



MAINTENANCE-OF-WAY (MOW) EMPLOYEE SAFETY SYSTEM – PHASE 1

SUMMARY

From June 2017 to August 2018, the Federal Railroad Administration (FRA) sponsored Transportation Technology Center, Inc. to develop a concept of operations (CONOPS) for a system capable of resolving the location of Maintenance-of-Way (MOW) workers and establishing working limits, and the initial applications that could utilize this data for enhanced safety and other potential functions.

The proposed MOW Employee Safety System (MOWESS) is not a single system, rather it is a set of risk-reducing applications that are intended to improve MOW worker safety by reducing specific risks. The following applications were identified and are described in detail in the CONOPS:

- MOWESS Train Location Application
- High Accuracy Train Location Application
- Train Approach Detection Application
- Watchman Warning System
- MOW Worker Position Monitoring

The CONOPS was developed based on operational use cases derived from MOW rules in the Code of Federal Regulations (CFR) and railroad operating rules, and potential hazards identified through a preliminary hazard analysis (PHA).

The purpose of the MOW worker operational use cases was to describe current railroad operating practices and scenarios associated with establishing and maintaining roadway worker protection. The PHA identified potential

hazards in each of these operational use cases and categorized them into hazard groups. These hazard groups identified the areas to address by the MOWESS.

The work was guided by a railroad advisory group (AG).

BACKGROUND

Each year, accidents occur within MOW work zones. These accidents also result in significant damage to equipment and property. One contributing factor in many of these incidents is a lack of or degraded situational awareness.

To address this concern, FRA and the railroad industry are interested in employing technology capable of resolving the location of roadway workers and establishing working limits. This information could be used to improve situational awareness of individual workers and the Employee in Charge (EIC) of roadway worker safety.

OBJECTIVES

There were four main objectives of this project. These objectives included the following:

- Assembly of an AG of railroad industry and other stakeholders
- Development of MOW operational use cases based on input received from the AG
- Development of a PHA to identify and categorize hazards associated with the MOW operational use cases



- Development of a high-level CONOPS for the initial set of roadway worker safety applications, with FRA and industry AG input

METHODS

The functions to be performed by the MOWESS were determined based on the outcome of analysis that identified the most significant hazards encountered by MOW workers in the MOW railroad environment.

TTCI worked with the AG, and referenced railroad operating rules and the CFR to identify existing methods of roadway worker protection. This information was used to establish a baseline for current MOW operating practices. This baseline information was used to develop operational use cases. A PHA was conducted on each of the operational use cases to identify hazards with the potential for risk reduction with the MOWESS. The hazard groups identified from the PHA were used as the basis for the applications conceived and documented in the CONOPS.

OPERATIONAL USE CASES

The purpose of the MOW worker operational use cases is to describe current railroad operating practices and scenarios associated with establishing and maintaining roadway worker protection. The use cases represent the base case for a PHA.

The use cases were developed based on current practices for roadway worker protection, derived from operating rules (including the General Code of Operating Rules [GCOR], and the Northeast Operating Rules Advisory Committee operating rules [NORAC]) and roadway worker protection rules from the CFR (Title 49 CFR Part 214). The use cases were grouped into sets based on the methods of establishing roadway worker protection.

PRELIMINARY HAZARD ANALYSIS

The PHA utilized the operational use cases to develop a matrix of potential hazards. Events that could lead to a hazardous condition were identified and given a distinct identifier. Potential causes for each of the identified hazards were then documented, noting that there could be more than one cause for a particular hazard. The effects and ultimately the potential mishaps resulting from each hazard were also documented in the PHA.

The hazards were then categorized into groups of hazard types. The following fundamental hazard groups were identified:

- Miscommunication
- Inattention
- Incorrect Individual Train Detection (ITD) Assessment
- Workmen Incapacitated

Once the hazards were organized into hazard groups, hazard mitigation concepts were created with the objective to reduce the risk associated with each of the identified hazard types.

MOWESS CONCEPT OF OPERATIONS

The proposed MOWESS is not a single system, rather it is a set of risk-reducing applications that are intended to improve MOW worker safety by reducing specific risks.

The user platform for the risk reduction application is a small portable device worn by the MOW worker, watchman, and EIC. A cell phone or tablet may have the capability to perform the functions of the MOWESS applications. However, to reduce the risk of distraction by other applications the device will need to be dedicated to the MOWESS application functions. This small portable device will have the capability to be used in different modes specific to the risk reduction application being utilized. The device will need to be able to alert the MOW worker, watchman, and EIC via a visual, audible, and physical alert.



The following applications were identified and are described in detail in the CONOPS:

- MOWESS Train Location Application
- High Accuracy Train Location Application
- Train Approach Detection Application
- Watchman Warning System
- MOW Worker Position Monitoring

CONCLUSIONS

The work conducted on the MOWESS Phase 1 project identified operational use cases and the hazards associated with them. The information produced was utilized by the AG and TTIC engineers to develop a suite of applications designed to reduce the risk to the MOW roadway worker.

FUTURE ACTION

Future project development phases may include an informal survey of the industry to identify technologies already in use that may provide some of the intended functionality or similar functionality in the area of MOW work zone limits monitoring and alerting. System requirements and interface control documents defining data and messages to be generated by roadway worker MOWESS equipment could be developed to further define the details of the system and be used in procurement requests to develop a functional prototype.

Future phases may also include contracting with selected vendor(s) to develop proof-of-concept MOW Work Zone Limits monitoring and Alerting Systems, as well as testing the functionality of the proof-of-concept MOW Work Zone Limits

monitoring and Alert Systems against system requirements at the Transportation Technology Center and on revenue track.

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