2014 Innovative Ideas Program
511 Traveler Information System Enhancements Final Report

Federal Work Order Number:

State Project Number: SP 8816-2222

Project Name: 511 Traveler Information System Enhancements

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Project Objective: This project included four separate but inter-related tasks that MnDOT elected to pursue under the 2014 Innovative Ideas ITS Program, all of which enhance its existing 511 traveler information service: 1) Integrating Public Input in 511; 2) Third-Gen Segment: Winter Driving Condition Reports; 3) Automated, Statewide Travel Times and Delays for 511; and 4) National Weather Service Integration for 511.

Task 1: Integrating Public Input in 511

This task deployed a software module called “CARS-Vox” that had already been initially developed by Castle Rock in partnership with MnDOT’s colleagues at the Idaho Transportation Department and the Iowa Department of Transportation. This tool opens up and enhances MnDOT’s existing 511 traveler information service to enable the public to contribute information to the system, rather than it being simply a one-way broadcast of “official” information. The tools include safeguards to help ensure that public input is relevant, on-topic, and free of offensive content.

Task 2: Third-Gen CARS-Segment Winter Driving Reports

Winter driving condition reporting is one of the key services that MnDOT offers to the public through its 511 service. In this task, Castle Rock built a new toolkit to help MnDOT improve its winter driving reporting operations. The new toolkit is called “Third-Gen CARS-Segment.” Third-Gen CARS-Segment improves the speed/performance of the existing winter driving condition reporting tools, updates the user interface, and includes better visual tools to help operators/reporters view and update existing conditions—particularly those that have grown out of date. It also focuses on dual support of both desktop and mobile reporting, as MnDOT utilizes a hybrid reporting model, with some conditions being reported in the field and some in a central office.

Task 3: Automated, Statewide Travel Times and Delays for 511

In this task, real-time travel delay information has been integrated more closely into the overall MN 511 system through a new module called CARS-Delay. CARS-Delay performs fully automated and regular travel time queries to determine the location of individual holdups using Google. Travel times queries are then used to dynamically update both the priority and traffic impact of existing events in CARS.
**Task 4: National Weather Service Integration**

In this task, Castle Rock deployed a module called “CARS-CAP” for MnDOT whose purpose is automatically to import National Weather Service (NWS) warnings into Minnesota’s 511 system. The CAP importer constantly monitors NWS’s CAP feed looking for warnings at the statewide level in Minnesota that meet the specified criteria for reporting on 511. When it finds a warning to be imported, CARS-CAP parses it and creates events, which are shared both with operators and with the public through 511.

**Project Partners:**
- Minnesota Department of Transportation, Castle Rock

**Work Completed:**

**Task 1: Integrating Public Input in 511**

- **One Page Summary:** The one page summary is complete.
- **Concept of Operations (Phases 1 & 2):** Castle Rock has created the Concept of Operations document for CARS-Vox that provides the basis for the subsequent software development roll-out.
- **Functional Requirements (Phases 1 & 2):** Castle Rock has created the Functional Requirements document for CARS-Vox that provides the basis for the subsequent software development roll-out.
- **System Design Document (Phases 1 & 2):** Castle Rock has developed the System Design Document for CARS-Vox that describes how the end product will meet the system functional requirements.
- **Software Development & Deployment (Phases 1 & 2):** Castle Rock has installed and configured the CARS-Vox software in a staging environment and demonstrated the software for MnDOT review.
- **Testing & Operational Release (Phases 1 & 2):** Castle Rock has tested the CARS-Vox system against the Functional Requirements, addressed identified issues, and released the systems for production use.

**Task 2: Third-Gen CARS-Segment Winter Driving Reports**

- **One Page Summary:** The one page summary is complete.
- **Concept of Operations:** Castle Rock has created the Concept of Operations document for TG CARS-Segment that provides the basis for the subsequent software development roll-out.
- **Functional Requirements:** Castle Rock has created the Functional Requirements document for TG CARS-Segment that provides the basis for the subsequent software development roll-out.
- **System Design Document**: Castle Rock has developed the System Design Document for TG CARS-Segment that describes how the end product will meet the system functional requirements.
- **Software Development & Deployment**: Castle Rock has installed and configured the TG CARS-Segment beta release in a staging environment for MnDOT review.
- **Testing and Operational Release**: Castle Rock has tested the TG CARS-Segment software against the Functional Requirements, addressed identified issues, and released the systems for production use.

Task 3: Automated, Statewide Travel Times and Delays for 511

- **One Page Summary**: The one page summary is complete.
- **Concept of Operations**: Castle Rock has created the Concept of Operations document for CARS-Delay that provides the basis for the subsequent software development roll-out.
- **Functional Requirements**: Castle Rock has created the Functional Requirements document for CARS-Delay that provides the basis for the subsequent software development roll-out.
- **System Design Document**: Castle Rock has developed the System Design Document for CARS-Delay that describes how the end product will meet the system functional requirements.
- **Software Development & Deployment**: Castle Rock has installed and configured the CARS-Delay beta release in a staging environment for MnDOT review.
- **Testing and Operational Release**: Castle Rock has tested the CARS-Delay software against the Functional Requirements, addressed identified issues, and released the systems for production use.

Task 4: National Weather Service Integration

- **One Page Summary**: The one page summary is complete.
- **Concept of Operations**: Castle Rock has created the Concept of Operations document for CARS-CAP that provides the basis for the subsequent software development roll-out.
- **Functional Requirements**: Castle Rock has created the Functional Requirements document for CARS-CAP that provides the basis for the subsequent software development roll-out.
- **System Design Document**: Castle Rock has developed the System Design Document for CARS-CAP that describes how the end product will meet the system functional requirements.
- **Software Development & Deployment**: Castle Rock has installed and configured the CARS-CAP software in a staging environment and demonstrated the software for MnDOT review.
- **Testing & Operational Release**: Castle Rock has tested the CARS-CAP system against the Functional Requirements, addressed identified issues, and released the systems for production use.
**Successes & Challenges:** The 511 Traveler Information System Enhancements project proposed to enhance MnDOT’s existing 511 Traveler Information System with new reporting tools and improve the quality of information available to the travelling public. All work began September 18\(^{th}\), 2014 and concluded on time and on budget by June 30\(^{th}\), 2015.

**Task 1: Integrating Public Input in 511**

Third-Gen CARS-Vox Phase 1 went live June 23\(^{rd}\) and Phase 2 went live on June 29\(^{th}\). In the course of the project, MnDOT elected to add the public reporting features only to the MN 511 web site. The idea of adding the public input controls to the Mn 511 app was dropped due to concerns about the potential for misuse / distracted driving. MnDOT has not yet begun publicizing the new public input features in 511 or training citizen reporters for the 2015/2016 winter season. However, an examination of existing events on the full-feature 511 public website shows that site visitors are already leaving useful event verification feedback.

**Task 2: Third-Gen CARS-Segment Winter Driving Reports**

Third-Gen CARS-Segment has been operating in staging since May 5\(^{th}\) as a desktop website, and has been available in staging since June 30\(^{th}\) as downloadable iOS and Android apps. TG CARS-Segment will be deployed as MnDOT’s live winter driving reporting system for the 2015/2016 winter reporting season.

**Task 3: Automated, Statewide Travel Times and Delays for 511**

CARS-Delay has been operating in staging since May 13\(^{th}\), is fully functional for Minnesota’s deployment, and is ready to deploy in MnDOT’s live 511 Traveler Information System.

**Task 4: National Weather Service Integration**

Third-Gen CARS-CAP went live on January 28\(^{th}\). Since system launch, Minnesota has experienced many CARS-CAP compliant weather events that have been successfully communicated to the travelling public via MnDOT’s 511 system, including Winter Storm Warnings, Severe Thunderstorm Warnings, Tornado Warnings, Blizzard Warnings, Flash Flood Warnings, High Wind Warnings, Freezing Rain Advisories, and Dense Fog Advisories.

The greatest challenge faced in this 511 Traveler Information System Enhancements project was designing, developing, testing, and delivering all software between notice to proceed, on September 18\(^{th}\), 2014 and the end of MnDOT’s fiscal year on June 30\(^{th}\). Software development can be unpredictable and therefore estimating accurate timelines can be difficult. Even if we are able to plan and account for the typical or expected hiccups throughout the development process, new and unforeseen complications often arise.
**Measures of Success:** The measures of success used to evaluate MnDOT's traveler information system enhancements may include both quantitative and qualitative assessments, as discussed below.

To capture the quantitative measures of success, MnDOT may draft and analyze an end-of-season public feedback survey that would be carried out to evaluate the success of the project work. Castle Rock will post the end-of-season electronic public feedback survey (using, for example, Survey Monkey) on the MnDOT 511 web site upon MnDOT request.

**Task 1: Integrating Public Input in 511**

In evaluating this success of this project, many of the system enhancement benefits can be measured directly: e.g., the number of end users who participate in the program; the % of end users that actively submit reports; frequency of report submittal; etc. Quantitative measures are indeed built in to the system enhancement design such that quantitative evaluation data will be, in effect, a direct project deliverable.

The concepts in this work can also be usefully evaluated from a qualitative perspective. These aspects—such as improving the traveling public's decision making during weather events, are more difficult to capture. However, the very nature of the project should again yield a rich supply of qualitative data as members of the public use the social media platforms we built to provide input and feedback.

Measures of success may include:

1. Citizen reports may help fill observation gaps, spatially and temporally
   - End users actively submit reports
   - Reports are submitted for Interstate, US, and State highways
   - Reports are submitted for local roads

2. Citizen reports provide accurate and timely information to MnDOT
   - Citizen reports are 95+% accurate; this can be measured if MnDOT vets individual end user reports.

3. The traveling public may be able to make more informed decisions based on the new information
   - Members of the public indicate through Twitter and other feedback forums that they find the new information useful.

4. The traveling public may perceive a benefit from the enhanced information
   - Citizen reports may help to reduce stress caused by transportation
   - End of winter reporting season public survey may indicate 50+% of responders directly benefited from citizen reports.
As of June 30th, MnDOT has not begun publicizing the new public input features in 511 or training citizen reporters for the 2015/2016 winter reporting season. The success of this project will largely be measured throughout the 2015/2016 winter reporting season.

**Task 2: Third-Gen CARS-Segment Winter Driving Reports**

Third-Gen CARS-Segment improves winter driving condition operations at MnDOT. Project outcome measurements will focus on system performance data collected during the 2015-16 winter reporting season.

Measures of success may include:

1. Overall system performance is improved during weather events
   - Reduction in support tickets created to solve system issues during winter reporting system

2. Winter road condition reporting accuracy and timeliness is improved by in-field reporting via the mobile app.

3. Winter road condition reporting accuracy is improved by additional geolocation and/or mapping features, and visual tools that will help operators/reporters view and update existing conditions.

4. The traveling public makes more informed decisions based on the improved winter road condition reporting accuracy and timeliness.

5. The traveling public perceives a benefit from the improved winter driving condition reporting
   - Improved winter road condition reporting helps to reduce stress caused by transportation
   - End of winter reporting season public survey indicates that 80+% of responders are satisfied with MnDOT’s winter road condition reporting

6. Internal MnDOT operations benefits from the improved speed/performance of reporting tools

7. Internal MnDOT operations benefits from in-field reporting
   - In-field mobile app reporting increases MnDOT operations efficiency by a perceivable margin

Third-Gen CARS-Segment will be used as the DOT’s winter road condition reporting tool beginning in the 2015/2016 winter reporting season. The success of this project will largely be measured throughout the 2015/2016 winter reporting season.

**Task 3: Automated, Statewide Travel Times and Delays for 511**
Automated, Statewide Travel Times for 511 provides additional context to the event reports currently carried by MnDOT’s 511 system such that end users can see not only the events along the roadway but also the impact they may currently be having on traffic.

Measures of success may include:

1. Additional travel time and delay reporting enhances the quality of information on MnDOT’s 511 system.

2. Improved travel time and delay reporting increases travel time reliability on Minnesota’s roadways.
   - End users will have a better understanding of whether or not a particular roadway or crash is currently affecting traffic conditions on their planned route.

3. The traveling public perceives a benefit from the improved travel time and delay information reporting on MnDOT’s 511 traveler information system.
   - Improved reporting helps to reduce stress caused by transportation
   - Members of the public indicate through Twitter and other feedback forums that they find the new information useful
   - Public survey indicates that 80+% of responders are satisfied with MnDOT’s travel time and delay information reporting

CARS-Delay will go live at the request of MnDOT. The success of this project will largely be measured throughout the rest of 2015 and into 2016.

Task 4: National Weather Service Integration

National Weather Service / 511 Integration improves the weather-related information that MnDOT offers on its 511 traveler information system to help manage the impact of weather on Minnesota’s roadways.

Measures of success may include:

1. Weather-related information reporting is improved by the automated import of National Weather Service warnings into MnDOT’s 511 traveler information system.

2. The traveling public makes more informed decisions based on the automated import of National Weather Service warnings and watches into MnDOT’s 511 traveler information system.

3. The traveling public perceives a benefit from the automated import of National Weather Service warnings and watches into MnDOT’s 511 traveler information system.
   - Improved reporting helps to reduce stress caused by transportation
   - Members of the public indicate through Twitter and other feedback forums that they find the new information useful
End of winter reporting season public survey indicates that 80+% of responders are satisfied with MnDOT's weather related information reporting.

As described above, Third-Gen CARS-CAP went live on January 28th. Since system launch, Minnesota has experienced many weather events that have been imported into CARS and 511 and shared with those end user bases. Including information about these weather events on MnDOT’s 511 Traveler Information System has improved weather-related information reporting in Minnesota.

Weather events that have been successfully communicated to the travelling public since launch include: Winter Storm Warnings, Severe Thunderstorm Warnings, Tornado Warnings, Blizzard Warnings, Flash Flood Warnings, High Wind Warnings, Freezing Rain Advisories, and Dense Fog Advisories. Further measures of success can be attained through public feedback about the new system as well as through a public survey, should MnDOT wish to post one.