mn DEPARTMENT OF TRANSPORTATION

TECHNICAL SUMMARY

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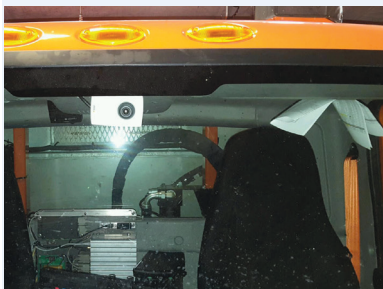
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PROJECT COST:
$128,888

To capture images of road conditions, MnDOT mounted cameras in the cabs of one-quarter of MnDOT's snowplow fleet.

Adding Snowplow Camera Images to MnDOT's Traveler Information System

What Was the Need?

Reliable information about road conditions during winter weather allows motorists to make informed travel decisions and helps MnDOT responders maintain roads. While meteorological updates on a winter storm and automated status reports on Minnesota's snowplow fleet are important sources of data, they do not provide visual information about road conditions.

In 2015, a pilot project allowed MnDOT to take road condition pictures from cameras mounted on selected snowplows during winter storms. The system was limited, however. Few snowplows were outfitted with these cameras, images were not available to the public, and network infrastructure did not allow for easy scaling. A larger scale program was needed to capture road imagery taken from snowplows across Minnesota and to share the pictures with Minnesota motorists.

What Was Our Goal?

MnDOT sought to install cameras on a sizable portion of MnDOT's snowplow fleet. In addition to making hardware and network enhancements to collect and compile the image data, MnDOT also set out to make the photos available in near-real-time to its internal maintenance staff and the traveling public.

What Did We Do?

In 2015 and 2016, MnDOT installed network dash cameras and ceiling-mounted cameras on 226 snowplows, approximately one-quarter of the agency's total snowplow fleet. The cameras, integrated with the onboard mobile data computer and automated vehicle location (AVL) equipment, automatically captured snapshots of road conditions during plowing. This system included the following key operational features:

- The dash cameras automatically recorded images whenever the computer-AVL system was on.

- The cameras recorded an image of the road ahead of the plow.

- Images were taken once every five minutes and were only retained if the plow was moving at least 10 mph.

- The cameras were capable of taking operator-initiated snapshots and video clips.

- Video clips could be classified into three categories: accident, general interest or work zone.

The system sent the plow camera images and metadata (geolocation, plow, camera and conditions) to a MnDOT server upgraded to accommodate the data. MnDOT set a data retention schedule for mobile snapshots and video segments as well as the data server.

Plow images were incorporated into several facets of MnDOT's 511 traveler information system, including the desktop and mobile versions of the website and the 511 app. Plow images plotted at 10-minute intervals on the 511 maps provided motorists with

MnDOT installed network cameras in the cabs of one-quarter of its snowplow fleet and upgraded its hardware, network, website and mobile app to make near-real-time road condition pictures available to the public. The up-to-the-minute data helps MnDOT maintenance staff and travelers alike make well-informed decisions during winter storm events.

MnDOT's 511 website features an interactive map, allowing users to see road conditions at a snowplow's current location, as well as at recent locations on its route.

up-to-the-minute, easily accessible information on road conditions. The images were also incorporated into MnDOT's internal website called Condition Acquisition and Reporting System.

What Did We Learn?

The project demonstrated the successful integration of various hardware, software and network systems, carrying the road weather imagery step by step from the cameras to the public 511 interface. The project also succeeded in scaling up an earlier, modest effort to furnish snowplows with cameras.

In addition, MnDOT collected input on the value of the cameras from a range of interested parties: the public, snowplow operators and supervisors, and MnDOT management staff.

The public response was overwhelmingly positive, with 319 Facebook users responding to a MnDOT post about the cameras. All the respondents used positive emote icons ("heart" or "thumbs up"). Several members of the public provided responses through Facebook and MnDOT's "Contact Us" Web page about the value of being able to view actual road conditions, though others expressed concern about the cost of the system.

Surveys of MnDOT snowplow drivers and supervisors and interviews of MnDOT managers revealed that supervisors and managers had a largely positive view of the program as well. Drivers provided mixed reviews. Comments from these groups yielded the following recommendations about implementing a program of this nature:

- Perform outreach efforts that clearly communicate benefits to achieve broad buy-in from snowplow drivers. Provide training and follow-up instruction on use of the camera's features to encourage drivers to use the manual snapshot and video features.

- Address drivers' concerns about privacy (such as "Big Brother is watching") directly, and understand that these concerns have lessened over time. Supervisors should be advised not to react too quickly to privacy concerns.

- Address concerns about in-cab distraction by adjusting the system configuration or hardware. This might include making dash camera screens dimmable at the driver's option, or placing screens and cameras out of critical sightlines.

What's Next?

This project was a success, with snowplow camera images providing significant benefits to MnDOT staff and the traveling public. Based on this work, MnDOT plans to install camera systems on additional snowplows in the state fleet—as deemed necessary by district management—and to continue displaying snowplow images on MnDOT's 511 system.