ENTERPRISE Transportation Pooled Fund Study TPF-5 (231)

Use and Impacts of Camera Images and Other Displays of Traveler Information

FINAL REPORT

Prepared by

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16. Abstract The overall objective of this project was to understand the use and impacts of camera images and other "unverified" displays of information that can be interpreted by travelers, especially when compared to the use of verified reports. It is anticipated that the results from this project could be used by agencies who are questioning whether to display "unverified" information to travelers or whether they should increase/decrease their current displays (e.g. add more cameras for display to the public). The focus of the project was on traveler information websites hosted by transportation agencies, as opposed to information accessed via agency 511 phone lines, changeable message signs on roadways, or other sources of traveler information.			
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Project Champions and Project Team

Bill Legg, Washington State Department of Transportation, was the ENTERPRISE Project Champion for this effort. Joop Van Bergen, Dutch Ministry of Transport (Rijkswaterstaat), initiated the project's problem statement and was the ENTERPRISE Project Co-Champion.

Members of the project team who provided input during the project, including feedback on the survey design, web usage statistics, and information about new camera deployments:

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Table of Contents

Executive Summary **1**
1.0 Background and Introduction **5**
2.0 Project Objective **7**
3.0 Project Approach **8**
4.0 Summary of Relevant Literature **9**
5.0 Online Survey of Travelers **10**
5.1 Survey Design and Participating Organizations 10
5.2 Survey Duration and Response Rate 12
5.3 Survey Results 12
5.3 Key Findings from Survey Results 21
6.0 Web Usage Comparisons **23**
6.1 Assessment Approach 23
6.2 Results of Web Usage Comparisons 23
6.3 Key Findings from Web Usage Comparisons 45
7.0 Impacts of New Camera Deployments **46**
7.1 Assessment Approach 46
7.2 Summary of Interview Responses 47
7.3 Key Findings from New Camera Deployments 56
8.0 Conclusions **57**

Appendix A – Survey Questions **A-1**

Executive Summary

At the highest level, traveler information provided by transportation agencies can be categorized in to two distinct types of dissemination:

1) **Verified Reports**: Information formulated and/or verified by transportation agencies that describes travel conditions on roadways, providing quantitative or qualitative descriptions about what travelers can expect on their route. Verified reports may include:

    - ***Traffic Maps -*** Maps that visually display measured traffic speeds
    - ***Congestion Reports / Travel Times*** – Descriptions that report time delays or travel times between two points
    - ***Incident Reports*** – Reports that describe locations of incidents (e.g. stalled vehicles, crashes, debris on the roadway) that could impact congestion or safety
    - ***Road Condition Maps and/or Reports*** – Maps and reports that describe weather-related driving conditions (good, fair, poor) or pavement conditions (dry, wet, icy, etc.)
    - ***Construction* Locations *and Road/Lane Closures* –** Maps and descriptions that indicate work zone locations and limits of lane or road closures

    For example, an incident report provided by an agency may indicate the location of an incident and the impact to the roadway (e.g. left lane closed). An incident report is typically verified by the agency by viewing the incident site via a live camera feed and/or verbal descriptions provided by dispatch or law enforcement on the scene.

2) **Unverified Displays**: Displays that provides information that is open to interpretation by travelers and may influence travel decisions. Unverified displays may include:

    - ***Camera Images*** – Real-time "snapshot" views that travelers may use to interpret travel conditions (e.g. traffic speeds or weather-related road conditions.)
    - ***Live Video –*** Real-time motion views that travelers may use to interpret travel conditions
    - ***Weather Monitoring Station Data*** – Current weather data (e.g. air temperature, wind speeds, etc.) that travelers may use to interpret how atmospheric conditions are impacting roadway conditions

    For example, one traveler may view a camera image on a transportation agency website and interpret the traffic condition as congested, whereas another traveler may view the same camera image and interpret the traffic condition as free flowing.

Objective

The overall objective of this project was to understand the use and impacts of camera images and other "unverified" displays of information that can be interpreted by travelers, especially when compared to verified reports. It is anticipated that the results from this project could be used by agencies who are questioning whether to display unverified displays to travelers or whether to increase/decrease their current displays (e.g. add or decrease cameras for display to the public.)

Project findings could also help agencies better understand potential issues and impacts associated with travelers' interpretation of various information types. For example, travelers who misunderstand unverified displays (e.g. weather information or camera images) may perceive conditions to be better or worse than actual conditions. In contrast, travelers who rely heavily on verified reports, which may not always be up-to-date and accurate, might be better served to see unverified displays of "real-time" conditions. For example, a section of road designated as "Dry" on a traveler information website may actually be snow-covered or icy, due to changing weather conditions, in which case travelers could receive more accurate information by viewing a camera image showing actual conditions.

Approach

The focus of the project was on traveler information websites hosted by transportation agencies, as opposed to information accessed via agency 511 phone lines, changeable message signs on roadways, or other sources of traveler information. The project consisted of four investigation approaches:

1) **Literature Search** - Relevant literature was reviewed and summarized in order to avoid duplication of efforts and learn from previous related efforts.

2) **Online Survey of Travelers** - A survey (posted on transportation agency traveler information websites) was conducted to gather feedback from motorists.

   - Five (5) state DOTs hosted the online survey.
   - The survey design included the following areas of inquiry:
     - Survey contributors were asked to rate the usefulness of various types of traveler information, including examples of verified reports and unverified displays.
     - Survey contributors were asked about the added value of viewing camera image in addition to color-coded traffic maps. They were also asked about the importance of viewing traffic maps in addition to camera images.
     - Survey contributors were asked to choose the information type (weather reports, road condition maps, camera images) that is the most useful when seeking weather-related road information.

3) **Web Usage Comparisons** - Web statistics from DOT traveler information websites were gathered and assessed to determine usage patterns for various traveler information types.

- Five (5) comparisons were completed, utilizing web usage statistics provided by four (4) state DOTs.
- Comparisons included both traveler information websites that cover mainly metropolitan areas and traveler information websites that provide statewide traveler information.

4) **Assessment of Impacts due to Deployment of New Cameras** - Interviews were conducted with staff from transportation agencies that have recently deployed new cameras, to determine if/how the deployments impacted travelers.
   - Three (3) state DOTs participated in interviews for this assessment.
   - Assessment sites with new camera deployments included six (6) cameras in rural Idaho, approximately six (6) cameras in the Tacoma, Washington metropolitan area, and approximately 46 camera images in rural Iowa that were made available to the public for the first time on Iowa DOT's Traveler Information Website.

Results

Overall findings indicate that unverified displays, specifically camera images and weather station data, are not as highly accessed as verified reports such as traffic maps and road condition maps/reports. However, many users of traveler information websites indicated that they highly value camera images, especially in combination with traffic maps and road condition maps/reports. Observations from agency staff indicated that the public expresses a strong desire to have as much information as possible about traffic and road conditions and will commonly express dissatisfaction when camera images are not available in specific areas of low coverage or are not functioning properly.

725 responses to the online survey of travelers were received. Results revealed a number of preferences reported by users of traveler information websites:

- Camera images are highly valued by many traveler information website users, especially to complement information provided by traffic maps and road condition reports. Camera images are often valued because they are considered to be more "real-time" than traffic maps.
- Most users of traveler information websites would not be satisfied with camera images alone, especially when obtaining information about traffic/congestion conditions.
- Camera images appear to be more useful to traveler information website users during inclement weather, especially in rural areas and by younger drivers.
- Camera images were rated nearly as highly as road condition reports, in terms of the most useful type of information when seeking weather-related road condition information. A number of users of traveler information websites expressed value in viewing a combination of camera images and road condition reports when seeking this information.
- Weather reports (air temperature, wind speeds, etc.) are not considered to be very useful.

The web usage comparisons provided observations about actual usage patterns for various types of information on traveler information websites*:*

- Unverified displays (camera images and weather station data) were not accessed as frequently as verified reports (traffic maps and/or road condition maps/reports). The lower use of camera images may indicate that visitors to traveler information websites are often satisfied with the information they receive from landing pages (typically verified reports such as traffic maps or road condition maps) and do not always need to see camera images to view actual conditions.
- The rate of access to camera images increased with inclement weather (e.g. significant winter storms, flooding events) and during construction seasons. In many cases, though access to other pages also increased with winter weather, the rate of increase was not as dramatic as the increase in access to camera images.
- In the Twin Cities metro area, cameras images were highly accessed near work zones that created significant congestion.
- Camera images appear to be highly accessed near work zones that create significant congestion.

Interviews with agency staff from the Idaho Transportation Department (ITD), Iowa DOT, and Washington State Department of Transportation (WSDOT) provided insights about the impacts of making new camera images available via traveler information websites:

- Decisions to deploy new cameras are not typically driven by public demand. Rather, these investments are typically made to improve traffic management and operations. In the Iowa DOT case, however, the decision to make cameras available throughout the state in rural areas was driven by the agency's desire to provide as much information as possible to motorists, especially in rural areas during winter weather events.
- Inclement weather (e.g. snow events) creates high demand for traveler information, as observed by WSDOT while monitoring web usage over time and noted by Iowa DOT as a motivating factor for making camera images in rural areas available via their traveler information website.
- The public generally expects to have as much information as possible about travel conditions. ITD received requests from the public for additional cameras and weather station data in areas where there were gaps in coverage. In each deployment case, agencies received expressions of appreciation after cameras were deployed.
- As new cameras and RWIS stations are deployed by ITD in areas with sparse coverage, district maintenance stations experience fewer calls from the public requesting road conditions.
- In the WSDOT case, news media played an important role in disseminating information about traffic conditions along the I-5 corridor where new cameras were deployed. WSDOT staff observed that when incidents are highly publicized, motorists tend to change their travel patterns accordingly. In this instance, the availability of camera images is influencing travel behavior, due to increased publicity.

1.0 Background and Introduction

At the highest level, traveler information provided by transportation agencies can be categorized into two distinct types of dissemination:

1) **Verified Reports**: Information formulated and/or verified by transportation agencies that describes travel conditions on roadways, providing quantitative or qualitative descriptions about what travelers can expect on their route. Verified reports may include:

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   - ***Road Condition Maps and/or Reports*** – Maps and reports that describe weather-related driving conditions (good, fair, poor) or pavement conditions (dry, wet, icy, etc.)
   - ***Construction* Locations *and Road/Lane Closures* –** Maps and descriptions that indicate work zone locations and limits of lane or road closures

   For example, an incident report provided by an agency may indicate the location of an incident and the impact to the roadway (e.g. left lane closed). An incident report is typically verified by the agency by viewing the incident site via a live camera feed and/or verbal descriptions provided by dispatch or law enforcement on the scene.

2) **Unverified Displays**: Displays that provides information that is open to interpretation by travelers and may influence travel decisions. Unverified displays may include:

   - ***Camera Images*** – Real-time "snapshot" views that travelers may use to interpret travel conditions (e.g. traffic speeds or weather-related road conditions.)
   - ***Live Video* –** Real-time motion views that travelers may use to interpret travel conditions
   - ***Weather Monitoring Station Data*** – Current weather data (e.g. air temperature, wind speeds, etc.) that travelers may use to interpret how atmospheric conditions are impacting roadway conditions

   For example, one traveler may view a camera image on a transportation agency website and interpret the traffic condition as congested, whereas another traveler may view the same camera image and interpret the traffic condition as free flowing.

The overall objective of this project was to understand the use and impacts of camera images and other "unverified" displays of information that can be interpreted by travelers, especially when compared to verified reports. It is anticipated that the results from this project could be used by agencies who are

questioning whether to display unverified displays to travelers or whether to increase/decrease their current displays (e.g. add or decrease cameras for display to the public.)

Project findings could also help agencies better understand potential issues and impacts associated with travelers' interpretation of various information types. For example, travelers who misunderstand unverified displays (e.g. weather information or camera images) may perceive conditions to be better or worse than actual conditions. In contrast, travelers who rely heavily on verified reports, which may not always be up-to-date and accurate, might be better served to see unverified displays of "real-time" conditions. For example, a section of road designated as "Dry" on a traveler information website may actually be snow-covered or icy, due to changing weather conditions, in which case travelers could receive more accurate information by viewing a camera image showing actual conditions.

2.0 Project Objective

The overall objective of this project was to better understand the use and impacts of "unverified displays" of traveler information. Unverified refers to displays that provide travelers with information that is open to interpretation by travelers and may influence travel decisions. For example, one traveler may view a camera image on a transportation agency website and interpret the traffic condition as congested whereas another traveler may view the same camera image and interpret the traffic condition as free flowing. In contrast, verified reports refer to information that is formulated and verified by transportation agencies and disseminated using pre-trip or en-route dissemination mechanisms. For example, an incident report provided by an agency to the public may indicate the location of the incident and the impact to the road (e.g. left lane closed). The incident report may be verified by the agency by viewing the incident site via a camera and/or by receiving information from dispatch or law enforcement on the scene.

Specific questions this project aimed to answer, in order to better understand how travelers use various displays of information, included:

- How are camera images and other information displays used and valued by travelers?
- How do the use of "unverified displays" compare to the use of "verified reports"?
- What are users' preferences and patterns when accessing various information types?
- How does the use of "unverified displays" impact the transportation network?

A number of assessment approaches were used to gather information in order to help address these questions, as described in the following sections of this report.

3.0 Project Approach

Several approaches were used to better understand the use of "unverified displays" of traveler information. The focus was on traveler information websites hosted by transportation agencies, as opposed to information accessed via agency 511 phone lines, changeable message signs on roadways, or other sources of traveler information.

The project consisted of four investigation approaches:

1) **Literature Search** - Relevant literature was reviewed and summarized in order to avoid duplication of efforts and learn from previous related efforts

2) **Online Survey of Travelers** - A survey (posted on traveler information websites of five transportation agencies) was conducted to gather feedback from motorists.

3) **Web Usage Comparisons** - Web statistics from DOT traveler information websites were gathered and assessed to determine usage patterns for various traveler information types.

4) **Assessment of Impacts due to Deployment of New Cameras** - Interviews were conducted with staff from transportation agencies that have recently deployed new cameras, to determine if/how the deployments impacted travelers.

ENTERPRISE members who participated on the project team provided input as the project investigation approaches were developed and information was gathered. ENTERPRISE members also provided website usage statistics and participated in interviews to determine impacts of new camera deployments.

4.0 Summary of Relevant Literature

An internet search of literature was conducted, to identify and summarize previous research relevant to the project. The search was conducted in order to verify that project efforts would not duplicate past studies. The search focused on finding information relevant to the following topics:

- Use and impacts of unverified displays (primarily weather information and camera images), including how these displays are used and valued by travelers.
- How the use of "unverified displays" compares to the use of "verified reports."

The search yielded a number of studies that investigated how motorists use traveler information, in general, but very few studies compared the use and impacts of unverified displays to verified reports. Relevant findings from the literature search included:

- NCHRP Web-Only Document 192 "Deployment, Use, and Effect of Real-Time Traveler Information Systems" Emanuel Robinson, Thomas Jacobs, Kathleen Frankle, Nayel Serulle, Michael Pack - November 2012) documents results from a study that assessed the potential effectiveness of traveler information systems as it relates to traveler perception and use. Results of a survey of traveler information users indicated that weather information and live traffic cameras (both unverified displays) were lower in reported use than traffic incidents, travel times, alternate routes, visual observations of traffic conditions, and roadwork/construction zones and road closures (all verified reports.) Results from focus groups with traveler information users found that weather information (an unverified display) and traffic incidents (a verified report) were highest in reported use, when compared to several other information types, both prior to trip start and while in transit. Live traffic cameras were nearly the lowest of all information types, in terms of reported use by focus group participants.
- In the report "Human Factors Analysis of Road Weather Advisory and Control Information: Final Report" (Christian M. Richard, John L. Campbell, Monica G. Lichty, Chris Cluett , Leon Osborne, Kevin Balke – March 2010), results of a traveler questionnaire indicated that when presented with several options to change travel plans based on road-weather information during a weather event, the most common responses were "driving with extra caution," "leaving earlier," and "taking a different route." This indicates road-weather information (possibly including a combination of verified reports and unverified displays) influences travel decisions.
- Results of a public survey documented in ENTERPRISE Final Report "Impacts of Traveler Information on the Overall Network" (Athey Creek Consultants - September 2012) indicate that over 51% of responders in Minnesota and Washington State prefer a combination of color-coded traffic maps, camera images, and travel times, when compared to these individual information types. The next highest preference was color-coded traffic maps.

Though some relevant information was found during the literature search, it did not offer consistent findings to allow overall conclusions to be made about the use and impacts of unverified displays.

5.0 Online Survey of Travelers

5.1 Survey Design and Participating Organizations

A public survey was created using an online tool (SurveyMonkey) as one mechanism to help understand the use and impacts of camera images and other displays of traveler information. The survey was linked from traveler information websites hosted by five State DOTs. The combination of participating states provided geographical diversity, warm-weather and cold-weather climates, and included both metro and rural areas.

State DOTs that hosted the survey included:

- Georgia Department of Transportation (GDOT) – Statewide Traveler Information Website
- Iowa Department of Transportation (Iowa DOT) – Statewide Traveler Information Website
- Idaho Transportation Department (ITD) – Statewide Traveler Information Website
- Minnesota Department of Transportation (MnDOT) – Twin Cities Metro Area Traveler Information Website
- Washington State Department of Transportation (WSDOT) – Statewide Traveler Information Website

Figure 5-1 provides a screen capture showing a link to the survey from the Iowa DOT Traveler Information Website. In addition to posting the survey to their traveler information website, Iowa DOT and Georgia DOT also posted the link on their Facebook pages to attract contributors.

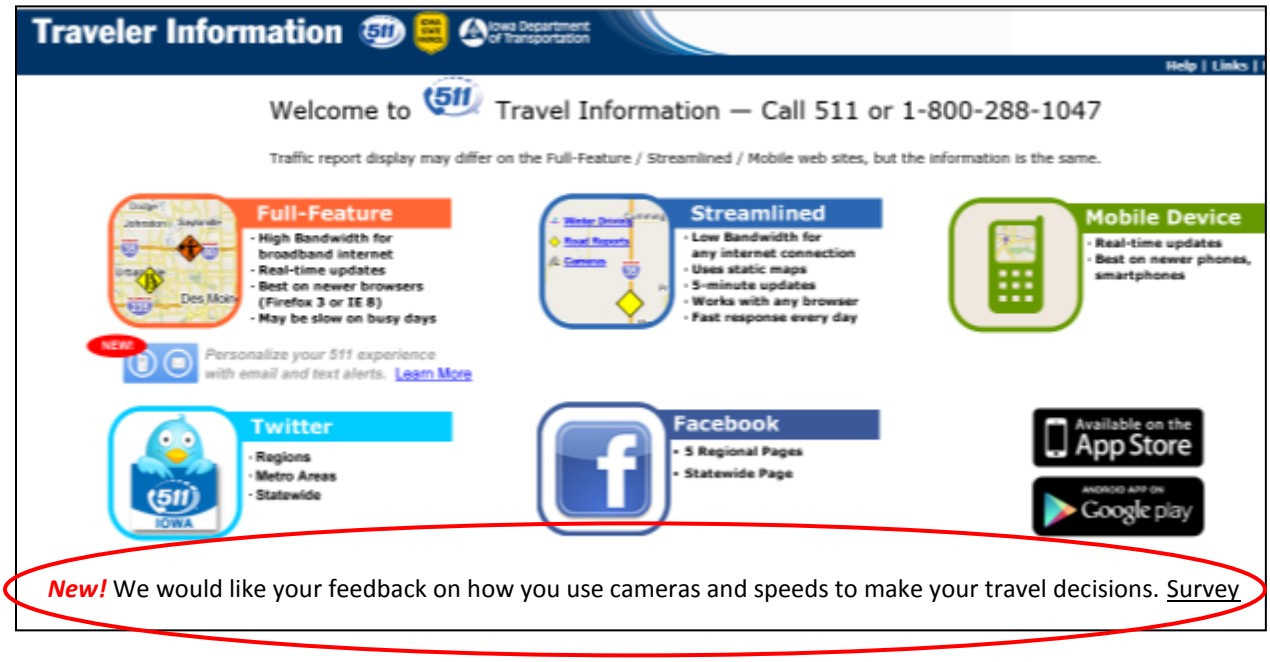


Figure 5-1: Screen Capture of Link to Survey from Iowa DOT 511 website

It is important to acknowledge that because the survey links originated from the travel information portion of State DOT websites, it is not considered 'non-biased' since the sample was not a representative sample of all drivers on highways. It is recognized that travelers who are visiting a DOT travel information website represent those travelers who seek (and most likely use) travel information. Nonetheless, the survey was intended to help understand how motorists who use traveler information websites are using various displays of information and what their information preferences are.

The purpose of the survey was to gather feedback from travelers regarding the usefulness of various types of traveler information, including verified reports and unverified displays. The survey was designed for respondents to quickly answer questions using multiple choice selections and to provide qualitative information by answering questions that requested open-ended responses. Since the survey was intended to collect responses from travelers in multiple states, the questions were formulated in a generic fashion, so respondents would not need to understand the different features of participating states' traveler information websites.

Desired outcomes of the survey included:

- **Outcome 1*:*** Assess the usefulness of specific types of traveler information, including how camera images and weather information compare to other information types.

- **Outcome 2*:*** Assess the use of traffic maps compared to camera images when seeking traffic conditions.

- **Outcome 3*:*** Assess the usefulness of weather information, compared to road condition reports and camera images, when seeking weather-related road information.

The beginning of the survey included three questions to learn about the survey contributors, including the state whose agency hosts the traveler information website they most often use, the area (metro or rural) in which they drive most often, and their age group.

After initial gathering of basic information about the survey contributors, the following questions asked about contributors' use of and preferences for various information types on traveler information websites, including verified reports and unverified displays.

A flow chart containing an abbreviated summary of the survey design can be found in Figure 5-2. The full survey with all complete questions can be found in Appendix A.

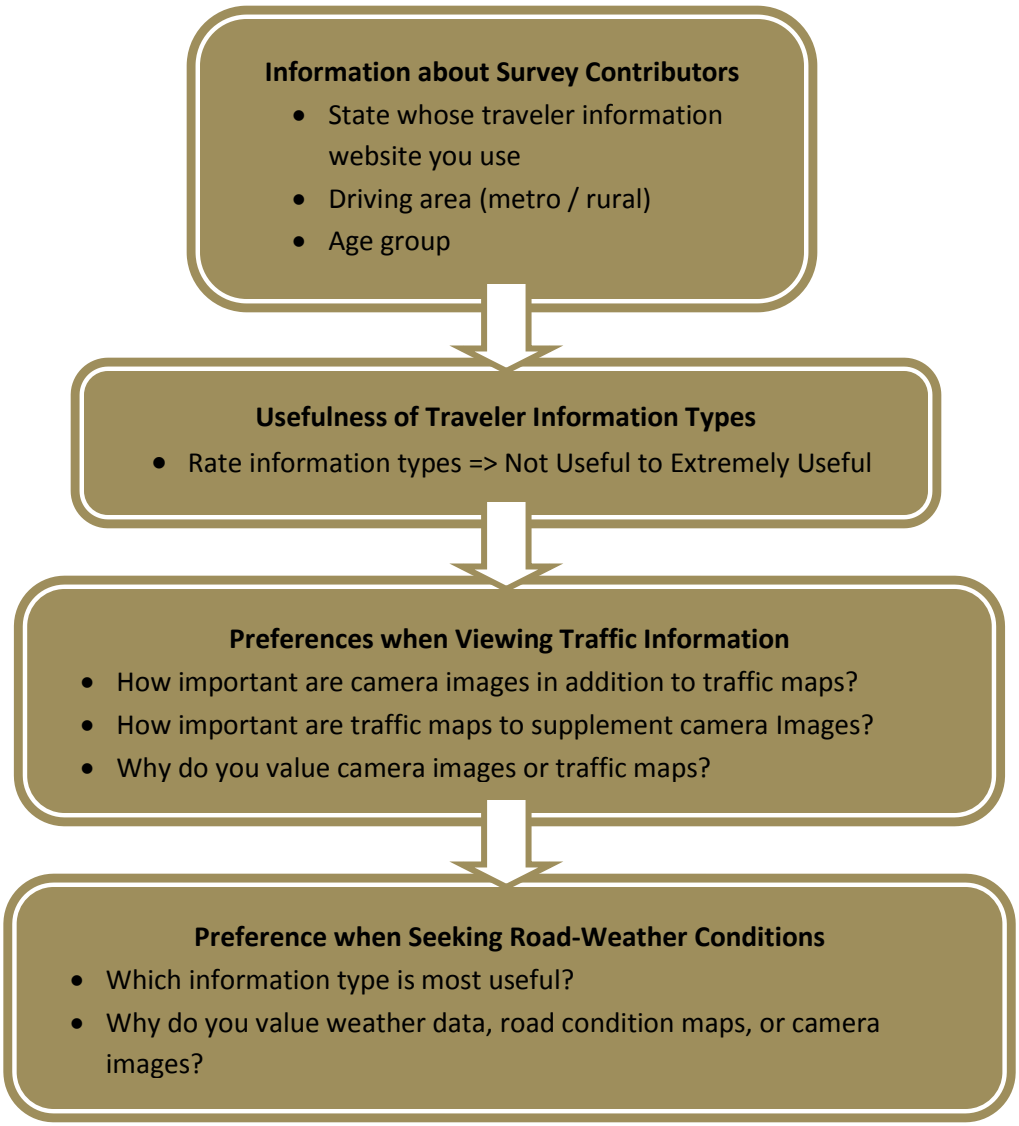


Figure 5-2: Overview of Survey Design

5.2 Survey Duration and Response Rate

The survey was available for approximately 2 ½ months, from late March to mid-June of 2013. 725 participants contributed to the survey.

5.3 Survey Results

Q1: Use of Traveler Information Websites by State

Survey contributors were asked to indicate the state whose agency hosts the traveler information website they typically use.

Over half (50.8%) of survey contributors indicated Minnesota as the state whose agency hosts the traveler information website they typically use. Iowa (24.8%) and Georgia (17.2%) were the next highest responses. Figure 5-3 provides an illustration of all responses. (Note that Kansas and Missouri were included as response options in the question agencies in these states had anticipated hosting the survey but were unable to do so.)

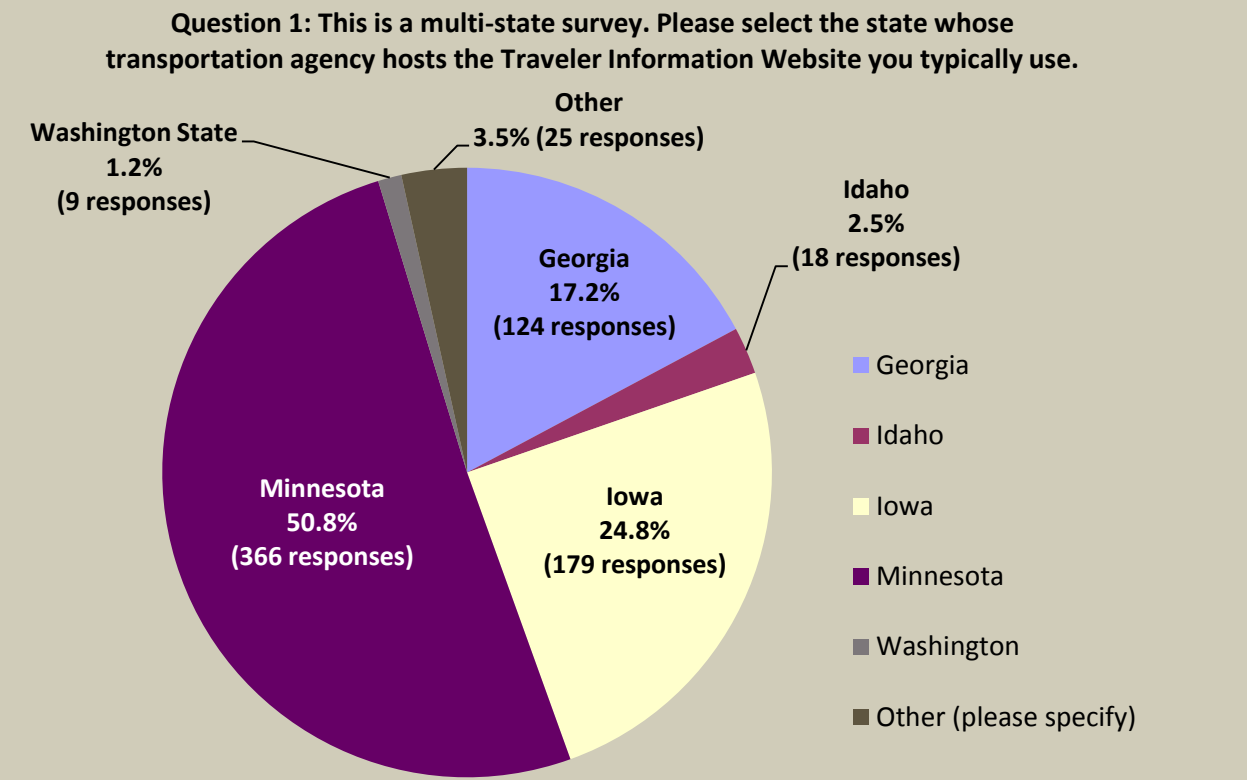


Figure 5-3: Use of Traveler Information Websites by State

Q2. Most Frequent Driving Area (Metro or Rural)

Survey contributors were asked to select the option that best describes where they most often drive their personal vehicle (metropolitan area or rural area.)

Over two-thirds of contributors (69.2%) indicated that most of their personal driving is in metropolitan areas, while the other 30.8% indicated that they most often drive in rural areas. Figure 5-4 provides a breakdown of responses.

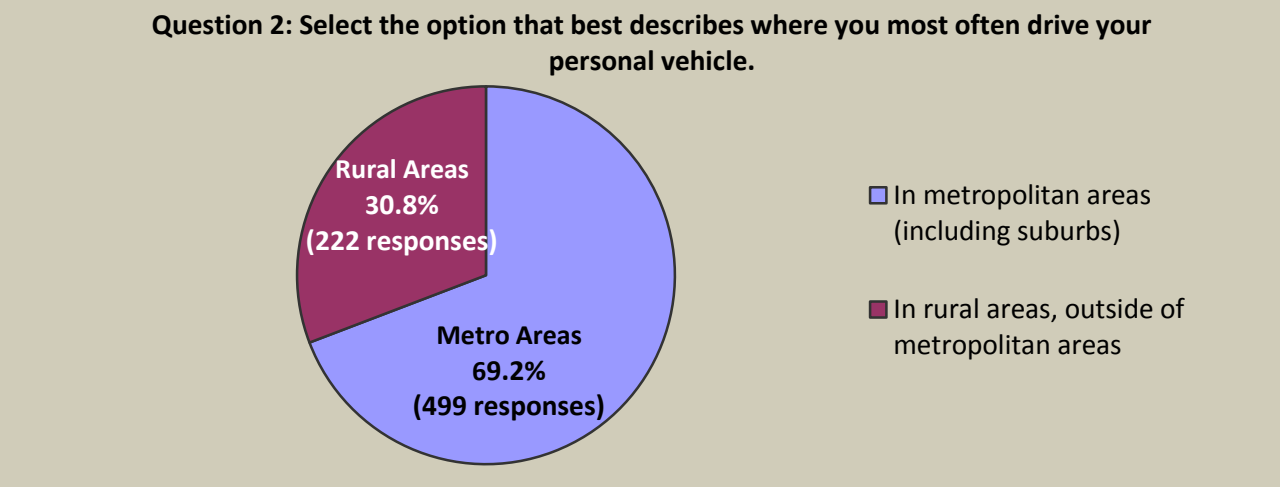


Figure 5-4: Most Frequent Driving Area (Metro or Rural) of Survey Contributors

Q3. Age of Survey Contributors

Survey contributors were asked to select their age group.

The majority of survey contributors were between 26 and 65 years old (83%). The complete age breakdown of survey contributors is illustrated in Figure 5-5.

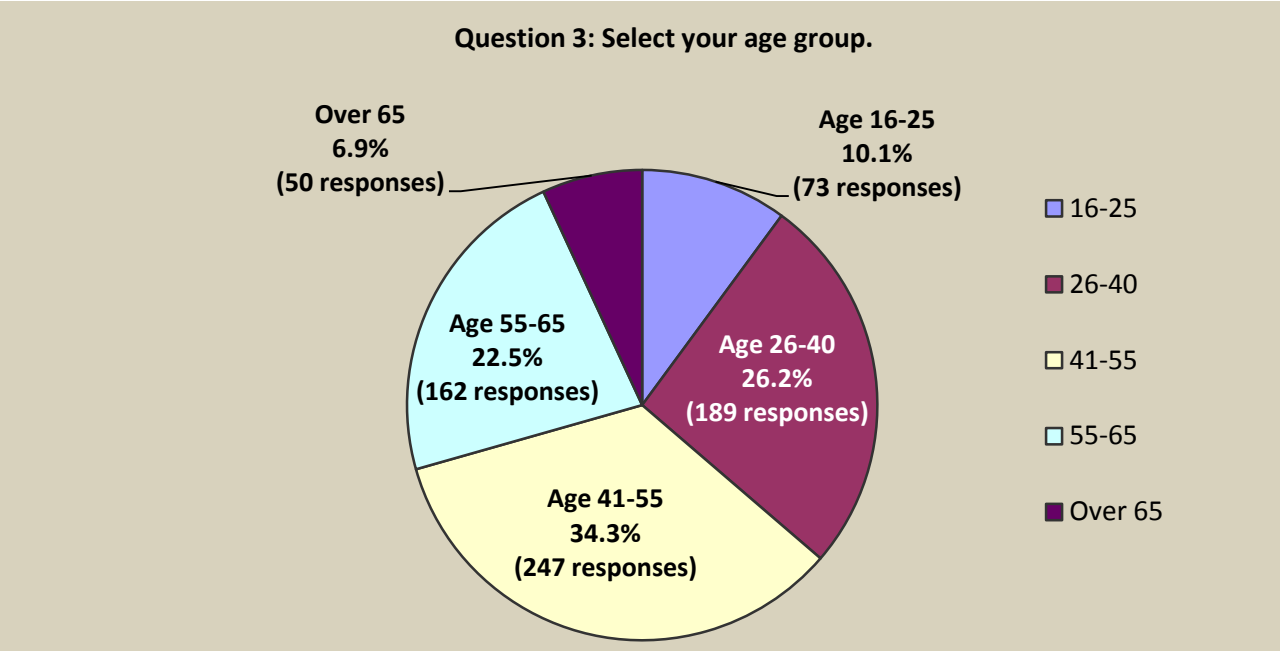


Figure 5-5: Age of Survey Contributors

Q4: Usefulness of Traveler Information Types

Survey contributors were asked to rate the usefulness of each information type shown in Figure 4. Response options and rating values included: Not at all Useful = 1; Slightly Useful = 2; Moderately Useful =3; Very Useful = 4; Extremely Useful = 5.

The information types that were rated highest for usefulness (greater than 4.0) were:

- Incidents/Crashes (4.48)
- Road Surface Conditions (4.29)
- Congestion/Traffic Levels (4.22)
- Current Construction Projects (4.21)
- Camera Images (4.13)

The information types that received the lowest usefulness ratings (less than 3.0) were:

- Commercial Vehicle Restrictions (2.28)
- Non-Auto Modes (2.54)

The unverified displays of traveler information (weather alerts, weather information, and camera images) provided as responses in this question are noted as such in Figure 5-5. Complete results are also illustrated in Figure 5-6.

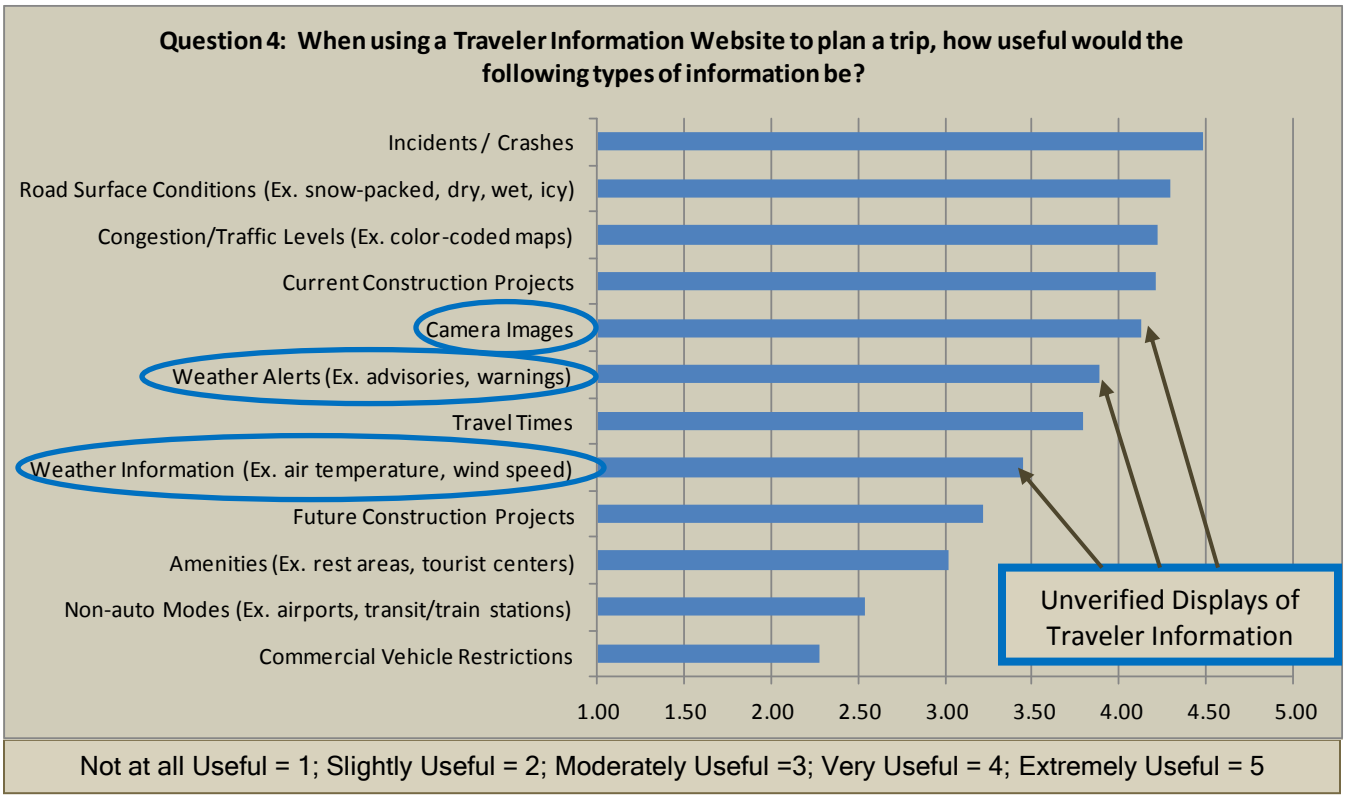


Figure 5-6: Usefulness of Information Types

After rating the usefulness of given information types, survey contributors were asked "In addition to the information types listed in Figure 5-5, what other information would you like to see on a traveler information website?" 610 responses to this question were received.

Common responses included:

- Live video streams (20 related responses)
- Mobile device apps (17 related responses)
- More up-to-date information, especially for closures and delays due to weather (15 related responses)
- Requests for additional cameras at specific locations or extended coverage of traffic maps (13 related responses)
- Bigger/clearer camera images (9 related responses)
- Cameras in rural areas, not just metro areas (9 related responses)
- Alternate routes (8 related responses)

Q5: Importance of Camera Images in Addition to Traffic Maps

Survey contributors were asked to indicate how important is it to view camera images along their route, in addition to viewing color-coded traffic maps.

- 46.4% indicated that camera images are very important and they prefer to view images of current conditions.

- 22.7% indicated that camera images are moderately important and they could draw any needed conclusions based on the map.
- 18.7% indicated that during inclement weather, camera images are preferred. However, during favorable weather, camera images are less important.
- 12.2% indicated that they rarely or never use camera images.

Figure 5-7 illustrates these results.

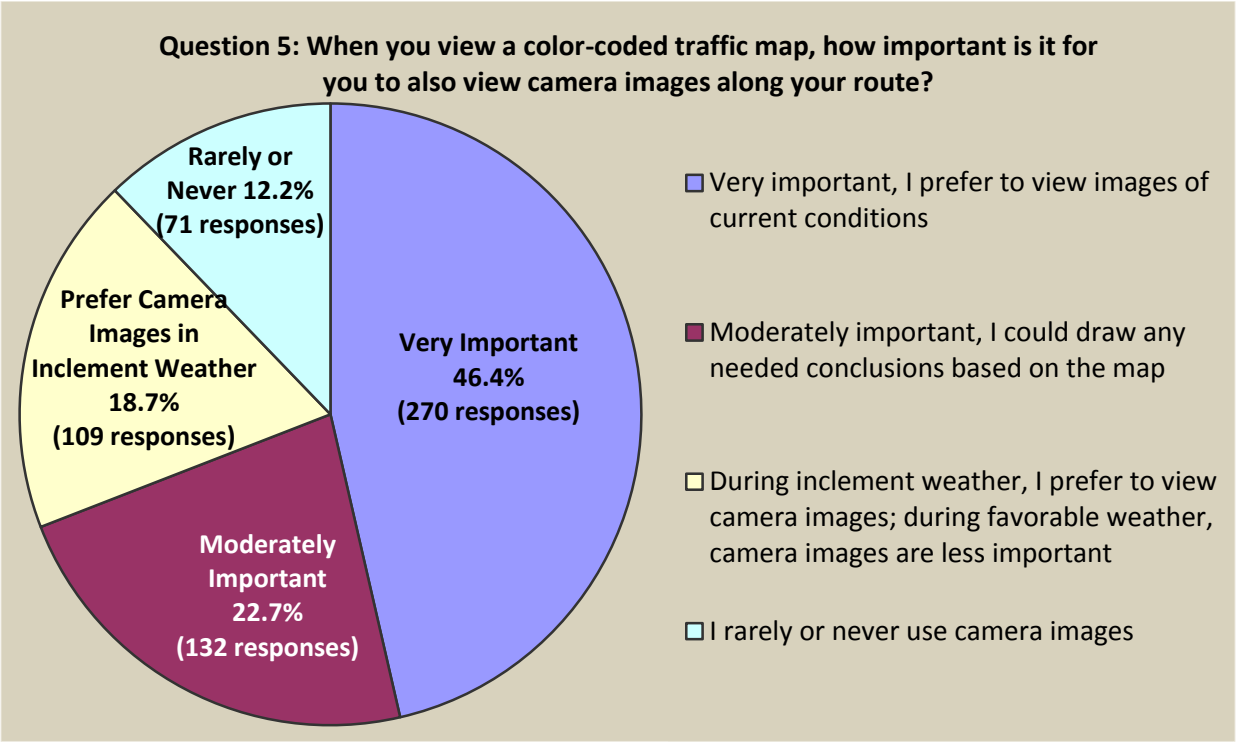


Figure5-7: Importance of Camera Images in Addition to Traffic Maps

As a follow-up to this question, survey contributors were asked to describe why they value (or do not value) camera images when viewing traffic information.

For those who indicated a preference for camera images, the most common themes of comments included:

- Camera images allow them to see actual traffic conditions (e.g. where congestion is occurring, severity of the conditions, and causes of congestion)
- Camera images are more "real-time" than traffic maps

Other comments indicated that camera images are more understandable and/or more accurate than traffic maps, and it is convenient to view road-weather conditions along with traffic conditions in one image.

Q6: Importance of Traffic Maps to Supplement Camera Images

In this question, survey contributors were asked when viewing camera images, how important it is to supplement camera images with traffic information such as speeds, traffic levels, and/or travel times.

Over half of the survey contributors (53.0%) indicated that it is very important to supplement camera images with traffic information (e.g. speeds, congestion levels, and/or travel times) because the images alone do not provide adequate information. Additionally, 36.3% reported that traffic information supplements were moderately important and they could usually obtain adequate information from camera images. Finally, 10.7% indicated that it is not important to supplement camera images with traffic information because the images present adequate information. These results are illustrated in Figure 5-8.

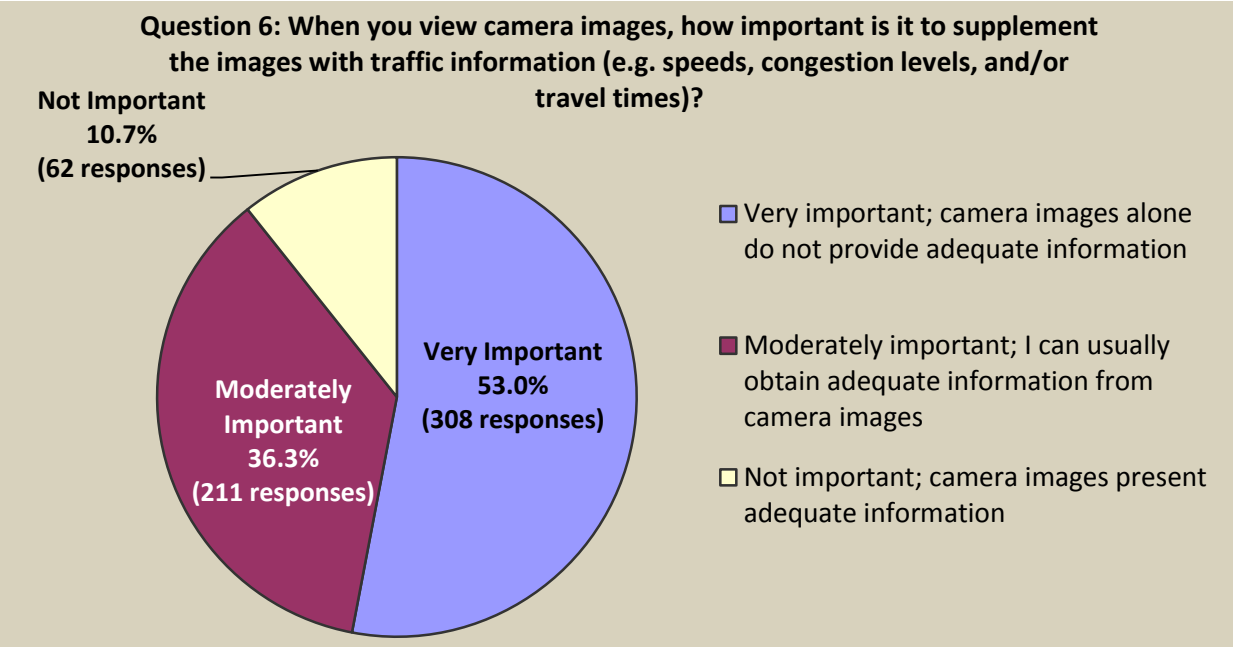


Figure 5-8: Importance of Traffic information to Supplement Camera Images

As a follow up to this question, survey contributors were asked to describe why they value (or do not value) traffic information such as color-coded maps showing speeds, congestion levels, and/or travel times.

Themes of common responses included:

- Traffic maps provide a complete "picture" of traffic conditions that can be viewed and understood quickly (e.g. lots of information is shown in one view, includes a wider extent of coverage than camera images)
- Traffic maps provide information that assists with planning trips and making travel decisions (e.g. avoiding highly congested areas, planning alternate routes, determining departure times, estimating arrival times)

- Speed information shown on traffic maps is highly valued. Since cameras only present a snapshot of current conditions, it is difficult to determine how fast vehicles are traveling.

Several comments also indicated that they want as much information as possible and that they often use traffic maps together with camera images.

Q7: Most Useful Information Type for Weather-Related Road Information

Survey contributors were asked to choose the information type that is the most useful when seeking weather-related road information. The following options, with example images as shown in Figure 5-9, were provided:

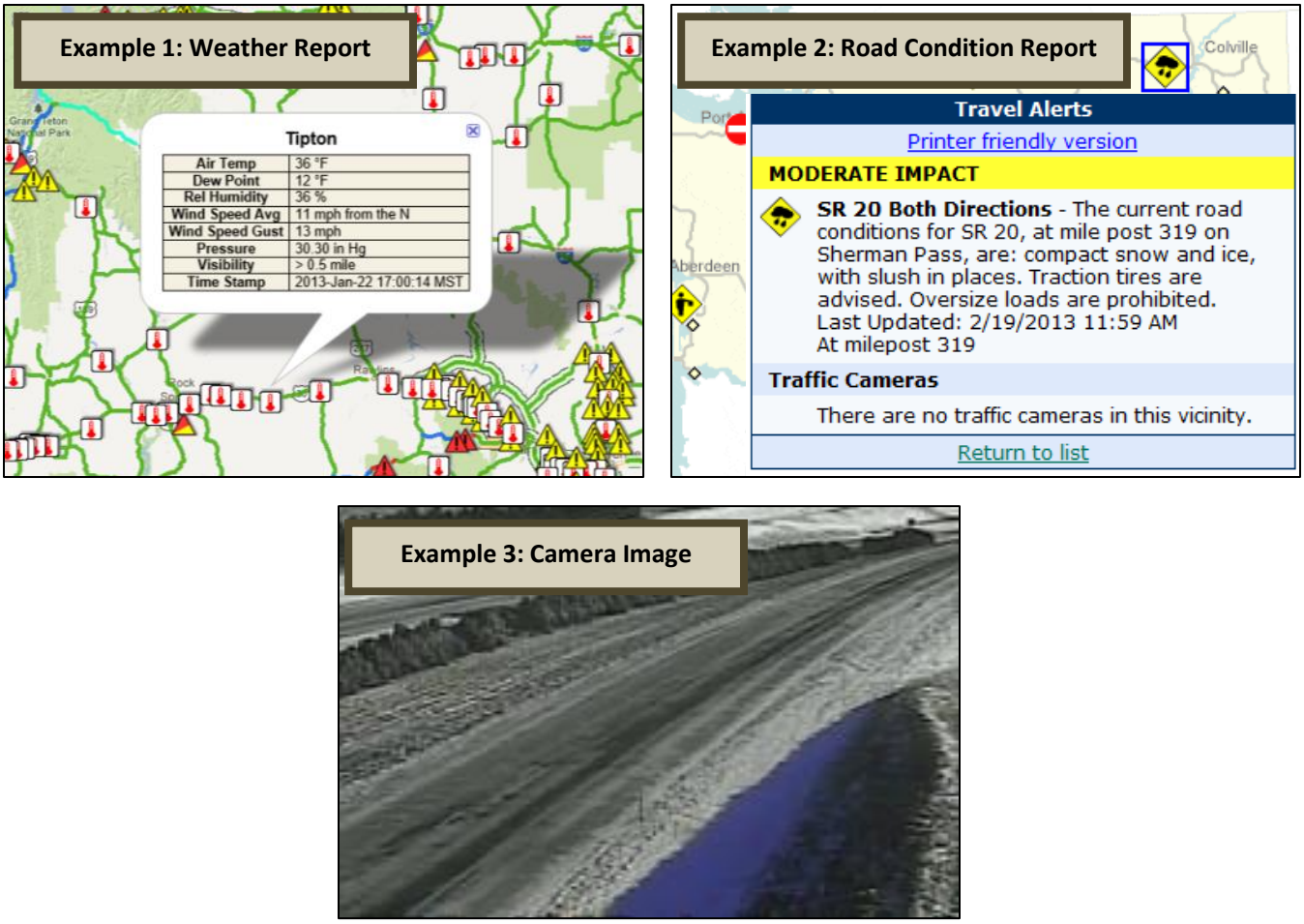


Figure 5-9: Example Images of Weather Report, Road Condition Report, and Camera Image

Road condition reports were indicated to be the most useful information type for weather-related road information by 51.1% of contributors, while 41.3% indicated that camera images are most useful. Only 8% responded that weather reports are the most useful information type. Figure 5-10 illustrates these results.

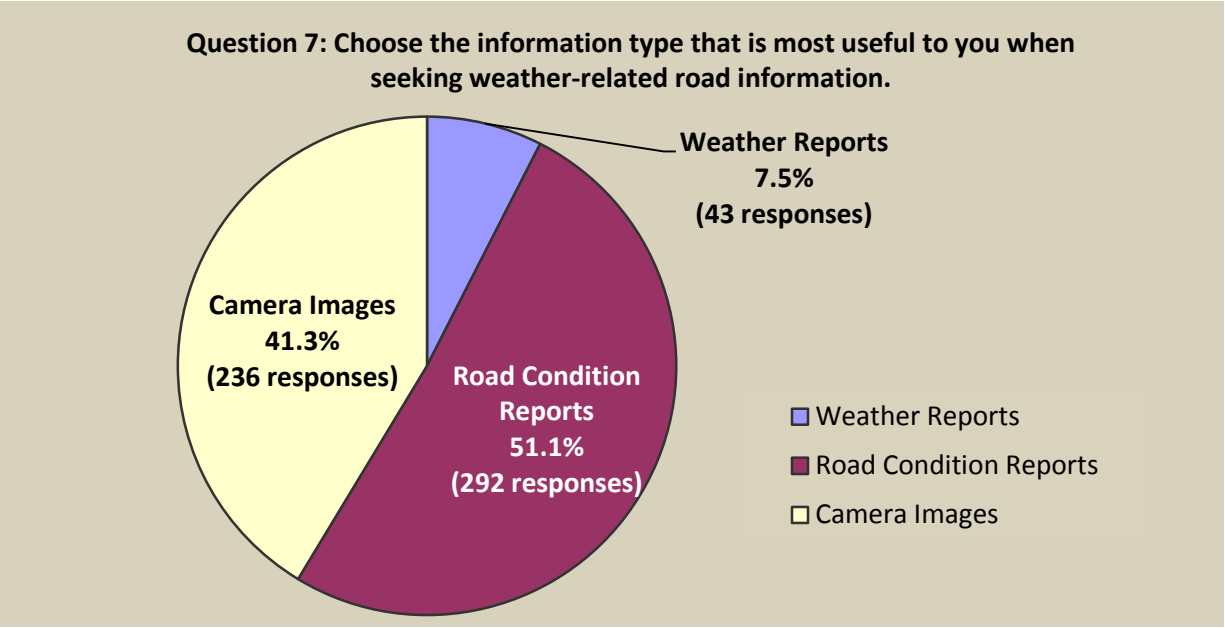


Figure 5-10: Most Useful Information Type for Weather-Related Road Information

As a follow-up to this question, survey contributors were asked to describe why they value the information they selected as most useful.

Common responses indicated the following:

- Road condition reports were valued because they provide the most relevant information that impacts travel time and safety. In addition, road condition reports cover a larger area than cameras and are more reliable when camera images are covered with ice or snow.
- Those who preferred camera images perceived that they more accurate than road condition reports and provide a quick way to view road conditions.
- Weather reports do not provide pertinent information for determining road conditions.
- A combination of road condition reports and camera images is an ideal scenario.

Differences by State, Driving Area, and Age

The beginning of the survey included three questions to learn about the survey contributors themselves, including the state whose agency hosts the traveler information website they most often use, the area (metro or rural) in which they drive most often, and their age group. This was done to identify whether differences in usage of verified reports vs. unverified displays of traveler information exist based on state, driving area (rural or urban) and age.

For the most part, the survey results did not indicate significant differences in these areas. However, some differences were seen in contributors' reported preferences for viewing camera images in addition to traffic maps, as detailed below.

Cameras in Addition to Traffic Maps - State Differences

A higher percentage of contributors in Minnesota responded with "very important" (56.3%) when compared to Georgia (34.9%) and Iowa (35.6%) when asked how important it is to view camera images in addition to traffic maps. Contributors from Iowa placed a higher importance on viewing cameras during inclement weather (32.2%), as compared to Georgia (8.3%) and Minnesota (14.3%). Table 5-1 shows these results along with the comprehensive results (all survey responses received).

Note: The survey hosted by the Minnesota DOT was posted to the Twin Cities Metro Traffic website, which provides information about traffic conditions in the Minneapolis – St. Paul metropolitan area. The majority (over 80%) of the Minnesota contributors indicated that they primarily drive metro areas.

Table 5-1: Cameras in Addition to Traffic Maps - State Differences

When you view a color-coded traffic map, how important is it for you to also view camera images along your route?	Minnesota	Georgia	Iowa	Comprehensive Results – All Responses
Very important, I prefer to view images of current conditions	56.3% (161 responses)	34.9% (38 responses)	35.6% (53 responses)	46.4% (270 responses)
Moderately important, I could draw any needed conclusions based on the map	21.0% (60 responses)	38.5% (42 responses)	14.8% (22 responses)	22.7% (132 responses)
During inclement weather, I prefer to view camera images; during favorable weather, camera images are less important	14.3% (41 responses)	8.3% (9 responses)	32.2% (48 responses)	18.7% (109 responses)
I rarely or never use camera images	8.4% (24 responses)	18.3% (20 responses)	17.4% (26 responses)	12.2% (71 responses)

Cameras in Addition to Traffic Maps – Age Differences

The largest differences in responses related viewing camera images in addition to traffic maps was found when comparing the youngest and oldest age groups. Contributors in the 16-25 age group indicated a stronger importance for viewing camera images in inclement weather (30.0%), when compared to the over 65 age group. In addition, contributors in the over 65 age group had a higher percentage of responses (20.5%) indicating they rarely or never use camera images, compared to the 16-25 age group (11.7%). Table 5-2 shows these results along with the comprehensive results (all survey responses received).

Table 5-2: Cameras in Addition to Traffic Maps - Age Differences

When you view a color-coded traffic map, how important is it for you to also view camera images along your route?	Age 16-25	Over Age 65	Comprehensive Results - All responses
Very important, I prefer to view images of current conditions	41.7% (25 responses)	38.5% (15 responses)	46.4% (270 responses)
Moderately important, I could draw any needed conclusions based on the map	16.7% (10 responses)	28.2% (11 responses)	22.7% (132 responses)
During inclement weather, I prefer to view camera images; during favorable weather, camera images are less important	30.0% (18 responses)	12.8% (5 responses)	18.7% (109 responses)
I rarely or never use camera images	11.7% (7 responses)	20.5% (8 responses)	12.2% (71 responses)

Cameras in Addition to Traffic Maps – Metro Area vs. Rural Area

When comparing the metro and rural groups, a higher percentage of metro area contributors indicated that viewing camera images is "moderately important and they could draw any needed conclusions based on the map" (25.9%), as compared to rural area contributors (15.3%.) Rural area contributors indicated a stronger preference for viewing cameras over traffic maps during inclement weather (29.9%), as compared to contributors from metro areas (13.8%). Table 5-3 shows these results along with the comprehensive results (all survey responses received).

Table 5-3: Cameras in Addition to Traffic Maps – Metro Area vs. Rural Area

When you view a color-coded traffic map, how important is it for you to also view camera images along your route?	Metro Area	Rural Area	Comprehensive Results - All responses
Very important, I prefer to view images of current conditions	48.9% (198 responses)	40.7% (72 responses)	46.4% (270 responses)
Moderately important, I could draw any needed conclusions based on the map	25.9% (105 responses)	15.3% (27 responses)	22.7% (132 responses)
During inclement weather, I prefer to view camera images; during favorable weather, camera images are less important	13.8% (56 responses)	29.9% (53 responses)	18.7% (109 responses)
I rarely or never use camera images	11.4% (46 responses)	14.1% (25 responses)	12.2% (71 responses)

5.3 Key Findings from Survey Results

Several key findings emerged from review of the survey results, which provided insights regarding information preferences of traveler information website users. Key findings include:

- Camera images are highly valued by many traveler information website users, especially to complement information provided by traffic maps and road condition reports. Camera images are often valued because they are considered to be more "real-time" than traffic maps.

- Most users of traveler information websites would not be satisfied with camera images alone, especially when obtaining information about traffic/congestion conditions.
- Camera images appear to be more useful to traveler information website users during inclement weather, especially in rural areas and by younger drivers.
- Camera images were rated nearly as highly as road condition reports, in terms of the most useful type of information when seeking weather-related road condition information. A number of traveler information users expressed value in viewing a combination of camera images and road condition reports when seeking this information.
- Weather reports (air temperature, wind speeds, etc.) are not considered to be very useful.

6.0 Web Usage Comparisons

6.1 Assessment Approach

Four state DOTs provided web usage statistics for the following traveler information websites, for inclusion in this assessment.

- Idaho Transportation Department (ITD)
  - Statewide "Streamlined" Traveler Information Website
    http://lb.511.idaho.gov/idlb/

- Iowa Department of Transportation (Iowa DOT)
  - Statewide "Streamlined" Traveler Information Website
    http://lb.511ia.org/ialb/

- Minnesota Department of Transportation (MnDOT)
  - Twin Cities Metro Traffic Website - General Usage
  - Twin Cities Metro Traffic Website - Temporary Cameras in Work Zones
    www.dot.state.mn.us/tmc/trafficinfo/traffic.html

- Illinois Department of Transportation (IDOT)
  - Travel Midwest Traveler Information Website
    www.travelmidwest.com

Each agency provided usage statistics for relevant web pages (e.g. URLs to traffic maps, camera images, weather station data, etc.) accessed by the public. Agency staff were consulted to determine which pages/URLs to track and the duration of historical data to assess in order to compare usage patterns that would inform the project's findings.

Note that it is difficult to compare individual DOTs' web usage patterns against one another to draw overall conclusions, due to numerous differences across traveler information websites (e.g. types of information displayed, format of displays, etc.) The intent of this assessment was to compare the use of verified reports to unverified displays at each individual website scenario, by tracking and observing trends. In some cases, overall conclusions were then drawn from observations at each website.

6.2 Results of Web Usage Comparisons

Results for each web usage comparison are shown on the following pages.

Idaho Transportation Dept. - Statewide "Streamlined" Traveler Information Website

The Idaho Transportation Department's Statewide "Streamlined" Traveler Information Website provides road reports, traffic speeds, restrictions, camera images, weather station data, winter driving conditions, and road conditions on mountain passes.

Description of Assessment:

The objective was to determine user preferences and patterns for viewing various information displays, when presented with options on the Landing Page (http://lb.511.idaho.gov/idlb/).

Pageviews per month to the following web pages were compared over a 24-month period:

- Landing Page
- Winter Driving Page
- Cameras = Camera Map + all Camera Images accessed
- Weather Stations = Weather Stations Map + all Weather Station Data accessed

Landing Page: The Landing Page (typically the first page a visitor views during a viewing session) defaults to the Winter Driving map when winter road conditions are present and being reported at any location in the state. During all other times, the Landing Page defaults to the Road Reports map. The Landing Page presents options, in the left column, to view other types of traveler information. Figure 6-1 below shows the Road Reports map as the Landing Page.

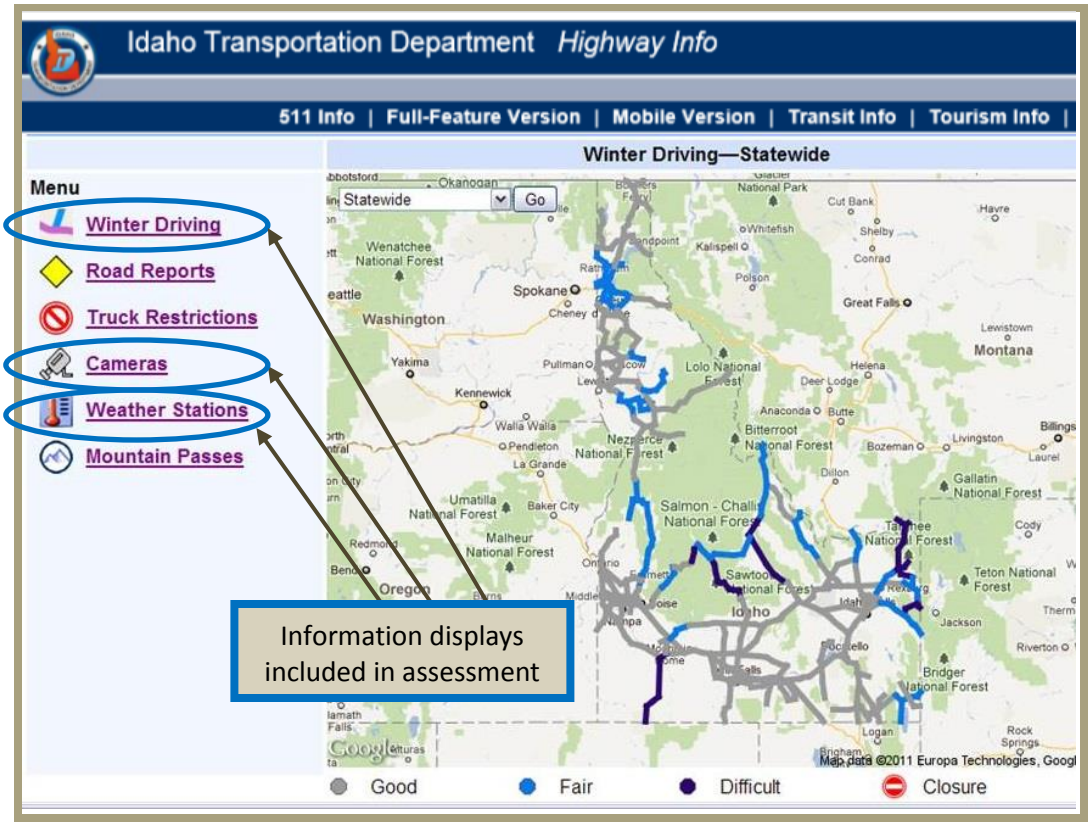


Figure 6-1: Idaho Transportation Department Landing Page

Winter Driving Page: The Idaho Transportation Department Winter Driving page (Figure 6-2) is a color-coded map showing road weather conditions (e.g. wet, dry, snow-packed, icy, etc.)

Figure 6-2: Idaho Transportation Department Winter Driving Page

Camera Map: Map showing locations of cameras throughout the state (Figure 6-3). Camera icons can be selected to view camera images at each location. Figure 6-4 on the next page shows an example of a camera images once a location is selected by the user.

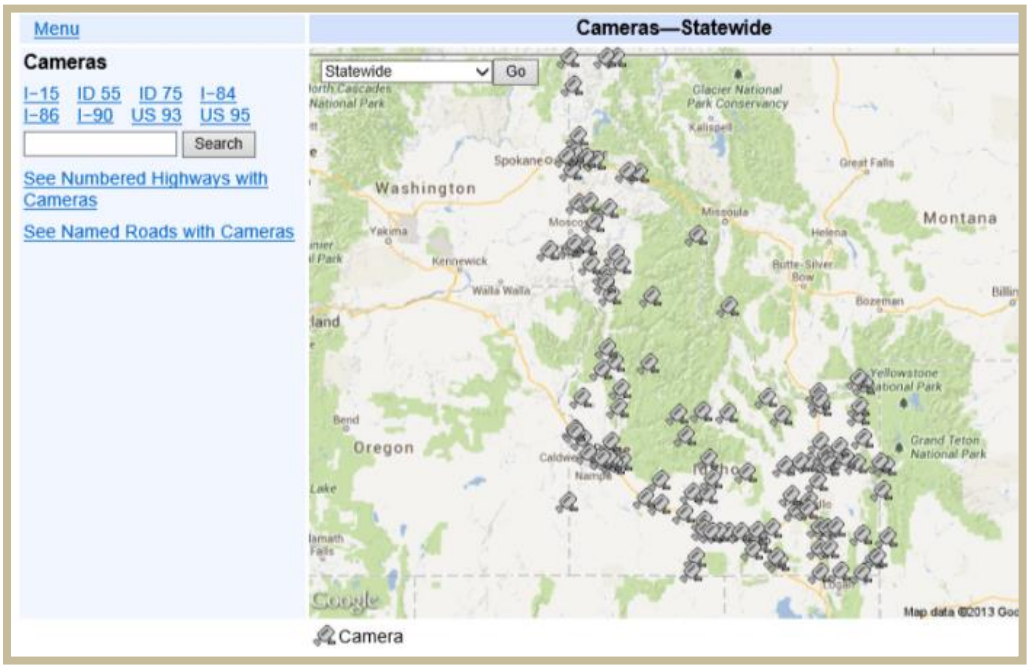


Figure 6-3: Idaho Transportation Department Camera Map Page

Camera Images: Idaho Transportation Department camera images rotate between two views, typically: 1) Horizontal View (zoomed out, to view longer stretches of roadway); and 2) Pavement View (zoomed in, to view pavement conditions.) See Figure 6-4.

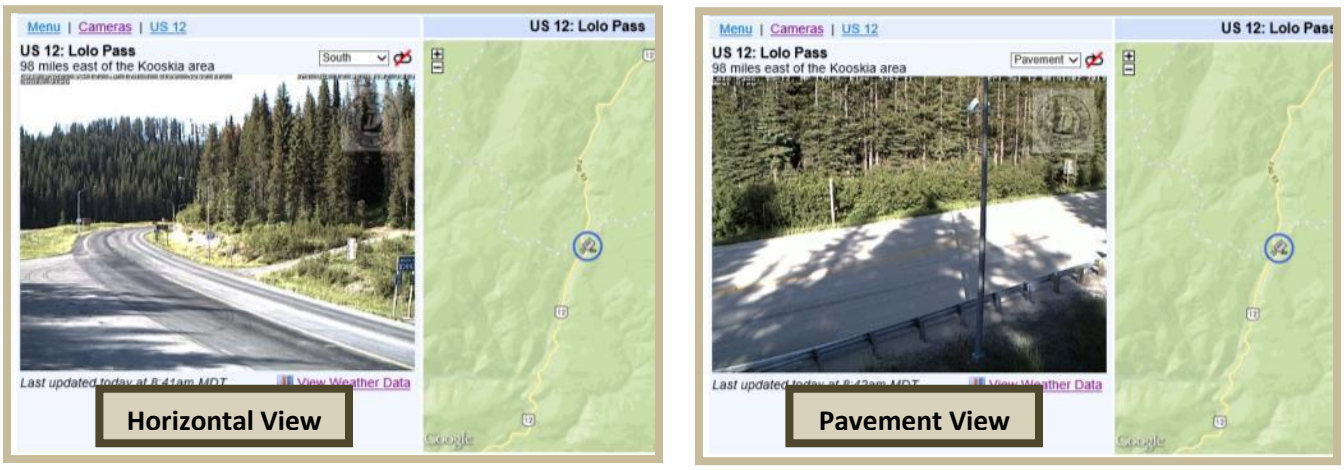


Figure 6-4: Idaho Transportation Department Horizontal and Pavement Views Camera Images Page

Weather Stations Map: Map showing all RWIS weather stations located throughout the state (Figure 6-5). Weather station icons can be selected to view weather data at each location. Figure 6-6 on the next page shows an example of the weather station information provided when a location is selected by the user.

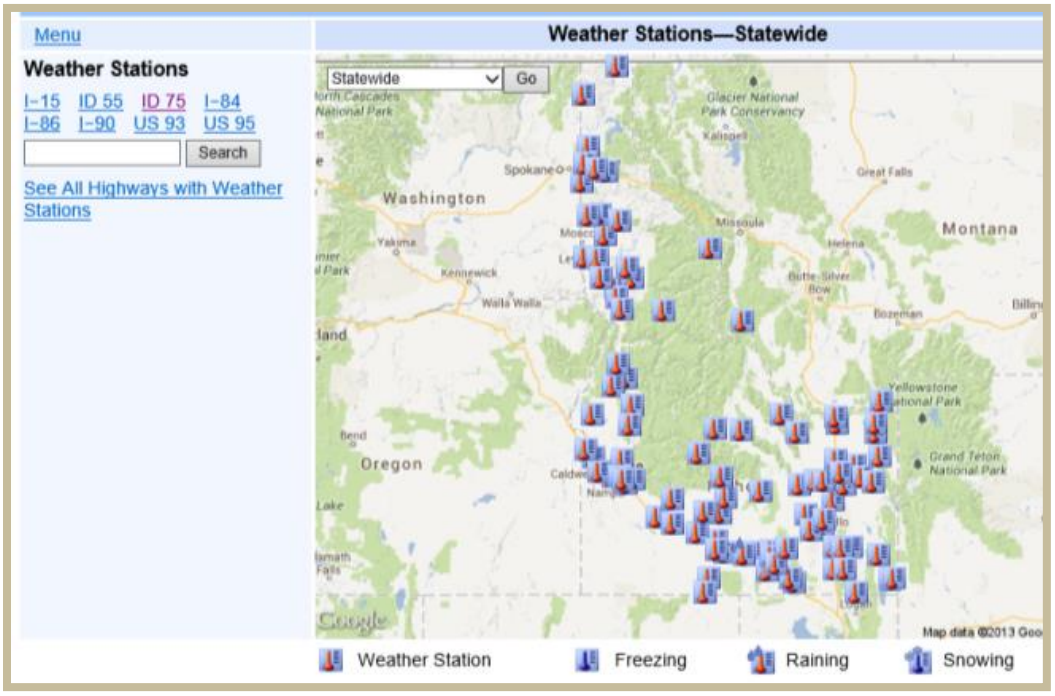


Figure 6-5: Idaho Transportation Department Weather Stations Map Page

Weather Station Data: Summary of weather data (e.g. air temperature, precipitation, wind speed, etc.) from RWIS stations (Figure 6-6).

Figure 6-6: Idaho Transportation Department Weather Stations Data Page

Results:

Figure 6-7 below plots the number of monthly pageviews for each information type (Landing page, winter driving page, cameras, and weather stations.)

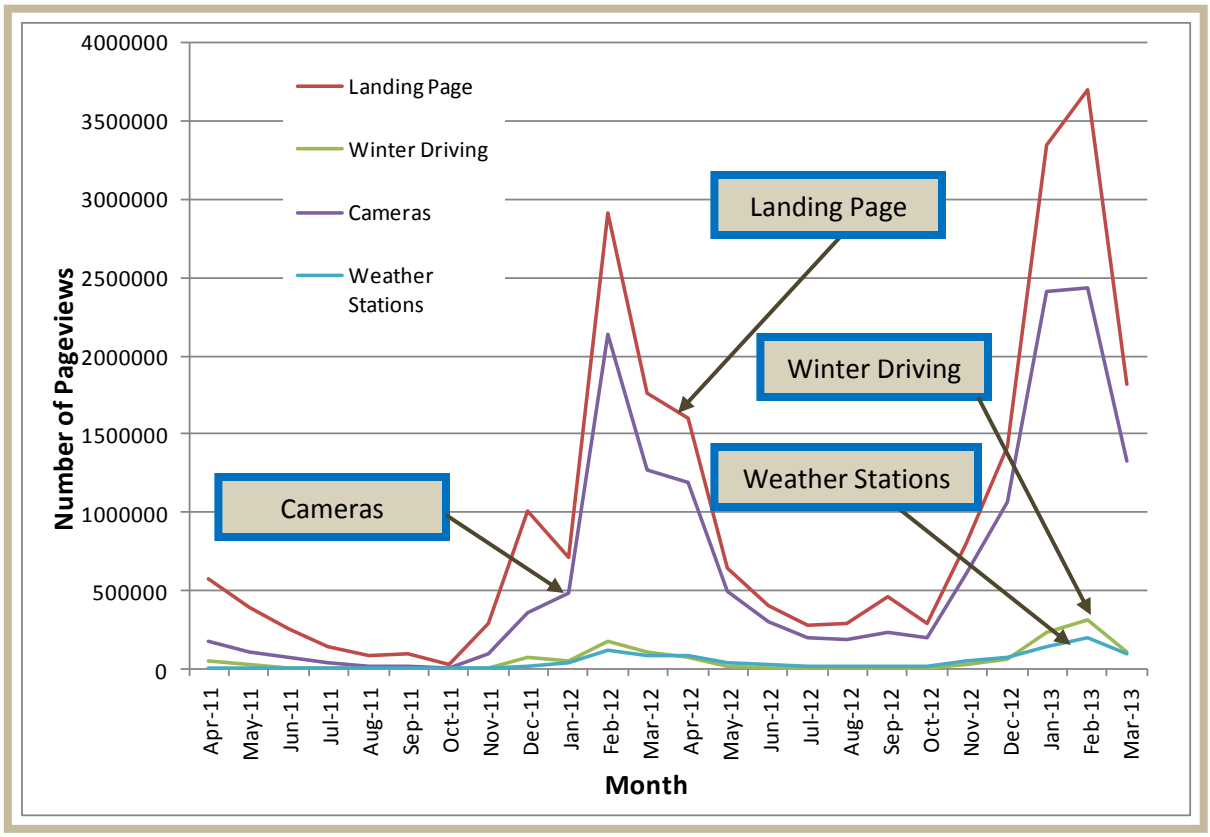


Figure 6-7: Number of Idaho Transportation Department Pageviews for each information type

Observations:

- The Winter Driving page is under-represented because the Landing Page defaults to the "winter driving" page during winter weather conditions.
- Camera images are highly accessed when compared to the Landing Page, indicating that the majority of visitors to the site view camera images at some point during their visit. The high rate of access to cameras could be reflective of ITD's well-established camera network that began with limited deployments over 10 years ago (with camera images being made available to the public for approximately 7 years) and now includes extensive coverage throughout the state. Regular visitors to the website are accustomed to accessing camera images.

  It is important to note that directly comparing use of camera images to road condition maps by counting pageviews is not necessarily a true reflection of user preferences. For instance, a single visitor looking for winter road conditions can view a large geographical area in one map pageview, while the same visitor would need to view several cameras (each counted as a separate pageview) to view conditions in the same geographical area.
- Camera images are much more highly accessed during the winter months.
- Weather station data is not highly accessed by visitors to the site.

Iowa DOT Statewide "Streamlined" Traveler Information Website

The Iowa DOT Statewide "Streamlined" Traveler Information Website (low bandwidth site) provides statewide information such as winter driving conditions, camera images, road reports, truck restrictions, traffic speeds, and postings on changeable message signs.

Description of Assessment:

The objective of this assessment was to determine user preferences and patterns for viewing various information displays, when presented with options on the landing page.

Pageviews per month for the following web pages were compared over a 24-month period:

- Landing Page
- Winter Driving Page
- Cameras = Camera Map + all Camera Images accessed
- Traffic Speeds = Statewide Traffic Speed Map + all Regional Traffic Speed Maps

Landing Page: The Landing Page (typically the first page a visitor views during a viewing session) defaults to show the Winter Driving map from October 15 to April 15 (Figure 6-8). During all other times, the landing page defaults to the Road Reports map (Figure 6-9). The Landing Page presents options, in the left column, to view other types of traveler information.

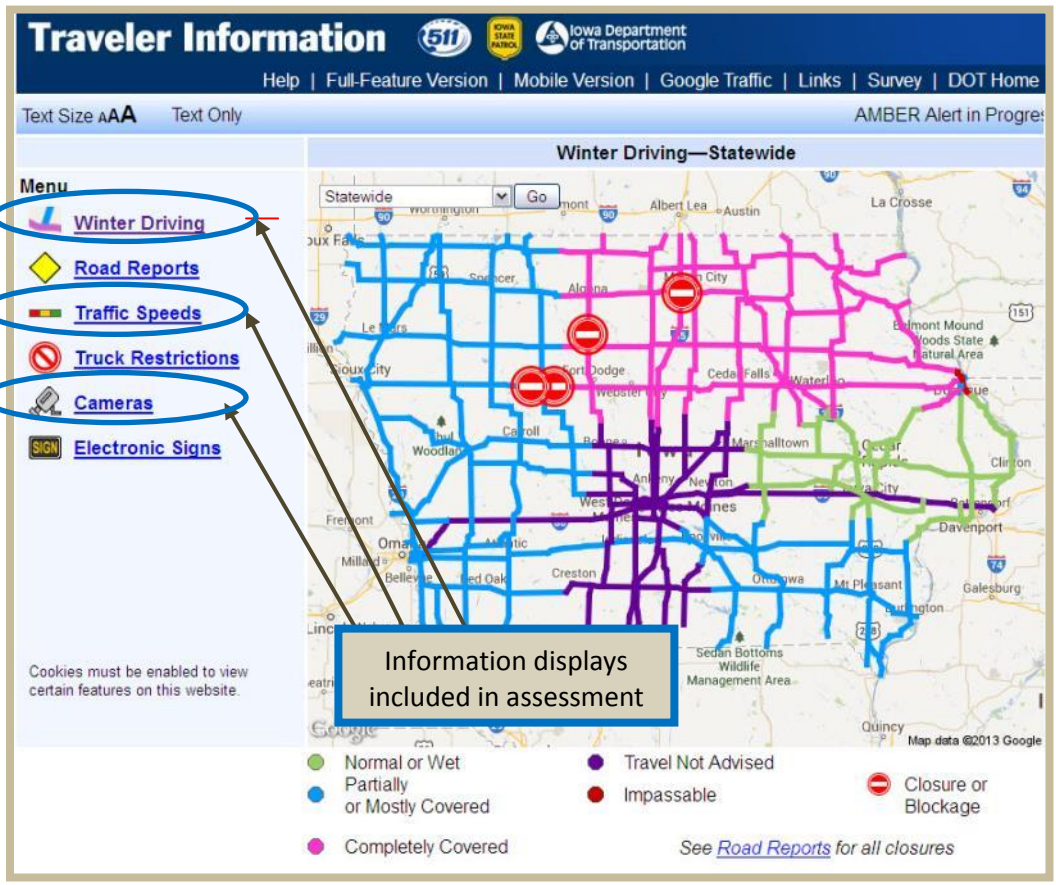


Figure 6-8: Iowa DOT Landing Page in Winter Months (Oct. 15 – Apr. 15)

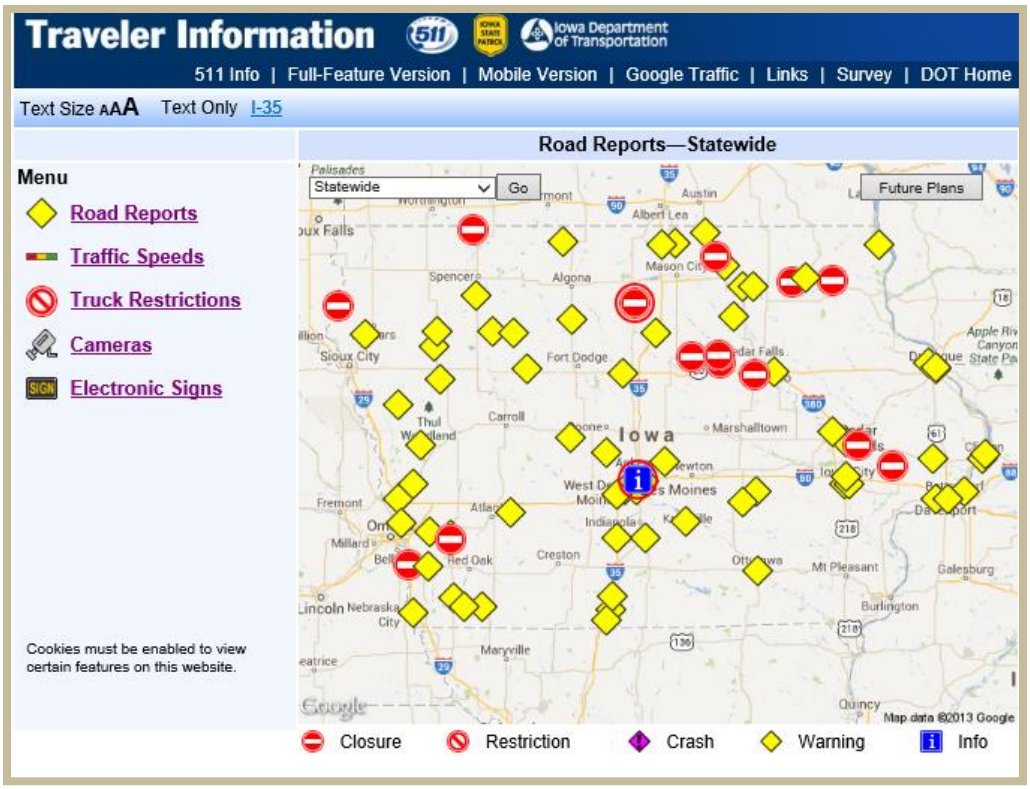


Figure 6-9: Iowa DOT Landing Page in Non-Winter Months (Apr. 16 – Oct. 14)

Winter Driving Page: The Winter Driving page is a color-coded map showing road weather conditions (e.g. wet, dry, snow-packed, icy, etc.). See Figure 6-10.

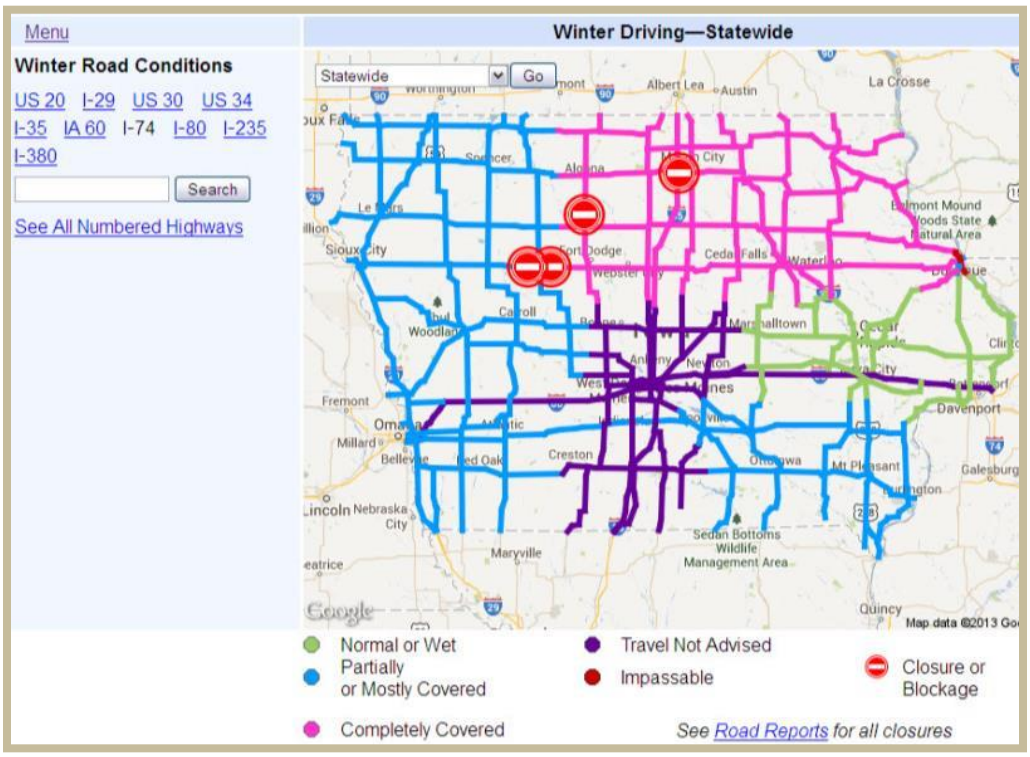


Figure 6-10: Iowa DOT Winter Driving Page

Camera Map: Map showing locations of cameras throughout the state. Camera icons can be selected to view camera images at each location. See Figure 6-11.

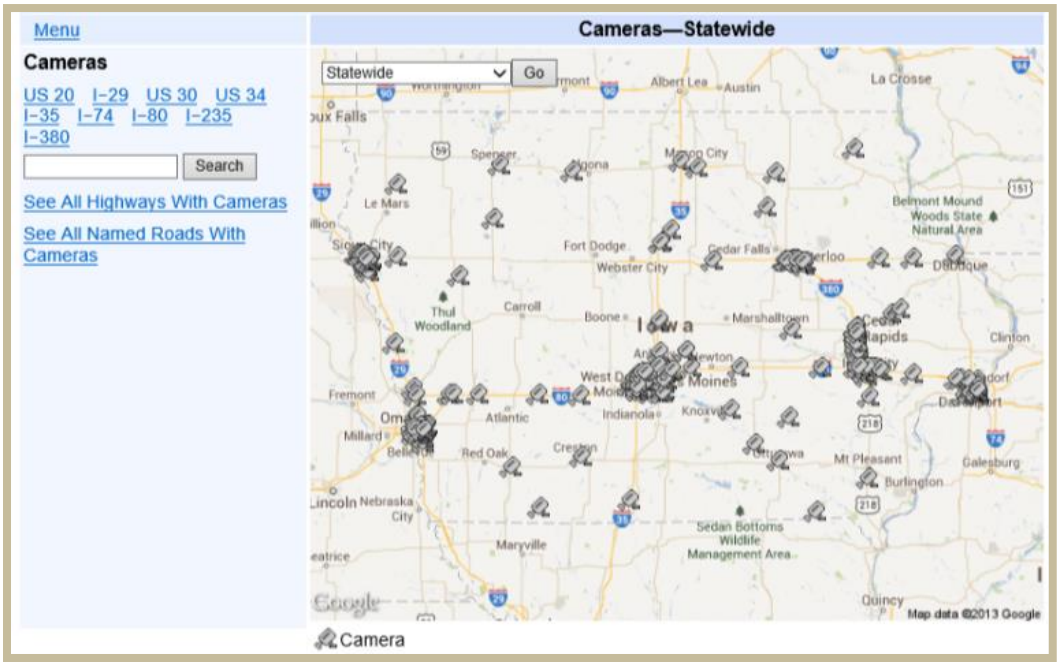


Figure 6-11: Iowa DOT Camera Map

Camera Images: Each camera image (Figure 6-12) shows a view of the roadway at the selected location.

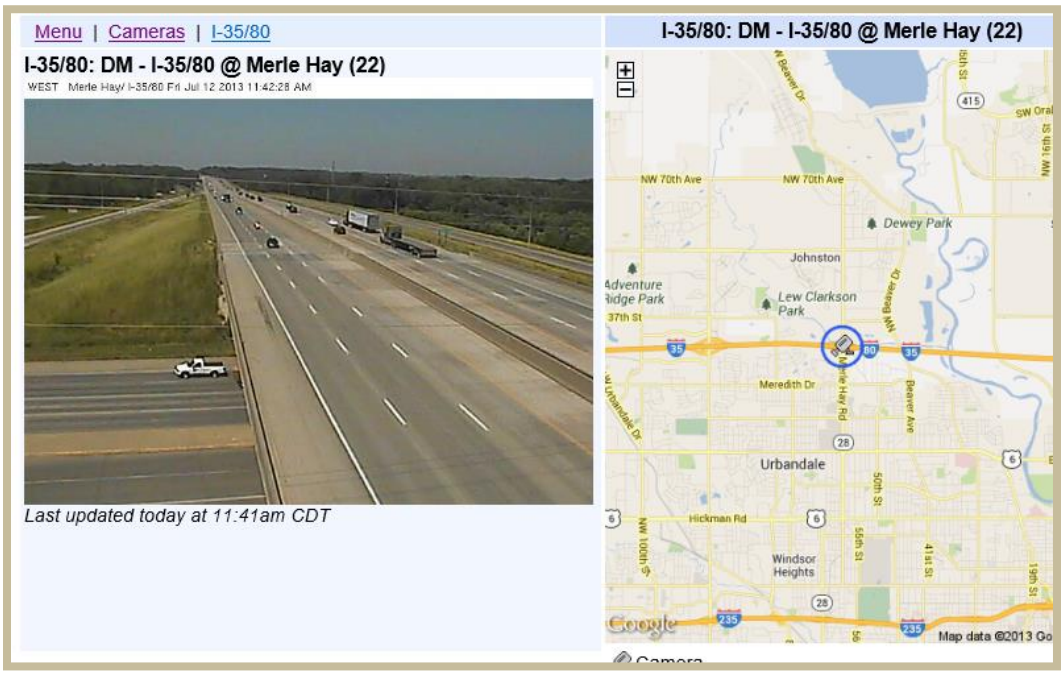


Figure 6-12: Iowa DOT Camera Image

Traffic Speed Maps: Traffic Speeds includes: 1) Statewide map showing six regions areas where traffic speed maps are available (Figure 6-13); and 2) Color-coded maps showing traffic speeds (slow to fast) and incidents at each region (Figure 6-14).

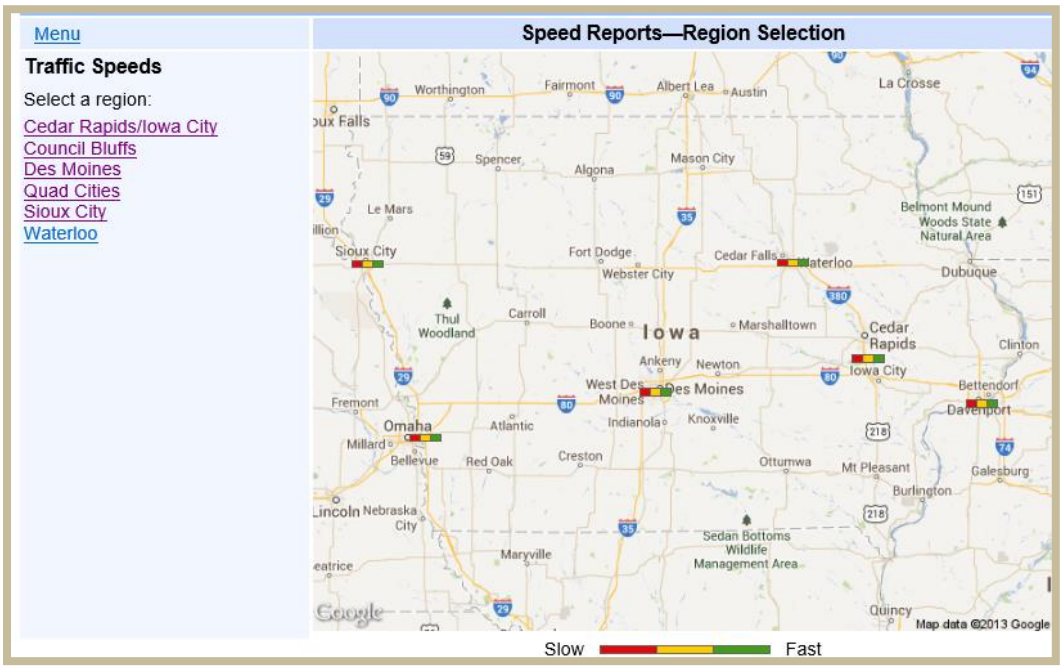


Figure 6-13: Iowa DOT Statewide Map Showing Location of Speed Maps

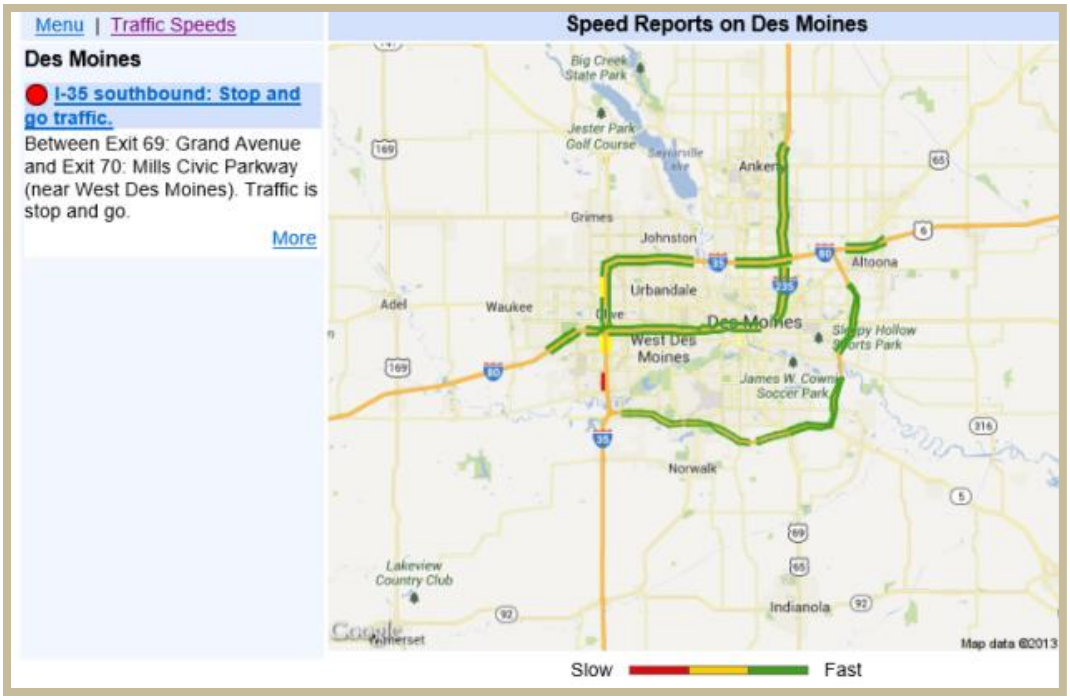


Figure 6-14: Iowa DOT Color-coded Map Showing Traffic Speeds

Results:

- The graph below plots the number of monthly pageviews for each information type (landing page, winter driving page, cameras, and traffic speeds.)

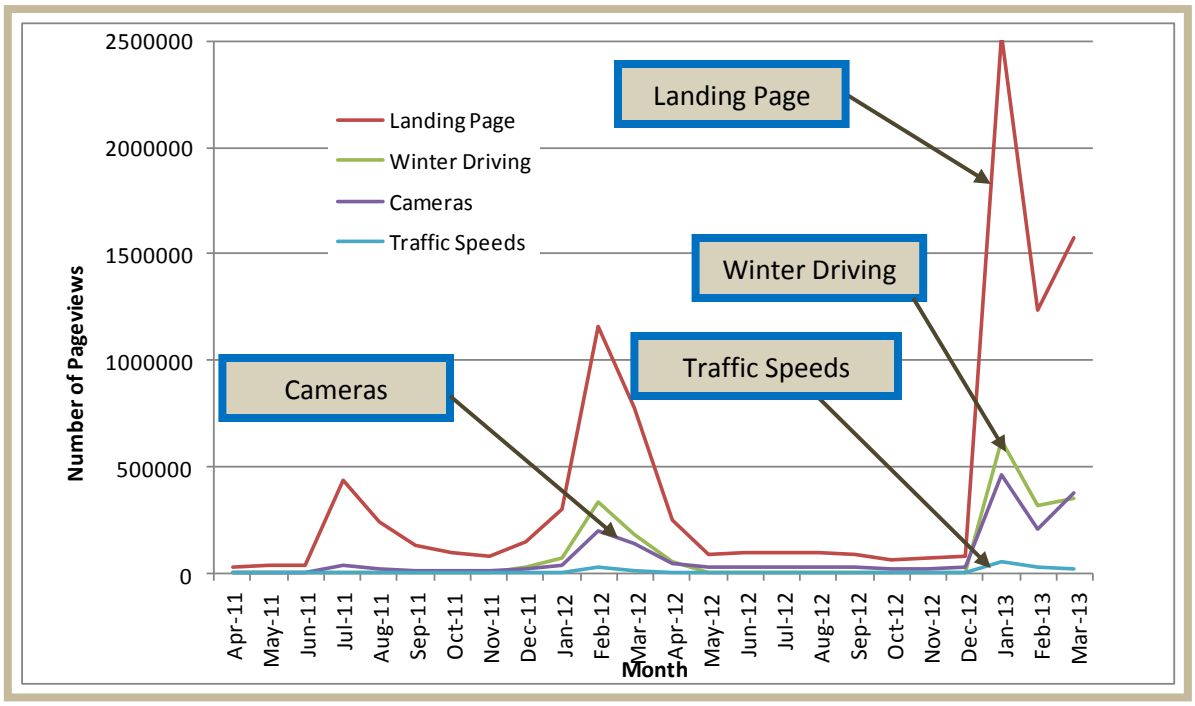


Figure 6-15: Iowa DOT Monthly Pageviews for each Information Type

Observations:

- The landing page is the most accessed web page. The winter driving page is under-represented because the Landing Page defaults to the Winter Driving map during winter months.
- Camera images are more frequently accessed in the during the winter months, with a significant spike seen in December 2012, when a significant winter storm occurred. The storm produced 12 inches of snow in two days with winds exceeding 50 MPH, forcing significant road closures throughout the state.
- Though views to all pages are higher in the winter, an increase in pageviews to the Landing Page is also seen in the summer of 2011. This could be due to an increased desire to view Road Reports (construction locations, lane closures, etc.) which is the default view on the Landing Page in non-winter months. However, camera images did not increase at the same rate during the summer of 2011, possibly indicating that visitors may be satisfied with the Road Reports page and do not need to access camera images to obtain additional information.
- Cameras are not as highly accessed as the winter diving and landing pages, possibly indicating that visitors are satisfied with the information they draw from the Landing Page map (either winter driving conditions or road reports) and often do not need to see camera images to view actual conditions. The Iowa DOT made over 45 camera images available to the public via their traveler information website in March 2013. Prior to this camera images were not available in rural areas.

Minnesota DOT Twin Cities Metro Traffic Website – General Usage

The Minnesota DOT Twin Cities Metro Traffic Website provides information about traffic conditions, including traffic levels, camera images, incidents, and travel times.

Description of Assessment:

The objective of this assessment was to determine user preferences for viewing various information displays when presented with options on the top navigation bar of the landing page.

Pageviews per month for the following web pages were compared over a 28-month period:

- Landing/Traffic Page
- Camera Map
- Incidents
- Travel Times

Landing/Traffic Page: Minnesota DOT color-coded map showing traffic conditions (free flowing, slow, congested, or no data). See Figure 6-16.

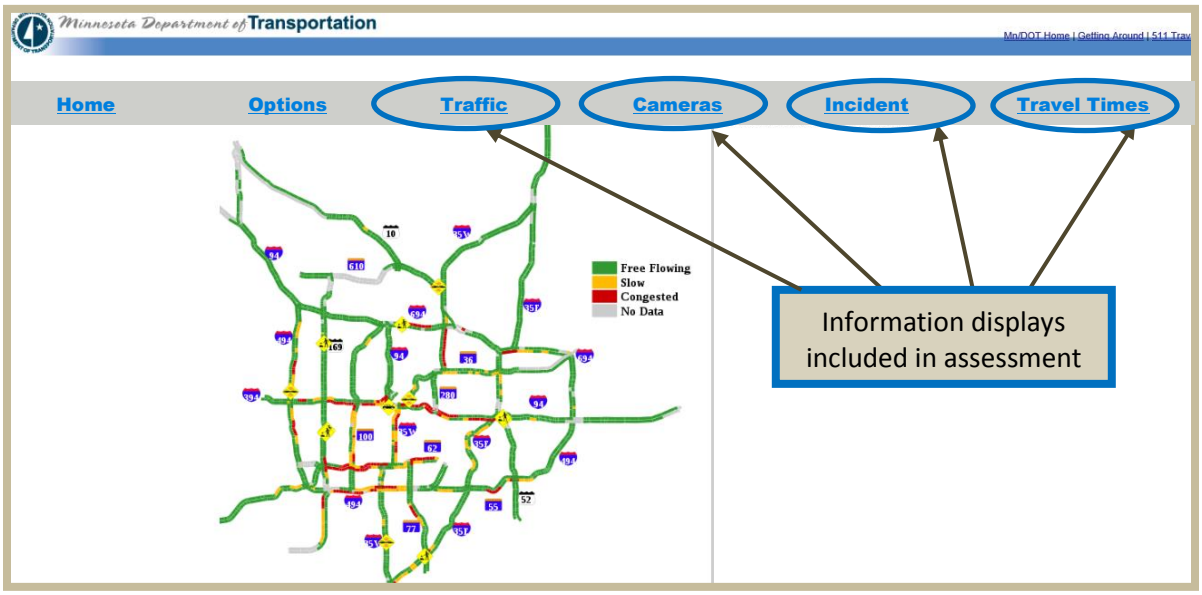


Figure 6-16: Minnesota DOT Landing/Traffic Page

Camera Map: Minnesota DOT map showing camera locations. Camera icons can be selected to view "snapshot" images of traffic conditions. See Figure 6-17.

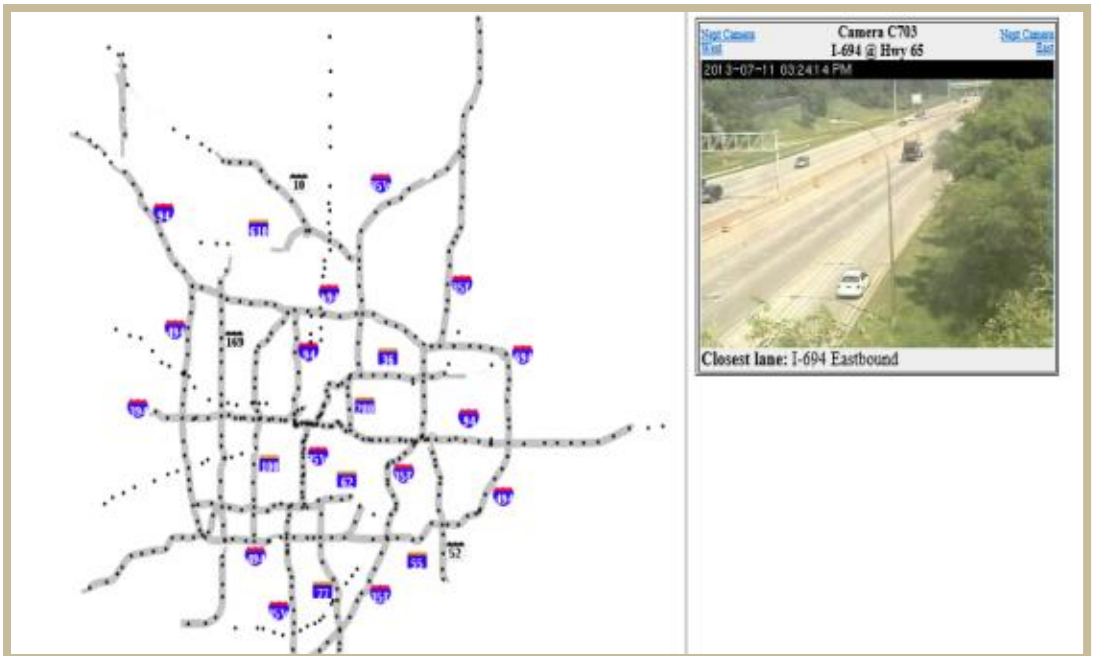


Figure 6-17: Minnesota DOT Camera Locations

Incidents: Minnesota DOT listing of incidents such as crashes, closures, roadwork and blocked lanes. See Figure 6-18.

Current Incidents

Camera	Description	Details	Location	Impact	Time
280	Crash on Exit		T.H.280 NB @ University Ave	Left lane partially blocked	Thu @ 14:44
6131	Roadwork on Exit		I-35W NB @ I-494 EB	Ramp Closed	Thu @ 05:29
512	Roadwork on Mainline		T.H.77 NB @ 66th St	Left lane blocked	Thu @ 09:53
915	Crash on Mainline		I-394 EB @ Penn Ave	Right shoulder blocked	Thu @ 15:20
854	Roadwork on Mainline		T.H.52 SB @ I-94 EB	Left lane blocked	Mon @ 20:01
907	Hazard on Exit	Debris	I-394 WB @ I-394 CD WB	Left lane partially blocked	Thu @ 15:35
918	Crash on Exit		I-94 WB @ I-394 CD WB	Left lane blocked	Thu @ 15:35
11	Roadwork on Mainline		I-35E NB @ McAndrews Rd	Left lane blocked	Mon @ 11:50
854	Roadwork on Merge		T.H.52 SB @ I-94 EB	Ramp Closed	Mon @ 20:01

Updated: Thu Jul 11 15:38

Figure 6-18: Minnesota DOT Incident Listing

Travel Times. Minnesota DOT listing of point-to-point travel times. See Figure 6-19.

I-35W SB @ 94th St to MN RI	3 MIN
I-35W SB @ 94th St to COUNTY RD 42	6 MIN
I-35 SB S of Co Rd 97 to 694 VIA 35	13 MIN
I-35W SB @ 35th St to 494	9 MIN
I-35W SB @ 35th St to MN RI	13 MIN
I-35W SB @ 35th St to RIVR VIA 77	15 MIN
T.H.62 WB E of Portland Ave to 100	10 MIN
T.H.62 WB E of Portland Ave to 169	13 MIN
I-35W SB @ 4th St to HWY 62	11 MIN
I-35W SB @ 4th St to 494	15 MIN
I-35E NB S of Lone Oak Rd to RI	5 MIN
I-35E NB S of Lone Oak Rd to 94	11 MIN

Figure 6-19: Minnesota DOT Travel Times Listing

Results:

The graph below plots the number of monthly web pageviews for each information type (landing/traffic page, camera map, incidents, and travel times.)

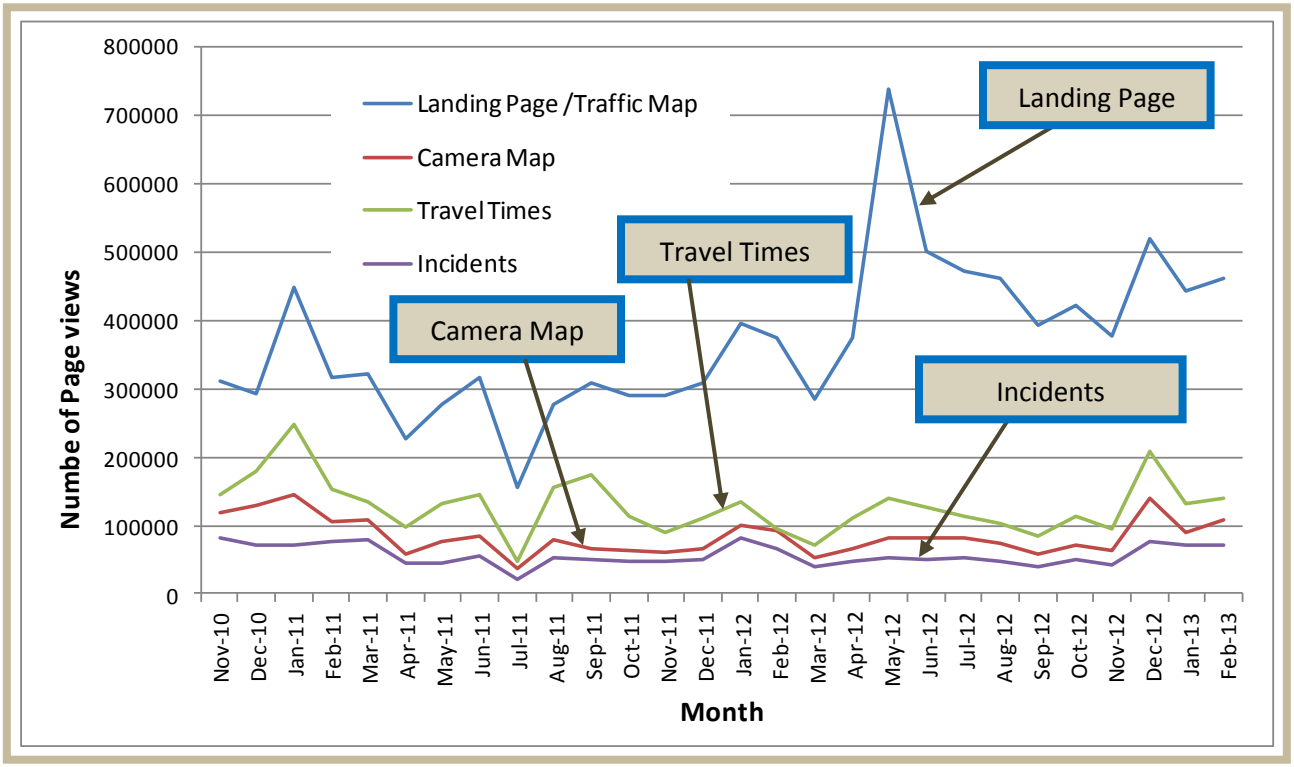


Figure 6-20: Minnesota DOT Pageviews for each Information Type

Observations:

- The “Landing/Traffic” page is understandably the most accessed web page.
- A significant decrease in total pageviews in July 2011 was due to a state government shutdown, at which time the site was unavailable to the public for nearly three weeks.
- Total usage increases during winter months (e.g. roughly December through March) and during construction that cause major congestion (e.g. heavy usage in May 2012 was due to specific construction events noted by MnDOT staff.)
- The “Landing/Traffic” page and the Travel Times page follow similar usage patterns. Similarly, the Cameras and Incidents pages follow similar usage patterns.
- The “Cameras” page is not as highly accessed as the “Landing/Traffic” page, possibly indicating that a majority of visitors who enter the site by viewing the “Landing/Traffic” page are satisfied with the traffic information they receive and do not choose to access cameras.

MnDOT Twin Cities Metro Traffic Website - Temporary Cameras in Work Zones

The deployment of temporary wireless cameras is often needed in order to retain visual coverage of traffic conditions during construction, as communications and locations of "permanent" cameras can be disrupted. MnDOT traffic management staff had noticed a high number of pageviews to images at cameras located near work zones where significant congestion was occurring near construction lane closures. For selected camera sites near work zones, MnDOT was interested in knowing the significance of the change in pageviews before, during and after construction, to help determine whether the cost of deploying wireless cameras in work zones is justified.

Description of Assessment:

The objective of this assessment was to determine usage patterns for camera images accessed near congested work zones.

Pageviews per month to camera images positioned to view traffic conditions near four separate work zones sites were tracked before, during, and after construction. Work zone sites and cameras included:

- Work Zone #1: Interstate 694 at White Bear Avenue (Camera 716)
- Work Zone #2: Interstate 35E at County Road 96 (Camera 42)
- Work Zone #3: Interstate 94 at Hwy 280 (Camera 841)
- Work Zone #4: Trunk Highway 77 at Cliff Road (Camera 506)

Work Zones #1 and #2 were located along stretches of highway that are not typically congested. Work Zones #3 and #4 were located along stretches of highway that are typically congested during peak periods.

Results:

The following graphs provide the number of pageviews by month before, after and during construction for Work Zone #1, #2, #3 and #4.

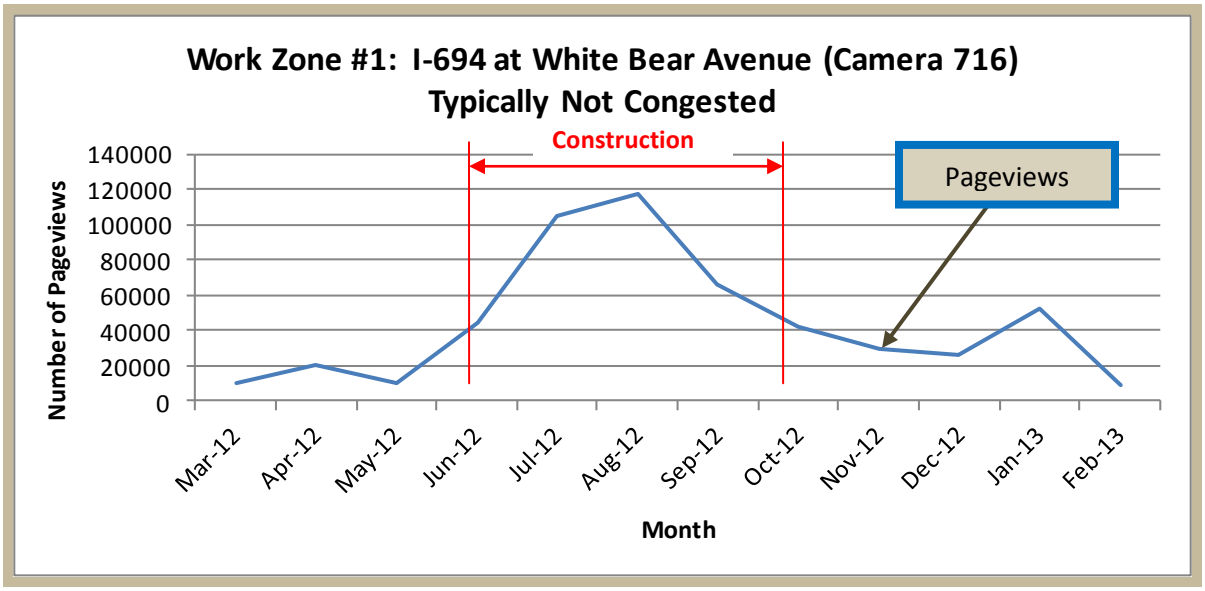


Figure 6-21: Work Zone #1 Pageviews Before, After, and During Construction

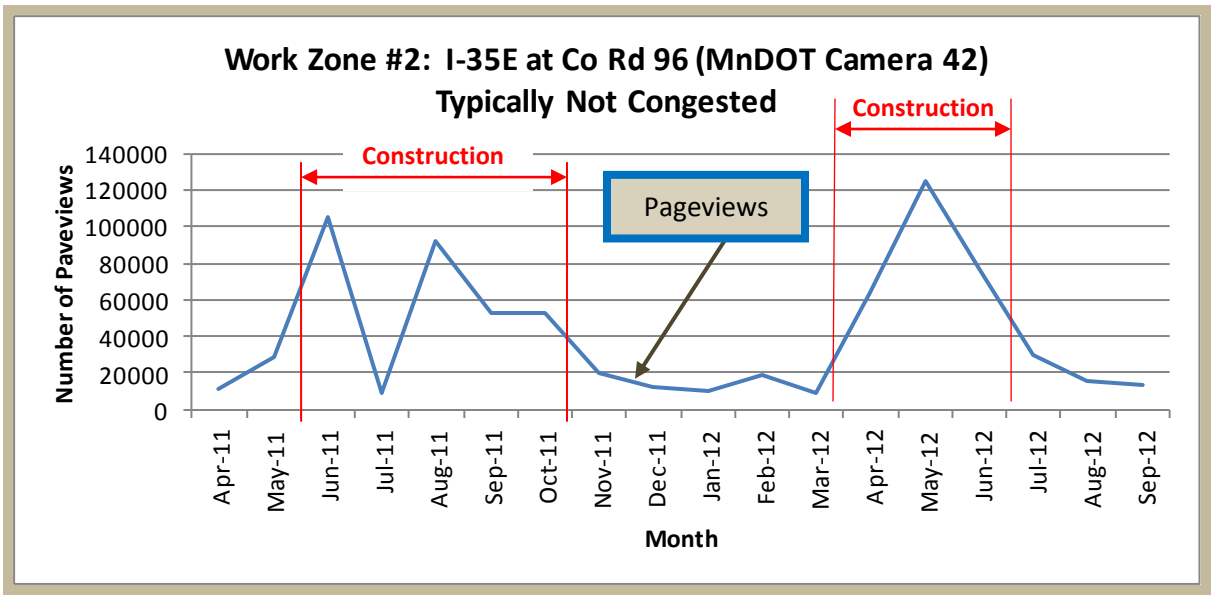


Figure 6-22: Work Zone #2 Pageviews Before, After, and During Construction

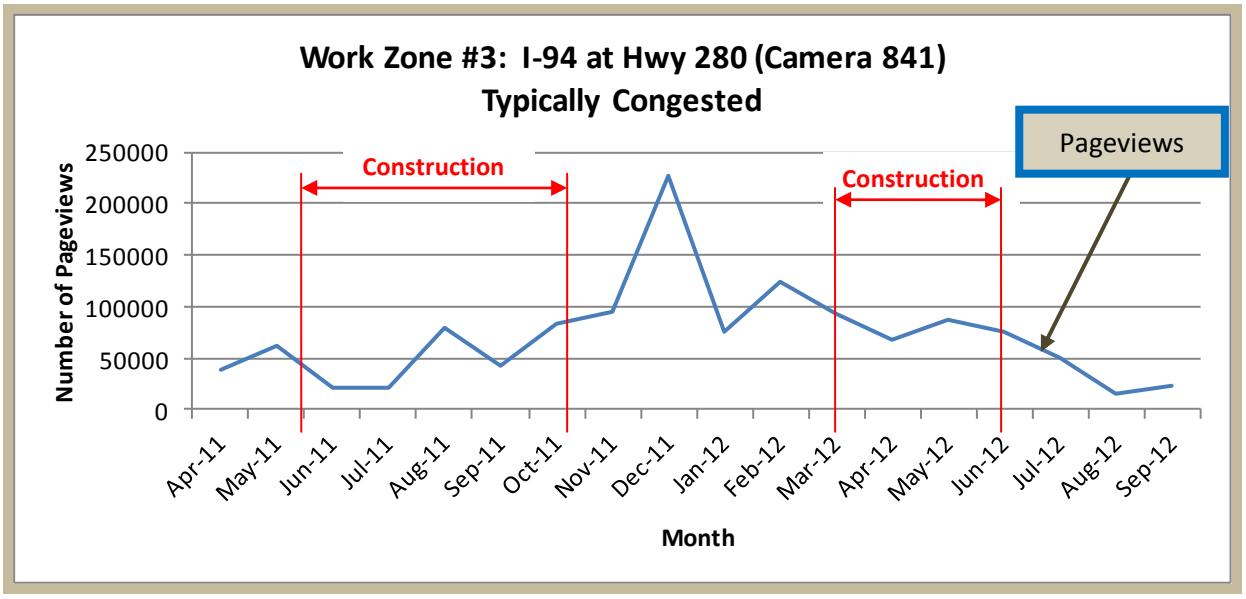


Figure 6-23: Work Zone #3 Pageviews Before, After, and During Construction

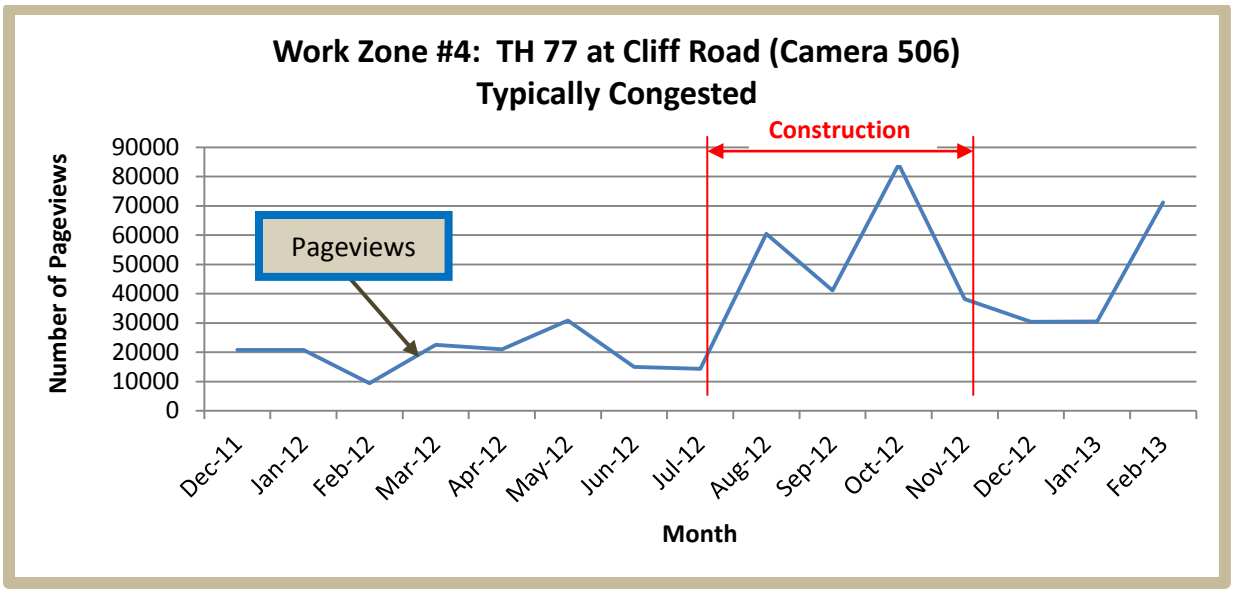


Figure 6-24: Work Zone #4 Pageviews Before, After, and During Construction

Observations:

- In nearly every work zone location, pageviews to camera images increased dramatically during construction. One exception was at Work Zone #3 (I-94 at Hwy 280), where pageviews did not experience dramatic increases.
- The magnitude of increase in pageviews to cameras during construction in locations that are not typically congested was much more pronounced than in locations that are not typically congested. When comparing the peak number of pageviews during construction to average usage before and after construction, cameras in Work Zones #1 and #2 experienced ranges of 4 - 7 times the number of pageviews in the peak month during construction. In comparison, cameras in Work Zones #3 and #4 experienced ranges of 1 - 2 times the number of pageviews during construction.

Travel Midwest Multi-area Traveler Information Website

Real-time maps displayed on the Travel Midwest Website are created from data provided by sources including the Illinois DOT, Illinois Tollway, Chicago Skyway, Wisconsin DOT, Indiana DOT, the Indiana Toll Road, Michigan DOT, City of Chicago (Office of Emergency Management and Communications and Chicago DOT) and Lake County, IL. The website provides travel times, congestion, construction, incidents, road labels and shields, detector data, dynamic message signs, cameras, and special events.

Metropolitan areas shown on the Travel Midwest website include:

- Chicago Area
- City of Chicago
- Lake County, IL
- Madison
- Milwaukee
- NW Indiana
- Quad Cities
- Rockford
- SW Michigan

Description of Assessment:

The objective of this assessment was to determine user preferences and patterns for viewing traffic maps and cameras when presented with options on the landing page.

Pageviews per month to the following web pages were compared over a 12-month period:

- Traffic Maps = Landing Page + Metro Area Traffic Maps (all)
- Cameras = Camera Report Page + Camera Views (all)

Landing Page: The landing page shows a traffic map of the Chicago area or the user's last map position, with a drop-down menu that allows visitors to select traffic maps of other metro areas. See Figure 6-25.

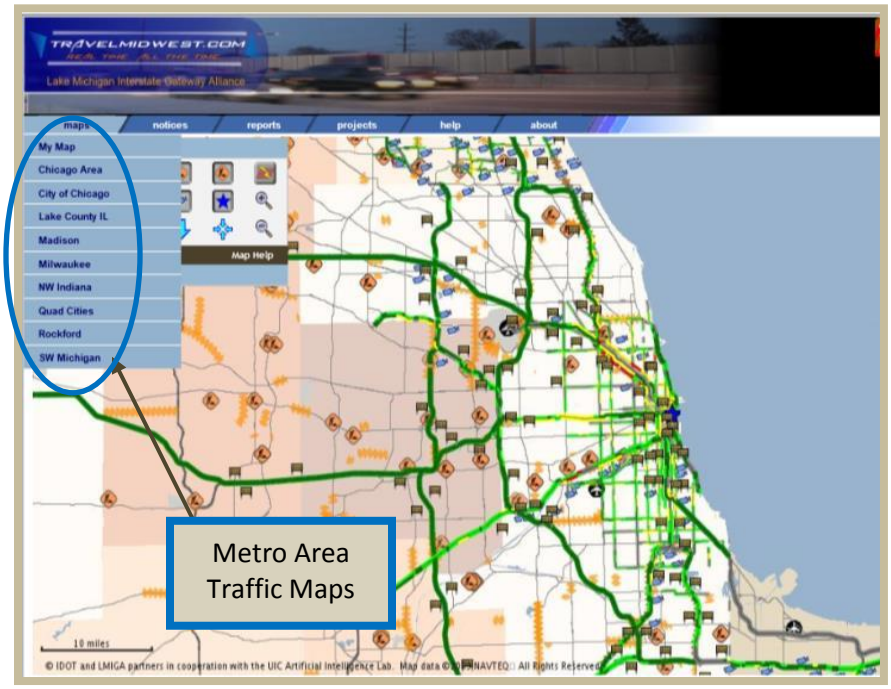


Figure 6-25: Travel Midwest Landing Page

Metro Area Traffic Maps: Color-coded traffic maps of each metro area that show congestion conditions, with map control options to hide or show additional information (e.g. travel times, construction, cameras, etc.) by toggling the features on or off. Figure 6-26 below shows the Milwaukee, WI traffic map; this is an example of one of the traffic maps that can be selected from the landing page.

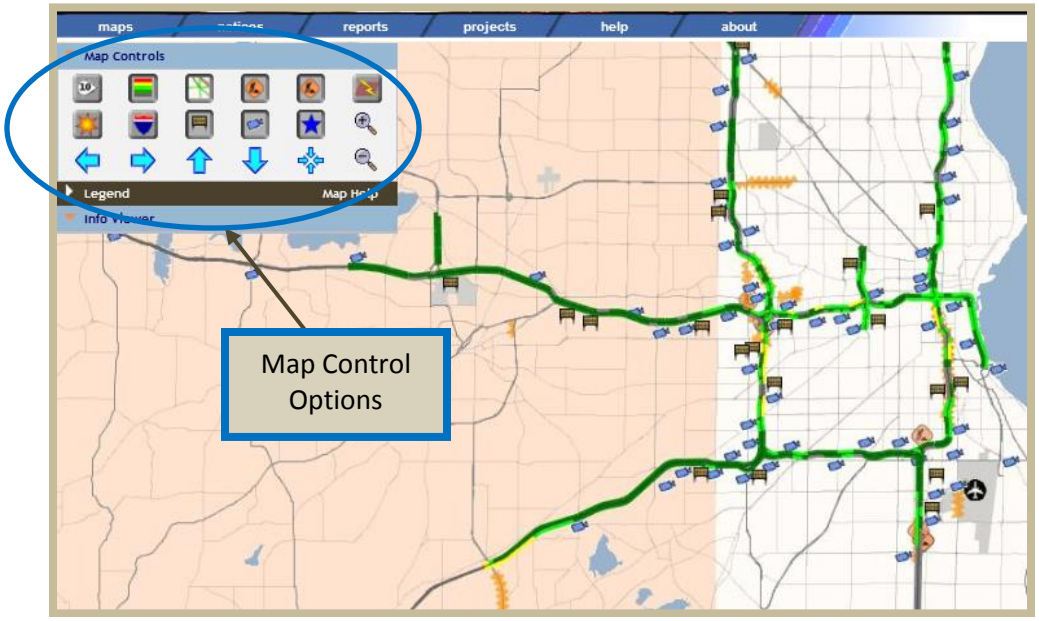


Figure 6-26: Milwaukee, Wisconsin Traffic Map

Camera Report Page: This page shows all locations where camera images are available and can be selected for viewing traffic conditions. See Figure 6-27.

Figure 6-27: Illinois DOT Camera Locations

Camera Views: Camera views show "snapshot" images of the roadway. Camera views can be selected from traffic map pages by selecting the camera icon and from the camera report page. See Figure 6-28.

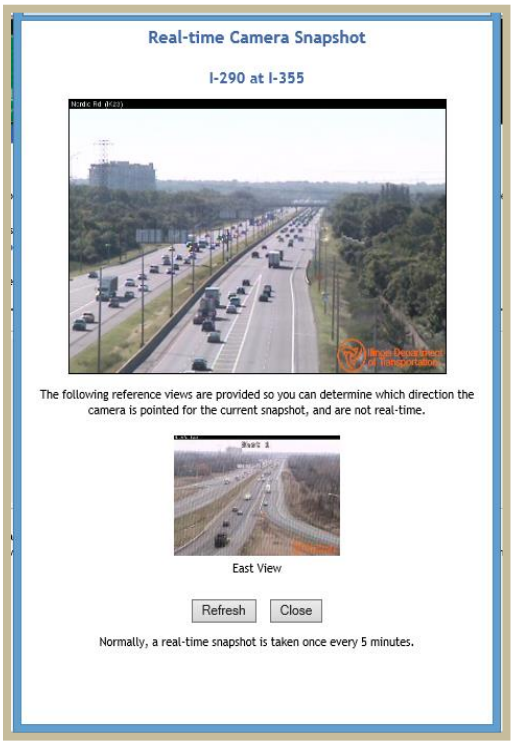


Figure 6-28: Illinois DOT Camera View

Results:

Figure 6-29 below shows the pageviews of the traffic maps and cameras by month for the Travel Midwest website.

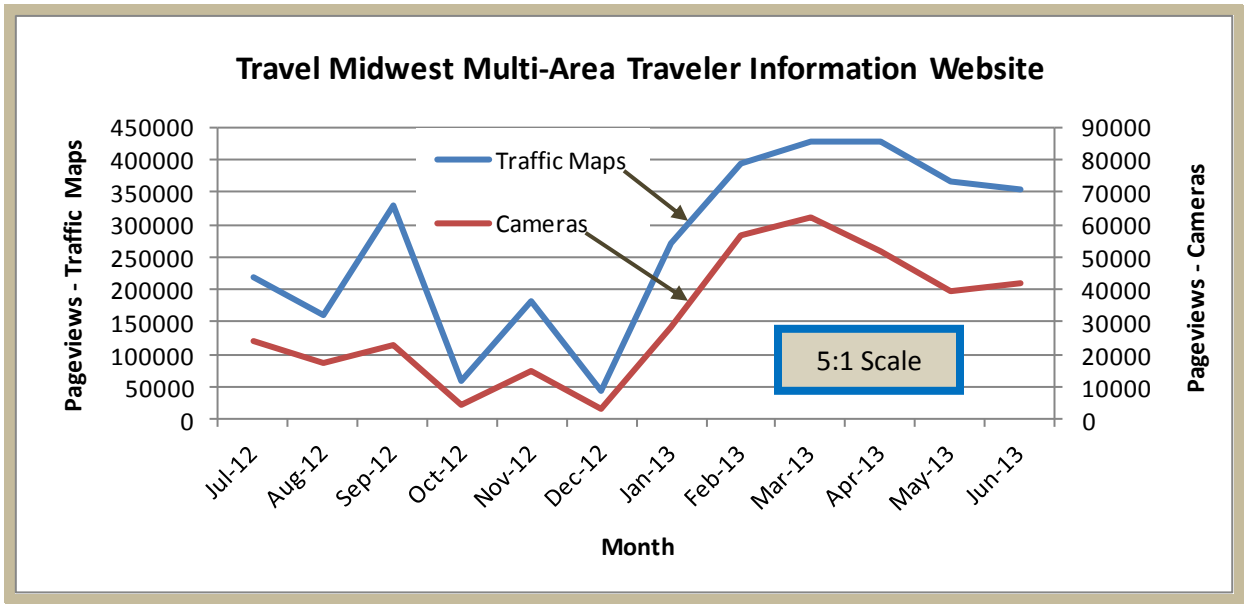


Figure 6-29: Traffic Maps and Cameras Pageview for Travel Midwest by Month

Observations:

- Pageviews to traffic maps are much higher than pageviews to camera pages. The difference ranged from 7 to 14 times more pageviews per month to traffic map pages, as compared to camera pages.
- Traffic maps and camera pages are accessed more frequently during months with snow events. According to the National Weather Service, February and March of 2013 experienced the highest snow accumulations and most days with snow accumulations over 1" of the winter, for the three largest metro areas (Chicago, Milwaukee, and South Bend) covered by TravelMidwest.com. Camera images were accessed at a higher rate in February and March of 2013, as compared to other months in the data set.
- In April 2013, usage of camera pages began to decline, while usage of traffic maps remained steady. According to Illinois DOT staff, several flooding-related incidents (e.g. road closures and flooding-related road conditions) were posted on traffic map pages, especially in the Chicago area, during the month of April. This could have resulted in steady usage of traffic maps even as winter weather tapered off and access to camera pages declined.

6.3 Key Findings from Web Usage Comparisons

The following key findings resulted from observations drawn from web usage comparisons:

- In general, unverified displays (camera images and weather station data) were not accessed as frequently as verified reports (traffic maps and/or road condition maps/reports). The lower use of camera images may indicate that visitors to traveler information websites are often satisfied with the information they receive from landing pages (typically verified reports such as traffic maps or road condition maps) and do not always need to see camera images to view actual conditions.
- The rate of access to camera images increased with inclement weather (e.g. significant winter storms, flooding events) and during construction seasons. In many cases, though access to other pages also increased with winter weather, the rate of increase was not as dramatic as the increase in access to camera images.
- In the Twin Cities metro area, cameras images were highly accessed near work zones that created significant congestion.

7.0 Impacts of New Camera Deployments

7.1 Assessment Approach

ENTERPRISE member agencies were polled to determine whether their agencies had recently deployed new cameras that would be available on their traveler information websites, or whether they planned to do so in the near future. Six agencies identified camera deployment sites for potential assessment. Due to construction or other installment delays, three of the six sites were not fully deployed during this project's duration. Therefore, only three deployment sites were included in this assessment. An overview of camera deployment sites is provided in Table 7-1.

Table 7-1: Overview of Camera Deployment Sites

Agency	Number of Cameras Deployed	Location	Date(s) of Deployment	Rural or Metro Area
Idaho Transportation Department	5 sites (2 cameras/site)	South Central Idaho	March 2013	Rural
Iowa DOT	Approx. 46	Statewide	Feb-March 2013	Rural
Washington State DOT	Approx. 6	I-5, South of Tacoma	Spring 2012	Metro

Interviews with agency staff were conducted to gather the following information:

- Reason(s) for deploying cameras
- Initial public response, if any, to the addition of camera image displays on the traveler information website (e.g. input received via DOT social media, emails)
- Noticeable changes in traffic patterns, web usage, or other differences that could be attributed to the new camera deployments
- Other observations or comments

The objective of the interviews was to gather perceptions from agency staff who observed conditions before and after deployments and could offer perspectives about public response and how traffic conditions may have been impacted. In the case of the Idaho Transportation Department deployment, web usage statistics were also used to help draw conclusions about the use of camera images.

7.2 Summary of Interview Responses

Summaries of interviews with agency staff, for each deployment site, are provided below.

Idaho Transportation Department (ITD) - Rural Cameras to Fill Gaps in Coverage

Responses provided by: Tony Ernest (Travel Services Coordinator), Dennis Jensen (Winter Maintenance Coordinator), and Phil Braun (INET Administrator)
Date of Interview: 5/14/13

Number of Cameras Deployed: 6 sites (Each site includes an RWIS station and 2 cameras)
Location(s): South Central Idaho
Date(s) of Deployment: March 2013

Why did you decide to add cameras?

RWIS stations/cameras are used for winter maintenance purposes and to provide road condition information to the pubic via ITD's 511 Travel Information website. The main factor in determining site locations was a desire to fill gaps in coverage for winter maintenance. An overarching goal is to create a network that enables automated road condition reports to be generated by RWIS for all freeways in the state.

ITD districts were asked to recommend site locations. When choosing locations, ITD takes into consideration input from a number of sources including the general public, other agencies such as the National Weather Service and county highway districts, and recreational groups. ITD had received emails from the public requesting additional RWIS stations/cameras in the vicinity the newly deployed sites.

What was the initial public response, if any, to the addition of camera image displays on your traveler information website (E.g. input received via DOT social media, emails, etc.)?

ITD District 4 issued a news release with information about three new sites/cameras located in that district. District 4 received calls from the public thanking them for the new station data/cameras at the Jerome Butte and Tuttle locations, as these areas previously had large gaps in coverage.

Were there any noticeable changes in traffic patterns, web usage, or other noticeable differences that could be attributed to the new camera deployments, especially shortly after the deployment?

If a segment of highway is not well-covered by RWIS stations/cameras, district maintenance stations receive calls from the public requesting road condition information. As new RWIS stations/cameras are deployed, districts typically experience fewer calls of this type because the information is available to the public via ITD's 511 Travel Information website.

Web usage statistics from ITD's Streamlined Traveler Information Website were reviewed, to glean insights about how visitors used the new cameras. After the deployment, the number of pageviews to new cameras was compared to the number of pageviews to the nearest adjacent camera. Results of this comparison are shown below.

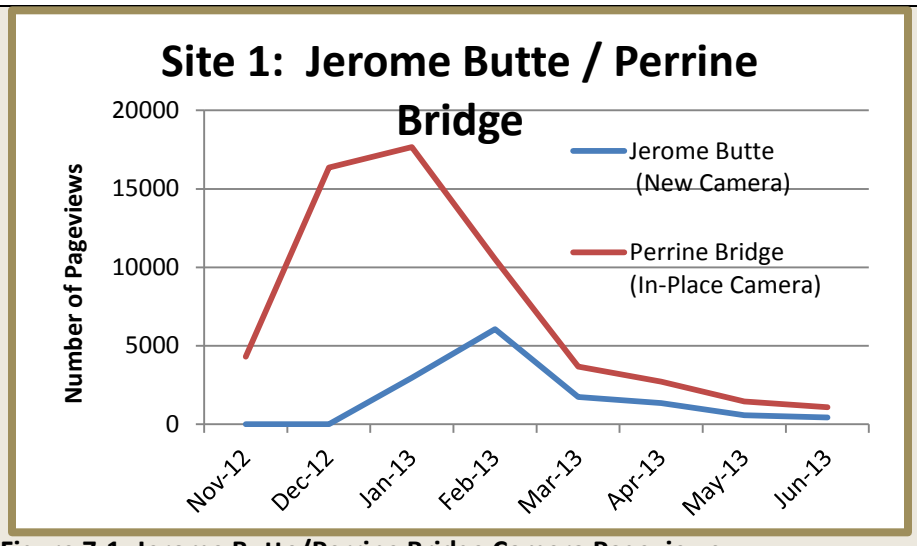


Figure 7-1: Jerome Butte/Perrine Bridge Camera Pageviews

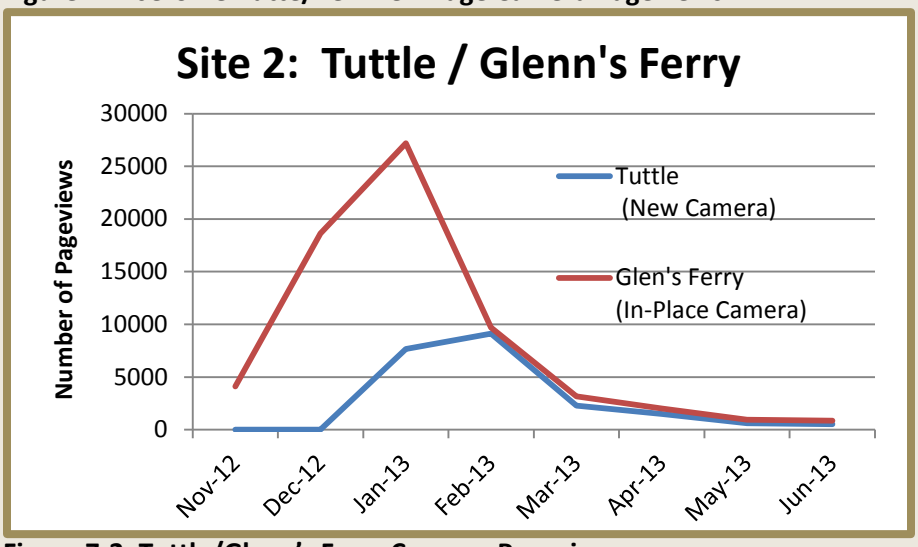


Figure 7-2: Tuttle/Gleen's Ferry Camera Pageviews

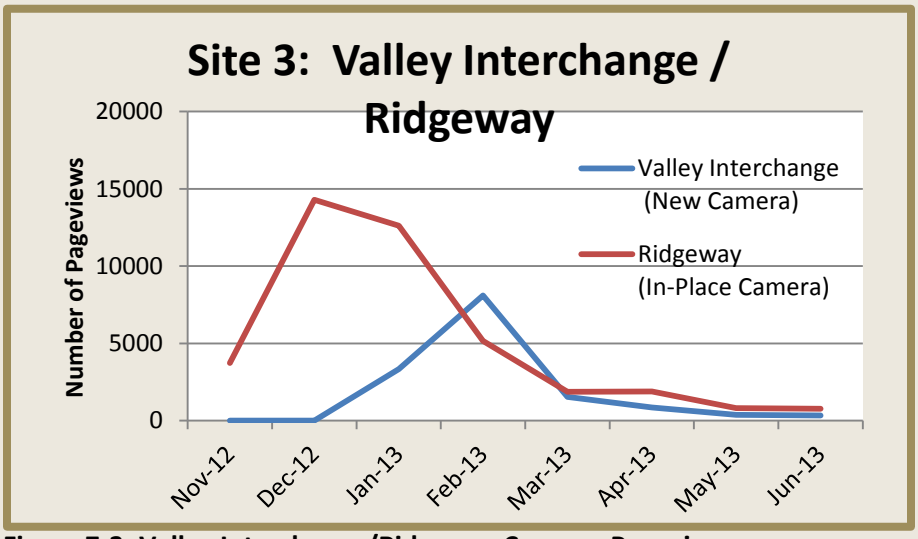


Figure 7-3: Valley Interchange/Ridgeway Camera Pageviews

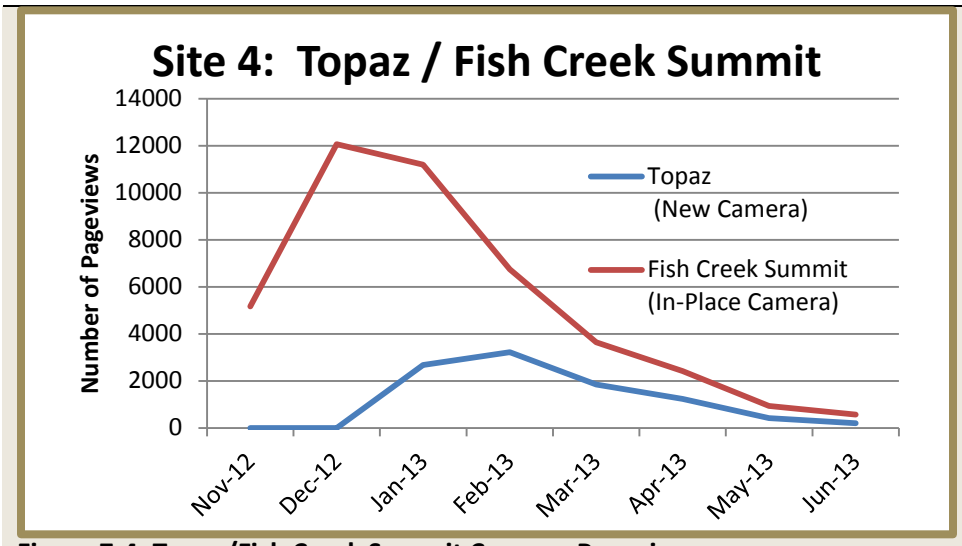


Figure 7-4: Topaz/Fish Creek Summit Camera Pageviews

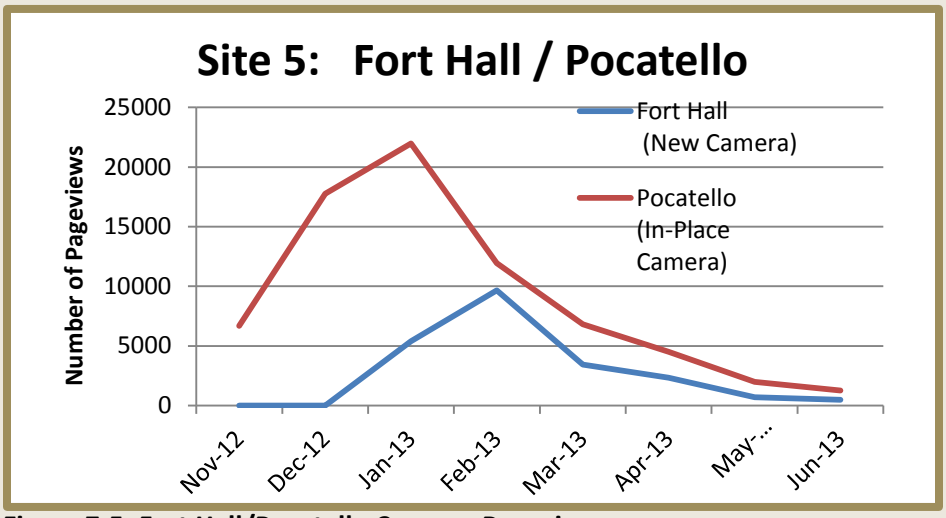


Figure 7-5: Fort Hall/Pocatello Camera Pageviews

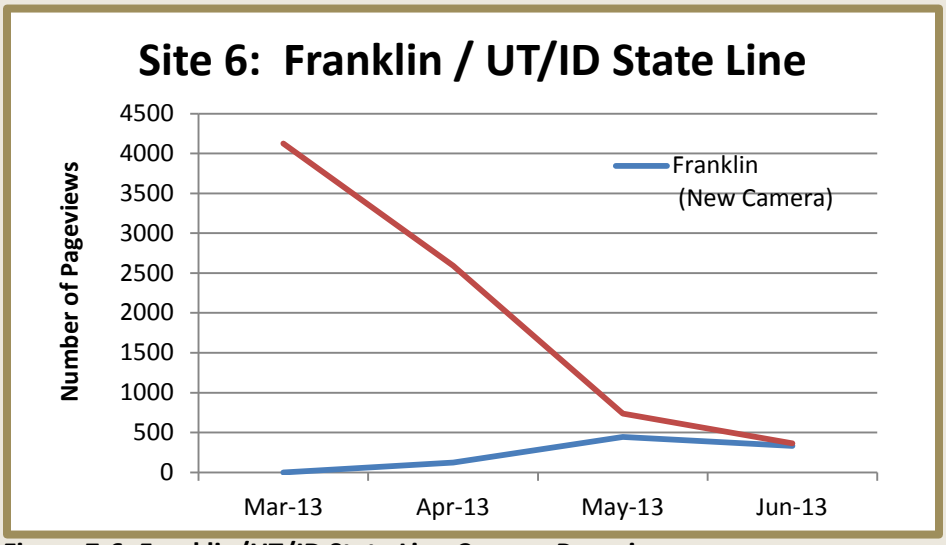


Figure 7-6: Franklin/UT/ID State Line Camera Pageviews

Observations from this web usage comparison:

- Most web visitors discover that a new camera is available fairly quickly.
- At first, when visitors see a new camera, they view it often. They then decide how valuable the new camera and fold it into their routine viewing patterns accordingly. The cameras they consider more useful, they tended to visit more often.

Other observations or comments:

ITD is now displaying two camera images at each RWIS station, typically: 1) Pavement View (zoomed in, to view pavement conditions); and 2) Horizontal View (to view longer stretches of roadway and often placed to view oncoming weather events (see Figure 6-4). ITD has received some feedback from the public expressing appreciation for adding a second camera image view, but this decision has mostly been driven by requests from maintenance staff.

Iowa DOT - Statewide Deployment of Camera Images in Rural Areas

Information Provided by: Sinclair Stolle, Traveler Information Program Engineer, Iowa DOT
Dates of Interviews: 3/22/13 and 7/2/13

Number of Cameras Deployed: Approximately 46
Dates of Deployment: February and March 2013
Location: Rural areas throughout the state. See Figure below for locations.

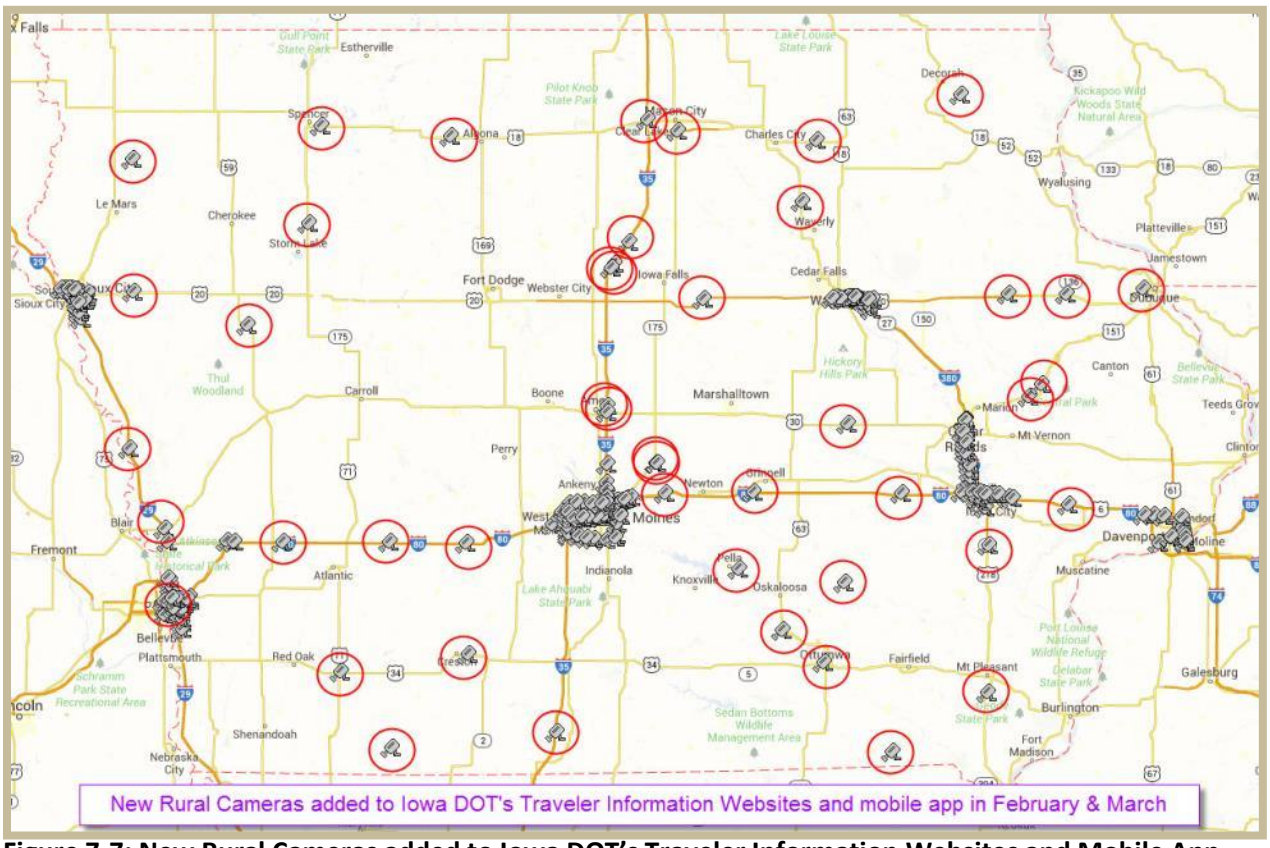


Figure 7-7: New Rural Cameras added to Iowa DOT's Traveler Information Websites and Mobile App

Why did you decide to add cameras?

Prior to this deployment, camera images showing road conditions in rural areas were essentially unavailable to the public. Iowa DOT was interested in providing as much information as possible to travelers in rural areas, especially information about winter road conditions. In addition, Iowa DOT had recently implemented a statewide ATMS system, which significantly streamlined the Traffic Management Center's access to camera feeds in rural areas. In many cases, cameras were in place in rural areas but had not been available via the Iowa DOT's Traveler Information Websites and Mobile App.

This deployment was significant in that it provided visual information about road conditions where none was previously available.

What has been the public response, if any?

Initial Response:

Shortly after the deployments, Iowa DOT announced the availability of the new camera images on their "Iowa 511 Traveler Information" Facebook pages (on statewide and five regional pages.) Several "likes" and positive comments were received from the public in response to the announcement.

Targeted input requested via Facebook (July 2013):

Approximately four months after the deployment, the Iowa DOT posted a brief survey to their 511 Facebook pages asking if followers found the new cameras useful over the winter months and during spring flooding. In addition, a message with an image of all of the deployed cameras was posted, asking for feedback on usefulness of the cameras. These two postings resulted in several "likes," one positive comment, and several survey votes indicating "absolutely" in response to the question about whether they found the new cameras useful.

Have there been any noticeable changes in traffic patterns, web usage, or other noticeable differences that could be attributed to the new camera deployments, especially shortly after the deployment?

None noted.

Other observations or comments:

None noted.

Washington State DOT (WSDOT) – Tacoma Area

Responses provided by WSDOT staff: Tony Leingang, Olympic Region Freeway Operations Engineer/Manager, and Jeremy Bertrand, Web and Social Media Manager
Date of Interview: 6/26/13

Number of Cameras Deployed: Approximately 6 cameras
Date(s) of Deployment: Spring 2012
Approximate Location(s) of Deployment: Interstate 5 south of Tacoma, between Dupont and Lakewood, filling gaps between existing cameras. See the figure below for deployment locations.

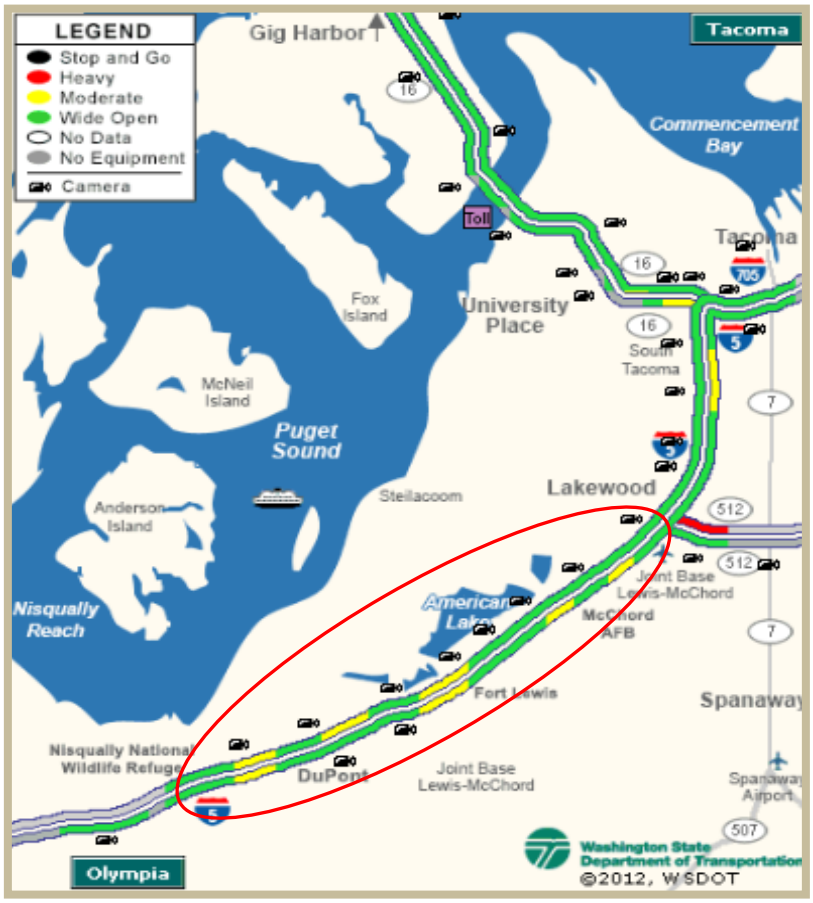


Figure 7-8: WSDOT Camera Deployment Location

Why did you decide to add cameras?

This route (I-5 between Dupont and Lakewood) is commonly congested during weekday peak periods and all day on Sundays during the summer, due to recreational traffic. Due to its location, which is bordered on the west by water and the east by Joint Base Lewis-McChord (a joint US Army/Air Force base), any alternate routes would include long detours, so motorists typically do not re-route. The main reason for adding cameras was to fill gaps between existing cameras, to improve operations (e.g. provide information to traffic management center (TMC) operators, state patrol, in order improve incident response and clear incidents more quickly; (also keeps management professionals informed.) In addition improving operations, the new cameras also provide information to the traveling public through image displays on WSDOT's Traveler Information Website.

What was the initial public response to the addition of camera image displays on your traveler information website (E.g. input received via DOT social media, emails, etc.)?

WSDOT publicized availability of the new camera images through mechanisms such as a news release, Twitter, Facebook, and email. WSDOT staff saw a fairly significant response from the general public (e.g. comments on social media) and news anchors after the change was communicated. Additionally, agency employees, friends, and family ~~c~~ommunicated appreciation for the extra information to DOT staff, and have in turn asked about future deployments, such as when/where more cameras will be added.

One of the most noticeable changes was in media coverage. It is now more common to see traffic reporting on this stretch from Seattle news media, whereas prior to the deployment, this segment was rarely covered. This deployment gave the media the information they needed in order to provide traffic reports to the public.

WSDOT has been providing traveler information to the public for a long time. Therefore, there is an expectation that they provide current, complete information to the public. WSDOT will more often receive inquiries about why there are no cameras at a location or expressions of frustration when cameras aren't functioning properly, as opposed to receiving feedback with appreciation when cameras are added.

Were there any noticeable changes in traffic patterns, web usage, or other noticeable differences that could be attributed to the new camera deployments, especially shortly after the deployment?

Nothing in particular noted. It is difficult to draw solid conclusions by looking at web usage because many users access third party data (e.g. mobile apps); these visits are not counted by typical analytics software.

General observations or comments:

In general, cameras don't seem to attract a large amount of attention in terms of views from the public, unless there's an incident/crash or during high-volume periods such as Friday afternoons and during highly publicized construction/maintenance events. During highly publicized incidents, motorists do tend to adjust travel behavior accordingly, which helps alleviate congestion.

Recently, people who follow WSDOT on Facebook or Twitter have begun to copy and share camera feeds along with posting comments (e.g. crowd-sourcing.)

Weather events generate over ten times the number of visits to the WSDOT Traveler Information Website than other time periods. After users visit the traveler information website to view road conditions, visits to other areas of the WSDOT site also increase. Incident responders and maintenance staff use camera images to reposition themselves based on storm patterns.

7.3 Key Findings from New Camera Deployments

The interviews resulted in a number of key findings about the impacts of deploying new cameras and/or making available new camera images that can be accessed by the public via traveler information websites:

- Decisions to deploy new cameras are not typically driven by public demand. Rather, these investments are typically made to improve traffic management and operations. In the Iowa DOT case, however, the decision to make cameras available throughout the state in rural areas was driven by the agency's desire to provide as much information as possible to motorists, especially in rural areas during winter weather events.
- Inclement weather (e.g. snow events) creates high demand for traveler information, as observed by WSDOT while monitoring web usage over time and noted by Iowa DOT as a motivating factor for making camera images in rural areas available via their traveler information website.
- The public generally expects to have as much information as possible about travel conditions. ITD received requests from the public for additional cameras and weather station data in areas where there were gaps in coverage. In each deployment case, agencies received expressions of appreciation after cameras were deployed.
- As new cameras and RWIS stations are deployed by ITD in areas with sparse coverage, district maintenance stations experience fewer calls from the public requesting road conditions.
- In the WSDOT case, news media played an important role in disseminating information about traffic conditions along the I-5 corridor where new cameras were deployed. WSDOT staff observed that when incidents are highly publicized, motorists tend to change their travel patterns accordingly. In this instance, the availability of camera images is influencing travel behavior, due to increased publicity.

8.0 Conclusions

Overall findings indicate that unverified displays, specifically camera images and weather station data, are not as highly accessed as verified reports such as traffic maps and road condition maps/reports. However, many users of traveler information websites indicated that they highly value camera images, especially in combination with traffic maps and road condition maps/reports. Observations from agency staff indicated that the public expresses a strong desire to have as much information as possible about traffic and road conditions and will commonly express dissatisfaction when camera images are not available in specific areas of low coverage or are not functioning properly.

Results from the survey of travelers revealed a number of preferences reported by users of traveler information websites:

- Camera images are highly valued by many traveler information website users, especially to complement traffic maps and road condition reports. Camera images are often valued because they are considered to be more "real-time" than verified reports. Camera images were reported to be more useful during inclement weather, especially in rural areas and by younger drivers.
- Most users of traveler information websites would not be satisfied with camera images alone, especially when obtaining information about traffic/congestion conditions.
- Weather data (air temperature, wind speeds, etc.) is not considered to be very useful when seeking road-weather information.

The web usage comparisons provided observations about actual usage patterns for various types of information on traveler information websites:

- Unverified displays (camera images and weather station data) were not accessed as frequently as verified reports (traffic maps and road condition maps/reports.) The lower use of camera images may indicate that visitors to traveler information websites are often satisfied with information shown on "landing pages" (often verified reports such as traffic maps or road condition maps), and they do not always need to view camera images to view actual conditions.
- The rate of access to camera images increased with inclement weather (e.g. significant winter storms, flooding events) and during construction seasons.
- Camera images appear to be highly accessed near work zones that create significant congestion.

Interviews with agency staff from the Idaho Transportation Department (ITD), Iowa DOT, and Washington State Department of Transportation (WSDOT) provided insights about the impacts of making new camera images available via traveler information websites:

- The public expects to have as much information as possible about travel conditions. In each deployment case, agencies received expressions of appreciation after cameras were deployed. Agencies also receive requests for new cameras in areas of low coverage and complaints when cameras are not functioning properly.
- Inclement weather (e.g. snow events) creates high demand for traveler information, as observed by WSDOT while monitoring web usage over time and noted by Iowa DOT as a

motivating factor for making camera images in rural areas available via their traveler information website.

- In the WSDOT case, news media played an important role in disseminating information about traffic conditions along the I-5 corridor after the new cameras were deployed. WSDOT staff observes that when incidents are highly publicized, motorists tend to change their travel patterns accordingly. Therefore, the availability of camera images is influencing travel behavior, due to increased publicity.

Appendix A – Survey Questions

Use of Camera Images and other Displays of Traveler Information

The purpose of this survey is to help the Department of Transportation understand how travelers use camera images and other information on state Department of Transportation Traveler Information Websites. Information on Traveler Information Websites varies from state to state. However, many sites include weather-related information, road conditions, construction locations and updates, traffic maps, and camera images of roadways.

Thank you for your time and assistance.

***1. This is a multi-state survey. Please select the state whose transportation agency hosts the Traveler Information Website you typically use.**

- ◯ Georgia
- ◯ Idaho
- ◯ Iowa
- ◯ Kansas
- ◯ Minnesota
- ◯ Missouri
- ◯ Washington
- ◯ Other (please specify)

***2. Select the option that best describes where you most often drive your personal vehicle.**

- ◯ In metropolitan areas (including suburbs)
- ◯ In rural areas, outside of metropolitan areas

***3. Select your age group.**

- ◯ 16-25
- ◯ 26-40
- ◯ 41-55
- ◯ 55-65
- ◯ Over 65

Page 1

Use of Camera Images and other Displays of Traveler Information

4. When using a Traveler Information Website to plan a trip, how useful would the following types of information be?

	Not at all Useful	Slightly Useful	Moderately Useful	Very Useful	Extremely Useful	I don't know what this is
Congestion/Traffic Levels (Ex. color-coded maps)	○	○	○	○	○	○
Road Surface Conditions (Ex. snow-packed, dry, wet, icy)	○	○	○	○	○	○
Weather Information (Ex. air temperature, wind speed)	○	○	○	○	○	○
Weather Alerts (Ex. advisories, warnings)	○	○	○	○	○	○
Incidents / Crashes	○	○	○	○	○	○
Camera Images	○	○	○	○	○	○
Travel Times	○	○	○	○	○	○
Current Construction Projects	○	○	○	○	○	○
Future Construction Projects	○	○	○	○	○	○
Amenities (Ex. rest areas, tourist centers)	○	○	○	○	○	○
Non-auto Modes (Ex. airports, transit/train stations)	○	○	○	○	○	○
Commercial Vehicle Restrictions	○	○	○	○	○	○

5. In addition to the information types listed above, what other information would you like to see on a Traveler Information Website? (Optional)

Page 2

Use of Camera Images and other Displays of Traveler Information

Below are examples of color-coded maps showing current traffic conditions (e.g. speeds, congestion levels, and/or travel times) and images from cameras on the roadside.

Review these examples, then answer the following questions.

6. When you view a color-coded traffic map, how important is it for you to also view camera images along your route?

- ◯ Very important, I prefer to view images of current conditions
- ◯ Moderately important, I could draw any needed conclusions based on the map
- ◯ During inclement weather, I prefer to view camera images; during favorable weather, camera images are less important
- ◯ I rarely or never use camera images

Please describe why you value (or do not value) camera images when viewing traffic information.

7. When you view camera images, how important is it to supplement the images with traffic information (e.g. speeds, congestion levels, and/or travel times)?

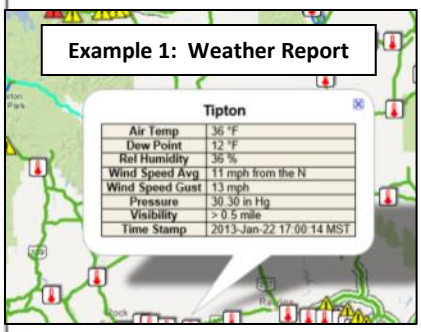
- ◯ Very important; camera images alone do not provide adequate information
- ◯ Moderately important; I can usually obtain adequate information from camera images
- ◯ Not important; camera images present adequate information

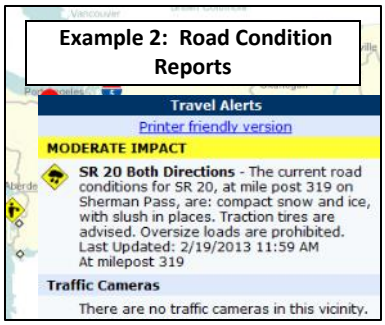
Please describe why you value (or do not value) traffic information such as color-coded maps showing speeds, congestion levels, and/or travel times.

Use of Camera Images and other Displays of Traveler Information

Below are examples that provide weather-related road information.

Review these examples, then answer the following question.





8. Choose the information type that is most useful to you when seeking weather-related road information.

- ◯ Weather Reports (Example 1 above)
- ◯ Road Condition Reports (Example 2 above)
- ◯ Camera Images (Example 3 above)

For the information type you selected as most useful, please describe why you value this.

Thank you for your responses. Your input will be used to help understand how Traveler Information Websites are used by motorists.

Page 4