Automated Visibility Warning Systems

CC 2

Photo: Courtesy of Neil Hetherington, WTI

Description: Automated visibility warning systems deploy weather sensors in order to detect inclement weather conditions (i.e., fog, snow, smoke, dust, white outs, etc.) and warn drivers before they enter reduced visibility areas through the use of dynamic message signs (see #TTI3), flashing lights, or in-pavement lighting. The automated visibility warning system may also communicate with a traffic management center (see #TM9) so that it may disseminate information on reduced visibility conditions through its integrated traveler information systems (see #TTI4).

Rural Transportation Critical Needs

- ☑ Crash Countermeasures
- ☐ Emergency Services
- ☑ Operations & Maintenance
- ☐ Rural Transit & Mobility
- ☑ Surface Transportation & Weather
- ☐ Tourism & Travel Information
- ☐ Traffic Management

Issues Addressed

- ☐ Road Geometry Warning
- ☐ Highway-Rail Crossing Warning
- ☐ Intersection Collision Warning
- ☐ Pedestrian Safety
- ☐ Bicycle Warning
- ☐ Animal Warning
- ☐ Collision Avoidance
- ☐ Collision Notification
- ☑ Weather Warning

Strategies Achieved

- ☑ Road User
- ☐ Road
- ☐ Vehicle
- ☐ Safety Culture
- ☑ Engineering
- ☐ Emergency Response
- ☐ Enforcement
- ☐ Education

Applicability	Partnerships	Key Components
•Visibility warning systems are applicable in both urban and rural environments that are prone to reduced visibility conditions (i.e., fog, snow, smoke, dust, white outs, etc.). These systems will work to reduce the number of crashes related to impaired visibility conditions.	•Applications benefit from collaboration among numerous agencies, which may include: •Departments of transportation (local, state, federal) •Law enforcement	•Weather sensor •Dynamic message sign •Static signs •Flashing beacons •Highway advisory radio •Traffic management center •Closed circuit television •Variable speed limit signs •Intergrated traveler information system

Examples of Implementation

- **Idaho Department of Transportation, I-84 Visibility Warning System**

The Idaho Department of Transportation (ITD) installed a visibility warning system on I-84 where blowing snow or dust caused reduced visibility. The visibility warning system consisted of an environmental sensor station, closed-circuit television (CCTV), vehicle detectors, and signs equipped with flashing lights. If the system determines that the visibility has been reduced below a predetermined amount, the Traffic Control Center (TCC) is alerted. The TCC can confirm conditions using the CCTV and decide to activate the signs.

- **Tennessee Department of Transportation, I-75 Fog Detection and Warning System**

The Tennessee Department of Transportation implemented fog detection and warning systems along 3 miles of I-75, where multiple crashes had occurred due to visibility issues. The system consisted of 9 forward scatter visibility sensors, 14 microwave radar vehicle detectors, and 21 CCTV cameras. Data from the system is sent to the TCC via a buried fiber optic cable. If reduced visibility conditions are present, a driver is warned through 6 warning signs with flashing lights, 10 variable speed limit signs, 10 Dynamic Message Signs (DMS), and a Highway Advisory Radio (HAR). Since the system was deployed, driver safety has improved during low visibility events and only one fog-related crash was recorded in 2001.

- **Arizona Department of Transportation, DUST Warning System**

Arizona Department of Transportation installed a Dual Use Safety Technology (DUST) Warning System along Interstate 10 to detect dust storms. This system has sensors that can detect high winds and low visibility. In addition to sensors, CCTV is used to view and confirm conditions. The DUST system is connected to nearby DMS and HAR, which can automatically display pre-recorded warning messages if sensors detect high winds or low visibility conditions. Furthermore, an email alert can be sent automatically to highway operations and law enforcement to warn of hazardous conditions.

Implementation Considerations (General)	Implementation Considerations (Pro)	Implementation Considerations (Con)
•Closed circuit television can be utilized to validate sensor results. •The types of sensors utilized should be selected based on the visibility issue (i.e. snow, fog) that is being addressed at a specific site. •For detection of reduced visibility conditions at night, a light source must be available.	•Reduces crashes due to limited visibility conditions. •Improves the safety of roads prone to low visibility conditions. •Requires little maintenance.	•Potential for false-positives. •System may require confirmation of detection before signs are activated (see IDT example).

Opportunities for Future Expansion

- Automated visibility warning systems could be implemented in conjunction with variable speed limit signs. If the system detects reduced visibility conditions, the speed limit can be automatically reduced.
- As vehicle to infrastructure (V2I) is implemented, a vehicle could provide a warning to the driver and/or automatically slow down.

Additional Resources

- *Best Practices for Road Weather Management*, found here: https://ops.fhwa.dot.gov/weather/mitigating_impacts/best_practices.htm

Useful Tip

A low-cost option would be to collocate a visibility warning system at an existing Road Weather Information System (RWIS) location that already has a pole, electricity and communications.

Cost Range

(Cost/financial information, where noted, is based on 2016 dollars (unless otherwise specified). Cost/financial information is estimated, and will vary based on size and scope of project, number of units, etc. In general, capital costs include initial purchase costs of hardware, software, and other required equipment. Maintenance and operations costs include staff time to operate, monitor and maintain systems; data collection; system upgrades; evaluation; etc.)

Capital Costs: The total capital cost for this tool ranges from medium ($50,000 to $100,000) to high ($100,000 to $250,000). For example, the Maryland State Highway Administration installed an automated fog warning system to a previously existing environmental sensor station on I-68. This warning system included signs and flashers that would activate during times of low visibility. The cost estimate for this project was $99,000[1]. As another example, the New Mexico Department of Transportation installed a low visibility detection system at two locations along I-10 to warn drivers of reduced visibility conditions during dust storms. The cost of the two installations was $250,000 (approximately $125,000 per location)[2].

Operations Costs: The operations and maintenance costs for this tool are typically low (Less than $50,000) unless the detection sensor would need to be completely replaced (if hit by snowplow for example). Power, communications, replacement bulbs, back-up batteries (for solar), and cleaning of sensors are some potential operations and maintenance costs.

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