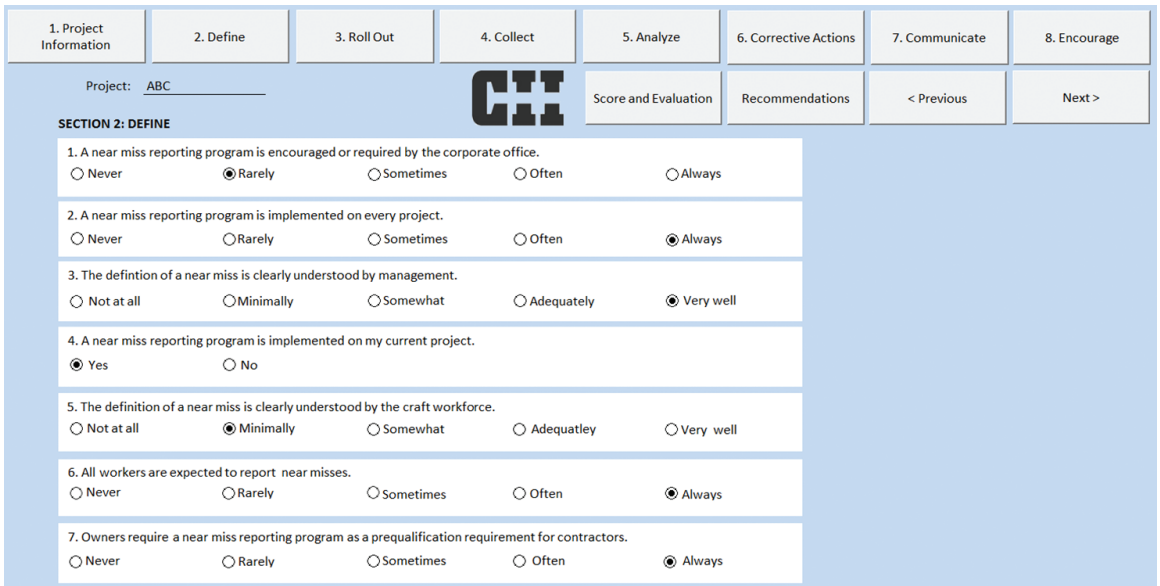

Figure 5. Sample User Interface of the Near Miss Reporting Evaluation Tool

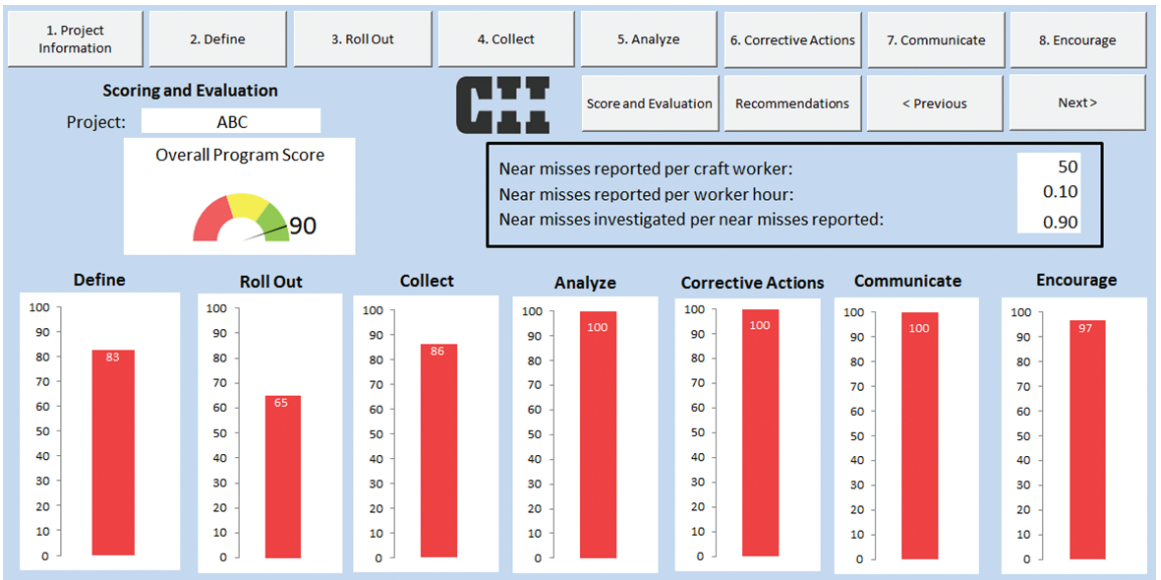

Figure 6. Scoring Interface for the Near Miss Reporting Evaluation Tool

4

Results

The research team performed statistical analyses on the quantitative data collected from the initial construction site personnel interviews. A stepwise regression analysis indicated that a majority of the construction companies interviewed that reported a higher number of near misses experienced a lower OSHA TRIR than companies with a lower number. This finding demonstrates that, for the companies surveyed, the OSHA TRIR was affected by the number of near misses reported.

Components of the near miss reporting program were implemented on six active construction sites for evaluation. The safety managers on these sites were periodically interviewed about the successes, failures, and metrics of their newly implemented near miss reporting program. The research team utilized a near-miss-to-work-hour ratio to evaluate the program's ability to generate near miss reports. Throughout the entire review period, five out of the six case studies experienced a net increase of near misses reporting per work hour.

Based on results of the periodic site personnel interviews, enablers and barriers were identified for the implemented near miss reporting programs. Communication was cited as the greatest enabler, including feedback to workers on near miss reports and near miss reporting training for all site personnel. The most often-reported barriers to implementing and maintaining the near miss reporting were fear of retaliation from management and fear that reporting will reflect poorly on worker performance and evaluation.

Other findings from the periodic interviews revealed several points that must be emphasized for successful program implementation. A project's near miss program must receive unwavering support from all levels of management, both from the owner and the contractor. This support must include the resources necessary to implement and manage

the program. Also, the intent and benefits of the program, the reporting methods, and the expected feedback on a reported near miss, must all be clearly communicated to all project personnel.

5

Conclusions

The construction industry strives toward the routine achievement of accident-free jobsites, with the most important goal of having a zero fatality rate for every construction project. The regulatory requirement to measure and record lagging indicators such as illnesses, injuries, and fatalities only provides for safety performance measurement after incidents occur. Identifying, reporting, and analyzing safety leading indicators, including near misses, has been shown to enhance employee abilities to identify hazards, improve training (e.g., safety training and process training), and validate performance metrics.

To investigate the most effective use of near miss reporting programs, RT 301 reviewed existing near miss reporting programs in construction and other industries. The research team further investigated specific components of near miss reporting programs, including definition of "near miss," reporting strategy, and information flow. The team then interviewed construction personnel on active construction sites with existing near miss reporting programs. A second phase of interviews periodically monitored active construction projects that had implemented the RT 301 Near Miss Reporting Program. The team used the interview results to create best practice guidelines for the near miss reporting program, an information process flowchart for near misses, and an evaluation tool for existing near miss reporting programs.

The results of this research indicate that near miss events can be recorded, analyzed, and corrected through an effective near miss reporting program. Furthermore, near miss reporting was found to enhance safety on the interviewed construction sites, as evidenced by lower OSHA TRIR rates, increased communication about safety (including worker safety training and education), and workers' improved ability to identify hazardous condition and situations. Most of the

companies studied reported an increase in employee motivation to identify and report construction site hazards, after the implementation of the near miss reporting program.

Future research should investigate automatic reporting and analysis of near miss data from active construction sites. New safety concepts and training could evolve from this analysis of near miss data. Moreover, and most importantly, safety personnel can use this analysis to alert workers to existing jobsite hazards and prevent accidents. The findings and products of the RT 301 research, along with such further developments in the use of safety leading indicators all promise to bring construction safety rates down to zero.

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