Rail Crossing Violation Warning (RCVW) System Prototype Development

Jeff Utterback
Battelle

Adrian Hellman
Volpe
Key Presentation Take-Aways

• An urgent need exists for protecting vehicle drivers at Highway Rail Grade Crossings (HRGCs) – also known as Highway Rail Intersections (HRIs) - beyond traditional active warning devices.

• Federal Railroad Administration (FRA) is researching whether the application of connected vehicle (CV) concepts and services may help.

• FRA previously funded the development and testing of a proof-of-concept prototype Rail Crossing Violation Warning (RCVW) system and is now focused on improving upon that initial prototype.
RCVW Background

  - No appreciable improvement in the frequency of HRGC incidents involving motor vehicles, fatalities, or injuries over the past 8-10 years.
  - HRGCs with traditional active warning devices are no more effective than those with passive crossing devices.
  - Top causes attributed to HRGC crashes includes distracted drivers and driver judgement errors.
- Existing warning devices are limited in effectiveness when a motorist’s situational awareness is compromised; they don’t communicate with roadway-vehicle systems.
RCVW Phase I Overview

• 24-month project (Oct. 2015 – Sep. 2017) funded by FRA and ITS-JPO in which Battelle, with support from CTC Inc. and Texas Transportation Institute:

  • Applied systems engineering to design, develop, test, and evaluate a prototype RCVW system.
  • Reviewed and revised Volpe-developed ConOps and System Requirements for a Vehicle-to-Infrastructure (V2I) application / system to warn drivers endangered at active rail crossings
  • Demonstrated the potential for leveraging real-time connected vehicle (CV) concepts and services to enhance and transform rail crossing safety.
  • Tested and evaluated the developed prototype RCVW system against requirements
  • Reported project and testing findings (https://rosap.ntl.bts.gov/view/dot/34852)
RCVW Phase I Prototype Design

Roadside-based Subsystem
- Road Weather Sensor
- Weather Sensor
- NTRIP Caster
- HRGC Warning System
- Traffic Signal Controller
- TMC Operator

Vehicle-based Subsystem
- Computing Platform
- RSU Radio
- GPS Module
- DVI
- OBU Radio

RCVW System of Interest

OEM Infotainment Display

Advance Preemption
Simultaneous Preemption (Interconnect)
RCVW Phase I Demonstration
RCVW Phase II Overview

• 18-month project phase that began in October 2018, funded by FRA to:
  • Revisit RCVW system needs and design bases
  • Leverage CV technology advances and update to current V2I and ITS standards
  • Base alerting on human factors research
  • Revise RCVW hardware and software to be readily deployable for pilots and demos
  • Rigorously test RCVW II against performance and functionality requirements

• The team for this project is led by Battelle with CTC Inc., Transportation Research Center, Inc. (TRC), and Honda R&D Americas (HRA)
RCVW Phase II Key Focus Areas

- Enhance RCVW functionality
  - Receive preemption via IEEE 1570 interface (supervised) or voltage based simultaneous preempt interconnect
  - Conduct human factors research and create actionable DVI alerts/warnings

- Improve RCVW performance
  - Enhance RCVW positioning
  - Research the use of OBD-II and CAN-based vehicle interface status details
  - Revisit the stopping distance algorithm to reduce complexity and risk of errors

- Evaluate functions & performance (alerts, communication and processing latency)
- Test using more precise vehicle maneuver control, more accurate collection of vehicle performance data, and more test iterations for confidence in results
• Project will be reviewed and valuable input obtained at the following candidate stakeholder outreach conferences:

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<th>Conference</th>
<th>Sponsor</th>
<th>Location</th>
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<tbody>
<tr>
<td>Joint Rail Conference on Railroad Engineering</td>
<td>ASME</td>
<td>Snowbird, Utah</td>
<td>April 9-12, 2019</td>
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<tr>
<td>Rail Crossing Committee Meeting</td>
<td>AAR</td>
<td>Columbus, Ohio</td>
<td>June 19-21, 2019</td>
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<tr>
<td>Rail Conference</td>
<td>APTA</td>
<td>Toronto, Ontario (Canada)</td>
<td>June 23-26, 2019</td>
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<td>Railway Interchange</td>
<td>AREMA</td>
<td>Minneapolis, Minnesota</td>
<td>September 22-25, 2019</td>
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