# Final Report of the FORETELL Consortium Operational Test: Weather Information for Surface Transportation

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U.S. Department of Transportation
ITS Joint Program Office, HVH-1
Room 3400
400 Seventh Street, S.W.
Washington, D.C., 20590

Prepared by:
Battelle
505 King Avenue
Columbus, OH 43201-2693

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# Final Report of the Evaluation of the FORETELL Consortium Operational Test: Weather Information for Surface Transportation

## FORETELL Consortium Operational Test: Weather Information for Surface Transportation (WIST)

## Principal Authors

Bradley Skarpness, Ph.D. (Battelle)
Fred Kitchener (Meyer, Mohaddes Associates)
Ed Boselly (Weather Solutions Group)
Amy Thomas (Battelle)

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## EXECUTIVE SUMMARY

Accurate weather information is a critical element in the daily lives of most Americans. In many cases, weather information helps determine when and if to take a trip, the route, and expected travel time. It guides the actions of state departments of transportation (DOTs) that maintain the interstates and state highways. It also affects how and when commerce is transported.

When weather turns wintry with snow and ice, it cannot only change daily habits, it can be deadly. Over 17 percent of all fatal crashes occur during winter weather conditions. Of those, 60 percent happen in rural areas (most on non-interstate roadways). The Federal Highway Administration (FHWA) Intelligent Transportation System (ITS) Joint Program Office and the recently formed Road Weather Management Program support the supposition that more accurate and accessible weather information could improve road maintenance and decrease fatal crashes. FHWA awarded a rural ITS Operational Test (OT) to the FORETELL™ Consortium (Castle Rock Consultants, Iowa, Wisconsin, and Missouri DOTs) in 1997 to develop an operational test of a multi-regional road and weather forecasting/dissemination system, in partnership with the National Weather Service (NWS) and Environment Canada (EC).

### ES.1 FORETELL System

A market analysis conducted by FORETELL indicated significant deficiencies with the current weather and road condition information development, production, and dissemination approaches. These deficiencies included:

- Lack of information and geographic coverage
- Insufficient timeliness
- Inaccuracies that result in lack of confidence in making decisions
- Lack of necessary detail
- Difficulties in acquiring information and the high cost of acquiring it

In response to these apparent deficiencies in the current system, FORETELL proposed to provide both nowcasts and forecasts of weather information and road conditions to highway maintenance operations staff, commercial vehicle operators, highway patrol, school administrators, transit operators, traffic managers, emergency medical units, and commuters and leisure travelers.

FORETELL planned to establish an Intelligent Transportation System (ITS) Service Center to provide an interface between the raw weather data and ITS users to deploy the weather information. The fundamental functions of the service center were to: use NWS and EC data sources and models for providing nowcasts and forecasts; use transfer energy balance models developed in Europe along with solar gain and snow drift algorithms for pavement condition forecasts; adjust weather forecast and pavement condition predictions using real time field sensor information from stationary and mobile road weather information systems (RWIS); disseminate value-added tailored information to state DOT highway maintenance personnel, travelers, and others using available/emerging commercial and ITS traveler information media.

FORETELL was a multi-state initiative bringing ITS together with advanced weather prediction systems to create operational highway maintenance management and traveler information systems throughout North America. FORETELL participants envisioned:

- a self-sustaining weather and road condition information system fully integrated within a wider basket of ITS services;
- a reduction in winter-condition related road deaths by at least 15 percent; and
- creation of a viable weather and road condition information network across the continent.

The FORETELL Consortium's mission was to deliver the benefits of advanced weather prediction systems and ITS technologies to travelers, shippers and transportation system operators. The program envisions a widely accessible real-time weather and road condition information system that would support seamless information sharing for travelers and highway maintenance operators (HMOs).[1] Major partners in FORETELL included state governments, private entities, Canadian agencies, and the U.S. Department of Transportation (U.S. DOT).

The FORETELL Consortium prepared a proprietary System Design Concept (SDC) document, which defined the goals and objectives of the program, the deficiencies in weather information within the transportation system, the FORETELL approaches to address these deficiencies, and the system configuration designed to achieve these goals. Rather than obtaining the information through multiple sources, FORETELL planned to provide a one-stop-shopping approach to obtaining the required data. The information was slated to be disseminated via the following methods:

- Internet/World Wide Web
- E-mail
- Fax
- Phone/Cell Phone
- Digital Messaging
- Pagers
- Fiber Optics
- Satellite

The FORETELL system has been constantly evolving since its conception. At the time of the evaluation, the FORETELL system was primarily an Internet website that displayed weather and road condition information for Iowa, Missouri, and Wisconsin. In addition, users of the website needed a username and password to gain access.

## ES.2 Evaluation Approach

As with all ITS Operational Tests, FHWA funded an independent evaluation of the project. In 1998, Battelle was selected to perform the evaluation. The purpose of the independent evaluation was to assess the effectiveness of the FORETELL operational test in achieving its goals and objectives. One of the goals of the evaluation process was to determine

[1] During the course of the FORETELL evaluation, the phrase "highway maintenance operators (HMOs)" evolved into the term "winter maintenance managers (WMMs)." According to the U.S. Department of Transportation's Road Weather Management web site, "Winter maintenance managers monitor weather and road conditions to determine when and where to dispatch crews to plow or apply materials (e.g., chemicals, abrasives) to road surfaces." For consistency with previous reports, the phrase "highway maintenance operators (HMOs)" is retained in the final report.

the feasibility of the FORETELL system and the possibility of widespread deployment. The following fundamental principles guided the evaluation team's conduct of the project evaluation:

- Extensive integration with FORETELL to ensure continuity and consistency
- Strategy consistent with and supportive of Advanced Rural Transportation Systems (ARTS) Strategic Plan goals
- Focus on user decisions and operational improvements
- Use of sound technical evaluation approaches (simple, meaningful, and achievable)
- Comprehensive in scope, but selective in practice (consistent with budget allocations)

A major goal of the evaluation was to address the following questions:

- Is the FORETELL information adding value to users beyond what they can obtain from existing sources?
- Is the new information changing users' behavior and how?
- What impact will this program have on ARTS goals and objectives (outcomes)?

The FORETELL evaluation focused on six user groups over three winter seasons. Each of these user groups had different needs and potential uses for the weather and pavement condition information. Each had different decisions and processes they aimed to impact with this new information. To some the information was new and packaged in a different format: the Internet. It was determined by the FORETELL Consortium that during the first year of operations only highway maintenance operators (HMOs) would have access to the website. The capacity of the servers hosting the website and the reliability and accuracy of the information would be initially assessed by HMOs. The system became operational during the winter of 2000-2001. In the fall of 1999, the evaluation team surveyed the HMOs to set up a baseline to compare their weather-related activities before and after FORETELL. Since the Consortium had no funds to market FORETELL to the general public, and it was uncertain whether the servers hosting the website could handle the potential high volume of hits simultaneously, five other user groups were selected and provided access to FORETELL during the second year of operation. The following additional user groups were surveyed after the winter of 2001-2002:

- Commercial Vehicle Operator (CVO) Personnel
- Highway Patrol Personnel
- School Administrators
- Transit Operators
- Traffic Managers

These user groups were selected because they needed weather and road condition information and they were interested in participating.

The HMOs were the largest user group surveyed. They were asked to evaluate the FORETELL system before it became operational and for two years after it became operational. Much of the information that was available through FORETELL was also available from a variety of sources. FORETELL brought the information from these many sources together in a single website and provided special features to assist users in viewing the information.

## ES.3 Evaluation Results

Many of the users were familiar with most of the information provided by FORETELL, but some of the information was new and/or presented in a new format. For example, one new item that was noted by the HMOs that was of great value to them was the dewpoint temperature. Other elements such as detailed weather forecasts, pavement temperature, and pavement conditions were among the highlighted new items across user groups. Although each user group had varying information needs, generally they thought the information packaged on a website was easy to obtain and useable, with a high percentage of them mentioning that they appreciated the special features such as the animation of the information over a specified time period. However, the survey results indicated both positive and negative aspects of the FORETELL system. ***Approximately 30-40 percent of the HMOs said that they changed their decisions based on FORETELL information, and greater than 50 percent of users said they want to continue using it in the future. However, less than 20 percent were willing to pay for the service.*** These numbers are significant given the challenges that were faced by the program.

The evaluation team believes that a changed decision based on FORETELL information was the true measure of the system's value. In this case, results among the users were mixed. ***The fact that 30-40 percent of HMO respondents indicated that they changed their decision based on this new information was significant***, given the natural reluctance to accept something new. However, the other users did not respond as favorably. In the case of the commercial vehicle operators, they appreciated the FORETELL information but did not think it would change their key decisions (when to go, if to go, where to go). The drive to get the products to their market destination was the most important decision criteria. However, it was interesting that the HMOs were less confident in their decisions using FORETELL, probably because of earlier problems they encountered with the system, while the other users were more confident (but less likely to change their decisions).

***It is of some significance to report that the majority of all users stated that they want to use FORETELL in the future.*** This may be the result of two primary interests on the part of the users. First, they found value in the information and were interested in using it for future winter seasons. Second, they did not have an opportunity to fully test the FORETELL system during a mild winter but saw enough promise to want to continue using the system and data. On the other hand, very few of these same users were willing to pay for the information and expected to continue receiving it at no cost. The confounding factors of the "institutional" issues and weather conditions mentioned make these results interesting but may not represent the true attitudes of the user group populations.

## ES.4 Caveats

FORETELL was the first in the industry to bring this much information together on a single website. Most first time endeavors of this magnitude are fraught with challenges. FORETELL was no different. The FORETELL program dealt with major partner changes, reluctant users (to changing the way they have done things in the past), schedule delays, information inaccuracy, and computer system and server issues that sometimes negatively affected the delivery of the information in a timely manner. Although unfortunate, these issues

were not unexpected for a project of this type. These "institutional" issues had an effect on how the system was perceived by some of the users and may have tainted their responses to surveys and phone interviews. In some instances, these issues may have impacted whether they used the system at all or were willing to participate in the evaluation.

Like any new tool provided to an operator (e.g., HMOs), FORETELL suffered from users' reluctance to use and accept something new. The evaluation team believes this resistance had a direct impact on the data collected from HMOs after the website became operational. In many cases, respondents to survey and phone interviews would not commit to agree or disagree with how they used or liked the system. This may be related to the fact that they did not really have a chance to use the system and did not feel comfortable responding one way or the other.

***Weather conditions also were a major factor that affected the evaluation of the FORETELL system.*** This was especially true for the other users (highway patrol, commercial vehicle operators, transit operators, school superintendents, and traffic managers), who only used the system one season (winter of 2001-2002). Comparing the overall weather of the evaluation winters with previous years indicates that the evaluation winters were extremely light, resulting in a diminished need for weather information. This situation affected the number of people willing to participate in the evaluation and the responses of those who did. Only 15 of the 34 CVOs, 5 of the 9 school administrators, and 3 of the 14 transit operators actually completed surveys or interviews. Almost all of the "other" users that were interviewed expressed concern that they had not had an opportunity to fully use and evaluate the system because of the mild winter. Also, the use of the FORETELL system by HMOs was significantly reduced during the final evaluation period compared to the prior season (where the data indicated they had a typical winter season). The evaluation team believes this reduced reliance on FORETELL was due in most part to the mild winter of 2001-2002.

Evaluating a new system that was still under development was a difficult task. Many users initially were reluctant to use a new system because its accuracy and reliability were unknown. However, users expressed an interest and perceived value in the FORETELL system and the weather/pavement condition information it provided. With continued system development, and enhancements to the system to improve accuracy and avoid system downtime, as well as to add some functionality, the changes could significantly affect future user perceptions of the FORETELL system. These potential enhancements could encourage continued use of the system, which could lead to expanded user acceptance and eventual changed behaviors of the user groups. ***Only after the FORETELL system is fully functional, reliable, tested for accuracy, made available to a wider user population, and marketed to a significant segment of user groups can a comprehensive evaluation be conducted.*** Therefore, additional evaluation activities in future years are required to fully evaluate the FORETELL system.

# 1.0 INTRODUCTION

The FORETELL™ program is a multi-state initiative integrating Intelligent Transportation Systems (ITS) with advanced weather prediction systems. The overall goals of the project include reducing accidents related to winter road conditions and creating a viable weather and road condition information network across North America. Improved weather information—specifically as it relates to road conditions—is expected to result in better public-agency response and traveler response to adverse winter weather.

The FORETELL program was initiated by the Federal Highway Administration's Road Weather Management Program as part of a Rural ITS program. The FORETELL Consortium consisted of state DOTs from Iowa, Missouri, and Wisconsin, which were supported by Castle Rock Consultants (formerly Castle Rock Services). Environment Canada and the Ministry of Transportation of Ontario were also initially part of the consortium.

As detailed below, FORETELL collected and combined raw weather information from many sources to provide the most recent and accurate weather data available. Advanced technology is used to link transportation systems and surface weather information systems. The power of the Internet is then used to disseminate road weather information on demand to a larger audience. The FORETELL System Design Concept (SDC) document (a proprietary report) defines in detail the information to be provided by FORETELL and how that information was generated.

FORETELL uses several weather sources to generate 24-hour weather forecasts as well as continuously updated current weather conditions. The FORETELL system also uses advanced temperature and heat exchange models to calculate road surface temperature and predict future road conditions. The FORETELL system gathered its weather information from a variety of sources, including the National Weather Service (NWS) models, agricultural sensors, airport weather sensor sites, and road weather information system (RWIS) sensors. Users have access to recent local data and forecasts on precipitation intensities, pavement conditions, wind speed and direction, and other road- and weather-related parameters.

## 1.1 Mission

FORETELL is one aspect of a U.S. DOT effort whose long-term plan was to provide accurate weather and road condition information to travelers in the general public, shippers, and transportation system operators. As a starting point toward this goal, an Operational Test focusing on three initial partner states, Iowa, Missouri, and Wisconsin, was conducted from 1998 to 2002.

As an ITS Operational Test, the FORETELL program included an evaluation effort to assess the ability of the system to meet the goals of providing both current and forecast weather and road condition information to highway operations and maintenance staff, commercial vehicle operators, highway patrol personnel, school administrators, transit operators, and traffic managers. The FORETELL Evaluation Plan (Battelle, 2001) was developed to describe how this

evaluation would be conducted and was used to guide the evaluation team in the data collection, compilation, and analysis steps.

This document presents the results of the FORETELL Evaluation. It reflects the evaluation team's understanding of the responses by various user groups who used the system during the evaluation period. More specifically, however, the team looked at how the FORETELL system was accessed and used by a variety of users and how the information from the FORETELL website aided these groups in managing transportation infrastructure. Data were collected through surveys and discussions with individuals in each of the user groups as well as by reviewing records of user access to the FORETELL system website. The team's mission was to effectively collect and analyze the data, objectively evaluate the results, and report on the effectiveness of the FORETELL system at disseminating weather and road condition information to make improvements in operations for the various user groups.

On a larger scale, the evaluation team was interested in understanding how the improved information would impact the goals and objectives of the Advanced Rural Transportation System (ARTS) Strategic Plan (Safety, Efficiency, Environment, Mobility, and Economic Vitality). The FORETELL evaluation initially did a careful assessment of the resources available to evaluate each of the ARTS goals. It was determined that only the safety goal was feasible to evaluate. The evaluation team demonstrated that it was possible to evaluate a decrease of at least 15 percent in weather-related fatal crashes, assuming that the FORETELL system was utilized by the highway maintenance personnel in Iowa and Missouri over three years, and that the Fatality Analysis Reporting System (FARS) data were available for analysis over this same time period. Unfortunately, the system was only fully operational during one winter, 2001-2002, and once operational, the system was not available to a wide enough audience to make a major comprehensive rural impact. Utilization of the FORETELL system over one winter was not sufficient to assess the safety impact of FORETELL. Therefore, the ARTS safety goal was not evaluated and efforts were concentrated on evaluating the different user groups.

The evaluation team initially planned to perform a comprehensive evaluation of all major potential user groups of FORETELL: highway maintenance operators (HMOs), commercial vehicle operators (CVOs), state patrol, emergency services, traffic managers, travelers, transit/paratransit operators, and school administrators. The evaluation team was successful in evaluating the target user group (HMOs) and, given the circumstances, did as much as possible to collect information from the other user groups. Travelers and commuters could not be evaluated because neither Castle Rock Consultants nor the states had funds to advertise the FORETELL website to these populations. Even if the FORETELL system were advertised, Castle Rock Consultants indicated that the FORETELL website could not handle the potential additional traffic.

## 1.2 What is FORETELL?

The FORETELL effort began with a concept of providing a single source for transportation-related weather information. Development of the system continued during the evaluation period. The resulting Internet-based system developed by Castle Rock Consultants provides both nowcast (near-term, 0 to 6 hours) and forecast (6 to 30 hours) weather and road condition information including the following:

Weather Information

- Wind Speed and Direction
- Cloud Thickness
- Precipitation
- Air Temperature
- Dewpoint and Humidity
- Radar Depiction

Road Information

- Overall Road Condition
- Pavement Temperature
- Pavement Condition
- Road Dewpoint
- Road Freeze Point
- Road Snow Depth.

The FORETELL system provides this information for Iowa, Wisconsin, and Missouri. It is a map-based system that allows the user to select weather parameters for an area within these states or pavement parameters for highways within the FORETELL coverage area. The nowcast information is updated once an hour, while the forecasts are renewed every 6 hours.

During the evaluation period, access to the password-protected website was made available to the user groups by issuing a unique username and password to each user. This allowed tracking of access for evaluation purposes.

### 1.3 Evaluation Scope

The objective of the evaluation was to determine user acceptance of and decision outcomes from a new technology for obtaining weather information for surface transportation. The evaluation focused on assessing how the various user groups perceived the value of the information provided by FORETELL. The user groups were identified based upon their perceived need for weather and road condition information. The evaluation team actively participated in the identification of the user groups and selection of the specific potential users. The user groups were asked to access the system for weather information primarily during the winters of 2000-2001 and 2001-2002, with most user groups participating only during the latter season. After the winter season, they were then asked specifically about their use of and experience with the system.

The FORETELL Consortium did not promote or market the system to the potential users beyond notifying them that the system was available and explaining to them what information the FORETELL system disseminates. Furthermore, the evaluation team was careful not to make statements regarding the accuracy or specific benefits of the system. The team was not responsible for assessing system accuracy, but rather tried to collect the users' assessments of the accuracy and comprehensiveness of the information being provided, as well as the benefits of the information for each user group.

The evaluation team was tasked with data collection from the users and from access records, as well as compilation and analysis of the data. The details of the data collection are provided in Section 2, Evaluation Process, while the results of the analysis are provided in Section 3, Evaluation Results. In addition, Section 4, External Factors, provides information regarding the specific weather conditions that may have affected the outcomes, and issues associated with the system and institutional performance. Section 5, Observations and

Recommendations, provides a discussion of issues that effected the evaluation, along with suggestions for future evaluations.

The purpose of the independent evaluation was to assess the effectiveness of the FORETELL program in achieving its goals and objectives and, secondly, to determine how it might possibly impact the ARTS goals. The primary goal of the evaluation was to determine the feasibility of the FORETELL program and the possibility of widespread deployment. Specifically, the evaluation attempted to address some fundamental questions:

- Is the FORETELL information providing added value to users beyond what they can obtain from existing sources?

- Is the new information changing user behavior and, if so, how?

- What impact will FORETELL have on ARTS outcomes relative to its goals and objectives?

The evaluation was designed to measure two types of success: outputs and outcomes. The output measures evaluate the FORETELL program system performance, information dissemination, and user decisions. The outcome measures evaluate the operational improvements achieved through the use of weather and road condition information from the FORETELL system. Both types of measures are valid and important to the success of the evaluation. The evaluation outcomes relate directly to the ARTS goals. The ARTS goals are:

- Safety;
- Efficiency;
- Environment;
- Mobility; and
- Economic vitality.

## 2.0 EVALUATION PROCESS

The evaluation effort began with the development of the FORETELL Evaluation Strategy (JPO, 1998). The strategy document framed the goals of FORETELL and outlined how the evaluation would assess those goals. After the evaluation strategy was approved by FHWA, the evaluation team developed the FORETELL Evaluation Plan, which documented in more detail the goals and objectives of the evaluation and provided a guide for the specific evaluation activities to assess each user group. The evaluation strategy discussed the importance of evaluating certain user groups. The evaluation plan described how each of those groups would be evaluated. The development of the evaluation plan also was used to ensure that all parties involved in the FORETELL program understood and agreed on the concepts being used to evaluate the system. This document provided the necessary guidance for later development of the individual test plans.

The initial plan was to concentrate primarily on the evaluation of output measures associated with the different primary user groups. In particular, the evaluation was to assess acceptance of the FORETELL information by highway maintenance operators and determine how the information affected their decision processes. The evaluation team was also requested to assess transportation improvements (outcomes) that may result from the user decisions and actions. In the evaluation plan, the evaluation team established an overall approach to measure the impacts of the FORETELL program on the user decisions and, in turn, the transportation systems. However, as mentioned earlier, it was not possible to determine whether the FORETLL information had a measurable impact on fatal crashes in Iowa or Missouri. The evaluation team, therefore, focused attention on gathering survey information from as many members of each user group as possible.

From 1999 to 2001, during the development of the evaluation plan and user group test plans, the evaluation team held a number of teleconferences with state [John Whited (IADOT), Bill Stone (MODOT) and Mike Adams (WIDOT)] and FHWA (Paul Pisano) participants, and occasionally with Castle Rock Consultants representatives. During these meetings, the participants discussed how and who would contact members of the different user groups (highway maintenance operators, school superintendents, state patrols, traffic managers, transit operators, and commercial vehicle dispatchers), how to inform the users of the FORETELL website and gain access, and determine if they would participate in the evaluation. Participation in the evaluation was limited by the number of people who had access to the FORETELL system and were willing to participate in the FORETELL evaluation. The states, FHWA, and Castle Rock Consultants wanted a significant number of users to be aware of the FORETELL website, but the constraints on budgets to fund public awareness of the website, and the fact that several users who had access never used the site because of the relatively mild winters, precluded an extensive participation within user groups in the evaluation.

Figure 2.1 identifies the major goal areas of the evaluation as System Performance (Castle Rock Consultants), User Acceptance (evaluation team), Decision Effectiveness (evaluation team), Operational Improvements (evaluation team), and Institutional Performance. The latter goal was added near the end of the evaluation due to the impact it had on the evaluation results.

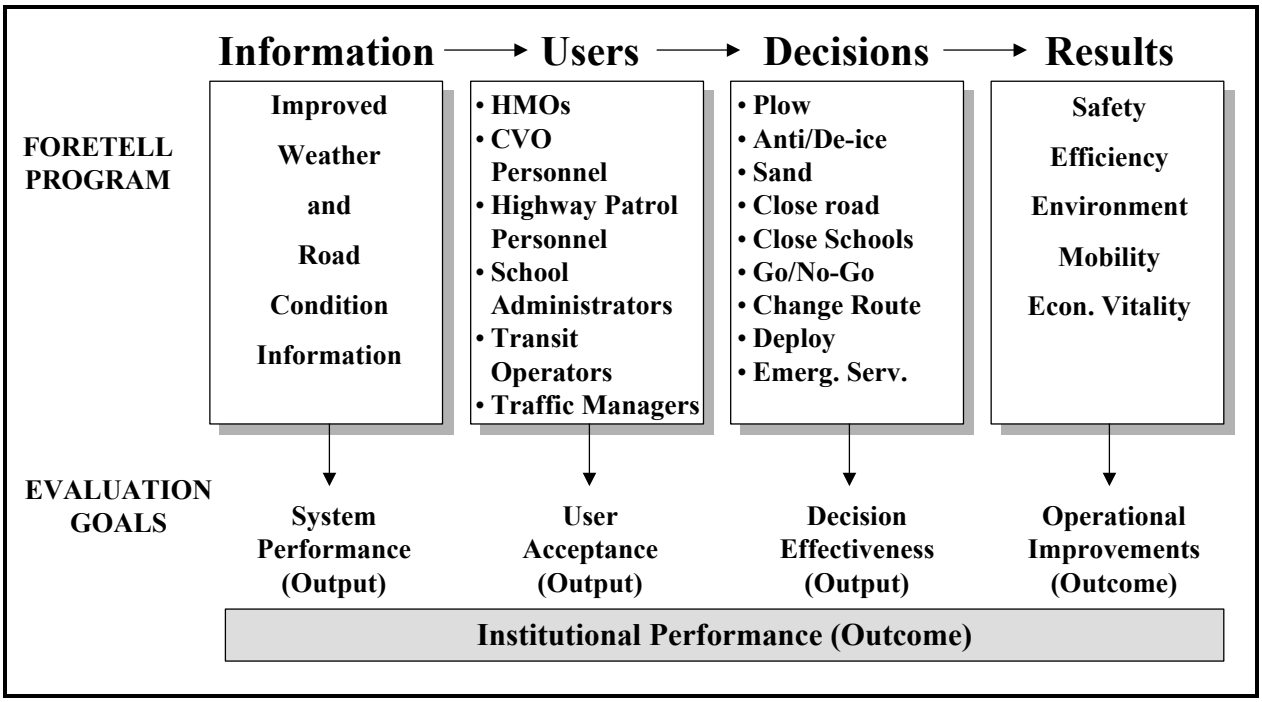



**Figure 2.1 Evaluation Goals**

The primary focus of the evaluation was an assessment of user acceptance and decision effectiveness. System performance was monitored and reported by Castle Rock Consultants with assistance from the states. An assessment of the accuracy of the information was provided to the states in a report by Castle Rock Consultants. As noted earlier, institutional performance was also outside the primary focus area, though several institutional performance issues are covered in this report because they had a significant impact on the results that are reported.

The primary "outcomes" measure was initially planned to be the Fatality Analysis Reporting System (FARS) data from the three states. The evaluation team was interested in determining if use of the FORETELL system might be associated with a reduction of at least 15 percent in winter weather-related fatal crashes on the highway. The FARS data are generally made available a year after they are collected. Unfortunately, the planned evaluation period was abbreviated (as explained later), and comparing only one winter where FORETELL was utilized against the previous years was determined to be an insufficient amount of time to assess a change in weather-related fatal crashes. The evaluation originally intended to include this safety component (weather-related fatal crashes) of the operational improvements area. However, the system was not in place for a sufficient length of time to make valid comparisons.

The approach to evaluating the FORETELL program was first to identify a set of hypotheses to test each of the user groups and decision areas shown in Table 2.1 for the evaluation team's initial goals: user acceptance and decision effectiveness. Next, it was determined that the best method to obtain the needed information to assess the evaluation goals was to survey and interview identified user groups. The third step was developing individual test plans to collect the data. Finally, the data were analyzed and the results presented in this report.

Following the approval of the evaluation plan, the details of conducting the evaluation were developed and documented in six individual test plans (one for each user group).

**Table 2.1 Evaluation Goals and Decision Areas**

| Evaluation Goal | User Groups | Decision Area |
|---|---|---|
| User Acceptance | HMOs | Receipt of information |
| | CVOs | Perceived value |
| | State Highway Patrol | Use of information |
| | Schools Administrators | Perceived value |
| | Transit/Paratransit | Behavior change |
| | Traffic Managers | Use of information |
| Decision Effectiveness | HMOs | Traffic operations |
| | | Highway maintenance |
| | CVOs | Trip delay |
| | | Route changes |
| | | Operational parameters |
| | State Highway Patrol | Road closure |
| | Schools Administrators | Delayed school start |
| | | Early release |
| | | School closure |
| | | Children transport |
| | Transit/Paratransit | Trip delay |
| | | Route changes |
| | | Operational parameters |
| | | Modal diversion |
| | Traffic Managers | Traffic monitors |
| | | Traffic operations |
| | | Road closure |
| | | Disseminate traveler information |

Originally, the schedule of evaluation activities coincided with the implementation of the FORETELL website development and included the following five opportunities for data collection and reporting:

- winter of 1998-1999: Develop evaluation plan and individual test plans. Collect baseline data.
- winter of 1999-2000: FORETELL operational. First evaluation data collection (i.e., first follow-up).
- winter of 2000-2001: Second evaluation data collection (i.e., second follow-up).
- winter of 2001-2002: Third and final evaluation data collection (i.e., third follow-up).
- summer and fall of 2002: Preparation of evaluation reports, dissemination of results.

During the first intended data collection period (winter of 1998-1999), it was determined that FORETELL would not become operational until the winter of 2000-2001. The evaluation plan and some of the test plans were developed, but the baseline data collection was delayed until the winter of 1999. This delay in implementing the system resulted in the elimination of one data collection period. The revised schedule is shown below:

- winter of 1998-1999: Develop evaluation plan and individual test plans.
- winter of 1999-2000: Baseline data collection.
- winter of 2000-2001: FORETELL operational. First evaluation data collection (i.e., first follow-up).
- winter of 2001-2002: Second evaluation data collection (i.e., second follow-up).
- summer and fall of 2002: Preparation of evaluation reports, dissemination of results.

After the FORETELL website became operational, it was determined by the FORETELL Consortium that during the first year of operations only highway maintenance operators would have access to the website. The capacity of the servers hosting the website and the perceived reliability and accuracy of the information would be initially assessed by this user group. Since there were no funds available to market FORETELL to the general public and it was uncertain whether the servers hosting the website could handle the potential high volume of hits simultaneously, only five other user groups were provided access to FORETELL. The entire list of user groups is shown below:

- Highway Maintenance Operators (HMOs)
- Commercial Vehicle Operator (CVO) Personnel
- Highway Patrol Personnel
- School Administrators
- Transit Operators
- Traffic Managers.

These user groups were selected based on their need for weather and road condition information and the ability to collect feedback from them. Once these user groups were identified, the team needed to select and contact potential users within each group. The initial contacts were used, in part, to gauge the likelihood that given individuals would need the information being offered by the FORETELL system and to solicit participation in the evaluation.

Test plans were then developed for each user group using the evaluation plan as guidance and tailoring the details and evaluation methods to each group. The test plans identified the

specific approach to be used for each group. They included surveys and/or interview guides as necessary with specific questions targeted toward the individual user group's operations. The data collection approach ultimately used with each user group is shown in Table 2.2.

**Table 2.2 User Group Evaluation Participation and Data Collection Approach**

| User Group | Participation Years | Number of Participants | Data Collection Approach |
|---|---|---|---|
| Highway Maintenance Operators | Fall of 1999(baseline) | 66 | Survey & Activity/Weather Logs |
| | Winter of 2000-2001 | 87 | Survey & Activity/Weather Logs |
| | Winter of 2001-2002 | 47 | Survey & Activity/Weather Logs |
| Other | | | |
| Commercial Vehicle Operator Personnel | Winter of 2001-2002 | 15 | Telephone Interview |
| Highway Patrol Personnel | Winter of 2001-2002 | 16 | Telephone Interview |
| School Administrators | Winter of 2001-2002 | 5 | Survey & Activity/Weather Logs |
| Transit Operators | Winter of 2001-2002 | 3 | Survey |
| Traffic Managers | Winter of 2001-2002 | 1 | Telephone Interview |

Each user group identified had a unique set of requirements and, therefore, used the information in different ways to best serve their needs. The evaluation team was interested in determining how each user group utilized the FORETELL information. The evaluation focused primarily on the HMOs in the three targeted states. The results reported herein are presented in two groups: HMOs and Other Users. While the other user groups are discussed individually, they have been separated from the HMO user group. There are several reasons for the focus on the HMO user group and for the use of this reporting approach.

First, true baseline data were only collected for the HMO user group. The other user groups did not participate in the FORETELL evaluation until 2001 for a variety of reasons that are related to accuracy and reliability issues of the FORETELL website. The other user groups were asked questions regarding their weather information collection prior to FORETELL only after they had been provided access to the FORETELL website. These user groups were primarily provided access to the FORETELL website during the winter of 2001-2002. They were surveyed only once, in the spring of 2002.

Second, including the baseline year, three successive years of data were collected from the HMO user group. This allowed the evaluation team to develop a detailed survey instrument and a web-based survey for the first and second follow-up. Members of the evaluation team attended some HMO training sessions and over time developed a working relationship with this user group. These factors contributed to the fact that the HMO users represent over 90 percent of respondents surveyed.

Finally, the HMO user group was targeted due to their responsibility to take action during many adverse weather events. Compared to the other groups, HMOs depend very heavily on accurate and timely weather information in order to perform their primary functions.

The following sub-sections discuss key components having an impact on the evaluation results: weather conditions and user group access.

## 2.1 Weather Conditions

Given that FORETELL is a transportation-related weather information system, the success of the evaluation ultimately depends on the weather conditions requiring the need to obtain weather information. The evaluation of FORETELL began with the baseline HMO surveys in the winter of 1999-2000. The evaluation then continued through the winters of 2000-2001 and 2001-2002.

To ensure a meaningful evaluation of activities dependent on weather information, it is important to have a significant number of weather events during the evaluation. It is also important to be able to compare one winter to another so that outcomes from one winter can be compared to outcomes of another winter.

Figures 2.2 and 2.3 show climatological data for Iowa for temperature and precipitation, respectively, for the months of November through April, which was essentially the evaluation period. The data contain the climatological normal period from 1971 through 2002.[2]

The data show that when compared to normal, the winters of 1999-2000 and 2001-2002 were significantly warmer and drier than normal. In fact, of the 32 seasons, these winters were the two warmest. In addition, these same winters were the fourth and tenth driest. In contrast, the winter of 2000-2001 was the third coldest and had above-normal precipitation. Data for Missouri and Wisconsin show similar trends.

One would expect that there could be a significant number of winter weather events during the winter of 2000-2001 and fewer in the next winter. Thus, one could also expect a significant number of evaluation inputs for the first winter evaluation period following the baseline year, and less inputs for the next (last evaluation) winter.

Section 4.1 discusses results from data collected by the evaluation team that provide insight to the actual weather events observed by the HMOs.

[2] One way of comparing weather over periods of time is to use a weather index. Research in Iowa resulted in an Iowa-specific weather index that could be used for inter-annual or inter-seasonal analyses (Temeyer, 2001). Unfortunately, that index was not available until after the evaluation was completed. Therefore, the evaluation team used standard climatological data available from the National Climate Data Center to compare the winters of the evaluation for the three-state evaluation area.

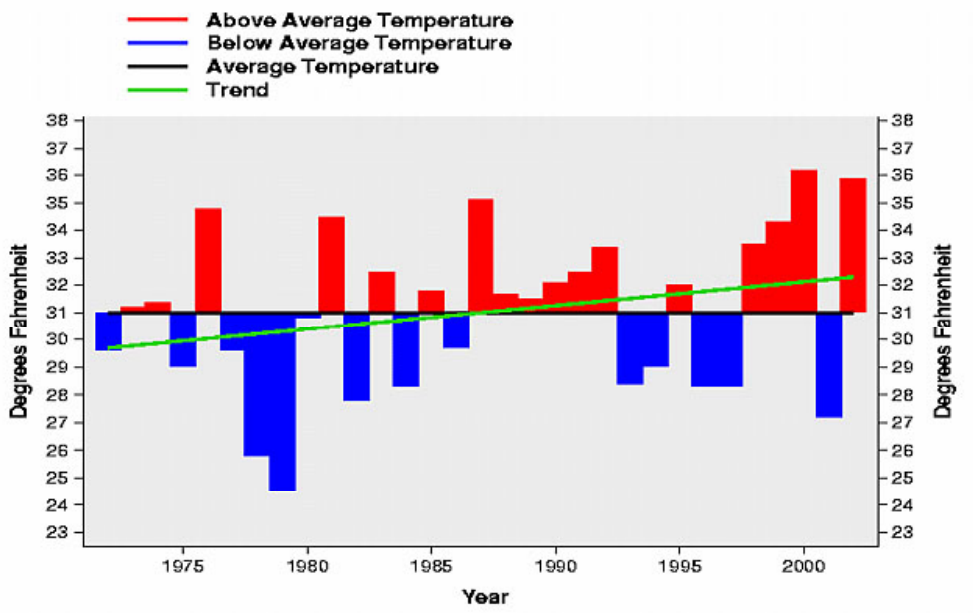



**Figure 2.2 Average Temperatures in Iowa for the Period Nov-Apr, 1971-2002 (Average: 31.0 degF) and Nov-Apr, 1971-2002 (Trend = 0.8 degF).**

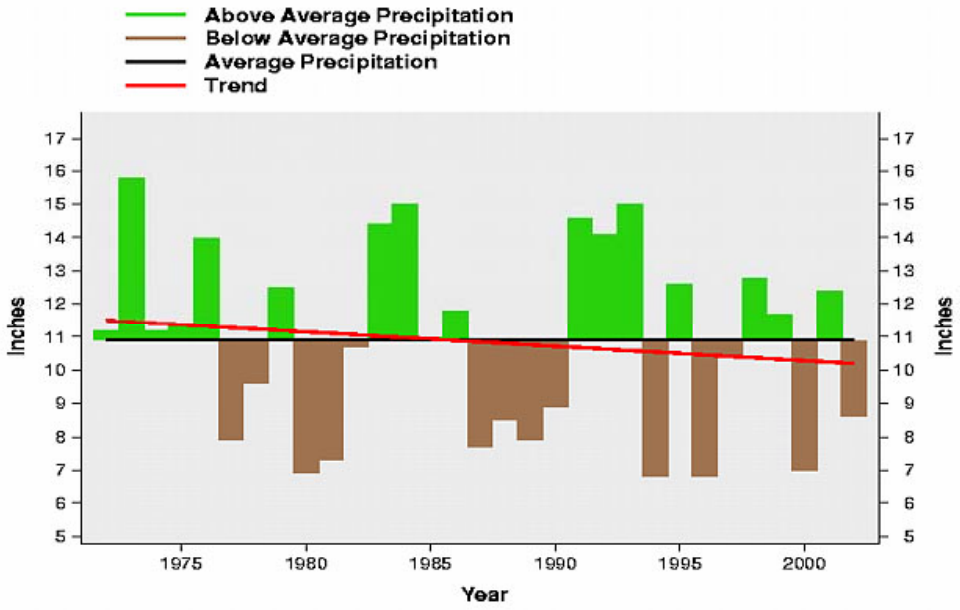



**Figure 2.3 Average Precipitation in Iowa for the Period Nov-Apr, 1971-2002 (Average: 10.85 Inches) and Nov-Apr, 1971-2002 (Trend = 0.45 Inches).**

## 2.2 User Access

In addition to the data collected by the evaluation team through surveys and discussions with individuals in each of the user groups, Castle Rock Consultants collected data on user access to the FORETELL website during the winter months (October through April) of

2000-2001 (Evaluation Year 2) and 2001-2002 (Evaluation Year 3). User access data were collected to provide information regarding who accessed the FORETELL system, what activities they undertook, and which variables were used most. All operations and keystrokes performed by users at the FORETELL website were recorded and logged. The totals do not include any activity performed by Castle Rock Consultants. A summary of the number of users in each group and the number of times the site was accessed, as well as the various types of data accessed, is presented below. The data may not be consistent with the survey and interview responses due to users sharing IDs and to varying viewpoints among users who responded to the surveys/interviews and those who did not. For example, while precipitation may have been the most accessed weather choice for all users, those responding to the surveys/interviews may have indicated using temperature more often.

Over the winters of 2000-2001 (Year 2) and 2001-2002 (Year 3), FORETELL was accessed 10,764 times by HMOs, highway patrol, CVOs, traffic managers, transit operators, and school administration personnel. Figure 2.4 presents the number of logins for each user group by month for the winters of 2000-2001 and 2001-2002. There were more than twice as many logins by HMOs during Year 2 than during Year 3. FORETELL was accessed 7,393 times by 199 individuals from the HMO user group in Year 2 and 2,770 times by 162 individuals in Year 3. Some of the decrease may be attributable to the mild weather conditions during Year 3. Other reasons may include a turnover in staff or a dissatisfaction with FORETELL.

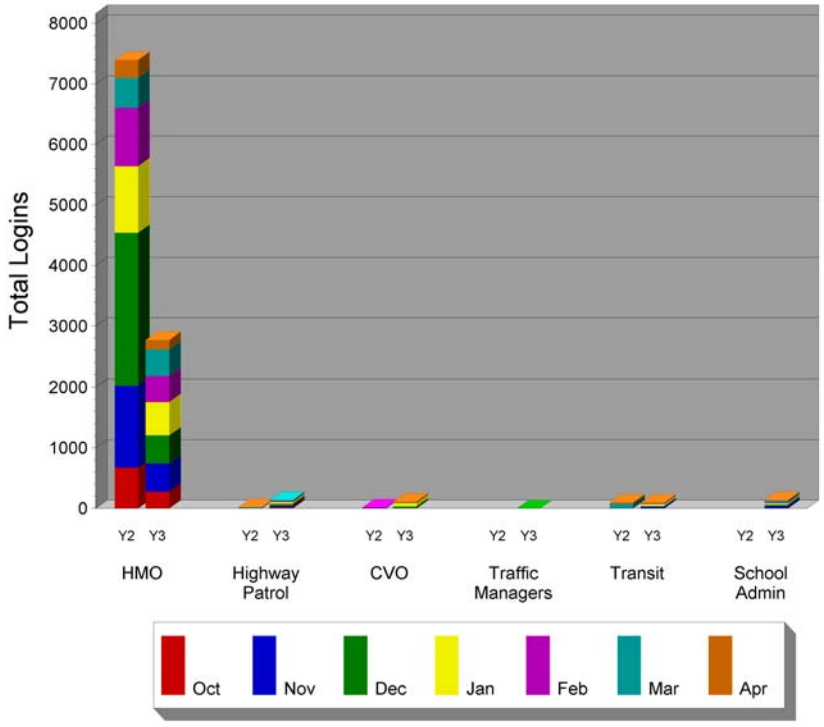



**Figure 2.4 Number of FORETELL Website Logins by User Group by Month and Evaluation Year (Y2 = Winter of 2000-2001, Y3 = Winter of 2001-2002)**

While the number of logins by HMOs decreased from Year 2 to Year 3, total logins for the other user groups increased during that time. Figure 2.5 presents in greater detail the number of logins by month and by year for highway patrol personnel, CVOs, traffic managers, transit operators, and school administrators. During Year 2, FORETELL was accessed 131 times by 2 highway patrol personnel, 2 CVOs, and 7 transit operators. During Year 3, FORETELL was accessed 471 times by 18 highway patrol personnel, 29 CVOs, 1 traffic manager, 4 transit operators, and 9 school administrators.

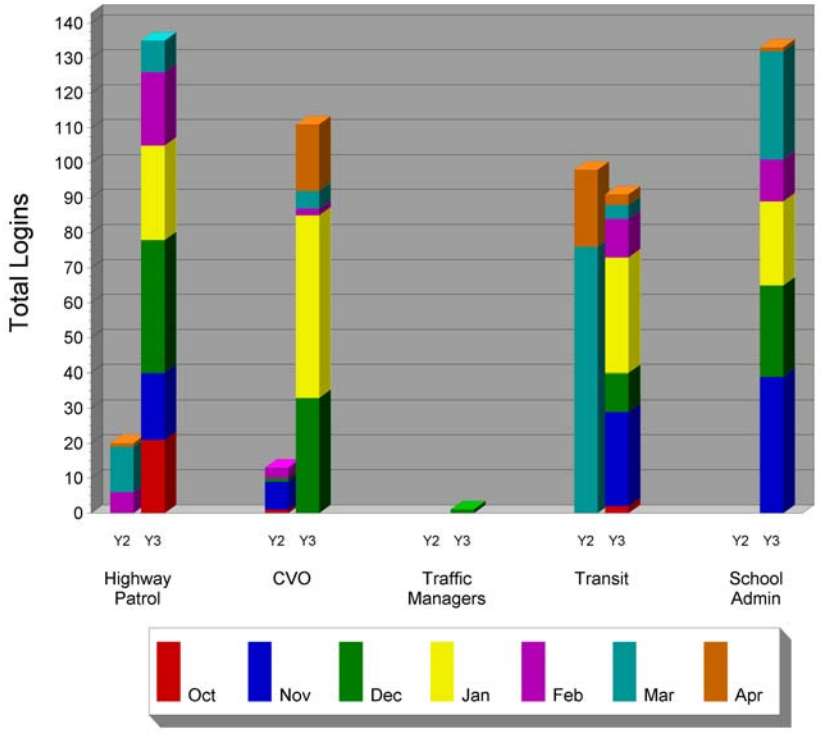



**Figure 2.5 Number of FORETELL Website Logins by User Group (excluding HMOs) by Month and Evaluation Year (Y2 = Winter of 2000-2001, Y3 = Winter of 2001-2002).**

Year 3 was the focus of the evaluation for non-HMO user groups. The Year 2 logins for these groups may or may not contain logins by the Year 3 survey/interview participants.

Even though the total number of logins increased for all user groups (except HMOs) from Year 2 to Year 3, there is a relative decrease in the use per person for the HMOs, the highway patrol personnel, and CVOs. Figure 2.6 shows the number of logins per person by evaluation year for each user group.

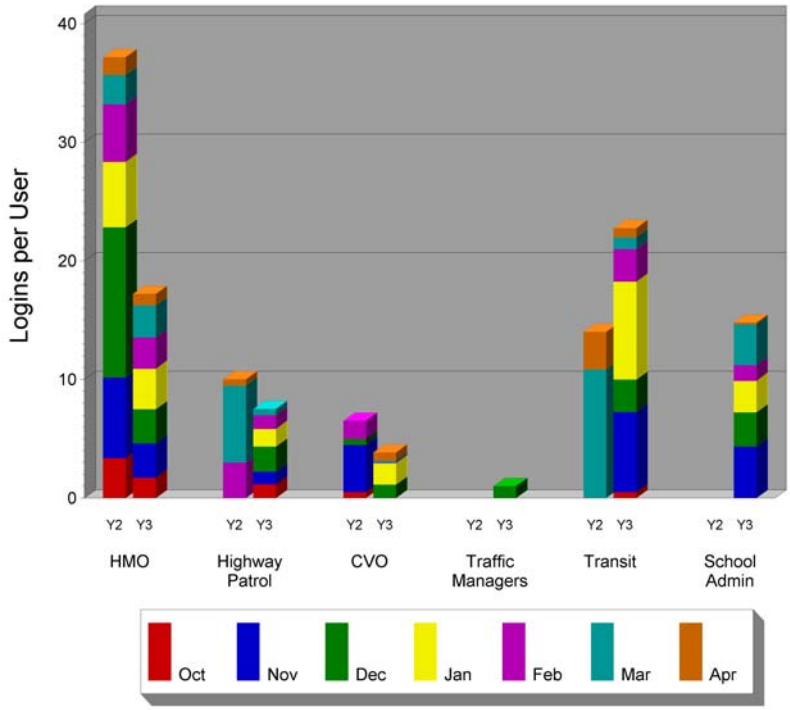



**Figure 2.6 Number of FORETELL Website Logins per Person by User Group by Month and Evaluation Year (Y2 = Winter of 2000-2001, Y3 = Winter of 2001-2002).**

Users accessed all weather choice options offered by FORETELL: clouds, dewpoint, frozen accumulation, humidity, precipitation, precipitation accumulation, pressure, radar, temperature, measured accumulation, combined precipitation and temperature, and wind speed and direction. However, the weather choices most selected by users over both winters were precipitation, temperature, and radar.[3] Users also accessed all road choice options offered by FORETELL: road condition, road decision support, road dewpoint, road freeze point, road pavement frost, road pavement temperature, road snow depth, road snow drift, and road temperature. Of these, road condition, road pavement temperature, and road temperature were the most selected choices over both winters.[3]

The Frame Choice selector at the top of the FORETELL website allows users to view forecasts up to 30 hours into the future. In general, the 6 to 12-hour and 30-hour forecasts were most often selected over both winters.[3] The 30-hour forecast time period was most often selected by users to be specifically reviewed, with nearly double the number of page views than

[3] Not including conditions selected by users who accessed the FORETELL site using the non-Java WebFT user ID.

any other time period. However, it should be noted that FORETELL added a new feature to display live radar data for Year 3, and that FORETELL does not have the ability to record information that distinguishes between time periods selected for forecast data and live radar data.

The animate function (a slow motion time-lapsed view of how conditions will change) was the most frequently used FORETELL feature. However, during the evaluation period, the FORETELL software was improved to recall the last feature selected for display by the user and to open the next session with this feature. With this improvement, the system recalls the last display when the user logs in, and the default login choice is no longer tracked.

FORETELL allows users to display data in a graphical manner. Over both winters, temperature and precipitation accumulation were the graphed conditions most often selected by users.[4]

While user access data provide meaningful information on the use of the system by all users, the evaluation results presented in subsequent sections of this report are based on data collected by the evaluation team through surveys and discussions with individuals representing each of the user groups. Conclusions are based on the survey and interview data.

[4] Not including conditions selected by users who accessed the FORETELL site using the non-Java WebFT user ID.

## 3.0 EVALUATION RESULTS

The results from each survey/interview are summarized in Section 3.1 for HMOs and Section 3.2 for the other five user groups. One set of questions was common across all surveys. These questions had to do with where the user usually obtained weather information and the usefulness of the information from FORETELL. The results of these cross-cutting questions are summarized in Section 3.3.

Overall, the results from the surveyed user groups indicate that FORETELL was a useful website for weather information for surface transportation. However, there are still a number of outstanding issues associated with user acceptance of the information and accuracy of the nowcast and pavement temperature predictions. Limited use due to mild winter conditions in the Midwest during two of the three evaluation years was another issue. One positive aspect of FORETELL was the development of a website that integrated weather and transportation system data into a one-stop-shop of actual weather reports and forecasts of weather and pavement conditions. State maps showed major interstate and state highways superimposed along with detailed weather conditions. The weather information was primarily focused on transportation issues. The FORETELL site also included several innovative features, such as meso-scale (a few kilometers to some tens of kilometers) models using NWS data (Geer, 1996), the integration of several sources of existing data, and data that were accessible to a wide audience. FORETELL also provided some information not found elsewhere, such as forecasted dewpoint and pavement condition information. Another indirect benefit of the FORETELL website was the additional training that was provided to HMOs to instruct them on how to best utilize the site. During the training, there were several discussions that related to highway winter maintenance strategies (e.g., plowing, spreading abrasives, applying anti-icing/deicing chemicals). HMOs were educated on how to obtain the appropriate information from the FORETELL website to better make road treatment decisions.

A key component of the evaluation was to test the assumption that the FORETELL website provided information that changed users' decision effectiveness. It was determined that the training associated with the use of the FORETELL website and other weather information sources that was provided to HMOs significantly increased their use of dewpoint information. On the other hand, CVO actions were generally not affected by the information because they needed to make their deliveries regardless of weather conditions. In general, users' confidence in weather-related decisions was increased by the use of FORETELL. Nearly one-third of all users indicated that FORETELL changed their actions. Over half of all users want to continue using FORETELL in the future. However, less than 20 percent indicated that they would be willing to pay for access to the FORETELL website in the future.

Several school administrators and state patrol attended the FORETELL training provided to the HMOs. The remaining user groups were provided a user manual and training guide in lieu of a focused training program. The user manual and training guide, developed by Castle Rock Consultants, is provided in Appendix G. Once they consented to participate, the CVOs, highway patrol personnel, transit operators, and traffic managers were given an access username, password, and the training materials developed by Castle Rock Consultants. These users for the most part only had access to the FORETELL website for the winter of 2001-2002, and the

weather was considered very mild compared to previous years, so the number of times they needed to access the FORETELL website was limited.

## 3.1 Highway Maintenance Operators

This section presents the results of the data collection effort for HMOs, the primary user group evaluated. This section presents an overview of the data collection effort and describes the types of weather-related information used by HMOs, HMOs' acceptance of the FORETELL system, the impact of FORETELL information on HMOs' decision processes, and the effect of FORETELL information on other factors such as safety and environmental conservation. Conclusions are offered on the basis of the data collected from HMO surveys.

### 3.1.1 User Group Overview

To measure the impacts of the FORETELL program on the decision-making of HMOs, three sets of survey information were obtained: baseline information and follow-up information from two subsequent winter seasons. In addition, HMOs completed activity/weather logs following each weather event in order to characterize the use of FORETELL information on a per-event basis. The logs collected data characterizing the weather events and the decisions made during these events, as well as the information used and the sources from which the information was obtained.

The baseline survey was conducted in November 1999. Self-administered questionnaires were mailed to 85 HMOs in Iowa, Missouri, and Wisconsin. Activity/weather logs were mailed to the same operators in Iowa and Missouri. Operators in Wisconsin did not complete activity/weather logs because they already complete a similar log as part of their job. In addition, contractually, Wisconsin could not request this of their operators. Sixty-six of the HMOs completed the baseline survey, while 37 operators returned a total of 224 logs during the baseline winter of 1999-2000. The Wisconsin log data were not incorporated into the analysis results because the data were unavailable.

The two follow-up surveys and activity/weather log data collections were conducted during and following the winters of 2000-2001 and 2001-2002. Each of the follow-up surveys was conducted using an Internet-based survey located on a secure website. Eighty-seven HMOs completed the first follow-up survey in 2001, and 47 completed the second follow-up survey in 2002. A total of 229 logs were returned by 28 operators during the winter of 2000-2001, while 136 logs were returned by 14 operators during the final evaluation year.

The response rate (the number of completed surveys/number of solicited surveys) for each survey was: 78 percent for the baseline survey, approximately 75 percent for the first follow-up survey, and approximately 71 percent for the second follow-up survey. A similar calculation cannot be made for the activity/weather logs since the completion of a log is dependent upon a weather event actually occurring. As noted earlier in Section 2.1, the severity of the weather generally declined from the first to second follow-up data collection. Section 4.1 provides a summary of the data collected from the activity/weather logs.

The following sections describe the results of the HMO survey and activity/weather log data analysis. The results are grouped by Information Used, User Acceptance, Decision Effectiveness, and Other Factors. In addition to the information presented here, Appendix A contains the data collection instruments along with summary tables of the data collected. Tables A-1 and A-2 describe the information collected from the activity/weather logs. Tables A-3 through A-6 summarize the HMO survey data for all states combined and by each state individually. Each table in Appendix A displays the number and percentage of responses to the questions from the baseline, first follow-up, and second follow-up surveys. In addition, a Chi-Square test was conducted to test for a change in the distribution of responses between surveys, taking into account repeated responses from the same respondent over a multi-year period. The p-values (i.e., observed statistical significance level) computed from the Chi-Square test are presented in the tables as well. Due to sparse data, responses from questions using the 5-point Likert Scale (e.g., Strongly Disagree to Strongly Agree) were collapsed into positive and non-positive categories. For instance, Strongly Agree and Agree were considered positive responses, while Strongly Disagree, Disagree, and Neutral were considered non-positive responses. If the response categories could not be dichotomized into positive/non-positive responses, the test was not performed. In addition, the test could not be performed if one of the response categories contained a zero frequency. Each special case is indicated in the tables.

The following sections summarize the most pertinent information found in Table A-3. Figures describing the data collected across the surveys are also included below. In all figures, "Y1" represents the baseline survey (Evaluation Year 1, 1999-2000), "Y2" corresponds to the first follow-up survey (Evaluation Year 2, 2000-2001), and "Y3" corresponds to the second follow-up survey (Evaluation Year 3, 2001-2002).

### 3.1.2 Information Used

Information Used refers to the types of weather-related data HMOs use in their road treatment decisions. They were asked which of the following types of weather information they used in making weather-related decisions: wind speed/direction, precipitation, atmospheric temperature, pavement temperature, pavement condition, and dewpoint. For each type of weather information used, they were asked whether they used actual readings, forecasted readings, or both.

As can be seen in Figure 3.1, HMOs tended to rely on both actual and forecasted information when a particular weather source was used.

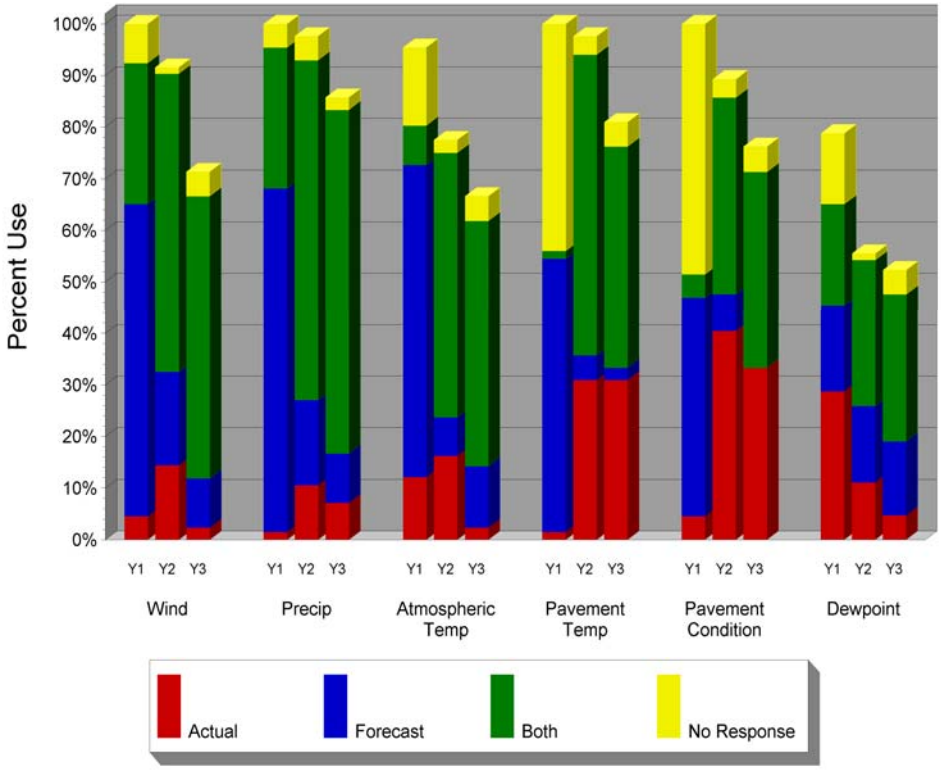



**Figure 3.1 Percent of Highway Maintenance Operators who Indicated Using a Forecasted and/or Actual Type of Weather Information.**

Fewer HMOs depended on forecast information for wind speed/direction, precipitation, atmospheric temperature, pavement temperature, and pavement condition in the evaluation years compared to the baseline year. There was a general decline in the percentage of HMOs that used each type of weather information from the baseline to the second evaluation year. Dewpoint was used the least of all weather information being utilized. However, it was still used by more than half of the HMOs during the course of the evaluation.

The follow-up surveys asked HMOs to indicate which sources of weather information they obtained from FORETELL. Figure 3.2 shows that roughly 50 percent of the operators surveyed obtained wind speed or direction, precipitation, and atmospheric temperature information from FORETELL. Between 30 percent and 50 percent of HMOs utilized FORETELL-supplied information on pavement temperature, pavement condition, and dewpoint. With the exception of atmospheric temperature and dewpoint, there was a slight decline in the percentage of HMOs that obtained information from FORETELL between the first follow-up and the second follow-up surveys. However, there were no statistically significant differences over time in the percentage of HMOs that obtained any type of weather information from FORETELL, which suggests that the use of FORETELL remained consistent across the evaluation, at least for the components covered in the surveys.

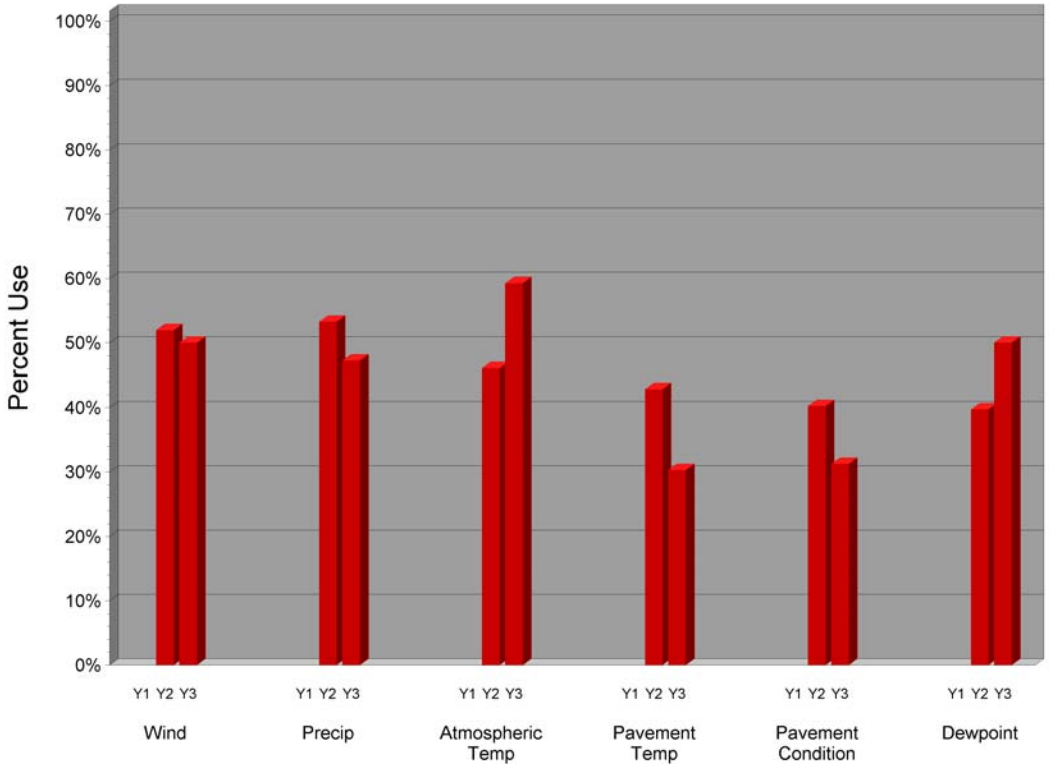



**Figure 3.2 Percent of Highway Maintenance Operators who Indicated Using the FORETELL System for each Type of Weather Information.**

Figure 3.3 illustrates the percentage of HMOs who used weather information daily, weekly, before a weather event, during a weather event, or after a weather event, along with the breakdown of how often. The baseline survey asked about weather information in general, while the evaluation periods refer specifically to information obtained from the FORETELL system. As can be seen in the figure, information was obtained at roughly the same rate before and during an event, with greater emphasis on obtaining the information hourly during a weather event. There was less frequent collection of weather information after a weather event occurred. This type of use is consistent with HMOs mobilizing before and during a weather event and then returning to routine monitoring after the event has occurred.

The declines, from the baseline survey to both follow-up surveys, in the percentage of HMOs using weather/FORETELL information daily and before, during, and after an event are statistically significant. However, the declines from the first follow-up to the second follow-up are not statistically significant. Several factors could explain these results. For instance, the mild winter during the second follow-up portion of the evaluation could account for some of the decline in use of weather information in general (see Figure 3.1). Another potential explanation is that the information from FORETELL was sufficient for the operators to decrease their frequency of access.

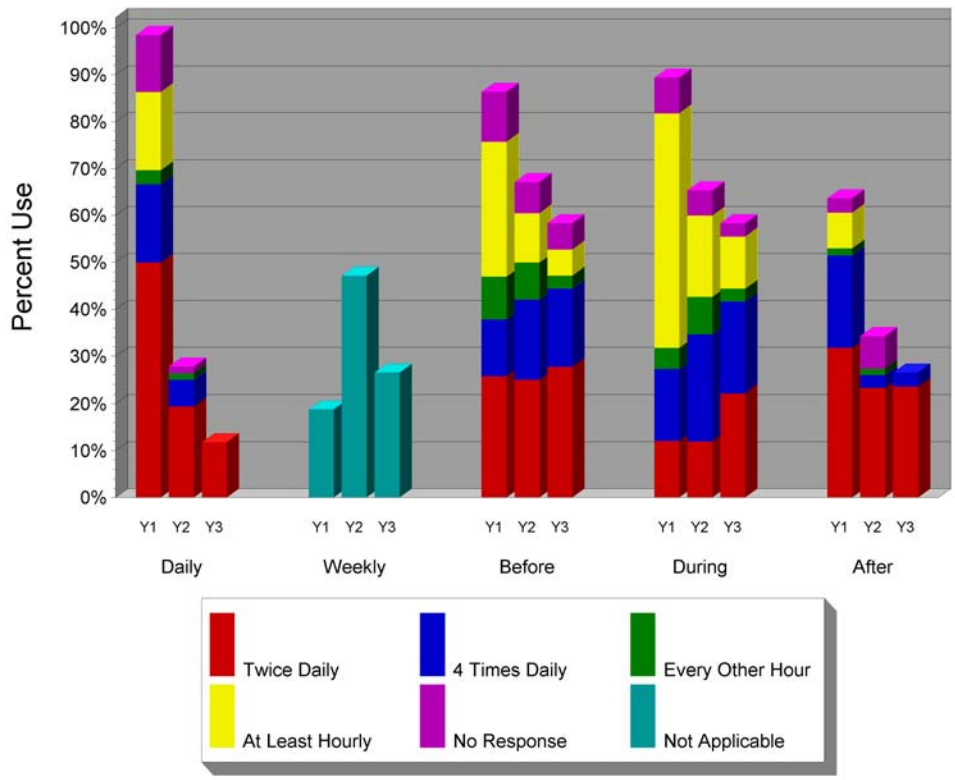



**Figure 3.3 Percent of Highway Maintenance Operators who Indicated How Often Weather Information was Obtained.**

### 3.1.3 User Acceptance

In this context, User Acceptance refers to the opinions of the HMOs who actually used FORETELL and the value they place on the FORETELL information they receive. For example, HMOs were asked how helpful the general weather information (baseline) or FORETELL information (follow-up) was to them in determining which snow and ice control strategies of anti-icing, de-icing, traction enhancement, and mechanical removal to employ. Figure 3.4 shows that the relative percentage of HMOs who found the information helpful (magenta and yellow sections combined) for their strategies was significantly higher, statistically, in the baseline year than in the two evaluation years. One possible explanation could be that HMOs were not using the technology once the novelty had worn off, but another possible explanation could be that the second evaluation winter (2001-2002) was much milder, so weather information was less of a factor during that time.

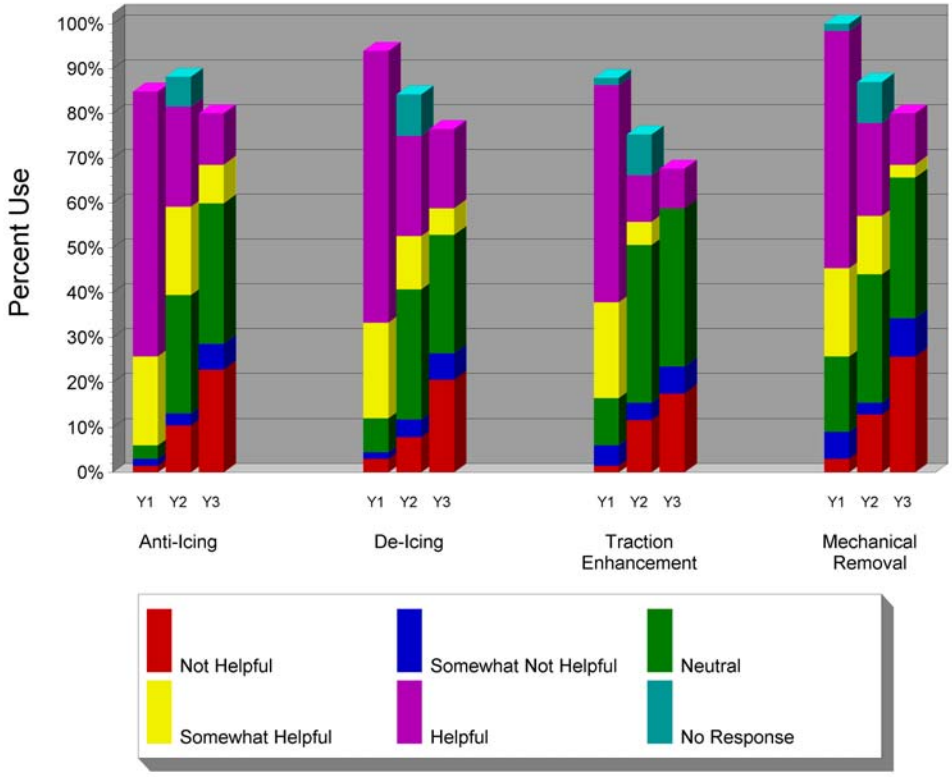



**Figure 3.4 Percent of Highway Maintenance Operators who Indicated How Helpful Weather Information was for Employing Snow and Ice Control Strategies.**

HMOs were also asked how understandable, usable, easily obtainable, accurate, and useful each type of weather information was to them. Recall that the baseline survey asked these questions about general weather information, while the follow-up surveys asked about FORETELL information specifically. Figures 3.5a through 3.5f illustrate the results of these quality assessments for each type of weather information for the HMOs who reported using FORETELL.

Approximately 40 percent of HMO users perceived that the wind speed/direction information provided by FORETELL was accurate (see Figure 3.5a). A very high percentage of HMO users, ranging between 50 percent and 90 percent, found the information provided by FORETELL to be understandable, usable, easily obtainable, and useful. Over time there appeared to be a decrease in the percentage of HMOs who agreed that the FORETELL information was understandable, usable, easily obtainable, and useful. However, only the decline from baseline to second follow-up information was statistically significant when judging how easily the weather/FORETELL information was obtained. This result may indicate a frustration with accessing information via the Internet, given the available resources for doing so (see Section 4.3). Figures 3.5b and 3.5c show similar results for precipitation and atmospheric temperature information.

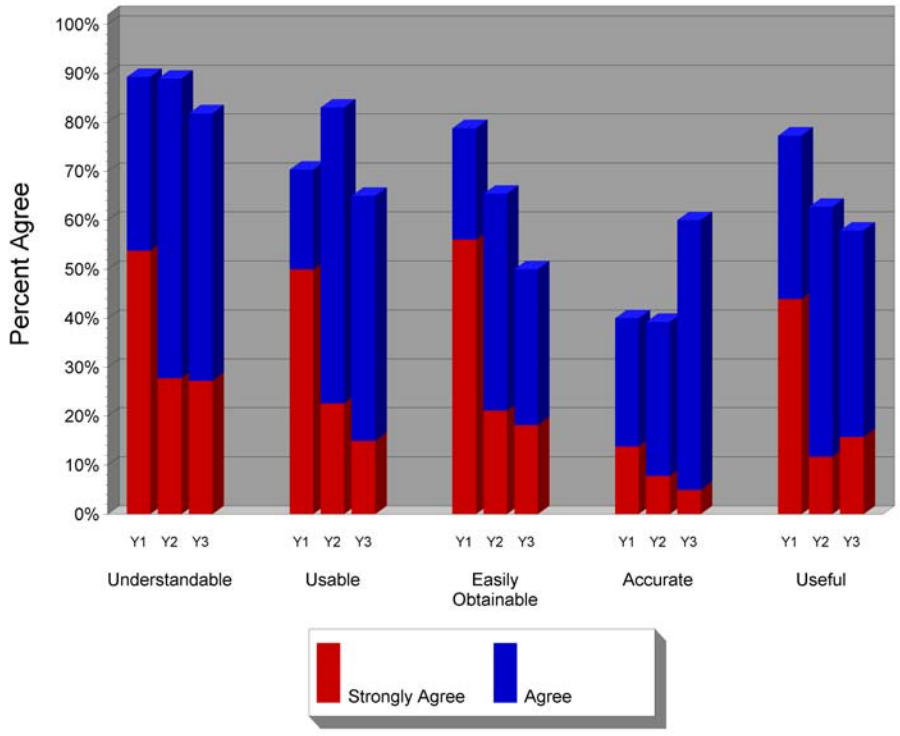



**Figure 3.5a Percent of Highway Maintenance Operator Users who Agree with Certain Characteristics Associated with Wind Speed/Direction Information.**

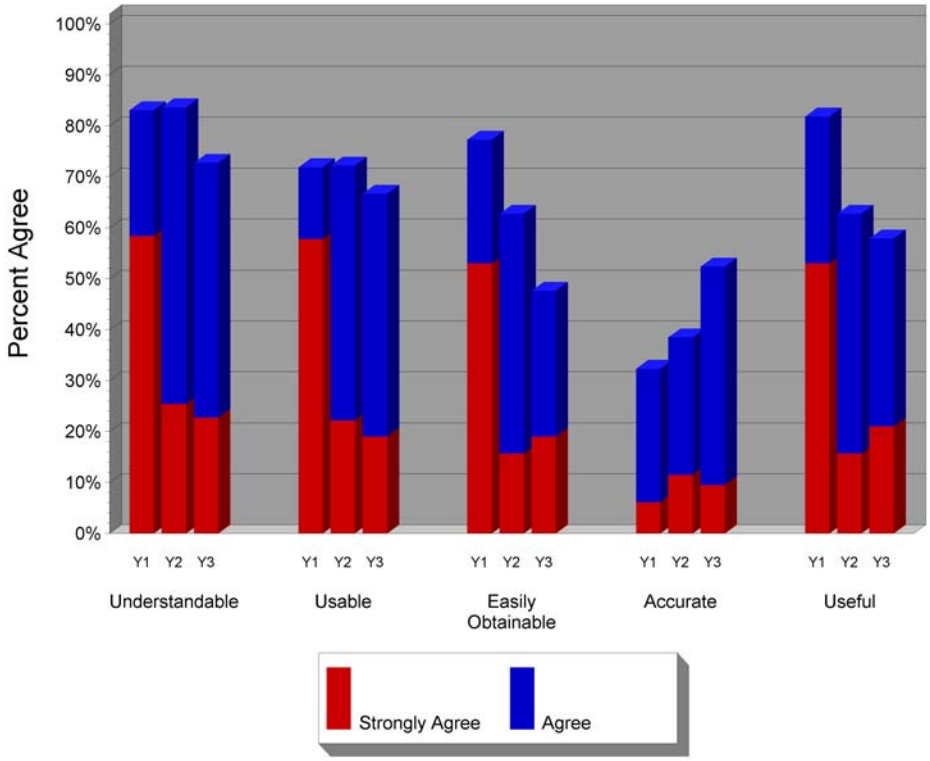



**Figure 3.5b** **Percent of Highway Maintenance Operator Users who Agree with Certain Characteristics Associated with Precipitation Information.**

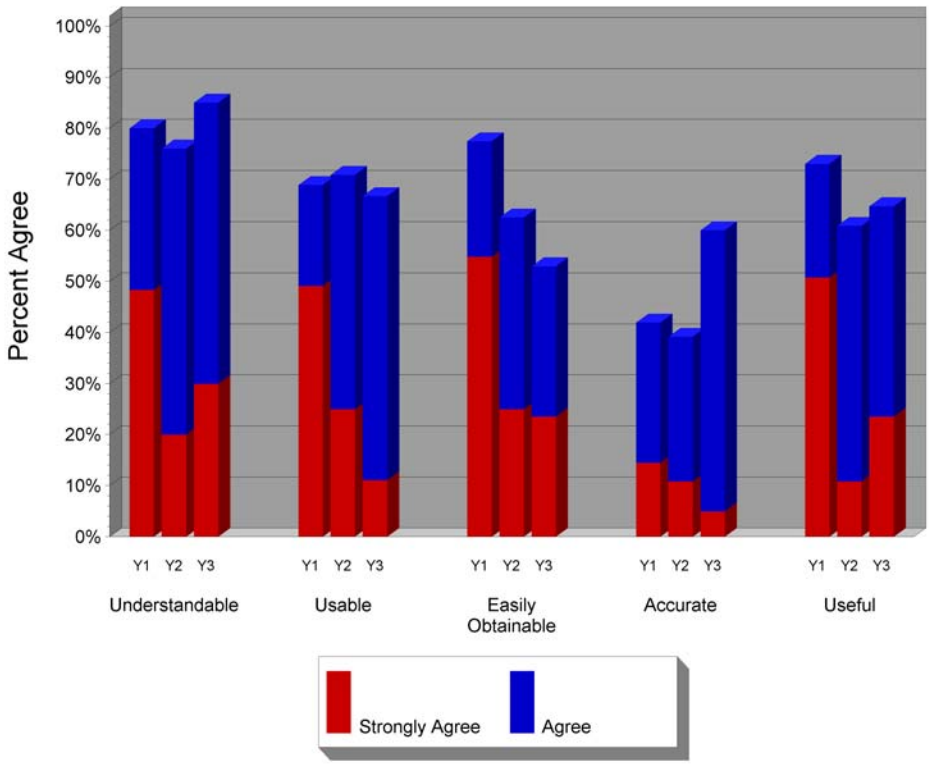



**Figure 3.5c** **Percent of Highway Maintenance Operator Users who Agree with Certain Characteristics Associated with Atmospheric Temperature Information.**

Figure 3.5d illustrates that pavement temperature information showed a much sharper decline in agreement from the baseline to the follow-up results than other weather information over time. This could be a result of pavement temperature being more variable than others or possibly being harder to predict. Overall, greater than 40 percent of HMOs using FORETELL found the pavement temperature information to be understandable, usable, easily obtainable, and useful. There were statistically significant differences in how understandable and usable the pavement temperature information was when the baseline and second follow-up surveys are compared, as well as when the first follow-up and second follow-up surveys are compared. There were also statistically significant differences in how easily obtainable and accurate the information was perceived to be between the baseline and each of the two follow-up surveys.

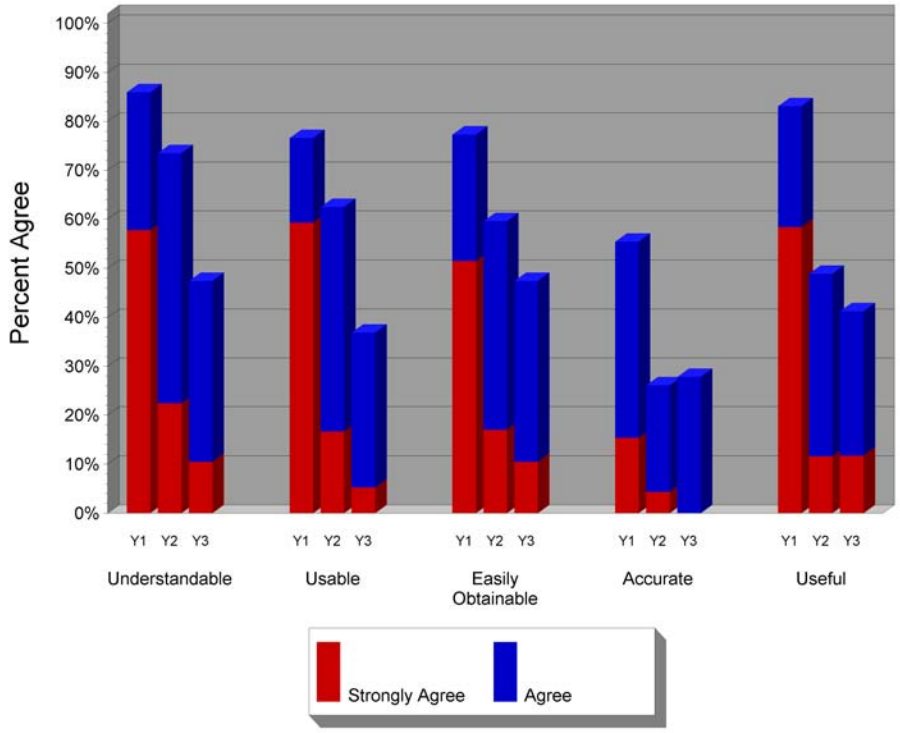



**Figure 3.5d Percent of Highway Maintenance Operator Users who Agree with Certain Characteristics Associated with Pavement Temperature Information.**

In the baseline and first follow-up year, more than 60 percent of HMOs using FORETELL responded that the pavement condition information was understandable, usable, and easily obtainable (see Figure 3.5e). However, less than 40 percent of HMOs surveyed in the second evaluation year found the pavement condition information to be understandable, usable, easily obtainable, accurate, and useful, which represents a statistically significant decrease for understandability and usability. The percentage of HMO users who indicated that they agreed that pavement condition information was easily obtainable was significantly lower, statistically, in the second follow-up than in the baseline year. Also, the perception of usefulness was lower in both follow-up years than in the baseline year. No other differences were statistically significant.

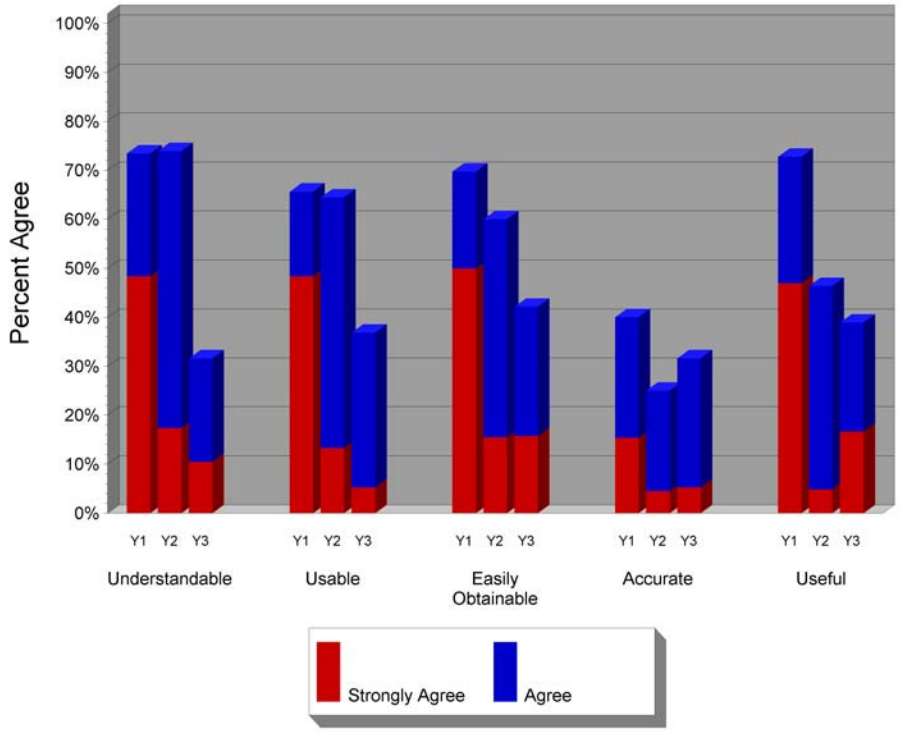



**Figure 3.5e Percent of Highway Maintenance Operator Users who Agree with Certain Characteristics Associated with Pavement Condition Information.**

The results for dewpoint information, as shown in Figure 3.5f, generally show much lower HMO agreement toward the usability, accuracy, and usefulness of the dewpoint information compared to wind speed/direction, precipitation, and atmospheric temperature. However, more than 50 percent of all HMOs using FORETELL found the dewpoint information to be understandable and easily obtainable. The results showed an increase over time in HMOs' perception of usability. Also, there was a statistically significant increase in the perceived accuracy of the information when the baseline and first follow-up surveys are compared to the second follow-up survey. There was also a statistically significant increase in the usefulness of dewpoint information from the first to the second evaluation year. No other comparisons were significantly different, statistically.

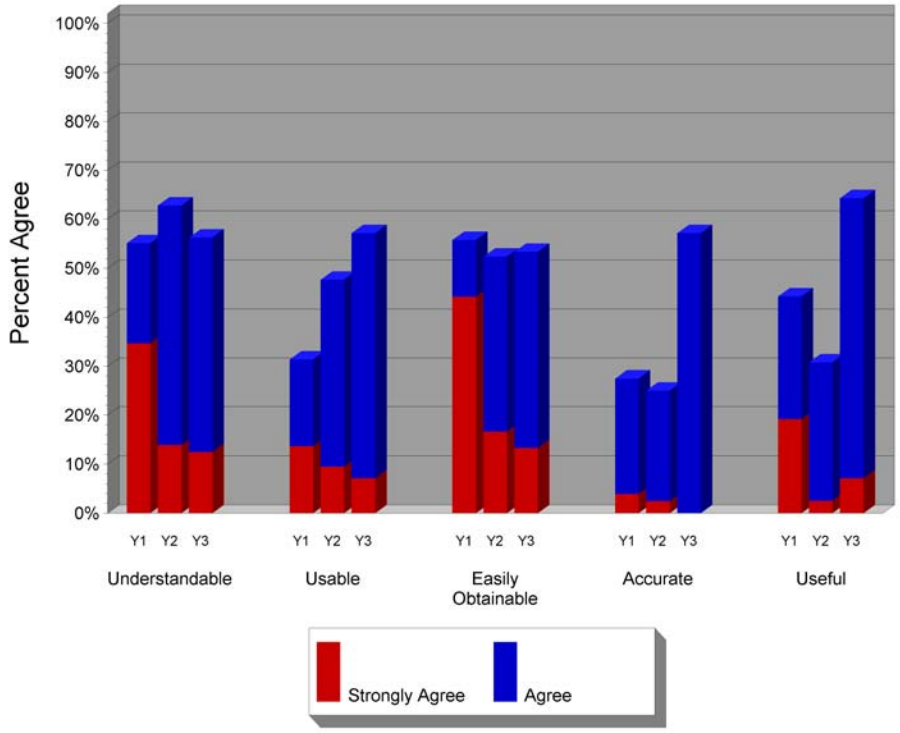



**Figure 3.5f Percent of Highway Maintenance Operator Users who Agree with Certain Characteristics Associated with Dewpoint Information.**

More than 30 percent of surveyed HMOs using FORETELL agreed that FORETELL information (general weather information in the baseline survey) was sufficient for making weather-related decisions, that it makes their jobs easier, and that FORETELL provides valuable information not available from other sources (see Figure 3.6).

Approximately 40 percent of all surveyed HMOs who used FORETELL in the second evaluation year, as compared to 30 percent in the third evaluation year, found FORETELL information to be valuable and unique. These percentages are not significantly different, statistically. However, there was a statistically significant decline from the baseline survey (91%) to both follow-up surveys (38% and 29%, respectively) in the percentage of HMOs who indicated that weather/FORETELL information made their jobs easier. The mild winter may have made weather information in general, including FORETELL, less important to job performance during the winter of 2001-2002.

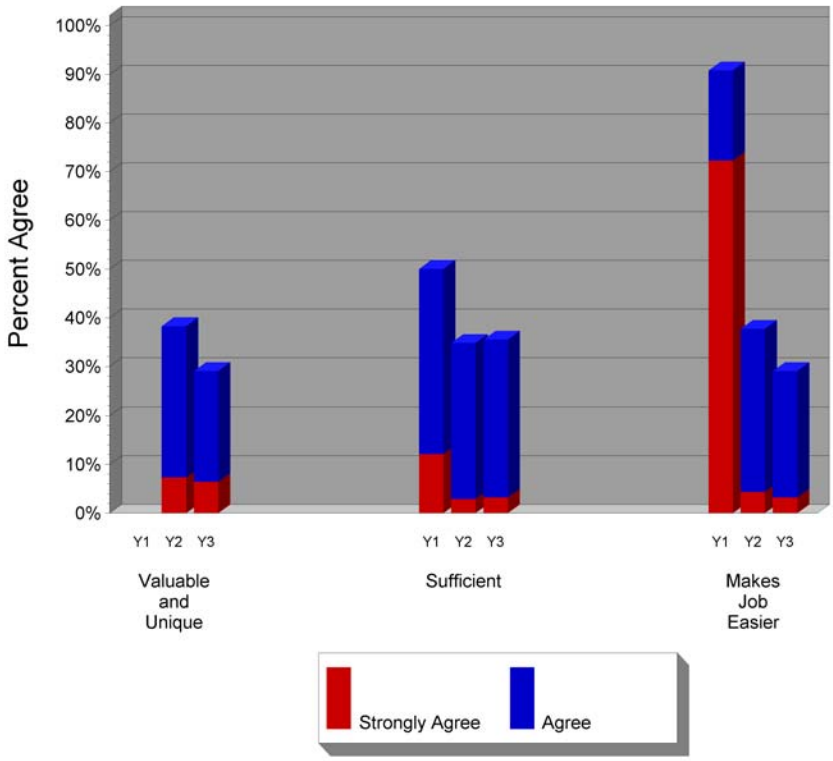



**Figure 3.6 Percent of Highway Maintenance Operator Users who Agree with Overall Qualities of Weather/FORETELL Information.**

### 3.1.4 Decision Effectiveness

Decision Effectiveness characterizes the impact FORETELL information had on the HMOs' weather-related decisions. Figures 3.7a through 3.7f present the percentage of HMOs who use weather/FORETELL information to determine what road surface treatments to apply and when and where to apply them for each of the types of weather information included in the surveys (wind speed/direction, precipitation, atmospheric temperature, pavement temperature, pavement condition, and dewpoint).

Each of the figures displays a similar pattern: a high percentage of operators in the baseline survey indicating use of the information for all three purposes (what, when, where), with a somewhat lower, yet still large percentage, indicating use of the information from FORETELL in the follow-up surveys. The notable exceptions are atmospheric temperature (Figure 3.7c) and dewpoint (Figure 3.7f). These figures show a lower overall percentage of respondents indicating use of the information for road surface treatment decisions. Figure 3.7f shows a statistically significant increase in the use of dewpoint information in road surface treatment decisions, particularly in what treatments to apply. This could indicate that FORETELL provided HMOs with a useful piece of information that they did not have access to before.

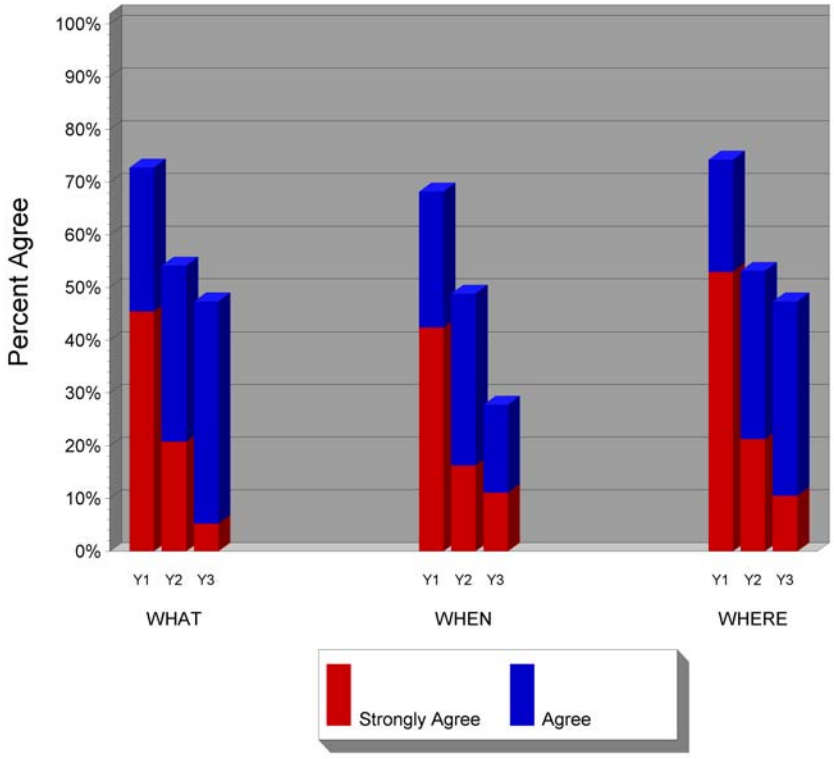



**Figure 3.7a Percent of Highway Maintenance Operators who Use Wind Speed/Direction Information in Road Surface Treatment Decisions.**

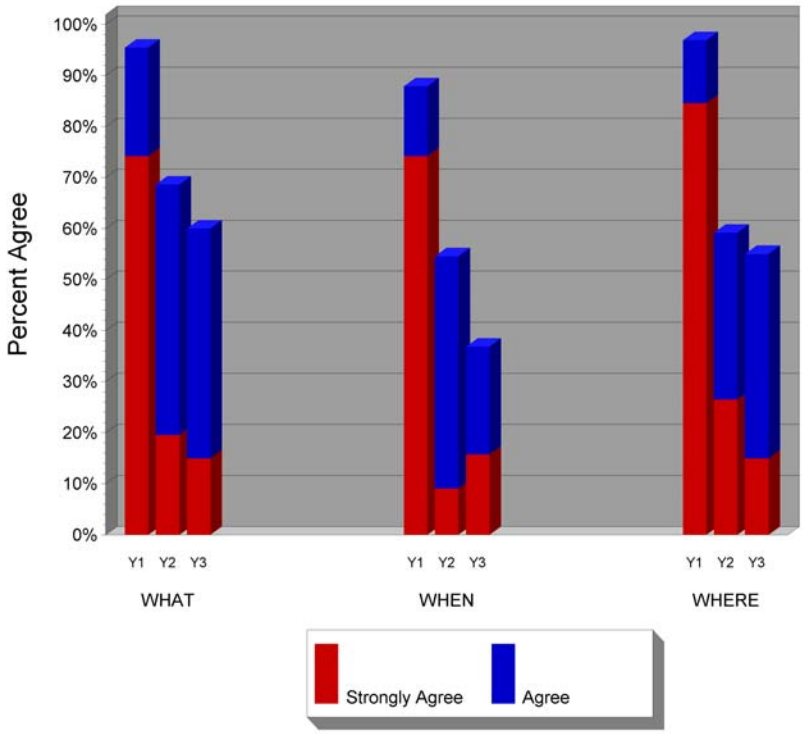



**Figure 3.7b** **Percent of Highway Maintenance Operators who Use Precipitation Information in Road Surface Treatment Decisions.**

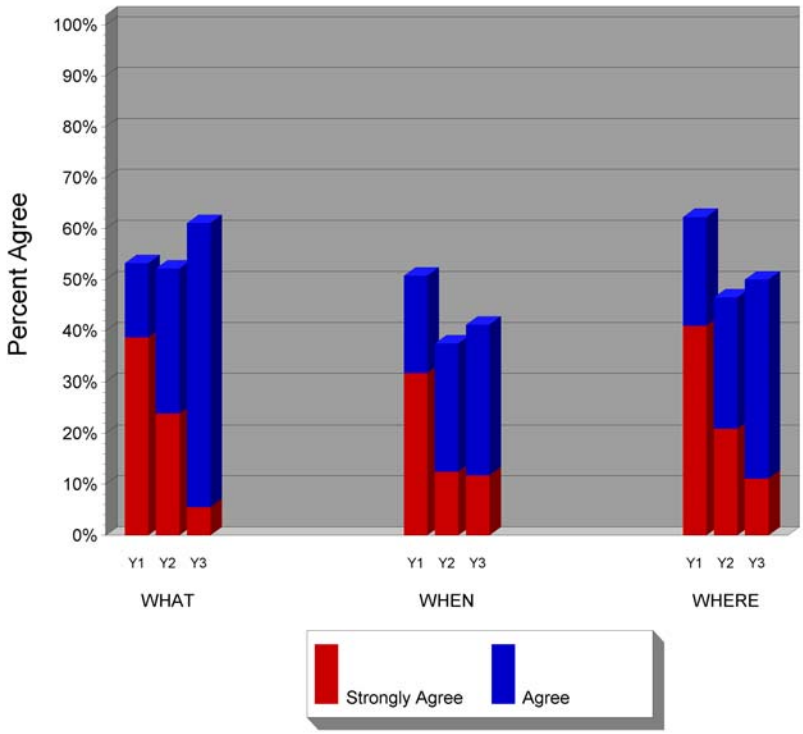



**Figure 3.7c** **Percent of Highway Maintenance Operators who Use Atmospheric Temperature Information in Road Surface Treatment Decisions.**

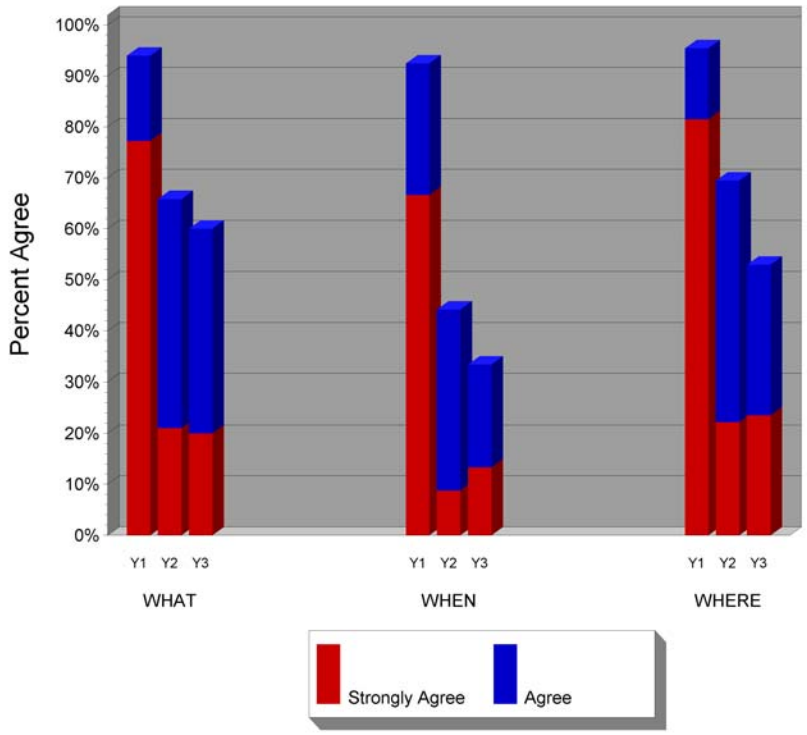



**Figure 3.7d** **Percent of Highway Maintenance Operators who Use Pavement Temperature Information in Road Surface Treatment Decisions.**

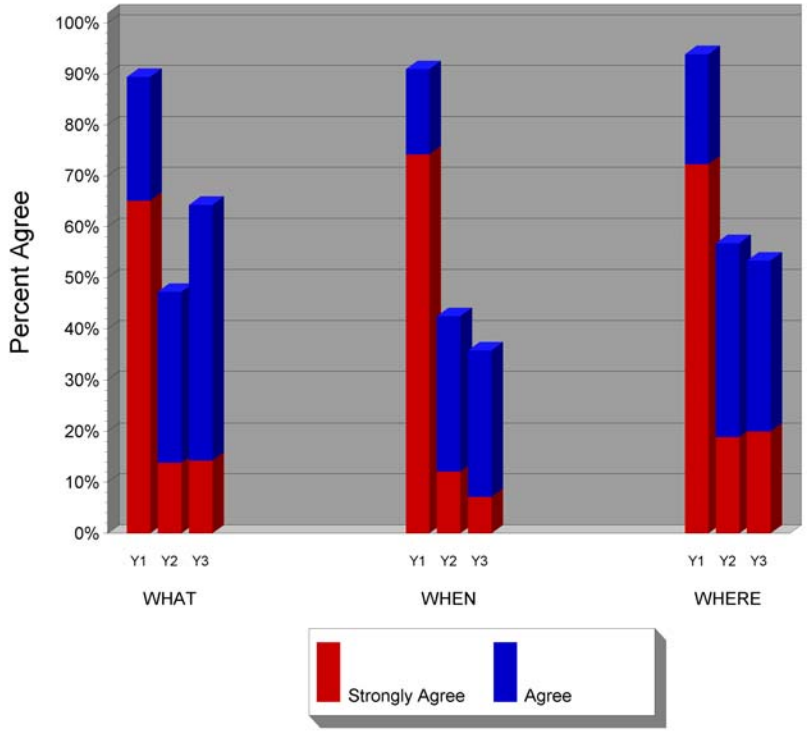



**Figure 3.7e** **Percent of Highway Maintenance Operators who Use Pavement Condition Information in Road Surface Treatment Decisions.**

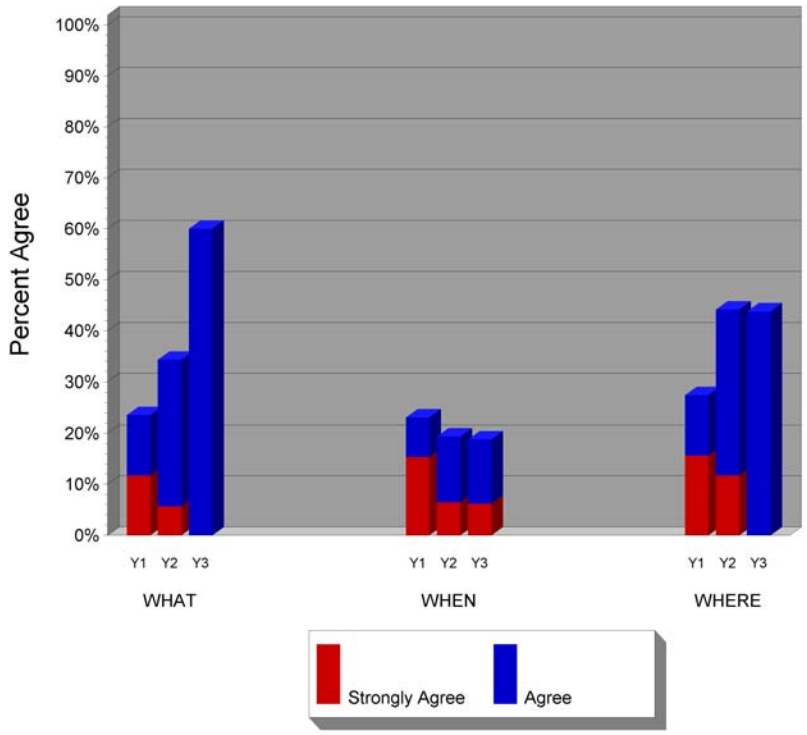



**Figure 3.7f Percent of Highway Maintenance Operators who Use Dewpoint Information in Road Surface Treatment Decisions.**

Figure 3.8 illustrates that roughly between 20 percent and 30 percent of the HMOs changed their decisions based on wind, precipitation, atmostpheric temperature, pavement temperature, pavement condition, or dewpoint information obtained from FORETELL. A slightly higher percentage of HMOs indicated changing a decision using precipitation information in the first follow-up survey, and a much lower percentage indicated changing a decision using dewpoint information in the first follow-up survey. Figure 3.8 indicates that FORETELL has successfully provided information that is used in the decision-making process.

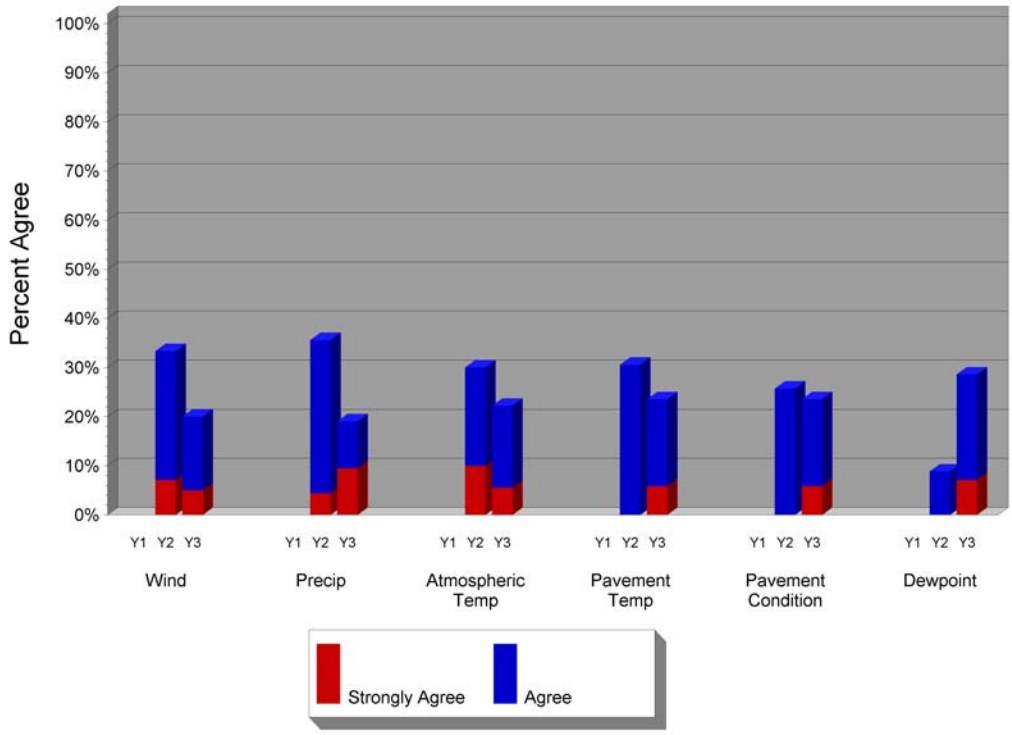



**Figure 3.8 Percent of Highway Maintenance Operators who Indicated Changing a Decision Based on FORETELL Information.**

Overall, with all categories of information combined, 40 percent of HMO users in the first follow-up survey and 32 percent of HMO users in the second follow-up survey indicated changing a decision based on some type of FORETELL information.

Figure 3.9 shows similar results for the questions of improving traffic efficiency (e.g., traffic flow, roadway mobility, roadway level of service), targeting snow and ice control measures, conducting highway maintenance activities, deploying staff, the timeliness of FORETELL information for making decisions, and the confidence in those decisions. The figure shows that even though there are statistically significant decreases from the baseline survey to the follow-up surveys in the percent of HMOs that perceive these improvements, still 20 to 30 percent do perceive some change for the better.

Just under 20 percent of the surveyed HMOs who used FORETELL indicated a willingness to pay for FORETELL information, yet 88 percent in the first follow-up survey and 53 percent in the second follow-up survey indicated a desire to continue using it in the future.

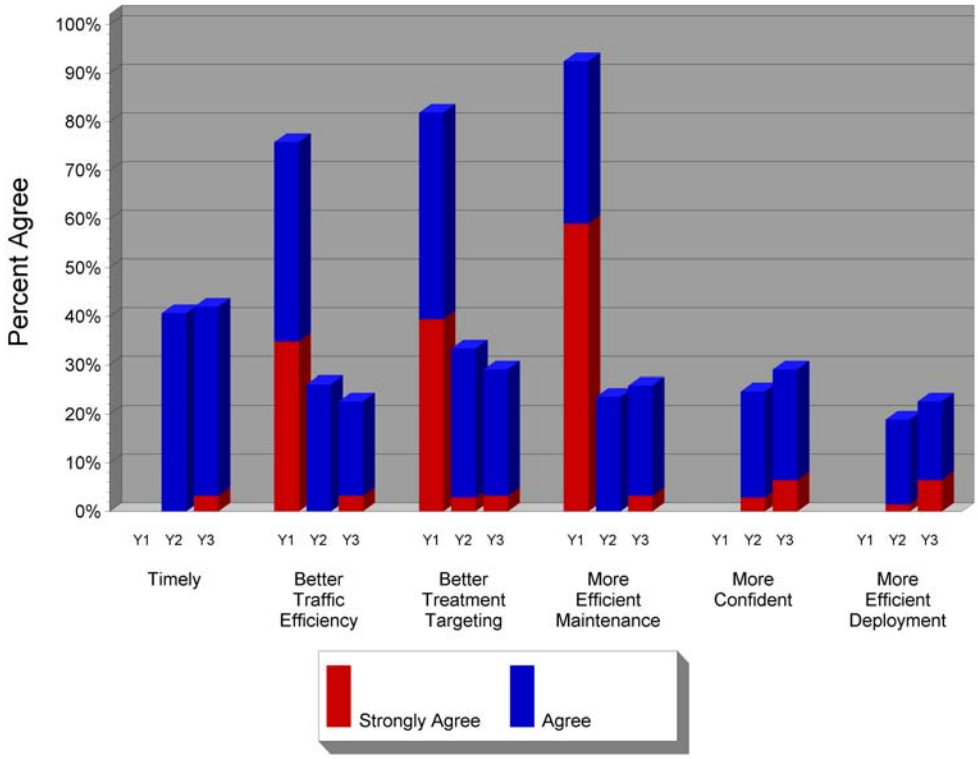



**Figure 3.9 Percent of Highway Maintenance Operators who Agreed to Improved Job Performance Using FORETELL Information.**

### 3.1.5 Other Factors

The evaluation effort aimed to answer questions of improved safety and less environmental contamination with the use of FORETELL information. Results are shown in Figure 3.10 below. Approximately 20 percent of the HMOs indicated that using information provided by FORETELL resulted in a quicker return of the roadways to a targeted level of service, an increase in the safety of their own workers, and a reduction in the amount of chemical applications needed. No other information was available for assessing these issues.

The activity/weather log information collected from the HMOs during each weather event was intended to characterize the weather conditions during the evaluation period, as well as summarize the impact FORETELL information had on each weather event. Unfortunately, only the former assessment was possible (see Section 4.1 for details). An attempt was made to develop a statistical model that would characterize the time to return to a targeted pavement condition in terms of other event-specific information such as amount and type of precipitation, worst pavement condition, and whether or not FORETELL information was used for decisions. A total of 589 logs were returned, with 98 logs indicating the use of FORETELL information. This small amount of information was not sufficient to support the development of planned models.

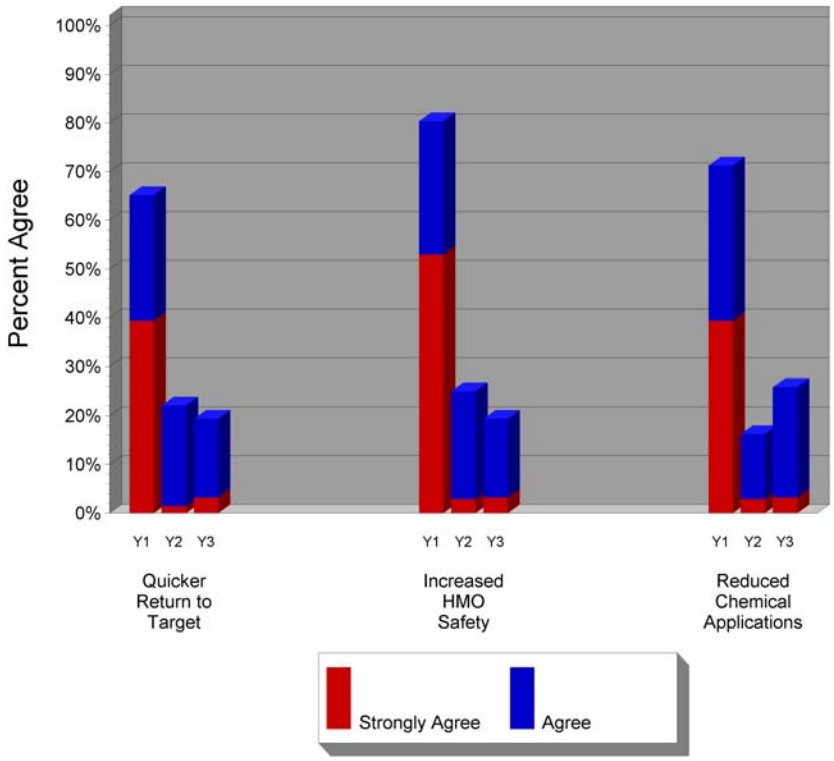



**Figure 3.10 Percent of Highway Maintenance Operators who Perceived an Improvement in Safety and/or Environmental Concerns When using FORETELL Information.**

Another potential contributor to the results of this evaluation is the amount of FORETELL training received by the participants. It is not known exactly how many of the responding HMOs received training on the use of the FORETELL system; however, it was offered in all three states on at least two occasions with reasonably good attendance. The difference in survey responses by HMOs who received training and those who did not is a potentially confounding effect that cannot be measured.

### 3.1.6 Conclusions

The results of the HMO surveys indicate some success of the FORETELL system within this user group:

- Anywhere from 30 percent to 60 percent of the respondents used FORETELL information.
- More users found the information helpful than not helpful in snow and ice control decisions.
- A very high percentage of HMO users, ranging between 50 percent and 90 percent, found FORETELL information to be understandable, usable, easily obtainable, accurate, and useful (for all categories of information combined).
- Approximately 30 percent to 40 percent of HMOs who used FORETELL found FORETELL information to be valuable and sufficient and to make their jobs easier.
- Between 30 and 40 percent of the respondents who used FORETELL changed their decisions based on FORETELL information.
- More than 50 percent of the respondents who used FORETELL want to continue using FORETELL in the future.
- Just under 20 percent of the HMOs who used FORETELL would be willing to pay for FORETELL information.

In general the survey results show positive feedback about FORETELL from the HMOs. While the results do not provide an obvious argument for the continuation of FORETELL, there are several factors that could be influencing that result, most importantly, the weather. Unfortunately, too few of the HMO survey respondents also completed activity/weather logs. Therefore, it was not possible to combine the weather information collected from the logs with the actual survey responses.

## 3.2 Other User Groups

This section presents the results of the data collection effort for CVOs, highway patrol, school administrators, transit operators, and traffic managers. For each user group, an overview of the data collection effort is presented, along with a description of the types of weather-related

information used, users' acceptance of the FORETELL system, the impact of FORETELL information on users' decision processes, the effect of FORETELL information on other factors such as safety and environmental conservation, and conclusions that may be drawn from the data collected.

### 3.2.1 Commercial Vehicle Operators

#### 3.2.1.1 *User Group Overview*

CVO personnel include truck drivers, dispatchers, terminal managers, safety coordinators, as well as vice presidents, presidents, and owners of trucking companies. This user group makes decisions in routing, schedules, and other operational parameters resulting from weather conditions to ensure the efficiency and safety of their operations. CVOs in the states involved in the FORETELL test accessed the FORETELL website in hopes of better understanding winter road conditions and making decisions regarding operations (e.g., trip deferral, departure time, route choice).

The effectiveness of the FORETELL website at disseminating relevant information to CVOs was evaluated through telephone interviews and records of their access to the website. Telephone interviews were conducted to assess the extent to which CVOs used FORETELL information (user acceptance) and to measure their ability to improve weather-event decisions (decision effectiveness), reduce exposure to unsafe road conditions (safety and security), and reduce delay (efficiency). An interview guide was developed to assist in conducting the telephone interviews. The guide provided consistency in the interviews while allowing information suitable for the analysis to be collected. Appendix B contains the interview guide used during the interviews, along with a summary of the responses to each question.

A 2000-2001 directory/list of 1,063 CVOs traveling in or through Iowa, Wisconsin, and/or Missouri was obtained. Due to time and resource constraints, nearly 100 randomly selected CVOs were contacted to gauge their level of interest and determine whether they had access to the Internet. Only 34 companies agreed to participate, and these therefore became a convenience sample of CVOs in the three test states. Some identified participants made use of the FORETELL website during the winter months of 2001-2002 to obtain road surface and weather condition information.

The evaluation team interviewed the potential evaluation participants, via telephone, about their use of the FORETELL system, how well the system worked (system acceptance), the purpose the information was used (e.g., routing or timing alterations/planning – decision effectiveness), and whether it provided improvements in safety, mobility, and operation.

The participating CVOs were divided into categories based on the number of drivers, as an indicator of the company size. Three categories of CVOs were developed for analysis:

- Smaller Companies – 1 to 24 drivers
- Medium Companies – 25 to 50 drivers
- Larger Companies – 51 to 900 drivers

As shown in Figure 3.11, 15 of the 34 CVOs completed interviews. They represent 487 drivers that travel in the three test states, as well as throughout the continental United States.

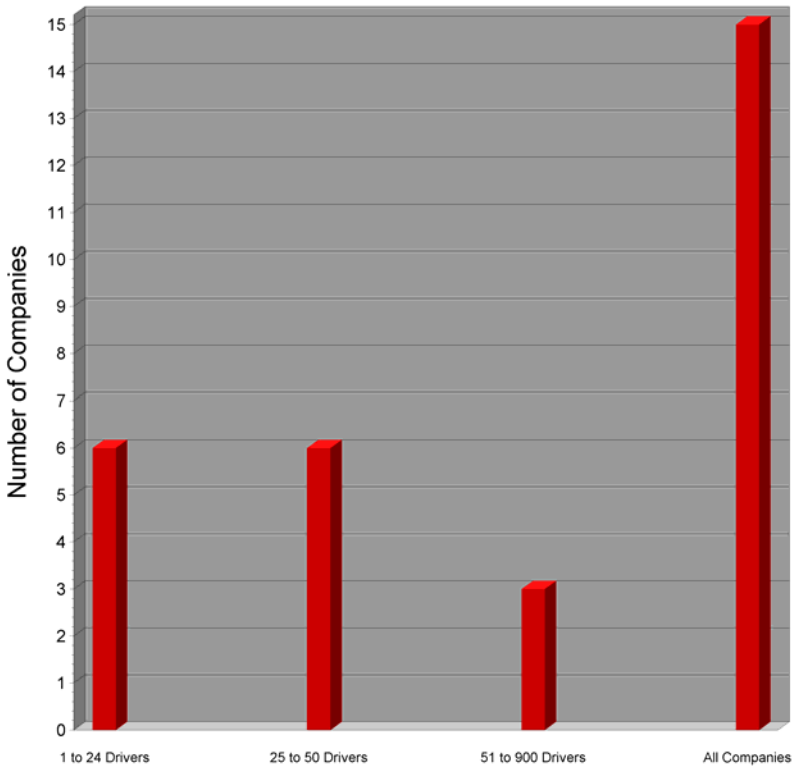



**Figure 3.11 Number of Commercial Vehicle Operators Completing Interviews, by Company Size.**

The interview questions strived to understand whether CVOs accepted weather and road condition information, if the information assisted in the effectiveness of their decisions, and if the information improved operations and safety. These questions were asked under the scenarios of "before knowing of FORETELL" and "after being introduced to FORETELL." Respondents may have differed in their responses to questions because they were uncertain whether the questions assumed that they would replace all other information sources with the FORETELL system or add the FORETELL system to their existing information sources.

Training materials, with assigned usernames and passwords, were sent to personnel willing to participate in the evaluation. Figure 3.12 identifies the percent of CVOs interviewed from each category that received training material and, of those, who felt the training material received was useful. The figure shows that many operators in the small- and medium-sized companies received the training material.

Some larger CVOs indicated that they did not find the training material to be useful. Companies that found the training material to be useful indicated during the interview that it was only useful in logging onto the website.

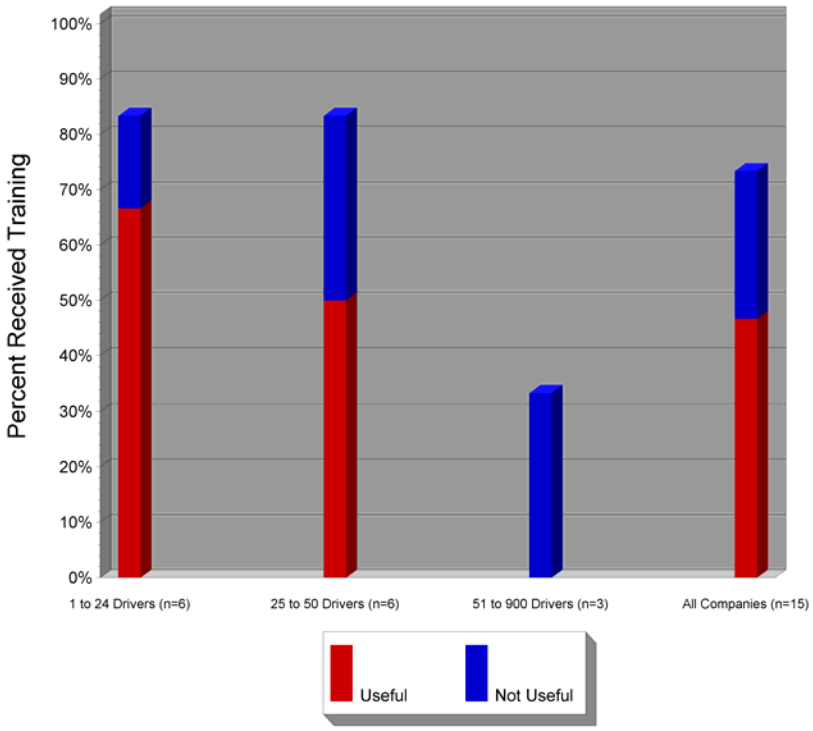



**Figure 3.12 Percent of Commercial Vehicle Operators who Received Training Material and the Usefulness of that Material, by Company Size.**

### 3.2.1.2 *Information Used*

The first part of the telephone interview concentrated on finding out what weather and road condition information CVOs sought and from what sources the information had been obtained before the users had knowledge of the FORETELL system. Figure 3.13 shows the types of weather-related information sought by CVOs and whether they used actual and/or forecasted information.

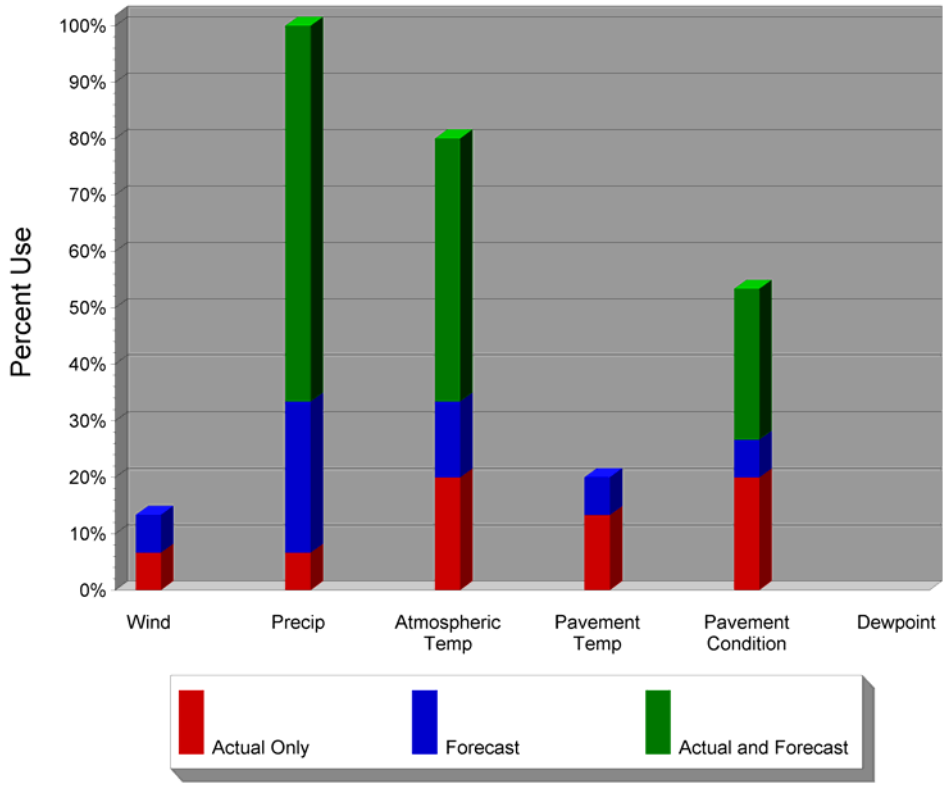



**Figure 3.13 Percent of Commercial Vehicle Operators who Indicated Using Various Weather-Related Information from Sources Other than FORETELL.**

Based on the information collected from this interview process, CVOs do not readily seek wind information, actual or forecasted. Companies favor information on precipitation, temperature, and pavement conditions. Perhaps viable wind, pavement temperature, and dewpoint information is not available among accessible sources. Available sources used to obtain the needed weather and road surface information are presented in Figure 3.14.

The CVO community has a variety of information sources providing current and forecasted weather and road condition information. However, the readily available, accessible, and en-route sources are those used frequently by CVOs. Figure 3.14 shows that the CVOs utilize AM/FM radios, private forecasting service, CB radios, television, cellular telephones, the Internet, and word of mouth to obtain weather and road condition information. Word of mouth (e.g., CVOs talking with each other at rest stops) is the most popular source, because it provides current, en-route information from very viable sources. Due to growing popularity, CVOs are installing, learning, and obtaining more information from the Internet.

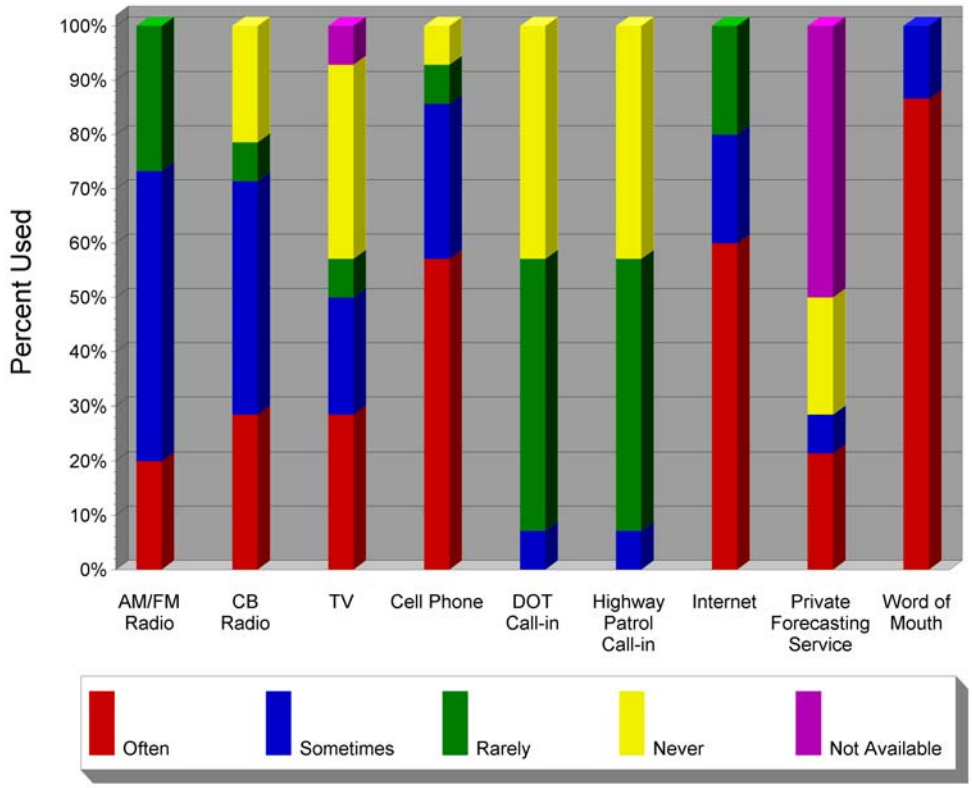



**Figure 3.14 Percent of Commercial Vehicle Operators who Indicated Other Sources of Weather Information were Available to Them and How Often Each Source was Used.**

Figure 3.15 shows FORETELL information accessed by CVOs. They accessed wind, pavement temperature, and dewpoint information from the FORETELL system, in contrast to the case before FORETELL (see Figure 3.13). FORETELL's interactive displays and maps captured CVOs' interest, according to respondents. CVOs did take time to view wind and pavement temperature information that, when using previous sources, they had not. Also notable was their interest in pavement temperature and condition. It is possible that FORETELL offered this information which was not obtainable from other sources.

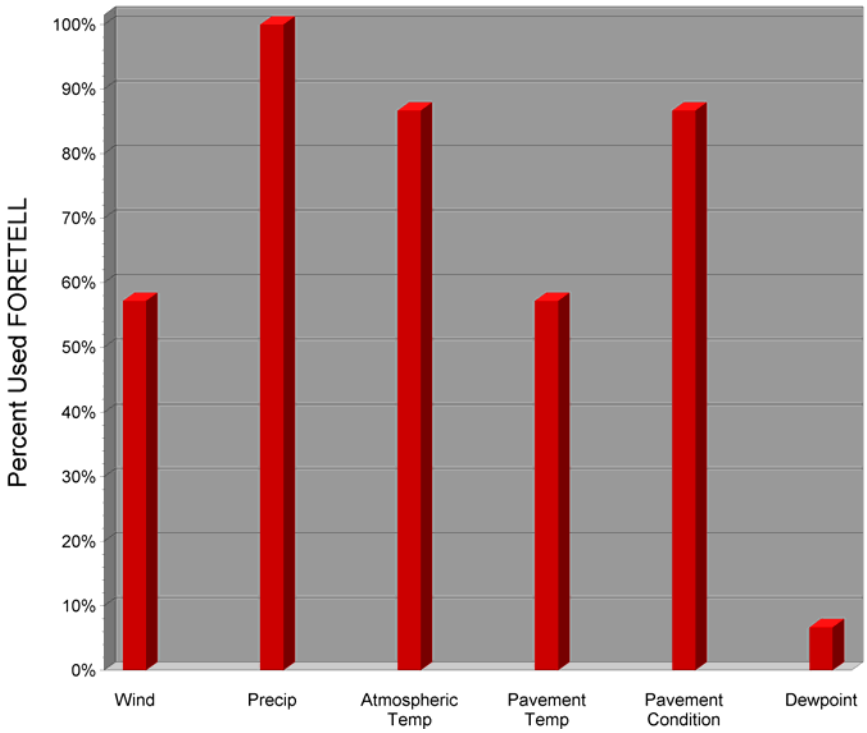



**Figure 3.15 Percent of Commercial Vehicle Operators who Indicated Using Various Types of FORETELL Information.**

Because the FORETELL system is an Internet website, analysis was completed to discover how many of the CVOs already used the Internet to visit sites providing weather and road condition information before having knowledge of the FORETELL system. The results are shown in Figure 3.16. As would be expected, the three largest companies utilize the Internet more than the other companies. Nearly 60 percent of all companies utilize the Internet often for weather and road condition information.

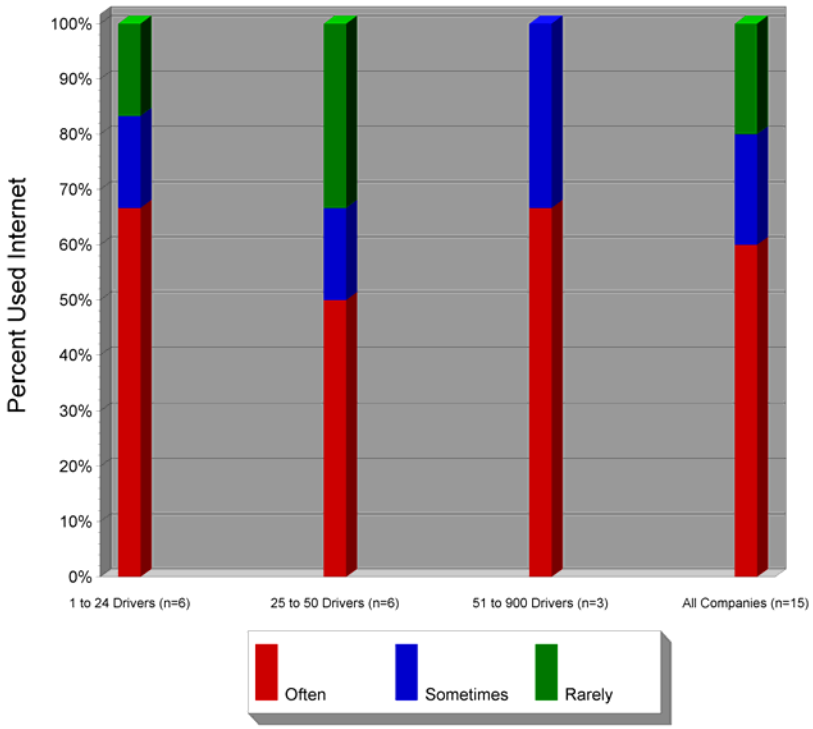



**Figure 3.16 Percent of Commercial Vehicle Operators who Indicated Using the Internet to Gather Weather-Related Information, by Company Size.**

### 3.2.1.3 *User Acceptance*

In both the "before knowing of FORETELL" and "after being introduced to FORETELL" scenarios, telephone interview questions strived to understand whether CVO personnel accepted weather and road condition information. Figure 3.17 shows how well CVOs accepted the information obtained from sources other than FORETELL. With questions ranging from source availability to data accuracy, approximately one-half of the CVO respondents agreed or strongly agreed that the information was acceptable.

The last column of Figure 3.17 ("The obtained information is very useful for the organization's operations") shows that CVOs indicated that they were very divided or unsure whether weather and road condition information was useful to their operations. Thirty-three percent of the CVOs responded "Neither Agree nor Disagree" when asked this question about the usefulness of other information sources. Approximately one-half of the respondents neither agreed nor disagreed that the weather and road condition information was accurate (47%) or up to date (40%). However, 87 percent agreed or strongly agreed that the information was easy to access and readily available.

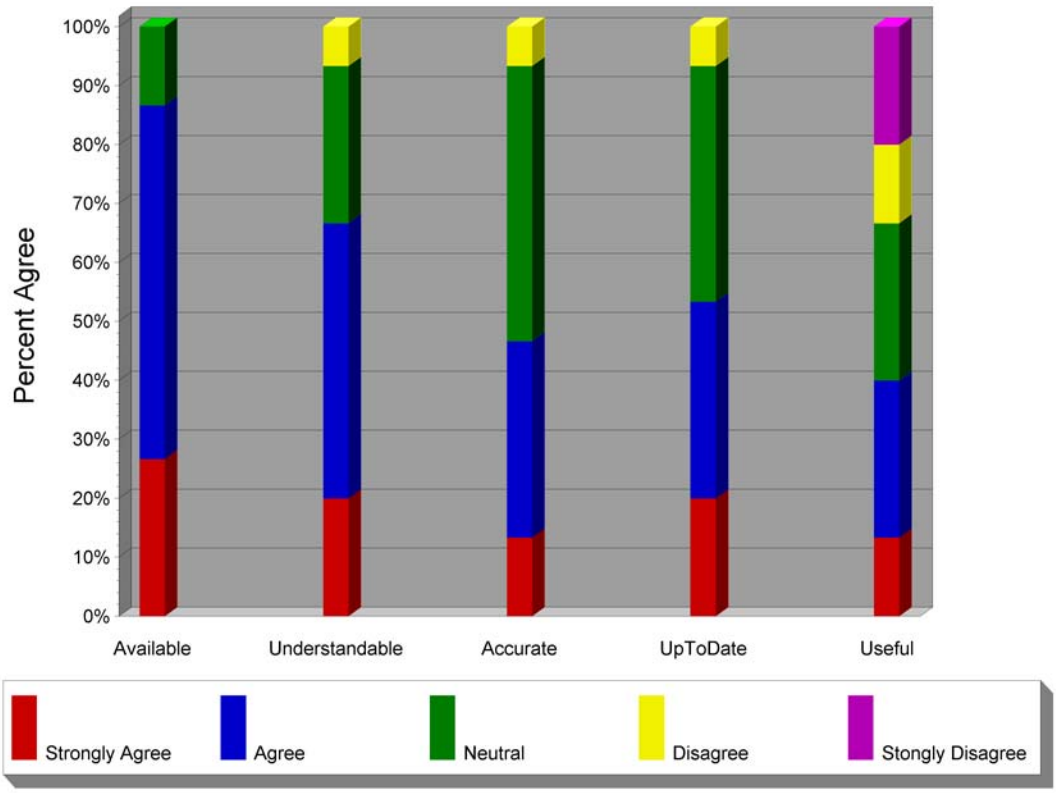



**Figure 3.17 Percent of Commercial Vehicle Operators who Indicated Agreement with Certain Characteristics of Weather Information They Received from Sources Other Than FORETELL.**

Figure 3.18 illustrates the interview responses concerning CVO acceptance of the FORETELL system information. The difference between the results of the "before" and "after" scenarios is not statistically significant. In both scenarios, CVO personnel found the information to be accessible and easily obtainable. However, when users were asked if the information was easy to understand, 67 percent of the CVOs reported they agreed or strongly agreed that the "before" source information was easy to understand versus 47 percent of CVO users understanding FORETELL information. Many CVOs replied that they neither agreed nor disagreed for both scenarios, which could mean that they did not access the information or they did not rely heavily on weather and road condition information sources to make decisions. The uncertainty may suggest minimal use of weather and road condition information sources during the mild winter season. However, a majority of the companies did accept the FORETELL information.

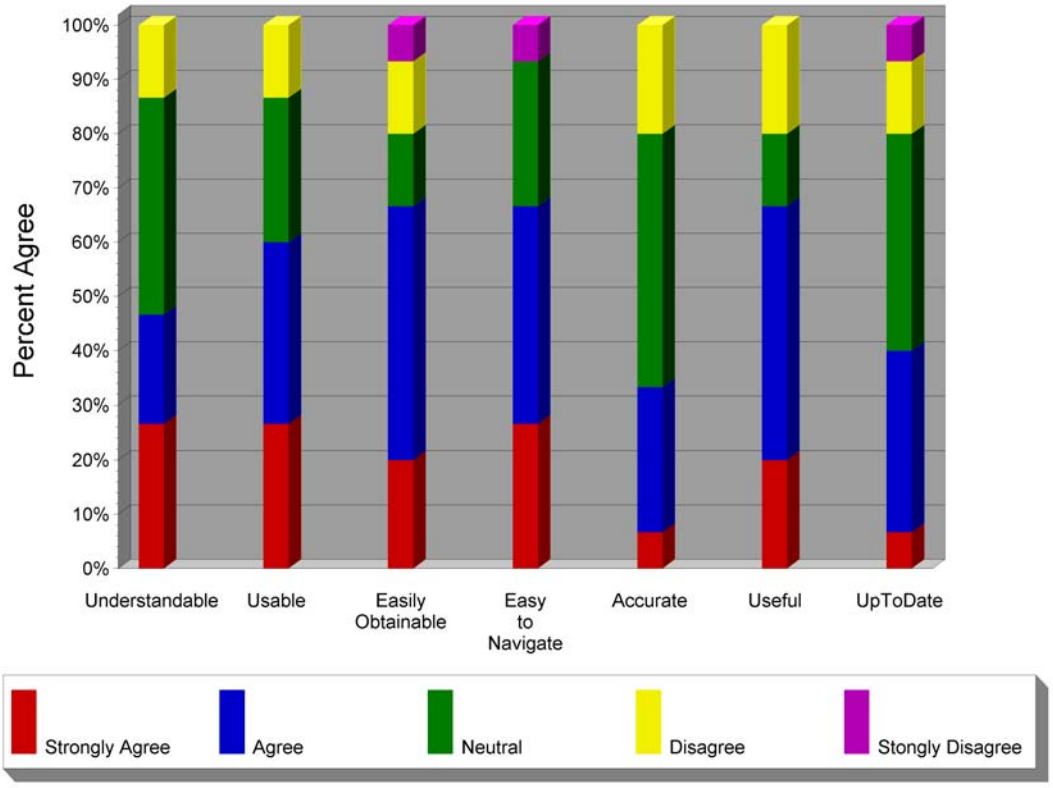



**Figure 3.18 Percent of Commercial Vehicle Operators who Indicated Agreement with Certain Characteristics of FORETELL Information.**

Questions on the telephone interview guide probed into the frequency of FORETELL use by CVOs and how their use correlated with weather events. Figure 3.19 shows the respondents' frequency of use of the FORETELL system. Of the CVOs responding, approximately 30 percent reported daily use and about 80 percent of the respondents used the system twice daily just before, during, or after a weather event. Although not shown in the graph, 41 percent of the respondents reported using the FORETELL system a "couple of times" during the winter season.

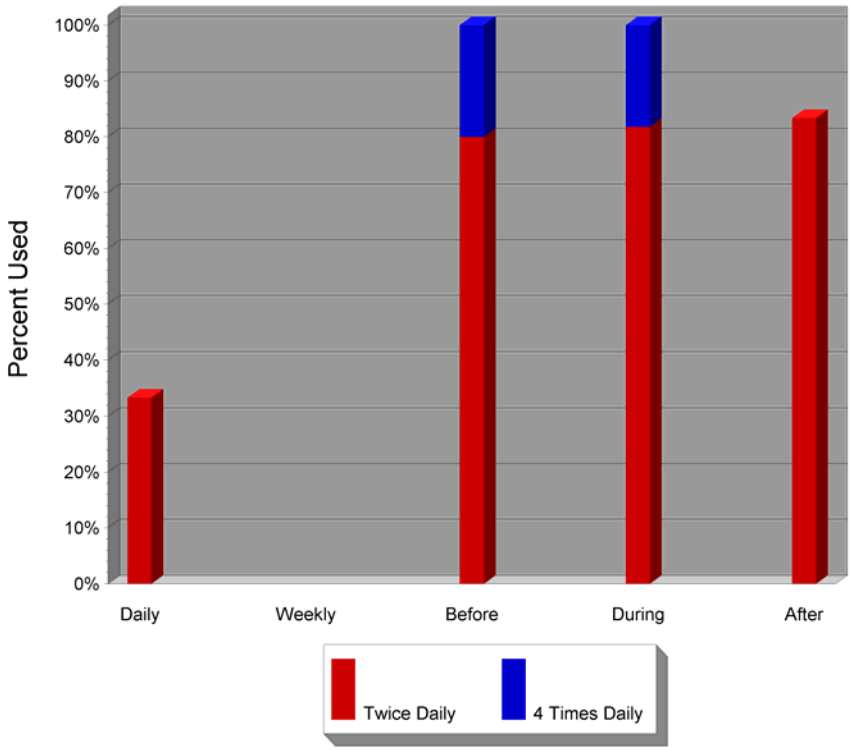



**Figure 3.19 Percent of Commercial Vehicle Operators who Indicated Use of FORETELL Information at Various Time Intervals.**

While responding to the frequency of use questions in the telephone interview, some CVOs expressed uncertainty in the number of times they had actually used the FORETELL system. Therefore, FORETELL's system records were accessed and logins to the system were determined by looking specifically at CVO-assigned usernames and passwords. Figure 3.20 displays the number of times CVOs accessed the FORETELL system, by month, during October 2001 through April 2002.

Figure 3.20, based on system records, shows that use of FORETELL was highest in January (the yellow portion) after a very slow start (little use in October or November). Use sharply declined thereafter. Figure 3.20 clearly shows that medium and larger companies accessed the FORETELL system more often than smaller companies. There were some discrepancies between what CVOs reported through the telephone interview and what the system records showed. The infrequency of use demonstrated in Figures 3.19 and 3.20 supports the statements by respondents that the mildness of this test winter led to a lack of familiarity with the FORETELL system.

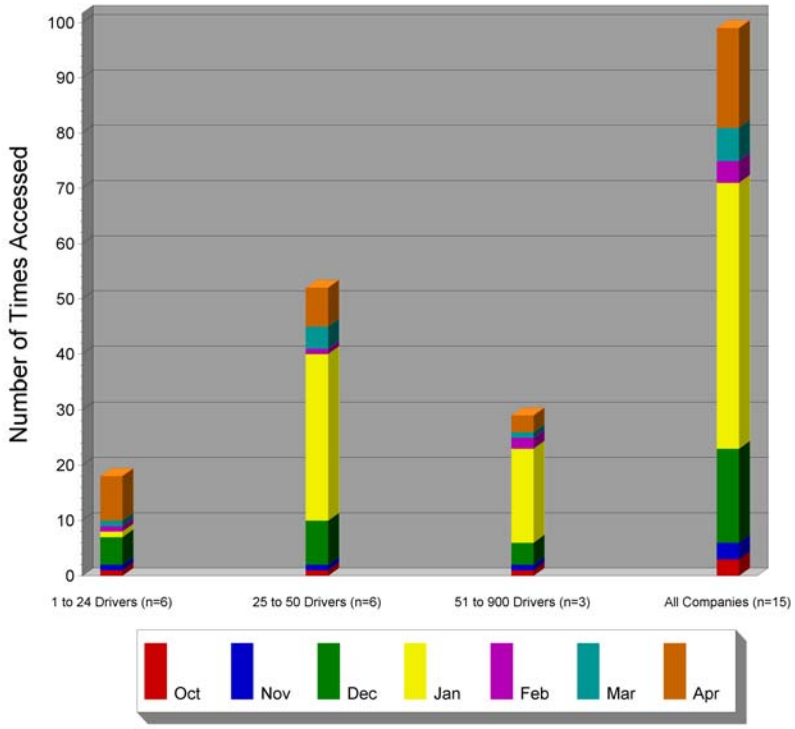



**Figure 3.20 Number of Times Commercial Vehicle Operators Accessed the FORETELL Website, According to FORETELL System Records.**

### 3.2.1.4 ***Decision Effectiveness***

Figure 3.21 shows the results of how the "before" information used by CVOs assisted in their perception of their decision effectiveness. CVOs' responses to the decision effectiveness questions show many responses in the "Neither Agree Nor Disagree" category. This is an indication that CVOs did not access the information or they did not rely heavily on weather and road condition information sources to make decisions. The uncertainty may suggest minimal use of weather and road condition information sources during the mild winter season.
Fifty-three percent of respondents did agree that information from other sources assisted them during a weather event in overall operational efficiency. In addition, 60 percent indicated that when they used the weather information they were more confident in their decisions.

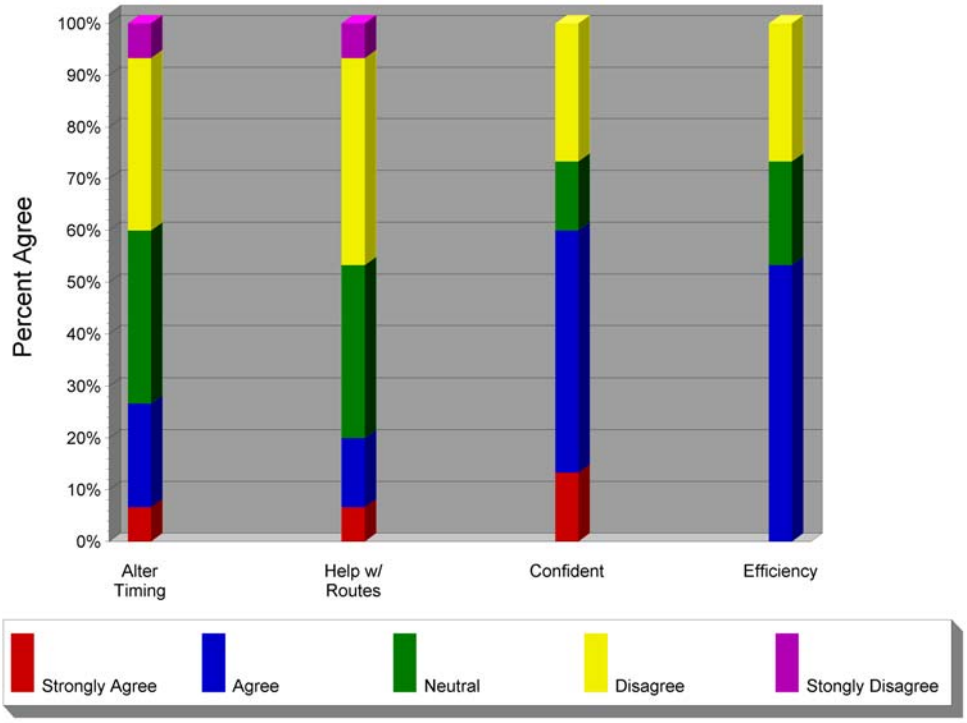



**Figure 3.21 Percent of Commercial Vehicle Operators who Indicated the Weather Information from Sources Other than FORETELL Made an Improvement in Their Jobs.**

Figure 3.22 shows the responses to similar questions asked regarding information from FORETELL. During the interview process, the majority of CVOs stated that they did not use FORETELL information to alter trip routes (60%) or trip timing (53%). However, more than 50 percent of the respondents felt that the information was timely and that they felt confident in making decisions using FORETELL information. In addition, 40 percent of the respondents indicated that FORETELL information improved the overall efficiency of their operations. A majority of the respondents indicated an acceptance of some aspects of FORETELL information as presented, and 20 percent to 60 percent of the respondents perceived the information to offer an improvement in their operations.

The results of the "before" and "after" scenarios do not vary significantly, statistically speaking; 60 percent and 67 percent of CVOs reported that the "before" and "after" information, respectively, increased confidence in their decisions. Fewer respondents agreed that having FORETELL information improved operational efficiency. Again, these results may be related to their lack of familiarity with the system due to insufficient use during a mild winter.

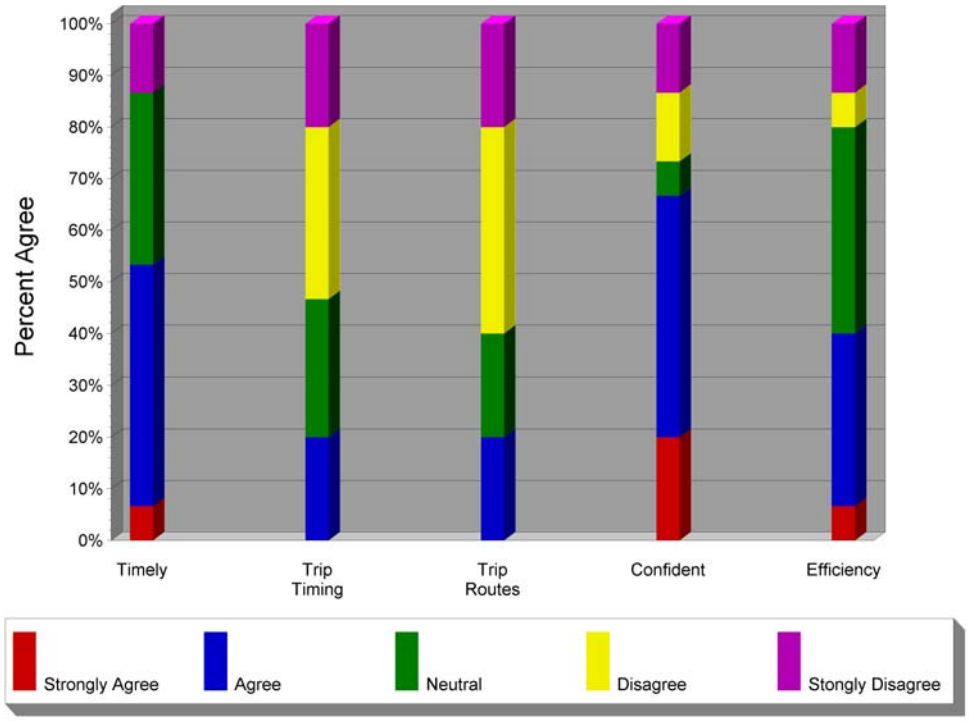



**Figure 3.22 Percent of Commercial Vehicle Operators who Indicated the FORETELL Information Made an Improvement in Their Jobs.**

### 3.2.1.5 *Other Factors*

Figure 3.23 illustrates, for each company size category, whether information from the "before" sources increased safety or reduced accidents. The opinions vary by category. All six of the medium-sized companies felt that weather and road condition information increased safety. Larger companies indicated that they have the flexibility to haul their goods in the southern states during severe weather conditions or stay on the interstates. Thus, two of the three larger companies agreed that having the information increased safety. The small CVOs were divided in their responses to the question of increased safety from the use of weather information.

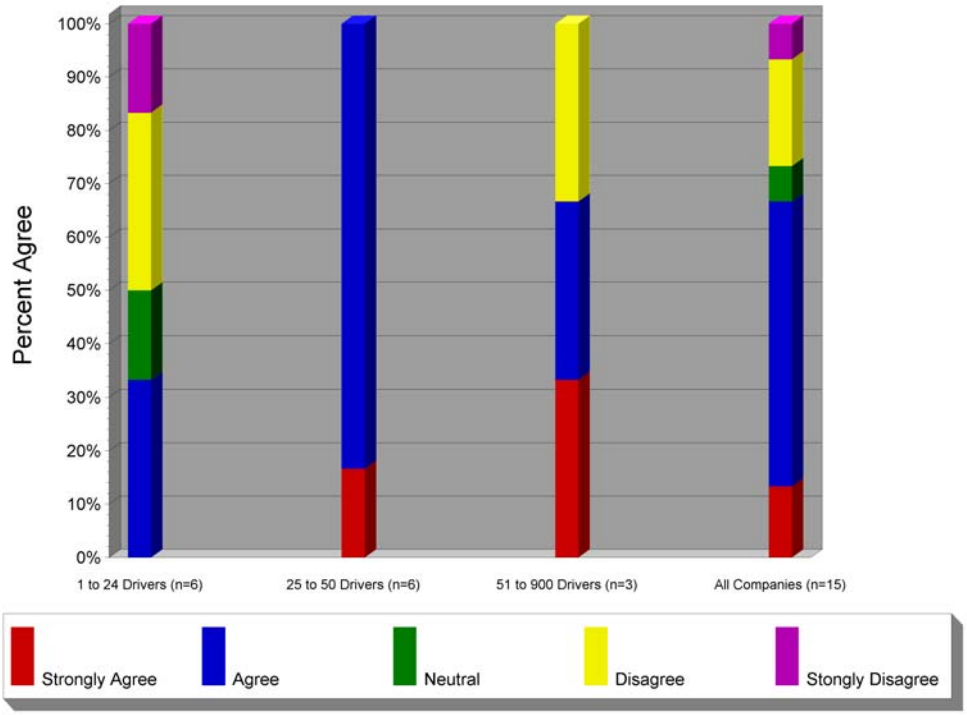



**Figure 3.23 Percent of Commercial Vehicle Operators who Think Information from Sources Other than FORETELL Increases Safety or Reduces Accidents.**

Figure 3.24 indicates whether CVOs felt having information from the FORETELL system increased safety or reduced accidents. Again, many of the CVOs expressed no opinion and felt they had not utilized the system sufficiently to voice an opinion on whether the FORETELL information enhanced safety. Overall, 40 percent of CVOs in all size categories responded "Neither Agree Nor Disagree." However, two of the three larger CVOs responded that information increased safety and reduced accidents. Three of the medium-sized companies did not perceive increased safety as a result of using FORETELL information.

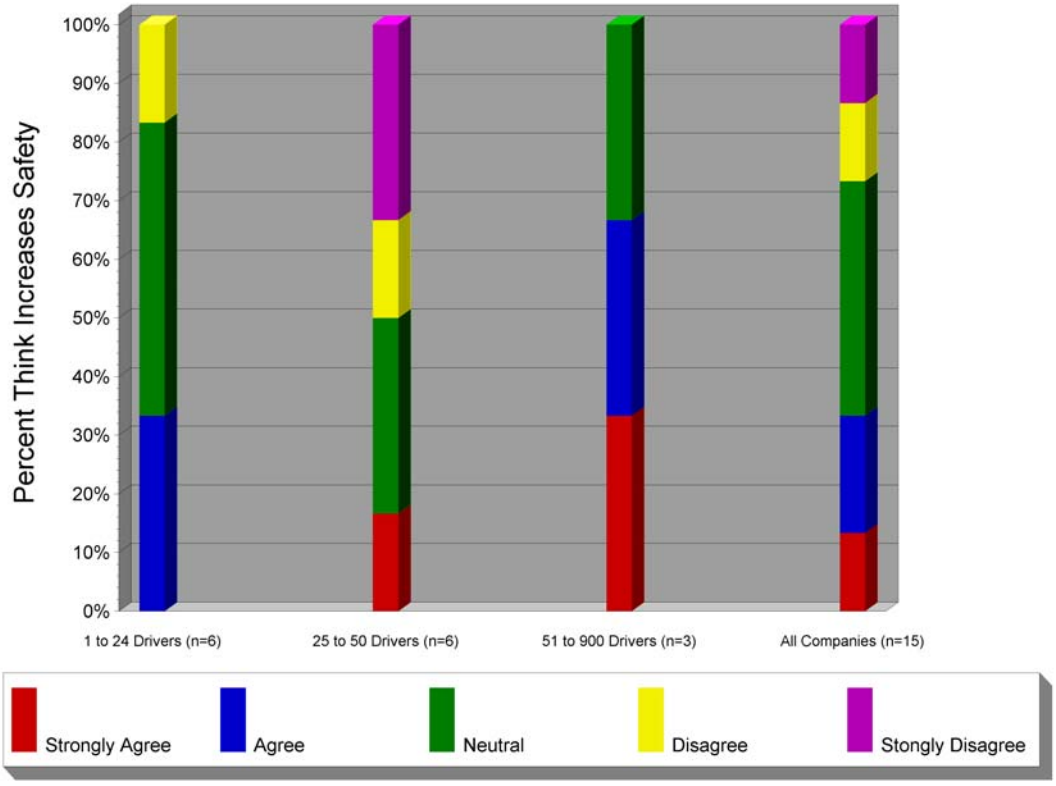



**Figure 3.24 Percent of Commercial Vehicle Operators who Think FORETELL System Information Increases Safety or Reduces Accidents.**

The final question asked if the CVOs would continue to access information from the FORETELL system. Figure 3.25 shows the general responses to this question by company size. Overall, more than 50 percent of the CVOs indicated a willingness to use FORETELL information in the future. However, three of the 12 CVOs responding from small- and medium-sized companies were not willing to use the system in the future. Overall, 20 percent of the CVOs opted to neither agree nor disagree to the continued use of FORETELL.

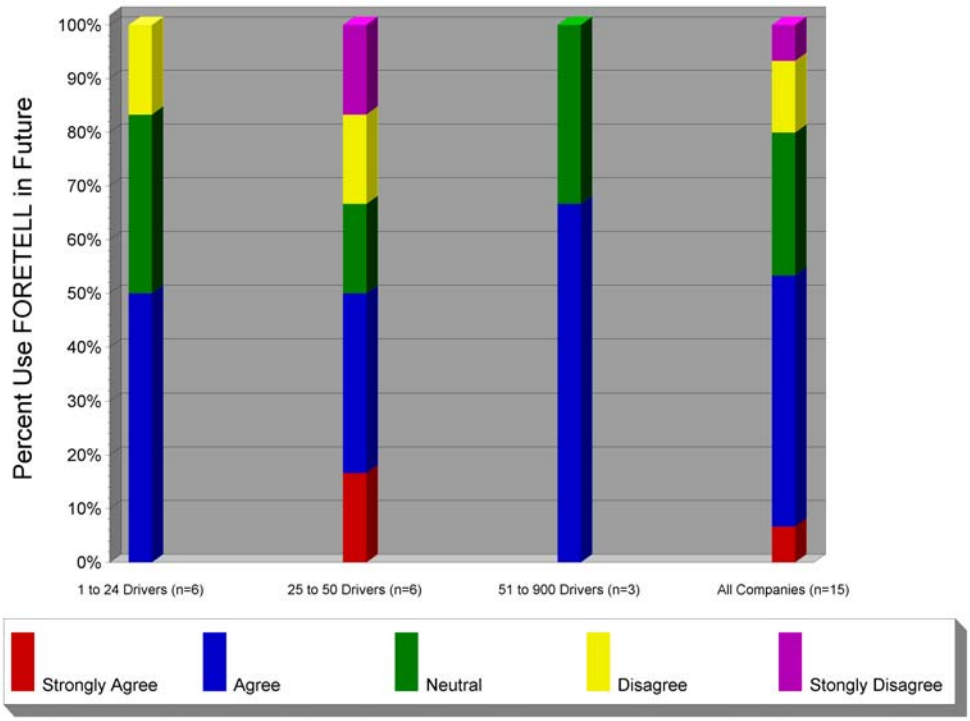



**Figure 3.25 Percent of Commercial Vehicle Operators who Indicated a Willingness to Continue Using FORETELL in the Future.**

#### 3.2.1.6 *Summary of CVO Results*

Key comments and results of the analysis learned from the telephone interview responses are listed below:

- The number of respondents is not sufficient to draw statistically significant conclusions.
- Many personnel suggested that they needed training and a harsher winter to fully take advantage of and test the FORETELL system.
- Through specific comments, CVOs stated that FORETELL information lacked coverage of their entire travel area. However, personnel liked the technology and animation.
- More than 65 percent of CVOs in every size category utilize the Internet for weather and road condition information.
- More than 50 percent of CVOs indicated a willingness to use FORETELL information in the future.

### 3.2.2 Highway Patrol

#### 3.2.2.1 *User Group Overview*

Highway patrol personnel make decisions that frequently must take into account the current and projected weather and pavement conditions. Thus, highway patrol communication personnel from Iowa, Wisconsin, and Missouri were involved in the FORETELL evaluation and made use of the FORETELL website during the winter months of 2001-2002 to better understand winter road surface and weather conditions. The FORETELL system proposed assisting the highway patrol user group in meeting their respective needs with better and more timely weather information.

The effectiveness of FORETELL at disseminating this information to highway patrol officers was evaluated through telephone interviews and records of their access to the FORETELL website. Telephone interviews were conducted to assess the extent of highway patrol use of FORETELL information (user acceptance) and to measure users' ability to improve weather event decisions (decision effectiveness), reduce exposure to unsafe road conditions (safety and security), and reduce delay (efficiency). An interview guide, contained in Appendix C, was developed to assist in conducting the telephone interviews. The guide provided consistency in the interviews while allowing information suitable for analysis to be collected.

The telephone interviews were conducted to gather data evaluating who used the FORETELL system, how well the system worked (system acceptance), for what purpose the

information was used (e.g., officer route or time assignments/planning – decision effectiveness), and whether it provided improvements in safety, mobility, and operation.

Nineteen highway patrol personnel were contacted and agreed to participate in the evaluation. Interviews were completed with information collected from 16 of the 19 highway patrol personnel (7 in Iowa, 2 in Missouri, and 7 in Wisconsin) as shown in Figure 3.26. Low participation by the Missouri highway patrol was apparently due to a lack of Internet access in their district communication offices. (As discussed in Section 4.3, Missouri's headquarters is the only office currently with Internet access.) Where there were multiple FORETELL system users in a single dispatch or communication center, a representative (usually the center manager) for all office personnel completed the interview.

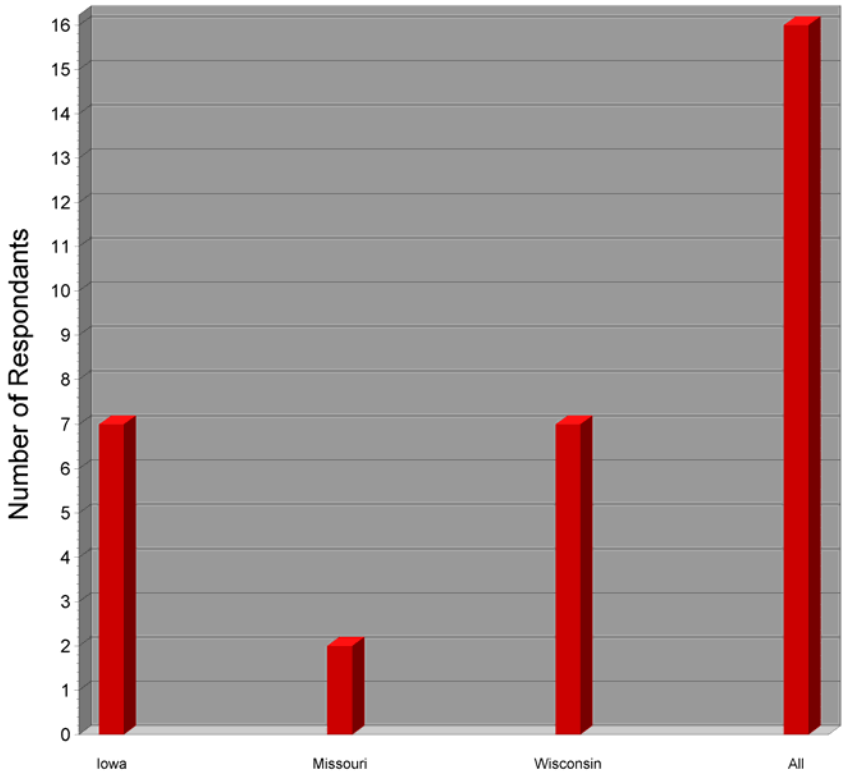



**Figure 3.26 Number of Highway Patrol Personnel Completing Interviews, by State.**

Training materials, including assignments of usernames and passwords, were developed and sent to personnel willing to participate in the evaluation. Figure 3.27 identifies, by state, the percent of highway patrol personnel interviewed who received some kind of FORETELL training material or participated in a training course. The figure also indicates whether personnel found the training to be helpful. A majority of the highway patrol personnel received training or training material; of those, most found it to be useful.

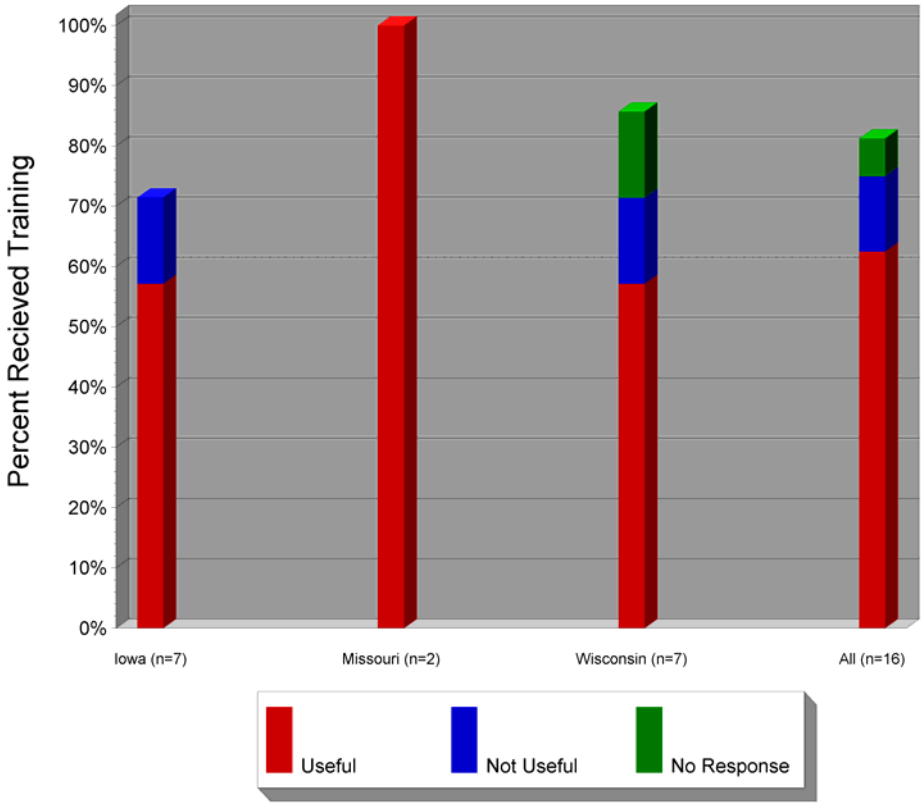



**Figure 3.27 Percent of Highway Patrol Personnel who Received Some Form of Training about the FORETELL System.**

As with CVOs, the highway patrol interview questions strived to understand whether highway patrol personnel accepted weather and road condition information, if the information assisted in the effectiveness of their decisions, and if the information improved operations and safety. These questions were asked under the scenarios of "before knowing of FORETELL" and "after being introduced to FORETELL." Respondents may have differed in their responses to questions because they were uncertain whether the questions assumed that they would replace all other information sources with the FORETELL system or add the FORETELL system to their existing information sources.

### 3.2.2.2 *Information Used*

The first part of the telephone interview concentrated on determining the type of information sought by highway patrol personnel and the sources of that information prior to their knowledge of FORETELL. Figure 3.28 shows the types of information desired by highway patrol personnel for performing their duties. Highway patrol personnel were asked to indicate whether the information obtained was actual or forecasted. Figure 3.28 shows that both actual and forecasted data were sought by users. According to interview responses, actual data were of most interest because users found that forecasted data were often unavailable or inaccurate.

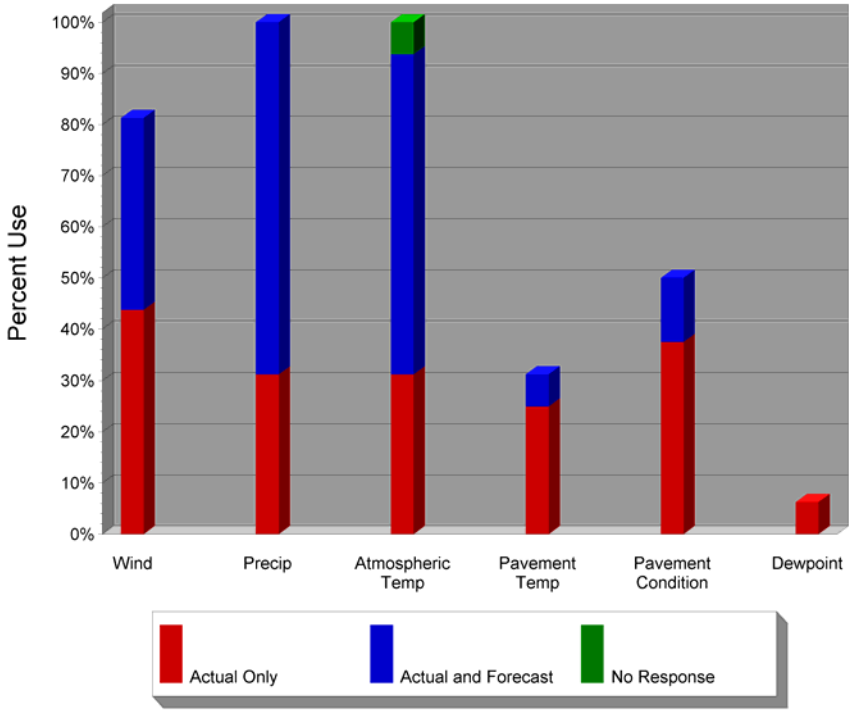



**Figure 3.28 Percent of Highway Patrol Personnel who Indicated Using Various Types of Weather Information.**

Sources (other than FORETELL) used by highway patrol personnel to obtain the needed weather and road condition information are presented in Figure 3.29. The figure also illustrates how often the information was used.

Of the highway patrol personnel who responded to the interview, 68 percent reported using the collected weather and road condition information for highway patrol operations and 39 percent reported that the information was also used for dissemination purposes.

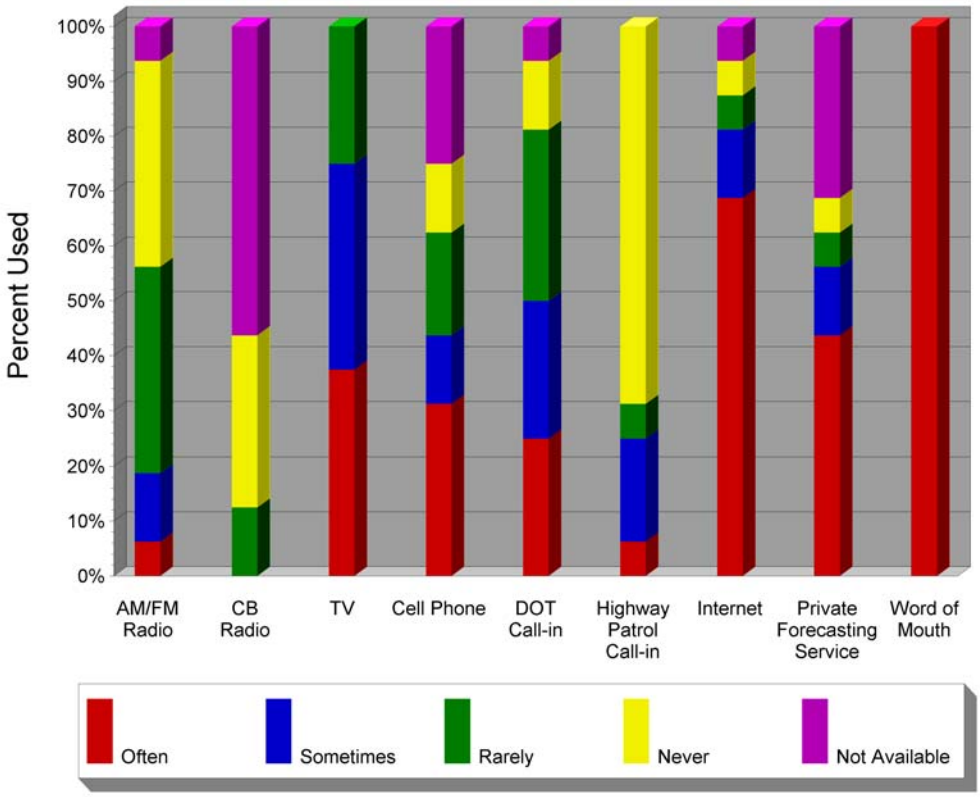



**Figure 3.29 Percent of Highway Patrol Personnel who Indicated Other Sources of Weather Information Were Available to Them and How Often Each Source Was Used.**

Because the FORETELL system is an Internet website, highway patrol personnel were asked if they used the Internet to visit sites providing weather and road condition information before they were introduced to the FORETELL system. Their Internet use is shown in Figure 3.30, by state. Iowa and Wisconsin personnel regularly use the Internet for obtaining needed information. However, Missouri provides Internet access only for upper management. Thus, Missouri's responses to the telephone interview show one of the two respondents using the Internet for weather-related information.

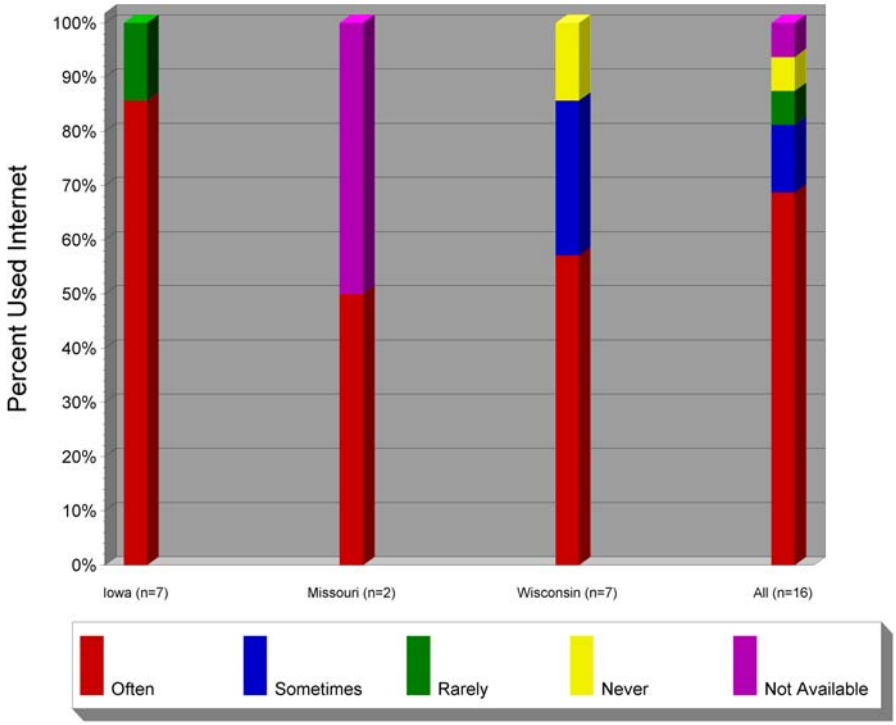



**Figure 3.30 Percent of Highway Patrol Personnel who Indicated Using the Internet to Gather Weather-Related Information, by State.**

### 3.2.2.3 *User Acceptance*

Figure 3.31 shows how well highway patrol personnel accepted weather information obtained from sources other than FORETELL (i.e., under the "before" scenario). With questions ranging from source accessibility and pertinence to particular coverage areas and data accuracy, a majority of the highway patrol respondents agreed or strongly agreed that the information was acceptable. Some respondents were undecided. These general acceptance questions of "before" sources of weather and road condition information provide an overall indication of how well highway patrol personnel accept current weather-related information.

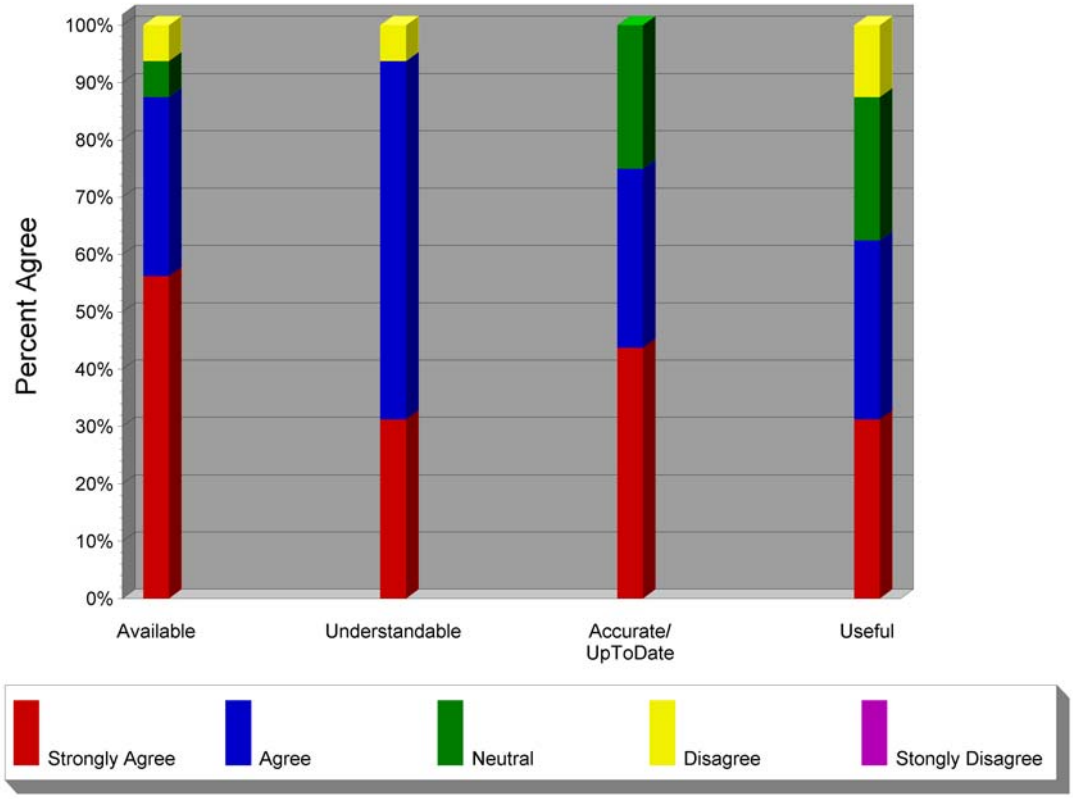



**Figure 3.31 Percent of Highway Patrol Personnel who Indicated Agreement with Certain Characteristics of Weather Information They Received.**

The telephone interview progressed from information sought and used by highway patrol personnel "before" being introduced to the FORETELL system to their acceptance and use of FORETELL information. More detailed questions probed into personnel's acceptance of the information gathered from the FORETELL system. Results of these questions are shown in Figure 3.32. Based on the acceptance responses of the interview in the "before" and "after" scenarios, there were a slightly higher number of highway patrol users who responded that they neither agreed nor disagreed with the "after" questions. However, these differences are not statistically different. This uncertainty may suggest insufficient use of FORETELL during the mild winter season. The mild winter reduced highway patrol personnel's use, testing, and thus familiarization with the new system. Approximately 55 percent to 87 percent of respondents did agree that FORETELL information had characteristics of interest.

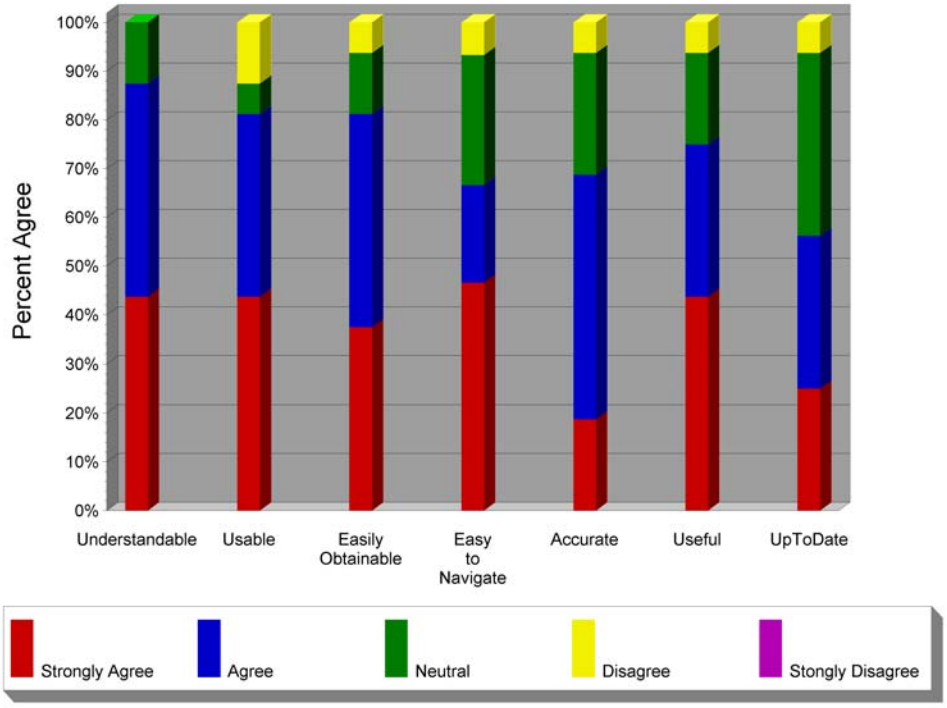



**Figure 3.32 Percent of Highway Patrol Personnel who Indicated Agreement with Certain Characteristics of FORETELL Information.**

The telephone interview included questions asking how often highway patrol personnel used FORETELL and how their use correlated with weather events. Figure 3.33 shows that no respondents used FORETELL on a daily basis. Approximately 80 percent reported using FORETELL information during a weather event, with about 10 percent of those personnel using it hourly. In addition, 50 percent to 60 percent of the respondents used FORETELL before and after weather events.

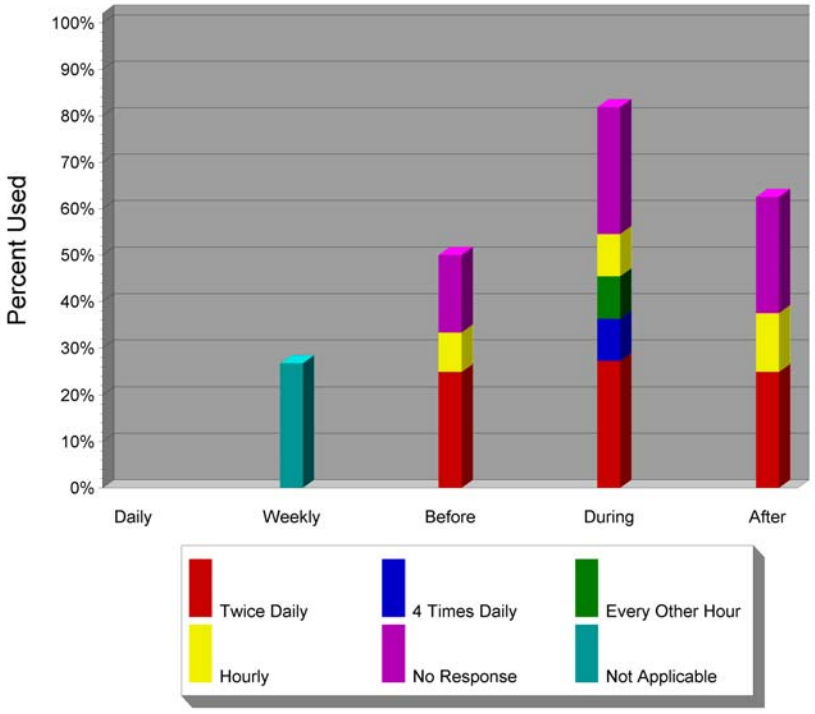



**Figure 3.33 Percent of Highway Patrol Personnel who Indicated Use of FORETELL Information at Various Time Intervals.**

Figure 3.34 indicates the percent of respondents accessing various types of weather information from the FORETELL system. Compared to Figure 3.28, (types of weather information used prior to knowledge of FORETELL), a greater percentage of personnel indicated accessing pavement condition information from the FORETELL system. Dewpoint was not a valuable piece of information to many highway patrol personnel either before (Figure 3.28) or after (Figure 3.34) knowledge of FORETELL. Wind, precipitation, atmospheric temperature, and pavement information were accessed by highway patrol personnel regularly from the FORETELL website.

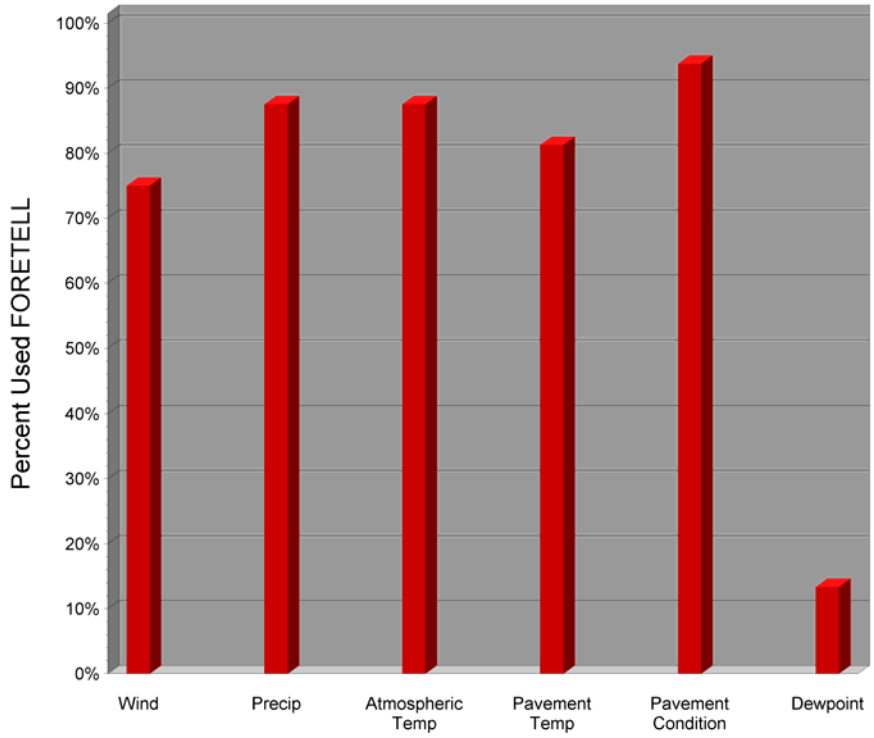



**Figure 3.34 Percent of Highway Patrol Personnel who Indicated Using Various Types of FORETELL Information.**

By assigning usernames and passwords to each evaluation participant, system records could show how often highway patrol personnel accessed the FORETELL system. At times, there appeared to be discrepancies in the frequency of use as noted in the telephone interview and recorded by the FORETELL system. The team based its conclusions on the interview results. However, the system records are summarized here for completeness.

Figure 3.35 shows the number of times each user, by state, accessed the FORETELL website, according to system records. The figure indicates that use of FORETELL was highest in December (green portion) and slowly tapered off by April. Highway patrol personnel's limited access of the system may be a result of mild weather conditions during the 2001-2002-winter.

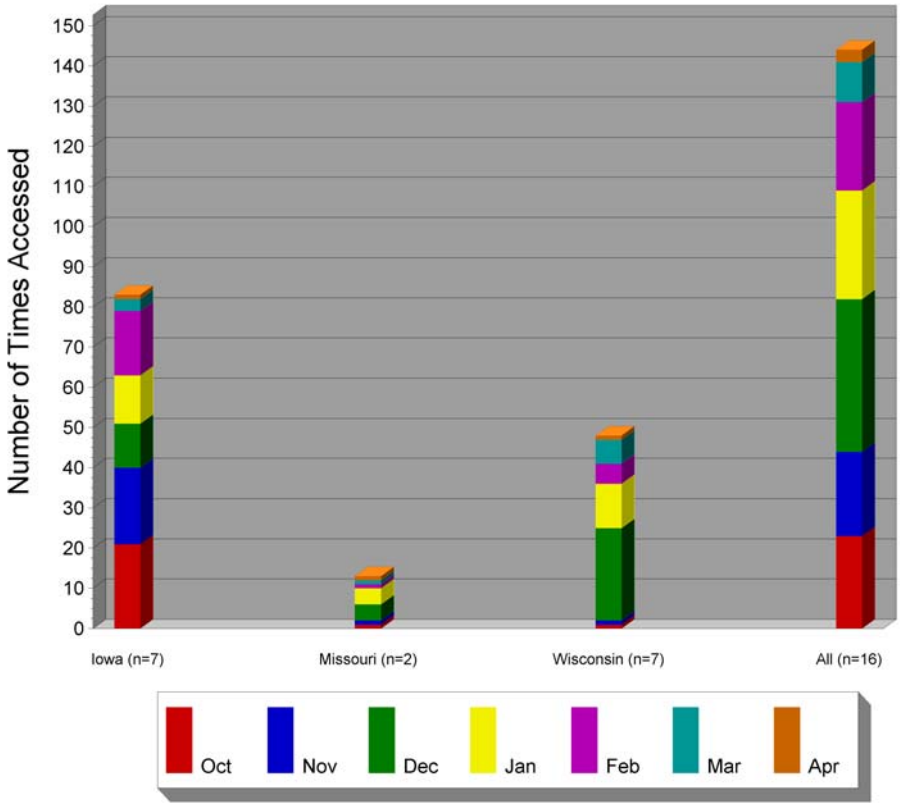



**Figure 3.35 Number of Times Highway Patrol Personnel Accessed the FORETELL Website, According to FORETELL System Records.**

### 3.2.2.4 ***Decision Effectiveness***

Figure 3.36 shows that more than 70 percent of respondents felt that weather information in general was useful in making decisions and helpful in taking specific actions.

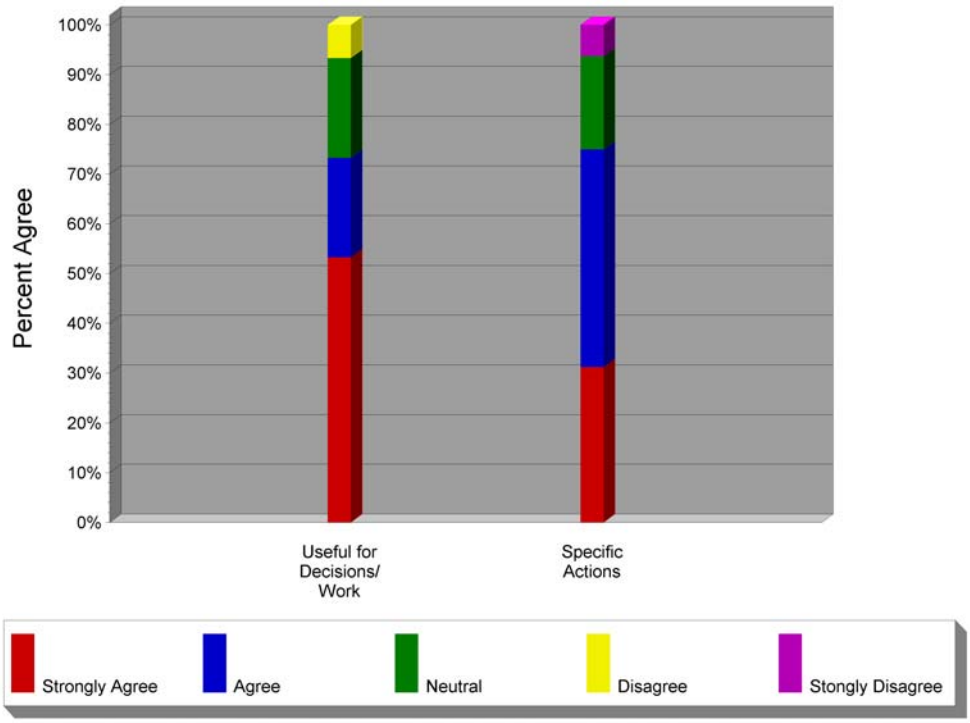



**Figure 3.36 Percent of Highway Patrol Personnel who Indicated Having Weather Information Was Helpful in Their Jobs.**

Figure 3.37 illustrates highway patrol personnel's responses to questions pertaining to the impact of FORETELL information on decision effectiveness. Questions related to the overall efficiency of operations and respondents' confidence in decisions made using FORETELL information. In the "before" scenario, 75 percent of respondents strongly agreed or agreed that other information sources assisted them in carrying out specific actions versus 57 percent of respondents who used the FORETELL system. There was also a difference in the "before" and "after" scenarios for responses related to the usefulness of information for making decisions and for performing general work responsibilities. Approximately 75 percent of highway patrol personnel agreed or strongly agreed that other sources are useful for making decisions and performing general work versus 57 percent who responded favorably when asked this question about FORETELL. The effect of FORETELL information on job performance is illustrated in the Strongly Disagree and Disagree percentages, indicating dissatisfaction. Again, this may be related to a lack of familiarity with the system due to insufficient use during a mild winter.

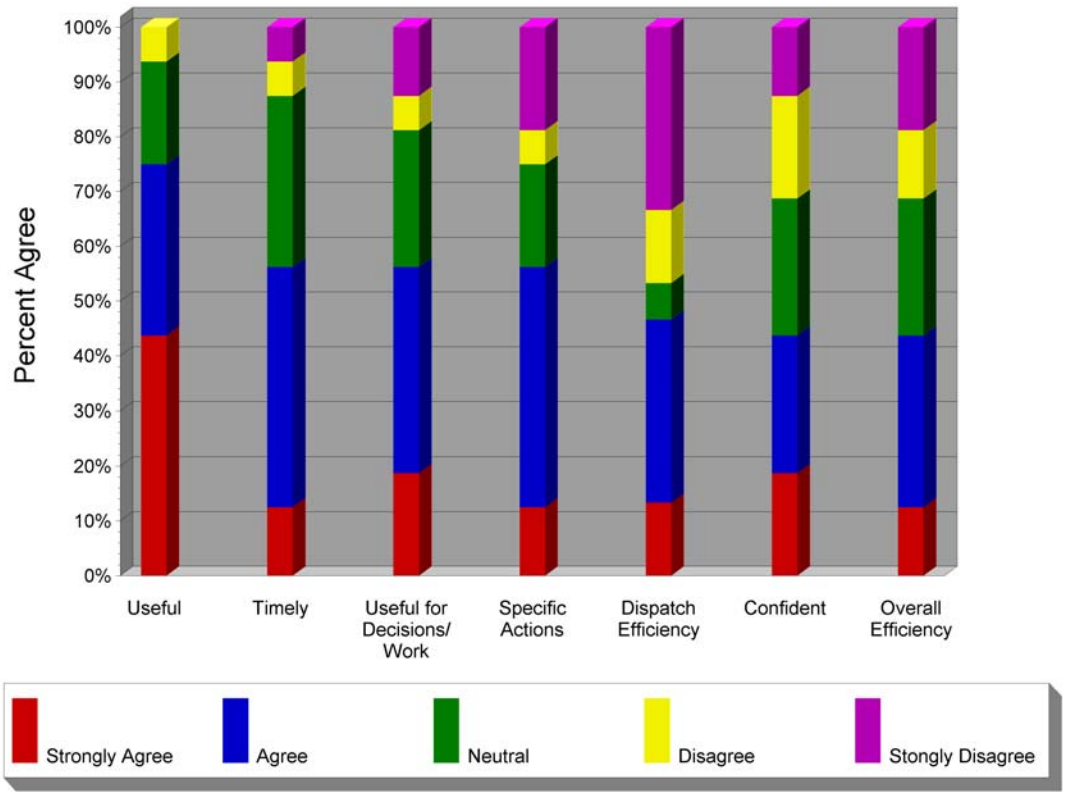



**Figure 3.37 Percent of Highway Patrol Personnel who Agreed to Improved Job Performance Using FORETELL Information.**

### 3.2.2.5 *Other Factors*

Figure 3.38 indicates whether highway patrol personnel felt having information from the FORETELL system increased their safety or reduced accidents among them. Responses concerning safety are provided for each state. Many of the highway patrol personnel expressed that they had not utilized the system enough to voice an opinion on whether the information enhanced safety. However, more than 20 percent of respondents did perceive an improvement in safety with the use of FORETELL information.

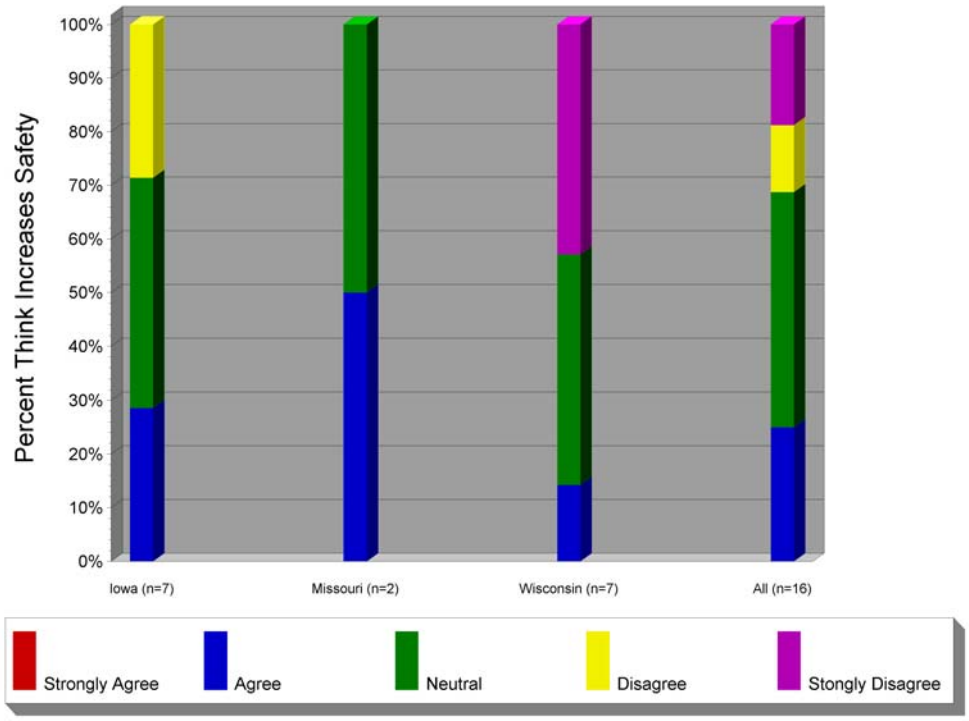



**Figure 3.38 Percent of Highway Patrol Personnel who Think FORETELL System Information Increases Safety or Reduces Accidents, by State.**

Finally, the questionnaire asked if highway patrol personnel would continue to access information from the FORETELL system. Figure 3.39 illustrates the general responses to this question by state, which demonstrates some interest in the new system. Respondents stated that FORETELL had potential.

Seven of the nine respondents in Iowa and Missouri stated that they would continue using the system in the future if it were available. A majority of Wisconsin respondents felt that system improvements needed to be made before they would commit to the continued use of FORETELL. Approximately 25 percent of highway patrol personnel interviewed chose to neither agree nor disagree when asked if they would continue their use of the FORETELL system.

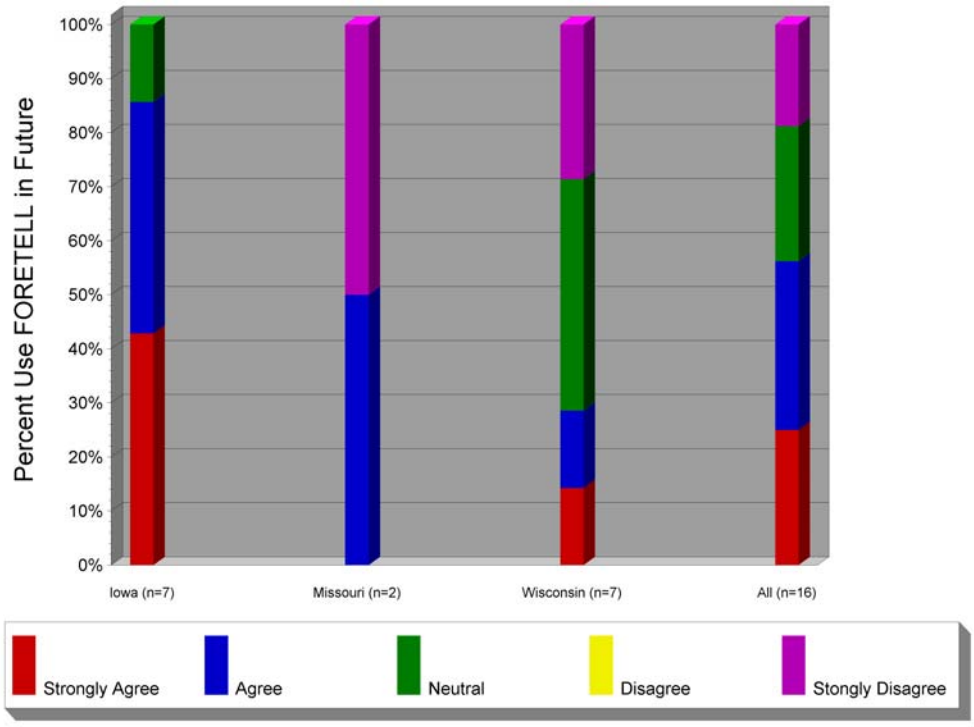



**Figure 3.39 Percent of Highway Patrol Personnel who Indicated a Willingness to Continue Using FORETELL in the Future, by State.**

### 3.2.2.6 ***Summary of Highway Patrol Results***

Key comments and results of the analysis of the telephone interview responses are listed below. Note that these results are based on at most 16 individuals. While a general sense of FORETELL performance can be developed, firm conclusions should be avoided.

- Highway patrol personnel had limited use of the FORETELL system because of the mild winter. They did not feel that they had fully tested its capabilities.

- Highway patrol users responded "Neither Agree Nor Disagree" to many questions because they had not sufficiently used the system to make a decisive judgment.

- Highway patrol personnel felt the FORETELL system had potential; however, they would rather pursue a system that could be integrated into their current operating systems and tools rather than add yet another, more complicated, layer to their operations.

- A majority of highway patrol users responding to interviews indicated a willingness to continue using FORETELL in the future.

### 3.2.3 School Administrators

#### 3.2.3.1 *User-Group Overview*

Nine school administration personnel in Iowa were identified as potential users of FORETELL during the winter of 2001-2002. Most of these personnel were school superintendents. One was Director of Personnel. The nine Iowa school administration personnel identified were part of a University of Northern Iowa (UNI) program to bring weather information to schools. As part of the UNI program, all nine school administrators attended training for FORETELL and for another weather information service.

In order to evaluate the use of FORETELL and its impacts on user decisions, a hard-copy questionnaire and an activity/weather log were developed to collect data from the nine school administration personnel identified as potential users of FORETELL. In January 2002, activity/weather logs were mailed to the nine school administrators to collect weather-related information on a per-event basis. In April 2002, hard-copy, self-administered questionnaires were mailed to the nine school administration personnel along with postage-paid return envelopes. Copies of the school administrator activity/weather log and questionnaire are provided in Appendix D.

Few data were obtained from this data collection effort. One activity/weather log was returned. Five of the nine (56%) school administration personnel surveyed returned questionnaires. Of these, three respondents did not complete the survey beyond the third question because they did not use FORETELL. This section summarizes the results of the school administrator survey and activity/weather log information collected for the winter of 2001-2002. Table D-1 in Appendix D contains the summarized responses to the school administrator survey.

#### 3.2.3.2 *Information Used*

The school administrator survey was designed to gather details regarding the types of weather-related information that are useful and accessible to school administrators in making decisions such as whether to cancel school, close school early, reroute buses, and so on. Four survey respondents indicated the types of information that they used in making weather-related management decisions. All four used snow accumulation, precipitation, atmospheric temperature, and radar. Three of the four also used road conditions and visibility information in making weather-related management decisions. Whether respondents used forecast information or actual readings varied.

Only two survey respondents indicated that they used FORETELL. Both respondents relied most heavily on local weather information for atmospheric temperature, with one respondent commenting that it was easier to access than FORETELL. Both relied most heavily on FORETELL for radar information. One respondent also relied on FORETELL for accumulation, precipitation, road conditions, and visibility. The other respondent commented that he relied on local television/radio reports in addition to FORETELL because it was a trial year for the FORETELL system.

The activity/weather log was also designed to gather information regarding the types of weather-related information that are useful and accessible to school administrators, as well as information on weather events that occurred, decisions made, weather information used, and outcomes that resulted from the event (e.g., bus accidents). A single activity/weather log was returned indicating a snow event with accumulation and drifting. The respondent used FORETELL during the event to obtain the following types of weather-related information: accumulation, road decision support, precipitation, atmospheric temperature, road snow depth, road conditions, radar, and visibility. The respondent also used local television stations and web sites for atmospheric temperature and road condition information. Both forecast and actual readings were used for all types of weather information obtained.

Notable comments from the two survey respondents who used FORETELL related to the accuracy of information obtained from FORETELL. One respondent commented that the information from FORETELL was very accurate. The other noted that, compared to local television and radio, FORETELL provided more accurate information, more quickly.

Both respondents agreed that the information from FORETELL was understandable, usable, accurate, easily obtainable, and useful. Neither respondent used FORETELL daily, but both respondents used FORETELL weekly, in advance of a weather event, and during a weather event.

#### 3.2.3.3 ***User Acceptance***

One of the respondents who used FORETELL during the winter of 2001-2002 commented that the winter was very mild and he did not need to use FORETELL very often. Three respondents indicated that they did not use FORETELL because the winter was too mild. Another school administrator returned the cover letter with a note stating that he was not able to complete the survey because the weather was so mild. The winter weather obviously had an effect on these respondents' needs for weather-related information and, thus, their use, or lack of use, of FORETELL. Both of the respondents who used FORETELL stated that they would like to use FORETELL again.

#### 3.2.3.4 ***Decision Effectiveness***

Both survey respondents who used FORETELL agreed that:

- Information from FORETELL helped them make more effective decisions to close schools early, close schools for the day, and change bus routing or scheduling;
- They were more confident in their decisions when they used information from FORETELL;
- FORETELL provided timely (up-to-date) information for making weather-related decisions; and
- FORETELL information helped to improve the overall efficiency of their operations.

The single activity/weather log received reported no decisions made as a result of a winter snow event.

#### 3.2.3.5 *Other Factors*

Both survey respondents who used FORETELL agreed that FORETELL information helps to improve safety or reduce accidents. Additional comments from these respondents related to the feasibility of schools using FORETELL. One respondent reported problems logging onto FORETELL from the school's computer system. One respondent commented that FORETELL is a useful aid but that it may be difficult for the school to justify expending funds for the service at the present time.

#### 3.2.3.6 *Summary of School Administrator Results*

It is important to note that the school administrators' use of FORETELL was limited due to the mild winter and that the number of respondents who used FORETELL during the winter of 2001-2002 (2) is not sufficient to draw statistically significant conclusions. Based on the responses from these two school administration personnel, FORETELL:

- Improved the overall efficiency of school administration operations,
- Improved safety/reduces accidents,
- Provided timely (up-to-date) information for making weather-related decisions,
- Increased confidence in making weather-related decisions, and
- Helped school administrators make more effective decisions.

Both respondents who used FORETELL felt that FORETELL was useful and indicated that they would like to continue using the system. However, it is uncertain whether school administrators would be willing to pay for information from FORETELL.

### 3.2.4 Transit Operators

#### 3.2.4.1 *User Group Overview*

Fourteen transit agencies were identified as potential FORETELL system users. Nine of these agencies were in Iowa and were identified by FORETELL through contact by the Iowa Department of Transportation. The evaluation team also verified through both electronic mail and telephone contact that the nine transit agencies in Iowa planned to participate. The evaluation team solicited an additional four agencies in Missouri and one in Kansas (Kansas City, Missouri, area) to participate in the FORETELL evaluation.

The evaluation of the transit agency users was anticipated to be a telephone survey. Appendix E contains the interview guide developed for this purpose. The interview would ascertain the acceptance by transit agencies of the FORETELL system and its effectiveness in making decisions. Twelve of the fourteen agencies were contacted by telephone, but limited responses to the interview questions were obtained.

#### 3.2.4.2 *Information Used*

Nine of the agencies contacted indicated that they did not use FORETELL during the winter of 2001-2002:

- One of the non-users indicated that he was unable to access the system.
- Another non-user said that he used local media for information.
- A third non-user stated that he found it easier to use a different website.
- A fourth indicated that he had used it last year, but tried once this year and had trouble accessing the system.

In contrast to the responses by the nine agency contacts indicating that they did not use FORETELL during the winter of 2001-2002, the user log for the winter of 2001-2002 (provided by Castle Rock Consultants) indicated that of the documented non-user agencies, one had accessed FORETELL 39 times: 24 times in March and 15 times in April. Another non-user agency had accessed FORETELL 33 times: 26 times in March and 7 times in April. No explanation for these apparent discrepancies can be offered other than the agency contact did not wish to be interviewed, the contact person forgot about accessing FORETELL, or the contact person was not the person who accessed the FORETELL site. Due to limited responses to the telephone interviews, no information was obtained on the different types of weather-related information used by transit operators.

#### 3.2.4.3 *User Acceptance/Decision Effectiveness*

There were few responses to interviews and little use of FORETELL by transit agencies. The three agencies that used FORETELL provided the following anecdotal comments:

- One stated that FORETELL was not helpful.

- One used FORETELL during two storms and thought that the information might be useful for street maintenance operations but was not helpful for his operations.

- The third stated that he could not understand whether or not FORETELL was useful for decision-making. He did access road temperatures a couple of times when it was raining ("just to see if it would help"). However, he mostly relied on a local television station to track a storm's progress. He commented that, "In reality, though, the weather wasn't bad enough to give the system a fair shot."

#### 3.2.4.4 *Summary of Transit Agency Results*

Though limited responses were obtained from transit agencies, the following observations are offered:

- The number of responses is not sufficient to draw any solid conclusions.

- For the agencies providing feedback, training is essential to ensure that users know how to access the available information and to demonstrate how to incorporate the appropriate information into their decision processes.

- The weather during the winter of 2001-2002 may have been too mild to provide sufficient significant weather events to test users' acceptance of the system.

### 3.2.5 Traffic Managers

#### 3.2.5.1 *User Group Overview*

The final potential user group of the FORETELL system evaluation was traffic managers. This user group consisted conceptually of state DOT or local government agency personnel with at least somewhat comprehensive responsibility for managing transportation infrastructure components aimed at improving traffic operations. Personnel making transportation impact decisions are generally also linked to a wide variety of information sources in order to maintain a clear, resolute picture of the changing conditions on facilities within their purview. In the current transportation management environment, this user group consists almost exclusively of traffic operations center personnel.

Prior to the evaluation period, only two traffic managers from local traffic operation centers were identified as potential users to participate in the evaluation. While other traffic operations centers in the three-state region covered by FORETELL were contacted, none was both fully operational and prepared to engage in use of the system. While a FORETELL training session was not provided to personnel at either of these centers, both were provided a training guide and users' manual. These documents served as the means for this user group to understand the use of and access to the FORETELL system.

Personnel at one of the centers reported using the FORETELL system on a number of occasions and, therefore, were able to provide valuable feedback regarding their use of the system. The director of the center was interviewed by telephone using the traffic manager's interview guide created prior to the evaluation period. The director indicated that three of the seven staff members had used the system. This respondent received feedback from the staff and incorporated their FORETELL experiences into the survey responses. The traffic managers interview guide is provided in Appendix F.

#### 3.2.5.2 *Information Used*

While the operations center personnel did use the FORETELL system, the respondent commented that their winter was also more mild than typical. Nonetheless, the responses indicated that personnel accessed the FORETELL site daily and, in association with weather events, they sought the same kinds of information that they had used prior to FORETELL. Specifically, they used precipitation, temperature, and pavement conditions both prior to and during the evaluation period. In addition, they also indicated that they obtained wind speed information from the FORETELL web site.

#### 3.2.5.3 *User Acceptance*

Personnel found the site easy to access and understandable by comparison with other sources of information. However, they noted some problems with the system from their standpoint. First, the information was not detailed enough or specific enough to the areas in which the center was interested. Second, access to the FORETELL system was not integrated into the systems already in use at the center. This meant that operators had to pull away from their normal duties and more traffic-oriented applications to access the FORETELL site. Also, using FORETELL required Internet access, which may not always be available on all of the workstations in the center. The director interviewed did not feel that the center would continue to access the FORETELL system for weather information due to the lack of integration into their existing systems. The benefits of the FORETELL system did not seem to warrant the extra effort required to access an independent system to obtain information that they can generally access through other means.

#### 3.2.5.4 *Decision Effectiveness*

The director's responses indicated that personnel thought that the information was accurate but that they were not always able to verify the accuracy. They found that the information was useful to some degree in aiding the center in taking action and that the information helped them to do this more efficiently and confidently. They were able to use the information to assist in adapting traffic control timing, roadway closures, and warning sign deployments, and in their duties to pass information on to others. However, the respondent did not feel that they had an opportunity to integrate use of the system into their daily operations enough to be certain of this.

#### 3.2.5.5 *Other Factors*

Other possibilities, such as increased safety or reduced crashes, were also noted as potential benefits but could not be determined during this brief evaluation period.

#### 3.2.5.6 *Summary of Traffic Manager Results*

The traffic manager (center director) felt that the FORETELL system had great potential to improve overall efficiency if used as a primary source of weather and road condition information. The responses, however, indicated that the center did not have ample experience with the system to be confident in the accuracy of the information, to integrate the system into their operations, or to fully explore the possible applications for using the information.

### 3.3 Comparison across User Groups

This section presents information comparing the responses among the six user groups. Information for transit operators is limited because no interviews were actually completed. The discussion is arranged into categories that explain the types of information used, opinions regarding that information, and the value of using that information.

Table 3.1 (at the end of this chapter) summarizes the responses obtained from each of the user groups during their respective interview or survey. Each column contains the percentage of respondents who indicated the particular item of interest, along with the number of respondents upon which the percentage is based. Results are presented in this manner because not all respondents answered every question. The total number of respondents within each user group is reported in the column headings. The table is categorized into User Information, User Acceptance, Decision Effectiveness, and Summary groupings.

### 3.3.1 Information Used

Information Used encompasses the various types of weather information obtained before and after FORETELL implementation. Respondents reported their use of wind speed or direction, precipitation, atmospheric temperature, pavement temperature, pavement condition, and/or dewpoint information in their decisions. In addition, they stated whether this information was obtained, along with how often, from the FORETELL system.

Figures 3.40 – 3.42 illustrate the User Information results. Note that when interpreting the graphical results, Table 3.1, presented at the end of this chapter, should be referenced to determine how many responses were available for each particular item. Figure 3.40 shows that a large majority of the users in each group indicated using precipitation, atmospheric temperature, and pavement condition in their weather-related decisions, regardless of the source of the information. Fewer respondents from each group indicated using wind speed/direction and pavement temperature, while only HMOs indicated prevalent use of dewpoint information in their decisions.

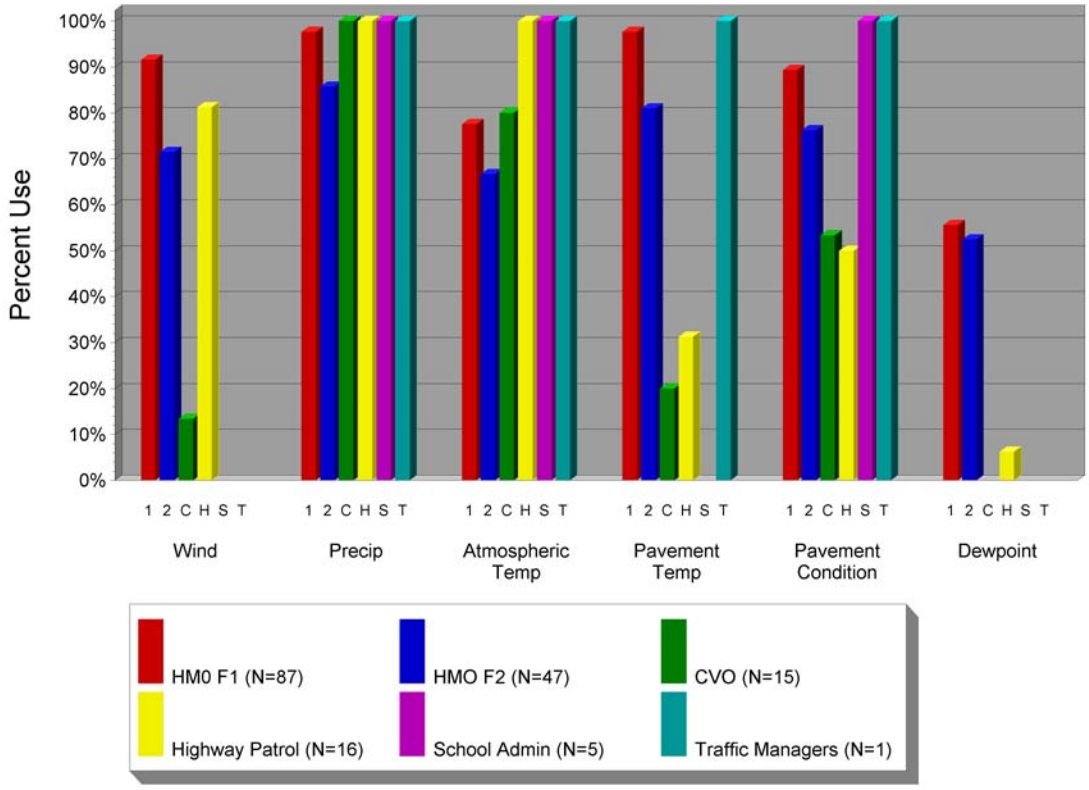



**Figure 3.40 Percent of Respondents Indicating Use of Various Types of Information in Making Weather-Related Decisions, by User Group.**

Figure 3.41 summarizes the number of users who obtained information from the FORETELL system. Not all respondents acquired the information that they used in their decisions from the system. In fact, about half as many HMO respondents indicated receiving their information from FORETELL, with the exception of dewpoint. More of the highway patrol and CVO respondents specified obtaining pavement temperature and condition data from FORETELL than actually using FORETELL information in their decisions. This suggests that some users access FORETELL to peruse the available data even though they typically do not utilize that type of information. The results presented in Figures 3.40 and 3.41 indicate that, although users did access FORETELL information, they still relied heavily on their previous sources of information. This could change over time as users become more familiar with and gain confidence in the FORETELL system.

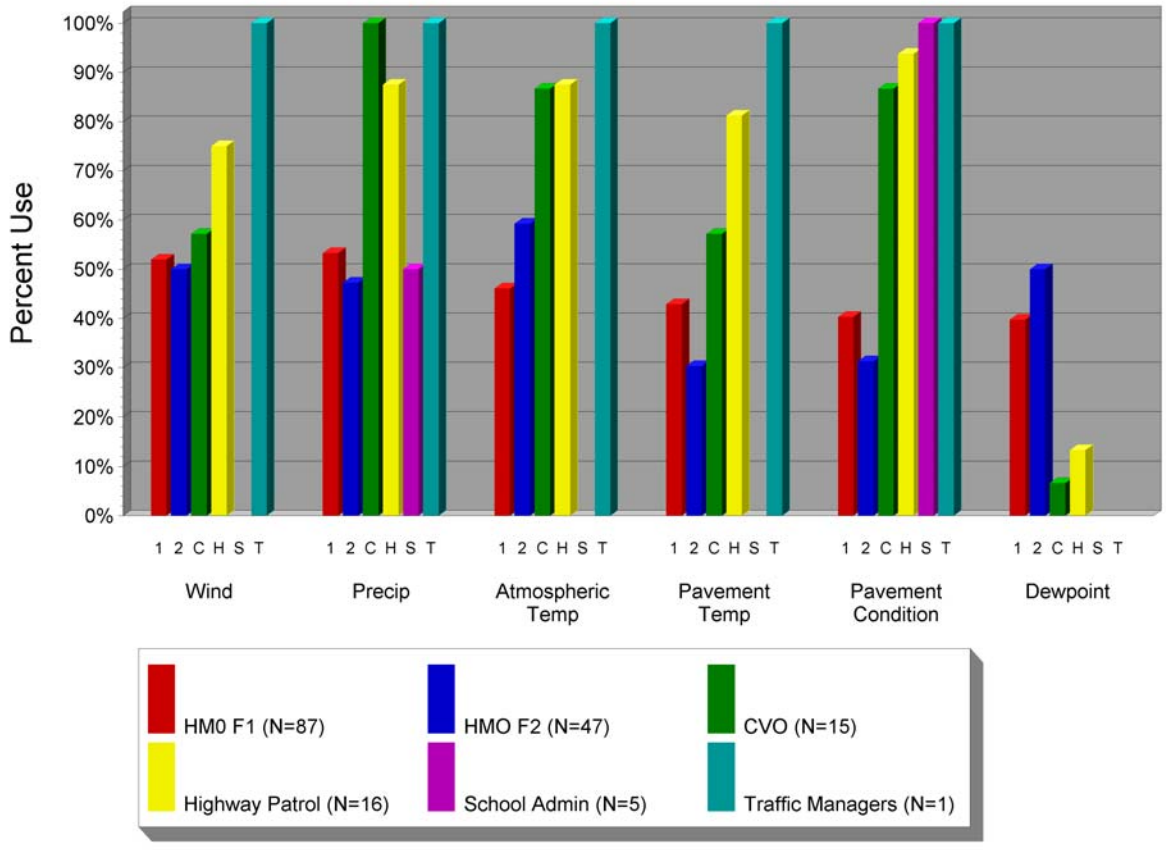



**Figure 3.41 Percent of Respondents Who Indicated Obtaining Various Types of Information from FORETELL, by User Group.**

Not many interviewed respondents reported accessing FORETELL information daily or even weekly. However, Figure 3.42 shows that reported access to FORETELL increased prior to and during a weather event.

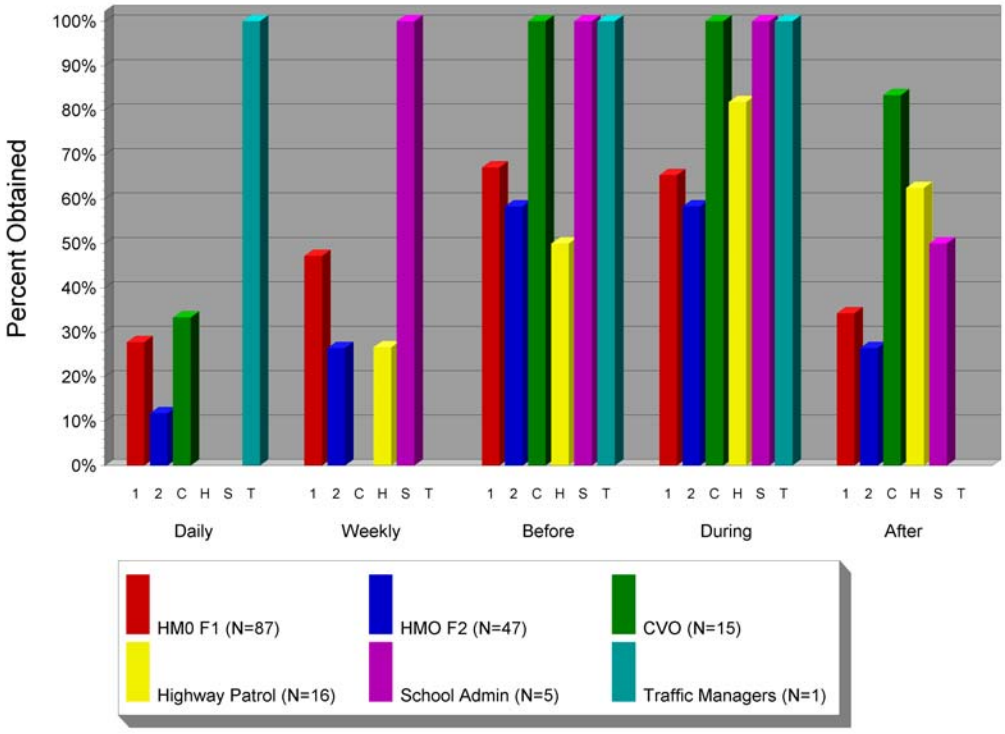



**Figure 3.42 Percent of Respondents Indicating How Often FORETELL Information was Obtained, by User Group.**

### 3.3.2 User Acceptance

User acceptance refers to opinions the user has regarding specific attributes of FORETELL information. Figure 3.43 presents the percent of respondents in each user group who agree or strongly agree that the FORETELL information is understandable, usable, easily obtainable, accurate, up-to-date, and/or useful. The figure shows that a majority of respondents in each user group agree with the listed characteristics. CVOs reported the fewest number of favorable responses. However, some traits are defined by as few as five respondents, as presented in Table 3.1.

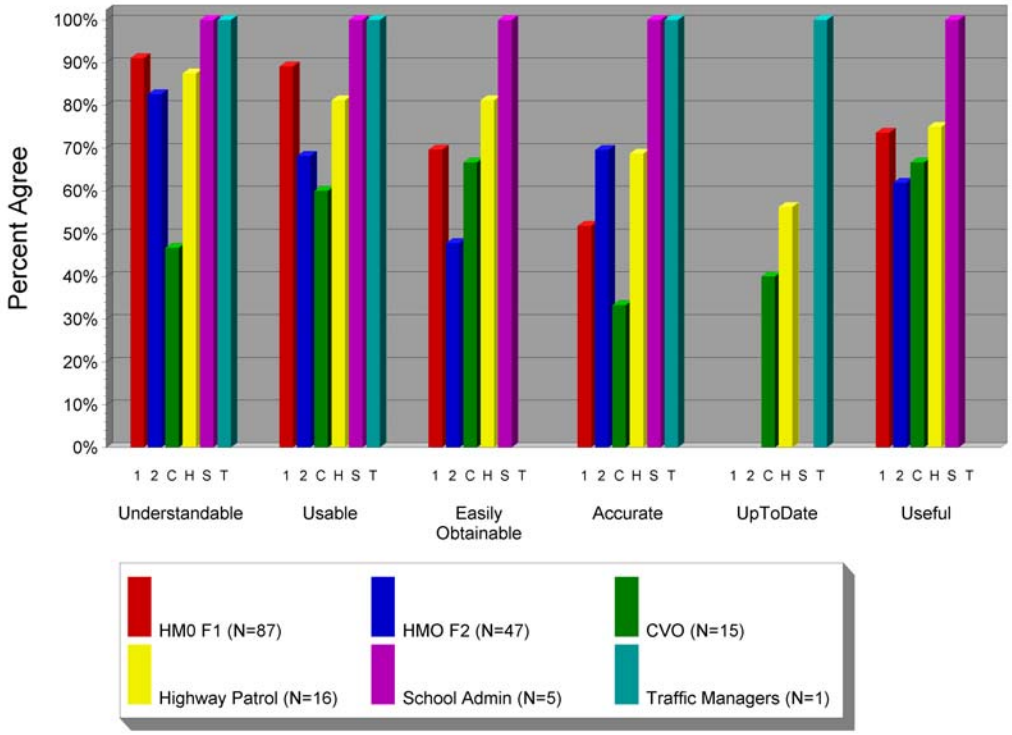



**Figure 3.43 Percent of Respondents Indicating Agreement with Certain Characteristics Associated with FORETELL Information, by User Group.**

### 3.3.3 Decision Effectiveness

Decision effectiveness characterizes the impact that using FORETELL information had on the respondents' weather-related decisions. For instance, Figure 3.44 illustrates that around 40 percent of the HMO respondents and more than half of the highway patrol and CVO respondents received FORETELL information in a timely manner. Less than 30 percent of the HMO users feel more confident in their decisions when FORETELL information is used, and less than 30 percent of HMO users believe that the information improves safety and/or efficiency of their operations. However, between 30 percent and 40 percent of HMO users indicated that they changed their decision based on FORETELL information.

Greater than 40 percent of the highway patrol and CVO users stated that they were more confident when FORETELL information was used and that it improved their operational efficiency. The figure illustrates that FORETELL did not have an impact on changing decisions or improving safety for many highway patrol and CVO personnel. Even though the graph depicts 100 percent agreement among traffic managers and school administrators for most of the attributes, those results are based on one or two total respondents.

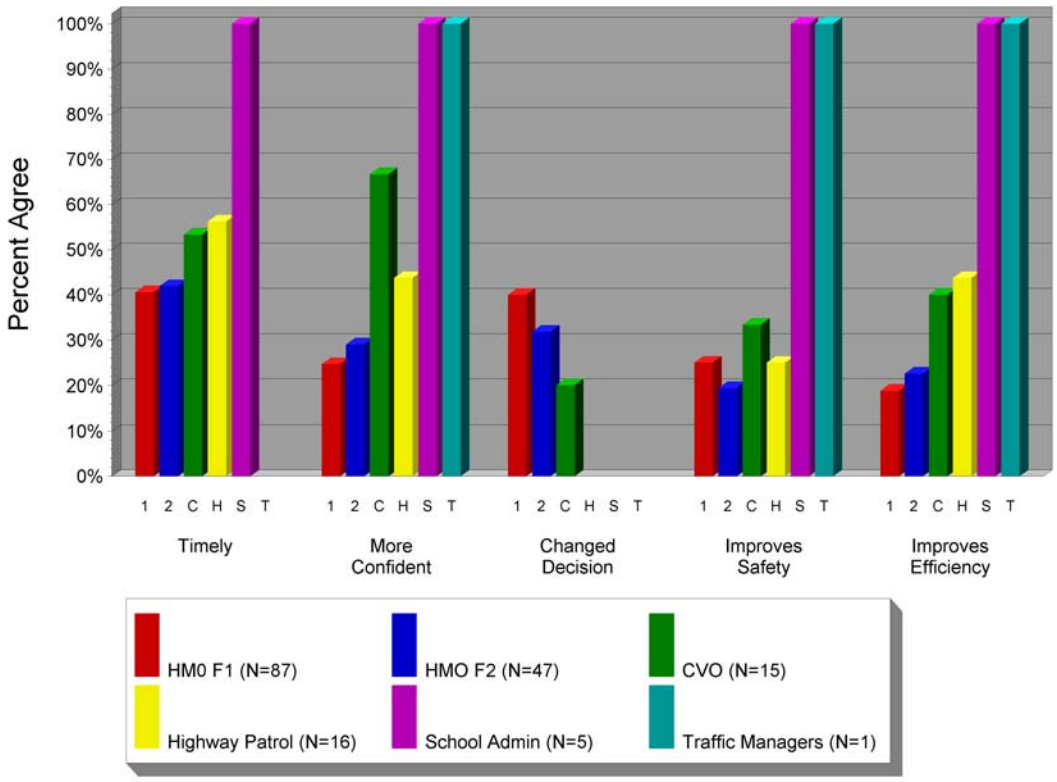



**Figure 3.44 Percent of Respondents Indicating Agreement with Decision Effectiveness Aspects of FORETELL Information, by User Group.**

### 3.3.4 Summary of Results across All Respondents

This section presents the general FORETELL experience reported by respondents, along with their future intentions regarding the FORETELL system. Figure 3.45 displays the percent of respondents indicating that they received FORETELL system training, used FORETELL information, wish to continue using FORETELL, and/or are willing to pay for the FORETELL services. The HMO surveys did not directly ask if the respondent received FORETELL training or used FORETELL. However, it is known that some training sessions were held for this user group. Other questions in the surveys provide a general description of the use patterns among HMO respondents. Section 2.3 presents further details on FORETELL system access for all user groups.

More than 70 percent of respondents in the other user groups indicated receiving some FORETELL training or training materials. All of the highway patrol, CVO, and traffic manager personnel used the FORETELL system during the winter of 2001-2002. However, the number of times the system was used was limited due to mild weather conditions. Greater than 50 percent of all respondents indicated a desire to continue using the FORETELL system in the future. However, less than 20 percent were willing to pay for the service.

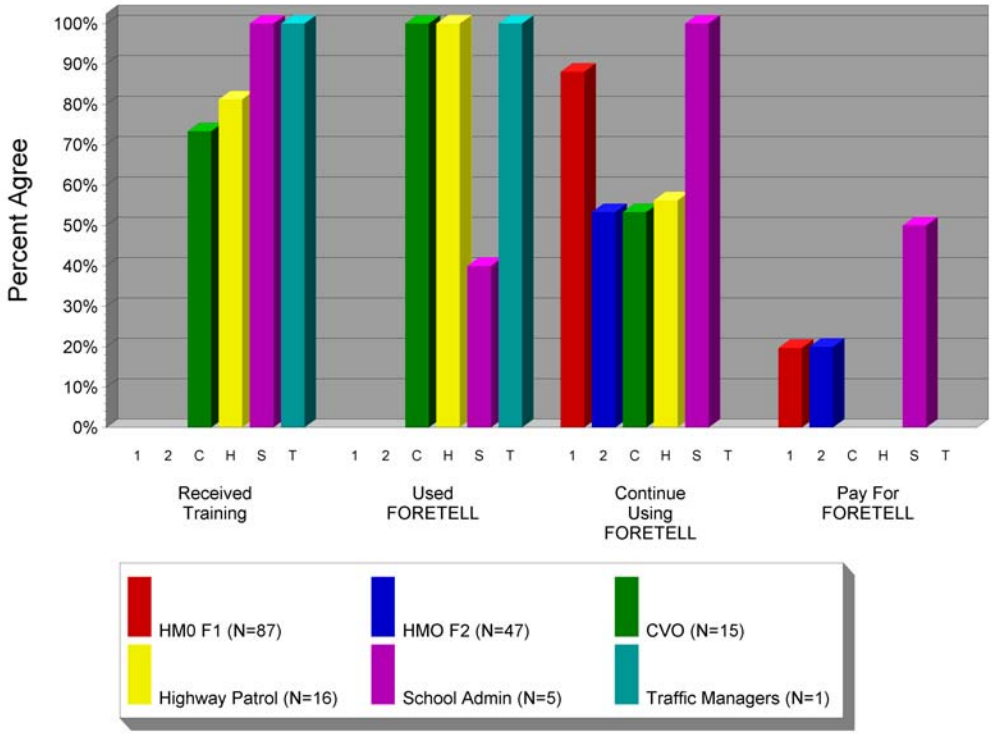



**Figure 3.45 Percent of Respondents Indicating General FORETELL Experience and Future FORETELL Intentions, by User Group.**

## Table 3.1 Comparison of Responses to Similar FORETELL Interview/Survey Questions Among the User Groups [1]

| Question | Response | Percentage (Number of Positive Responses)[2] | | | | | |
|---|---|---|---|---|---|---|---|
| | | HMO First Follow-Up (N=87) | HMO Second Follow-Up (N=47) | Highway Patrol (N=16) | Commercial Vehicle Operators (N=15) | Traffic Managers (N=1) | School Administrators (N=5) |
| **User Information** | | | | | | | |
| What types of weather information do you use in making decisions? | Wind Speed or Direction | 91.57% (76) | 71.43% (30) | 81.25% (13) | 13.33% (2) | 0.00% (0) | 0.00% (0) |
| | Precipitation | 97.65% (83) | 85.71% (36) | 100.00% (16) | 100.00% (15) | 100.00% (1) | 100.00% (4) |
| | Atmospheric Temperature | 77.50% (62) | 66.67% (28) | 100.00% (16) | 80.00% (12) | 100.00% (1) | 100.00% (4) |
| | Pavement Temperature | 97.62% (82) | 80.95% (34) | 31.25% (5) | 20.00% (3) | 100.00% (1) | 0.00% (0) |
| | Pavement Conditions | 89.29% (75) | 76.19% (32) | 50.00% (8) | 53.33% (8) | 100.00% (1) | 100.00% (3) |
| | Dewpoint | 55.56% (45) | 52.38% (22) | 6.25% (1) | 0.00% (0) | 0.00% (0) | 0.00% (0) |
| What types of information do you obtain from FORETELL? | Wind Speed or Direction | 51.95% (40) | 50.00% (14) | 75.00% (12) | 57.14% (8) | 100.00% (1) | 0.00% (0) |
| | Precipitation | 53.25% (41) | 47.22% (17) | 87.50% (14) | 100.00% (15) | 100.00% (1) | 50.00% (1) |
| | Atmospheric Temperature | 46.05% (35) | 59.26% (16) | 87.50% (14) | 86.67% (13) | 100.00% (1) | 0.00% (0) |
| | Pavement Temperature | 42.86% (33) | 30.30% (10) | 81.25% (13) | 57.14% (8) | 100.00% (1) | 0.00% (0) |
| | Pavement Conditions | 40.26% (31) | 31.25% (10) | 93.75% (15) | 86.67% (13) | 100.00% (1) | 100.00% (1) |
| | Dewpoint | 39.73% (29) | 50.00% (10) | 13.33% (2) | 6.67% (1) | 0.00% (0) | 0.00% (0) |
| How often do you obtain information from the FORETELL system? | Daily | 27.78% (20) | 11.76% (4) | 0.00% (0) | 33.33% (1) | 100.00% (1) | 0.00% (0) |
| | Weekly | 47.14% (33) | 26.47% (9) | 26.67% (4) | 0.00% (0) | 0.00% (0) | 100.00% (2) |
| | In advance of a weather event | 67.11% (51) | 58.33% (21) | 50.00% (6) | 100.00% (5) | 100.00% (1) | 100.00% (2) |
| | During a weather event | 65.33% (49) | 58.33% (21) | 81.82% (9) | 100.00% (11) | 100.00% (1) | 100.00% (2) |
| | After a weather event | 34.25% (25) | 26.47% (9) | 62.50% (5) | 83.33% (5) | 0.00% (0) | 50.00% (1) |

[1] No information is presented for the Transit Operators since official interviews could not be completed.
[2] Statistics are based on the responses provided to each question.
[3] This question was not asked on the HMO surveys. However, the operators did receive some training.
[4] This question was not directly asked on the HMO surveys. However, user access information was available from Castle Rock. See Section 2.3 for more details.

**Table 3.1 Comparison of Responses to Similar FORETELL Interview/Survey Questions Among the User Groups [1] (continued)**

| Question | Response | Percentage (Number of Positive Responses)[2] | | | | | |
|---|---|---|---|---|---|---|---|
| | | HMO First Follow-Up (N=87) | HMO Second Follow-Up (N=47) | Highway Patrol (N=16) | Commercial Vehicle Operators (N=15) | Traffic Managers (N=1) | School Administrators (N=5) |
| **User Acceptance** | | | | | | | |
| The information obtained from the FORETELL system was: | Under-standable | 91.07% (51) | 82.61% (19) | 87.50% (14) | 46.67% (7) | 100.00% (1) | 100.00% (1) |
| | Usable | 89.09% (49) | 68.18% (15) | 81.25% (13) | 60.00% (9) | 100.00% (1) | 100.00% (2) |
| | Easily Obtainable | 69.64% (39) | 47.83% (11) | 81.25% (13) | 66.67% (10) | 0.00% (0) | 100.00% (2) |
| | Accurate | 51.85% (28) | 69.57% (16) | 68.75% (11) | 33.33% (5) | 100.00% (1) | 100.00% (2) |
| | Up-to-Date | N/A | N/A | 56.25% (9) | 40.00% (6) | 100.00% (1) | N/A |
| | Useful | 73.58% (39) | 61.90% (13) | 75.00% (12) | 66.67% (10) | 0.00% (0) | 100.00% (2) |
| **Decision Effectiveness** | | | | | | | |
| FORETELL provides information is a timely manner. | Yes | 40.58% (28) | 41.94% (13) | 56.25% (9) | 53.33% (8) | 0.00% (0) | 100.00% (2) |
| You are more confident in your decisions when using FORETELL information. | Yes | 24.64% (17) | 29.03% (9) | 43.75% (7) | 66.67% (10) | 100.00% (1) | 100.00% (2) |
| You changed your decision based on information from FORETELL. | Yes | 40.00% (18) | 31.82% (7) | N/A | 20.00% (3) | N/A | 0.00% (0) |
| FORETELL information helps to improve safety and reduce accidents. | Yes | 25.00% (17) | 19.35% (6) | 25.00% (4) | 33.33% (5) | 100.00% (1) | 100.00% (2) |
| FORETELL information helps to improve the efficiency of your operations. | Yes | 18.84% (13) | 22.58% (7) | 43.75% (7) | 40.00% (6) | 100.00% (1) | 100.00% (2) |

1 No information is presented for the Transit Operators since official interviews could not be completed.
2 Statistics are based on the responses provided to each question.
3 This question was not asked on the HMO surveys. However, the operators did receive some training.
4 This question was not directly asked on the HMO surveys. However, user access information was available from Castle Rock. See Section 2.3 for more details.

## Table 3.1 Comparison of Responses to Similar FORETELL Interview/Survey Questions Among the User Groups [1] (continued)

| Question | Response | Percentage (Number of Positive Responses)[2] | | | | | |
|---|---|---|---|---|---|---|---|
| | | HMO First Follow-Up (N=87) | HMO Second Follow-Up (N=47) | Highway Patrol (N=16) | Commercial Vehicle Operators (N=15) | Traffic Managers (N=1) | School Administrators (N=5) |
| **Summary** | | | | | | | |
| Did you receive any FORETELL Training? | Yes | N/A[3] | N/A[3] | 81.25% (13) | 73.33% (11) | 100.00% (1) | 100.00% (5) |
| Did you use FORETELL? | Yes | N/A[4] | N/A[4] | 100.00% (16) | 100.00% (15) | 100.00% (1) | 40.00% (2) |
| Do you want to use FORETELL in the future? | Yes | 88.06% (59) | 53.33% (16) | 56.25% (9) | 53.33% (8) | 0.00% (0) | 100.00% (2) |
| Are you willing to pay for FORETELL? | Yes | 19.70% (13) | 20.00% (6) | N/A | N/A | N/A | 50.00% (1) |

[1] No information is presented for the Transit Operators since official interviews could not be completed.
[2] Statistics are based on the responses provided to each question.
[3] This question was not asked on the HMO surveys. However, the operators did receive some training.
[4] This question was not directly asked on the HMO surveys. However, user access information was available from Castle Rock. See Section 2.3 for more details.

# 4.0 EXTERNAL FACTORS

This chapter provides details on factors beyond the control of the evaluation team that had significant impacts on the results. Section 4.1 provides a detailed analysis of the weather information collected from HMOs during the evaluation. Sections 4.2 and 4.3 describe the System Performance and Institutional Performance evaluations, respectively.

## 4.1 Weather Analysis

Part of the evaluation data collection included activity/weather logs completed by the Highway Maintenance Operators (HMOs) in Iowa and Missouri. A separate log was to be completed for each weather event. Information was collected on the temperature and precipitation of each event, along with maintenance information such as worst pavement conditions, road surface treatments, and whether or not FORETELL was used. This section presents a summary of the activity/weather log data for the three winter seasons of data collection.

Tables 4.1 to 4.3 illustrate the number of logs that were completed, the type and average amount of precipitation reported, and the average minimum and maximum atmospheric temperatures reported during the events. Note that the event durations vary and could occur overnight. The information is presented separately by month for November through April 1999 – 2002.

**Table 4.1 Activity/Weather Log Summary Table - 1999-2000**

| | 1999-2000 | | | | | | |
|---|---|---|---|---|---|---|---|
| | Number of Events (from 37 Operators) (Average Precipitation in Inches, Number Average Based on) | | | | | | |
| | November | December | January | February | March | April | All |
| Snow | 1 (3.00, 1) | 66 (2.59, 56) | 75 (2.43, 56) | 33 (3.63, 24) | 9 (2.71, 7) | 2 (10.00, 1) | 186 (2.76, 145) |
| Freezing Rain | 0 | 8 (N/A) | 18 (0.18, 6) | 9 (0.25, 2) | 0 | 0 | 35 (0.20, 8) |
| Frost | 0 | 12 (N/A) | 2 (N/A) | 0 | 0 | 0 | 14 (N/A) |
| Rain | 0 | 5 (0.63, 2) | 11 (0.07, 4) | 8 (0.83, 3) | 1 (0.10, 1) | 0 | 25 (0.41, 10) |
| | | | | | | | |
| Number of Events | 1 | 84 | 91 | 37 | 9 | 2 | 224 |
| Average Atmospheric Temperature Range (F) | 20.0 - 32.0 | 19.0 - 29.4 | 19.9 - 30.1 | 25.9 - 31.6 | 29.7 - 34.8 | 30.0 - 38.5 | 21.0 - 30.4 |

## Table 4.2 Activity/Weather Log Summary Table - 2000-2001

| | 2000-2001 | | | | | | |
|---|---|---|---|---|---|---|---|
| | Number of Events (from 28 Operators) (Average Precipitation in Inches, Number Average Based on) | | | | | | |
| | November | December | January | February | March | April | All |
| Snow | 5 (3.00, 1) | 90 (3.84, 69) | 44 (1.52, 26) | 28 (1.87, 17) | 7 (2.67, 3) | 0 | 174 (2.99, 116) |
| Freezing Rain | 2 (N/A) | 22 (0.52, 10) | 9 (0.27, 3) | 16 (0.33, 6) | 2 (N/A) | 0 | 51 (0.42, 19) |
| Frost | 0 | 0 | 5 (N/A) | 4 (N/A) | 0 | 0 | 9 (N/A) |
| Rain | 1 (N/A) | 6 (0.25, 1) | 11 (0.67, 6) | 4 (1.00, 2) | 7 (0.11, 1) | 9 (N/A) | 38 (0.64, 10) |
| | | | | | | | |
| Number of Events | 6 | 101 | 58 | 42 | 13 | 9 | 229 |
| Average Atmospheric Temperature Range (F) | 24.3 - 29.5 | 9.3 - 19.8 | 24.1 - 31.1 | 20.2 - 28.9 | 31.5 - 35.5 | 52.1 - 61.6 | 18.7 - 27.2 |

## Table 4.3 Activity/Weather Log Summary Table - 2001-2002

| | 2001-2002 | | | | | | |
|---|---|---|---|---|---|---|---|
| | Number of Events (from 14 Operators) (Average Precipitation in Inches, Number Average Based on) | | | | | | |
| | November | December | January | February | March | April | All |
| Snow | 1 | 22 (0.86, 9) | 26 (2.63, 18) | 20 (1.63, 8) | 17 (2.65, 15) | 2 (N/A) | 88 (2.16, 50) |
| Freezing Rain | 1 (0.25, 1) | 2 (N/A) | 10 (0.50, 1) | 0 | 7 (0.50, 2) | 0 | 20 (0.44, 4) |
| Frost | 0 | 6 (0.50, 1) | 7 (N/A) | 8 (N/A) | 4 (N/A) | 0 | 25 (0.50, 1) |
| Rain | 2 (0.25, 2) | 3 (N/A) | 1 (2.50, 1) | 4 (0.37, 3) | 7 (0.34, 4) | 4 (0.50, 1) | 21 (0.54, 11) |
| | | | | | | | |
| Number of Events | 2 | 31 | 39 | 30 | 27 | 7 | 136 |
| Average Atmospheric Temperature Range (F) | 30.5 - 36.5 | 22.2 - 27.6 | 24.4 - 29.9 | 24.9 - 30.3 | 20.3 - 30.7 | 37.9 - 44.1 | 24.1 - 30.5 |

The following figures present analogous information. Figure 4.1 shows that about the same number of activity/weather logs were completed during the winters of 1999-2000 and 2000-2001. However, this does not necessarily imply that the winters had the same number of weather events. The winter of 1999-2000 was the baseline year of data collection, with 37 different HMOs reporting events (approximately six logs per operator). The winter of 2000-2001 had only 28 different HMOs reporting events (~ eight logs per operator). Far fewer logs (136) were completed by 14 HMOs during the final evaluation year (~ ten logs per operator).

The climatological data in Section 2.2 show that the winter of 2000-2001 was colder and had more precipitation than the other two evaluation winters. The activity/weather log results seem to be inconsistent with this fact, since the number of logs completed per operator increased throughout the evaluation period. This discrepancy may be due to the smaller number of operators participating over time or a learning curve among the operators to report *all* weather events, including those with only rain or frost. Also, some operators completed more logs, on average, than others.

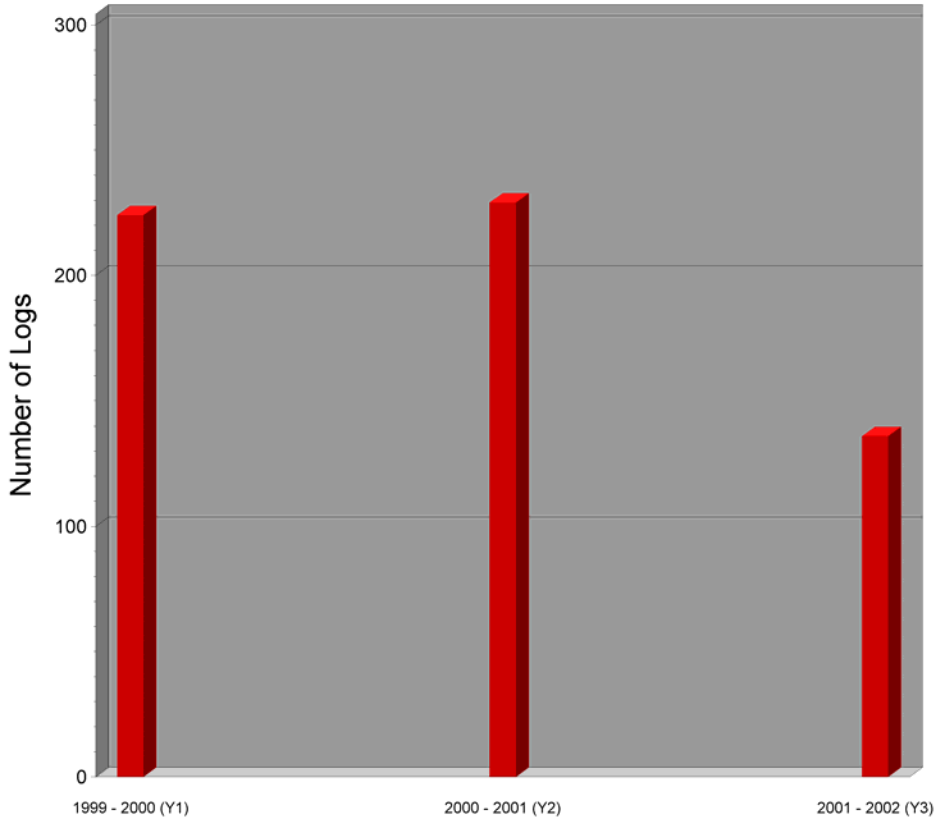



**Figure 4.1 The Number of Activity/Weather Logs Completed by Evaluation Year.**

Figure 4.2 presents the percent of events in each evaluation year that reported various types of precipitation. Understandably, the majority of events in each year reported snow. In addition, the figure shows that while not statistically significant, there was a general increase in the percentage of the events reporting the types of precipitation requiring little or no intervention on the part of HMOs. For example, more events in the final evaluation year reported frost than rain.

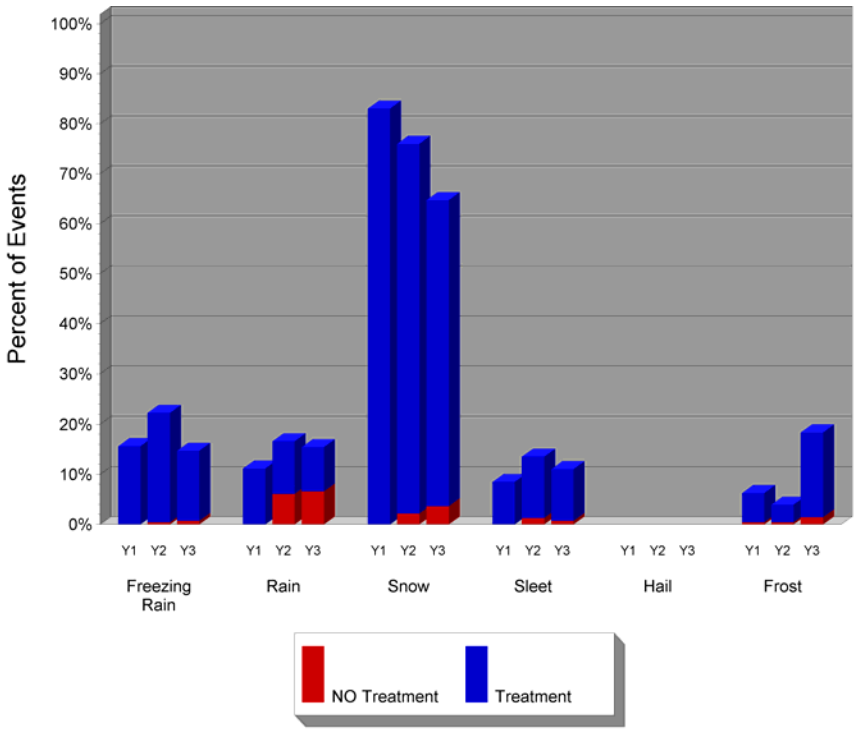



**Figure 4.2 The Percentage of Weather Events Reported to Have Various Types of Precipitation.**

Figure 4.3 shows the average low and average high temperatures per reported event. The figure shows that the event temperatures stayed fairly consistent across the evaluation period. However, the temperatures for the events reported in the second year of the evaluation were slightly lower, which is consistent with the climatological data presented in Section 2.2.

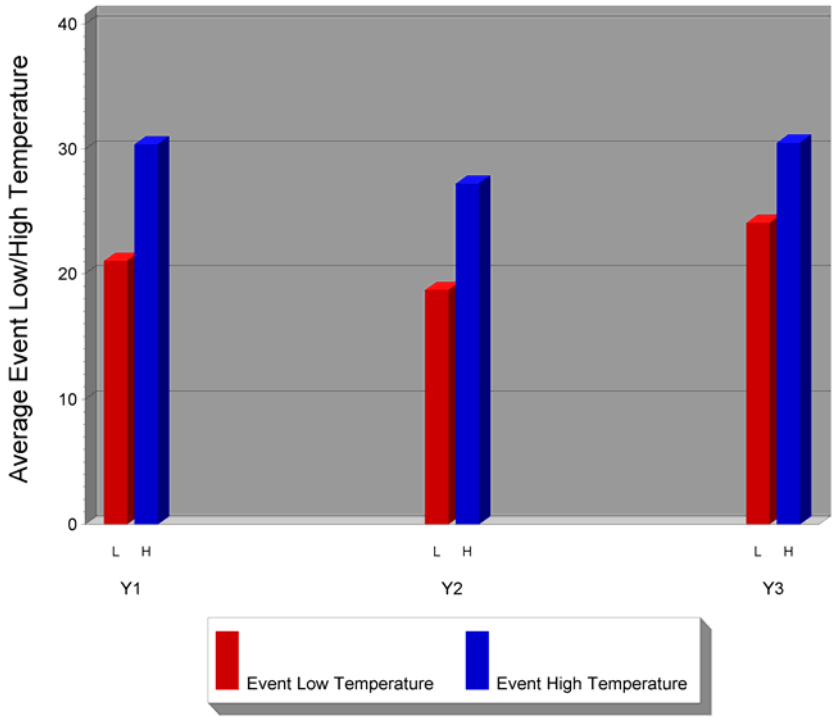



**Figure 4.3 The Average Low and Average High Temperatures per Reported Weather Event.**

Figures 4.4 – 4.6 illustrate the worst and targeted pavement conditions associated with each event for each year of data collection. The figures indicate that the worst pavement condition among the reported events decreased in severity during the evaluation period, with the majority of the worst conditions being "Patchy Snow or Ice" for the last two winters. In addition, while the targeted condition was "Bare Pavement" for approximately 90 percent of the reported events in all three seasons, the winter of 2000-2001 may have had more severe events, as evidenced by the target conditions of "Plowed and Treated" and "Wheel Tracks Bare."

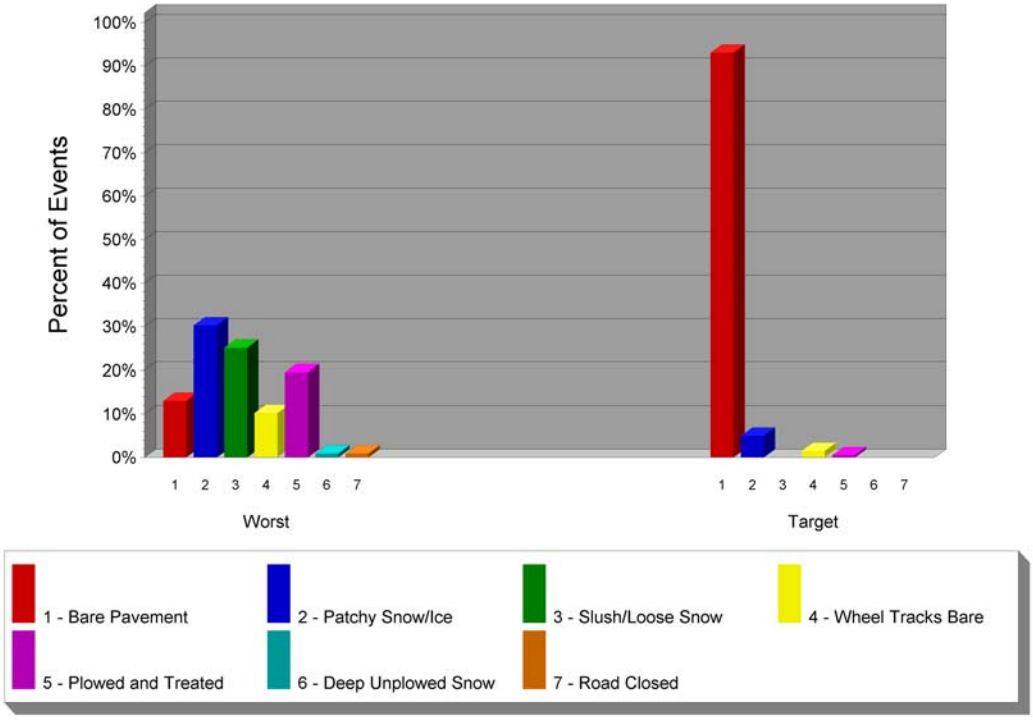



**Figure 4.4 Percent of Events Reporting Various Worst and Targeted Pavement Conditions for Evaluation Year 1 (1999-2000).**

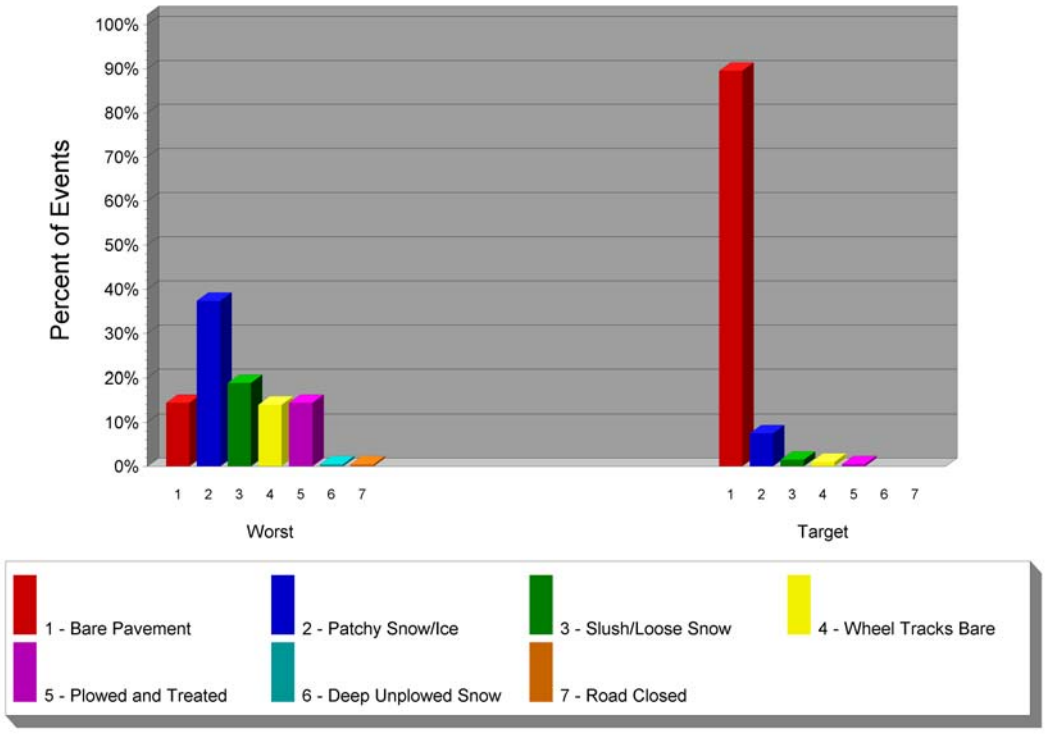



**Figure 4.5 Percent of Events Reporting Various Worst and Targeted Pavement Conditions for Evaluation Year 2 (2000-2001).**

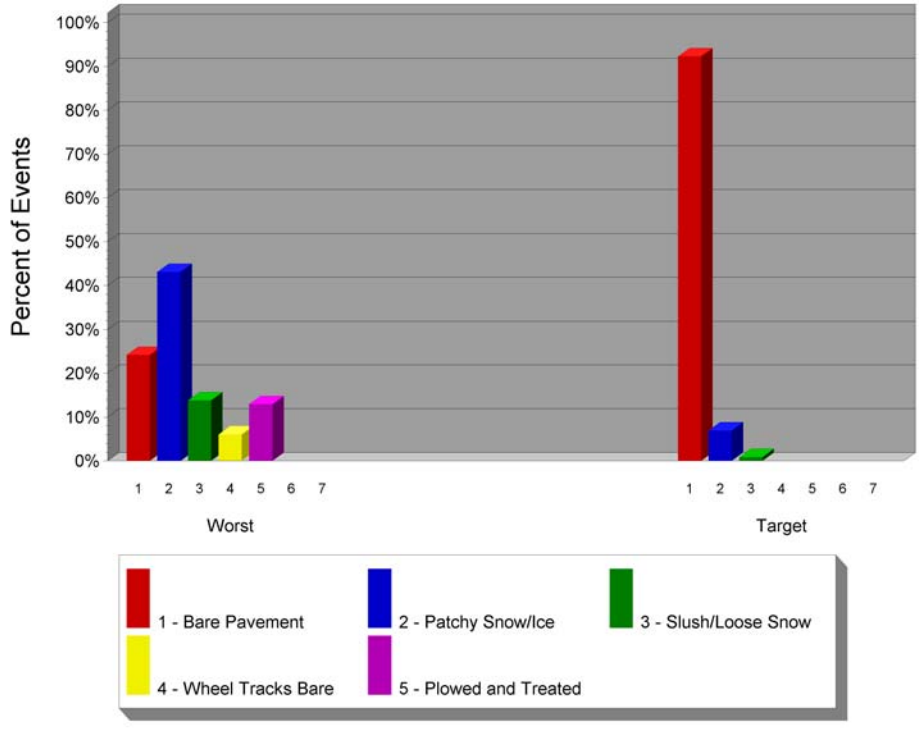



**Figure 4.6 Percent of Events Reporting Various Worst and Targeted Pavement Conditions for Evaluation Year 3 (2001-2002).**

Figure 4.7 presents the number of events in each winter season reporting various snow and ice control measures being used. These results are consistent with the pavement conditions reported in the previous figures. For instance, patchy snow and ice, the worst condition in the majority of reported events, would be treated with de-icing measures, the method utilized in the majority of events.

The activity/weather log results are generally consistent with the fact that the first and last years of the evaluation were warmer and drier (i.e., reduced need for highway maintenance). These mild winters affected the evaluation effort by reducing the opportunities most of the user groups had to access and use FORETELL information in real-life situations.

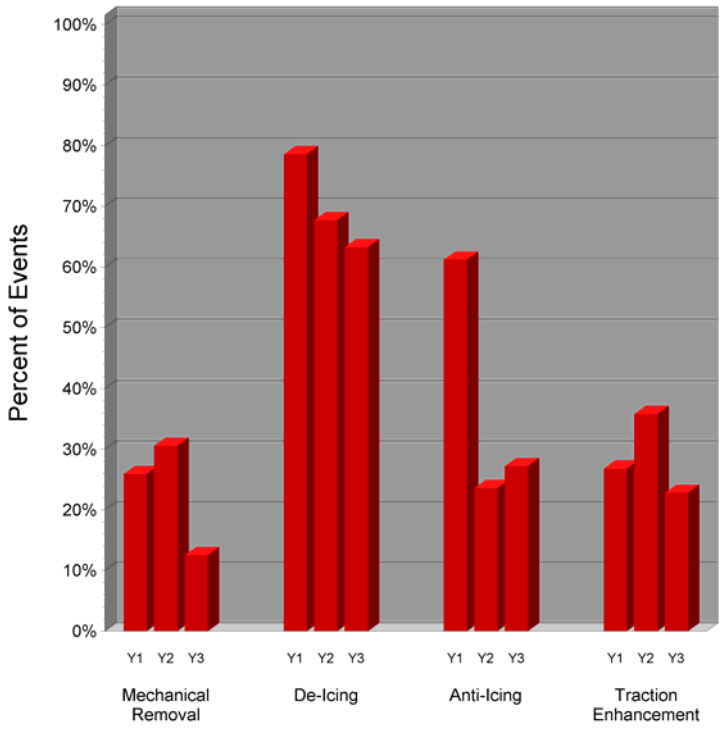



**Figure 4.7 Percent of Events Reporting Various Snow and Ice Control Measures being Utilized by Evaluation Year.**

## 4.2 System Performance

The evaluation team was not responsible for collecting data concerning the performance of the FORETELL system (e.g., system downtime, data reliability, forecast accuracy, etc.). Castle Rock Consultants is preparing a separate system performance report for Iowa and FHWA. The report will document the system performance during the evaluation period and is expected to contain:

- Information regarding system uptime (website and models) and the reliability of forecast/data updates;
- Reasons for system downtime (e.g., software or Internet service failure) and details on computer/data redundancy needs;
- Details on safeguards and redundancies that were implemented, such as implementing a backup web server and teaming with a local weather provider to act as a data stream backup;
- System performance from a weather-forecasting point of view and road model performance (e.g., accuracy or bias in the models).

The evaluation team and HMOs experienced a general increase over time in the operational availability of the information provided by FORETELL.

## 4.3 Institutional Performance

Several issues related to the development and marketing of FORETELL had a significant impact on the use of FORETELL and on the FORETELL evaluation. While these institutional issues were not part of the evaluation focus, they are noted here because of their relevance to the results that are reported.

In 1996 the original FORETELL Consortium included Castle Rock Consultants, the Federal Highway Administration, the National Weather Service (NWS), NOAA's Forecast Systems Laboratory, Environment Canada, and the states of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. Participation by the states meant contribution to a FORETELL pooled fund. By contributing, states would have weather products tailored for their use, as well as access to the FORETELL system. Early in the project, Minnesota and Illinois decided not to contribute to the development. Their participation was therefore limited to initial stakeholder meetings and the early development of the System Design Concept.

In the early stages of development of the FORETELL system, Castle Rock Consultants planned to team with the Forecast Systems Laboratory (FSL) and the National Weather Service (NWS) to download NWS data and develop meso-scale models. The relationship between Castle Rock Consultants, FSL, and NWS never materialized. Subsequently, the FORETELL program was delayed by nearly one year while Castle Rock Consultants contracted with a FSL meteorologist to develop the weather-related models. As a result, FORETELL did not become operational until the winter of 2000-2001.

During the evaluation period, various issues with the information provided on the FORETELL website appeared to be incorrect and may have affected users of the system. In addition, a few flaws with the graphical user interface (GUI) were found, such as map displays with road systems in the wrong location. The Collision and Accident Reporting System (CARS) information was overlaid onto the weather GUI, although it was not exactly suited for the display. Castle Rock Consultants did not incorporate road weather information system (RWIS) sensor data into FORETELL until the second winter of operation. Although the system was operational most of the time, it did go down on several occasions. One memorable occasion occurred early during the winter of 2001. The FORETELL system went down for a couple of days due to server failure, during the first major winter storm. Following the event, FORETELL added a backup server to help ensure redundancy and to improve system availability. These situations appear to be typical problems that occur during the implementation of a new system.

Another issue relates to the focus of the weather information displayed on the website. It was tailored to assist HMOs maintenance activities. Thus, the information provided by FORETELL may not have been as useful as a website designed to meet the information needs of the other user groups.

Marketing efforts for potential user groups were limited and resulted, in some cases, in minimal participation or the inability to access the FORETELL website. The evaluation team itself encouraged FORETELL use by CVOs, traffic managers, and transit operators so that these user groups could be included in the evaluation. Some user groups (e.g., travelers) could not be evaluated at all, since the FORETELL Consortium did not make the password-protected website available to this user group.

In Iowa and Missouri, participation in the FORETELL program by HMOs was coordinated through the state departments of transportation. For instance, the surveys were sent to state DOT personnel who distributed the surveys to the operators. In Iowa, the department of transportation underwent a major reduction in force during the spring of 2001. This reduction directly impacted the participation of highway maintenance personnel in completing the first follow-up survey. In Missouri, over a hundred operators attended FORETELL training, but because many of them had older computers that used older and slower telephone modems, their access to FORETELL was very limited. Also, Missouri's State Engineer was hesitant to encourage reliance upon computers or RWIS sensor data, which FORETELL uses in its road condition model.

In Wisconsin, highway maintenance is not provided by a state department of transportation, as it is in many other states. Individual counties provide highway maintenance for the state through a contractual arrangement. Because the FORETELL program was outside of the contractual agreement for maintenance, the state had little authority to request HMOs to participate in the FORETELL evaluation. As a result, HMOs in Wisconsin were not asked to complete activity/weather logs, and few HMOs responded to the surveys.

# 5.0 OBSERVATIONS AND RECOMMENDATIONS

The FORETELL evaluation focused on six user groups over one to three winter seasons. Each of these user groups had different needs and potential uses for the weather and road condition information. Each had different decisions and processes they aimed to impact with this new information. To some, the information was not that new (just packaged differently), while others were seeing this kind of information for the first time, packaged in a new medium, such as the Internet. This section attempts to provide some overall observations common to the user groups and then to offer recommendations for future activities.

## 5.1 Observations

The following observations are made by the evaluation team after a thorough review of all evaluation results presented in this report:

***The FORETELL system offered new information in a new format***. FORETELL attempted to package weather and road condition information in a new way and provide it to the users in a one-stop-shop approach. For the most part this goal was achieved. For the HMO, much of this information was already available through a variety of sources, and FORETELL brought it together in a website format with special features to assist in viewing volumes of information in a straightforward way. The one new item that was noted by the HMOs that was of great value was the dewpoint. On the other hand, for the other users (CVOs, highway patrol, school administrators, transit operators, and traffic managers), some of the FORETELL information was both new to them and presented in a new format. Elements such as detailed weather forecasts, pavement temperature, and pavement conditions were among the highlighted new items. Clearly, they were intrigued and interested in this information. Although each user had varying information needs, generally they thought this new information in this new packaging was easy to obtain and usable, with a high percentage of them mentioning that they appreciated the special features such as the animation of the information over a specified time period.

***FORETELL had aggressive goals and encountered difficulties typical of new systems***. FORETELL's goals of bringing much information together in a new format was a first in the industry. The evaluation team understands that new deployments are fraught with challenges. FORETELL was no different. As discussed in Section 4.3, Institutional Performance, the program dealt with major partner changes, users reluctant to changing the way they have done things in the past, schedule delays, information accuracy, and computer/systems/server issues that sometimes negatively affected the delivery of the information in a timely manner. Although unfortunate, these issues were not unexpected for a project of this type. Apparently, these "institutional" challenges had an effect on how the system was perceived by some of the users and may have tainted their responses to surveys and telephone interviews. In some instances these issues may have impacted whether they used the system at all or were willing to participate in the evaluation. Subsequently, the results indicated both positive and negative aspects of the FORETELL system. Between 30 and 40 percent of the HMOs said that they changed their decisions based on FORETELL information, and greater than 50 percent of all users said they want to continue using FORETELL in the future. However, less than 20 percent were willing to

pay for the service. These numbers are a good sign, given the challenges that were faced by the program.

***User's resistance to change affected FORETELL use***. Like any new tool provided to an operator, FORETELL suffered from users' reluctance to use and accept something new. The team believes this resistance had a direct impact on users' responses about the FORETELL system. In many cases, respondents would not commit to agreeing or disagreeing with how they used or liked the FORETELL system. This may be related to the fact that they really did not use the system, so they did not feel comfortable responding either way.

***Weather conditions affected use of the FORETELL system and therefore the ability to evaluate its performance***. Weather conditions, or lack thereof, was a major factor in being able to evaluate the system. This was especially true for the non-HMO users (CVOs, highway patrol, school administrators, transit operators, and traffic managers), who only had one season to use the system (winter of 2001-2002). As can be seen in Sections 2.2 and 4.1, data are provided to support the conclusion that this season was an extremely light winter and therefore the need for FORETELL information was diminished or non-existent. This situation affected the number of people willing to participate in the evaluation and the responses of the ones who did. Only 15 of the 34 CVOs, 5 of the 9 school administrators, and 3 of the 14 transit operators agreed to actually participate in the evaluation after accepting the offer prior to the start of the winter season. Almost all of the "other" users interviewed expressed concern that they had not had an opportunity to fully use and evaluate the system because of the mild winter. Also, the HMOs' use of the FORETELL system was significantly reduced during the final evaluation period compared to the prior season (where the data indicate they had a typical winter season). The evaluation team believes this reduced reliance on FORETELL was due in most part to the mild winter of 2001-2002.

***Users' decision effectiveness using FORETELL system was mixed***. Obtaining, understanding, and using the information were one evaluation criterion (user acceptance). However, how the users put the information to use, which in some way changed their decisions, was the most important criterion. The evaluation team believes that a changed decision based on FORETELL information was the true measure of the system's value. In this case, the results among the users were mixed. As mentioned earlier, the fact that 30 to 40 percent of HMO respondents indicated that they changed their decisions based on this new information was significant, given the natural reluctance to accept something new. However, the other users did not respond as favorably. In the case of the CVOs, they appreciated the FORETELL information, but did not think it would change their key decisions (when to go, if to go, where to go). This is probably driven by the market conditions to get products where they need to go. It was interesting, however, that the HMOs were less confident in their decisions using FORETELL, while the other users were more confident (but less likely to change their decisions). The confounding factors of the "institutional" performance and weather conditions mentioned earlier make these results interesting but may not represent the true attitudes of some of the user groups.

***Majority of users expressed an interest in using FORETELL in the future***. After the evaluation data were collected, and all the other criteria were evaluated, it is significant that the majority of all users stated they want to use FORETELL in the future. The team believes this is

a result of two primary interests on the part of the users. First, they found value in the information and were interested in using it for future winter seasons. Second, they did not have an opportunity to fully test the system during a mild winter but saw enough promise in the system to want to continue using the FORETELL system and data. On the other hand, very few of these same users were willing to pay for the information and expected to continue receiving it at no cost.

## 5.2 Recommendations

From the results presented in this report, the evaluation team recommends the following:

***FORETELL system development and future enhancements***. Evaluating a new system that is still under development is a difficult task at best. Many HMO users initially were reluctant to use a new system that had unknown accuracy and reliability. These biases toward the system are hard to overcome. Clearly the users expressed an interest and perceived value in the FORETELL system and the weather/pavement condition information it provided. With continued system development and enhancements to the system's robustness to improve accuracy and avoid system downtime, as well as some added functionality, the changes could significantly affect future user perceptions of this product. It is very likely that these potential enhancements will encourage continued use of the system, which could lead to expanded acceptance and eventual increases in changed behaviors among the user groups.

Therefore, additional evaluation activities in future years are required to fully evaluate the system for most users. The only evaluation conducted for the "other" users was during a very mild winter, and therefore a meaningful evaluation was not possible. Only after the FORETELL system is fully functional and reliable, and marketed to a significant segment of user group populations, can a comprehensive evaluation be conducted.

***Training on the use of weather information is essential to effective decision-making.*** Most users understand how weather phenomena affect their operations, but they do not necessarily understand how they can use weather information to make more timely and efficient decisions that can improve their operations. It became obvious from the increased use of dewpoint information that the training provided by the states to utilize the FORETELL information significantly affected their decision processes. Dewpoint is a critical factor in the anti-ice versus de-ice HMO road maintenance strategy. Similar training tailored to individual user groups may be beneficial. Such a program could involve a general introduction to weather and road condition monitoring and forecasting, how to obtain desired information from the FORETELL system, and how such information can be used to enhance operational procedures and improve transportation outcomes (e.g., improve safety by reducing crash risk, improve mobility by minimizing travel time delay, improve productivity by decreasing road treatment costs). The evaluation team believes that early and appropriate training could have improved the understanding and use of the FORETELL website.

## 6.0 BIBLIOGRAPHY / REFERENCES

Battelle, “Evaluation of the FORETELL Consortium Operational Test: Weather Information for Surface Transportation, Evaluation Plan,” Battelle report to the US Department of Transportation Joint Program Office, April 2001.

Geer, Ira W., ed., "Glossary of Weather and Climate," American Meteorological Society, Boston, MA, 1996.

JPO, “Evaluation of the FORETELL Consortium Operational Test: Weather Information for Surface Transportation, Evaluation Strategy,” Battelle report to the US Department of Transportation Joint Program Office, July 1998. Available at http://www.itsdocs.fhwa.dot.gov/jpodocs/repts_te/7tr01!.pdf

Temeyer, Bradley E., et al, "A Winter Weather Index for Estimating Roadway Winter Maintenance Costs in the Midwest," unpublished preliminary report, Iowa State University, Ames, IA, 2001.

# APPENDIX A:
# HIGHWAY MAINTENANCE OPERATORS —

# DATA COLLECTION INSTRUMENTS
# AND
# SUMMARY TABLES

# ACTIVITY/WEATHER LOG

U.S. Department of Transportation
Federal Highway Administration

# FORETELL Activity/Weather Log for Weather Events*

**ID Number 01**

***Please mail or fax to Shawna Collins at Battelle Memorial Institute, Columbus, OH 43201, (614)424-4611 (fax).***

**Event Location** _____

**Event Start**
Date: _____
Time: _____ AM ☐ PM ☐

**Event End**
Date: _____
Time: _____ AM ☐ PM ☐

## Event Temperatures and Wind Speed

Atmospheric High: ____ ° F Low: ____ ° F
Pavement High: ____ ° F Low: ____ ° F
Maximum Wind Speed ____ mph

## Event Precipitation (Please ▇ all that apply)

| Type | Amount in Inches (if applicable) | Type | Amount in Inches (if applicable) |
|---|---|---|---|
| ☐ Freezing Rain | | ☐ Sleet | |
| ☐ Snow | | ☐ Rain | |
| ↳ ☐ Wet ☐ Dry ☐ Drifting | | ☐ Hail | |
| | | ☐ Frost | |

## Method of Treatment During Event
**(Please ▇ all that apply)**

| | Type | Amount (units / ln-mi) |
|---|---|---|
| ☐ Plowing | — NA — | — NA — |
| ☐ Deicing | | |
| ☐ Anti-icing | | |
| ☐ Abrasives | | |
| ☐ Other | | |
| ☐ None | | |

## Information Used During Event

| Did you use: (▇ all that apply) | Type (▇ all that apply) | | Source (▇ all that apply) | |
|---|---|---|---|---|
| ☐ Maximum Wind Speed/Direction | ☐ Forecast | ☐ Actual | ☐ FORETELL | ☐ Other |
| ☐ Precipitation | ☐ Forecast | ☐ Actual | ☐ FORETELL | ☐ Other |
| ☐ Atmospheric Temperature | ☐ Forecast | ☐ Actual | ☐ FORETELL | ☐ Other |
| ☐ Pavement Temperature | ☐ Forecast | ☐ Actual | ☐ FORETELL | ☐ Other |
| ☐ Pavement Conditions | ☐ Forecast | ☐ Actual | ☐ FORETELL | ☐ Other |
| ☐ Other _____ | ☐ Forecast | ☐ Actual | ☐ FORETELL | ☐ Other |

## Road Condition During Event

| Condition | Worst Condition (▇ only one) | Duration at Worst Condition (hrs) | Target Condition (▇ only one) | Time to Achieve Target Condition (hrs) |
|---|---|---|---|---|
| Bare Pavement | ☐ | | ☐ | |
| Patchy snow, ice, or slush | ☐ | | ☐ | |
| Slush or loose snow (no packed snow or ice) | ☐ | | ☐ | |
| Continuous packed snow or ice; wheel track(s) bare | ☐ | | ☐ | |
| Build-up of compacted snow; plowed and treated with abrasives/chemicals | ☐ | | ☐ | |
| Build-up of compacted, deep, unplowed snow; ruts in ice pack | ☐ | | ☐ | |
| Road closed due to weather conditions | ☐ | | ☐ | |

* A weather event can include high winds, precipitation, extreme atmospheric temperatures, etc.

Comments: _____

# BASELINE QUESTIONNAIRE

U.S. Department of Transportation
Federal Highway Administration

# FORETELL *Highway Maintenance Operator Field Operational Test*

1. Please check the box next to **each** type of road your location maintains and indicate **how many miles** of each type of road you maintain.

| | MILES |
|---|---|
| ☐ Single lane, bi-directional traffic | |
| ☐ Two lane | |
| ☐ Four lane and limited access | |
| ☐ Suburban and Urban | |

2. How many **Full Time** employees do you supervise? (Write in '000' if you supervise *no* employees.) Number of Employees .....

3. How many **Winter Seasonal** employees do you supervise? (Write in '000' if you supervise *no* employees.) Number of Employees .....

4. Do you have access to a computer at work? ☐ Yes ☐ No **Skip to Q7.**

   **A.** What kind of computer do you have access to (e.g., IBM-compatible PC, Macintosh, Unix, etc.)?

5. Do you have access to the Internet at work? ☐ Yes ☐ No

   **A.** Which browser (such as Netscape Communicator 4.5, etc.) do you use?

6. Do you have access to an email account at work? ☐ Yes ☐ No

   **A.** What is your email address?

7. From what sources have you obtained weather-related information? (Please ✓ all that apply.)

   ☐ Roadside and in-pavement sensors
   ☐ Tailored, site-specific forecast
   ☐ National Weather Service forecast
   ☐ Satellite data
   ☐ Radar data
   ☐ Other (please specify)

8. How have you obtained weather-related information? (Please ✓ all that apply.)

   ☐ Internet/World Wide Web
   ☐ Email
   ☐ Fax
   ☐ Phone/Cell Phone
   ☐ Television
   ☐ Radio
   ☐ Pager
   ☐ Digital Messaging
   ☐ Satellite Delivery
   ☐ Computer-based subscription services
   ☐ Other (please specify)

**9.** How often do you obtain weather information?

| | If YES, please answer Col. A. | | A. | | | |
|---|---|---|---|---|---|---|
| | YES | NO | TWICE A DAY | 4 TIMES A DAY | EVERY OTHER HOUR | HOURLY |
| a. Daily | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| b. Weekly | ❑ | ❑ | NOT APPLICABLE | | | |
| c. In advance of a weather event* | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| d. During a weather event* | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| e. After a weather event* | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |

**A weather event can include high winds, precipitation, extreme atmospheric temperatures, etc.*

**10.** What snow and ice control strategies do you employ in your winter maintenance operations? (Please ✓ all that apply.)

| | If YES, please answer Col. A. | | A. For each "yes," indicate whether or not weather-related information is helpful in making decisions about employing the strategy. Please circle one number for each strategy you use. | | | | |
|---|---|---|---|---|---|---|---|
| | YES | NO | NOT HELPFUL → | | | | HELPFUL |
| a. Anti-Icing | ❑ | ❑ | 1 | 2 | 3 | 4 | 5 |
| b. De-Icing | ❑ | ❑ | 1 | 2 | 3 | 4 | 5 |
| c. Friction Enhancement (Abrasives) | ❑ | ❑ | 1 | 2 | 3 | 4 | 5 |
| d. Mechanical Removal (Plowing) | ❑ | ❑ | 1 | 2 | 3 | 4 | 5 |
| e. Some other strategy? *Please specify* | ❑ | ❑ | 1 | 2 | 3 | 4 | 5 |

SPECIFY: _____

**11.** What weather information do you use in making storm management decisions? Do you use:

| | If YES, please answer Col. A. | | A. Do you use actual readings, forecast information, or both? (Please ✓ the appropriate box[es]) | |
|---|---|---|---|---|
| | YES | NO | **Actual Readings** | **Forecast Information** |
| a. Wind speed or direction? | ❑ | ❑ | ❑ | ❑ |
| b. Precipitation? | ❑ | ❑ | ❑ | ❑ |
| c. Atmospheric temperature? | ❑ | ❑ | ❑ | ❑ |
| d. Pavement temperature? | ❑ | ❑ | ❑ | ❑ |
| e. Pavement conditions? | ❑ | ❑ | ❑ | ❑ |
| f. Dew point temperature? | ❑ | ❑ | ❑ | ❑ |
| g. Some other indicator? *Please specify* | ❑ | ❑ | ❑ | ❑ |

SPECIFY: _____

**Thinking about the weather information you use, that is, those you checked "yes" in Question 11, indicate how strongly you disagree or agree with the following statements. Please circle one number for each category you use.**

| | | A. Wind Speed/ Direction | | | | | B. Precipitation | | | | | C. Atmospheric Temperature | | | | | D. Pavement Temperature | | | | | E. Pavement Conditions | | | | | F. Dew Point Temperature | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Strongly Disagree | | | | Strongly Agree | Strongly Disagree | | | | Strongly Agree | Strongly Disagree | | | | Strongly Agree | Strongly Disagree | | | | Strongly Agree | Strongly Disagree | | | | Strongly Agree | Strongly Disagree | | | | Strongly Agree |
| 12. | You use the above weather information to: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| a. | make storm management decisions, such as deciding **WHAT** road surface treatments should be used. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| b. | help determine **WHERE** to apply road surface treatments during winter conditions. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| c. | help determine **WHEN** to apply road surface treatments during winter conditions. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| 13. | The above weather information you receive is: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| a. | **UNDERSTANDABLE** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| b. | **USABLE** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| c. | **EASILY OBTAINABLE** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| d. | **ACCURATE** | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| e. | **USEFUL** in making storm management decisions. | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |

**Please indicate how strongly you disagree or agree with the following statements. Please circle your response.**

| | | Strongly Disagree → Strongly Agree | | | | |
|---|---|---|---|---|---|---|
| **14.** | The weather information you receive is sufficient for making storm management decisions. | 1 | 2 | 3 | 4 | 5 |
| **15.** | Having weather-related information makes your job easier. | 1 | 2 | 3 | 4 | 5 |
| **16.** | The weather information you receive helps you to improve the traffic efficiency of roadways. | 1 | 2 | 3 | 4 | 5 |
| **17.** | The weather information you receive helps you to target snow and ice control measures. | 1 | 2 | 3 | 4 | 5 |
| **18.** | Highway maintenance activities are conducted and/or managed more efficiently using weather-related information. | 1 | 2 | 3 | 4 | 5 |
| **19.** | The weather information you receive helps you return the roads to a targeted pavement condition quickly. | 1 | 2 | 3 | 4 | 5 |
| **20.** | Having weather information increases the safety of the Highway Maintenance Operator. | 1 | 2 | 3 | 4 | 5 |
| **21.** | The weather information you receive helps to lessen the amount of chemical applications and improve the quality of the environment. | 1 | 2 | 3 | 4 | 5 |

**22.** If there is any weather-related information that would be helpful to you in your job that you cannot receive, please explain.

_____

_____

**23.** Is there any other information you would like to tell us about the weather-related information you receive, how you receive it, or how you use the information in your decision-making process?

_____

_____

**Thank you for taking the time to complete this questionnaire.**

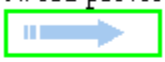
***FOR OFFICE USE ONLY***

NO: ___ DATE: ___ EDITOR: 0___

# FOLLOW-UP QUESTIONNAIRE

# Battelle's Interactive System for Internet Surveys (ISIS)

If you have registered a login password previously, continue on to the survey...



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If you are new to this site, please provide a login password you would like for use at this site ( 5 to 14 characters in length ). Be certain to record this login password, so you may enter the site later and review your responses.

(Note: if your requested password is assigned to another user already, you will return to this page so you may request an alternate login password)

*password*

*confirm password*

Register

---

FORETELL Survey

The Federal Highway Administration is conducting an evaluation of the FORETELL system. Please complete the following survey as completely and honestly as possible. Your responses will be used to assess the quality, performance, and customer satisfaction of the FORETELL system.

---

# Battelle's Interactive System for Internet Surveys (ISIS)

Please **read** the information **below**.
When you are finished, you may hit the OK button to continue.

---

FORETELL Survey

The Federal Highway Administration is conducting an evaluation of the FORETELL system. Please complete the following survey as completely and honestly as possible. Your responses will be used to assess the quality, performance, and customer satisfaction of the FORETELL system.

Your participation in this study is completely voluntary. All of the information you provide in this interview will be kept strictly confidential and will not be disclosed to anyone but the researchers conducting the study.

The survey should take about 10 minutes to complete.

---

OK

# FORETELL Survey

*The Federal Highway Administration is conducting an evaluation of the FORETELL system. Please complete the following survey as completely and honestly as possible. Your responses will be used to assess the quality, performance, and customer satisfaction of the FORETELL system.*

*1. Please check the box next to each type of road your location maintains and indicate how many miles of each type of road you maintain.*

| Type of road: | Check if maintained: | Miles |
|---|---|---|
| Single lane, bi-directional traffic | Yes ○ No ○ | |
| Two lane | Yes ○ No ○ | |
| Four lane and limited access | Yes ○ No ○ | |
| Suburban and Urban | Yes ○ No ○ | |

Next

Progress:

# FORETELL Survey

2. How many Full Time employees do you supervise? (Write in '000' if you supervise no employees.)

Number of Employees

3. How many Winter Seasonal employees do you supervise? (Write in '000' if you supervise no employees.)

Number of Employees

Previous Next

*Review*

Progress:

# FORETELL Survey

*When you use a computer for work...*

**4a. What operating system do you use?**

- ☐ Windows 3.1
- ☐ Windows 95
- ☐ Windows 98
- ☐ Windows NT
- ☐ Windows 2000
- ☐ Unix
- ☐ OS/390
- ☐ Linux
- ☐ Other

If "Other", please specify: [ ]

**4b. Which Internet browser (such as Netscape, Microsoft Internet Explorer, etc.) do you use?**

[Please choose a browser ▼]

If "Other", please specify: [ ]

[Previous] [Next]

[* Review *]

Progress:

# FORETELL Survey

5. Please provide the following contact information. This information will NOT be distributed to ANYONE outside of Battelle.

| | Enter Requested Information |
|---|---|
| First Name | |
| Last Name | |
| **Work** email address | |
| **Work** Site Name | |
| **Work** Street & No | |
| **Work** City | |
| **Work** State | |
| **Work** Zip | |

Previous Next

*Review*

Progress:

# FORETELL Survey

6. What information do you use in making weather-related management decisions? For each type of information you use, please indicate whether you use Actual Readings, Forecast Information, or both, by checking the appropriate box[es]. Then choose the source you rely on most heavily for obtaining that information.

| Type of Information | Do you use this information? | Do you use **Actual Readings**? | Do you use **Forecast Information**? | What is the source you rely on most heavily for this information? |
|---|---|---|---|---|
| Wind speed or direction | Yes ○ No ○ | ○ Yes ○ No | ○ Yes ○ No | Choose Source |
| Precipitation | Yes ○ No ○ | ○ Yes ○ No | ○ Yes ○ No | Choose Source |
| Atmospheric temperature | Yes ○ No ○ | ○ Yes ○ No | ○ Yes ○ No | Choose Source |
| Pavement temperature | Yes ○ No ○ | ○ Yes ○ No | ○ Yes ○ No | Choose Source |
| Pavement conditions | Yes ○ No ○ | ○ Yes ○ No | ○ Yes ○ No | Choose Source |
| Dewpoint | Yes ○ No ○ | ○ Yes ○ No | ○ Yes ○ No | Choose Source |
| Some other type Specify ==> | | ○ Yes ○ No | ○ Yes ○ No | Choose Source |

Choose Source
automated weather station
CNN
DTN
FORETELL
Intellicast
Local Weather
National Weather Service
SSI
Weather Channel
*Other

Previous Next

*Review*

Progress:

# FORETELL Survey

6a. *These next two questions refer to your answers in the previous, large block of questions.*

Among your answers to question 6, you indicated that you rely most heavily on a source of information not found within our survey's listings. Please specify any other sources of information.

If you use any other indicators for your weather-related management decisions, which are other than those you specified in question 6, please enter those indicators here.

Previous Next

*Review*

Progress:

# FORETELL Survey

7. For the each type of information, please indicate whether you use FORETELL as a source of that information, and if you do not, please describe the reason(s) why.

| Type of Information | Do you use FORETELL as a source of this information? | If "No", please describe why you do not rely on FORETELL as a source of this information |
|---|---|---|
| Wind speed or direction | ○ Yes ○ No | |
| Precipitation | ○ Yes ○ No | |
| Atmospheric temperature | ○ Yes ○ No | |
| Pavement temperature | ○ Yes ○ No | |
| Pavement conditions | ○ Yes ○ No | |
| Dewpoint | ○ Yes ○ No | |
| Other Specify => | | |

Previous Next

# FORETELL Survey

8. Do you obtain information from the FORETELL System....

| Do you use FORETELL... | Check "Yes" or "No" | | Twice Daily<br>4 Times Daily<br>Every Other Hour<br>At Least Hourly |
|---|---|---|---|
| Daily? | Yes ○ | No ○ | Please Choose an Answer |
| Weekly? | Yes ○ | No ○ | Not Applicable |
| In advance of a weather event? | Yes ○ | No ○ | Please Choose an Answer |
| During a weather event? | Yes ○ | No ○ | Please Choose an Answer |
| After a weather event? | Yes ○ | No ○ | Please Choose an Answer |

Please Choose an Answer
Twice daily
4 Times Daily
Every Other Hour
At Least Hourly
Not Applicable

Previous Next

*Review*

Progress:

# FORETELL Survey

9. Which feature(s) of FORETELL do you like? (Check all that apply)

- ☐ Animation
- ☐ Long-term forecast
- ☐ Scroll labeling
- ☐ Zoom capability
- ☐ Map display
- ☐ Other
- ☐ None of the above

If "Other", please specify:

Previous Next

*Review*

Progress:

# FORETELL Survey

10. Which feature(s) of FORETELL do you dislike?(Check all that apply)

- ☐ Animation
- ☐ Long-term forecast
- ☐ Scroll labeling
- ☐ Zoom capability
- ☐ Map display
- ☐ Other
- ☐ None of the above

If "Other", please specify:

Previous Next

*Review*

Progress:

# FORETELL Survey

11a. Do you employ the following snow and ice control strategies in your maintenance decisions? If so, please also indicate, on a scale of 1 to 5, the degree to which FORETELL was helpful in making decisions about employing a strategy.

| Do you use | Check "Yes" or "No" | | FORETELL was Not Helpful(1) - Helpful(5) |
|---|---|---|---|
| Anti-Icing? | Yes ○ | No ○ | Please Answer |
| De-Icing? | Yes ○ | No ○ | Please Answer |
| Traction Enhancement (Abrasives)? | Yes ○ | No ○ | Please Answer |
| Mechanical Removal (Plowing)? | Yes ○ | No ○ | Please Answer |

Please Answer
1 - Not Helpful
2
3 - Neutral
4
5 - Helpful

Previous Next

*Review*

Progress:

# FORETELL Survey

11b. Do you employ other maintenance activities that can depend on weather information? If so please also indicate, on a scale of 1 to 5, the degree to which FORETELL was helpful in making decisions about each activity you perform.

| Do you perform | Check "Yes" or "No" | FORETELL was Not Helpful(1) - Helpful(5) |
|---|---|---|
| Normal highway maintenance (non-snow and ice control)? | Yes ○ No ○ | Please Answer |
| Between-storm activities (e.g., vehicle maintenance, equipment washing)? | Yes ○ No ○ | Please Answer |
| Other maintenance activity? | Specify: | Please Answer |

Please Answer
1 - Not Helpful
2
3 - Neutral
4
5 - Helpful

Previous Next

* Review *

Progress:

# FORETELL Survey

12a. Think about the information you obtain using the FORETELL System (e.g. wind speed/direction, precipitation, etc.). Please indicate how strongly you disagree or agree with the following statements. Choose 'Not Applicable' if you do not use FORETELL for a given decision process.

| You use the FORETELL System to: | Wind Speed/Direction | Precipitation | Atmospheric Temperature |
|---|---|---|---|
| make weather-related management decisions, such as deciding **WHAT** road surface treatments should be used. | Please Choose an Answer (Please Choose an Answer / Strongly Disagree / Disagree / Neutral / Agree / Strongly Agree / Not Applicable) | Please Choose an Answer | Please Choose an Answer |
| help determine **WHERE** to apply road surface treatments during winter conditions. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |
| help determine **WHEN** to apply road surface treatments during winter conditions. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |

Previous Next

# FORETELL Survey

12b. Think about the information you obtain using the FORETELL System (e.g. wind speed/direction, precipitation, etc.). Please indicate how strongly you disagree or agree with the following statements. Choose 'Not Applicable' if you do not use FORETELL for a given decision process.

| You use the FORETELL System to: | Pavement Temperature | Pavement Conditions | Dewpoint |
|---|---|---|---|
| make weather-related management decisions, such as deciding **WHAT** road surface treatments should be used. | Please Choose an Answer (Please Choose an Answer / Strongly Disagree / Disagree / Neutral / Agree / Strongly Agree / Not Applicable) | Please Choose an Answer | Please Choose an Answer |
| help determine **WHERE** to apply road surface treatments during winter conditions. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |
| help determine **WHEN** to apply road surface treatments during winter conditions. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |

Previous Next

# FORETELL Survey

13a. Please indicate how strongly you disagree or agree with the following statements. Choose 'Not Applicable' if you do not use FORETELL to obtain a given type of information.

| The information from the FORETELL System was: | Wind Speed/Direction | Precipitation | Atmospheric Temperature |
|---|---|---|---|
| UNDERSTANDABLE. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |
| USABLE. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |
| EASILY OBTAINABLE. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |
| ACCURATE. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |
| USEFUL in making weather-related management decisions. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |
| 14. Information from the FORETELL System changed the weather-related management decisions you made. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |

Please Choose an Answer
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree
Not Applicable

Previous Next

* Review *

Progress:

# FORETELL Survey

13b. Please indicate how strongly you disagree or agree with the following statements. Choose 'Not Applicable' if you do not use FORETELL to obtain a given type of information.

| The information from the FORETELL System was: | Pavement Temperature | Pavement Conditions | Dewpoint |
|---|---|---|---|
| UNDERSTANDABLE. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |
| USABLE. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |
| EASILY OBTAINABLE. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |
| ACCURATE. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |
| USEFUL in making weather-related management decisions. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |
| 14. Information from the FORETELL System changed the weather-related management decisions you made. | Please Choose an Answer | Please Choose an Answer | Please Choose an Answer |

Please Choose an Answer
Strongly Disagree
Disagree
Neutral
Agree
Strongly Agree
Not Applicable

Previous Next

*Review*

Progress:

# FORETELL Survey

*For questions 15 through 18, please indicate how strongly you disagree or agree with the following statements by choosing the appropriate option.*

| | Strongly Disagree <---> Strongly Agree |
|---|---|
| 15. The FORETELL system provides valuable information that is not avaliable from other sources. | Please choose an answer |
| 16. You receive the information from the FORETELL System in time to incorporate it into weather-related management decisions. | Please choose an answer |
| 17. The information provided by the FORETELL System is sufficient for making weather-related management decisions. | Please choose an answer |
| 18. Your agency would be willing to pay for the benefit of having information from the FORETELL System, assuming it's reasonably priced. | Please choose an answer |

Please choose an answer
Strongly disagree
Disagree
Neutral
Agree
Strongly agree

Previous Next

* Review *

Progress:

*For questions 19 through 27, think about your experiences before FORETELL was implemented, compared to your present experience. Please indicate how strongly you disagree or agree with the following statements by choosing the appropriate option.*

| | Strongly Disagree <---> Strongly Agree |
|---|---|
| 19. Having information from the FORETELL System makes your job easier. | Please choose an answer |
| 20. With the FORETELL System you are better able to improve the traffic efficiency of roadways. | Please choose an answer |
| 21. With the FORETELL System you are better able to target snow and ice control measures. | Please choose an answer |
| 22. Highway maintenance activities are conducted and/or managed more efficiently using information from the FORETELL System. | Please choose an answer |
| 23. You are more confident in making weather-related management decisions when you use information from the FORETELL System. | Please choose an answer |
| 24. You deploy staff more efficiently when using information from the FORETELL System. | Please choose an answer |
| 25. Information from the FORETELL System helps you return the roads to a targeted pavement condition more quickly that without FORETELL information. | Please choose an answer |
| 26. Having information from the FORETELL System increases the safety of the Highway Maintenance Operator. | Please choose an answer |
| 27. Information from the FORETELL System helps to lessen the amount of chemical applications. | Please choose an answer |

Previous Next

# FORETELL Survey

*Think about your experience before FORETELL was implemented compared to your present experience.*

28. Are you able to make highway maintenance decisions more effectively because of information received from the FORETELL System?

- ○ Yes
- ○ No

Previous Next

*Review*

Progress:

# FORETELL Survey

28a. On average, when using FORETELL, how much sooner do you learn about weather events prior to their occurrence?

- ○ 0-3 Hours
- ○ 3-6 Hours
- ○ 6-12 Hours
- ○ > 12 Hours

Previous Next

*Review*

Progress:

# FORETELL Survey

*Think about your experience before FORETELL was implemented compared to your present experience.*

29. Are roads returned to an acceptable level of service more quickly because of information received from the FORETELL System?

- ○ Yes
- ○ No

Previous Next

* Review *

Progress:

# FORETELL Survey

29a. On average, when using FORETELL, how much more quickly are the roads returned to an acceptable level of service?

- ○ 0-3 Hours
- ○ 3-6 Hours
- ○ 6-12 Hours
- ○ > 12 Hours

Previous Next

* Review *

Progress:

# FORETELL Survey

30. Would you like to use information from the FORETELL System in the future?

- ○ Yes
- ○ No

31. Is there anything you would change about the FORETELL System (for example, how you receive the information or the types of information you receive)? If so, what would it be?

32. Is there anything that would improve your experience with the FORETELL System? If so, what?

33. Is there any weather-related information that would be helpful to you in your job that you currently cannot receive through the FORETELL System? If so, please explain.

34. Please provide us with any other comments.

Previous Next

* Review *

Progress:

# FORETELL Survey

Thank you for your participation.

---

At this time, you may review your answers by clicking the "Review" button.

If, however, you are satisfied your responses best reflect your opinions and experience, simply click the "Finished" button. Please be aware that after you press the "Finished" button, you will no longer be able to view, modify, or add information (i.e. your account will be closed).

If you would like to end the session now, but review your responses later, simply close your browser. Your responses will be automatically saved. To re-enter the system, use the hyperlink (http://www.sdas.battelle.org/FORETELL/FORETELL.asp) and Login ID provided to you via email.

Previous Review Finished

# Battelle's Interactive System for Internet Surveys (ISIS)

# Thank You

**for participating in the FORETELL Survey**

---

This completes the survey process. Your responses have been saved. They will be used along with those submitted by this survey's other participants for discovering and reporting aggregate findings.

| Click here to | Or click here to |
| --- | --- |
| visit us | Participate |
| on the web. | in another survey. |

CONFIDENTIALITY: This information collection complies with the Federal Statistical Confidentiality Order. Therfore, by law, your responses may be used only for statistical purposes and may not be disclosed, or used, in identifiable form for any other purpose. Your survey instrument will be treated as confidential.

# SUMMARY TABLES

## Table A-1. Summary of Responses to Questions from the FORETELL Activity/Weather Log

| Activity\Weather Log Section | SAS Variable Name | Description | Response Category | Iowa (N=399) | Missouri (N=190) | All (N=589) |
|---|---|---|---|---|---|---|
| Event Temperatures and Wind Speed | atmhightemp | Atmospheric High Temperature (F) | Mean | 28.4 | 30.9 | 29.2 |
| | | | Standard Deviation | 11.1 | 7.0 | 10.0 |
| | | | 25th Percentile | 23.0 | 27.0 | 25.0 |
| | | | Median | 30.0 | 32.0 | 30.0 |
| | | | 75th Percentile | 34.0 | 35.0 | 34.0 |
| | | | No. of Logs | 381 | 185 | 566 |
| | | | No. of Missing | 18 | 5 | 23 |
| | atmlowtemp | Atmospheric Low Temperature (F) | Mean | 20.8 | 20.7 | 20.8 |
| | | | Standard Deviation | 12.8 | 9.3 | 11.7 |
| | | | 25th Percentile | 12.0 | 15.0 | 13.0 |
| | | | Median | 23.0 | 22.5 | 23.0 |
| | | | 75th Percentile | 29.0 | 28.0 | 29.0 |
| | | | No. of Logs | 352 | 182 | 534 |
| | | | No. of Missing | 47 | 8 | 55 |
| | pavhightemp | Pavement High Temperature (F) | Mean | 31.0 | 32.5 | 31.4 |
| | | | Standard Deviation | 11.7 | 6.8 | 10.6 |
| | | | 25th Percentile | 25.0 | 30.0 | 27.0 |
| | | | Median | 31.0 | 34.0 | 32.0 |
| | | | 75th Percentile | 36.0 | 36.0 | 36.0 |
| | | | No. of Logs | 351 | 136 | 487 |
| | | | No. of Missing | 48 | 54 | 102 |
| | pavlowtemp | Pavement Low Temperature (F) | Mean | 22.2 | 22.4 | 22.2 |
| | | | Standard Deviation | 12.5 | 8.6 | 11.5 |
| | | | 25th Percentile | 15.3 | 17.0 | 16.0 |
| | | | Median | 25.0 | 25.0 | 25.0 |
| | | | 75th Percentile | 30.0 | 30.0 | 30.0 |
| | | | No. of Logs | 332 | 141 | 473 |
| | | | No. of Missing | 67 | 49 | 116 |
| Event Temperatures and Wind Speed | eventmaxwind | Maximum Wind Speed (mph) | Mean | 18.0 | 16.5 | 17.6 |
| | | | Standard Deviation | 9.2 | 8.7 | 9.1 |
| | | | 25th Percentile | 11.0 | 10.0 | 10.0 |
| | | | Median | 17.0 | 15.0 | 17.0 |
| | | | 75th Percentile | 24.0 | 22.0 | 24.0 |
| | | | No. of Logs | 373 | 117 | 490 |
| | | | No. of Missing | 24 | 69 | 93 |
| | | | Other Written Response | a | 1 | 1 |
| | | | No. of Trace | 2 | 3 | 5 |

**Table A-1. Summary of Responses to Questions from the FORETELL Activity/Weather Log (continued)**

| Activity\Weather Log Section | SAS Variable Name | Description | Response Category | Iowa (N=399) | Missouri (N=190) | All (N=589) |
|---|---|---|---|---|---|---|
| Event Precipitation | frain | Was there any Freezing Rain During the Weather Event? | Yes | 64 ( 16.0%) | 42 ( 22.1%) | 106 ( 18.0%) |
| | | | No | 335 ( 84.0%) | 148 ( 77.9%) | 483 ( 82.0%) |
| | frainamt | Amount of Freezing Rain (inches) | Mean | 0.3 | 0.4 | 0.4 |
| | | | Standard Deviation | 0.2 | 0.3 | 0.3 |
| | | | 25th Percentile | 0.1 | 0.1 | 0.1 |
| | | | Median | 0.3 | 0.3 | 0.3 |
| | | | 75th Percentile | 0.5 | 0.5 | 0.5 |
| | | | No. of Logs | 14 | 17 | 31 |
| | | | No. of Calm | 19 | 10 | 29 |
| | | | No. of Appropriate Skip | 335 | 148 | 483 |
| | | | No. of Missing | 31 | 15 | 46 |
| | snow | Was there any Snow during the Weather Event? | Yes | 285 ( 71.4%) | 163 ( 85.8%) | 448 ( 76.1%) |
| | | | No | 114 ( 28.6%) | 27 ( 14.2%) | 141 ( 23.9%) |
| | snowwet | Was the Snow Wet? | Yes | 115 ( 40.4%) | 81 ( 49.7%) | 196 ( 43.8%) |
| | | | No | 170 ( 59.6%) | 82 ( 50.3%) | 252 ( 56.3%) |
| | | | No. of Appropriate Skip | 114 | 27 | 141 |
| | snowdry | Was the Snow Dry? | Yes | 122 ( 42.8%) | 77 ( 47.2%) | 199 ( 44.4%) |
| | | | No | 163 ( 57.2%) | 86 ( 52.8%) | 249 ( 55.6%) |
| | | | No. of Appropriate Skip | 114 | 27 | 141 |
| | snowdrift | Was the Snow Drifting? | Yes | 77 ( 27.0%) | 19 ( 11.7%) | 96 ( 21.4%) |
| | | | No | 208 ( 73.0%) | 144 ( 88.3%) | 352 ( 78.6%) |
| | | | No. of Appropriate Skip | 114 | 27 | 141 |
| | snowamt | Amount of Snow (inches) | Mean | 2.8 | 2.6 | 2.7 |
| | | | Standard Deviation | 2.5 | 2.3 | 2.4 |
| | | | 25th Percentile | 1.0 | 1.0 | 1.0 |
| | | | Median | 2.0 | 2.0 | 2.0 |
| | | | 75th Percentile | 4.0 | 3.0 | 4.0 |
| | | | No. of Logs | 194 | 117 | 311 |
| | | | Other Written Response | a | 1 | 1 |
| | | | No. of Calm | 22 | 19 | 41 |
| | | | No. of Appropriate Skip | 114 | 27 | 141 |
| | | | No. of Missing | 69 | 26 | 95 |

**Table A-1. Summary of Responses to Questions from the FORETELL Activity/Weather Log (continued)**

| Activity\Weather Log Section | SAS Variable Name | Description | Response Category | Iowa (N=399) | Missouri (N=190) | All (N=589) |
|---|---|---|---|---|---|---|
| Event Precipitation | sleet | Was there any Sleet during the Weather Event? | Yes | 37 ( 9.3%) | 28 ( 14.7%) | 65 ( 11.0%) |
| | | | No | 362 ( 90.7%) | 162 ( 85.3%) | 524 ( 89.0%) |
| | sleetamt | Amount of Sleet (inches) | Mean | 0.6 | 0.7 | 0.6 |
| | | | Standard Deviation | 0.3 | 0.6 | 0.5 |
| | | | 25th Percentile | 0.5 | 0.2 | 0.5 |
| | | | Median | 0.5 | 0.5 | 0.5 |
| | | | 75th Percentile | 1.0 | 1.0 | 1.0 |
| | | | No. of Logs | 9 | 8 | 17 |
| | | | Other Written Response | 1 | a | 1 |
| | | | No. of Calm | 10 | 8 | 18 |
| | | | No. of Appropriate Skip | 362 | 162 | 524 |
| | | | No. of Missing | 17 | 12 | 29 |
| | rain | Was there any Rain during the Weather Event? | Yes | 49 ( 12.3%) | 35 ( 18.4%) | 84 ( 14.3%) |
| | | | No | 350 ( 87.7%) | 155 ( 81.6%) | 505 ( 85.7%) |
| | rainamt | Amount of Rain (inches) | Mean | 0.3 | 0.7 | 0.5 |
| | | | Standard Deviation | 0.2 | 0.8 | 0.6 |
| | | | 25th Percentile | 0.2 | 0.1 | 0.1 |
| | | | Median | 0.3 | 0.3 | 0.3 |
| | | | 75th Percentile | 0.5 | 1.0 | 0.5 |
| | | | No. of Logs | 13 | 18 | 31 |
| | | | No. of Calm | 1 | 5 | 6 |
| | | | No. of Appropriate Skip | 350 | 155 | 505 |
| | | | No. of Missing | 35 | 12 | 47 |
| | hail | Was there any Hail During the Weather Event? | No | 399 (100.0%) | 190 (100.0%) | 589 (100.0%) |
| | hailamt | Amount of Hail (inches) | No. of Appropriate Skip | 399 | 190 | 589 |
| | frost | Was there any Frost During the Weather Event? | Yes | 44 ( 11.0%) | 4 ( 2.1%) | 48 ( 8.1%) |
| | | | No | 355 ( 89.0%) | 186 ( 97.9%) | 541 ( 91.9%) |
| | frostamt | Amount of Frost | Mean | 0.5 | a | 0.5 |
| | | | Standard Deviation | a | a | a |
| | | | 25th Percentile | 0.5 | a | 0.5 |
| | | | Median | 0.5 | a | 0.5 |
| | | | 75th Percentile | 0.5 | a | 0.5 |
| | | | No. of Logs | 1 | 0 | 1 |
| | | | Other Written Response | 1 | a | 1 |
| | | | No. of Calm | a | 1 | 1 |
| | | | No. of Appropriate Skip | 355 | 186 | 541 |
| | | | No. of Missing | 42 | 3 | 45 |

**Table A-1. Summary of Responses to Questions from the FORETELL Activity/Weather Log (continued)**

| Activity\Weather Log Section | SAS Variable Name | Description | Response Category | Iowa (N=399) | Missouri (N=190) | All (N=589) |
|---|---|---|---|---|---|---|
| Information Used During Event | maxwindinfo | Did you Use Maximum Wind Speed/Direction Information During the Event? | Yes | 256 ( 64.2%) | 74 ( 38.9%) | 330 ( 56.0%) |
| | | | No | 143 ( 35.8%) | 116 ( 61.1%) | 259 ( 44.0%) |
| | maxwindforecast | Was the Maximum Wind Speed/Direction Information Forecasted Readings? | Yes | 198 ( 77.3%) | 55 ( 74.3%) | 253 ( 76.7%) |
| | | | No | 58 ( 22.7%) | 19 ( 25.7%) | 77 ( 23.3%) |
| | | | No. of Appropriate Skip | 143 | 116 | 259 |
| | maxwindactual | Was the Maximum Wind Speed/Direction Information Actual Readings? | Yes | 228 ( 89.1%) | 50 ( 67.6%) | 278 ( 84.2%) |
| | | | No | 28 ( 10.9%) | 24 ( 32.4%) | 52 ( 15.8%) |
| | | | No. of Appropriate Skip | 143 | 116 | 259 |
| | maxwindforetell | Was the Maximum Wind Speed/Direction Information from FORETELL? | Yes | 40 ( 15.6%) | 14 ( 18.9%) | 54 ( 16.4%) |
| | | | No | 216 ( 84.4%) | 60 ( 81.1%) | 276 ( 83.6%) |
| | | | No. of Appropriate Skip | 143 | 116 | 259 |
| | maxwindother | Did you Obtain Maximum Wind Speed/Direction Information from Sources Other than FORETELL? | Yes | 119 ( 46.5%) | 40 ( 54.1%) | 159 ( 48.2%) |
| | | | No | 137 ( 53.5%) | 34 ( 45.9%) | 171 ( 51.8%) |
| | | | No. of Appropriate Skip | 143 | 116 | 259 |
| | precip | Did you Use Precipitation Information During the Event? | Yes | 302 ( 75.7%) | 158 ( 83.2%) | 460 ( 78.1%) |
| | | | No | 97 ( 24.3%) | 32 ( 16.8%) | 129 ( 21.9%) |
| | precipforecast | Was Precipitation Information Forecasted Readings? | Yes | 240 ( 79.5%) | 104 ( 65.8%) | 344 ( 74.8%) |
| | | | No | 62 ( 20.5%) | 54 ( 34.2%) | 116 ( 25.2%) |
| | | | No. of Appropriate Skip | 97 | 32 | 129 |
| | precipactual | Was Precipitation Information Actual Readings? | Yes | 275 ( 91.1%) | 131 ( 82.9%) | 406 ( 88.3%) |
| | | | No | 27 ( 8.9%) | 27 ( 17.1%) | 54 ( 11.7%) |
| | | | No. of Appropriate Skip | 97 | 32 | 129 |
| | precipforetell | Did You Obtain Precipitation Information from FORETELL? | Yes | 59 ( 19.5%) | 26 ( 16.5%) | 85 ( 18.5%) |
| | | | No | 243 ( 80.5%) | 132 ( 83.5%) | 375 ( 81.5%) |
| | | | No. of Appropriate Skip | 97 | 32 | 129 |
| | precipother | Did You Obtain Precipitation Information from Sources Other than FORETELL? | Yes | 151 ( 50.0%) | 94 ( 59.5%) | 245 ( 53.3%) |
| | | | No | 151 ( 50.0%) | 64 ( 40.5%) | 215 ( 46.7%) |
| | | | No. of Appropriate Skip | 97 | 32 | 129 |
| | atmtemp | Did you Use Atmospheric Temperature Information During the Event? | Yes | 320 ( 80.2%) | 155 ( 81.6%) | 475 ( 80.6%) |
| | | | No | 79 ( 19.8%) | 35 ( 18.4%) | 114 ( 19.4%) |
| | atmtempforecast | Was Atmospheric Temperature Information Forecasted Readings? | Yes | 247 ( 77.2%) | 97 ( 62.6%) | 344 ( 72.4%) |
| | | | No | 73 ( 22.8%) | 58 ( 37.4%) | 131 ( 27.6%) |
| | | | No. of Appropriate Skip | 79 | 35 | 114 |
| | atmtempactual | Was the Atmospheric Temperature Information Actual Readings? | Yes | 285 ( 89.1%) | 134 ( 86.5%) | 419 ( 88.2%) |
| | | | No | 35 ( 10.9%) | 21 ( 13.5%) | 56 ( 11.8%) |
| | | | No. of Appropriate Skip | 79 | 35 | 114 |

**Table A-1. Summary of Responses to Questions from the FORETELL Activity/Weather Log (continued)**

| Activity\Weather Log Section | SAS Variable Name | Description | Response Category | Iowa (N=399) | Missouri (N=190) | All (N=589) |
|---|---|---|---|---|---|---|
| Information Used During Event | atmtempforetell | Did You Obtain Atmospheric Temperature Information from FORETELL? | Yes | 35 ( 10.9%) | 23 ( 14.8%) | 58 ( 12.2%) |
| | | | No | 285 ( 89.1%) | 132 ( 85.2%) | 417 ( 87.8%) |
| | | | No. of Appropriate Skip | 79 | 35 | 114 |
| | atmtempother | Did You Obtain Atmospheric Temperature Information from Sources Other than FORETELL? | Yes | 129 ( 40.3%) | 93 ( 60.0%) | 222 ( 46.7%) |
| | | | No | 191 ( 59.7%) | 62 ( 40.0%) | 253 ( 53.3%) |
| | | | No. of Appropriate Skip | 79 | 35 | 114 |
| | pavetemp | Did you Use Pavement Temperature Information During the Event? | Yes | 321 ( 80.5%) | 142 ( 74.7%) | 463 ( 78.6%) |
| | | | No | 78 ( 19.5%) | 48 ( 25.3%) | 126 ( 21.4%) |
| | pavetempforecast | Was the Pavement Temperature Information Forecasted Readings? | Yes | 254 ( 79.1%) | 20 ( 14.1%) | 274 ( 59.2%) |
| | | | No | 67 ( 20.9%) | 122 ( 85.9%) | 189 ( 40.8%) |
| | | | No. of Appropriate Skip | 78 | 48 | 126 |
| | pavetempactual | Was the Pavement Temperature Information Actual Readings? | Yes | 286 ( 89.1%) | 120 ( 84.5%) | 406 ( 87.7%) |
| | | | No | 35 ( 10.9%) | 22 ( 15.5%) | 57 ( 12.3%) |
| | | | No. of Appropriate Skip | 78 | 48 | 126 |
| | pavetempforetell | Did You Obtain Pavement Temperature Information from FORETELL? | Yes | 43 ( 13.4%) | 6 ( 4.2%) | 49 ( 10.6%) |
| | | | No | 278 ( 86.6%) | 136 ( 95.8%) | 414 ( 89.4%) |
| | | | No. of Appropriate Skip | 78 | 48 | 126 |
| | pavetempother | Did You Obtain Pavement Temperature Information from Sources Other than FORETELL? | Yes | 134 ( 41.7%) | 46 ( 32.4%) | 180 ( 38.9%) |
| | | | No | 187 ( 58.3%) | 96 ( 67.6%) | 283 ( 61.1%) |
| | | | No. of Appropriate Skip | 78 | 48 | 126 |
| | pavecond | Did you Use Pavement Condition Information During the Event? | Yes | 271 ( 67.9%) | 147 ( 77.4%) | 418 ( 71.0%) |
| | | | No | 128 ( 32.1%) | 43 ( 22.6%) | 171 ( 29.0%) |
| | pavecondforecast | Was the Pavement Condition Information Forecasted Readings? | Yes | 171 ( 63.1%) | 38 ( 25.9%) | 209 ( 50.0%) |
| | | | No | 100 ( 36.9%) | 109 ( 74.1%) | 209 ( 50.0%) |
| | | | No. of Appropriate Skip | 128 | 43 | 171 |
| | pavecondactual | Was the Pavement Condition Information Actual Readings? | Yes | 245 ( 90.4%) | 128 ( 87.1%) | 373 ( 89.2%) |
| | | | No | 26 ( 9.6%) | 19 ( 12.9%) | 45 ( 10.8%) |
| | | | No. of Appropriate Skip | 128 | 43 | 171 |
| | pavecondforetell | Did You Obtain Pavement Condition Information from FORETELL? | Yes | 17 ( 6.3%) | 5 ( 3.4%) | 22 ( 5.3%) |
| | | | No | 254 ( 93.7%) | 142 ( 96.6%) | 396 ( 94.7%) |
| | | | No. of Appropriate Skip | 128 | 43 | 171 |
| | pavecondother | Did You Obtain Pavement Condition Information from Sources Other than FORETELL? | Yes | 87 ( 32.1%) | 53 ( 36.1%) | 140 ( 33.5%) |
| | | | No | 184 ( 67.9%) | 94 ( 63.9%) | 278 ( 66.5%) |
| | | | No. of Appropriate Skip | 128 | 43 | 171 |
| | otherinfo | Did you Use Other Information During the Event? | Yes | 241 ( 60.4%) | 80 ( 42.1%) | 321 ( 54.5%) |
| | | | No | 158 ( 39.6%) | 110 ( 57.9%) | 268 ( 45.5%) |
| | otherforecast | Was Other Information from Forecasted Readings? | Yes | 104 ( 43.2%) | 5 ( 6.3%) | 109 ( 34.0%) |
| | | | No | 137 ( 56.8%) | 75 ( 93.8%) | 212 ( 66.0%) |
| | | | No. of Appropriate Skip | 158 | 110 | 268 |

**Table A-1. Summary of Responses to Questions from the FORETELL Activity/Weather Log (continued)**

| Activity\Weather Log Section | SAS Variable Name | Description | Response Category | Iowa (N=399) | Missouri (N=190) | All (N=589) |
|---|---|---|---|---|---|---|
| Information Used During Event | otheractual | Was Other Information from Actual Readings? | Yes | 89 ( 36.9%) | 4 ( 5.0%) | 93 ( 29.0%) |
| | | | No | 152 ( 63.1%) | 76 ( 95.0%) | 228 ( 71.0%) |
| | | | No. of Appropriate Skip | 158 | 110 | 268 |
| Information Used During Event | otherforetell | Did You Obtain Other Information from FORETELL? | Yes | 12 ( 5.0%) | 0 ( 0.0%) | 12 ( 3.7%) |
| | | | No | 229 ( 95.0%) | 80 (100.0%) | 309 ( 96.3%) |
| | | | No. of Appropriate Skip | 158 | 110 | 268 |
| Information Used During Event | otherother | Did you Obtain Other Information from Sources Other than FORETELL? | Yes | 47 ( 19.5%) | 4 ( 5.0%) | 51 ( 15.9%) |
| | | | No | 194 ( 80.5%) | 76 ( 95.0%) | 270 ( 84.1%) |
| | | | No. of Appropriate Skip | 158 | 110 | 268 |
| Road Condition During Event | worst | Worst Road Condition Encountered During Event | Bare Pavement | 82 ( 22.1%) | 6 ( 3.3%) | 88 ( 15.9%) |
| | | | Patchy snow, ice, or slush | 130 ( 35.0%) | 68 ( 37.4%) | 198 ( 35.8%) |
| | | | Slush or loose snow (no packed snow or ice) | 69 ( 18.6%) | 43 ( 23.6%) | 112 ( 20.3%) |
| | | | Continuous packed snow or ice; wheel track(s) bare | 28 ( 7.5%) | 32 ( 17.6%) | 60 ( 10.8%) |
| | | | Build-up of compacted snow; plowed and treated with abrasives/chemicals | 58 ( 15.6%) | 31 ( 17.0%) | 89 ( 16.1%) |
| | | | Build-up of compacted, deep, unplowed snow; ruts in ice pack | 3 ( 0.8%) | 0 ( 0.0%) | 3 ( 0.5%) |
| | | | Road closed due to weather conditions | 1 ( 0.3%) | 2 ( 1.1%) | 3 ( 0.5%) |
| | | | Missing | 28 | 8 | 36 |
| Time to Target Condition | worsttime | Duration of Worst Road Condition | Mean | 6.2 | 6.3 | 6.2 |
| | | | Standard Deviation | 6.3 | 6.6 | 6.4 |
| | | | 25th Percentile | 2.0 | 2.0 | 2.0 |
| | | | Median | 4.0 | 4.0 | 4.0 |
| | | | 75th Percentile | 8.0 | 8.0 | 8.0 |
| | | | No. of Logs | 297 | 175 | 472 |
| | | | No. of Missing | 102 | 15 | 117 |

**Table A-1. Summary of Responses to Questions from the FORETELL Activity/Weather Log (continued)**

| Activity\Weather Log Section | SAS Variable Name | Description | Response Category | Iowa (N=399) | Missouri (N=190) | All (N=589) |
|---|---|---|---|---|---|---|
| Road Condition During Event | target | Target Road Condition Following Event | Bare Pavement | 309 ( 90.6%) | 165 ( 93.2%) | 474 ( 91.5%) |
| | | | Patchy snow, ice, or slush | 22 ( 6.5%) | 11 ( 6.2%) | 33 ( 6.4%) |
| | | | Slush or loose snow (no packed snow or ice) | 4 ( 1.2%) | 0 ( 0.0%) | 4 ( 0.8%) |
| | | | Continuous packed snow or ice; wheel track(s) bare | 5 ( 1.5%) | 0 ( 0.0%) | 5 ( 1.0%) |
| | | | Build-up of compacted snow; plowed and treated with abrasives/chemicals | 1 ( 0.3%) | 1 ( 0.6%) | 2 ( 0.4%) |
| | | | Missing | 58 | 13 | 71 |
| Time to Target Condition | targettime | Time to Achieve Target Road Condition | Mean | 9.1 | 10.6 | 9.7 |
| | | | Standard Deviation | 9.7 | 10.8 | 10.2 |
| | | | 25th Percentile | 3.0 | 4.0 | 3.0 |
| | | | Median | 6.0 | 7.0 | 6.0 |
| | | | 75th Percentile | 12.0 | 12.0 | 12.0 |
| | | | No. of Logs | 270 | 169 | 439 |
| | | | No. of Missing | 129 | 21 | 150 |

**Table A-2. Summary of the Methods of Treatment Used During Weather Events as Reported in the FORETELL Activity/Weather Log**

| Activity\Weather Log Section | SAS Variable Name | Description | Units | Response Category | Iowa (N=399) | Missouri (N=190) | All (N=589) |
|---|---|---|---|---|---|---|---|
| Method of Treatment During Event | plowing | Was Plowing Used as a Method of Treatment? | N/A | Yes | 100 ( 25.1%) | 45 ( 23.7%) | 145 ( 24.6%) |
| | | | | No | 299 ( 74.9%) | 145 ( 76.3%) | 444 ( 75.4%) |
| Method of Treatment During Event | deicing | Was Deicing Used as a Method of Treatment? | N/A | Yes | 259 ( 64.9%) | 158 ( 83.2%) | 417 ( 70.8%) |
| | | | | No | 140 ( 35.1%) | 32 ( 16.8%) | 172 ( 29.2%) |
| | deicingamt | Amount of Deicing Substance Applied | Not Given | Mean | 468 | 175 | 377 |
| | | | | Standard Deviation | 1917 | 126 | 1593 |
| | | | | 25th Percentile | 200 | 100 | 150 |
| | | | | Median | 200 | 175 | 200 |
| | | | | 75th Percentile | 200 | 200 | 200 |
| | | | | No. of Logs | 53 | 24 | 77 |
| | | | gals | Mean | 131 | 27 | 109 |
| | | | | Standard Deviation | 418 | 3 | 371 |
| | | | | 25th Percentile | 40 | 25 | 28 |
| | | | | Median | 50 | 25 | 48 |
| | | | | 75th Percentile | 50 | 30 | 50 |
| | | | | No. of Logs | 22 | 6 | 28 |
| | | | lbs | Mean | 206 | 163 | 186 |
| | | | | Standard Deviation | 55 | 63 | 63 |
| | | | | 25th Percentile | 200 | 100 | 150 |
| | | | | Median | 200 | 200 | 200 |
| | | | | 75th Percentile | 250 | 200 | 200 |
| | | | | No. of Logs | 135 | 119 | 254 |
| | | | tons | Mean | 73 | a | 73 |
| | | | | Standard Deviation | 90 | a | 90 |
| | | | | 25th Percentile | 12 | a | 12 |
| | | | | Median | 37 | a | 37 |
| | | | | 75th Percentile | 100 | a | 100 |
| | | | | No. of Logs | 26 | 0 | 26 |
| | | | yds | Mean | a | 50 | 50 |
| | | | | Standard Deviation | a | a | a |
| | | | | 25th Percentile | a | 50 | 50 |
| | | | | Median | a | 50 | 50 |
| | | | | 75th Percentile | a | 50 | 50 |
| | | | | No. of Logs | 0 | 1 | 1 |

**Table A-2. Summary of the Methods of Treatment Used During Weather Events as Reported in the FORETELL Activity/Weather Log (continued)**

| Activity\Weather Log Section | SAS Variable Name | Description | Units | Response Category | Iowa (N=399) | Missouri (N=190) | All (N=589) |
|---|---|---|---|---|---|---|---|
| Method of Treatment During Event | deicingamt | Amount of Deicing Substance Applied | N/A | No. of Appropriate Skip | 140 | 32 | 172 |
| | | | | No. of Missing | 23 | 8 | 31 |
| | antiicing | Was Anti-Icing Used as a Method of Treatment? | N/A | Yes | 141 ( 35.3%) | 87 ( 45.8%) | 228 ( 38.7%) |
| | | | | No | 258 ( 64.7%) | 103 ( 54.2%) | 361 ( 61.3%) |
| | antiicingamt | Amount of Anti-Icing Substance Applied | Not Given | Mean | 2083 | 173 | 1379 |
| | | | | Standard Deviation | 5226 | 240 | 4196 |
| | | | | 25th Percentile | 108 | 25 | 60 |
| | | | | Median | 225 | 100 | 200 |
| | | | | 75th Percentile | 1113 | 200 | 325 |
| | | | | No. of Logs | 12 | 7 | 19 |
| | | | gals | Mean | 544 | 24 | 342 |
| | | | | Standard Deviation | 3141 | 28 | 2464 |
| | | | | 25th Percentile | 40 | 10 | 15 |
| | | | | Median | 45 | 25 | 40 |
| | | | | 75th Percentile | 50 | 26 | 50 |
| | | | | No. of Logs | 82 | 52 | 134 |
| | | | lbs | Mean | 187 | 135 | 170 |
| | | | | Standard Deviation | 71 | 61 | 72 |
| | | | | 25th Percentile | 150 | 90 | 100 |
| | | | | Median | 200 | 100 | 200 |
| | | | | 75th Percentile | 200 | 200 | 200 |
| | | | | No. of Logs | 38 | 19 | 57 |
| | | | N/A | No. of Appropriate Skip | 258 | 103 | 361 |
| | | | | No. of Missing | 9 | 9 | 18 |
| | abrasives | Were Abrasives Used as a Method of Treatment? | N/A | Yes | 115 ( 28.8%) | 58 ( 30.5%) | 173 ( 29.4%) |
| | | | | No | 284 ( 71.2%) | 132 ( 69.5%) | 416 ( 70.6%) |
| | abrasiveamt | Amount of Abrasives Applied | Not Given | Mean | 183 | 318 | 221 |
| | | | | Standard Deviation | 87 | 189 | 137 |
| | | | | 25th Percentile | 150 | 200 | 150 |
| | | | | Median | 200 | 350 | 200 |
| | | | | 75th Percentile | 250 | 400 | 250 |
| | | | | No. of Logs | 25 | 10 | 35 |

**Table A-2. Summary of the Methods of Treatment Used During Weather Events as Reported in the FORETELL Activity/Weather Log (continued)**

| Activity\Weather Log Section | SAS Variable Name | Description | Units | Response Category | Iowa (N=399) | Missouri (N=190) | All (N=589) |
|---|---|---|---|---|---|---|---|
| Method of Treatment During Event | abrasiveamt | Amount of Abrasives Applied | gals | Mean | 30 | a | 30 |
| | | | | Standard Deviation | 28 | a | 28 |
| | | | | 25th Percentile | 10 | a | 10 |
| | | | | Median | 30 | a | 30 |
| | | | | 75th Percentile | 50 | a | 50 |
| | | | | No. of Logs | 2 | 0 | 2 |
| | abrasiveamt | Amount of Abrasives Applied | lbs | Mean | 240 | 226 | 234 |
| | | | | Standard Deviation | 57 | 93 | 74 |
| | | | | 25th Percentile | 200 | 200 | 200 |
| | | | | Median | 250 | 200 | 200 |
| | | | | 75th Percentile | 250 | 250 | 250 |
| | | | | No. of Logs | 59 | 42 | 101 |
| | | | tons | Mean | 92 | 20 | 88 |
| | | | | Standard Deviation | 111 | a | 109 |
| | | | | 25th Percentile | 12 | 20 | 13 |
| | | | | Median | 26 | 20 | 26 |
| | | | | 75th Percentile | 250 | 20 | 163 |
| | | | | No. of Logs | 15 | 1 | 16 |
| | | | N/A | No. of Missing | 14 | 5 | 19 |
| | | | | No. of Appropriate Skip | 284 | 132 | 416 |
| | othertrt | Were Other Methods Used as a Method of Treatment? | N/A | Yes | 60 ( 15.0%) | 17 ( 8.9%) | 77 ( 13.1%) |
| | | | | No | 339 ( 85.0%) | 173 ( 91.1%) | 512 ( 86.9%) |
| | | Amount of Other Substance Applied | Not Given | Mean | 735 | 200 | 682 |
| | | | | Standard Deviation | 1429 | a | 1358 |
| | | | | 25th Percentile | 10 | 200 | 10 |
| | | | | Median | 150 | 200 | 175 |
| | | | | 75th Percentile | 200 | 200 | 200 |
| | | | | No. of Logs | 9 | 1 | 10 |
| | | | gals | Mean | 203 | 18 | 179 |
| | | | | Standard Deviation | 511 | 9 | 480 |
| | | | | 25th Percentile | 10 | 10 | 10 |
| | | | | Median | 40 | 18 | 40 |
| | | | | 75th Percentile | 50 | 25 | 45 |
| | | | | No. of Logs | 27 | 4 | 31 |

**Table A-2. Summary of the Methods of Treatment Used During Weather Events as Reported in the FORETELL Activity/Weather Log (continued)**

| Activity\Weather Log Section | SAS Variable Name | Description | Units | Response Category | Iowa (N=399) | Missouri (N=190) | All (N=589) |
|---|---|---|---|---|---|---|---|
| Method of Treatment During Event | otheramt | Amount of Other Substance Applied | lbs | Mean | 224 | 283 | 231 |
| | | | | Standard Deviation | 72 | 166 | 81 |
| | | | | 25th Percentile | 225 | 165 | 200 |
| | | | | Median | 250 | 283 | 250 |
| | | | | 75th Percentile | 250 | 400 | 250 |
| | | | | No. of Logs | 16 | 2 | 18 |
| | | | tons | Mean | a | 71 | 71 |
| | | | | Standard Deviation | a | 19 | 19 |
| | | | | 25th Percentile | a | 62 | 62 |
| | | | | Median | a | 67 | 67 |
| | | | | 75th Percentile | a | 87 | 87 |
| | | | | No. of Logs | 0 | 6 | 6 |
| | | | N/A | No. of Appropriate Skip | 339 | 173 | 512 |
| | | | | No. of Missing | 8 | 4 | 12 |
| | none | Was There No Method of Treatment? | N/A | Yes | 38 ( 9.5%) | 3 ( 1.6%) | 41 ( 7.0%) |
| | | | | No | 361 ( 90.5%) | 187 ( 98.4%) | 548 ( 93.0%) |

**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States.**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q6aa | Uses Wind Speed/Direction in Weather-Related Decisions | Yes | 100.00% (66) | 91.57% (76) | 71.43% (30) | N/A [4] | N/A [4] | 0.0049 |
| | | No | 0.00% (0) | 8.43% (7) | 28.57% (12) | | | |
| Q6ab | Uses Actual Wind Speed/Direction Readings | No Actual Readings | 68.18% (45) | 21.05% (16) | 20.00% (6) | <.0001 | 0.0001 | 0.8960 |
| | | Uses Actual Readings | 31.82% (21) | 78.95% (60) | 80.00% (24) | | | |
| Q6ac | Uses Forecast Wind Speed/Direction Readings | No Forecast Information | 12.12% (8) | 17.11% (13) | 10.00% (3) | 0.3817 | 0.7395 | 0.3648 |
| | | Uses Forecast Information | 87.88% (58) | 82.89% (63) | 90.00% (27) | | | |
| Q6ba | Uses Precipitation in Weather-Related Decisions | Yes | 100.00% (66) | 97.65% (83) | 85.71% (36) | N/A [4] | N/A [4] | 0.0205 |
| | | No | 0.00% (0) | 2.35% (2) | 14.29% (6) | | | |
| Q6bb | Uses Actual Precipitation Readings | No Actual Readings | 71.21% (47) | 21.69% (18) | 13.89% (5) | <.0001 | <.0001 | 0.3237 |
| | | Uses Actual Readings | 28.79% (19) | 78.31% (65) | 86.11% (31) | | | |
| Q6bc | Uses Forecast Precipitation Readings | No Forecast Information | 6.06% (4) | 15.66% (13) | 11.11% (4) | 0.0748 | 0.3682 | 0.5180 |
| | | Uses Forecast Information | 93.94% (62) | 84.34% (70) | 88.89% (32) | | | |
| Q6ca | Uses Atmospheric Temperature in Weather-Related Decisions | Yes | 95.45% (63) | 77.50% (62) | 66.67% (28) | 0.0055 | 0.0006 | 0.1823 |
| | | No | 4.55% (3) | 22.50% (18) | 33.33% (14) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q6cb | Uses Actual Atmospheric Temperature Readings | No Actual Readings | 79.37% (50) | 12.90% (8) | 25.00% (7) | <.0001 | <.0001 | 0.1353 |
| | | Uses Actual Readings | 20.63% (13) | 87.10% (54) | 75.00% (21) | | | |
| Q6cc | Uses Forecast Atmospheric Temperature Readings | No Forecast Information | 28.57% (18) | 24.19% (15) | 10.71% (3) | 0.5708 | 0.0607 | 0.1219 |
| | | Uses Forecast Information | 71.43% (45) | 75.81% (47) | 89.29% (25) | | | |
| Q6da | Uses Pavement Temperature in Weather-Related Decisions | Yes | 100.00% (66) | 97.62% (82) | 80.95% (34) | N/A [4] | N/A [4] | 0.0051 |
| | | No | 0.00% (0) | 2.38% (2) | 19.05% (8) | | | |
| Q6db | Uses Actual Pavement Temperature Readings | No Actual Readings | 96.97% (64) | 8.54% (7) | 8.82% (3) | <.0001 | <.0001 | 0.9599 |
| | | Uses Actual Readings | 3.03% (2) | 91.46% (75) | 91.18% (31) | | | |
| Q6dc | Uses Forecast Pavement Temperature Readings | No Forecast Information | 45.45% (30) | 35.37% (29) | 44.12% (15) | 0.1789 | 0.8931 | 0.3328 |
| | | Uses Forecast Information | 54.55% (36) | 64.63% (53) | 55.88% (19) | | | |
| Q6ea | Uses Pavement Condition in Weather-Related Decisions | Yes | 100.00% (66) | 89.29% (75) | 76.19% (32) | N/A [4] | N/A [4] | 0.0599 |
| | | No | 0.00% (0) | 10.71% (9) | 23.81% (10) | | | |
| Q6eb | Uses Actual Pavement Condition Readings | No Actual Readings | 90.91% (60) | 12.00% (9) | 6.25% (2) | <.0001 | <.0001 | 0.3793 |
| | | Uses Actual Readings | 9.09% (6) | 88.00% (66) | 93.75% (30) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q6ec | Uses Forecast Pavement Condition Readings | No Forecast Information | 53.03% (35) | 49.33% (37) | 50.00% (16) | 0.6498 | 0.7850 | 0.9471 |
| | | Uses Forecast Information | 46.97% (31) | 50.67% (38) | 50.00% (16) | | | |
| Q6fa | Uses Dewpoint in Weather-Related Decisions | Yes | 78.79% (52) | 55.56% (45) | 52.38% (22) | 0.0032 | 0.0032 | 0.7319 |
| | | No | 21.21% (14) | 44.44% (36) | 47.62% (20) | | | |
| Q6fb | Uses Actual Dewpoint Readings | No Actual Readings | 38.46% (20) | 28.89% (13) | 36.36% (8) | 0.3510 | 0.8722 | 0.5269 |
| | | Uses Actual Readings | 61.54% (32) | 71.11% (32) | 63.64% (14) | | | |
| Q6fc | Uses Forecast Dewpoint Readings | No Forecast Information | 53.85% (28) | 22.22% (10) | 18.18% (4) | 0.0008 | 0.0035 | 0.6965 |
| | | Uses Forecast Information | 46.15% (24) | 77.78% (35) | 81.82% (18) | | | |
| Q7aa | Uses FORETELL to Receive Wind Speed/Direction Readings | Yes | N/A [2] | 51.95% (40) | 50.00% (14) | N/A [2] | N/A [2] | 0.8511 |
| | | No | N/A [2] | 48.05% (37) | 50.00% (14) | | | |
| Q7ba | Uses FORETELL to Receive Precipitation Readings | Yes | N/A [2] | 53.25% (41) | 47.22% (17) | N/A [2] | N/A [2] | 0.5231 |
| | | No | N/A [2] | 46.75% (36) | 52.78% (19) | | | |
| Q7ca | Uses FORETELL to Receive Atmospheric Temperature Readings | Yes | N/A [2] | 46.05% (35) | 59.26% (16) | N/A [2] | N/A [2] | 0.2308 |
| | | No | N/A [2] | 53.95% (41) | 40.74% (11) | | | |

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**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q7da | Uses FORETELL to Receive Pavement Temperature Readings | Yes | N/A [2] | 42.86% (33) | 30.30% (10) | N/A [2] | N/A [2] | 0.2193 |
| | | No | N/A [2] | 57.14% (44) | 69.70% (23) | | | |
| Q7ea | Uses FORETELL to Receive Pavement Condition Readings | Yes | N/A [2] | 40.26% (31) | 31.25% (10) | N/A [2] | N/A [2] | 0.3740 |
| | | No | N/A [2] | 59.74% (46) | 68.75% (22) | | | |
| Q8aa | Uses Weather Information [1] Daily | Yes | 98.48% (65) | 27.78% (20) | 11.76% (4) | <.0001 | <.0001 | 0.0666 |
| | | No | 1.52% (1) | 72.22% (52) | 88.24% (30) | | | |
| Q8ab | Uses Weather Information [1] Daily (How Often) | Twice daily | 57.89% (33) | 73.68% (14) | 100.00% (4) | N/A [5] | N/A [5] | N/A [5] |
| | | 4 Times Daily | 19.30% (11) | 21.05% (4) | 0.00% (0) | | | |
| | | Every Other Hour | 3.51% (2) | 5.26% (1) | 0.00% (0) | | | |
| | | At Least Hourly | 19.30% (11) | 0.00% (0) | 0.00% (0) | | | |
| Q8ba | Uses Weather Information [1] Weekly | Yes | 18.75% (12) | 47.14% (33) | 26.47% (9) | 0.0007 | 0.4000 | 0.0535 |
| | | No | 81.25% (52) | 52.86% (37) | 73.53% (25) | | | |
| Q8ca | Uses Weather Information [1] In Advance of a Weather Event | Yes | 86.36% (57) | 67.11% (51) | 58.33% (21) | 0.0077 | 0.0006 | 0.3582 |
| | | No | 13.64% (9) | 32.89% (25) | 41.67% (15) | | | |
| Q8cb | Uses Weather Information [1] In Advance of a Weather Event (How Often) | Twice daily | 34.00% (17) | 41.30% (19) | 52.63% (10) | N/A [5] | N/A [5] | N/A [5] |
| | | 4 Times Daily | 16.00% (8) | 28.26% (13) | 31.58% (6) | | | |
| | | Every Other Hour | 12.00% (6) | 13.04% (6) | 5.26% (1) | | | |
| | | At Least Hourly | 38.00% (19) | 17.39% (8) | 10.53% (2) | | | |
| Q8da | Uses Weather Information [1] During a Weather Event | Yes | 89.39% (59) | 65.33% (49) | 58.33% (21) | 0.0008 | 0.0002 | 0.4510 |
| | | No | 10.61% (7) | 34.67% (26) | 41.67% (15) | | | |

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**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q8db | Uses Weather Information [1] During a Weather Event (How Often) | Twice daily | 14.81% (8) | 20.00% (9) | 40.00% (8) | N/A [5] | N/A [5] | N/A [5] |
| | | 4 Times Daily | 18.52% (10) | 37.78% (17) | 35.00% (7) | | | |
| | | Every Other Hour | 5.56% (3) | 13.33% (6) | 5.00% (1) | | | |
| | | At Least Hourly | 61.11% (33) | 28.89% (13) | 20.00% (4) | | | |
| Q8ea | Uses Weather Information [1] After a Weather Event | Yes | 63.64% (42) | 34.25% (25) | 26.47% (9) | 0.0008 | 0.0006 | 0.4179 |
| | | No | 36.36% (24) | 65.75% (48) | 73.53% (25) | | | |
| Q8eb | Uses Weather Information [1] After a Weather Event (How Often) | Twice daily | 52.50% (21) | 85.00% (17) | 88.89% (8) | N/A [5] | N/A [5] | N/A [5] |
| | | 4 Times Daily | 32.50% (13) | 10.00% (2) | 11.11% (1) | | | |
| | | Every Other Hour | 2.50% (1) | 5.00% (1) | 0.00% (0) | | | |
| | | At Least Hourly | 12.50% (5) | 0.00% (0) | 0.00% (0) | | | |
| Q9_Q10a | FORETELL Features - Animation | Like Most | N/A [2] | 100.00% (51) | 96.30% (26) | N/A [2] | N/A [2] | N/A [4] |
| | | Like Least | N/A [2] | 0.00% (0) | 3.70% (1) | | | |
| Q9_Q10b | FORETELL Features - Long-Term Forecast | Like Most | N/A [2] | 82.50% (33) | 50.00% (9) | N/A [2] | N/A [2] | 0.0088 |
| | | Like Least | N/A [2] | 17.50% (7) | 50.00% (9) | | | |
| Q9_Q10c | FORETELL Features - Scroll Labeling | Like Most | N/A [2] | 87.50% (21) | 80.00% (8) | N/A [2] | N/A [2] | 0.4872 |
| | | Like Least | N/A [2] | 12.50% (3) | 20.00% (2) | | | |
| Q9_Q10d | FORETELL Features - Zoom Capability | Like Most | N/A [2] | 100.00% (54) | 95.83% (23) | N/A [2] | N/A [2] | N/A [4] |
| | | Like Least | N/A [2] | 0.00% (0) | 4.17% (1) | | | |
| Q9_Q10e | FORETELL Features - Map Display | Like Most | N/A [2] | 95.83% (46) | 84.21% (16) | N/A [2] | N/A [2] | 0.1273 |
| | | Like Least | N/A [2] | 4.17% (2) | 15.79% (3) | | | |
| Q11aaa | Uses Anti-Icing Strategies in Maintenance Decisions | Yes | 84.85% (56) | 88.16% (67) | 80.00% (28) | 0.5673 | 0.5290 | 0.2493 |
| | | No | 15.15% (10) | 11.84% (9) | 20.00% (7) | | | |

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**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q11aab | How Helpful is Weather Information [1] in Employing Anti-Icing Strategies | Not Very Helpful | 1.79% (1) | 12.90% (8) | 28.57% (8) | <.0001 | <.0001 | 0.0094 |
| | | Not Helpful | 1.79% (1) | 3.23% (2) | 7.14% (2) | | | |
| | | Neutral | 3.57% (2) | 32.26% (20) | 39.29% (11) | | | |
| | | Helpful | 23.21% (13) | 24.19% (15) | 10.71% (3) | | | |
| | | Very Helpful | 69.64% (39) | 27.42% (17) | 14.29% (4) | | | |
| Q11aba | Uses De-Icing Strategies in Maintenance Decisions | Yes | 93.94% (62) | 84.21% (64) | 76.47% (26) | 0.0772 | 0.0150 | 0.3187 |
| | | No | 6.06% (4) | 15.79% (12) | 23.53% (8) | | | |
| Q11abb | How Helpful is Weather Information [1] in Employing De-Icing Strategies | Not Very Helpful | 3.23% (2) | 10.53% (6) | 26.92% (7) | <.0001 | <.0001 | 0.1655 |
| | | Not Helpful | 1.61% (1) | 5.26% (3) | 7.69% (2) | | | |
| | | Neutral | 8.06% (5) | 38.60% (22) | 34.62% (9) | | | |
| | | Helpful | 22.58% (14) | 15.79% (9) | 7.69% (2) | | | |
| | | Very Helpful | 64.52% (40) | 29.82% (17) | 23.08% (6) | | | |
| Q11aca | Uses Traction Enhancement Strategies in Maintenance Decisions | Yes | 87.88% (58) | 75.32% (58) | 67.65% (23) | 0.0372 | 0.0163 | 0.3761 |
| | | No | 12.12% (8) | 24.68% (19) | 32.35% (11) | | | |
| Q11acb | How Helpful is Weather Information [1] in Employing Traction Enhancement Strategies | Not Very Helpful | 1.75% (1) | 17.65% (9) | 26.09% (6) | <.0001 | <.0001 | 0.3176 |
| | | Not Helpful | 5.26% (3) | 5.88% (3) | 8.70% (2) | | | |
| | | Neutral | 12.28% (7) | 52.94% (27) | 52.17% (12) | | | |
| | | Helpful | 24.56% (14) | 7.84% (4) | 0.00% (0) | | | |
| | | Very Helpful | 56.14% (32) | 15.69% (8) | 13.04% (3) | | | |
| Q11ada | Uses Mechanical Removal Strategies in Maintenance Decisions | Yes | 100.00% (66) | 87.01% (67) | 80.00% (28) | N/A [4] | N/A [4] | 0.3363 |
| | | No | 0.00% (0) | 12.99% (10) | 20.00% (7) | | | |

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| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q11adb | How Helpful is Weather Information [1] in Employing Mechanical Removal Strategies | Not Very Helpful | 3.08% (2) | 16.67% (10) | 32.14% (9) | 0.0005 | <.0001 | 0.0154 |
| | | Not Helpful | 6.15% (4) | 3.33% (2) | 10.71% (3) | | | |
| | | Neutral | 16.92% (11) | 36.67% (22) | 39.29% (11) | | | |
| | | Helpful | 20.00% (13) | 16.67% (10) | 3.57% (1) | | | |
| | | Very Helpful | 53.85% (35) | 26.67% (16) | 14.29% (4) | | | |
| Q12aaa | Uses Wind Speed/Direction Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 4.55% (3) | 2.08% (1) | 10.53% (2) | 0.0243 | 0.0310 | 0.5935 |
| | | Disagree | 4.55% (3) | 4.17% (2) | 0.00% (0) | | | |
| | | Neutral | 18.18% (12) | 39.58% (19) | 42.11% (8) | | | |
| | | Agree | 27.27% (18) | 33.33% (16) | 42.11% (8) | | | |
| | | Strongly Agree | 45.45% (30) | 20.83% (10) | 5.26% (1) | | | |
| Q12aab | Uses Precipitation Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 0.00% (0) | 1.96% (1) | 5.00% (1) | 0.0006 | 0.0004 | 0.4824 |
| | | Disagree | 0.00% (0) | 0.00% (0) | 5.00% (1) | | | |
| | | Neutral | 4.55% (3) | 29.41% (15) | 30.00% (6) | | | |
| | | Agree | 21.21% (14) | 49.02% (25) | 45.00% (9) | | | |
| | | Strongly Agree | 74.24% (49) | 19.61% (10) | 15.00% (3) | | | |
| Q12aac | Uses Atmospheric Temperature Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 8.06% (5) | 2.17% (1) | 5.56% (1) | 0.9079 | 0.5618 | 0.4859 |
| | | Disagree | 4.84% (3) | 4.35% (2) | 0.00% (0) | | | |
| | | Neutral | 33.87% (21) | 41.30% (19) | 33.33% (6) | | | |
| | | Agree | 14.52% (9) | 28.26% (13) | 55.56% (10) | | | |
| | | Strongly Agree | 38.71% (24) | 23.91% (11) | 5.56% (1) | | | |
| Q12baa | Uses Pavement Temperature Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 1.52% (1) | 2.63% (1) | 6.67% (1) | 0.0006 | 0.0028 | 0.6941 |
| | | Disagree | 0.00% (0) | 2.63% (1) | 0.00% (0) | | | |
| | | Neutral | 4.55% (3) | 28.95% (11) | 33.33% (5) | | | |
| | | Agree | 16.67% (11) | 44.74% (17) | 40.00% (6) | | | |
| | | Strongly Agree | 77.27% (51) | 21.05% (8) | 20.00% (3) | | | |

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| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q12bab | Uses Pavement Condition Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 1.52% (1) | 2.78% (1) | 7.14% (1) | <.0001 | 0.0161 | 0.2706 |
| | | Disagree | 3.03% (2) | 5.56% (2) | 7.14% (1) | | | |
| | | Neutral | 6.06% (4) | 44.44% (16) | 21.43% (3) | | | |
| | | Agree | 24.24% (16) | 33.33% (12) | 50.00% (7) | | | |
| | | Strongly Agree | 65.15% (43) | 13.89% (5) | 14.29% (2) | | | |
| Q12bac | Uses Dewpoint Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 15.69% (8) | 8.57% (3) | 6.67% (1) | 0.2546 | 0.0060 | 0.0561 |
| | | Disagree | 19.61% (10) | 11.43% (4) | 6.67% (1) | | | |
| | | Neutral | 41.18% (21) | 45.71% (16) | 26.67% (4) | | | |
| | | Agree | 11.76% (6) | 28.57% (10) | 60.00% (9) | | | |
| | | Strongly Agree | 11.76% (6) | 5.71% (2) | 0.00% (0) | | | |
| Q12aba | Uses Wind Speed/Direction Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 4.55% (3) | 2.33% (1) | 11.11% (2) | 0.0404 | 0.0019 | 0.1370 |
| | | Disagree | 6.06% (4) | 9.30% (4) | 11.11% (2) | | | |
| | | Neutral | 21.21% (14) | 39.53% (17) | 50.00% (9) | | | |
| | | Agree | 25.76% (17) | 32.56% (14) | 16.67% (3) | | | |
| | | Strongly Agree | 42.42% (28) | 16.28% (7) | 11.11% (2) | | | |
| Q12abb | Uses Precipitation Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 0.00% (0) | 2.27% (1) | 5.26% (1) | 0.0001 | <.0001 | 0.1538 |
| | | Disagree | 1.52% (1) | 4.55% (2) | 10.53% (2) | | | |
| | | Neutral | 10.61% (7) | 38.64% (17) | 47.37% (9) | | | |
| | | Agree | 13.64% (9) | 45.45% (20) | 21.05% (4) | | | |
| | | Strongly Agree | 74.24% (49) | 9.09% (4) | 15.79% (3) | | | |
| Q12abc | Uses Atmospheric Temperature Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 4.76% (3) | 0.00% (0) | 5.88% (1) | 0.1643 | 0.4795 | 0.7715 |
| | | Disagree | 14.29% (9) | 5.00% (2) | 11.76% (2) | | | |
| | | Neutral | 30.16% (19) | 57.50% (23) | 41.18% (7) | | | |
| | | Agree | 19.05% (12) | 25.00% (10) | 29.41% (5) | | | |
| | | Strongly Agree | 31.75% (20) | 12.50% (5) | 11.76% (2) | | | |

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| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q12bba | Uses Pavement Temperature Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 1.52% (1) | 2.94% (1) | 6.67% (1) | <.0001 | <.0001 | 0.5039 |
| | | Disagree | 0.00% (0) | 2.94% (1) | 6.67% (1) | | | |
| | | Neutral | 6.06% (4) | 50.00% (17) | 53.33% (8) | | | |
| | | Agree | 25.76% (17) | 35.29% (12) | 20.00% (3) | | | |
| | | Strongly Agree | 66.67% (44) | 8.82% (3) | 13.33% (2) | | | |
| Q12bbb | Uses Pavement Condition Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 1.52% (1) | 3.03% (1) | 7.14% (1) | <.0001 | <.0001 | 0.6548 |
| | | Disagree | 0.00% (0) | 6.06% (2) | 28.57% (4) | | | |
| | | Neutral | 7.58% (5) | 48.48% (16) | 28.57% (4) | | | |
| | | Agree | 16.67% (11) | 30.30% (10) | 28.57% (4) | | | |
| | | Strongly Agree | 74.24% (49) | 12.12% (4) | 7.14% (1) | | | |
| Q12bbc | Uses Dewpoint Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 19.23% (10) | 6.45% (2) | 6.25% (1) | 0.6875 | 0.6954 | 0.9602 |
| | | Disagree | 23.08% (12) | 12.90% (4) | 12.50% (2) | | | |
| | | Neutral | 34.62% (18) | 61.29% (19) | 62.50% (10) | | | |
| | | Agree | 7.69% (4) | 12.90% (4) | 12.50% (2) | | | |
| | | Strongly Agree | 15.38% (8) | 6.45% (2) | 6.25% (1) | | | |
| Q12aca | Uses Wind Speed/Direction Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 3.03% (2) | 0.00% (0) | 10.53% (2) | 0.0098 | 0.0260 | 0.6517 |
| | | Disagree | 3.03% (2) | 10.64% (5) | 0.00% (0) | | | |
| | | Neutral | 19.70% (13) | 36.17% (17) | 42.11% (8) | | | |
| | | Agree | 21.21% (14) | 31.91% (15) | 36.84% (7) | | | |
| | | Strongly Agree | 53.03% (35) | 21.28% (10) | 10.53% (2) | | | |
| Q12acb | Uses Precipitation Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 0.00% (0) | 0.00% (0) | 5.00% (1) | <.0001 | 0.0001 | 0.7510 |
| | | Disagree | 0.00% (0) | 4.08% (2) | 5.00% (1) | | | |
| | | Neutral | 3.08% (2) | 36.73% (18) | 35.00% (7) | | | |
| | | Agree | 12.31% (8) | 32.65% (16) | 40.00% (8) | | | |
| | | Strongly Agree | 84.62% (55) | 26.53% (13) | 15.00% (3) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q12acc | Uses Atmospheric Temperature Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 8.20% (5) | 0.00% (0) | 5.56% (1) | 0.0752 | 0.3698 | 0.8036 |
| | | Disagree | 6.56% (4) | 4.65% (2) | 5.56% (1) | | | |
| | | Neutral | 22.95% (14) | 48.84% (21) | 38.89% (7) | | | |
| | | Agree | 21.31% (13) | 25.58% (11) | 38.89% (7) | | | |
| | | Strongly Agree | 40.98% (25) | 20.93% (9) | 11.11% (2) | | | |
| Q12bca | Uses Pavement Temperature Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 1.54% (1) | 2.78% (1) | 5.88% (1) | 0.0013 | <.0001 | 0.2479 |
| | | Disagree | 0.00% (0) | 5.56% (2) | 0.00% (0) | | | |
| | | Neutral | 3.08% (2) | 22.22% (8) | 41.18% (7) | | | |
| | | Agree | 13.85% (9) | 47.22% (17) | 29.41% (5) | | | |
| | | Strongly Agree | 81.54% (53) | 22.22% (8) | 23.53% (4) | | | |
| Q12bcb | Uses Pavement Condition Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 1.54% (1) | 2.70% (1) | 6.67% (1) | <.0001 | 0.0004 | 0.8257 |
| | | Disagree | 0.00% (0) | 8.11% (3) | 6.67% (1) | | | |
| | | Neutral | 4.62% (3) | 32.43% (12) | 33.33% (5) | | | |
| | | Agree | 21.54% (14) | 37.84% (14) | 33.33% (5) | | | |
| | | Strongly Agree | 72.31% (47) | 18.92% (7) | 20.00% (3) | | | |
| Q12bcc | Uses Dewpoint Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 21.57% (11) | 5.88% (2) | 12.50% (2) | 0.0879 | 0.2020 | 0.9788 |
| | | Disagree | 19.61% (10) | 14.71% (5) | 0.00% (0) | | | |
| | | Neutral | 31.37% (16) | 35.29% (12) | 43.75% (7) | | | |
| | | Agree | 11.76% (6) | 32.35% (11) | 43.75% (7) | | | |
| | | Strongly Agree | 15.69% (8) | 11.76% (4) | 0.00% (0) | | | |
| Q13aaa | Wind Speed/Direction Information [1] is Understandable | Strongly Disagree | 1.54% (1) | 0.00% (0) | 0.00% (0) | 0.9522 | 0.3771 | 0.4232 |
| | | Disagree | 1.54% (1) | 0.00% (0) | 4.55% (1) | | | |
| | | Neutral | 7.69% (5) | 11.11% (6) | 13.64% (3) | | | |
| | | Agree | 35.38% (23) | 61.11% (33) | 54.55% (12) | | | |
| | | Strongly Agree | 53.85% (35) | 27.78% (15) | 27.27% (6) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q13aab | Precipitation Information [1] is Understandable | Strongly Disagree | 0.00% (0) | 0.00% (0) | 4.55% (1) | 0.9336 | 0.3022 | 0.3064 |
| | | Disagree | 4.62% (3) | 1.82% (1) | 4.55% (1) | | | |
| | | Neutral | 12.31% (8) | 14.55% (8) | 18.18% (4) | | | |
| | | Agree | 24.62% (16) | 58.18% (32) | 50.00% (11) | | | |
| | | Strongly Agree | 58.46% (38) | 25.45% (14) | 22.73% (5) | | | |
| Q13aac | Atmospheric Temperature Information [1] is Understandable | Strongly Disagree | 3.33% (2) | 2.00% (1) | 0.00% (0) | 0.6128 | 0.6264 | 0.4058 |
| | | Disagree | 5.00% (3) | 0.00% (0) | 0.00% (0) | | | |
| | | Neutral | 11.67% (7) | 22.00% (11) | 15.00% (3) | | | |
| | | Agree | 31.67% (19) | 56.00% (28) | 55.00% (11) | | | |
| | | Strongly Agree | 48.33% (29) | 20.00% (10) | 30.00% (6) | | | |
| Q13baa | Pavement Temperature Information [1] is Understandable | Strongly Disagree | 1.56% (1) | 4.08% (2) | 5.26% (1) | 0.1030 | 0.0014 | 0.0385 |
| | | Disagree | 1.56% (1) | 2.04% (1) | 15.79% (3) | | | |
| | | Neutral | 10.94% (7) | 20.41% (10) | 31.58% (6) | | | |
| | | Agree | 28.13% (18) | 51.02% (25) | 36.84% (7) | | | |
| | | Strongly Agree | 57.81% (37) | 22.45% (11) | 10.53% (2) | | | |
| Q13bab | Pavement Condition Information [1] is Understandable | Strongly Disagree | 0.00% (0) | 2.17% (1) | 10.53% (2) | 0.9569 | 0.0007 | 0.0026 |
| | | Disagree | 4.69% (3) | 6.52% (3) | 21.05% (4) | | | |
| | | Neutral | 21.88% (14) | 17.39% (8) | 36.84% (7) | | | |
| | | Agree | 25.00% (16) | 56.52% (26) | 21.05% (4) | | | |
| | | Strongly Agree | 48.44% (31) | 17.39% (8) | 10.53% (2) | | | |
| Q13bac | Dewpoint Information [1] is Understandable | Strongly Disagree | 18.37% (9) | 2.33% (1) | 0.00% (0) | 0.4517 | 0.9293 | 0.6333 |
| | | Disagree | 8.16% (4) | 4.65% (2) | 0.00% (0) | | | |
| | | Neutral | 18.37% (9) | 30.23% (13) | 43.75% (7) | | | |
| | | Agree | 20.41% (10) | 48.84% (21) | 43.75% (7) | | | |
| | | Strongly Agree | 34.69% (17) | 13.95% (6) | 12.50% (2) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q13aba | Wind Speed/Direction Information [1] is Usable | Strongly Disagree | 4.69% (3) | 0.00% (0) | 0.00% (0) | 0.1278 | 0.6332 | 0.1026 |
| | | Disagree | 1.56% (1) | 3.77% (2) | 10.00% (2) | | | |
| | | Neutral | 23.44% (15) | 13.21% (7) | 25.00% (5) | | | |
| | | Agree | 20.31% (13) | 60.38% (32) | 50.00% (10) | | | |
| | | Strongly Agree | 50.00% (32) | 22.64% (12) | 15.00% (3) | | | |
| Q13abb | Precipitation Information [1] is Usable | Strongly Disagree | 3.13% (2) | 0.00% (0) | 9.52% (2) | 0.9636 | 0.6348 | 0.6260 |
| | | Disagree | 1.56% (1) | 5.56% (3) | 9.52% (2) | | | |
| | | Neutral | 23.44% (15) | 22.22% (12) | 14.29% (3) | | | |
| | | Agree | 14.06% (9) | 50.00% (27) | 47.62% (10) | | | |
| | | Strongly Agree | 57.81% (37) | 22.22% (12) | 19.05% (4) | | | |
| Q13abc | Atmospheric Temperature Information [1] is Usable | Strongly Disagree | 8.20% (5) | 2.08% (1) | 0.00% (0) | 0.8150 | 0.8562 | 0.7339 |
| | | Disagree | 3.28% (2) | 2.08% (1) | 11.11% (2) | | | |
| | | Neutral | 19.67% (12) | 25.00% (12) | 22.22% (4) | | | |
| | | Agree | 19.67% (12) | 45.83% (22) | 55.56% (10) | | | |
| | | Strongly Agree | 49.18% (30) | 25.00% (12) | 11.11% (2) | | | |
| Q13bba | Pavement Temperature Information [1] is Usable | Strongly Disagree | 3.13% (2) | 4.17% (2) | 5.26% (1) | 0.1172 | 0.0038 | 0.0596 |
| | | Disagree | 4.69% (3) | 0.00% (0) | 26.32% (5) | | | |
| | | Neutral | 15.63% (10) | 33.33% (16) | 31.58% (6) | | | |
| | | Agree | 17.19% (11) | 45.83% (22) | 31.58% (6) | | | |
| | | Strongly Agree | 59.38% (38) | 16.67% (8) | 5.26% (1) | | | |
| Q13bbb | Pavement Condition Information [1] is Usable | Strongly Disagree | 3.13% (2) | 2.22% (1) | 10.53% (2) | 0.9034 | 0.0272 | 0.0420 |
| | | Disagree | 6.25% (4) | 6.67% (3) | 31.58% (6) | | | |
| | | Neutral | 25.00% (16) | 26.67% (12) | 21.05% (4) | | | |
| | | Agree | 17.19% (11) | 51.11% (23) | 31.58% (6) | | | |
| | | Strongly Agree | 48.44% (31) | 13.33% (6) | 5.26% (1) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q13bbc | Dewpoint Information [1] is Usable | Strongly Disagree | 17.65% (9) | 4.76% (2) | 0.00% (0) | 0.1175 | 0.0691 | 0.5288 |
| | | Disagree | 17.65% (9) | 2.38% (1) | 0.00% (0) | | | |
| | | Neutral | 33.33% (17) | 45.24% (19) | 42.86% (6) | | | |
| | | Agree | 17.65% (9) | 38.10% (16) | 50.00% (7) | | | |
| | | Strongly Agree | 13.73% (7) | 9.52% (4) | 7.14% (1) | | | |
| Q13abb | Precipitation Information [1] is Usable | Strongly Disagree | 3.13% (2) | 0.00% (0) | 9.52% (2) | 0.9636 | 0.6348 | 0.6260 |
| | | Disagree | 1.56% (1) | 5.56% (3) | 9.52% (2) | | | |
| | | Neutral | 23.44% (15) | 22.22% (12) | 14.29% (3) | | | |
| | | Agree | 14.06% (9) | 50.00% (27) | 47.62% (10) | | | |
| | | Strongly Agree | 57.81% (37) | 22.22% (12) | 19.05% (4) | | | |
| Q13aca | Wind Speed/Direction Information [1] is Easily Obtainable | Strongly Disagree | 0.00% (0) | 3.85% (2) | 13.64% (3) | 0.1079 | 0.0142 | 0.1607 |
| | | Disagree | 1.52% (1) | 19.23% (10) | 9.09% (2) | | | |
| | | Neutral | 19.70% (13) | 11.54% (6) | 27.27% (6) | | | |
| | | Agree | 22.73% (15) | 44.23% (23) | 31.82% (7) | | | |
| | | Strongly Agree | 56.06% (37) | 21.15% (11) | 18.18% (4) | | | |
| Q13acb | Precipitation Information [1] is Easily Obtainable | Strongly Disagree | 0.00% (0) | 3.92% (2) | 9.52% (2) | 0.0945 | 0.0114 | 0.1921 |
| | | Disagree | 3.03% (2) | 17.65% (9) | 14.29% (3) | | | |
| | | Neutral | 19.70% (13) | 15.69% (8) | 28.57% (6) | | | |
| | | Agree | 24.24% (16) | 47.06% (24) | 28.57% (6) | | | |
| | | Strongly Agree | 53.03% (35) | 15.69% (8) | 19.05% (4) | | | |
| Q13acc | Atmospheric Temperature Information [1] is Easily Obtainable | Strongly Disagree | 1.61% (1) | 4.17% (2) | 5.88% (1) | 0.0976 | 0.0573 | 0.4489 |
| | | Disagree | 3.23% (2) | 18.75% (9) | 5.88% (1) | | | |
| | | Neutral | 17.74% (11) | 14.58% (7) | 35.29% (6) | | | |
| | | Agree | 22.58% (14) | 37.50% (18) | 29.41% (5) | | | |
| | | Strongly Agree | 54.84% (34) | 25.00% (12) | 23.53% (4) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q13bca | Pavement Temperature Information [1] is Easily Obtainable | Strongly Disagree | 4.55% (3) | 2.13% (1) | 10.53% (2) | 0.0443 | 0.0139 | 0.3474 |
| | | Disagree | 3.03% (2) | 14.89% (7) | 10.53% (2) | | | |
| | | Neutral | 15.15% (10) | 23.40% (11) | 31.58% (6) | | | |
| | | Agree | 25.76% (17) | 42.55% (20) | 36.84% (7) | | | |
| | | Strongly Agree | 51.52% (34) | 17.02% (8) | 10.53% (2) | | | |
| Q13bcb | Pavement Condition Information [1] is Easily Obtainable | Strongly Disagree | 1.52% (1) | 2.22% (1) | 10.53% (2) | 0.2635 | 0.0215 | 0.1709 |
| | | Disagree | 6.06% (4) | 17.78% (8) | 10.53% (2) | | | |
| | | Neutral | 22.73% (15) | 20.00% (9) | 36.84% (7) | | | |
| | | Agree | 19.70% (13) | 44.44% (20) | 26.32% (5) | | | |
| | | Strongly Agree | 50.00% (33) | 15.56% (7) | 15.79% (3) | | | |
| Q13bcc | Dewpoint Information [1] is Easily Obtainable | Strongly Disagree | 13.46% (7) | 4.76% (2) | 0.00% (0) | 0.7458 | 0.8675 | 0.9431 |
| | | Disagree | 11.54% (6) | 19.05% (8) | 0.00% (0) | | | |
| | | Neutral | 19.23% (10) | 23.81% (10) | 46.67% (7) | | | |
| | | Agree | 11.54% (6) | 35.71% (15) | 40.00% (6) | | | |
| | | Strongly Agree | 44.23% (23) | 16.67% (7) | 13.33% (2) | | | |
| Q13ada | Wind Speed/Direction Information [1] is Accurate | Strongly Disagree | 1.54% (1) | 0.00% (0) | 5.00% (1) | 0.9313 | 0.1253 | 0.0877 |
| | | Disagree | 20.00% (13) | 19.61% (10) | 5.00% (1) | | | |
| | | Neutral | 38.46% (25) | 41.18% (21) | 30.00% (6) | | | |
| | | Agree | 26.15% (17) | 31.37% (16) | 55.00% (11) | | | |
| | | Strongly Agree | 13.85% (9) | 7.84% (4) | 5.00% (1) | | | |
| Q13adb | Precipitation Information [1] is Accurate | Strongly Disagree | 6.15% (4) | 7.69% (4) | 14.29% (3) | 0.5042 | 0.1196 | 0.2207 |
| | | Disagree | 16.92% (11) | 13.46% (7) | 14.29% (3) | | | |
| | | Neutral | 44.62% (29) | 40.38% (21) | 19.05% (4) | | | |
| | | Agree | 26.15% (17) | 26.92% (14) | 42.86% (9) | | | |
| | | Strongly Agree | 6.15% (4) | 11.54% (6) | 9.52% (2) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q13adc | Atmospheric Temperature Information [1] is Accurate | Strongly Disagree | 3.23% (2) | 0.00% (0) | 5.00% (1) | 0.7597 | 0.1738 | 0.0946 |
| | | Disagree | 17.74% (11) | 15.22% (7) | 10.00% (2) | | | |
| | | Neutral | 37.10% (23) | 45.65% (21) | 25.00% (5) | | | |
| | | Agree | 27.42% (17) | 28.26% (13) | 55.00% (11) | | | |
| | | Strongly Agree | 14.52% (9) | 10.87% (5) | 5.00% (1) | | | |
| Q13bda | Pavement Temperature Information [1] is Accurate | Strongly Disagree | 0.00% (0) | 4.35% (2) | 16.67% (3) | 0.0040 | 0.0512 | 0.8878 |
| | | Disagree | 12.31% (8) | 13.04% (6) | 27.78% (5) | | | |
| | | Neutral | 32.31% (21) | 56.52% (26) | 27.78% (5) | | | |
| | | Agree | 40.00% (26) | 21.74% (10) | 27.78% (5) | | | |
| | | Strongly Agree | 15.38% (10) | 4.35% (2) | 0.00% (0) | | | |
| Q13bdb | Pavement Condition Information [1] is Accurate | Strongly Disagree | 3.08% (2) | 4.55% (2) | 21.05% (4) | 0.1066 | 0.5081 | 0.5723 |
| | | Disagree | 18.46% (12) | 15.91% (7) | 31.58% (6) | | | |
| | | Neutral | 38.46% (25) | 54.55% (24) | 15.79% (3) | | | |
| | | Agree | 24.62% (16) | 20.45% (9) | 26.32% (5) | | | |
| | | Strongly Agree | 15.38% (10) | 4.55% (2) | 5.26% (1) | | | |
| Q13bdc | Dewpoint Information [1] is Accurate | Strongly Disagree | 7.84% (4) | 7.50% (3) | 0.00% (0) | 0.7923 | 0.0441 | 0.0186 |
| | | Disagree | 31.37% (16) | 17.50% (7) | 14.29% (2) | | | |
| | | Neutral | 33.33% (17) | 50.00% (20) | 28.57% (4) | | | |
| | | Agree | 23.53% (12) | 22.50% (9) | 57.14% (8) | | | |
| | | Strongly Agree | 3.92% (2) | 2.50% (1) | 0.00% (0) | | | |
| Q13aea | Wind Speed/Direction Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 1.96% (1) | 0.00% (0) | 0.0953 | 0.0913 | 0.7260 |
| | | Disagree | 3.03% (2) | 3.92% (2) | 5.26% (1) | | | |
| | | Neutral | 19.70% (13) | 31.37% (16) | 36.84% (7) | | | |
| | | Agree | 33.33% (22) | 50.98% (26) | 42.11% (8) | | | |
| | | Strongly Agree | 43.94% (29) | 11.76% (6) | 15.79% (3) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q13aeb | Precipitation Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 5.88% (3) | 5.26% (1) | 0.0210 | 0.0216 | 0.7070 |
| | | Disagree | 1.52% (1) | 5.88% (3) | 10.53% (2) | | | |
| | | Neutral | 16.67% (11) | 25.49% (13) | 26.32% (5) | | | |
| | | Agree | 28.79% (19) | 47.06% (24) | 36.84% (7) | | | |
| | | Strongly Agree | 53.03% (35) | 15.69% (8) | 21.05% (4) | | | |
| Q13aec | Atmospheric Temperature Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 4.35% (2) | 0.00% (0) | 0.1770 | 0.4890 | 0.7785 |
| | | Disagree | 4.76% (3) | 4.35% (2) | 11.76% (2) | | | |
| | | Neutral | 22.22% (14) | 30.43% (14) | 23.53% (4) | | | |
| | | Agree | 22.22% (14) | 50.00% (23) | 41.18% (7) | | | |
| | | Strongly Agree | 50.79% (32) | 10.87% (5) | 23.53% (4) | | | |
| Q13bea | Pavement Temperature Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 4.65% (2) | 17.65% (3) | 0.0004 | 0.0006 | 0.5823 |
| | | Disagree | 3.08% (2) | 6.98% (3) | 11.76% (2) | | | |
| | | Neutral | 13.85% (9) | 39.53% (17) | 29.41% (5) | | | |
| | | Agree | 24.62% (16) | 37.21% (16) | 29.41% (5) | | | |
| | | Strongly Agree | 58.46% (38) | 11.63% (5) | 11.76% (2) | | | |
| Q13beb | Pavement Condition Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 1.52% (1) | 4.88% (2) | 16.67% (3) | 0.0098 | 0.0095 | 0.5811 |
| | | Disagree | 4.55% (3) | 14.63% (6) | 22.22% (4) | | | |
| | | Neutral | 21.21% (14) | 34.15% (14) | 22.22% (4) | | | |
| | | Agree | 25.76% (17) | 41.46% (17) | 22.22% (4) | | | |
| | | Strongly Agree | 46.97% (31) | 4.88% (2) | 16.67% (3) | | | |
| Q13bec | Dewpoint Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 13.46% (7) | 7.69% (3) | 0.00% (0) | 0.1931 | 0.1599 | 0.0214 |
| | | Disagree | 17.31% (9) | 15.38% (6) | 0.00% (0) | | | |
| | | Neutral | 25.00% (13) | 46.15% (18) | 35.71% (5) | | | |
| | | Agree | 25.00% (13) | 28.21% (11) | 57.14% (8) | | | |
| | | Strongly Agree | 19.23% (10) | 2.56% (1) | 7.14% (1) | | | |

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5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q14afa | FORETELL Wind Speed/Direction Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 7.14% (3) | 15.00% (3) | N/A [2] | N/A [2] | 0.2401 |
| | | Disagree | N/A [2] | 16.67% (7) | 25.00% (5) | | | |
| | | Neutral | N/A [2] | 42.86% (18) | 40.00% (8) | | | |
| | | Agree | N/A [2] | 26.19% (11) | 15.00% (3) | | | |
| | | Strongly Agree | N/A [2] | 7.14% (3) | 5.00% (1) | | | |
| Q14afb | FORETELL Precipitation Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 6.67% (3) | 14.29% (3) | N/A [2] | N/A [2] | 0.1648 |
| | | Disagree | N/A [2] | 17.78% (8) | 23.81% (5) | | | |
| | | Neutral | N/A [2] | 40.00% (18) | 42.86% (9) | | | |
| | | Agree | N/A [2] | 31.11% (14) | 9.52% (2) | | | |
| | | Strongly Agree | N/A [2] | 4.44% (2) | 9.52% (2) | | | |
| Q14afc | FORETELL Atmospheric Temperature Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 7.50% (3) | 16.67% (3) | N/A [2] | N/A [2] | 0.4923 |
| | | Disagree | N/A [2] | 12.50% (5) | 22.22% (4) | | | |
| | | Neutral | N/A [2] | 50.00% (20) | 38.89% (7) | | | |
| | | Agree | N/A [2] | 20.00% (8) | 16.67% (3) | | | |
| | | Strongly Agree | N/A [2] | 10.00% (4) | 5.56% (1) | | | |
| Q14bfa | FORETELL Pavement Temperature Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 8.33% (3) | 17.65% (3) | N/A [2] | N/A [2] | 0.5849 |
| | | Disagree | N/A [2] | 22.22% (8) | 47.06% (8) | | | |
| | | Neutral | N/A [2] | 38.89% (14) | 11.76% (2) | | | |
| | | Agree | N/A [2] | 30.56% (11) | 17.65% (3) | | | |
| | | Strongly Agree | N/A [2] | 0.00% (0) | 5.88% (1) | | | |
| Q14bfb | FORETELL Pavement Condition Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 5.71% (2) | 23.53% (4) | N/A [2] | N/A [2] | 0.8618 |
| | | Disagree | N/A [2] | 25.71% (9) | 41.18% (7) | | | |
| | | Neutral | N/A [2] | 42.86% (15) | 11.76% (2) | | | |
| | | Agree | N/A [2] | 25.71% (9) | 17.65% (3) | | | |
| | | Strongly Agree | N/A [2] | 0.00% (0) | 5.88% (1) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q14bfc | FORETELL Dewpoint Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 11.76% (4) | 14.29% (2) | N/A [2] | N/A [2] | 0.0912 |
| | | Disagree | N/A [2] | 14.71% (5) | 21.43% (3) | | | |
| | | Neutral | N/A [2] | 64.71% (22) | 35.71% (5) | | | |
| | | Agree | N/A [2] | 8.82% (3) | 21.43% (3) | | | |
| | | Strongly Agree | N/A [2] | 0.00% (0) | 7.14% (1) | | | |
| Q15 | FORETELL Provides Valuable Information Not Provided Elsewhere | Strongly Disagree | N/A [2] | 17.65% (12) | 22.58% (7) | N/A [2] | N/A [2] | 0.3365 |
| | | Disagree | N/A [2] | 16.18% (11) | 29.03% (9) | | | |
| | | Neutral | N/A [2] | 27.94% (19) | 19.35% (6) | | | |
| | | Agree | N/A [2] | 30.88% (21) | 22.58% (7) | | | |
| | | Strongly Agree | N/A [2] | 7.35% (5) | 6.45% (2) | | | |
| Q16 | Receive FORETELL Information in Time to Make Weather-Related Decisions | Strongly Disagree | N/A [2] | 10.14% (7) | 12.90% (4) | N/A [2] | N/A [2] | 0.8945 |
| | | Disagree | N/A [2] | 13.04% (9) | 16.13% (5) | | | |
| | | Neutral | N/A [2] | 36.23% (25) | 29.03% (9) | | | |
| | | Agree | N/A [2] | 40.58% (28) | 38.71% (12) | | | |
| | | Strongly Agree | N/A [2] | 0.00% (0) | 3.23% (1) | | | |
| Q17 | Weather Information [1] is Sufficient for Making Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 7.25% (5) | 16.13% (5) | 0.0689 | 0.1823 | 0.9422 |
| | | Disagree | 16.67% (11) | 24.64% (17) | 16.13% (5) | | | |
| | | Neutral | 33.33% (22) | 33.33% (23) | 32.26% (10) | | | |
| | | Agree | 37.88% (25) | 31.88% (22) | 32.26% (10) | | | |
| | | Strongly Agree | 12.12% (8) | 2.90% (2) | 3.23% (1) | | | |
| Q18 | Willing to Pay for FORETELL | Strongly Disagree | N/A [2] | 12.12% (8) | 26.67% (8) | N/A [2] | N/A [2] | 0.9708 |
| | | Disagree | N/A [2] | 15.15% (10) | 13.33% (4) | | | |
| | | Neutral | N/A [2] | 53.03% (35) | 40.00% (12) | | | |
| | | Agree | N/A [2] | 18.18% (12) | 13.33% (4) | | | |
| | | Strongly Agree | N/A [2] | 1.52% (1) | 6.67% (2) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q19 | Having Weather Information [1] Makes Job Easier | Strongly Disagree | 0.00% (0) | 10.14% (7) | 16.13% (5) | <.0001 | <.0001 | 0.4044 |
| | | Disagree | 3.08% (2) | 8.70% (6) | 16.13% (5) | | | |
| | | Neutral | 6.15% (4) | 43.48% (30) | 38.71% (12) | | | |
| | | Agree | 18.46% (12) | 33.33% (23) | 25.81% (8) | | | |
| | | Strongly Agree | 72.31% (47) | 4.35% (3) | 3.23% (1) | | | |
| Q20 | Weather Information [1] Helps You Improve Traffic Efficiency of Roadways | Strongly Disagree | 0.00% (0) | 10.14% (7) | 16.13% (5) | <.0001 | <.0001 | 0.6884 |
| | | Disagree | 1.52% (1) | 7.25% (5) | 3.23% (1) | | | |
| | | Neutral | 22.73% (15) | 56.52% (39) | 58.06% (18) | | | |
| | | Agree | 40.91% (27) | 26.09% (18) | 19.35% (6) | | | |
| | | Strongly Agree | 34.85% (23) | 0.00% (0) | 3.23% (1) | | | |
| Q21 | Weather Information [1] Helps You to Target Snow and Ice Control Measures | Strongly Disagree | 1.52% (1) | 10.14% (7) | 9.68% (3) | <.0001 | <.0001 | 0.6440 |
| | | Disagree | 3.03% (2) | 11.59% (8) | 16.13% (5) | | | |
| | | Neutral | 13.64% (9) | 44.93% (31) | 45.16% (14) | | | |
| | | Agree | 42.42% (28) | 30.43% (21) | 25.81% (8) | | | |
| | | Strongly Agree | 39.39% (26) | 2.90% (2) | 3.23% (1) | | | |
| Q22 | Highway Maintenance Activities are Conducted More Efficiently Using Weather Information [1] | Strongly Disagree | 0.00% (0) | 10.29% (7) | 9.68% (3) | <.0001 | <.0001 | 0.7916 |
| | | Disagree | 0.00% (0) | 14.71% (10) | 29.03% (9) | | | |
| | | Neutral | 7.58% (5) | 51.47% (35) | 35.48% (11) | | | |
| | | Agree | 33.33% (22) | 23.53% (16) | 22.58% (7) | | | |
| | | Strongly Agree | 59.09% (39) | 0.00% (0) | 3.23% (1) | | | |
| Q23 | FORETELL Information Makes You More Confident in Making Weather-Related Decisions | Strongly Disagree | N/A [2] | 10.14% (7) | 12.90% (4) | N/A [2] | N/A [2] | 0.5997 |
| | | Disagree | N/A [2] | 14.49% (10) | 22.58% (7) | | | |
| | | Neutral | N/A [2] | 50.72% (35) | 35.48% (11) | | | |
| | | Agree | N/A [2] | 21.74% (15) | 22.58% (7) | | | |
| | | Strongly Agree | N/A [2] | 2.90% (2) | 6.45% (2) | | | |

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5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q24 | FORETELL Information Helps You Deploy Staff More Efficiently | Strongly Disagree | N/A [2] | 11.59% (8) | 9.68% (3) | N/A [2] | N/A [2] | 0.6507 |
| | | Disagree | N/A [2] | 15.94% (11) | 22.58% (7) | | | |
| | | Neutral | N/A [2] | 53.62% (37) | 45.16% (14) | | | |
| | | Agree | N/A [2] | 17.39% (12) | 16.13% (5) | | | |
| | | Strongly Agree | N/A [2] | 1.45% (1) | 6.45% (2) | | | |
| Q25 | Roads Return to Targeted Level of Service More Quickly with Weather Information [1] | Strongly Disagree | 0.00% (0) | 11.76% (8) | 9.68% (3) | <.0001 | <.0001 | 0.7536 |
| | | Disagree | 3.03% (2) | 16.18% (11) | 25.81% (8) | | | |
| | | Neutral | 31.82% (21) | 50.00% (34) | 45.16% (14) | | | |
| | | Agree | 25.76% (17) | 20.59% (14) | 16.13% (5) | | | |
| | | Strongly Agree | 39.39% (26) | 1.47% (1) | 3.23% (1) | | | |
| Q26 | Safety of the Highway Maintenance Operator is Increased with Weather Information [1] | Strongly Disagree | 1.52% (1) | 10.29% (7) | 16.13% (5) | <.0001 | <.0001 | 0.5229 |
| | | Disagree | 6.06% (4) | 16.18% (11) | 12.90% (4) | | | |
| | | Neutral | 12.12% (8) | 48.53% (33) | 51.61% (16) | | | |
| | | Agree | 27.27% (18) | 22.06% (15) | 16.13% (5) | | | |
| | | Strongly Agree | 53.03% (35) | 2.94% (2) | 3.23% (1) | | | |
| Q27 | Weather Information [1] Helps to Lessen the Amount of Chemical Applications | Strongly Disagree | 1.52% (1) | 10.29% (7) | 16.13% (5) | <.0001 | <.0001 | 0.2113 |
| | | Disagree | 4.55% (3) | 22.06% (15) | 12.90% (4) | | | |
| | | Neutral | 22.73% (15) | 51.47% (35) | 45.16% (14) | | | |
| | | Agree | 31.82% (21) | 13.24% (9) | 22.58% (7) | | | |
| | | Strongly Agree | 39.39% (26) | 2.94% (2) | 3.23% (1) | | | |
| Q28 | Make Highway Maintenance Decisions More Efficiently because of FORETELL Information | Yes | N/A [2] | 54.55% (36) | 38.71% (12) | N/A [2] | N/A [2] | 0.1238 |
| | | No | N/A [2] | 45.45% (30) | 61.29% (19) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-3. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Respondents from All States (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=66) | First Follow-Up (N=87) | Second Follow-Up (N=47) | P-value [3] | | |
| Q28a | How Much Sooner Do You Learn about Weather Events when Using FORETELL Information | 0-3 Hours | N/A [2] | 17.65% (6) | 50.00% (6) | N/A [2] | N/A [2] | N/A [5] |
| | | 3-6 Hours | N/A [2] | 38.24% (13) | 8.33% (1) | | | |
| | | 6-12 Hours | N/A [2] | 38.24% (13) | 25.00% (3) | | | |
| | | > 12 Hours | N/A [2] | 5.88% (2) | 16.67% (2) | | | |
| Q29 | Roads are More Quickly Returned to Acceptable Level of Service when Using FORETELL Information | Yes | N/A [2] | 33.33% (22) | 22.58% (7) | N/A [2] | N/A [2] | 0.2782 |
| | | No | N/A [2] | 66.67% (44) | 77.42% (24) | | | |
| Q29a | How Much More Quickly are Roads Returned to Service when Using FORETELL Information | 0-3 Hours | N/A [2] | 47.62% (10) | 71.43% (5) | N/A [2] | N/A [2] | N/A [5] |
| | | 3-6 Hours | N/A [2] | 47.62% (10) | 14.29% (1) | | | |
| | | 6-12 Hours | N/A [2] | 4.76% (1) | 14.29% (1) | | | |
| Q30 | Would Like to Use FORETELL Information in the Future | Yes | N/A [2] | 88.06% (59) | 53.33% (16) | N/A [2] | N/A [2] | <.0001 |
| | | No | N/A [2] | 11.94% (8) | 46.67% (14) | | | |

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**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q6aa | Uses Wind Speed/Direction in Weather-Related Decisions | Yes | 100.00% (30) | 96.08% (49) | 100.00% (11) | N/A [4] | N/A [4] | N/A [4] |
| | | No | 0.00% (0) | 3.92% (2) | 0.00% (0) | | | |
| Q6ab | Uses Actual Wind Speed/Direction Readings | No Actual Readings | 83.33% (25) | 6.12% (3) | 9.09% (1) | <.0001 | 0.0008 | 0.7219 |
| | | Uses Actual Readings | 16.67% (5) | 93.88% (46) | 90.91% (10) | | | |
| Q6ac | Uses Forecast Wind Speed/Direction Readings | No Forecast Information | 0.00% (0) | 20.41% (10) | 0.00% (0) | N/A [4] | N/A [4] | N/A [4] |
| | | Uses Forecast Information | 100.00% (30) | 79.59% (39) | 100.00% (11) | | | |
| Q6ba | Uses Precipitation in Weather-Related Decisions | Yes | 100.00% (30) | 98.04% (50) | 100.00% (11) | N/A [4] | N/A [4] | N/A [4] |
| | | No | 0.00% (0) | 1.96% (1) | 0.00% (0) | | | |
| Q6bb | Uses Actual Precipitation Readings | No Actual Readings | 93.33% (28) | 20.00% (10) | 18.18% (2) | <.0001 | 0.0001 | 0.8891 |
| | | Uses Actual Readings | 6.67% (2) | 80.00% (40) | 81.82% (9) | | | |
| Q6bc | Uses Forecast Precipitation Readings | No Forecast Information | 10.00% (3) | 18.00% (9) | 0.00% (0) | 0.3345 | N/A [4] | N/A [4] |
| | | Uses Forecast Information | 90.00% (27) | 82.00% (41) | 100.00% (11) | | | |

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**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q6ca | Uses Atmospheric Temperature in Weather-Related Decisions | Yes | 96.67% (29) | 76.00% (38) | 81.82% (9) | 0.0369 | 0.1435 | 0.6791 |
| | | No | 3.33% (1) | 24.00% (12) | 18.18% (2) | | | |
| Q6cb | Uses Actual Atmospheric Temperature Readings | No Actual Readings | 79.31% (23) | 10.53% (4) | 11.11% (1) | <.0001 | 0.0034 | 0.9589 |
| | | Uses Actual Readings | 20.69% (6) | 89.47% (34) | 88.89% (8) | | | |
| Q6cc | Uses Forecast Atmospheric Temperature Readings | No Forecast Information | 24.14% (7) | 21.05% (8) | 11.11% (1) | 0.7513 | 0.4172 | 0.4994 |
| | | Uses Forecast Information | 75.86% (22) | 78.95% (30) | 88.89% (8) | | | |
| Q6da | Uses Pavement Temperature in Weather-Related Decisions | Yes | 100.00% (30) | 98.04% (50) | 100.00% (11) | N/A [4] | N/A [4] | N/A [4] |
| | | No | 0.00% (0) | 1.96% (1) | 0.00% (0) | | | |
| Q6db | Uses Actual Pavement Temperature Readings | No Actual Readings | 96.67% (29) | 8.00% (4) | 0.00% (0) | <.0001 | N/A [4] | N/A [4] |
| | | Uses Actual Readings | 3.33% (1) | 92.00% (46) | 100.00% (11) | | | |
| Q6dc | Uses Forecast Pavement Temperature Readings | No Forecast Information | 16.67% (5) | 22.00% (11) | 18.18% (2) | 0.5735 | 0.9131 | 0.7764 |
| | | Uses Forecast Information | 83.33% (25) | 78.00% (39) | 81.82% (9) | | | |
| Q6ea | Uses Pavement Condition in Weather-Related Decisions | Yes | 100.00% (30) | 88.24% (45) | 90.91% (10) | N/A [4] | N/A [4] | 0.8015 |
| | | No | 0.00% (0) | 11.76% (6) | 9.09% (1) | | | |

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**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q6eb | Uses Actual Pavement Condition Readings | No Actual Readings | 93.33% (28) | 8.89% (4) | 0.00% (0) | <.0001 | N/A [4] | N/A [4] |
| | | Uses Actual Readings | 6.67% (2) | 91.11% (41) | 100.00% (10) | | | |
| Q6ec | Uses Forecast Pavement Condition Readings | No Forecast Information | 36.67% (11) | 40.00% (18) | 40.00% (4) | 0.7760 | 0.8608 | 1.0000 |
| | | Uses Forecast Information | 63.33% (19) | 60.00% (27) | 60.00% (6) | | | |
| Q6fa | Uses Dewpoint in Weather-Related Decisions | Yes | 80.00% (24) | 58.00% (29) | 63.64% (7) | 0.0620 | 0.2851 | 0.7293 |
| | | No | 20.00% (6) | 42.00% (21) | 36.36% (4) | | | |
| Q6fb | Uses Actual Dewpoint Readings | No Actual Readings | 62.50% (15) | 20.69% (6) | 14.29% (1) | 0.0036 | 0.0677 | 0.7011 |
| | | Uses Actual Readings | 37.50% (9) | 79.31% (23) | 85.71% (6) | | | |
| Q6fc | Uses Forecast Dewpoint Readings | No Forecast Information | 54.17% (13) | 24.14% (7) | 14.29% (1) | 0.0258 | 0.0894 | 0.5764 |
| | | Uses Forecast Information | 45.83% (11) | 75.86% (22) | 85.71% (6) | | | |
| Q7aa | Uses FORETELL to Receive Wind Speed/Direction Readings | Yes | N/A [2] | 60.00% (27) | 45.45% (5) | N/A [2] | N/A [2] | 0.3643 |
| | | No | N/A [2] | 40.00% (18) | 54.55% (6) | | | |
| Q7ba | Uses FORETELL to Receive Precipitation Readings | Yes | N/A [2] | 57.78% (26) | 45.45% (5) | N/A [2] | N/A [2] | 0.4453 |
| | | No | N/A [2] | 42.22% (19) | 54.55% (6) | | | |

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**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q7ca | Uses FORETELL to Receive Atmospheric Temperature Readings | Yes | N/A [2] | 50.00% (22) | 55.56% (5) | N/A [2] | N/A [2] | 0.7707 |
| | | No | N/A [2] | 50.00% (22) | 44.44% (4) | | | |
| Q7da | Uses FORETELL to Receive Pavement Temperature Readings | Yes | N/A [2] | 48.89% (22) | 27.27% (3) | N/A [2] | N/A [2] | 0.2151 |
| | | No | N/A [2] | 51.11% (23) | 72.73% (8) | | | |
| Q7ea | Uses FORETELL to Receive Pavement Condition Readings | Yes | N/A [2] | 46.67% (21) | 30.00% (3) | N/A [2] | N/A [2] | 0.3545 |
| | | No | N/A [2] | 53.33% (24) | 70.00% (7) | | | |
| Q8aa | Uses Weather Information [1] Daily | Yes | 100.00% (30) | 30.23% (13) | 9.09% (1) | N/A [4] | N/A [4] | 0.1541 |
| | | No | 0.00% (0) | 69.77% (30) | 90.91% (10) | | | |
| Q8ab | Uses Weather Information [1] Daily (How Often) | Twice daily | 53.33% (16) | 66.67% (8) | 100.00% (1) | N/A [5] | N/A [5] | N/A [5] |
| | | 4 Times Daily | 26.67% (8) | 25.00% (3) | 0.00% (0) | | | |
| | | Every Other Hour | 0.00% (0) | 8.33% (1) | 0.00% (0) | | | |
| | | At Least Hourly | 20.00% (6) | 0.00% (0) | 0.00% (0) | | | |
| Q8ba | Uses Weather Information [1] Weekly | Yes | 17.86% (5) | 50.00% (21) | 27.27% (3) | 0.0075 | 0.5205 | 0.2044 |
| | | No | 82.14% (23) | 50.00% (21) | 72.73% (8) | | | |
| Q8ca | Uses Weather Information [1] In Advance of a Weather Event | Yes | 83.33% (25) | 72.09% (31) | 54.55% (6) | 0.2345 | 0.0302 | 0.2717 |
| | | No | 16.67% (5) | 27.91% (12) | 45.45% (5) | | | |
| Q8cb | Uses Weather Information [1] In Advance of a Weather Event (How Often) | Twice daily | 16.67% (4) | 45.16% (14) | 50.00% (3) | N/A [5] | N/A [5] | N/A [5] |
| | | 4 Times Daily | 29.17% (7) | 29.03% (9) | 33.33% (2) | | | |
| | | Every Other Hour | 20.83% (5) | 9.68% (3) | 16.67% (1) | | | |
| | | At Least Hourly | 33.33% (8) | 16.13% (5) | 0.00% (0) | | | |

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| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q8da | Uses Weather Information [1] During a Weather Event | Yes | 86.67% (26) | 72.09% (31) | 72.73% (8) | 0.1121 | 0.2342 | 0.9665 |
| | | No | 13.33% (4) | 27.91% (12) | 27.27% (3) | | | |
| Q8db | Uses Weather Information [1] During a Weather Event (How Often) | Twice daily | 8.00% (2) | 16.13% (5) | 62.50% (5) | N/A [5] | N/A [5] | N/A [5] |
| | | 4 Times Daily | 12.00% (3) | 48.39% (15) | 25.00% (2) | | | |
| | | Every Other Hour | 0.00% (0) | 9.68% (3) | 0.00% (0) | | | |
| | | At Least Hourly | 80.00% (20) | 25.81% (8) | 12.50% (1) | | | |
| Q8ea | Uses Weather Information [1] After a Weather Event | Yes | 76.67% (23) | 38.10% (16) | 27.27% (3) | 0.0027 | 0.0083 | 0.5039 |
| | | No | 23.33% (7) | 61.90% (26) | 72.73% (8) | | | |
| Q8eb | Uses Weather Information [1] After a Weather Event (How Often) | Twice daily | 50.00% (11) | 86.67% (13) | 66.67% (2) | N/A [5] | N/A [5] | N/A [5] |
| | | 4 Times Daily | 36.36% (8) | 6.67% (1) | 33.33% (1) | | | |
| | | Every Other Hour | 0.00% (0) | 6.67% (1) | 0.00% (0) | | | |
| | | At Least Hourly | 13.64% (3) | 0.00% (0) | 0.00% (0) | | | |
| Q9_Q10a | FORETELL Features - Animation | Like Most | N/A [2] | 100.00% (35) | 88.89% (8) | N/A [2] | N/A [2] | N/A [4] |
| | | Like Least | N/A [2] | 0.00% (0) | 11.11% (1) | | | |
| Q9_Q10b | FORETELL Features - Long-Term Forecast | Like Most | N/A [2] | 85.19% (23) | 62.50% (5) | N/A [2] | N/A [2] | 0.1641 |
| | | Like Least | N/A [2] | 14.81% (4) | 37.50% (3) | | | |
| Q9_Q10c | FORETELL Features - Scroll Labeling | Like Most | N/A [2] | 88.89% (16) | 60.00% (3) | N/A [2] | N/A [2] | 0.0701 |
| | | Like Least | N/A [2] | 11.11% (2) | 40.00% (2) | | | |
| Q9_Q10d | FORETELL Features - Zoom Capability | Like Most | N/A [2] | 100.00% (35) | 88.89% (8) | N/A [2] | N/A [2] | N/A [4] |
| | | Like Least | N/A [2] | 0.00% (0) | 11.11% (1) | | | |
| Q9_Q10e | FORETELL Features - Map Display | Like Most | N/A [2] | 93.10% (27) | 71.43% (5) | N/A [2] | N/A [2] | 0.1329 |
| | | Like Least | N/A [2] | 6.90% (2) | 28.57% (2) | | | |

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|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q11aaa | Uses Anti-Icing Strategies in Maintenance Decisions | Yes | 100.00% (30) | 86.05% (37) | 72.73% (8) | N/A [4] | N/A [4] | 0.2890 |
| | | No | 0.00% (0) | 13.95% (6) | 27.27% (3) | | | |
| Q11aab | How Helpful is Weather Information [1] in Employing Anti-Icing Strategies | Not Very Helpful | 0.00% (0) | 8.33% (3) | 25.00% (2) | 0.0067 | 0.0003 | 0.0269 |
| | | Not Helpful | 3.33% (1) | 2.78% (1) | 12.50% (1) | | | |
| | | Neutral | 3.33% (1) | 27.78% (10) | 50.00% (4) | | | |
| | | Helpful | 16.67% (5) | 25.00% (9) | 0.00% (0) | | | |
| | | Very Helpful | 76.67% (23) | 36.11% (13) | 12.50% (1) | | | |
| Q11aba | Uses De-Icing Strategies in Maintenance Decisions | Yes | 100.00% (30) | 86.05% (37) | 72.73% (8) | N/A [4] | N/A [4] | 0.2890 |
| | | No | 0.00% (0) | 13.95% (6) | 27.27% (3) | | | |
| Q11abb | How Helpful is Weather Information [1] in Employing De-Icing Strategies | Not Very Helpful | 0.00% (0) | 5.56% (2) | 37.50% (3) | 0.0017 | 0.0006 | 0.2742 |
| | | Not Helpful | 0.00% (0) | 5.56% (2) | 0.00% (0) | | | |
| | | Neutral | 6.67% (2) | 41.67% (15) | 37.50% (3) | | | |
| | | Helpful | 30.00% (9) | 11.11% (4) | 12.50% (1) | | | |
| | | Very Helpful | 63.33% (19) | 36.11% (13) | 12.50% (1) | | | |
| Q11aca | Uses Traction Enhancement Strategies in Maintenance Decisions | Yes | 93.33% (28) | 72.09% (31) | 54.55% (6) | 0.0141 | 0.0083 | 0.2673 |
| | | No | 6.67% (2) | 27.91% (12) | 45.45% (5) | | | |

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| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q11acb | How Helpful is Weather Information [1] in Employing Traction Enhancement Strategies | Not Very Helpful | 0.00% (0) | 10.00% (3) | 33.33% (2) | <.0001 | 0.0051 | 0.7329 |
| | | Not Helpful | 7.41% (2) | 3.33% (1) | 0.00% (0) | | | |
| | | Neutral | 7.41% (2) | 63.33% (19) | 50.00% (3) | | | |
| | | Helpful | 22.22% (6) | 3.33% (1) | 0.00% (0) | | | |
| | | Very Helpful | 62.96% (17) | 20.00% (6) | 16.67% (1) | | | |
| Q11ada | Uses Mechanical Removal Strategies in Maintenance Decisions | Yes | 100.00% (30) | 86.05% (37) | 72.73% (8) | N/A [4] | N/A [4] | 0.3070 |
| | | No | 0.00% (0) | 13.95% (6) | 27.27% (3) | | | |
| Q11adb | How Helpful is Weather Information [1] in Employing Mechanical Removal Strategies | Not Very Helpful | 0.00% (0) | 11.11% (4) | 25.00% (2) | 0.0109 | 0.0052 | 0.2074 |
| | | Neutral | 20.00% (6) | 38.89% (14) | 50.00% (4) | | | |
| | | Helpful | 23.33% (7) | 13.89% (5) | 12.50% (1) | | | |
| | | Very Helpful | 56.67% (17) | 36.11% (13) | 12.50% (1) | | | |
| Q12aaa | Uses Wind Speed/Direction Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 3.33% (1) | 0.00% (0) | 0.00% (0) | 0.0170 | 0.0169 | 0.1738 |
| | | Disagree | 0.00% (0) | 3.45% (1) | 0.00% (0) | | | |
| | | Neutral | 10.00% (3) | 34.48% (10) | 75.00% (3) | | | |
| | | Agree | 40.00% (12) | 34.48% (10) | 25.00% (1) | | | |
| | | Strongly Agree | 46.67% (14) | 27.59% (8) | 0.00% (0) | | | |
| Q12aab | Uses Precipitation Information [1] to Decide WHAT Road Surface Treatments to Use | Neutral | 6.67% (2) | 38.71% (12) | 60.00% (3) | 0.0080 | 0.0090 | 0.3839 |
| | | Agree | 13.33% (4) | 41.94% (13) | 40.00% (2) | | | |
| | | Strongly Agree | 80.00% (24) | 19.35% (6) | 0.00% (0) | | | |

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5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q12aac | Uses Atmospheric Temperature Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 3.57% (1) | 0.00% (0) | 0.00% (0) | 0.5866 | 0.5933 | 0.7802 |
| | | Disagree | 3.57% (1) | 7.14% (2) | 0.00% (0) | | | |
| | | Neutral | 57.14% (16) | 50.00% (14) | 50.00% (2) | | | |
| | | Agree | 14.29% (4) | 21.43% (6) | 50.00% (2) | | | |
| | | Strongly Agree | 21.43% (6) | 21.43% (6) | 0.00% (0) | | | |
| Q12baa | Uses Pavement Temperature Information [1] to Decide WHAT Road Surface Treatments to Use | Disagree | 0.00% (0) | 4.76% (1) | 0.00% (0) | 0.0093 | 0.0952 | 0.8763 |
| | | Neutral | 3.33% (1) | 33.33% (7) | 33.33% (1) | | | |
| | | Agree | 6.67% (2) | 42.86% (9) | 33.33% (1) | | | |
| | | Strongly Agree | 90.00% (27) | 19.05% (4) | 33.33% (1) | | | |
| Q12bab | Uses Pavement Condition Information [1] to Decide WHAT Road Surface Treatments to Use | Disagree | 0.00% (0) | 5.00% (1) | 0.00% (0) | 0.0033 | N/A [4] | N/A [4] |
| | | Neutral | 10.00% (3) | 50.00% (10) | 0.00% (0) | | | |
| | | Agree | 26.67% (8) | 30.00% (6) | 100.00% (2) | | | |
| | | Strongly Agree | 63.33% (19) | 15.00% (3) | 0.00% (0) | | | |
| Q12bac | Uses Dewpoint Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 8.00% (2) | 5.26% (1) | 0.00% (0) | 0.3675 | N/A [4] | N/A [4] |
| | | Disagree | 20.00% (5) | 10.53% (2) | 0.00% (0) | | | |
| | | Neutral | 52.00% (13) | 52.63% (10) | 100.00% (2) | | | |
| | | Agree | 16.00% (4) | 21.05% (4) | 0.00% (0) | | | |
| | | Strongly Agree | 4.00% (1) | 10.53% (2) | 0.00% (0) | | | |
| Q12aba | Uses Wind Speed/Direction Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 3.33% (1) | 0.00% (0) | 0.00% (0) | 0.0560 | 0.0739 | 0.3482 |
| | | Disagree | 0.00% (0) | 7.69% (2) | 0.00% (0) | | | |
| | | Neutral | 13.33% (4) | 30.77% (8) | 66.67% (2) | | | |
| | | Agree | 43.33% (13) | 38.46% (10) | 0.00% (0) | | | |
| | | Strongly Agree | 40.00% (12) | 23.08% (6) | 33.33% (1) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q12abb | Uses Precipitation Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Disagree | 0.00% (0) | 3.85% (1) | 0.00% (0) | 0.0029 | 0.0104 | 0.2700 |
| | | Neutral | 10.00% (3) | 42.31% (11) | 75.00% (3) | | | |
| | | Agree | 6.67% (2) | 42.31% (11) | 0.00% (0) | | | |
| | | Strongly Agree | 83.33% (25) | 11.54% (3) | 25.00% (1) | | | |
| Q12abc | Uses Atmospheric Temperature Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 3.45% (1) | 0.00% (0) | 0.00% (0) | 0.7824 | 0.8683 | 0.9621 |
| | | Disagree | 17.24% (5) | 7.69% (2) | 0.00% (0) | | | |
| | | Neutral | 41.38% (12) | 57.69% (15) | 66.67% (2) | | | |
| | | Agree | 17.24% (5) | 23.08% (6) | 33.33% (1) | | | |
| | | Strongly Agree | 20.69% (6) | 11.54% (3) | 0.00% (0) | | | |
| Q12bba | Uses Pavement Temperature Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Disagree | 0.00% (0) | 5.26% (1) | 0.00% (0) | 0.0007 | 0.0185 | 0.7922 |
| | | Neutral | 6.67% (2) | 52.63% (10) | 66.67% (2) | | | |
| | | Agree | 13.33% (4) | 26.32% (5) | 33.33% (1) | | | |
| | | Strongly Agree | 80.00% (24) | 15.79% (3) | 0.00% (0) | | | |
| Q12bbb | Uses Pavement Condition Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Disagree | 0.00% (0) | 5.56% (1) | 50.00% (1) | 0.0011 | 0.0927 | 0.8738 |
| | | Neutral | 6.67% (2) | 50.00% (9) | 0.00% (0) | | | |
| | | Agree | 23.33% (7) | 27.78% (5) | 50.00% (1) | | | |
| | | Strongly Agree | 70.00% (21) | 16.67% (3) | 0.00% (0) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q12bbc | Uses Dewpoint Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 16.00% (4) | 0.00% (0) | 0.00% (0) | 0.7741 | 0.7219 | 0.8405 |
| | | Disagree | 24.00% (6) | 11.11% (2) | 0.00% (0) | | | |
| | | Neutral | 36.00% (9) | 61.11% (11) | 66.67% (2) | | | |
| | | Agree | 16.00% (4) | 16.67% (3) | 0.00% (0) | | | |
| | | Strongly Agree | 8.00% (2) | 11.11% (2) | 33.33% (1) | | | |
| Q12aca | Uses Wind Speed/Direction Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Disagree | 3.33% (1) | 6.90% (2) | 0.00% (0) | 0.0196 | 0.8151 | 0.4751 |
| | | Neutral | 16.67% (5) | 37.93% (11) | 25.00% (1) | | | |
| | | Agree | 23.33% (7) | 31.03% (9) | 75.00% (3) | | | |
| | | Strongly Agree | 56.67% (17) | 24.14% (7) | 0.00% (0) | | | |
| Q12acb | Uses Precipitation Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Disagree | 0.00% (0) | 6.90% (2) | 0.00% (0) | N/A [4] | N/A [4] | 0.2392 |
| | | Neutral | 0.00% (0) | 44.83% (13) | 20.00% (1) | | | |
| | | Agree | 6.90% (2) | 24.14% (7) | 60.00% (3) | | | |
| | | Strongly Agree | 93.10% (27) | 24.14% (7) | 20.00% (1) | | | |
| Q12acc | Uses Atmospheric Temperature Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 3.70% (1) | 0.00% (0) | 0.00% (0) | 0.1464 | 0.5585 | 0.2362 |
| | | Disagree | 11.11% (3) | 7.41% (2) | 0.00% (0) | | | |
| | | Neutral | 37.04% (10) | 62.96% (17) | 33.33% (1) | | | |
| | | Agree | 29.63% (8) | 14.81% (4) | 66.67% (2) | | | |
| | | Strongly Agree | 18.52% (5) | 14.81% (4) | 0.00% (0) | | | |
| Q12bca | Uses Pavement Temperature Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Disagree | 0.00% (0) | 10.00% (2) | 0.00% (0) | N/A [4] | N/A [4] | 0.8371 |
| | | Neutral | 0.00% (0) | 25.00% (5) | 40.00% (2) | | | |
| | | Agree | 10.34% (3) | 50.00% (10) | 20.00% (1) | | | |
| | | Strongly Agree | 89.66% (26) | 15.00% (3) | 40.00% (2) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
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3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q12bcb | Uses Pavement Condition Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Disagree | 0.00% (0) | 10.00% (2) | 0.00% (0) | 0.0025 | 0.1769 | 0.6980 |
| | | Neutral | 6.90% (2) | 35.00% (7) | 33.33% (1) | | | |
| | | Agree | 20.69% (6) | 40.00% (8) | 33.33% (1) | | | |
| | | Strongly Agree | 72.41% (21) | 15.00% (3) | 33.33% (1) | | | |
| Q12bcc | Uses Dewpoint Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 16.67% (4) | 0.00% (0) | 0.00% (0) | 0.1863 | 0.7535 | 0.7297 |
| | | Disagree | 20.83% (5) | 22.22% (4) | 0.00% (0) | | | |
| | | Neutral | 37.50% (9) | 33.33% (6) | 66.67% (2) | | | |
| | | Agree | 20.83% (5) | 33.33% (6) | 33.33% (1) | | | |
| | | Strongly Agree | 4.17% (1) | 11.11% (2) | 0.00% (0) | | | |
| Q13aaa | Wind Speed/Direction Information [1] is Understandable | Disagree | 0.00% (0) | 0.00% (0) | 14.29% (1) | 0.6713 | 0.0684 | 0.0952 |
| | | Neutral | 3.45% (1) | 5.71% (2) | 14.29% (1) | | | |
| | | Agree | 31.03% (9) | 65.71% (23) | 42.86% (3) | | | |
| | | Strongly Agree | 65.52% (19) | 28.57% (10) | 28.57% (2) | | | |
| Q13aab | Precipitation Information [1] is Understandable | Disagree | 3.45% (1) | 2.94% (1) | 14.29% (1) | 0.8381 | 0.2826 | 0.2956 |
| | | Neutral | 6.90% (2) | 8.82% (3) | 14.29% (1) | | | |
| | | Agree | 24.14% (7) | 70.59% (24) | 42.86% (3) | | | |
| | | Strongly Agree | 65.52% (19) | 17.65% (6) | 28.57% (2) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q13aac | Atmospheric Temperature Information [1] is Understandable | Disagree | 3.85% (1) | 0.00% (0) | 0.00% (0) | 0.5167 | 0.8840 | 0.8046 |
| | | Neutral | 15.38% (4) | 12.90% (4) | 16.67% (1) | | | |
| | | Agree | 30.77% (8) | 70.97% (22) | 33.33% (2) | | | |
| | | Strongly Agree | 50.00% (13) | 16.13% (5) | 50.00% (3) | | | |
| Q13baa | Pavement Temperature Information [1] is Understandable | Strongly Disagree | 0.00% (0) | 3.23% (1) | 16.67% (1) | 0.3630 | 0.0085 | 0.0355 |
| | | Disagree | 0.00% (0) | 3.23% (1) | 16.67% (1) | | | |
| | | Neutral | 10.71% (3) | 12.90% (4) | 33.33% (2) | | | |
| | | Agree | 17.86% (5) | 58.06% (18) | 33.33% (2) | | | |
| | | Strongly Agree | 71.43% (20) | 22.58% (7) | 0.00% (0) | | | |
| Q13bab | Pavement Condition Information [1] is Understandable | Disagree | 3.57% (1) | 3.45% (1) | 50.00% (3) | 0.7145 | 0.0282 | 0.0185 |
| | | Neutral | 25.00% (7) | 20.69% (6) | 33.33% (2) | | | |
| | | Agree | 10.71% (3) | 58.62% (17) | 16.67% (1) | | | |
| | | Strongly Agree | 60.71% (17) | 17.24% (5) | 0.00% (0) | | | |
| Q13bac | Dewpoint Information [1] is Understandable | Strongly Disagree | 4.55% (1) | 0.00% (0) | 0.00% (0) | 0.7503 | 0.9200 | 0.9347 |
| | | Disagree | 9.09% (2) | 3.85% (1) | 0.00% (0) | | | |
| | | Neutral | 9.09% (2) | 23.08% (6) | 25.00% (1) | | | |
| | | Agree | 22.73% (5) | 53.85% (14) | 75.00% (3) | | | |
| | | Strongly Agree | 54.55% (12) | 19.23% (5) | 0.00% (0) | | | |
| Q13aba | Wind Speed/Direction Information [1] is Usable | Strongly Disagree | 6.90% (2) | 0.00% (0) | 0.00% (0) | 0.1291 | 0.1560 | 0.0053 |
| | | Disagree | 0.00% (0) | 0.00% (0) | 20.00% (1) | | | |
| | | Neutral | 17.24% (5) | 8.82% (3) | 40.00% (2) | | | |
| | | Agree | 27.59% (8) | 67.65% (23) | 40.00% (2) | | | |
| | | Strongly Agree | 48.28% (14) | 23.53% (8) | 0.00% (0) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q13abb | Precipitation Information [1] is Usable | Strongly Disagree | 6.90% (2) | 0.00% (0) | 0.00% (0) | 0.7530 | 0.7905 | 0.6676 |
| | | Disagree | 0.00% (0) | 3.03% (1) | 16.67% (1) | | | |
| | | Neutral | 20.69% (6) | 21.21% (7) | 16.67% (1) | | | |
| | | Agree | 17.24% (5) | 54.55% (18) | 50.00% (3) | | | |
| | | Strongly Agree | 55.17% (16) | 21.21% (7) | 16.67% (1) | | | |
| Q13abc | Atmospheric Temperature Information [1] is Usable | Strongly Disagree | 10.71% (3) | 0.00% (0) | 0.00% (0) | 0.1731 | 0.7412 | 0.2900 |
| | | Disagree | 3.57% (1) | 3.45% (1) | 20.00% (1) | | | |
| | | Neutral | 17.86% (5) | 13.79% (4) | 20.00% (1) | | | |
| | | Agree | 25.00% (7) | 51.72% (15) | 60.00% (3) | | | |
| | | Strongly Agree | 42.86% (12) | 31.03% (9) | 0.00% (0) | | | |
| Q13bba | Pavement Temperature Information [1] is Usable | Strongly Disagree | 6.90% (2) | 3.33% (1) | 0.00% (0) | 0.3967 | 0.0261 | 0.0729 |
| | | Disagree | 0.00% (0) | 0.00% (0) | 33.33% (2) | | | |
| | | Neutral | 10.34% (3) | 23.33% (7) | 33.33% (2) | | | |
| | | Agree | 24.14% (7) | 50.00% (15) | 33.33% (2) | | | |
| | | Strongly Agree | 58.62% (17) | 23.33% (7) | 0.00% (0) | | | |
| Q13bbb | Pavement Condition Information [1] is Usable | Strongly Disagree | 6.90% (2) | 0.00% (0) | 0.00% (0) | 0.4714 | 0.1545 | 0.0613 |
| | | Disagree | 3.45% (1) | 0.00% (0) | 50.00% (3) | | | |
| | | Neutral | 24.14% (7) | 25.00% (7) | 16.67% (1) | | | |
| | | Agree | 17.24% (5) | 53.57% (15) | 33.33% (2) | | | |
| | | Strongly Agree | 48.28% (14) | 21.43% (6) | 0.00% (0) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q13bbc | Dewpoint Information [1] is Usable | Strongly Disagree | 16.67% (4) | 0.00% (0) | 0.00% (0) | 0.1847 | 0.1969 | 0.4919 |
| | | Disagree | 16.67% (4) | 0.00% (0) | 0.00% (0) | | | |
| | | Neutral | 29.17% (7) | 44.00% (11) | 25.00% (1) | | | |
| | | Agree | 12.50% (3) | 40.00% (10) | 75.00% (3) | | | |
| | | Strongly Agree | 25.00% (6) | 16.00% (4) | 0.00% (0) | | | |
| Q13aca | Wind Speed/Direction Information [1] is Easily Obtainable | Disagree | 0.00% (0) | 12.12% (4) | 14.29% (1) | 0.1908 | 0.1244 | 0.4892 |
| | | Neutral | 6.67% (2) | 6.06% (2) | 14.29% (1) | | | |
| | | Agree | 26.67% (8) | 57.58% (19) | 57.14% (4) | | | |
| | | Strongly Agree | 66.67% (20) | 24.24% (8) | 14.29% (1) | | | |
| Q13acb | Precipitation Information [1] is Easily Obtainable | Disagree | 0.00% (0) | 10.00% (3) | 28.57% (2) | 0.0494 | 0.0157 | 0.2643 |
| | | Neutral | 3.33% (1) | 13.33% (4) | 14.29% (1) | | | |
| | | Agree | 26.67% (8) | 60.00% (18) | 42.86% (3) | | | |
| | | Strongly Agree | 70.00% (21) | 16.67% (5) | 14.29% (1) | | | |
| Q13acc | Atmospheric Temperature Information [1] is Easily Obtainable | Disagree | 3.57% (1) | 10.34% (3) | 0.00% (0) | 0.4987 | 0.4306 | 0.7055 |
| | | Neutral | 7.14% (2) | 6.90% (2) | 25.00% (1) | | | |
| | | Agree | 25.00% (7) | 51.72% (15) | 50.00% (2) | | | |
| | | Strongly Agree | 64.29% (18) | 31.03% (9) | 25.00% (1) | | | |
| Q13bca | Pavement Temperature Information [1] is Easily Obtainable | Disagree | 0.00% (0) | 7.14% (2) | 16.67% (1) | 0.0433 | 0.0883 | 0.8153 |
| | | Neutral | 6.67% (2) | 21.43% (6) | 16.67% (1) | | | |
| | | Agree | 30.00% (9) | 50.00% (14) | 50.00% (3) | | | |
| | | Strongly Agree | 63.33% (19) | 21.43% (6) | 16.67% (1) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q13bcb | Pavement Condition Information [1] is Easily Obtainable | Disagree | 6.67% (2) | 7.41% (2) | 16.67% (1) | 0.2241 | 0.3619 | 0.8576 |
| | | Neutral | 10.00% (3) | 22.22% (6) | 16.67% (1) | | | |
| | | Agree | 26.67% (8) | 51.85% (14) | 50.00% (3) | | | |
| | | Strongly Agree | 56.67% (17) | 18.52% (5) | 16.67% (1) | | | |
| Q13bcc | Dewpoint Information [1] is Easily Obtainable | Strongly Disagree | 4.00% (1) | 0.00% (0) | 0.00% (0) | 0.8192 | 0.7109 | 0.8108 |
| | | Disagree | 8.00% (2) | 8.33% (2) | 0.00% (0) | | | |
| | | Neutral | 16.00% (4) | 16.67% (4) | 20.00% (1) | | | |
| | | Agree | 12.00% (3) | 54.17% (13) | 60.00% (3) | | | |
| | | Strongly Agree | 60.00% (15) | 20.83% (5) | 20.00% (1) | | | |
| Q13ada | Wind Speed/Direction Information [1] is Accurate | Disagree | 24.14% (7) | 21.88% (7) | 0.00% (0) | 0.5646 | 0.8171 | 0.5596 |
| | | Neutral | 31.03% (9) | 40.63% (13) | 50.00% (3) | | | |
| | | Agree | 34.48% (10) | 28.13% (9) | 50.00% (3) | | | |
| | | Strongly Agree | 10.34% (3) | 9.38% (3) | 0.00% (0) | | | |
| Q13adb | Precipitation Information [1] is Accurate | Strongly Disagree | 0.00% (0) | 6.45% (2) | 0.00% (0) | 0.5467 | 0.3801 | 0.5999 |
| | | Disagree | 24.14% (7) | 22.58% (7) | 33.33% (2) | | | |
| | | Neutral | 44.83% (13) | 32.26% (10) | 16.67% (1) | | | |
| | | Agree | 27.59% (8) | 29.03% (9) | 50.00% (3) | | | |
| | | Strongly Agree | 3.45% (1) | 9.68% (3) | 0.00% (0) | | | |
| Q13adc | Atmospheric Temperature Information [1] is Accurate | Disagree | 21.43% (6) | 18.52% (5) | 0.00% (0) | 0.8992 | 0.3084 | 0.3429 |
| | | Neutral | 35.71% (10) | 37.04% (10) | 33.33% (2) | | | |
| | | Agree | 32.14% (9) | 37.04% (10) | 66.67% (4) | | | |
| | | Strongly Agree | 10.71% (3) | 7.41% (2) | 0.00% (0) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q13bda | Pavement Temperature Information [1] is Accurate | Strongly Disagree | 0.00% (0) | 3.57% (1) | 0.00% (0) | 0.0532 | 0.1752 | 0.6858 |
| | | Disagree | 6.90% (2) | 17.86% (5) | 20.00% (1) | | | |
| | | Neutral | 37.93% (11) | 50.00% (14) | 60.00% (3) | | | |
| | | Agree | 41.38% (12) | 28.57% (8) | 20.00% (1) | | | |
| | | Strongly Agree | 13.79% (4) | 0.00% (0) | 0.00% (0) | | | |
| Q13bdb | Pavement Condition Information [1] is Accurate | Strongly Disagree | 3.45% (1) | 3.70% (1) | 0.00% (0) | 0.9094 | 0.6144 | 0.6535 |
| | | Disagree | 20.69% (6) | 14.81% (4) | 40.00% (2) | | | |
| | | Neutral | 44.83% (13) | 51.85% (14) | 40.00% (2) | | | |
| | | Agree | 20.69% (6) | 25.93% (7) | 20.00% (1) | | | |
| | | Strongly Agree | 10.34% (3) | 3.70% (1) | 0.00% (0) | | | |
| Q13bdc | Dewpoint Information [1] is Accurate | Strongly Disagree | 4.17% (1) | 4.35% (1) | 0.00% (0) | 0.6809 | 0.1135 | 0.1503 |
| | | Disagree | 37.50% (9) | 17.39% (4) | 0.00% (0) | | | |
| | | Neutral | 29.17% (7) | 43.48% (10) | 25.00% (1) | | | |
| | | Agree | 25.00% (6) | 30.43% (7) | 75.00% (3) | | | |
| | | Strongly Agree | 4.17% (1) | 4.35% (1) | 0.00% (0) | | | |
| Q13aea | Wind Speed/Direction Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 3.13% (1) | 0.00% (0) | 0.0823 | 0.0111 | 0.1464 |
| | | Disagree | 0.00% (0) | 3.13% (1) | 0.00% (0) | | | |
| | | Neutral | 13.33% (4) | 25.00% (8) | 66.67% (4) | | | |
| | | Agree | 46.67% (14) | 56.25% (18) | 16.67% (1) | | | |
| | | Strongly Agree | 40.00% (12) | 12.50% (4) | 16.67% (1) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q13aeb | Precipitation Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 3.23% (1) | 0.00% (0) | 0.2026 | 0.1383 | 0.5364 |
| | | Disagree | 0.00% (0) | 9.68% (3) | 16.67% (1) | | | |
| | | Neutral | 20.00% (6) | 22.58% (7) | 33.33% (2) | | | |
| | | Agree | 30.00% (9) | 51.61% (16) | 33.33% (2) | | | |
| | | Strongly Agree | 50.00% (15) | 12.90% (4) | 16.67% (1) | | | |
| Q13aec | Atmospheric Temperature Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 3.70% (1) | 0.00% (0) | 0.6511 | 0.6885 | 0.9032 |
| | | Disagree | 3.45% (1) | 7.41% (2) | 20.00% (1) | | | |
| | | Neutral | 27.59% (8) | 25.93% (7) | 20.00% (1) | | | |
| | | Agree | 27.59% (8) | 51.85% (14) | 20.00% (1) | | | |
| | | Strongly Agree | 41.38% (12) | 11.11% (3) | 40.00% (2) | | | |
| Q13bea | Pavement Temperature Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 3.70% (1) | 0.00% (0) | 0.0041 | 0.0111 | 0.4953 |
| | | Disagree | 0.00% (0) | 7.41% (2) | 33.33% (2) | | | |
| | | Neutral | 13.33% (4) | 40.74% (11) | 33.33% (2) | | | |
| | | Agree | 26.67% (8) | 40.74% (11) | 16.67% (1) | | | |
| | | Strongly Agree | 60.00% (18) | 7.41% (2) | 16.67% (1) | | | |
| Q13beb | Pavement Condition Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 3.85% (1) | 0.00% (0) | 0.0496 | 0.0907 | 0.7283 |
| | | Disagree | 0.00% (0) | 11.54% (3) | 28.57% (2) | | | |
| | | Neutral | 23.33% (7) | 34.62% (9) | 28.57% (2) | | | |
| | | Agree | 26.67% (8) | 42.31% (11) | 14.29% (1) | | | |
| | | Strongly Agree | 50.00% (15) | 7.69% (2) | 28.57% (2) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q13bec | Dewpoint Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 12.00% (3) | 4.55% (1) | 0.00% (0) | 0.4284 | 0.3430 | 0.1680 |
| | | Disagree | 16.00% (4) | 18.18% (4) | 0.00% (0) | | | |
| | | Neutral | 24.00% (6) | 40.91% (9) | 25.00% (1) | | | |
| | | Agree | 32.00% (8) | 31.82% (7) | 75.00% (3) | | | |
| | | Strongly Agree | 16.00% (4) | 4.55% (1) | 0.00% (0) | | | |
| Q14afa | FORETELL Wind Speed/Direction Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 3.85% (1) | 0.00% (0) | N/A [2] | N/A [2] | N/A [4] |
| | | Disagree | N/A [2] | 15.38% (4) | 40.00% (2) | | | |
| | | Neutral | N/A [2] | 38.46% (10) | 60.00% (3) | | | |
| | | Agree | N/A [2] | 34.62% (9) | 0.00% (0) | | | |
| | | Strongly Agree | N/A [2] | 7.69% (2) | 0.00% (0) | | | |
| Q14afb | FORETELL Precipitation Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 3.70% (1) | 0.00% (0) | N/A [2] | N/A [2] | N/A [4] |
| | | Disagree | N/A [2] | 18.52% (5) | 40.00% (2) | | | |
| | | Neutral | N/A [2] | 40.74% (11) | 60.00% (3) | | | |
| | | Agree | N/A [2] | 29.63% (8) | 0.00% (0) | | | |
| | | Strongly Agree | N/A [2] | 7.41% (2) | 0.00% (0) | | | |
| Q14afc | FORETELL Atmospheric Temperature Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 4.35% (1) | 0.00% (0) | N/A [2] | N/A [2] | N/A [4] |
| | | Disagree | N/A [2] | 13.04% (3) | 25.00% (1) | | | |
| | | Neutral | N/A [2] | 47.83% (11) | 75.00% (3) | | | |
| | | Agree | N/A [2] | 21.74% (5) | 0.00% (0) | | | |
| | | Strongly Agree | N/A [2] | 13.04% (3) | 0.00% (0) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q14bfa | FORETELL Pavement Temperature Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 4.55% (1) | 0.00% (0) | N/A [2] | N/A [2] | 0.7305 |
| | | Disagree | N/A [2] | 27.27% (6) | 60.00% (3) | | | |
| | | Neutral | N/A [2] | 40.91% (9) | 20.00% (1) | | | |
| | | Agree | N/A [2] | 27.27% (6) | 20.00% (1) | | | |
| Q14bfb | FORETELL Pavement Condition Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 4.55% (1) | 0.00% (0) | N/A [2] | N/A [2] | 0.7305 |
| | | Disagree | N/A [2] | 27.27% (6) | 60.00% (3) | | | |
| | | Neutral | N/A [2] | 40.91% (9) | 20.00% (1) | | | |
| | | Agree | N/A [2] | 27.27% (6) | 20.00% (1) | | | |
| Q14bfc | FORETELL Dewpoint Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 5.26% (1) | 0.00% (0) | N/A [2] | N/A [2] | 0.3062 |
| | | Disagree | N/A [2] | 10.53% (2) | 33.33% (1) | | | |
| | | Neutral | N/A [2] | 73.68% (14) | 33.33% (1) | | | |
| | | Agree | N/A [2] | 10.53% (2) | 33.33% (1) | | | |
| Q15 | FORETELL Provides Valuable Information Not Provided Elsewhere | Strongly Disagree | N/A [2] | 17.07% (7) | 11.11% (1) | N/A [2] | N/A [2] | 0.2764 |
| | | Disagree | N/A [2] | 17.07% (7) | 44.44% (4) | | | |
| | | Neutral | N/A [2] | 24.39% (10) | 22.22% (2) | | | |
| | | Agree | N/A [2] | 31.71% (13) | 11.11% (1) | | | |
| | | Strongly Agree | N/A [2] | 9.76% (4) | 11.11% (1) | | | |
| Q16 | Receive FORETELL Information in Time to Make Weather-Related Decisions | Strongly Disagree | N/A [2] | 7.14% (3) | 0.00% (0) | N/A [2] | N/A [2] | 0.9653 |
| | | Disagree | N/A [2] | 11.90% (5) | 22.22% (2) | | | |
| | | Neutral | N/A [2] | 35.71% (15) | 33.33% (3) | | | |
| | | Agree | N/A [2] | 45.24% (19) | 44.44% (4) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q17 | Weather Information [1] is Sufficient for Making Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 9.52% (4) | 33.33% (3) | 0.1339 | 0.6495 | 0.5971 |
| | | Disagree | 13.33% (4) | 21.43% (9) | 11.11% (1) | | | |
| | | Neutral | 33.33% (10) | 33.33% (14) | 11.11% (1) | | | |
| | | Agree | 33.33% (10) | 30.95% (13) | 44.44% (4) | | | |
| | | Strongly Agree | 20.00% (6) | 4.76% (2) | 0.00% (0) | | | |
| Q18 | Willing to Pay for FORETELL | Strongly Disagree | N/A [2] | 9.76% (4) | 22.22% (2) | N/A [2] | N/A [2] | 0.6920 |
| | | Disagree | N/A [2] | 12.20% (5) | 22.22% (2) | | | |
| | | Neutral | N/A [2] | 51.22% (21) | 22.22% (2) | | | |
| | | Agree | N/A [2] | 26.83% (11) | 11.11% (1) | | | |
| | | Strongly Agree | N/A [2] | 0.00% (0) | 22.22% (2) | | | |
| Q19 | Having Weather Information [1] Makes Job Easier | Strongly Disagree | 0.00% (0) | 9.52% (4) | 0.00% (0) | 0.0004 | 0.0004 | 0.5216 |
| | | Disagree | 3.45% (1) | 7.14% (3) | 22.22% (2) | | | |
| | | Neutral | 3.45% (1) | 38.10% (16) | 44.44% (4) | | | |
| | | Agree | 24.14% (7) | 40.48% (17) | 22.22% (2) | | | |
| | | Strongly Agree | 68.97% (20) | 4.76% (2) | 11.11% (1) | | | |
| Q20 | Weather Information [1] Helps You Improve Traffic Efficiency of Roadways | Strongly Disagree | 0.00% (0) | 9.52% (4) | 0.00% (0) | <.0001 | 0.0093 | 0.6612 |
| | | Disagree | 3.33% (1) | 4.76% (2) | 0.00% (0) | | | |
| | | Neutral | 16.67% (5) | 59.52% (25) | 66.67% (6) | | | |
| | | Agree | 46.67% (14) | 26.19% (11) | 22.22% (2) | | | |
| | | Strongly Agree | 33.33% (10) | 0.00% (0) | 11.11% (1) | | | |
| Q21 | Weather Information [1] Helps You to Target Snow and Ice Control Measures | Strongly Disagree | 0.00% (0) | 9.52% (4) | 0.00% (0) | 0.0003 | 0.0021 | 0.6697 |
| | | Disagree | 6.67% (2) | 11.90% (5) | 11.11% (1) | | | |
| | | Neutral | 6.67% (2) | 38.10% (16) | 55.56% (5) | | | |
| | | Agree | 43.33% (13) | 40.48% (17) | 22.22% (2) | | | |
| | | Strongly Agree | 43.33% (13) | 0.00% (0) | 11.11% (1) | | | |

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2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q22 | Highway Maintenance Activities are Conducted More Efficiently Using Weather Information [1] | Strongly Disagree | 0.00% (0) | 9.76% (4) | 0.00% (0) | <.0001 | 0.0003 | 0.5783 |
| | | Disagree | 0.00% (0) | 14.63% (6) | 33.33% (3) | | | |
| | | Neutral | 6.67% (2) | 51.22% (21) | 33.33% (3) | | | |
| | | Agree | 33.33% (10) | 24.39% (10) | 22.22% (2) | | | |
| | | Strongly Agree | 60.00% (18) | 0.00% (0) | 11.11% (1) | | | |
| Q23 | FORETELL Information Makes You More Confident in Making Weather-Related Decisions | Strongly Disagree | N/A [2] | 9.52% (4) | 11.11% (1) | N/A [2] | N/A [2] | 0.3621 |
| | | Disagree | N/A [2] | 9.52% (4) | 22.22% (2) | | | |
| | | Neutral | N/A [2] | 52.38% (22) | 22.22% (2) | | | |
| | | Agree | N/A [2] | 23.81% (10) | 33.33% (3) | | | |
| | | Strongly Agree | N/A [2] | 4.76% (2) | 11.11% (1) | | | |
| Q24 | FORETELL Information Helps You Deploy Staff More Efficiently | Strongly Disagree | N/A [2] | 9.52% (4) | 0.00% (0) | N/A [2] | N/A [2] | 0.9582 |
| | | Disagree | N/A [2] | 16.67% (7) | 33.33% (3) | | | |
| | | Neutral | N/A [2] | 52.38% (22) | 44.44% (4) | | | |
| | | Agree | N/A [2] | 21.43% (9) | 11.11% (1) | | | |
| | | Strongly Agree | N/A [2] | 0.00% (0) | 11.11% (1) | | | |
| Q25 | Roads Return to Targeted Level of Service More Quickly with Weather Information [1] | Strongly Disagree | 0.00% (0) | 9.76% (4) | 0.00% (0) | 0.0004 | 0.0188 | 0.8932 |
| | | Disagree | 3.33% (1) | 14.63% (6) | 22.22% (2) | | | |
| | | Neutral | 30.00% (9) | 51.22% (21) | 55.56% (5) | | | |
| | | Agree | 26.67% (8) | 24.39% (10) | 11.11% (1) | | | |
| | | Strongly Agree | 40.00% (12) | 0.00% (0) | 11.11% (1) | | | |
| Q26 | Safety of the Highway Maintenance Operator is Increased with Weather Information [1] | Strongly Disagree | 3.33% (1) | 9.76% (4) | 11.11% (1) | 0.0002 | 0.0117 | 0.9612 |
| | | Disagree | 6.67% (2) | 14.63% (6) | 0.00% (0) | | | |
| | | Neutral | 10.00% (3) | 41.46% (17) | 55.56% (5) | | | |
| | | Agree | 36.67% (11) | 31.71% (13) | 22.22% (2) | | | |
| | | Strongly Agree | 43.33% (13) | 2.44% (1) | 11.11% (1) | | | |

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3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q27 | Weather Information [1] Helps to Lessen the Amount of Chemical Applications | Strongly Disagree | 0.00% (0) | 9.76% (4) | 11.11% (1) | 0.0005 | 0.6494 | 0.0403 |
| | | Disagree | 10.00% (3) | 17.07% (7) | 11.11% (1) | | | |
| | | Neutral | 26.67% (8) | 51.22% (21) | 22.22% (2) | | | |
| | | Agree | 23.33% (7) | 19.51% (8) | 55.56% (5) | | | |
| | | Strongly Agree | 40.00% (12) | 2.44% (1) | 0.00% (0) | | | |
| Q28 | Make Highway Maintenance Decisions More Efficiently because of FORETELL Information | Yes | N/A [2] | 62.50% (25) | 44.44% (4) | N/A [2] | N/A [2] | 0.3022 |
| | | No | N/A [2] | 37.50% (15) | 55.56% (5) | | | |
| Q28a | How Much Sooner Do You Learn about Weather Events when Using FORETELL Information | 0-3 Hours | N/A [2] | 24.00% (6) | 50.00% (2) | N/A [2] | N/A [2] | N/A [5] |
| | | 3-6 Hours | N/A [2] | 36.00% (9) | 25.00% (1) | | | |
| | | 6-12 Hours | N/A [2] | 32.00% (8) | 25.00% (1) | | | |
| | | > 12 Hours | N/A [2] | 8.00% (2) | 0.00% (0) | | | |
| Q29 | Roads are More Quickly Returned to Acceptable Level of Service when Using FORETELL Information | Yes | N/A [2] | 45.00% (18) | 33.33% (3) | N/A [2] | N/A [2] | 0.5423 |
| | | No | N/A [2] | 55.00% (22) | 66.67% (6) | | | |
| Q29a | How Much More Quickly are Roads Returned to Service when Using FORETELL Information | 0-3 Hours | N/A [2] | 41.18% (7) | 66.67% (2) | N/A [2] | N/A [2] | N/A [5] |
| | | 3-6 Hours | N/A [2] | 52.94% (9) | 0.00% (0) | | | |
| | | 6-12 Hours | N/A [2] | 5.88% (1) | 33.33% (1) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-4. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Iowa Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=30) | First Follow-Up (N=51) | Second Follow-Up (N=11) | P-value [3] | | |
| Q30 | Would Like to Use FORETELL Information in the Future | Yes | N/A [2] | 92.68% (38) | 55.56% (5) | N/A [2] | N/A [2] | 0.0037 |
| | | No | N/A [2] | 7.32% (3) | 44.44% (4) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q6aa | Uses Wind Speed/Direction in Weather-Related Decisions | Yes | 100.00% (29) | 81.48% (22) | 53.85% (14) | N/A[4] | N/A[4] | 0.0274 |
| | | No | 0.00% (0) | 18.52% (5) | 46.15% (12) | | | |
| Q6ab | Uses Actual Wind Speed/Direction Readings | No Actual Readings | 48.28% (14) | 50.00% (11) | 35.71% (5) | 0.9127 | 0.4671 | 0.3270 |
| | | Uses Actual Readings | 51.72% (15) | 50.00% (11) | 64.29% (9) | | | |
| Q6ac | Uses Forecast Wind Speed/Direction Readings | No Forecast Information | 24.14% (7) | 9.09% (2) | 14.29% (2) | 0.1264 | 0.4062 | 0.6313 |
| | | Uses Forecast Information | 75.86% (22) | 90.91% (20) | 85.71% (12) | | | |
| Q6ba | Uses Precipitation in Weather-Related Decisions | Yes | 100.00% (29) | 96.55% (28) | 76.92% (20) | N/A[4] | N/A[4] | 0.0544 |
| | | No | 0.00% (0) | 3.45% (1) | 23.08% (6) | | | |
| Q6bb | Uses Actual Precipitation Readings | No Actual Readings | 51.72% (15) | 21.43% (6) | 10.00% (2) | 0.0275 | 0.0109 | 0.3086 |
| | | Uses Actual Readings | 48.28% (14) | 78.57% (22) | 90.00% (18) | | | |
| Q6bc | Uses Forecast Precipitation Readings | No Forecast Information | 3.45% (1) | 14.29% (4) | 15.00% (3) | 0.1788 | 0.1784 | 0.9459 |
| | | Uses Forecast Information | 96.55% (28) | 85.71% (24) | 85.00% (17) | | | |

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5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q6ca | Uses Atmospheric Temperature in Weather-Related Decisions | Yes | 93.10% (27) | 80.00% (20) | 61.54% (16) | 0.1798 | 0.0117 | 0.1474 |
| | | No | 6.90% (2) | 20.00% (5) | 38.46% (10) | | | |
| Q6cb | Uses Actual Atmospheric Temperature Readings | No Actual Readings | 77.78% (21) | 15.00% (3) | 25.00% (4) | 0.0002 | 0.0008 | 0.4613 |
| | | Uses Actual Readings | 22.22% (6) | 85.00% (17) | 75.00% (12) | | | |
| Q6cc | Uses Forecast Atmospheric Temperature Readings | No Forecast Information | 37.04% (10) | 30.00% (6) | 12.50% (2) | 0.6202 | 0.0727 | 0.1533 |
| | | Uses Forecast Information | 62.96% (17) | 70.00% (14) | 87.50% (14) | | | |
| Q6da | Uses Pavement Temperature in Weather-Related Decisions | Yes | 100.00% (29) | 96.43% (27) | 69.23% (18) | N/A[4] | N/A[4] | 0.0224 |
| | | No | 0.00% (0) | 3.57% (1) | 30.77% (8) | | | |
| Q6db | Uses Actual Pavement Temperature Readings | No Actual Readings | 96.55% (28) | 11.11% (3) | 16.67% (3) | <.0001 | <.0001 | 0.5907 |
| | | Uses Actual Readings | 3.45% (1) | 88.89% (24) | 83.33% (15) | | | |
| Q6dc | Uses Forecast Pavement Temperature Readings | No Forecast Information | 75.86% (22) | 59.26% (16) | 66.67% (12) | 0.1267 | 0.4751 | 0.6132 |
| | | Uses Forecast Information | 24.14% (7) | 40.74% (11) | 33.33% (6) | | | |
| Q6ea | Uses Pavement Condition in Weather-Related Decisions | Yes | 100.00% (29) | 92.86% (26) | 65.38% (17) | N/A[4] | N/A[4] | 0.0245 |
| | | No | 0.00% (0) | 7.14% (2) | 34.62% (9) | | | |

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5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q6eb | Uses Actual Pavement Condition Readings | No Actual Readings | 89.66% (26) | 19.23% (5) | 11.76% (2) | <.0001 | 0.0002 | 0.5229 |
| | | Uses Actual Readings | 10.34% (3) | 80.77% (21) | 88.24% (15) | | | |
| Q6ec | Uses Forecast Pavement Condition Readings | No Forecast Information | 72.41% (21) | 65.38% (17) | 58.82% (10) | 0.5257 | 0.3611 | 0.6790 |
| | | Uses Forecast Information | 27.59% (8) | 34.62% (9) | 41.18% (7) | | | |
| Q6fa | Uses Dewpoint in Weather-Related Decisions | Yes | 75.86% (22) | 53.85% (14) | 42.31% (11) | 0.0622 | 0.0103 | 0.4013 |
| | | No | 24.14% (7) | 46.15% (12) | 57.69% (15) | | | |
| Q6fb | Uses Actual Dewpoint Readings | No Actual Readings | 13.64% (3) | 42.86% (6) | 54.55% (6) | 0.0741 | 0.0217 | 0.5421 |
| | | Uses Actual Readings | 86.36% (19) | 57.14% (8) | 45.45% (5) | | | |
| Q6fc | Uses Forecast Dewpoint Readings | No Forecast Information | 63.64% (14) | 21.43% (3) | 18.18% (2) | 0.0043 | 0.0055 | 0.8357 |
| | | Uses Forecast Information | 36.36% (8) | 78.57% (11) | 81.82% (9) | | | |
| Q7aa | Uses FORETELL to Receive Wind Speed/Direction Readings | Yes | N/A[2] | 40.74% (11) | 58.33% (7) | N/A[2] | N/A[2] | 0.2478 |
| | | No | N/A[2] | 59.26% (16) | 41.67% (5) | | | |
| Q7ba | Uses FORETELL to Receive Precipitation Readings | Yes | N/A[2] | 48.15% (13) | 55.00% (11) | N/A[2] | N/A[2] | 0.5927 |
| | | No | N/A[2] | 51.85% (14) | 45.00% (9) | | | |

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**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q7ca | Uses FORETELL to Receive Atmospheric Temperature Readings | Yes | N/A[2] | 44.44% (12) | 60.00% (9) | N/A[2] | N/A[2] | 0.2789 |
| | | No | N/A[2] | 55.56% (15) | 40.00% (6) | | | |
| Q7da | Uses FORETELL to Receive Pavement Temperature Readings | Yes | N/A[2] | 40.74% (11) | 35.29% (6) | N/A[2] | N/A[2] | 0.7091 |
| | | No | N/A[2] | 59.26% (16) | 64.71% (11) | | | |
| Q7ea | Uses FORETELL to Receive Pavement Condition Readings | Yes | N/A[2] | 37.04% (10) | 35.29% (6) | N/A[2] | N/A[2] | 0.9007 |
| | | No | N/A[2] | 62.96% (17) | 64.71% (11) | | | |
| Q8aa | Uses Weather Information [1] Daily | Yes | 96.55% (28) | 20.83% (5) | 16.67% (3) | <.0001 | <.0001 | 0.7354 |
| | | No | 3.45% (1) | 79.17% (19) | 83.33% (15) | | | |
| Q8ab | Uses Weather Information [1] Daily (How Often) | Twice daily | 75.00% (15) | 80.00% (4) | 100.00% (3) | N/A[5] | N/A[5] | N/A[5] |
| | | 4 Times Daily | 10.00% (2) | 20.00% (1) | 0.00% (0) | | | |
| | | Every Other Hour | 10.00% (2) | 0.00% (0) | 0.00% (0) | | | |
| | | At Least Hourly | 5.00% (1) | 0.00% (0) | 0.00% (0) | | | |
| Q8ba | Uses Weather Information [1] Weekly | Yes | 17.24% (5) | 34.78% (8) | 27.78% (5) | 0.1746 | 0.4249 | 0.6374 |
| | | No | 82.76% (24) | 65.22% (15) | 72.22% (13) | | | |
| Q8ca | Uses Weather Information [1] In Advance of a Weather Event | Yes | 89.66% (26) | 57.14% (16) | 65.00% (13) | 0.0117 | 0.0377 | 0.5664 |
| | | No | 10.34% (3) | 42.86% (12) | 35.00% (7) | | | |
| Q8cb | Uses Weather Information [1] In Advance of a Weather Event (How Often) | Twice daily | 60.00% (12) | 16.67% (2) | 54.55% (6) | N/A[5] | N/A[5] | N/A[5] |
| | | 4 Times Daily | 5.00% (1) | 33.33% (4) | 36.36% (4) | | | |
| | | Every Other Hour | 5.00% (1) | 25.00% (3) | 0.00% (0) | | | |
| | | At Least Hourly | 30.00% (6) | 25.00% (3) | 9.09% (1) | | | |

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**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q8da | Uses Weather Information [1] During a Weather Event | Yes | 93.10% (27) | 57.14% (16) | 55.00% (11) | 0.0048 | 0.0041 | 0.8692 |
| | | No | 6.90% (2) | 42.86% (12) | 45.00% (9) | | | |
| Q8db | Uses Weather Information [1] During a Weather Event (How Often) | Twice daily | 21.74% (5) | 16.67% (2) | 20.00% (2) | N/A[5] | N/A[5] | N/A[5] |
| | | 4 Times Daily | 30.43% (7) | 16.67% (2) | 50.00% (5) | | | |
| | | Every Other Hour | 8.70% (2) | 25.00% (3) | 10.00% (1) | | | |
| | | At Least Hourly | 39.13% (9) | 41.67% (5) | 20.00% (2) | | | |
| Q8ea | Uses Weather Information [1] After a Weather Event | Yes | 51.72% (15) | 30.77% (8) | 33.33% (6) | 0.1106 | 0.2002 | 0.8575 |
| | | No | 48.28% (14) | 69.23% (18) | 66.67% (12) | | | |
| Q8eb | Uses Weather Information [1] After a Weather Event (How Often) | Twice daily | 71.43% (10) | 75.00% (3) | 100.00% (6) | N/A[5] | N/A[5] | N/A[5] |
| | | 4 Times Daily | 14.29% (2) | 25.00% (1) | 0.00% (0) | | | |
| | | Every Other Hour | 7.14% (1) | 0.00% (0) | 0.00% (0) | | | |
| | | At Least Hourly | 7.14% (1) | 0.00% (0) | 0.00% (0) | | | |
| Q9_Q10a | FORETELL Features - Animation | Like Most | N/A[2] | 100.00% (13) | 100.00% (15) | N/A[2] | N/A[2] | N/A[4] |
| Q9_Q10b | FORETELL Features - Long-Term Forecast | Like Most | N/A[2] | 90.91% (10) | 44.44% (4) | N/A[2] | N/A[2] | 0.0418 |
| | | Like Least | N/A[2] | 9.09% (1) | 55.56% (5) | | | |
| Q9_Q10c | FORETELL Features - Scroll Labeling | Like Most | N/A[2] | 75.00% (3) | 100.00% (4) | N/A[2] | N/A[2] | N/A[4] |
| | | Like Least | N/A[2] | 25.00% (1) | 0.00% (0) | | | |
| Q9_Q10d | FORETELL Features - Zoom Capability | Like Most | N/A[2] | 100.00% (16) | 100.00% (12) | N/A[2] | N/A[2] | N/A[4] |
| Q9_Q10e | FORETELL Features - Map Display | Like Most | N/A[2] | 100.00% (16) | 90.91% (10) | N/A[2] | N/A[2] | N/A[4] |
| | | Like Least | N/A[2] | 0.00% (0) | 9.09% (1) | | | |

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5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q11aaa | Uses Anti-Icing Strategies in Maintenance Decisions | Yes | 79.31% (23) | 89.29% (25) | 89.47% (17) | 0.3074 | 0.3554 | 0.9834 |
| | | No | 20.69% (6) | 10.71% (3) | 10.53% (2) | | | |
| Q11aab | How Helpful is Weather Information [1] in Employing Anti-Icing Strategies | Not Very Helpful | 4.35% (1) | 14.29% (3) | 35.29% (6) | 0.0009 | 0.0004 | 0.4834 |
| | | Neutral | 4.35% (1) | 47.62% (10) | 35.29% (6) | | | |
| | | Helpful | 30.43% (7) | 23.81% (5) | 11.76% (2) | | | |
| | | Very Helpful | 60.87% (14) | 14.29% (3) | 17.65% (3) | | | |
| Q11aba | Uses De-Icing Strategies in Maintenance Decisions | Yes | 86.21% (25) | 82.14% (23) | 83.33% (15) | 0.6699 | 0.7806 | 0.9149 |
| | | No | 13.79% (4) | 17.86% (5) | 16.67% (3) | | | |
| Q11abb | How Helpful is Weather Information [1] in Employing De-Icing Strategies | Not Very Helpful | 8.00% (2) | 11.76% (2) | 26.67% (4) | 0.0807 | 0.0150 | 0.3438 |
| | | Not Helpful | 4.00% (1) | 0.00% (0) | 6.67% (1) | | | |
| | | Neutral | 12.00% (3) | 41.18% (7) | 33.33% (5) | | | |
| | | Helpful | 16.00% (4) | 29.41% (5) | 6.67% (1) | | | |
| | | Very Helpful | 60.00% (15) | 17.65% (3) | 26.67% (4) | | | |
| Q11aca | Uses Traction Enhancement Strategies in Maintenance Decisions | Yes | 82.76% (24) | 79.31% (23) | 83.33% (15) | 0.7178 | 0.9588 | 0.7261 |
| | | No | 17.24% (5) | 20.69% (6) | 16.67% (3) | | | |
| Q11acb | How Helpful is Weather Information [1] in Employing Traction Enhancement Strategies | Not Very Helpful | 4.17% (1) | 23.53% (4) | 26.67% (4) | 0.0182 | 0.0009 | 0.2915 |
| | | Not Helpful | 4.17% (1) | 11.76% (2) | 6.67% (1) | | | |
| | | Neutral | 20.83% (5) | 35.29% (6) | 53.33% (8) | | | |
| | | Helpful | 25.00% (6) | 17.65% (3) | 0.00% (0) | | | |
| | | Very Helpful | 45.83% (11) | 11.76% (2) | 13.33% (2) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q11ada | Uses Mechanical Removal Strategies in Maintenance Decisions | Yes | 100.00% (29) | 86.21% (25) | 89.47% (17) | N/A[4] | N/A[4] | 0.7343 |
| | | No | 0.00% (0) | 13.79% (4) | 10.53% (2) | | | |
| Q11adb | How Helpful is Weather Information [1] in Employing Mechanical Removal Strategies | Not Very Helpful | 7.14% (2) | 21.05% (4) | 41.18% (7) | 0.1083 | 0.0043 | 0.1517 |
| | | Not Helpful | 14.29% (4) | 5.26% (1) | 5.88% (1) | | | |
| | | Neutral | 17.86% (5) | 36.84% (7) | 35.29% (6) | | | |
| | | Helpful | 14.29% (4) | 21.05% (4) | 0.00% (0) | | | |
| | | Very Helpful | 46.43% (13) | 15.79% (3) | 17.65% (3) | | | |
| Q12aaa | Uses Wind Speed/Direction Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 3.45% (1) | 0.00% (0) | 16.67% (2) | 0.0376 | 0.4141 | 0.3709 |
| | | Disagree | 10.34% (3) | 6.67% (1) | 0.00% (0) | | | |
| | | Neutral | 24.14% (7) | 60.00% (9) | 33.33% (4) | | | |
| | | Agree | 17.24% (5) | 26.67% (4) | 41.67% (5) | | | |
| | | Strongly Agree | 44.83% (13) | 6.67% (1) | 8.33% (1) | | | |
| Q12aab | Uses Precipitation Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 0.00% (0) | 0.00% (0) | 8.33% (1) | N/A[4] | N/A[4] | 0.6438 |
| | | Neutral | 0.00% (0) | 18.75% (3) | 16.67% (2) | | | |
| | | Agree | 27.59% (8) | 68.75% (11) | 50.00% (6) | | | |
| | | Strongly Agree | 72.41% (21) | 12.50% (2) | 25.00% (3) | | | |
| Q12aac | Uses Atmospheric Temperature Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 11.11% (3) | 0.00% (0) | 9.09% (1) | 0.6515 | 0.4024 | 0.6402 |
| | | Disagree | 7.41% (2) | 0.00% (0) | 0.00% (0) | | | |
| | | Neutral | 3.70% (1) | 28.57% (4) | 27.27% (3) | | | |
| | | Agree | 14.81% (4) | 42.86% (6) | 54.55% (6) | | | |
| | | Strongly Agree | 62.96% (17) | 28.57% (4) | 9.09% (1) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q12baa | Uses Pavement Temperature Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 0.00% (0) | 0.00% (0) | 10.00% (1) | 0.0668 | 0.0395 | 0.5553 |
| | | Neutral | 6.90% (2) | 28.57% (4) | 30.00% (3) | | | |
| | | Agree | 27.59% (8) | 42.86% (6) | 40.00% (4) | | | |
| | | Strongly Agree | 65.52% (19) | 28.57% (4) | 20.00% (2) | | | |
| Q12bab | Uses Pavement Condition Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 0.00% (0) | 0.00% (0) | 10.00% (1) | 0.0130 | 0.0082 | 0.7662 |
| | | Disagree | 3.45% (1) | 7.69% (1) | 0.00% (0) | | | |
| | | Neutral | 3.45% (1) | 38.46% (5) | 30.00% (3) | | | |
| | | Agree | 20.69% (6) | 38.46% (5) | 40.00% (4) | | | |
| | | Strongly Agree | 72.41% (21) | 15.38% (2) | 20.00% (2) | | | |
| Q12bac | Uses Dewpoint Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 25.00% (5) | 7.69% (1) | 8.33% (1) | 0.4329 | 0.0033 | 0.0334 |
| | | Disagree | 25.00% (5) | 15.38% (2) | 8.33% (1) | | | |
| | | Neutral | 30.00% (6) | 46.15% (6) | 16.67% (2) | | | |
| | | Agree | 0.00% (0) | 30.77% (4) | 66.67% (8) | | | |
| | | Strongly Agree | 20.00% (4) | 0.00% (0) | 0.00% (0) | | | |
| Q12aba | Uses Wind Speed/Direction Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 6.90% (2) | 0.00% (0) | 16.67% (2) | 0.0703 | 0.0482 | 0.8432 |
| | | Disagree | 13.79% (4) | 14.29% (2) | 16.67% (2) | | | |
| | | Neutral | 20.69% (6) | 57.14% (8) | 41.67% (5) | | | |
| | | Agree | 10.34% (3) | 21.43% (3) | 16.67% (2) | | | |
| | | Strongly Agree | 48.28% (14) | 7.14% (1) | 8.33% (1) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q12abb | Uses Precipitation Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 0.00% (0) | 0.00% (0) | 8.33% (1) | 0.0266 | 0.0186 | 0.5512 |
| | | Disagree | 3.45% (1) | 0.00% (0) | 8.33% (1) | | | |
| | | Neutral | 6.90% (2) | 40.00% (6) | 33.33% (4) | | | |
| | | Agree | 24.14% (7) | 53.33% (8) | 33.33% (4) | | | |
| | | Strongly Agree | 65.52% (19) | 6.67% (1) | 16.67% (2) | | | |
| Q12abc | Uses Atmospheric Temperature Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 7.41% (2) | 0.00% (0) | 8.33% (1) | 0.0896 | 0.1504 | 0.8555 |
| | | Disagree | 11.11% (3) | 0.00% (0) | 16.67% (2) | | | |
| | | Neutral | 14.81% (4) | 61.54% (8) | 33.33% (4) | | | |
| | | Agree | 22.22% (6) | 30.77% (4) | 25.00% (3) | | | |
| | | Strongly Agree | 44.44% (12) | 7.69% (1) | 16.67% (2) | | | |
| Q12bba | Uses Pavement Temperature Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 0.00% (0) | 0.00% (0) | 10.00% (1) | 0.0089 | 0.0003 | 0.2416 |
| | | Disagree | 0.00% (0) | 0.00% (0) | 10.00% (1) | | | |
| | | Neutral | 6.90% (2) | 46.15% (6) | 50.00% (5) | | | |
| | | Agree | 34.48% (10) | 53.85% (7) | 10.00% (1) | | | |
| | | Strongly Agree | 58.62% (17) | 0.00% (0) | 20.00% (2) | | | |
| Q12bbb | Uses Pavement Condition Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 3.45% (1) | 0.00% (0) | 10.00% (1) | 0.0055 | 0.0020 | 0.7693 |
| | | Disagree | 0.00% (0) | 7.69% (1) | 20.00% (2) | | | |
| | | Neutral | 6.90% (2) | 46.15% (6) | 30.00% (3) | | | |
| | | Agree | 6.90% (2) | 38.46% (5) | 30.00% (3) | | | |
| | | Strongly Agree | 82.76% (24) | 7.69% (1) | 10.00% (1) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q12bbc | Uses Dewpoint Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 28.57% (6) | 9.09% (1) | 8.33% (1) | 0.4714 | 0.8402 | 0.5993 |
| | | Disagree | 28.57% (6) | 18.18% (2) | 16.67% (2) | | | |
| | | Neutral | 23.81% (5) | 63.64% (7) | 58.33% (7) | | | |
| | | Agree | 0.00% (0) | 9.09% (1) | 16.67% (2) | | | |
| | | Strongly Agree | 19.05% (4) | 0.00% (0) | 0.00% (0) | | | |
| Q12aca | Uses Wind Speed/Direction Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 6.90% (2) | 0.00% (0) | 16.67% (2) | 0.0942 | 0.0730 | 0.6248 |
| | | Disagree | 3.45% (1) | 14.29% (2) | 0.00% (0) | | | |
| | | Neutral | 17.24% (5) | 35.71% (5) | 41.67% (5) | | | |
| | | Agree | 24.14% (7) | 35.71% (5) | 33.33% (4) | | | |
| | | Strongly Agree | 48.28% (14) | 14.29% (2) | 8.33% (1) | | | |
| Q12acb | Uses Precipitation Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 0.00% (0) | 0.00% (0) | 8.33% (1) | N/A [4] | N/A [4] | 0.1395 |
| | | Neutral | 0.00% (0) | 18.75% (3) | 33.33% (4) | | | |
| | | Agree | 20.69% (6) | 50.00% (8) | 41.67% (5) | | | |
| | | Strongly Agree | 79.31% (23) | 31.25% (5) | 16.67% (2) | | | |
| Q12acc | Uses Atmospheric Temperature Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 11.11% (3) | 0.00% (0) | 8.33% (1) | 0.7373 | 0.1423 | 0.2616 |
| | | Disagree | 3.70% (1) | 0.00% (0) | 8.33% (1) | | | |
| | | Neutral | 3.70% (1) | 23.08% (3) | 25.00% (3) | | | |
| | | Agree | 11.11% (3) | 46.15% (6) | 41.67% (5) | | | |
| | | Strongly Agree | 70.37% (19) | 30.77% (4) | 16.67% (2) | | | |
| Q12bca | Uses Pavement Temperature Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 0.00% (0) | 0.00% (0) | 10.00% (1) | 0.1498 | 0.0007 | 0.3669 |
| | | Neutral | 6.90% (2) | 23.08% (3) | 30.00% (3) | | | |
| | | Agree | 20.69% (6) | 46.15% (6) | 40.00% (4) | | | |
| | | Strongly Agree | 72.41% (21) | 30.77% (4) | 20.00% (2) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q12bcb | Uses Pavement Condition Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 0.00% (0) | 0.00% (0) | 10.00% (1) | 0.0143 | 0.0154 | 0.8903 |
| | | Disagree | 0.00% (0) | 7.14% (1) | 0.00% (0) | | | |
| | | Neutral | 3.45% (1) | 35.71% (5) | 30.00% (3) | | | |
| | | Agree | 20.69% (6) | 35.71% (5) | 40.00% (4) | | | |
| | | Strongly Agree | 75.86% (22) | 21.43% (3) | 20.00% (2) | | | |
| Q12bcc | Uses Dewpoint Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 28.57% (6) | 7.69% (1) | 16.67% (2) | 0.1394 | 0.0321 | 0.4269 |
| | | Disagree | 23.81% (5) | 7.69% (1) | 0.00% (0) | | | |
| | | Neutral | 28.57% (6) | 46.15% (6) | 33.33% (4) | | | |
| | | Agree | 0.00% (0) | 30.77% (4) | 50.00% (6) | | | |
| | | Strongly Agree | 19.05% (4) | 7.69% (1) | 0.00% (0) | | | |
| Q13aaa | Wind Speed/Direction Information [1] is Understandable | Strongly Disagree | 3.45% (1) | 0.00% (0) | 0.00% (0) | 0.8143 | 0.8826 | 0.7415 |
| | | Neutral | 13.79% (4) | 20.00% (3) | 15.38% (2) | | | |
| | | Agree | 37.93% (11) | 60.00% (9) | 61.54% (8) | | | |
| | | Strongly Agree | 44.83% (13) | 20.00% (3) | 23.08% (3) | | | |
| Q13aab | Precipitation Information [1] is Understandable | Disagree | 3.45% (1) | 0.00% (0) | 0.00% (0) | 0.8229 | 0.8688 | 0.9767 |
| | | Neutral | 17.24% (5) | 23.53% (4) | 23.08% (3) | | | |
| | | Agree | 31.03% (9) | 47.06% (8) | 53.85% (7) | | | |
| | | Strongly Agree | 48.28% (14) | 29.41% (5) | 23.08% (3) | | | |
| Q13aac | Atmospheric Temperature Information [1] is Understandable | Strongly Disagree | 7.41% (2) | 0.00% (0) | 0.00% (0) | 0.4174 | 0.7047 | 0.3056 |
| | | Disagree | 3.70% (1) | 0.00% (0) | 0.00% (0) | | | |
| | | Neutral | 11.11% (3) | 33.33% (5) | 16.67% (2) | | | |
| | | Agree | 33.33% (9) | 40.00% (6) | 58.33% (7) | | | |
| | | Strongly Agree | 44.44% (12) | 26.67% (4) | 25.00% (3) | | | |

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2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q13baa | Pavement Temperature Information [1] is Understandable | Disagree | 3.45% (1) | 0.00% (0) | 0.00% (0) | 0.2335 | 0.1678 | 0.7369 |
| | | Neutral | 13.79% (4) | 33.33% (5) | 40.00% (4) | | | |
| | | Agree | 41.38% (12) | 46.67% (7) | 40.00% (4) | | | |
| | | Strongly Agree | 41.38% (12) | 20.00% (3) | 20.00% (2) | | | |
| Q13bab | Pavement Condition Information [1] is Understandable | Disagree | 3.45% (1) | 7.14% (1) | 10.00% (1) | 0.9554 | 0.0183 | 0.0560 |
| | | Neutral | 17.24% (5) | 14.29% (2) | 50.00% (5) | | | |
| | | Agree | 41.38% (12) | 64.29% (9) | 20.00% (2) | | | |
| | | Strongly Agree | 37.93% (11) | 14.29% (2) | 20.00% (2) | | | |
| Q13bac | Dewpoint Information [1] is Understandable | Strongly Disagree | 33.33% (7) | 7.14% (1) | 0.00% (0) | 0.2719 | 0.3127 | 1.0000 |
| | | Disagree | 9.52% (2) | 7.14% (1) | 0.00% (0) | | | |
| | | Neutral | 23.81% (5) | 35.71% (5) | 50.00% (5) | | | |
| | | Agree | 23.81% (5) | 50.00% (7) | 30.00% (3) | | | |
| | | Strongly Agree | 9.52% (2) | 0.00% (0) | 20.00% (2) | | | |
| Q13aba | Wind Speed/Direction Information [1] is Usable | Strongly Disagree | 3.57% (1) | 0.00% (0) | 0.00% (0) | 0.3953 | 0.5328 | 0.8059 |
| | | Disagree | 0.00% (0) | 6.67% (1) | 7.69% (1) | | | |
| | | Neutral | 35.71% (10) | 20.00% (3) | 23.08% (3) | | | |
| | | Agree | 14.29% (4) | 53.33% (8) | 53.85% (7) | | | |
| | | Strongly Agree | 46.43% (13) | 20.00% (3) | 15.38% (2) | | | |
| Q13abb | Precipitation Information [1] is Usable | Strongly Disagree | 0.00% (0) | 0.00% (0) | 7.69% (1) | 0.6726 | 0.8748 | 0.6011 |
| | | Disagree | 3.57% (1) | 5.88% (1) | 7.69% (1) | | | |
| | | Neutral | 25.00% (7) | 17.65% (3) | 15.38% (2) | | | |
| | | Agree | 14.29% (4) | 52.94% (9) | 46.15% (6) | | | |
| | | Strongly Agree | 57.14% (16) | 23.53% (4) | 23.08% (3) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q13abc | Atmospheric Temperature Information [1] is Usable | Strongly Disagree | 7.69% (2) | 0.00% (0) | 0.00% (0) | 0.5070 | 0.7201 | 0.8203 |
| | | Disagree | 0.00% (0) | 0.00% (0) | 9.09% (1) | | | |
| | | Neutral | 23.08% (6) | 40.00% (6) | 27.27% (3) | | | |
| | | Agree | 11.54% (3) | 40.00% (6) | 45.45% (5) | | | |
| | | Strongly Agree | 57.69% (15) | 20.00% (3) | 18.18% (2) | | | |
| Q13bba | Pavement Temperature Information [1] is Usable | Disagree | 7.14% (2) | 0.00% (0) | 20.00% (2) | 0.3447 | 0.1704 | 0.5129 |
| | | Neutral | 25.00% (7) | 46.67% (7) | 40.00% (4) | | | |
| | | Agree | 14.29% (4) | 46.67% (7) | 30.00% (3) | | | |
| | | Strongly Agree | 53.57% (15) | 6.67% (1) | 10.00% (1) | | | |
| Q13bbb | Pavement Condition Information [1] is Usable | Disagree | 3.57% (1) | 21.43% (3) | 30.00% (3) | 0.5124 | 0.1449 | 0.3909 |
| | | Neutral | 28.57% (8) | 21.43% (3) | 30.00% (3) | | | |
| | | Agree | 21.43% (6) | 57.14% (8) | 30.00% (3) | | | |
| | | Strongly Agree | 46.43% (13) | 0.00% (0) | 10.00% (1) | | | |
| Q13bbc | Dewpoint Information [1] is Usable | Strongly Disagree | 23.81% (5) | 7.14% (1) | 0.00% (0) | 0.1359 | 0.0737 | 0.7159 |
| | | Disagree | 19.05% (4) | 7.14% (1) | 0.00% (0) | | | |
| | | Neutral | 38.10% (8) | 42.86% (6) | 50.00% (4) | | | |
| | | Agree | 14.29% (3) | 42.86% (6) | 37.50% (3) | | | |
| | | Strongly Agree | 4.76% (1) | 0.00% (0) | 12.50% (1) | | | |
| Q13aca | Wind Speed/Direction Information [1] is Easily Obtainable | Strongly Disagree | 0.00% (0) | 6.67% (1) | 23.08% (3) | 0.3220 | 0.3527 | 0.9755 |
| | | Disagree | 3.45% (1) | 26.67% (4) | 7.69% (1) | | | |
| | | Neutral | 34.48% (10) | 20.00% (3) | 23.08% (3) | | | |
| | | Agree | 20.69% (6) | 26.67% (4) | 23.08% (3) | | | |
| | | Strongly Agree | 41.38% (12) | 20.00% (3) | 23.08% (3) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q13acb | Precipitation Information [1] is Easily Obtainable | Strongly Disagree | 0.00% (0) | 5.88% (1) | 16.67% (2) | 0.7184 | 0.6027 | 0.8665 |
| | | Disagree | 6.90% (2) | 23.53% (4) | 8.33% (1) | | | |
| | | Neutral | 34.48% (10) | 17.65% (3) | 25.00% (3) | | | |
| | | Agree | 20.69% (6) | 35.29% (6) | 25.00% (3) | | | |
| | | Strongly Agree | 37.93% (11) | 17.65% (3) | 25.00% (3) | | | |
| Q13acc | Atmospheric Temperature Information [1] is Easily Obtainable | Strongly Disagree | 3.70% (1) | 6.67% (1) | 9.09% (1) | 0.0947 | 0.5016 | 0.4303 |
| | | Disagree | 0.00% (0) | 26.67% (4) | 9.09% (1) | | | |
| | | Neutral | 29.63% (8) | 26.67% (4) | 27.27% (3) | | | |
| | | Agree | 18.52% (5) | 20.00% (3) | 27.27% (3) | | | |
| | | Strongly Agree | 48.15% (13) | 20.00% (3) | 27.27% (3) | | | |
| Q13bca | Pavement Temperature Information [1] is Easily Obtainable | Strongly Disagree | 6.90% (2) | 0.00% (0) | 20.00% (2) | 0.5676 | 0.6253 | 1.0000 |
| | | Disagree | 6.90% (2) | 25.00% (4) | 10.00% (1) | | | |
| | | Neutral | 27.59% (8) | 25.00% (4) | 20.00% (2) | | | |
| | | Agree | 20.69% (6) | 37.50% (6) | 40.00% (4) | | | |
| | | Strongly Agree | 37.93% (11) | 12.50% (2) | 10.00% (1) | | | |
| Q13bcb | Pavement Condition Information [1] is Easily Obtainable | Strongly Disagree | 3.45% (1) | 0.00% (0) | 20.00% (2) | 0.9027 | 0.3651 | 0.4943 |
| | | Disagree | 6.90% (2) | 33.33% (5) | 10.00% (1) | | | |
| | | Neutral | 34.48% (10) | 13.33% (2) | 30.00% (3) | | | |
| | | Agree | 10.34% (3) | 40.00% (6) | 20.00% (2) | | | |
| | | Strongly Agree | 44.83% (13) | 13.33% (2) | 20.00% (2) | | | |
| Q13bcc | Dewpoint Information [1] is Easily Obtainable | Strongly Disagree | 28.57% (6) | 6.67% (1) | 0.00% (0) | 0.6663 | 0.4121 | 0.1708 |
| | | Disagree | 19.05% (4) | 33.33% (5) | 0.00% (0) | | | |
| | | Neutral | 19.05% (4) | 33.33% (5) | 50.00% (4) | | | |
| | | Agree | 4.76% (1) | 13.33% (2) | 37.50% (3) | | | |
| | | Strongly Agree | 28.57% (6) | 13.33% (2) | 12.50% (1) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q13ada | Wind Speed/Direction Information [1] is Accurate | Strongly Disagree | 0.00% (0) | 0.00% (0) | 8.33% (1) | 0.4312 | 0.0763 | 0.2295 |
| | | Disagree | 13.79% (4) | 6.67% (1) | 0.00% (0) | | | |
| | | Neutral | 51.72% (15) | 46.67% (7) | 25.00% (3) | | | |
| | | Agree | 17.24% (5) | 40.00% (6) | 58.33% (7) | | | |
| | | Strongly Agree | 17.24% (5) | 6.67% (1) | 8.33% (1) | | | |
| Q13adb | Precipitation Information [1] is Accurate | Strongly Disagree | 10.34% (3) | 0.00% (0) | 23.08% (3) | 0.2492 | 0.0390 | 0.1803 |
| | | Disagree | 13.79% (4) | 0.00% (0) | 0.00% (0) | | | |
| | | Neutral | 51.72% (15) | 58.82% (10) | 15.38% (2) | | | |
| | | Agree | 13.79% (4) | 23.53% (4) | 46.15% (6) | | | |
| | | Strongly Agree | 10.34% (3) | 17.65% (3) | 15.38% (2) | | | |
| Q13adc | Atmospheric Temperature Information [1] is Accurate | Strongly Disagree | 3.70% (1) | 0.00% (0) | 8.33% (1) | 0.9614 | 0.3030 | 0.2341 |
| | | Disagree | 14.81% (4) | 0.00% (0) | 8.33% (1) | | | |
| | | Neutral | 40.74% (11) | 60.00% (9) | 25.00% (3) | | | |
| | | Agree | 22.22% (6) | 20.00% (3) | 50.00% (6) | | | |
| | | Strongly Agree | 18.52% (5) | 20.00% (3) | 8.33% (1) | | | |
| Q13bda | Pavement Temperature Information [1] is Accurate | Strongly Disagree | 0.00% (0) | 0.00% (0) | 20.00% (2) | 0.1942 | 0.6611 | 0.5008 |
| | | Disagree | 17.24% (5) | 0.00% (0) | 20.00% (2) | | | |
| | | Neutral | 34.48% (10) | 73.33% (11) | 20.00% (2) | | | |
| | | Agree | 31.03% (9) | 13.33% (2) | 40.00% (4) | | | |
| | | Strongly Agree | 17.24% (5) | 13.33% (2) | 0.00% (0) | | | |
| Q13bdb | Pavement Condition Information [1] is Accurate | Strongly Disagree | 0.00% (0) | 0.00% (0) | 18.18% (2) | 0.2159 | 0.8248 | 0.2003 |
| | | Disagree | 20.69% (6) | 14.29% (2) | 27.27% (3) | | | |
| | | Neutral | 37.93% (11) | 64.29% (9) | 9.09% (1) | | | |
| | | Agree | 24.14% (7) | 14.29% (2) | 36.36% (4) | | | |
| | | Strongly Agree | 17.24% (5) | 7.14% (1) | 9.09% (1) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q13bdc | Dewpoint Information [1] is Accurate | Strongly Disagree | 14.29% (3) | 7.14% (1) | 0.00% (0) | 0.4591 | 0.1432 | 0.0190 |
| | | Disagree | 28.57% (6) | 14.29% (2) | 12.50% (1) | | | |
| | | Neutral | 33.33% (7) | 64.29% (9) | 37.50% (3) | | | |
| | | Agree | 19.05% (4) | 14.29% (2) | 50.00% (4) | | | |
| | | Strongly Agree | 4.76% (1) | 0.00% (0) | 0.00% (0) | | | |
| Q13aea | Wind Speed/Direction Information [1] is Useful for Weather-Related Decisions | Disagree | 3.45% (1) | 6.67% (1) | 9.09% (1) | 0.7296 | 0.9089 | 0.8461 |
| | | Neutral | 31.03% (9) | 33.33% (5) | 27.27% (3) | | | |
| | | Agree | 20.69% (6) | 46.67% (7) | 45.45% (5) | | | |
| | | Strongly Agree | 44.83% (13) | 13.33% (2) | 18.18% (2) | | | |
| Q13aeb | Precipitation Information [1] is Useful for Weather-Related Decisions | Disagree | 0.00% (0) | 0.00% (0) | 9.09% (1) | 0.2171 | 0.1088 | 0.7476 |
| | | Neutral | 17.24% (5) | 31.25% (5) | 27.27% (3) | | | |
| | | Agree | 31.03% (9) | 50.00% (8) | 36.36% (4) | | | |
| | | Strongly Agree | 51.72% (15) | 18.75% (3) | 27.27% (3) | | | |
| Q13aec | Atmospheric Temperature Information [1] is Useful for Weather-Related Decisions | Disagree | 3.70% (1) | 0.00% (0) | 10.00% (1) | 0.4770 | 0.1594 | 0.4102 |
| | | Neutral | 14.81% (4) | 26.67% (4) | 30.00% (3) | | | |
| | | Agree | 18.52% (5) | 60.00% (9) | 40.00% (4) | | | |
| | | Strongly Agree | 62.96% (17) | 13.33% (2) | 20.00% (2) | | | |
| Q13bea | Pavement Temperature Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 0.00% (0) | 25.00% (2) | 0.2690 | 0.0951 | 0.5964 |
| | | Disagree | 3.57% (1) | 0.00% (0) | 0.00% (0) | | | |
| | | Neutral | 17.86% (5) | 38.46% (5) | 25.00% (2) | | | |
| | | Agree | 28.57% (8) | 38.46% (5) | 37.50% (3) | | | |
| | | Strongly Agree | 50.00% (14) | 23.08% (3) | 12.50% (1) | | | |

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5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | % (n) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q13beb | Pavement Condition Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 3.45% (1) | 0.00% (0) | 25.00% (2) | 0.2734 | 0.1144 | 0.5679 |
| | | Disagree | 3.45% (1) | 16.67% (2) | 12.50% (1) | | | |
| | | Neutral | 24.14% (7) | 33.33% (4) | 25.00% (2) | | | |
| | | Agree | 27.59% (8) | 50.00% (6) | 25.00% (2) | | | |
| | | Strongly Agree | 41.38% (12) | 0.00% (0) | 12.50% (1) | | | |
| Q13bec | Dewpoint Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 19.05% (4) | 7.14% (1) | 0.00% (0) | 0.7452 | 0.1007 | 0.0843 |
| | | Disagree | 19.05% (4) | 7.14% (1) | 0.00% (0) | | | |
| | | Neutral | 28.57% (6) | 57.14% (8) | 37.50% (3) | | | |
| | | Agree | 19.05% (4) | 28.57% (4) | 50.00% (4) | | | |
| | | Strongly Agree | 14.29% (3) | 0.00% (0) | 12.50% (1) | | | |
| Q14afa | FORETELL Wind Speed/Direction Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 8.33% (1) | 23.08% (3) | N/A [2] | N/A [2] | 0.6123 |
| | | Disagree | N/A [2] | 16.67% (2) | 15.38% (2) | | | |
| | | Neutral | N/A [2] | 58.33% (7) | 38.46% (5) | | | |
| | | Agree | N/A [2] | 16.67% (2) | 15.38% (2) | | | |
| | | Strongly Agree | N/A [2] | 0.00% (0) | 7.69% (1) | | | |
| Q14afb | FORETELL Precipitation Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 7.14% (1) | 21.43% (3) | N/A [2] | N/A [2] | 0.6404 |
| | | Disagree | N/A [2] | 14.29% (2) | 14.29% (2) | | | |
| | | Neutral | N/A [2] | 42.86% (6) | 35.71% (5) | | | |
| | | Agree | N/A [2] | 35.71% (5) | 14.29% (2) | | | |
| | | Strongly Agree | N/A [2] | 0.00% (0) | 14.29% (2) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q14afc | FORETELL Atmospheric Temperature Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A[2] | 7.69% (1) | 25.00% (3) | N/A[2] | N/A[2] | 0.8908 |
| | | Disagree | N/A[2] | 7.69% (1) | 16.67% (2) | | | |
| | | Neutral | N/A[2] | 61.54% (8) | 33.33% (4) | | | |
| | | Agree | N/A[2] | 15.38% (2) | 16.67% (2) | | | |
| | | Strongly Agree | N/A[2] | 7.69% (1) | 8.33% (1) | | | |
| Q14bfa | FORETELL Pavement Temperature Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A[2] | 9.09% (1) | 22.22% (2) | N/A[2] | N/A[2] | 0.8811 |
| | | Disagree | N/A[2] | 18.18% (2) | 33.33% (3) | | | |
| | | Neutral | N/A[2] | 36.36% (4) | 11.11% (1) | | | |
| | | Agree | N/A[2] | 36.36% (4) | 22.22% (2) | | | |
| | | Strongly Agree | N/A[2] | 0.00% (0) | 11.11% (1) | | | |
| Q14bfb | FORETELL Pavement Condition Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A[2] | 0.00% (0) | 22.22% (2) | N/A[2] | N/A[2] | 0.5054 |
| | | Disagree | N/A[2] | 30.00% (3) | 33.33% (3) | | | |
| | | Neutral | N/A[2] | 50.00% (5) | 11.11% (1) | | | |
| | | Agree | N/A[2] | 20.00% (2) | 22.22% (2) | | | |
| | | Strongly Agree | N/A[2] | 0.00% (0) | 11.11% (1) | | | |
| Q14bfc | FORETELL Dewpoint Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A[2] | 16.67% (2) | 11.11% (1) | N/A[2] | N/A[2] | 0.1806 |
| | | Disagree | N/A[2] | 16.67% (2) | 11.11% (1) | | | |
| | | Neutral | N/A[2] | 58.33% (7) | 44.44% (4) | | | |
| | | Agree | N/A[2] | 8.33% (1) | 22.22% (2) | | | |
| | | Strongly Agree | N/A[2] | 0.00% (0) | 11.11% (1) | | | |

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2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q15 | FORETELL Provides Valuable Information Not Provided Elsewhere | Strongly Disagree | N/A[2] | 22.73% (5) | 23.53% (4) | N/A[2] | N/A[2] | 0.7219 |
| | | Disagree | N/A[2] | 4.55% (1) | 17.65% (3) | | | |
| | | Neutral | N/A[2] | 36.36% (8) | 17.65% (3) | | | |
| | | Agree | N/A[2] | 31.82% (7) | 35.29% (6) | | | |
| | | Strongly Agree | N/A[2] | 4.55% (1) | 5.88% (1) | | | |
| Q16 | Receive FORETELL Information in Time to Make Weather-Related Decisions | Strongly Disagree | N/A[2] | 9.09% (2) | 17.65% (3) | N/A[2] | N/A[2] | 0.6743 |
| | | Disagree | N/A[2] | 13.64% (3) | 11.76% (2) | | | |
| | | Neutral | N/A[2] | 36.36% (8) | 23.53% (4) | | | |
| | | Agree | N/A[2] | 40.91% (9) | 41.18% (7) | | | |
| | | Strongly Agree | N/A[2] | 0.00% (0) | 5.88% (1) | | | |
| Q17 | Weather Information [1] is Sufficient for Making Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 0.00% (0) | 5.88% (1) | 0.7180 | 0.6587 | 0.9382 |
| | | Disagree | 20.69% (6) | 31.82% (7) | 17.65% (3) | | | |
| | | Neutral | 37.93% (11) | 31.82% (7) | 41.18% (7) | | | |
| | | Agree | 34.48% (10) | 36.36% (8) | 29.41% (5) | | | |
| | | Strongly Agree | 6.90% (2) | 0.00% (0) | 5.88% (1) | | | |
| Q18 | Willing to Pay for FORETELL | Strongly Disagree | N/A[2] | 15.00% (3) | 25.00% (4) | N/A[2] | N/A[2] | 0.7462 |
| | | Disagree | N/A[2] | 15.00% (3) | 6.25% (1) | | | |
| | | Neutral | N/A[2] | 60.00% (12) | 56.25% (9) | | | |
| | | Agree | N/A[2] | 5.00% (1) | 12.50% (2) | | | |
| | | Strongly Agree | N/A[2] | 5.00% (1) | 0.00% (0) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q19 | Having Weather Information [1] Makes Job Easier | Strongly Disagree | 0.00% (0) | 9.09% (2) | 17.65% (3) | <.0001 | <.0001 | 0.8737 |
| | | Disagree | 0.00% (0) | 13.64% (3) | 11.76% (2) | | | |
| | | Neutral | 10.34% (3) | 50.00% (11) | 41.18% (7) | | | |
| | | Agree | 13.79% (4) | 22.73% (5) | 29.41% (5) | | | |
| | | Strongly Agree | 75.86% (22) | 4.55% (1) | 0.00% (0) | | | |
| Q20 | Weather Information [1] Helps You Improve Traffic Efficiency of Roadways | Strongly Disagree | 0.00% (0) | 9.09% (2) | 17.65% (3) | 0.0101 | 0.0011 | 0.2157 |
| | | Disagree | 0.00% (0) | 9.09% (2) | 5.88% (1) | | | |
| | | Neutral | 31.03% (9) | 50.00% (11) | 58.82% (10) | | | |
| | | Agree | 37.93% (11) | 31.82% (7) | 17.65% (3) | | | |
| | | Strongly Agree | 31.03% (9) | 0.00% (0) | 0.00% (0) | | | |
| Q21 | Weather Information [1] Helps You to Target Snow and Ice Control Measures | Strongly Disagree | 3.45% (1) | 9.09% (2) | 5.88% (1) | 0.0002 | 0.0007 | 0.9485 |
| | | Disagree | 0.00% (0) | 9.09% (2) | 23.53% (4) | | | |
| | | Neutral | 20.69% (6) | 59.09% (13) | 47.06% (8) | | | |
| | | Agree | 44.83% (13) | 13.64% (3) | 23.53% (4) | | | |
| | | Strongly Agree | 31.03% (9) | 9.09% (2) | 0.00% (0) | | | |
| Q22 | Highway Maintenance Activities are Conducted More Efficiently Using Weather Information [1] | Strongly Disagree | 0.00% (0) | 9.09% (2) | 5.88% (1) | <.0001 | <.0001 | 0.9485 |
| | | Disagree | 0.00% (0) | 13.64% (3) | 35.29% (6) | | | |
| | | Neutral | 6.90% (2) | 54.55% (12) | 35.29% (6) | | | |
| | | Agree | 34.48% (10) | 22.73% (5) | 23.53% (4) | | | |
| | | Strongly Agree | 58.62% (17) | 0.00% (0) | 0.00% (0) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q23 | FORETELL Information Makes You More Confident in Making Weather-Related Decisions | Strongly Disagree | N/A[2] | 9.09% (2) | 5.88% (1) | N/A[2] | N/A[2] | 0.5859 |
| | | Disagree | N/A[2] | 22.73% (5) | 29.41% (5) | | | |
| | | Neutral | N/A[2] | 50.00% (11) | 41.18% (7) | | | |
| | | Agree | N/A[2] | 18.18% (4) | 17.65% (3) | | | |
| | | Strongly Agree | N/A[2] | 0.00% (0) | 5.88% (1) | | | |
| Q24 | FORETELL Information Helps You Deploy Staff More Efficiently | Strongly Disagree | N/A[2] | 13.64% (3) | 5.88% (1) | N/A[2] | N/A[2] | 0.6362 |
| | | Disagree | N/A[2] | 13.64% (3) | 23.53% (4) | | | |
| | | Neutral | N/A[2] | 54.55% (12) | 47.06% (8) | | | |
| | | Agree | N/A[2] | 13.64% (3) | 17.65% (3) | | | |
| | | Strongly Agree | N/A[2] | 4.55% (1) | 5.88% (1) | | | |
| Q25 | Roads Return to Targeted Level of Service More Quickly with Weather Information [1] | Strongly Disagree | 0.00% (0) | 13.64% (3) | 5.88% (1) | 0.0103 | 0.0020 | 0.6532 |
| | | Disagree | 3.45% (1) | 18.18% (4) | 35.29% (6) | | | |
| | | Neutral | 34.48% (10) | 45.45% (10) | 41.18% (7) | | | |
| | | Agree | 24.14% (7) | 18.18% (4) | 17.65% (3) | | | |
| | | Strongly Agree | 37.93% (11) | 4.55% (1) | 0.00% (0) | | | |
| Q26 | Safety of the Highway Maintenance Operator is Increased with Weather Information [1] | Strongly Disagree | 0.00% (0) | 9.09% (2) | 11.76% (2) | <.0001 | <.0001 | 0.8340 |
| | | Disagree | 6.90% (2) | 18.18% (4) | 23.53% (4) | | | |
| | | Neutral | 13.79% (4) | 59.09% (13) | 52.94% (9) | | | |
| | | Agree | 24.14% (7) | 9.09% (2) | 11.76% (2) | | | |
| | | Strongly Agree | 55.17% (16) | 4.55% (1) | 0.00% (0) | | | |

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5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q27 | Weather Information [1] Helps to Lessen the Amount of Chemical Applications | Strongly Disagree | 3.45% (1) | 9.09% (2) | 11.76% (2) | <.0001 | <.0001 | 0.3223 |
| | | Disagree | 0.00% (0) | 27.27% (6) | 17.65% (3) | | | |
| | | Neutral | 20.69% (6) | 54.55% (12) | 52.94% (9) | | | |
| | | Agree | 34.48% (10) | 4.55% (1) | 11.76% (2) | | | |
| | | Strongly Agree | 41.38% (12) | 4.55% (1) | 5.88% (1) | | | |
| Q28 | Make Highway Maintenance Decisions More Efficiently because of FORETELL Information | Yes | N/A [2] | 42.86% (9) | 35.29% (6) | N/A [2] | N/A [2] | 0.6032 |
| | | No | N/A [2] | 57.14% (12) | 64.71% (11) | | | |
| Q28a | How Much Sooner Do You Learn about Weather Events when Using FORETELL Information | 0-3 Hours | N/A [2] | 0.00% (0) | 50.00% (3) | N/A [2] | N/A [2] | N/A [5] |
| | | 3-6 Hours | N/A [2] | 44.44% (4) | 0.00% (0) | | | |
| | | 6-12 Hours | N/A [2] | 55.56% (5) | 16.67% (1) | | | |
| | | > 12 Hours | N/A [2] | 0.00% (0) | 33.33% (2) | | | |
| Q29 | Roads are More Quickly Returned to Acceptable Level of Service when Using FORETELL Information | Yes | N/A [2] | 19.05% (4) | 17.65% (3) | N/A [2] | N/A [2] | 0.8961 |
| | | No | N/A [2] | 80.95% (17) | 82.35% (14) | | | |
| Q29a | How Much More Quickly are Roads Returned to Service when Using FORETELL Information | 0-3 Hours | N/A [2] | 75.00% (3) | 66.67% (2) | N/A [2] | N/A [2] | N/A [5] |
| | | 3-6 Hours | N/A [2] | 25.00% (1) | 33.33% (1) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-5. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Missouri Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=29) | First Follow-Up (N=31) | Second Follow-Up (N=29) | P-value [3] | | |
| Q30 | Would Like to Use FORETELL Information in the Future | Yes | N/A[2] | 85.71% (18) | 50.00% (8) | N/A[2] | N/A[2] | 0.0204 |
| | | No | N/A[2] | 14.29% (3) | 50.00% (8) | | | |

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5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q6aa | Uses Wind Speed/Direction in Weather-Related Decisions | Yes | 100.00% (7) | 100.00% (5) | 100.00% (5) | N/A [4] | N/A [4] | N/A [4] |
| Q6ab | Uses Actual Wind Speed/Direction Readings | No Actual Readings | 85.71% (6) | 40.00% (2) | 0.00% (0) | 0.1151 | N/A [4] | N/A [4] |
| | | Uses Actual Readings | 14.29% (1) | 60.00% (3) | 100.00% (5) | | | |
| Q6ac | Uses Forecast Wind Speed/Direction Readings | No Forecast Information | 14.29% (1) | 20.00% (1) | 20.00% (1) | 0.8039 | 0.7869 | 1.0000 |
| | | Uses Forecast Information | 85.71% (6) | 80.00% (4) | 80.00% (4) | | | |
| Q6ba | Uses Precipitation in Weather-Related Decisions | Yes | 100.00% (7) | 100.00% (5) | 100.00% (5) | N/A [4] | N/A [4] | N/A [4] |
| Q6bb | Uses Actual Precipitation Readings | No Actual Readings | 57.14% (4) | 40.00% (2) | 20.00% (1) | 0.5483 | 0.2461 | 0.4880 |
| | | Uses Actual Readings | 42.86% (3) | 60.00% (3) | 80.00% (4) | | | |
| Q6bc | Uses Forecast Precipitation Readings | No Forecast Information | 0.00% (0) | 0.00% (0) | 20.00% (1) | N/A [4] | N/A [4] | N/A [4] |
| | | Uses Forecast Information | 100.00% (7) | 100.00% (5) | 80.00% (4) | | | |
| Q6ca | Uses Atmospheric Temperature in Weather-Related Decisions | Yes | 100.00% (7) | 80.00% (4) | 60.00% (3) | N/A [4] | N/A [4] | 0.2574 |
| | | No | 0.00% (0) | 20.00% (1) | 40.00% (2) | | | |

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**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q6cb | Uses Actual Atmospheric Temperature Readings | No Actual Readings | 85.71% (6) | 25.00% (1) | 66.67% (2) | 0.0555 | 0.5140 | 0.0971 |
| | | Uses Actual Readings | 14.29% (1) | 75.00% (3) | 33.33% (1) | | | |
| Q6cc | Uses Forecast Atmospheric Temperature Readings | No Forecast Information | 14.29% (1) | 25.00% (1) | 0.00% (0) | 0.6460 | N/A [4] | N/A [4] |
| | | Uses Forecast Information | 85.71% (6) | 75.00% (3) | 100.00% (3) | | | |
| Q6da | Uses Pavement Temperature in Weather-Related Decisions | Yes | 100.00% (7) | 100.00% (5) | 100.00% (5) | N/A [4] | N/A [4] | N/A [4] |
| Q6db | Uses Actual Pavement Temperature Readings | No Actual Readings | 100.00% (7) | 0.00% (0) | 0.00% (0) | N/A [4] | N/A [4] | N/A [4] |
| | | Uses Actual Readings | 0.00% (0) | 100.00% (5) | 100.00% (5) | | | |
| Q6dc | Uses Forecast Pavement Temperature Readings | No Forecast Information | 42.86% (3) | 40.00% (2) | 20.00% (1) | 0.9227 | 0.4224 | 0.4357 |
| | | Uses Forecast Information | 57.14% (4) | 60.00% (3) | 80.00% (4) | | | |
| Q6ea | Uses Pavement Condition in Weather-Related Decisions | Yes | 100.00% (7) | 80.00% (4) | 100.00% (5) | N/A [4] | N/A [4] | N/A [4] |
| | | No | 0.00% (0) | 20.00% (1) | 0.00% (0) | | | |
| Q6eb | Uses Actual Pavement Condition Readings | No Actual Readings | 85.71% (6) | 0.00% (0) | 0.00% (0) | N/A [4] | N/A [4] | N/A [4] |
| | | Uses Actual Readings | 14.29% (1) | 100.00% (4) | 100.00% (5) | | | |
| Q6ec | Uses Forecast Pavement Condition Readings | No Forecast Information | 42.86% (3) | 50.00% (2) | 40.00% (2) | 0.8192 | 0.9234 | 0.6195 |
| | | Uses Forecast Information | 57.14% (4) | 50.00% (2) | 60.00% (3) | | | |

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**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q6fa | Uses Dewpoint in Weather-Related Decisions | Yes | 85.71% (6) | 40.00% (2) | 80.00% (4) | 0.0419 | 0.4825 | 0.0613 |
| | | No | 14.29% (1) | 60.00% (3) | 20.00% (1) | | | |
| Q6fb | Uses Actual Dewpoint Readings | No Actual Readings | 33.33% (2) | 50.00% (1) | 25.00% (1) | 0.7006 | 0.7696 | 0.5474 |
| | | Uses Actual Readings | 66.67% (4) | 50.00% (1) | 75.00% (3) | | | |
| Q6fc | Uses Forecast Dewpoint Readings | No Forecast Information | 16.67% (1) | 0.00% (0) | 25.00% (1) | N/A [4] | 0.7416 | N/A [4] |
| | | Uses Forecast Information | 83.33% (5) | 100.00% (2) | 75.00% (3) | | | |
| Q7aa | Uses FORETELL to Receive Wind Speed/Direction Readings | Yes | N/A [2] | 40.00% (2) | 40.00% (2) | N/A [2] | N/A [2] | 1.0000 |
| | | No | N/A [2] | 60.00% (3) | 60.00% (3) | | | |
| Q7ba | Uses FORETELL to Receive Precipitation Readings | Yes | N/A [2] | 40.00% (2) | 20.00% (1) | N/A [2] | N/A [2] | 0.5601 |
| | | No | N/A [2] | 60.00% (3) | 80.00% (4) | | | |
| Q7ca | Uses FORETELL to Receive Atmospheric Temperature Readings | Yes | N/A [2] | 20.00% (1) | 66.67% (2) | N/A [2] | N/A [2] | 0.1415 |
| | | No | N/A [2] | 80.00% (4) | 33.33% (1) | | | |
| Q7da | Uses FORETELL to Receive Pavement Temperature Readings | Yes | N/A [2] | 0.00% (0) | 20.00% (1) | N/A [2] | N/A [2] | N/A [4] |
| | | No | N/A [2] | 100.00% (5) | 80.00% (4) | | | |
| Q7ea | Uses FORETELL to Receive Pavement Condition Readings | Yes | N/A [2] | 0.00% (0) | 20.00% (1) | N/A [2] | N/A [2] | N/A [4] |
| | | No | N/A [2] | 100.00% (5) | 80.00% (4) | | | |
| Q8aa | Uses Weather Information [1] Daily | Yes | 100.00% (7) | 40.00% (2) | 0.00% (0) | N/A [4] | N/A [4] | N/A [4] |
| | | No | 0.00% (0) | 60.00% (3) | 100.00% (5) | | | |

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| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q8ab | Uses Weather Information [1] Daily (How Often) | Twice daily | 28.57% (2) | 100.00% (2) | 0.00% (0) | N/A [5] | N/A [5] | N/A [5] |
| | | 4 Times Daily | 14.29% (1) | 0.00% (0) | 0.00% (0) | | | |
| | | At Least Hourly | 57.14% (4) | 0.00% (0) | 0.00% (0) | | | |
| Q8ba | Uses Weather Information [1] Weekly | Yes | 28.57% (2) | 80.00% (4) | 20.00% (1) | 0.0861 | 0.7457 | 0.0645 |
| | | No | 71.43% (5) | 20.00% (1) | 80.00% (4) | | | |
| Q8ca | Uses Weather Information [1] in Advance of a Weather Event | Yes | 85.71% (6) | 80.00% (4) | 40.00% (2) | 0.7869 | 0.0888 | 0.1756 |
| | | No | 14.29% (1) | 20.00% (1) | 60.00% (3) | | | |
| Q8cb | Uses Weather Information [1] In Advance of a Weather Event (How Often) | Twice daily | 16.67% (1) | 100.00% (3) | 50.00% (1) | N/A [5] | N/A [5] | N/A [5] |
| | | At Least Hourly | 83.33% (5) | 0.00% (0) | 50.00% (1) | | | |
| Q8da | Uses Weather Information [1] During a Weather Event | Yes | 85.71% (6) | 50.00% (2) | 40.00% (2) | 0.2052 | 0.0888 | 0.7535 |
| | | No | 14.29% (1) | 50.00% (2) | 60.00% (3) | | | |
| Q8db | Uses Weather Information [1] During a Weather Event (How Often) | Twice daily | 16.67% (1) | 100.00% (2) | 50.00% (1) | N/A [5] | N/A [5] | N/A [5] |
| | | Every Other Hour | 16.67% (1) | 0.00% (0) | 0.00% (0) | | | |
| | | At Least Hourly | 66.67% (4) | 0.00% (0) | 50.00% (1) | | | |
| Q8ea | Uses Weather Information [1] After a Weather Event | Yes | 57.14% (4) | 20.00% (1) | 0.00% (0) | 0.1657 | N/A [4] | N/A [4] |
| | | No | 42.86% (3) | 80.00% (4) | 100.00% (5) | | | |
| Q8eb | Uses Weather Information [1] After a Weather Event (How Often) | Twice daily | 0.00% (0) | 100.00% (1) | 0.00% (0) | N/A [5] | N/A [5] | N/A [5] |
| | | 4 Times Daily | 75.00% (3) | 0.00% (0) | 0.00% (0) | | | |
| | | At Least Hourly | 25.00% (1) | 0.00% (0) | 0.00% (0) | | | |
| Q9_Q10a | FORETELL Features - Animation | Like Most | N/A [2] | 100.00% (3) | 100.00% (3) | N/A [2] | N/A [2] | N/A [4] |

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| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q9_Q10b | FORETELL Features - Long-Term Forecast | Like Least | N/A [2] | 100.00% (2) | 100.00% (1) | N/A [2] | N/A [2] | N/A [4] |
| Q9_Q10c | FORETELL Features - Scroll Labeling | Like Most | N/A [2] | 100.00% (2) | 100.00% (1) | N/A [2] | N/A [2] | N/A [4] |
| Q9_Q10d | FORETELL Features - Zoom Capability | Like Most | N/A [2] | 100.00% (3) | 100.00% (3) | N/A [2] | N/A [2] | N/A [4] |
| Q9_Q10e | FORETELL Features - Map Display | Like Most | N/A [2] | 100.00% (3) | 100.00% (1) | N/A [2] | N/A [2] | N/A [4] |
| Q11aaa | Uses Anti-Icing Strategies in Maintenance Decisions | Yes | 42.86% (3) | 100.00% (5) | 60.00% (3) | N/A [4] | 0.4821 | N/A [4] |
| | | No | 57.14% (4) | 0.00% (0) | 40.00% (2) | | | |
| Q11aab | How Helpful is Weather Information [1] in Employing Anti-Icing Strategies | Not Very Helpful | 0.00% (0) | 40.00% (2) | 0.00% (0) | N/A [4] | N/A [4] | 0.7246 |
| | | Not Helpful | 0.00% (0) | 20.00% (1) | 33.33% (1) | | | |
| | | Neutral | 0.00% (0) | 0.00% (0) | 33.33% (1) | | | |
| | | Helpful | 33.33% (1) | 20.00% (1) | 33.33% (1) | | | |
| | | Very Helpful | 66.67% (2) | 20.00% (1) | 0.00% (0) | | | |
| Q11aba | Uses De-Icing Strategies in Maintenance Decisions | Yes | 100.00% (7) | 80.00% (4) | 60.00% (3) | N/A [4] | N/A [4] | 0.4357 |
| | | No | 0.00% (0) | 20.00% (1) | 40.00% (2) | | | |
| Q11abb | How Helpful is Weather Information [1] in Employing De-Icing Strategies | Not Very Helpful | 0.00% (0) | 50.00% (2) | 0.00% (0) | N/A [4] | N/A [4] | 0.3206 |
| | | Not Helpful | 0.00% (0) | 25.00% (1) | 33.33% (1) | | | |
| | | Neutral | 0.00% (0) | 0.00% (0) | 33.33% (1) | | | |
| | | Helpful | 14.29% (1) | 0.00% (0) | 0.00% (0) | | | |
| | | Very Helpful | 85.71% (6) | 25.00% (1) | 33.33% (1) | | | |
| Q11aca | Uses Traction Enhancement Strategies in Maintenance Decisions | Yes | 85.71% (6) | 80.00% (4) | 40.00% (2) | 0.7869 | 0.0888 | 0.0613 |
| | | No | 14.29% (1) | 20.00% (1) | 60.00% (3) | | | |

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2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q11acb | How Helpful is Weather Information [1] in Employing Traction Enhancement Strategies | Not Very Helpful | 0.00% (0) | 50.00% (2) | 0.00% (0) | N/A [4] | N/A [4] | N/A [4] |
| | | Not Helpful | 0.00% (0) | 0.00% (0) | 50.00% (1) | | | |
| | | Neutral | 0.00% (0) | 50.00% (2) | 50.00% (1) | | | |
| | | Helpful | 33.33% (2) | 0.00% (0) | 0.00% (0) | | | |
| | | Very Helpful | 66.67% (4) | 0.00% (0) | 0.00% (0) | | | |
| Q11ada | Uses Mechanical Removal Strategies in Maintenance Decisions | Yes | 100.00% (7) | 100.00% (5) | 60.00% (3) | N/A [4] | N/A [4] | N/A [4] |
| | | No | 0.00% (0) | 0.00% (0) | 40.00% (2) | | | |
| Q11adb | How Helpful is Weather Information [1] in Employing Mechanical Removal Strategies | Not Very Helpful | 0.00% (0) | 40.00% (2) | 0.00% (0) | N/A [4] | N/A [4] | N/A [4] |
| | | Not Helpful | 0.00% (0) | 20.00% (1) | 66.67% (2) | | | |
| | | Neutral | 0.00% (0) | 20.00% (1) | 33.33% (1) | | | |
| | | Helpful | 28.57% (2) | 20.00% (1) | 0.00% (0) | | | |
| | | Very Helpful | 71.43% (5) | 0.00% (0) | 0.00% (0) | | | |
| Q12aaa | Uses Wind Speed/Direction Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 14.29% (1) | 25.00% (1) | 0.00% (0) | 0.5636 | 0.7830 | 0.7830 |
| | | Neutral | 28.57% (2) | 0.00% (0) | 33.33% (1) | | | |
| | | Agree | 14.29% (1) | 50.00% (2) | 66.67% (2) | | | |
| | | Strongly Agree | 42.86% (3) | 25.00% (1) | 0.00% (0) | | | |
| Q12aab | Uses Precipitation Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 0.00% (0) | 25.00% (1) | 0.00% (0) | 0.6460 | 0.1160 | 0.2571 |
| | | Disagree | 0.00% (0) | 0.00% (0) | 33.33% (1) | | | |
| | | Neutral | 14.29% (1) | 0.00% (0) | 33.33% (1) | | | |
| | | Agree | 28.57% (2) | 25.00% (1) | 33.33% (1) | | | |
| | | Strongly Agree | 57.14% (4) | 50.00% (2) | 0.00% (0) | | | |

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5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q12aac | Uses Atmospheric Temperature Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 14.29% (1) | 25.00% (1) | 0.00% (0) | 0.2734 | 0.1418 | 0.5714 |
| | | Neutral | 57.14% (4) | 25.00% (1) | 33.33% (1) | | | |
| | | Agree | 14.29% (1) | 25.00% (1) | 66.67% (2) | | | |
| | | Strongly Agree | 14.29% (1) | 25.00% (1) | 0.00% (0) | | | |
| Q12baa | Uses Pavement Temperature Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 14.29% (1) | 33.33% (1) | 0.00% (0) | 0.4720 | 0.3140 | 0.7110 |
| | | Neutral | 0.00% (0) | 0.00% (0) | 50.00% (1) | | | |
| | | Agree | 14.29% (1) | 66.67% (2) | 50.00% (1) | | | |
| | | Strongly Agree | 71.43% (5) | 0.00% (0) | 0.00% (0) | | | |
| Q12bab | Uses Pavement Condition Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 14.29% (1) | 33.33% (1) | 0.00% (0) | 0.2551 | 0.5771 | 0.3270 |
| | | Disagree | 14.29% (1) | 0.00% (0) | 50.00% (1) | | | |
| | | Neutral | 0.00% (0) | 33.33% (1) | 0.00% (0) | | | |
| | | Agree | 28.57% (2) | 33.33% (1) | 50.00% (1) | | | |
| | | Strongly Agree | 42.86% (3) | 0.00% (0) | 0.00% (0) | | | |
| Q12bac | Uses Dewpoint Information [1] to Decide WHAT Road Surface Treatments to Use | Strongly Disagree | 16.67% (1) | 33.33% (1) | 0.00% (0) | 0.6611 | N/A [4] | N/A [4] |
| | | Neutral | 33.33% (2) | 0.00% (0) | 0.00% (0) | | | |
| | | Agree | 33.33% (2) | 66.67% (2) | 100.00% (1) | | | |
| | | Strongly Agree | 16.67% (1) | 0.00% (0) | 0.00% (0) | | | |
| Q12aba | Uses Wind Speed/Direction Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 0.00% (0) | 33.33% (1) | 0.00% (0) | 0.7942 | 0.7074 | 1.0000 |
| | | Neutral | 57.14% (4) | 33.33% (1) | 66.67% (2) | | | |
| | | Agree | 14.29% (1) | 33.33% (1) | 33.33% (1) | | | |
| | | Strongly Agree | 28.57% (2) | 0.00% (0) | 0.00% (0) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q12abb | Uses Precipitation Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 0.00% (0) | 33.33% (1) | 0.00% (0) | 0.2989 | N/A [4] | N/A [4] |
| | | Disagree | 0.00% (0) | 33.33% (1) | 33.33% (1) | | | |
| | | Neutral | 28.57% (2) | 0.00% (0) | 66.67% (2) | | | |
| | | Agree | 0.00% (0) | 33.33% (1) | 0.00% (0) | | | |
| | | Strongly Agree | 71.43% (5) | 0.00% (0) | 0.00% (0) | | | |
| Q12abc | Uses Atmospheric Temperature Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Disagree | 14.29% (1) | 0.00% (0) | 0.00% (0) | N/A [4] | 0.8579 | N/A [4] |
| | | Neutral | 42.86% (3) | 0.00% (0) | 50.00% (1) | | | |
| | | Agree | 14.29% (1) | 0.00% (0) | 50.00% (1) | | | |
| | | Strongly Agree | 28.57% (2) | 100.00% (1) | 0.00% (0) | | | |
| Q12bba | Uses Pavement Temperature Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 14.29% (1) | 50.00% (1) | 0.00% (0) | N/A [4] | 0.3140 | N/A [4] |
| | | Neutral | 0.00% (0) | 50.00% (1) | 50.00% (1) | | | |
| | | Agree | 42.86% (3) | 0.00% (0) | 50.00% (1) | | | |
| | | Strongly Agree | 42.86% (3) | 0.00% (0) | 0.00% (0) | | | |
| Q12bbb | Uses Pavement Condition Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 0.00% (0) | 50.00% (1) | 0.00% (0) | N/A [4] | N/A [4] | N/A [4] |
| | | Disagree | 0.00% (0) | 0.00% (0) | 50.00% (1) | | | |
| | | Neutral | 14.29% (1) | 50.00% (1) | 50.00% (1) | | | |
| | | Agree | 28.57% (2) | 0.00% (0) | 0.00% (0) | | | |
| | | Strongly Agree | 57.14% (4) | 0.00% (0) | 0.00% (0) | | | |
| Q12bbc | Uses Dewpoint Information [1] to Decide WHERE Road Surface Treatments Should be Applied | Strongly Disagree | 0.00% (0) | 50.00% (1) | 0.00% (0) | N/A [4] | N/A [4] | N/A [4] |
| | | Neutral | 66.67% (4) | 50.00% (1) | 100.00% (1) | | | |
| | | Strongly Agree | 33.33% (2) | 0.00% (0) | 0.00% (0) | | | |

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2. The question was not asked in the Baseline Survey.
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5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q12aca | Uses Wind Speed/Direction Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Disagree | 0.00% (0) | 25.00% (1) | 0.00% (0) | 0.8237 | 0.3803 | 0.6240 |
| | | Neutral | 42.86% (3) | 25.00% (1) | 66.67% (2) | | | |
| | | Agree | 0.00% (0) | 25.00% (1) | 0.00% (0) | | | |
| | | Strongly Agree | 57.14% (4) | 25.00% (1) | 33.33% (1) | | | |
| Q12acb | Uses Precipitation Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Disagree | 0.00% (0) | 0.00% (0) | 33.33% (1) | 0.4216 | N/A [4] | N/A [4] |
| | | Neutral | 28.57% (2) | 50.00% (2) | 66.67% (2) | | | |
| | | Agree | 0.00% (0) | 25.00% (1) | 0.00% (0) | | | |
| | | Strongly Agree | 71.43% (5) | 25.00% (1) | 0.00% (0) | | | |
| Q12acc | Uses Atmospheric Temperature Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 14.29% (1) | 0.00% (0) | 0.00% (0) | 0.4099 | N/A [4] | N/A [4] |
| | | Neutral | 42.86% (3) | 33.33% (1) | 100.00% (3) | | | |
| | | Agree | 28.57% (2) | 33.33% (1) | 0.00% (0) | | | |
| | | Strongly Agree | 14.29% (1) | 33.33% (1) | 0.00% (0) | | | |
| Q12bca | Uses Pavement Temperature Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 14.29% (1) | 33.33% (1) | 0.00% (0) | 0.4720 | N/A [4] | N/A [4] |
| | | Neutral | 0.00% (0) | 0.00% (0) | 100.00% (2) | | | |
| | | Agree | 0.00% (0) | 33.33% (1) | 0.00% (0) | | | |
| | | Strongly Agree | 85.71% (6) | 33.33% (1) | 0.00% (0) | | | |
| Q12bcb | Uses Pavement Condition Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 14.29% (1) | 33.33% (1) | 0.00% (0) | 0.4720 | N/A [4] | N/A [4] |
| | | Disagree | 0.00% (0) | 0.00% (0) | 50.00% (1) | | | |
| | | Neutral | 0.00% (0) | 0.00% (0) | 50.00% (1) | | | |
| | | Agree | 28.57% (2) | 33.33% (1) | 0.00% (0) | | | |
| | | Strongly Agree | 57.14% (4) | 33.33% (1) | 0.00% (0) | | | |
| Q12bcc | Uses Dewpoint Information [1] to Decide WHEN Road Surface Treatments Should be Applied | Strongly Disagree | 16.67% (1) | 33.33% (1) | 0.00% (0) | 1.0000 | N/A [4] | N/A [4] |
| | | Neutral | 16.67% (1) | 0.00% (0) | 100.00% (1) | | | |
| | | Agree | 16.67% (1) | 33.33% (1) | 0.00% (0) | | | |
| | | Strongly Agree | 50.00% (3) | 33.33% (1) | 0.00% (0) | | | |

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4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q13aaa | Wind Speed/Direction Information [1] is Understandable | Disagree | 14.29% (1) | 0.00% (0) | 0.00% (0) | 0.6744 | N/A [4] | N/A [4] |
| | | Neutral | 0.00% (0) | 25.00% (1) | 0.00% (0) | | | |
| | | Agree | 42.86% (3) | 25.00% (1) | 50.00% (1) | | | |
| | | Strongly Agree | 42.86% (3) | 50.00% (2) | 50.00% (1) | | | |
| Q13aab | Precipitation Information [1] is Understandable | Strongly Disagree | 0.00% (0) | 0.00% (0) | 50.00% (1) | 0.9127 | 0.4216 | 0.6538 |
| | | Disagree | 14.29% (1) | 0.00% (0) | 0.00% (0) | | | |
| | | Neutral | 14.29% (1) | 25.00% (1) | 0.00% (0) | | | |
| | | Agree | 0.00% (0) | 0.00% (0) | 50.00% (1) | | | |
| | | Strongly Agree | 71.43% (5) | 75.00% (3) | 0.00% (0) | | | |
| Q13aac | Atmospheric Temperature Information [1] is Understandable | Strongly Disagree | 0.00% (0) | 25.00% (1) | 0.00% (0) | 0.0555 | N/A [4] | N/A [4] |
| | | Disagree | 14.29% (1) | 0.00% (0) | 0.00% (0) | | | |
| | | Neutral | 0.00% (0) | 50.00% (2) | 0.00% (0) | | | |
| | | Agree | 28.57% (2) | 0.00% (0) | 100.00% (2) | | | |
| | | Strongly Agree | 57.14% (4) | 25.00% (1) | 0.00% (0) | | | |
| Q13baa | Pavement Temperature Information [1] is Understandable | Strongly Disagree | 14.29% (1) | 33.33% (1) | 0.00% (0) | 0.1160 | 0.1160 | 1.000 |
| | | Disagree | 0.00% (0) | 0.00% (0) | 66.67% (2) | | | |
| | | Neutral | 0.00% (0) | 33.33% (1) | 0.00% (0) | | | |
| | | Agree | 14.29% (1) | 0.00% (0) | 33.33% (1) | | | |
| | | Strongly Agree | 71.43% (5) | 33.33% (1) | 0.00% (0) | | | |
| Q13bab | Pavement Condition Information [1] is Understandable | Strongly Disagree | 0.00% (0) | 33.33% (1) | 66.67% (2) | 0.5712 | 0.3803 | 1.0000 |
| | | Disagree | 14.29% (1) | 33.33% (1) | 0.00% (0) | | | |
| | | Neutral | 28.57% (2) | 0.00% (0) | 0.00% (0) | | | |
| | | Agree | 14.29% (1) | 0.00% (0) | 33.33% (1) | | | |
| | | Strongly Agree | 42.86% (3) | 33.33% (1) | 0.00% (0) | | | |
| Q13bac | Dewpoint Information [1] is Understandable | Strongly Disagree | 16.67% (1) | 0.00% (0) | 0.00% (0) | 0.6611 | 1.0000 | 0.7110 |
| | | Neutral | 33.33% (2) | 66.67% (2) | 50.00% (1) | | | |
| | | Agree | 0.00% (0) | 0.00% (0) | 50.00% (1) | | | |
| | | Strongly Agree | 50.00% (3) | 33.33% (1) | 0.00% (0) | | | |
| Q13aba | Wind Speed/Direction Information [1] is Usable | Disagree | 14.29% (1) | 25.00% (1) | 0.00% (0) | 0.2571 | N/A [4] | N/A [4] |
| | | Neutral | 0.00% (0) | 25.00% (1) | 0.00% (0) | | | |
| | | Agree | 14.29% (1) | 25.00% (1) | 50.00% (1) | | | |
| | | Strongly Agree | 71.43% (5) | 25.00% (1) | 50.00% (1) | | | |

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| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q13abb | Precipitation Information [1] is Usable | Strongly Disagree | 0.00% (0) | 0.00% (0) | 50.00% (1) | 0.1367 | 0.4216 | 0.5474 |
| | | Disagree | 0.00% (0) | 25.00% (1) | 0.00% (0) | | | |
| | | Neutral | 28.57% (2) | 50.00% (2) | 0.00% (0) | | | |
| | | Agree | 0.00% (0) | 0.00% (0) | 50.00% (1) | | | |
| | | Strongly Agree | 71.43% (5) | 25.00% (1) | 0.00% (0) | | | |
| Q13abc | Atmospheric Temperature Information [1] is Usable | Strongly Disagree | 0.00% (0) | 25.00% (1) | 0.00% (0) | 0.1295 | N/A [4] | N/A [4] |
| | | Disagree | 14.29% (1) | 0.00% (0) | 0.00% (0) | | | |
| | | Neutral | 14.29% (1) | 50.00% (2) | 0.00% (0) | | | |
| | | Agree | 28.57% (2) | 25.00% (1) | 100.00% (2) | | | |
| | | Strongly Agree | 42.86% (3) | 0.00% (0) | 0.00% (0) | | | |
| Q13bba | Pavement Temperature Information [1] is Usable | Strongly Disagree | 0.00% (0) | 33.33% (1) | 33.33% (1) | N/A [4] | 0.1160 | N/A [4] |
| | | Disagree | 14.29% (1) | 0.00% (0) | 33.33% (1) | | | |
| | | Neutral | 0.00% (0) | 66.67% (2) | 0.00% (0) | | | |
| | | Agree | 0.00% (0) | 0.00% (0) | 33.33% (1) | | | |
| | | Strongly Agree | 85.71% (6) | 0.00% (0) | 0.00% (0) | | | |
| Q13bbb | Pavement Condition Information [1] is Usable | Strongly Disagree | 0.00% (0) | 33.33% (1) | 66.67% (2) | N/A [4] | 0.3803 | N/A [4] |
| | | Disagree | 28.57% (2) | 0.00% (0) | 0.00% (0) | | | |
| | | Neutral | 14.29% (1) | 66.67% (2) | 0.00% (0) | | | |
| | | Agree | 0.00% (0) | 0.00% (0) | 33.33% (1) | | | |
| | | Strongly Agree | 57.14% (4) | 0.00% (0) | 0.00% (0) | | | |
| Q13bbc | Dewpoint Information [1] is Usable | Strongly Disagree | 0.00% (0) | 33.33% (1) | 0.00% (0) | N/A [4] | 1.0000 | N/A [4] |
| | | Disagree | 16.67% (1) | 0.00% (0) | 0.00% (0) | | | |
| | | Neutral | 33.33% (2) | 66.67% (2) | 50.00% (1) | | | |
| | | Agree | 50.00% (3) | 0.00% (0) | 50.00% (1) | | | |
| Q13aca | Wind Speed/Direction Information [1] is Easily Obtainable | Strongly Disagree | 0.00% (0) | 25.00% (1) | 0.00% (0) | N/A [4] | N/A [4] | N/A [4] |
| | | Disagree | 0.00% (0) | 50.00% (2) | 0.00% (0) | | | |
| | | Neutral | 14.29% (1) | 25.00% (1) | 100.00% (2) | | | |
| | | Agree | 14.29% (1) | 0.00% (0) | 0.00% (0) | | | |
| | | Strongly Agree | 71.43% (5) | 0.00% (0) | 0.00% (0) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q13acb | Precipitation Information [1] is Easily Obtainable | Strongly Disagree | 0.00% (0) | 25.00% (1) | 0.00% (0) | N/A [4] | N/A [4] | N/A [4] |
| | | Disagree | 0.00% (0) | 50.00% (2) | 0.00% (0) | | | |
| | | Neutral | 28.57% (2) | 25.00% (1) | 100.00% (2) | | | |
| | | Agree | 28.57% (2) | 0.00% (0) | 0.00% (0) | | | |
| | | Strongly Agree | 42.86% (3) | 0.00% (0) | 0.00% (0) | | | |
| Q13acc | Atmospheric Temperature Information [1] is Easily Obtainable | Strongly Disagree | 0.00% (0) | 25.00% (1) | 0.00% (0) | N/A [4] | N/A [4] | N/A [4] |
| | | Disagree | 14.29% (1) | 50.00% (2) | 0.00% (0) | | | |
| | | Neutral | 14.29% (1) | 25.00% (1) | 100.00% (2) | | | |
| | | Agree | 28.57% (2) | 0.00% (0) | 0.00% (0) | | | |
| | | Strongly Agree | 42.86% (3) | 0.00% (0) | 0.00% (0) | | | |
| Q13bca | Pavement Temperature Information [1] is Easily Obtainable | Strongly Disagree | 14.29% (1) | 33.33% (1) | 0.00% (0) | N/A [4] | N/A [4] | N/A [4] |
| | | Disagree | 0.00% (0) | 33.33% (1) | 0.00% (0) | | | |
| | | Neutral | 0.00% (0) | 33.33% (1) | 100.00% (3) | | | |
| | | Agree | 28.57% (2) | 0.00% (0) | 0.00% (0) | | | |
| | | Strongly Agree | 57.14% (4) | 0.00% (0) | 0.00% (0) | | | |
| Q13bcb | Pavement Condition Information [1] is Easily Obtainable | Strongly Disagree | 0.00% (0) | 33.33% (1) | 0.00% (0) | N/A [4] | N/A [4] | N/A [4] |
| | | Disagree | 0.00% (0) | 33.33% (1) | 0.00% (0) | | | |
| | | Neutral | 28.57% (2) | 33.33% (1) | 100.00% (3) | | | |
| | | Agree | 28.57% (2) | 0.00% (0) | 0.00% (0) | | | |
| | | Strongly Agree | 42.86% (3) | 0.00% (0) | 0.00% (0) | | | |
| Q13bcc | Dewpoint Information [1] is Easily Obtainable | Strongly Disagree | 0.00% (0) | 33.33% (1) | 0.00% (0) | N/A [4] | N/A [4] | N/A [4] |
| | | Disagree | 0.00% (0) | 33.33% (1) | 0.00% (0) | | | |
| | | Neutral | 33.33% (2) | 33.33% (1) | 100.00% (2) | | | |
| | | Agree | 33.33% (2) | 0.00% (0) | 0.00% (0) | | | |
| | | Strongly Agree | 33.33% (2) | 0.00% (0) | 0.00% (0) | | | |
| Q13ada | Wind Speed/Direction Information [1] is Accurate | Strongly Disagree | 14.29% (1) | 0.00% (0) | 0.00% (0) | 0.5193 | 0.8579 | 0.5474 |
| | | Disagree | 28.57% (2) | 50.00% (2) | 50.00% (1) | | | |
| | | Neutral | 14.29% (1) | 25.00% (1) | 0.00% (0) | | | |
| | | Agree | 28.57% (2) | 25.00% (1) | 50.00% (1) | | | |
| | | Strongly Agree | 14.29% (1) | 0.00% (0) | 0.00% (0) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q13adb | Precipitation Information [1] is Accurate | Strongly Disagree | 14.29% (1) | 50.00% (2) | 0.00% (0) | 0.1367 | N/A [4] | N/A [4] |
| | | Disagree | 0.00% (0) | 0.00% (0) | 50.00% (1) | | | |
| | | Neutral | 14.29% (1) | 25.00% (1) | 50.00% (1) | | | |
| | | Agree | 71.43% (5) | 25.00% (1) | 0.00% (0) | | | |
| Q13adc | Atmospheric Temperature Information [1] is Accurate | Strongly Disagree | 14.29% (1) | 0.00% (0) | 0.00% (0) | N/A [4] | 0.8819 | N/A [4] |
| | | Disagree | 14.29% (1) | 50.00% (2) | 50.00% (1) | | | |
| | | Neutral | 28.57% (2) | 50.00% (2) | 0.00% (0) | | | |
| | | Agree | 28.57% (2) | 0.00% (0) | 50.00% (1) | | | |
| | | Strongly Agree | 14.29% (1) | 0.00% (0) | 0.00% (0) | | | |
| Q13bda | Pavement Temperature Information [1] is Accurate | Strongly Disagree | 0.00% (0) | 33.33% (1) | 33.33% (1) | N/A [4] | N/A [4] | N/A [4] |
| | | Disagree | 14.29% (1) | 33.33% (1) | 66.67% (2) | | | |
| | | Neutral | 0.00% (0) | 33.33% (1) | 0.00% (0) | | | |
| | | Agree | 71.43% (5) | 0.00% (0) | 0.00% (0) | | | |
| | | Strongly Agree | 14.29% (1) | 0.00% (0) | 0.00% (0) | | | |
| Q13bdb | Pavement Condition Information [1] is Accurate | Strongly Disagree | 14.29% (1) | 33.33% (1) | 66.67% (2) | N/A [4] | N/A [4] | N/A [4] |
| | | Disagree | 0.00% (0) | 33.33% (1) | 33.33% (1) | | | |
| | | Neutral | 14.29% (1) | 33.33% (1) | 0.00% (0) | | | |
| | | Agree | 42.86% (3) | 0.00% (0) | 0.00% (0) | | | |
| | | Strongly Agree | 28.57% (2) | 0.00% (0) | 0.00% (0) | | | |
| Q13bdc | Dewpoint Information [1] is Accurate | Strongly Disagree | 0.00% (0) | 33.33% (1) | 0.00% (0) | N/A [4] | 0.7204 | N/A [4] |
| | | Disagree | 16.67% (1) | 33.33% (1) | 50.00% (1) | | | |
| | | Neutral | 50.00% (3) | 33.33% (1) | 0.00% (0) | | | |
| | | Agree | 33.33% (2) | 0.00% (0) | 50.00% (1) | | | |
| Q13aea | Wind Speed/Direction Information [1] is Useful for Weather-Related Decisions | Disagree | 14.29% (1) | 0.00% (0) | 0.00% (0) | 0.0798 | N/A [4] | N/A [4] |
| | | Neutral | 0.00% (0) | 75.00% (3) | 0.00% (0) | | | |
| | | Agree | 28.57% (2) | 25.00% (1) | 100.00% (2) | | | |
| | | Strongly Agree | 57.14% (4) | 0.00% (0) | 0.00% (0) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q13aeb | Precipitation Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 50.00% (2) | 50.00% (1) | 0.0798 | 0.3140 | 0.5474 |
| | | Disagree | 14.29% (1) | 0.00% (0) | 0.00% (0) | | | |
| | | Neutral | 0.00% (0) | 25.00% (1) | 0.00% (0) | | | |
| | | Agree | 14.29% (1) | 0.00% (0) | 50.00% (1) | | | |
| | | Strongly Agree | 71.43% (5) | 25.00% (1) | 0.00% (0) | | | |
| Q13aec | Atmospheric Temperature Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 25.00% (1) | 0.00% (0) | N/A [4] | N/A [4] | N/A [4] |
| | | Disagree | 14.29% (1) | 0.00% (0) | 0.00% (0) | | | |
| | | Neutral | 28.57% (2) | 75.00% (3) | 0.00% (0) | | | |
| | | Agree | 14.29% (1) | 0.00% (0) | 100.00% (2) | | | |
| | | Strongly Agree | 42.86% (3) | 0.00% (0) | 0.00% (0) | | | |
| Q13bea | Pavement Temperature Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 33.33% (1) | 33.33% (1) | N/A [4] | 0.1160 | N/A [4] |
| | | Disagree | 14.29% (1) | 33.33% (1) | 0.00% (0) | | | |
| | | Neutral | 0.00% (0) | 33.33% (1) | 33.33% (1) | | | |
| | | Agree | 0.00% (0) | 0.00% (0) | 33.33% (1) | | | |
| | | Strongly Agree | 85.71% (6) | 0.00% (0) | 0.00% (0) | | | |
| Q13beb | Pavement Condition Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 33.33% (1) | 33.33% (1) | N/A [4] | 0.2551 | N/A [4] |
| | | Disagree | 28.57% (2) | 33.33% (1) | 33.33% (1) | | | |
| | | Neutral | 0.00% (0) | 33.33% (1) | 0.00% (0) | | | |
| | | Agree | 14.29% (1) | 0.00% (0) | 33.33% (1) | | | |
| | | Strongly Agree | 57.14% (4) | 0.00% (0) | 0.00% (0) | | | |
| Q13bec | Dewpoint Information [1] is Useful for Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 33.33% (1) | 0.00% (0) | N/A [4] | 0.6440 | N/A [4] |
| | | Disagree | 16.67% (1) | 33.33% (1) | 0.00% (0) | | | |
| | | Neutral | 16.67% (1) | 33.33% (1) | 50.00% (1) | | | |
| | | Agree | 16.67% (1) | 0.00% (0) | 50.00% (1) | | | |
| | | Strongly Agree | 50.00% (3) | 0.00% (0) | 0.00% (0) | | | |
| Q14afa | FORETELL Wind Speed/Direction Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 25.00% (1) | 0.00% (0) | N/A [2] | N/A [2] | 0.1785 |
| | | Disagree | N/A [2] | 25.00% (1) | 50.00% (1) | | | |
| | | Neutral | N/A [2] | 25.00% (1) | 0.00% (0) | | | |
| | | Agree | N/A [2] | 0.00% (0) | 50.00% (1) | | | |
| | | Strongly Agree | N/A [2] | 25.00% (1) | 0.00% (0) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
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5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q14afb | FORETELL Precipitation Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 25.00% (1) | 0.00% (0) | N/A [2] | N/A [2] | N/A [4] |
| | | Disagree | N/A [2] | 25.00% (1) | 50.00% (1) | | | |
| | | Neutral | N/A [2] | 25.00% (1) | 50.00% (1) | | | |
| | | Agree | N/A [2] | 25.00% (1) | 0.00% (0) | | | |
| Q14afc | FORETELL Atmospheric Temperature Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 25.00% (1) | 0.00% (0) | N/A [2] | N/A [2] | 0.1785 |
| | | Disagree | N/A [2] | 25.00% (1) | 50.00% (1) | | | |
| | | Neutral | N/A [2] | 25.00% (1) | 0.00% (0) | | | |
| | | Agree | N/A [2] | 25.00% (1) | 50.00% (1) | | | |
| Q14bfa | FORETELL Pavement Temperature Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 33.33% (1) | 33.33% (1) | N/A [2] | N/A [2] | N/A [4] |
| | | Disagree | N/A [2] | 0.00% (0) | 66.67% (2) | | | |
| | | Neutral | N/A [2] | 33.33% (1) | 0.00% (0) | | | |
| | | Agree | N/A [2] | 33.33% (1) | 0.00% (0) | | | |
| Q14bfb | FORETELL Pavement Condition Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 33.33% (1) | 66.67% (2) | N/A [2] | N/A [2] | N/A [4] |
| | | Disagree | N/A [2] | 0.00% (0) | 33.33% (1) | | | |
| | | Neutral | N/A [2] | 33.33% (1) | 0.00% (0) | | | |
| | | Agree | N/A [2] | 33.33% (1) | 0.00% (0) | | | |
| Q14bfc | FORETELL Dewpoint Information Changed Weather-Related Decisions You Made | Strongly Disagree | N/A [2] | 33.33% (1) | 50.00% (1) | N/A [2] | N/A [2] | N/A [4] |
| | | Disagree | N/A [2] | 33.33% (1) | 50.00% (1) | | | |
| | | Neutral | N/A [2] | 33.33% (1) | 0.00% (0) | | | |
| Q15 | FORETELL Provides Valuable Information Not Provided Elsewhere | Strongly Disagree | N/A [2] | 0.00% (0) | 40.00% (2) | N/A [2] | N/A [2] | N/A [4] |
| | | Disagree | N/A [2] | 60.00% (3) | 40.00% (2) | | | |
| | | Neutral | N/A [2] | 20.00% (1) | 20.00% (1) | | | |
| | | Agree | N/A [2] | 20.00% (1) | 0.00% (0) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q16 | Receive FORETELL Information in Time to Make Weather-Related Decisions | Strongly Disagree | N/A [2] | 40.00% (2) | 20.00% (1) | N/A [2] | N/A [2] | N/A [4] |
| | | Disagree | N/A [2] | 20.00% (1) | 20.00% (1) | | | |
| | | Neutral | N/A [2] | 40.00% (2) | 40.00% (2) | | | |
| | | Agree | N/A [2] | 0.00% (0) | 20.00% (1) | | | |
| Q17 | Weather Information [1] is Sufficient for Making Weather-Related Decisions | Strongly Disagree | 0.00% (0) | 20.00% (1) | 20.00% (1) | 0.0434 | 0.1874 | 1.0000 |
| | | Disagree | 14.29% (1) | 20.00% (1) | 20.00% (1) | | | |
| | | Neutral | 14.29% (1) | 40.00% (2) | 40.00% (2) | | | |
| | | Agree | 71.43% (5) | 20.00% (1) | 20.00% (1) | | | |
| Q18 | Willing to Pay for FORETELL | Strongly Disagree | N/A [2] | 20.00% (1) | 40.00% (2) | N/A [2] | N/A [2] | N/A [4] |
| | | Disagree | N/A [2] | 40.00% (2) | 20.00% (1) | | | |
| | | Neutral | N/A [2] | 40.00% (2) | 20.00% (1) | | | |
| | | Agree | N/A [2] | 0.00% (0) | 20.00% (1) | | | |
| Q19 | Having Weather Information [1] Makes Job Easier | Strongly Disagree | 0.00% (0) | 20.00% (1) | 40.00% (2) | 0.0308 | 0.0308 | 1.0000 |
| | | Disagree | 14.29% (1) | 0.00% (0) | 20.00% (1) | | | |
| | | Neutral | 0.00% (0) | 60.00% (3) | 20.00% (1) | | | |
| | | Agree | 14.29% (1) | 20.00% (1) | 20.00% (1) | | | |
| | | Strongly Agree | 71.43% (5) | 0.00% (0) | 0.00% (0) | | | |
| Q20 | Weather Information [1] Helps You Improve Traffic Efficiency of Roadways | Strongly Disagree | 0.00% (0) | 20.00% (1) | 40.00% (2) | N/A [4] | 0.0308 | N/A [4] |
| | | Disagree | 0.00% (0) | 20.00% (1) | 0.00% (0) | | | |
| | | Neutral | 14.29% (1) | 60.00% (3) | 40.00% (2) | | | |
| | | Agree | 28.57% (2) | 0.00% (0) | 20.00% (1) | | | |
| | | Strongly Agree | 57.14% (4) | 0.00% (0) | 0.00% (0) | | | |
| Q21 | Weather Information [1] Helps You to Target Snow and Ice Control Measures | Strongly Disagree | 0.00% (0) | 20.00% (1) | 40.00% (2) | 0.1341 | 0.1918 | 0.3638 |
| | | Disagree | 0.00% (0) | 20.00% (1) | 0.00% (0) | | | |
| | | Neutral | 14.29% (1) | 40.00% (2) | 20.00% (1) | | | |
| | | Agree | 28.57% (2) | 20.00% (1) | 40.00% (2) | | | |
| | | Strongly Agree | 57.14% (4) | 0.00% (0) | 0.00% (0) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q22 | Highway Maintenance Activities are Conducted More Efficiently Using Weather Information [1] | Strongly Disagree | 0.00% (0) | 20.00% (1) | 40.00% (2) | 0.0308 | 0.0308 | 1.0000 |
| | | Disagree | 0.00% (0) | 20.00% (1) | 0.00% (0) | | | |
| | | Neutral | 14.29% (1) | 40.00% (2) | 40.00% (2) | | | |
| | | Agree | 28.57% (2) | 20.00% (1) | 20.00% (1) | | | |
| | | Strongly Agree | 57.14% (4) | 0.00% (0) | 0.00% (0) | | | |
| Q23 | FORETELL Information Makes You More Confident in Making Weather-Related Decisions | Strongly Disagree | N/A [2] | 20.00% (1) | 40.00% (2) | N/A [2] | N/A [2] | 1.0000 |
| | | Disagree | N/A [2] | 20.00% (1) | 0.00% (0) | | | |
| | | Neutral | N/A [2] | 40.00% (2) | 40.00% (2) | | | |
| | | Agree | N/A [2] | 20.00% (1) | 20.00% (1) | | | |
| Q24 | FORETELL Information Helps You Deploy Staff More Efficiently | Strongly Disagree | N/A [2] | 20.00% (1) | 40.00% (2) | N/A [2] | N/A [2] | N/A [4] |
| | | Disagree | N/A [2] | 20.00% (1) | 0.00% (0) | | | |
| | | Neutral | N/A [2] | 60.00% (3) | 40.00% (2) | | | |
| | | Agree | N/A [2] | 0.00% (0) | 20.00% (1) | | | |
| Q25 | Roads Return to Targeted Level of Service More Quickly with Weather Information [1] | Strongly Disagree | 0.00% (0) | 20.00% (1) | 40.00% (2) | N/A [4] | 0.1874 | N/A [4] |
| | | Disagree | 0.00% (0) | 20.00% (1) | 0.00% (0) | | | |
| | | Neutral | 28.57% (2) | 60.00% (3) | 40.00% (2) | | | |
| | | Agree | 28.57% (2) | 0.00% (0) | 20.00% (1) | | | |
| | | Strongly Agree | 42.86% (3) | 0.00% (0) | 0.00% (0) | | | |
| Q26 | Safety of the Highway Maintenance Operator is Increased with Weather Information [1] | Strongly Disagree | 0.00% (0) | 20.00% (1) | 40.00% (2) | N/A [4] | 0.0308 | N/A [4] |
| | | Disagree | 0.00% (0) | 20.00% (1) | 0.00% (0) | | | |
| | | Neutral | 14.29% (1) | 60.00% (3) | 40.00% (2) | | | |
| | | Agree | 0.00% (0) | 0.00% (0) | 20.00% (1) | | | |
| | | Strongly Agree | 85.71% (6) | 0.00% (0) | 0.00% (0) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q27 | Weather Information [1] Helps to Lessen the Amount of Chemical Applications | Strongly Disagree | 0.00% (0) | 20.00% (1) | 40.00% (2) | N/A [4] | N/A [4] | N/A [4] |
| | | Disagree | 0.00% (0) | 40.00% (2) | 0.00% (0) | | | |
| | | Neutral | 14.29% (1) | 40.00% (2) | 60.00% (3) | | | |
| | | Agree | 57.14% (4) | 0.00% (0) | 0.00% (0) | | | |
| | | Strongly Agree | 28.57% (2) | 0.00% (0) | 0.00% (0) | | | |
| Q28 | Make Highway Maintenance Decisions More Efficiently because of FORETELL Information | Yes | N/A [2] | 40.00% (2) | 40.00% (2) | N/A [2] | N/A [2] | 1.0000 |
| | | No | N/A [2] | 60.00% (3) | 60.00% (3) | | | |
| Q28a | How Much Sooner Do You Learn about Weather Events when Using FORETELL Information | 0-3 Hours | N/A [2] | 0.00% (0) | 50.00% (1) | N/A [2] | N/A [2] | N/A [5] |
| | | 6-12 Hours | N/A [2] | 0.00% (0) | 50.00% (1) | | | |
| Q29 | Roads are More Quickly Returned to Acceptable Level of Service when Using FORETELL Information | Yes | N/A [2] | 0.00% (0) | 20.00% (1) | N/A [2] | N/A [2] | N/A [4] |
| | | No | N/A [2] | 100.00% (5) | 80.00% (4) | | | |
| Q29a | How Much More Quickly are Roads Returned to Service when Using FORETELL Information | 0-3 Hours | N/A [2] | 0.00% (0) | 100.00% (1) | N/A [2] | N/A [2] | N/A [5] |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

**Table A-6. Frequency and Percentage Distribution for Questions from the Highway Maintenance Operator Baseline and Follow-up Surveys, along with Associated P-Values Computed from the Chi-Square Distribution Testing for Effect between Surveys, Wisconsin Respondents Only (continued)**

| Question | Question Label | Response | Percentage (Number of Non-Missing Responses) | | | Baseline vs. First Follow-Up | Baseline vs. Second Follow-Up | First Follow-Up vs. Second Follow-Up |
|---|---|---|---|---|---|---|---|---|
| | | | Baseline (N=7) | First Follow-Up (N=5) | Second Follow-Up (N=5) | P-value [3] | | |
| Q30 | Would Like to Use FORETELL Information in the Future | Yes | N/A [2] | 60.00% (3) | 60.00% (3) | N/A [2] | N/A [2] | 1.0000 |
| | | No | N/A [2] | 40.00% (2) | 40.00% (2) | | | |

1. "Weather Information" in the Follow-Up Surveys specifically refers to FORETELL.
2. The question was not asked in the Baseline Survey.
3. Questions with more than two response categories were collapsed into positive and non-positive responses for the Chi-Square Test of Effect between surveys. Neutral responses were considered non-positive.
4. Cells with N/A pertain to questions containing zero-frequency response categories. Therefore, the test cannot be performed.
5. The test was not performed for these questions because the responses could not be collapsed into positive and non-positive categories.

# APPENDIX B:
# COMMERCIAL VEHICLE OPERATORS —

# DATA COLLECTION INSTRUMENT
# AND
# SUMMARY TABLE

# INTERVIEW GUIDE

# COMMERCIAL VEHICLE OPERATORS INTERVIEW GUIDE

**Introduction for discussion:**

- We are assisting Battelle Memorial Institute to conduct an FHWA-sponsored independent evaluation of a new road surface/weather information system called FORETELL.
- We are conducting telephone interviews to evaluate who has used the FORETELL web site, how well the system works (accuracy), for what purpose the information is being used (e.g., routing or timing alterations), and whether or not it provides improvements in operations, mobility, and safety. The results of our evaluation will be used to improve the FORETELL system and the information it provides to help you make weather-related decisions.
- You were contacted previously as a potential user and identified as one who is interested in using (or trying) the FORETELL web site and assisting us in this evaluation process
- Have you had an opportunity to familiarize and use the FORETELL system (if not, thank you for your time; this questionnaire was developed for evaluation of those who have experience in some minimal amount of FORETELL products). Are you willing to help us in this evaluation?

Be assured that company and individual information will be kept confidential. The following information will be used for the purpose of this survey only.

- This will take 15-25 minutes. Is this a good time to talk or would you prefer to talk at a different time? Would it be more appropriate to speak to a dispatcher, driver, or other person in your company?
- I appreciate your time. If you would like to interrupt the interview at any time, please let me know.

Name: _____ Title: _____

Organization: _____ Operating Area: _____

Office Location: _____ No. of Drivers: _____

Business Type/Haul: _____ No. of Trucks: _____

Date/Time: _____

**The first set of questions pertain to information available prior to your use of the FORETELL web site.**

1. Before introduced to the FORETELL web site, what information sources did you use for road surface and weather information? I'm going to read a list of different information sources. Please indicate whether the sources were available, how often you used them, and when you used them (e.g., before a trip or en-route).

| Source of Information | Not Avail | Frequency of Use | | | | Type of Use | |
|---|---|---|---|---|---|---|---|
| | | Often | Sometimes | Rarely | Never | Pre-trip | En-route |
| AM/FM Radio | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| CB Radio | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| TV | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Cell Phone | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| DOT Call-in | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Highway Patrol Call-in | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Internet | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Private Forecasting Service | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Word of Mouth | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Other(s) Specify: _____ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

***Note: If no previous sources were used to access road surface and weather information, skip to question 12 of this questionnaire.***

**Please indicate how strongly you disagree or agree with the following statements based on a scale of 1 to 5, 1 being strongly disagree and 5 being strongly agree.**

| | Strongly Disagree → Strongly Agree | | | | |
|---|---|---|---|---|---|
| 2. The information sources used were easy to access. | 1 | 2 | 3 | 4 | 5 |
| 3. Generally speaking, the content (information) from the above sources was easy to understand. | 1 | 2 | 3 | 4 | 5 |
| 4. Of the information sources your organization accessed, the information was very accurate. | 1 | 2 | 3 | 4 | 5 |
| 5. Your organization found the information to be up to date. | 1 | 2 | 3 | 4 | 5 |
| 6. The road surface and weather information was very useful for your organizations operations. | 1 | 2 | 3 | 4 | 5 |

If so, comment how: _____

_____

| | | | | | |
|---|---|---|---|---|---|
| 7. Information accessed was used to alter trip timing during a weather event. | 1 | 2 | 3 | 4 | 5 |
| 8. Obtained information assisted your drivers and dispatchers in route decisions. | 1 | 2 | 3 | 4 | 5 |

How? _____

_____

| | | | | | |
|---|---|---|---|---|---|
| 9. Use of information from these sources made you more confident in your decisions to alter your schedule or route during a weather related event. | 1 | 2 | 3 | 4 | 5 |
| 10. The information from these sources assisted in overall driver safety during weather events. | 1 | 2 | 3 | 4 | 5 |
| 11. During a weather event, road surface and weather information assisted in the efficiency of overall operations. | 1 | 2 | 3 | 4 | 5 |

12. What information do you use in making weather-related management decisions?

*If YES, please go to box A.* →

| Do you use: | YES | NO | Do you use actual readings, forecast information, or both? (Please check the appropriate box[es]) Actual Readings | Forecast Information |
|---|---|---|---|---|
| a. Wind speed or direction? | ❑ | ❑ | ❑ | ❑ |
| b. Precipitation? | ❑ | ❑ | ❑ | ❑ |
| c. Atmospheric temperature? | ❑ | ❑ | ❑ | ❑ |
| d. Pavement temperature? | ❑ | ❑ | ❑ | ❑ |
| e. Pavement conditions? | ❑ | ❑ | ❑ | ❑ |
| f. Dewpoint? | ❑ | ❑ | ❑ | ❑ |
| g. Some other indicator? *Please specify*.. | ❑ | ❑ | ❑ | ❑ |

SPECIFY: _____

**The remaining questions pertain to information obtained through your use of FORETELL.**

13. a) Have you or your organization received any training or training material regarding the FORETELL system?

❑ Yes ❑ No

b) Was it useful? ❑ Yes ❑ No

14. Do you obtain the following information from FORETELL?

| | YES | NO |
|---|---|---|
| a. Wind speed or direction | ❑ | ❑ |
| b. Precipitation | ❑ | ❑ |
| c. Atmosphere temperature | ❑ | ❑ |
| d. Pavement temperature | ❑ | ❑ |
| e. Pavement conditions | ❑ | ❑ |
| f. Dewpoint | ❑ | ❑ |

15. If you don't use the information, why not? _____

_____

_____

16. How often do you obtain information from the FORETELL System…
(please check all that apply)

| | YES | NO | TWICE A DAY | 4 TIMES A DAY | EVERY OTHER HOUR | HOURLY |
|---|---|---|---|---|---|---|
| a. Daily? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| b. Weekly? | ❑ | ❑ | **NOT APPLICABLE** | | | |
| c. In advance of a weather event*? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| d. During a weather event*? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| e. After a weather event*? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |

** A weather event can include high winds, precipitation, extreme atmospheric temperatures, frost, etc.*

**Again, please rate the following statements based on a scale of 1 to 5, 1 being strongly disagree and 5 being strongly agree. [Interviewer: If an answer is Disagree or Strongly Disagree, ask the respondent to please explain.]**

| | | Strongly Disagree → | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 17. | Information received from the FORETELL system is understandable. | 1 | 2 | 3 | 4 | 5 |
| 18. | Information received from the FORETELL system is usable. | 1 | 2 | 3 | 4 | 5 |
| 19. | Information received from the FORETELL system is easily obtainable. | 1 | 2 | 3 | 4 | 5 |
| 20. | The FORETELL web site was easy to navigate. | 1 | 2 | 3 | 4 | 5 |

Comment: _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 21. | Information received from the FORETELL system is accurate. | 1 | 2 | 3 | 4 | 5 |

Explain: _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 22. | Information received from the FORETELL system is useful. | 1 | 2 | 3 | 4 | 5 |

Comment: _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 23. | Information provided by the FORETELL web site was up to date. | 1 | 2 | 3 | 4 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 24. | You received the information from the FORETELL System in time to incorporate it into weather-related management decisions. | 1 | 2 | 3 | 4 | 5 |
| 25. | Use of the FORETELL web site provided information that played a role in altering trip timing. | 1 | 2 | 3 | 4 | 5 |

How? _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 26. | Information accessed on the FORETELL web site played a role in altering trip routes. | 1 | 2 | 3 | 4 | 5 |

How? _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 27. | You are more confident in making weather-related management decisions when you use information from the FORETELL System. | 1 | 2 | 3 | 4 | 5 |

Explain: _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 28. | Having information from the FORETELL System increases safety and/or reduces accidents. | 1 | 2 | 3 | 4 | 5 |

How? _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 29. | Information obtained on the FORETELL web site improved the overall efficiency of your operations. | 1 | 2 | 3 | 4 | 5 |

Explain: _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 30. | Your organization will likely continue to access information on the FORETELL web site. | 1 | 2 | 3 | 4 | 5 |

Do you have other comments (e.g., ways to improve FORETELL)?: _____

_____

_____

_____

Thank you for taking the time to participate in this interview. If you have any questions concerning the evaluation, please call me at 208-345-4630. Do you think it would it be beneficial to speak to a dispatcher, a driver, or another person in your company?

Name: _____ Title: _____ Phone: _____

# SUMMARY TABLE

**Table B.1 Frequency and Percentage Distribution for Questions from the Commercial Vehicle Operators Survey**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=15) |
|---|---|---|---|
| No__Drivers | Number of Drivers | Mean | 91.9 |
| | | Standard Deviation | 225.0 |
| | | 25th Percentile | 20.0 |
| | | Median | 26.0 |
| | | 75th Percentile | 50.0 |
| | | n | 15 |
| No__Trucks | Number of Trucks | Mean | 64.9 |
| | | Standard Deviation | 123.0 |
| | | 25th Percentile | 18.0 |
| | | Median | 26.0 |
| | | 75th Percentile | 50.0 |
| | | n | 15 |
| Q1aa | Use of AM/FM Radio Before FORETELL | Often | 3 ( 20.0%) |
| | | Sometimes | 8 ( 53.3%) |
| | | Rarely | 4 ( 26.7%) |
| Q1ab | Type of Use of AM/FM Radio Before FORETELL | Pre-trip | 3 ( 20.0%) |
| | | En-route | 6 ( 40.0%) |
| | | Both | 6 ( 40.0%) |
| Q1ba | Use of CB Radio before FORETELL | Often | 4 ( 28.6%) |
| | | Sometimes | 6 ( 42.9%) |
| | | Rarely | 1 ( 7.1%) |
| | | Never | 3 ( 21.4%) |
| | | Refused | 1 |
| Q1bb | Type of Use of CB Radio Before FORETELL | En-route | 10 ( 90.9%) |
| | | Both | 1 ( 9.1%) |
| | | Refused | 1 |
| | | No. of Appropriate Skip | 3 |
| Q1ca | Use of TV Before FORETELL | Often | 4 ( 28.6%) |
| | | Sometimes | 3 ( 21.4%) |
| | | Rarely | 1 ( 7.1%) |
| | | Never | 5 ( 35.7%) |
| | | Not Available | 1 ( 7.1%) |
| | | Refused | 1 |

1. Percentages are calculated based on the non-missing responses.

**Table B.1 Frequency and Percentage Distribution for Questions from the Commercial Vehicle Operators Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=15) |
|---|---|---|---|
| Q1cb | Type of Use of TV Before FORETELL | Pre-trip | 4 ( 50.0%) |
| | | Both | 4 ( 50.0%) |
| | | Refused | 1 |
| | | No. of Appropriate Skip | 6 |
| Q1da | Use of Cell Phone Before FORETELL | Often | 8 ( 57.1%) |
| | | Sometimes | 4 ( 28.6%) |
| | | Rarely | 1 ( 7.1%) |
| | | Never | 1 ( 7.1%) |
| | | Refused | 1 |
| Q1db | Type of Use of Cell Phone Before FORETELL | En-route | 5 ( 45.5%) |
| | | Both | 6 ( 54.5%) |
| | | Refused | 3 |
| | | No. of Appropriate Skip | 1 |
| Q1ea | Use of DOT Call Before FORETELL | Sometimes | 1 ( 7.1%) |
| | | Rarely | 7 ( 50.0%) |
| | | Never | 6 ( 42.9%) |
| | | Refused | 1 |
| Q1eb | Type of Use of DOT Call Before FORETELL | Pre-trip | 3 ( 50.0%) |
| | | En-route | 1 ( 16.7%) |
| | | Both | 2 ( 33.3%) |
| | | Refused | 3 |
| | | No. of Appropriate Skip | 6 |
| Q1fa | Use of Highway Patrol Call Before FORETELL | Sometimes | 1 ( 7.1%) |
| | | Rarely | 7 ( 50.0%) |
| | | Never | 6 ( 42.9%) |
| | | Refused | 1 |
| Q1fb | Type of Use of Highway Patrol Call Before FORETELL | Pre-trip | 3 ( 50.0%) |
| | | En-route | 1 ( 16.7%) |
| | | Both | 2 ( 33.3%) |
| | | Refused | 3 |
| | | No. of Appropriate Skip | 6 |
| Q1ga | Use of Internet Before FORETELL | Often | 9 ( 60.0%) |
| | | Sometimes | 3 ( 20.0%) |
| | | Rarely | 3 ( 20.0%) |
| Q1gb | Type of Use of Internet Before FORETELL | Pre-trip | 8 ( 61.5%) |
| | | Both | 5 ( 38.5%) |
| | | Refused | 2 |

1. Percentages are calculated based on the non-missing responses.

**Table B.1 Frequency and Percentage Distribution for Questions from the Commercial Vehicle Operators Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=15) |
|---|---|---|---|
| Q1ha | Use of Private Forecasting Service Before FORETELL | Often | 3 ( 21.4%) |
| | | Sometimes | 1 ( 7.1%) |
| | | Never | 3 ( 21.4%) |
| | | Not Available | 7 ( 50.0%) |
| | | Refused | 1 |
| Q1hb | Type of Use of Private Forecasting Service Before FORETELL | Pre-trip | 2 ( 66.7%) |
| | | Both | 1 ( 33.3%) |
| | | Refused | 2 |
| | | No. of Appropriate Skip | 10 |
| Q1ia | Use of Word of Mouth Before FORETELL | Often | 13 ( 86.7%) |
| | | Sometimes | 2 ( 13.3%) |
| Q1ib | Type of Use of Word of Mouth Before FORETELL | Pre-trip | 1 ( 7.7%) |
| | | En-route | 1 ( 7.7%) |
| | | Both | 11 ( 84.6%) |
| | | Refused | 2 |
| Q1ja | Use of Other Source Before FORETELL | Never | 1 (100.0%) |
| | | Refused | 14 |
| Q1jb | Type of Use of Other Source Before FORETELL | Refused | 14 |
| | | No. of Appropriate Skip | 1 |
| Q2 | Agree/Disagree Information Easy to Access | Neutral | 2 ( 13.3%) |
| | | Agree | 9 ( 60.0%) |
| | | Strongly Agree | 4 ( 26.7%) |
| Q3 | Agree/Disagree Content Easy to Understand | Disagree | 1 ( 6.7%) |
| | | Neutral | 4 ( 26.7%) |
| | | Agree | 7 ( 46.7%) |
| | | Strongly Agree | 3 ( 20.0%) |
| Q4 | Agree/Disagree Information Accurate | Disagree | 1 ( 6.7%) |
| | | Neutral | 7 ( 46.7%) |
| | | Agree | 5 ( 33.3%) |
| | | Strongly Agree | 2 ( 13.3%) |
| Q5 | Agree/Disagree Information Up to Date | Disagree | 1 ( 6.7%) |
| | | Neutral | 6 ( 40.0%) |
| | | Agree | 5 ( 33.3%) |
| | | Strongly Agree | 3 ( 20.0%) |
| Q6 | Agree/Disagree Information Useful in Operations | Strongly Disagree | 3 ( 20.0%) |
| | | Disagree | 2 ( 13.3%) |
| | | Neutral | 4 ( 26.7%) |
| | | Agree | 4 ( 26.7%) |
| | | Strongly Agree | 2 ( 13.3%) |

1. Percentages are calculated based on the non-missing responses.

**Table B.1 Frequency and Percentage Distribution for Questions from the Commercial Vehicle Operators Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=15) |
|---|---|---|---|
| Q7 | Agree/Disagree Information Used to Alter Trip Timing During Weather Event | Strongly Disagree | 1 ( 6.7%) |
| | | Disagree | 5 ( 33.3%) |
| | | Neutral | 5 ( 33.3%) |
| | | Agree | 3 ( 20.0%) |
| | | Strongly Agree | 1 ( 6.7%) |
| Q8 | Agree/Disagree Information Assisted Drivers and Dispatchers in Route Decisions | Strongly Disagree | 1 ( 6.7%) |
| | | Disagree | 6 ( 40.0%) |
| | | Neutral | 5 ( 33.3%) |
| | | Agree | 2 ( 13.3%) |
| | | Strongly Agree | 1 ( 6.7%) |
| Q9 | Agree/Disagree Information Made You More Confident in Decisions to Alter Schedule or Route | Disagree | 4 ( 26.7%) |
| | | Neutral | 2 ( 13.3%) |
| | | Agree | 7 ( 46.7%) |
| | | Strongly Agree | 2 ( 13.3%) |
| Q10 | Agree/Disagree Information Assisted in Overall Driver Safety During Weather Events | Strongly Disagree | 1 ( 6.7%) |
| | | Disagree | 3 ( 20.0%) |
| | | Neutral | 1 ( 6.7%) |
| | | Agree | 8 ( 53.3%) |
| | | Strongly Agree | 2 ( 13.3%) |
| Q11 | Agree/Disagree Information Assisted in Efficiency of Overall Operations | Disagree | 4 ( 26.7%) |
| | | Neutral | 3 ( 20.0%) |
| | | Agree | 8 ( 53.3%) |
| Q12a | Use Wind Speed/Direction Information For Decisions | Yes | 2 ( 13.3%) |
| | | No | 13 ( 86.7%) |
| Q12aa | Which Information Used for Wind Speed/Direction | Forecast Information | 1 ( 50.0%) |
| | | Actual Information | 1 ( 50.0%) |
| | | No. of Appropriate Skip | 13 |
| Q12b | Use Precipitation Information for Decisions | Yes | 15 (100.0%) |
| Q12ba | Which Information Used for Precipitation | Forecast Information | 1 ( 6.7%) |
| | | Actual Information | 4 ( 26.7%) |
| | | Both | 10 ( 66.7%) |
| Q12c | Use Atmospheric Temperature Information for Decisions | Yes | 12 ( 80.0%) |
| | | No | 3 ( 20.0%) |
| Q12ca | Which Information Used for Atmospheric Temperature | Forecast Information | 3 ( 25.0%) |
| | | Actual Information | 2 ( 16.7%) |
| | | Both | 7 ( 58.3%) |
| | | No. of Appropriate Skip | 3 |

1. Percentages are calculated based on the non-missing responses.

**Table B.1 Frequency and Percentage Distribution for Questions from the Commercial Vehicle Operators Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=15) |
|---|---|---|---|
| Q12d | Use Pavement Temperature Information for Decisions | Yes | 3 ( 20.0%) |
| | | No | 12 ( 80.0%) |
| Q12da | Which Information Used for Pavement Temperature | Forecast Information | 2 ( 66.7%) |
| | | Actual Information | 1 ( 33.3%) |
| | | No. of Appropriate Skip | 12 |
| Q12e | Use Pavement Condition Information for Decisions | Yes | 8 ( 53.3%) |
| | | No | 7 ( 46.7%) |
| Q12ea | Which Information Used for Pavement Condition | Forecast Information | 3 ( 37.5%) |
| | | Actual Information | 1 ( 12.5%) |
| | | Both | 4 ( 50.0%) |
| | | No. of Appropriate Skip | 7 |
| Q12f | Use Dewpoint Information for Decisions | No | 14 (100.0%) |
| | | Refused | 1 |
| Q12fa | Which Information Used for Dewpoint | Refused | 15 |
| Q12g | Use Other Information for Decisions | Yes | 1 ( 33.3%) |
| | | No | 2 ( 66.7%) |
| | | Refused | 12 |
| Q12ga | Which Information Used for Other | Both | 1 (100.0%) |
| | | Refused | 12 |
| | | No. of Appropriate Skip | 2 |
| Q13a | Received Training Material for FORETELL | Yes | 11 ( 73.3%) |
| | | No | 4 ( 26.7%) |
| Q13b | Was FORETELL Training Material Helpful | Yes | 7 ( 63.6%) |
| | | No | 4 ( 36.4%) |
| | | No. of Appropriate Skip | 4 |
| Q14a | Obtain Wind Speed/Direction Information from FORETELL | Yes | 8 ( 57.1%) |
| | | No | 6 ( 42.9%) |
| | | Refused | 1 |
| Q14b | Obtain Precipitation Information from FORETELL | Yes | 15 (100.0%) |
| Q14c | Obtain Atmospheric Temperature Information from FORETELL | Yes | 13 ( 86.7%) |
| | | No | 2 ( 13.3%) |
| Q14d | Obtain Pavement Temperature Information from FORETELL | Yes | 8 ( 57.1%) |
| | | No | 6 ( 42.9%) |
| | | Refused | 1 |
| Q14e | Obtain Pavement Condition Information from FORETELL | Yes | 13 ( 86.7%) |
| | | No | 2 ( 13.3%) |
| Q14f | Obtain Dewpoint Information from FORETELL | Yes | 1 ( 6.7%) |
| | | No | 14 ( 93.3%) |

1. Percentages are calculated based on the non-missing responses.

**Table B.1 Frequency and Percentage Distribution for Questions from the Commercial Vehicle Operators Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=15) |
|---|---|---|---|
| Q16aa | Obtain Information from FORETELL - Daily | Yes | 1 ( 33.3%) |
| | | No | 2 ( 66.7%) |
| | | Refused | 12 |
| Q16ab | How Often Daily | Twice a Day | 1 (100.0%) |
| | | Refused | 12 |
| | | No. of Appropriate Skip | 2 |
| Q16b | Obtain Information from FORETELL - Weekly | No | 2 (100.0%) |
| | | Refused | 13 |
| Q16ca | Obtain Information from FORETELL - Before Event | Yes | 5 (100.0%) |
| | | Refused | 10 |
| Q16cb | How Often Before Event | Twice a Day | 4 ( 80.0%) |
| | | 4 Times a Day | 1 ( 20.0%) |
| | | Refused | 10 |
| Q16da | Obtain Information from FORETELL - During Event | Yes | 11 (100.0%) |
| | | Refused | 4 |
| Q16db | How Often During Event | Twice a Day | 9 ( 81.8%) |
| | | 4 Times a Day | 2 ( 18.2%) |
| | | Refused | 4 |
| Q16ea | Obtain Information from FORETELL - After Event | Yes | 5 ( 83.3%) |
| | | No | 1 ( 16.7%) |
| | | Refused | 9 |
| Q16eb | How Often After Event | Twice a Day | 5 (100.0%) |
| | | Refused | 9 |
| | | No. of Appropriate Skip | 1 |
| Q17 | Agree/Disagree Information from FORETELL System Understandable | Disagree | 2 ( 13.3%) |
| | | Neutral | 6 ( 40.0%) |
| | | Agree | 3 ( 20.0%) |
| | | Strongly Agree | 4 ( 26.7%) |
| Q18 | Agree/Disagree Information from FORETELL System is Usable | Disagree | 2 ( 13.3%) |
| | | Neutral | 4 ( 26.7%) |
| | | Agree | 5 ( 33.3%) |
| | | Strongly Agree | 4 ( 26.7%) |
| Q19 | Agree/Disagree Information from FORETELL System is Easily Obtained | Strongly Disagree | 1 ( 6.7%) |
| | | Disagree | 2 ( 13.3%) |
| | | Neutral | 2 ( 13.3%) |
| | | Agree | 7 ( 46.7%) |
| | | Strongly Agree | 3 ( 20.0%) |

1. Percentages are calculated based on the non-missing responses.

**Table B.1 Frequency and Percentage Distribution for Questions from the Commercial Vehicle Operators Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=15) |
|---|---|---|---|
| Q20 | Agree/Disagree FORETELL Web Site Easy to Navigate | Strongly Disagree | 1 ( 6.7%) |
| | | Neutral | 4 ( 26.7%) |
| | | Agree | 6 ( 40.0%) |
| | | Strongly Agree | 4 ( 26.7%) |
| Q21 | Agree/Disagree Information from FORETELL System is Accurate | Disagree | 3 ( 20.0%) |
| | | Neutral | 7 ( 46.7%) |
| | | Agree | 4 ( 26.7%) |
| | | Strongly Agree | 1 ( 6.7%) |
| Q22 | Agree/Disagree Information from FORETELL System is Useful | Disagree | 3 ( 20.0%) |
| | | Neutral | 2 ( 13.3%) |
| | | Agree | 7 ( 46.7%) |
| | | Strongly Agree | 3 ( 20.0%) |
| Q23 | Agree/Disagree Information from FORETELL Web Site is Up to Date | Strongly Disagree | 1 ( 6.7%) |
| | | Disagree | 2 ( 13.3%) |
| | | Neutral | 6 ( 40.0%) |
| | | Agree | 5 ( 33.3%) |
| | | Strongly Agree | 1 ( 6.7%) |
| Q24 | Agree/Disagree Received Information from FORETELL System in Time to Incorporate into Decisions | Strongly Disagree | 2 ( 13.3%) |
| | | Neutral | 5 ( 33.3%) |
| | | Agree | 7 ( 46.7%) |
| | | Strongly Agree | 1 ( 6.7%) |
| Q25 | Agree/Disagree FORETELL Information Played Role in Altering Trip Timing | Strongly Disagree | 3 ( 20.0%) |
| | | Disagree | 5 ( 33.3%) |
| | | Neutral | 4 ( 26.7%) |
| | | Agree | 3 ( 20.0%) |
| Q26 | Agree/Disagree FORETELL Information Played Role in Altering Trip Routes | Strongly Disagree | 3 ( 20.0%) |
| | | Disagree | 6 ( 40.0%) |
| | | Neutral | 3 ( 20.0%) |
| | | Agree | 3 ( 20.0%) |
| Q27 | Agree/Disagree More Confident with Decisions When Using FORETELL Information | Strongly Disagree | 2 ( 13.3%) |
| | | Disagree | 2 ( 13.3%) |
| | | Neutral | 1 ( 6.7%) |
| | | Agree | 7 ( 46.7%) |
| | | Strongly Agree | 3 ( 20.0%) |
| Q28 | Agree/Disagree FORETELL Information Increases Safety and/or Reduces Accidents | Strongly Disagree | 2 ( 13.3%) |
| | | Disagree | 2 ( 13.3%) |
| | | Neutral | 6 ( 40.0%) |
| | | Agree | 3 ( 20.0%) |
| | | Strongly Agree | 2 ( 13.3%) |

1. Percentages are calculated based on the non-missing responses.

**Table B.1 Frequency and Percentage Distribution for Questions from the Commercial Vehicle Operators Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=15) |
|---|---|---|---|
| Q29 | Agree/Disagree FORETELL Information Increased Overall Efficiency of Operations | Strongly Disagree | 2 ( 13.3%) |
| | | Disagree | 1 ( 6.7%) |
| | | Neutral | 6 ( 40.0%) |
| | | Agree | 5 ( 33.3%) |
| | | Strongly Agree | 1 ( 6.7%) |
| Q30 | Agree/Disagree Will Continue to Use FORETELL | Strongly Disagree | 1 ( 6.7%) |
| | | Disagree | 2 ( 13.3%) |
| | | Neutral | 4 ( 26.7%) |
| | | Agree | 7 ( 46.7%) |
| | | Strongly Agree | 1 ( 6.7%) |

1. Percentages are calculated based on the non-missing responses.

# APPENDIX C:
# HIGHWAY PATROL PERSONNEL—

# DATA COLLECTION INSTRUMENT
# AND
# SUMMARY TABLE

# INTERVIEW GUIDE

# HIGHWAY PATROL PERSONNEL INTERVIEW GUIDE

## Introduction for discussion:

- We are assisting Battelle Memorial Institute to conduct an FHWA-sponsored independent evaluation of a new road surface/weather information system called FORETELL.
- We are conducting telephone interviews to evaluate who has used the FORETELL web site, how well the system works (accuracy), for what purpose the information is being used (e.g., routing or timing alterations), and whether or not it provides improvements in operations, mobility, and safety. The results of our evaluation will be used to improve the FORETELL system and the information it provides to help you make weather-related decisions.
- You were contacted previously as a potential user and identified as one who is interested in using (or trying) the FORETELL web site and assisting us in this evaluation process
- Have you had an opportunity to familiarize and use the FORETELL system (if not, thank you for your time; this questionnaire was developed for evaluation of those who have experience in some minimal amount of FORETELL products). Are you willing to help us in this evaluation?

Be assured that company and individual information will be kept confidential. The following information will be used for the purpose of this survey only.

- This will take 15-25 minutes. Is this a good time to talk or would you prefer to talk at a different time? Would it be beneficial to speak to operations personnel?
- I appreciate your time. If you would like to interrupt the interview at any time, please let me know.

Name: _____ Title: _____

State Highway Patrol: _____ Patrolling Area: _____

Office Location: _____ Number of Officers: _____

Date/Time: _____

**The first set of Questions pertain to information available prior to your use of the FORETELL web site.**

1. Before introduced to the FORETELL web site, what information sources were used, if any, to get road surface and weather information? I'm going to read a list of different information sources. Please indicate whether the sources are available, how often you used them, and your type of use.

| Source of Information | Not Avail | Frequency of Use | | | | Type of Use | |
|---|---|---|---|---|---|---|---|
| | | Often | Sometimes | Rarely | Never | Operate | Disseminate |
| AM/FM Radio | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| CB Radio | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| TV | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Cell Phone | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| DOT Call-in | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Highway Patrol Call-in | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Internet | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Private Forecasting Service | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Word of Mouth | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Other(s) Specify: _____ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

***Note: If no previous sources were used to access road surface and weather information, skip to question 8 of this questionnaire.***

**Please indicate how strongly you disagree or agree with the following statements based on a scale of 1 to 5, 1 being strongly disagree and 5 being strongly agree.**

| | Strongly Disagree → Strongly Agree | | | | |
|---|---|---|---|---|---|
| 2. The information sources used were easy to access and readily available. | 1 | 2 | 3 | 4 | 5 |
| 3. The content (information) from the above sources was easy to understand. | 1 | 2 | 3 | 4 | 5 |
| 4. Of the information sources your organization accessed, the information was accurate and up to date. | 1 | 2 | 3 | 4 | 5 |
| 5. The road surface and weather information obtained was very useful for making decisions and performing your work. | 1 | 2 | 3 | 4 | 5 |

Comment:_____

_____

| | | | | | |
|---|---|---|---|---|---|
| 6. Information pertained to your coverage area with the necessary detail. | 1 | 2 | 3 | 4 | 5 |
| 7. Obtained information assisted you in making decisions and carrying out specific actions. | 1 | 2 | 3 | 4 | 5 |

How?_____

_____

8. What information do you use in making weather-related management decisions?

*If YES, please go to box A.* →

Do you use actual readings, forecast information, or both? (Please check the appropriate box[es])

Do you use:

| | YES | NO | Actual Readings | Forecast Information |
|---|---|---|---|---|
| a. Wind speed or direction? ..... | ❑ | ❑ | ❑ | ❑ |
| b. Precipitation? ..... | ❑ | ❑ | ❑ | ❑ |
| c. Atmospheric temperature? ..... | ❑ | ❑ | ❑ | ❑ |
| d. Pavement temperature? ..... | ❑ | ❑ | ❑ | ❑ |
| e. Pavement conditions? ..... | ❑ | ❑ | ❑ | ❑ |
| f. Dewpoint? ..... | ❑ | ❑ | ❑ | ❑ |
| g. Some other indicator? *Please specify*... | ❑ | ❑ | ❑ | ❑ |

SPECIFY: _____

**The remaining questions pertain to information obtained through your use of FORETELL.**

9. a) Have you or your organization received any training or training material regarding the FORETELL system?

❒Yes ❒No

b) Was it useful? ❒Yes ❒No

10. Do you obtain the following information from FORETELL?

| | YES | NO |
|---|---|---|
| a. Wind speed or direction ..... | ❑ | ❑ |
| b. Precipitation ..... | ❑ | ❑ |
| c. Atmosphere temperature ..... | ❑ | ❑ |
| d. Pavement temperature ..... | ❑ | ❑ |
| e. Pavement conditions ..... | ❑ | ❑ |
| f. Dewpoint ..... | ❑ | ❑ |

If not, why not? _____

11. How often do you obtain information from the FORETELL System…
(please check all that apply)

| | YES | NO | TWICE A DAY | 4 TIMES A DAY | EVERY OTHER HOUR | HOURLY |
|---|---|---|---|---|---|---|
| a. Daily? ..... | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| b. Weekly? ..... | ❑ | ❑ | **NOT APPLICABLE** | | | |
| c. In advance of a weather event*? .. | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| d. During a weather event*? ..... | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| e. After a weather event*? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |

**A weather event can include high winds, precipitation, extreme atmospheric temperatures, frost, etc.*

**Again, please rate the following statements based on a scale of 1 to 5, 1 being strongly disagree and 5 being strongly agree. [Interviewer: If an answer is Disagree or Strongly Disagree, ask the respondent to please explain.]**

| | | Strongly Disagree → Strongly Agree | | | | |
|---|---|---|---|---|---|---|
| 12. | Information received from the FORETELL system is understandable. | 1 | 2 | 3 | 4 | 5 |
| 13. | Information received from the FORETELL system is usable. | 1 | 2 | 3 | 4 | 5 |
| 14. | Information received from the FORETELL system is easily obtainable. | 1 | 2 | 3 | 4 | 5 |
| 15. | The FORETELL web site was easy to navigate. | 1 | 2 | 3 | 4 | 5 |

Comment: _____

---

| | | | | | | |
|---|---|---|---|---|---|---|
| 16. | Information received from the FORETELL system is accurate. | 1 | 2 | 3 | 4 | 5 |

Explain: _____

---

| | | | | | | |
|---|---|---|---|---|---|---|
| 17. | Information received from the FORETELL system is useful. | 1 | 2 | 3 | 4 | 5 |

Comment: _____

---

| | | | | | | |
|---|---|---|---|---|---|---|
| 18. | Information provided by the FORETELL web site was up to date. | 1 | 2 | 3 | 4 | 5 |
| 19. | You received the information from the FORETELL System in time to incorporate it into weather-related management decisions. | 1 | 2 | 3 | 4 | 5 |
| 20. | The road surface and weather information obtained on the FORETELL web site was very useful for making decisions and performing your work. | 1 | 2 | 3 | 4 | 5 |

How? _____

---

| | | | | | | |
|---|---|---|---|---|---|---|
| 21. | Obtained information assisted you in making decisions and carrying out specific actions (road closures and advisories). | 1 | 2 | 3 | 4 | 5 |

How? _____

---

| | | | | | | |
|---|---|---|---|---|---|---|
| 22. | Road surface and weather information is compiled and disseminated more efficiently for dispatch purposes. | 1 | 2 | 3 | 4 | 5 |

Explain: _____

---

| | | | | | | |
|---|---|---|---|---|---|---|
| 23. | You are more confident in making weather-related management decisions when you use information from the FORETELL System. | 1 | 2 | 3 | 4 | 5 |

Explain: _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 24. | Having information from the FORETELL System increases safety and/or reduces accidents. | 1 | 2 | 3 | 4 | 5 |

How? _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 25. | Information obtained on the FORETELL web site improved the overall efficiency of your operations. | 1 | 2 | 3 | 4 | 5 |

Explain: _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 26. | Your organization will likely continue to access information on the FORETELL web site and rely on it more over time than you do on other alternative sources. | 1 | 2 | 3 | 4 | 5 |

Do you have other comments (e.g., ways to improve FORETELL)?: _____

_____

_____

_____

Thank you for taking the time to participate in this interview. If you have any questions concerning the evaluation, please call me at 208-345-4630. Do you think it would be beneficial to speak to a dispatch or communications officer?

Name: _____ Title: _____ Phone: _____

# SUMMARY TABLE

**Table C.1 Frequency and Percentage Distribution for Questions from the Highway Patrol Survey**.

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=16) |
|---|---|---|---|
| Users | Number of Officers at Location | Mean | 14.3 |
| | | Standard Deviation | 23.0 |
| | | 25th Percentile | 6.5 |
| | | Median | 9.0 |
| | | 75th Percentile | 11.0 |
| | | n | 16 |
| Q1aa | Use of AM/FM Radio Before FORETELL | Often | 1 ( 6.3%) |
| | | Sometimes | 2 ( 12.5%) |
| | | Rarely | 6 ( 37.5%) |
| | | Never | 6 ( 37.5%) |
| | | Not Available | 1 ( 6.3%) |
| Q1ab | Type of Use of AM/FM Radio Before FORETELL | Operate | 6 ( 66.7%) |
| | | Both | 3 ( 33.3%) |
| | | No. of Appropriate Skip | 7 |
| Q1ba | Use of CB Radio before FORETELL | Rarely | 2 ( 12.5%) |
| | | Never | 5 ( 31.3%) |
| | | Not Available | 9 ( 56.3%) |
| Q1bb | Type of Use of CB Radio Before FORETELL | Refused | 2 |
| | | No. of Appropriate Skip | 14 |
| Q1ca | Use of TV Before FORETELL | Often | 6 ( 37.5%) |
| | | Sometimes | 6 ( 37.5%) |
| | | Rarely | 4 ( 25.0%) |
| Q1cb | Type of Use of TV Before FORETELL | Operate | 13 ( 81.3%) |
| | | Both | 3 ( 18.8%) |
| Q1da | Use of Cell Phone Before FORETELL | Often | 5 ( 31.3%) |
| | | Sometimes | 2 ( 12.5%) |
| | | Rarely | 3 ( 18.8%) |
| | | Never | 2 ( 12.5%) |
| | | Not Available | 4 ( 25.0%) |
| Q1db | Type of Use of Cell Phone Before FORETELL | Operate | 5 ( 50.0%) |
| | | Both | 5 ( 50.0%) |
| | | No. of Appropriate Skip | 6 |
| Q1ea | Use of DOT Call-In Before FORETELL | Often | 4 ( 25.0%) |
| | | Sometimes | 4 ( 25.0%) |
| | | Rarely | 5 ( 31.3%) |
| | | Never | 2 ( 12.5%) |
| | | Not Available | 1 ( 6.3%) |
| Q1eb | Type of Use of DOT Call-In Before FORETELL | Operate | 8 ( 61.5%) |
| | | Disseminate | 1 ( 7.7%) |
| | | Both | 4 ( 30.8%) |
| | | No. of Appropriate Skip | 3 |
| Q1fa | Use of Highway Patrol Call-In Before FORETELL | Often | 1 ( 6.3%) |
| | | Sometimes | 3 ( 18.8%) |
| | | Rarely | 1 ( 6.3%) |
| | | Never | 11 ( 68.8%) |

1. Percentages are calculated based on the non-missing responses.

**Table C.1 Frequency and Percentage Distribution for Questions from the Highway Patrol Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=16) |
|---|---|---|---|
| Q1fb | Type of Use of Highway Patrol Call-In Before FORETELL | Operate | 2 ( 40.0%) |
| | | Both | 3 ( 60.0%) |
| | | No. of Appropriate Skip | 11 |
| Q1ga | Use of Internet Before FORETELL | Often | 11 ( 68.8%) |
| | | Sometimes | 2 ( 12.5%) |
| | | Rarely | 1 ( 6.3%) |
| | | Never | 1 ( 6.3%) |
| | | Not Available | 1 ( 6.3%) |
| Q1gb | Type of Use of Internet Before FORETELL | Operate | 4 ( 30.8%) |
| | | Both | 9 ( 69.2%) |
| | | Refused | 1 |
| | | No. of Appropriate Skip | 2 |
| Q1ha | Use of Private Forecasting Service Before FORETELL | Often | 7 ( 43.8%) |
| | | Sometimes | 2 ( 12.5%) |
| | | Rarely | 1 ( 6.3%) |
| | | Never | 1 ( 6.3%) |
| | | Not Available | 5 ( 31.3%) |
| Q1hb | Type of Use of Private Forecasting Service Before FORETELL | Operate | 3 ( 30.0%) |
| | | Both | 7 ( 70.0%) |
| | | No. of Appropriate Skip | 6 |
| Q1ia | Use of Word of Mouth Before FORETELL | Often | 15 (100.0%) |
| | | Refused | 1 |
| Q1ib | Type of Use of Word of Mouth Before FORETELL | Operate | 2 ( 12.5%) |
| | | Both | 14 ( 87.5%) |
| Q1ja | Use of Other Source Before FORETELL | Often | 14 ( 87.5%) |
| | | Sometimes | 2 ( 12.5%) |
| Q1jb | Type of Use of Other Source Before FORETELL | Operate | 2 ( 12.5%) |
| | | Both | 14 ( 87.5%) |
| Q2 | Agree/Disagree Information Easy and Readily Available | Disagree | 1 ( 6.3%) |
| | | Neutral | 1 ( 6.3%) |
| | | Agree | 5 ( 31.3%) |
| | | Strongly Agree | 9 ( 56.3%) |
| Q3 | Agree/Disagree Content Easy to Understand | Disagree | 1 ( 6.3%) |
| | | Agree | 10 ( 62.5%) |
| | | Strongly Agree | 5 ( 31.3%) |
| Q4 | Agree/Disagree Information Accurate and Current | Neutral | 4 ( 25.0%) |
| | | Agree | 5 ( 31.3%) |
| | | Strongly Agree | 7 ( 43.8%) |
| Q5 | Agree/Disagree Information Useful in Decisions | Disagree | 1 ( 6.7%) |
| | | Neutral | 3 ( 20.0%) |
| | | Agree | 3 ( 20.0%) |
| | | Strongly Agree | 8 ( 53.3%) |
| | | Refused | 1 |
| Q6 | Agree/Disagree Information for Area with Detail | Disagree | 2 ( 12.5%) |
| | | Neutral | 4 ( 25.0%) |
| | | Agree | 5 ( 31.3%) |
| | | Strongly Agree | 5 ( 31.3%) |

1. Percentages are calculated based on the non-missing responses.

**Table C.1 Frequency and Percentage Distribution for Questions from the Highway Patrol Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=16) |
|---|---|---|---|
| Q7 | Agree/Disagree Information Assisted in Decisions | Strongly Disagree | 1 ( 6.3%) |
| | | Neutral | 3 ( 18.8%) |
| | | Agree | 7 ( 43.8%) |
| | | Strongly Agree | 5 ( 31.3%) |
| Q8a | Use Wind Speed/Direction Information for Decisions | Yes | 13 ( 81.3%) |
| | | No | 3 ( 18.8%) |
| Q8ab | Which Information used for Wind Speed/Direction | Forecast Information | 7 ( 53.8%) |
| | | Both | 6 ( 46.2%) |
| | | No. of Appropriate Skip | 3 |
| Q8b | Use Precipitation Information for Decisions | Yes | 16 (100.0%) |
| Q8ba | Which Information Used for Precipitation | Forecast Information | 5 ( 31.3%) |
| | | Both | 11 ( 68.8%) |
| Q8c | Use Atmospheric Temperature Information for Decisions | Yes | 16 (100.0%) |
| Q8ca | Which Information Used for Atmospheric Temperature | Forecast Information | 5 ( 33.3%) |
| | | Both | 10 ( 66.7%) |
| | | Refused | 1 |
| Q8d | Use Pavement Temperature Information for Decisions | Yes | 5 ( 31.3%) |
| | | No | 11 ( 68.8%) |
| Q8da | Which Information Used for Pavement Temperature | Forecast Information | 4 ( 80.0%) |
| | | Both | 1 ( 20.0%) |
| | | No. of Appropriate Skip | 11 |
| Q8e | Use Pavement Condition Information for Decisions | Yes | 8 ( 50.0%) |
| | | No | 8 ( 50.0%) |
| Q8ea | Which Information Used for Pavement Condition | Forecast Information | 6 ( 75.0%) |
| | | Both | 2 ( 25.0%) |
| | | No. of Appropriate Skip | 8 |
| Q8f | Use Dewpoint Information for Decisions | Yes | 1 ( 6.3%) |
| | | No | 15 ( 93.8%) |
| Q8fa | Which Information Used for Dewpoint | Forecast Information | 1 (100.0%) |
| | | No. of Appropriate Skip | 15 |
| Q8g | Use Other Information for Decisions | Yes | 1 ( 6.3%) |
| | | No | 15 ( 93.8%) |
| Q8ga | Which Information Used for Other | Both | 1 (100.0%) |
| | | No. of Appropriate Skip | 15 |
| Q9a | Received Training Material for FORETELL | Yes | 13 ( 81.3%) |
| | | No | 3 ( 18.8%) |
| Q9b | Was Training Material Helpful | Yes | 10 ( 83.3%) |
| | | No | 2 ( 16.7%) |
| | | Refused | 1 |
| | | No. of Appropriate Skip | 3 |
| Q10a | Obtain Wind Information from FORETELL | Yes | 12 ( 75.0%) |
| | | No | 4 ( 25.0%) |
| Q10b | Obtain Precipitation Information from FORETELL | Yes | 14 ( 87.5%) |
| | | No | 2 ( 12.5%) |

1. Percentages are calculated based on the non-missing responses.

**Table C.1 Frequency and Percentage Distribution for Questions from the Highway Patrol Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=16) |
|---|---|---|---|
| Q10c | Obtain Atmospheric Temperature Information from FORETELL | Yes | 14 ( 87.5%) |
| | | No | 2 ( 12.5%) |
| Q10d | Obtain Pavement Temperature Information from FORETELL | Yes | 13 ( 81.3%) |
| | | No | 3 ( 18.8%) |
| Q10e | Obtain Pavement Condition Information from FORETELL | Yes | 15 ( 93.8%) |
| | | No | 1 ( 6.3%) |
| Q10f | Obtain Dewpoint Information from FORETELL | Yes | 2 ( 13.3%) |
| | | No | 13 ( 86.7%) |
| | | Refused | 1 |
| Q10h | Why Not Use FORETELL Information | Refused | 16 |
| Q11aa | Obtain Information from FORETELL - Daily | No | 1 (100.0%) |
| | | Refused | 15 |
| Q11ab | How Often Daily | Refused | 15 |
| | | No. of Appropriate Skip | 1 |
| Q11b | Obtain Information from FORETELL - Weekly | Yes | 4 ( 26.7%) |
| | | No | 11 ( 73.3%) |
| | | Refused | 1 |
| Q11ca | Obtain Information from FORETELL - Before Event | Yes | 6 ( 50.0%) |
| | | No | 6 ( 50.0%) |
| | | Refused | 4 |
| Q11cb | How Often Before Event | Twice a Day | 3 ( 75.0%) |
| | | Every Hour | 1 ( 25.0%) |
| | | Refused | 6 |
| | | No. of Appropriate Skip | 6 |
| Q11da | Obtain Information from FORETELL - During Event | Yes | 9 ( 81.8%) |
| | | No | 2 ( 18.2%) |
| | | Refused | 5 |
| Q11db | How Often During Event | Twice a Day | 3 ( 50.0%) |
| | | 4 Times a Day | 1 ( 16.7%) |
| | | Every Other Hour | 1 ( 16.7%) |
| | | Every Hour | 1 ( 16.7%) |
| | | Refused | 8 |
| | | No. of Appropriate Skip | 2 |
| Q11ea | Obtain Information from FORETELL - After Event | Yes | 5 ( 62.5%) |
| | | No | 3 ( 37.5%) |
| | | Refused | 8 |
| Q11eb | How Often After Event | Twice a Day | 2 ( 66.7%) |
| | | Every Hour | 1 ( 33.3%) |
| | | Refused | 10 |
| | | No. of Appropriate Skip | 3 |
| Q12 | Agree/Disagree System Understandable | Neutral | 2 ( 12.5%) |
| | | Agree | 7 ( 43.8%) |
| | | Strongly Agree | 7 ( 43.8%) |
| Q13 | Agree/Disagree Information is Usable | Disagree | 2 ( 12.5%) |
| | | Neutral | 1 ( 6.3%) |
| | | Agree | 6 ( 37.5%) |
| | | Strongly Agree | 7 ( 43.8%) |

1. Percentages are calculated based on the non-missing responses.

**Table C.1 Frequency and Percentage Distribution for Questions from the Highway Patrol Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=16) |
|---|---|---|---|
| Q14 | Agree/Disagree Information is Easily Obtained | Disagree | 1 ( 6.3%) |
| | | Neutral | 2 ( 12.5%) |
| | | Agree | 7 ( 43.8%) |
| | | Strongly Agree | 6 ( 37.5%) |
| Q15 | Agree/Disagree Web Site Easy to Navigate | Disagree | 1 ( 6.7%) |
| | | Neutral | 4 ( 26.7%) |
| | | Agree | 3 ( 20.0%) |
| | | Strongly Agree | 7 ( 46.7%) |
| | | Refused | 1 |
| Q16 | Agree/Disagree Information Accurate and Current | Disagree | 1 ( 6.3%) |
| | | Neutral | 4 ( 25.0%) |
| | | Agree | 8 ( 50.0%) |
| | | Strongly Agree | 3 ( 18.8%) |
| Q17 | Agree/Disagree Information is Useful | Disagree | 1 ( 6.3%) |
| | | Neutral | 3 ( 18.8%) |
| | | Agree | 5 ( 31.3%) |
| | | Strongly Agree | 7 ( 43.8%) |
| Q18 | Agree/Disagree Information is Up to Date | Disagree | 1 ( 6.3%) |
| | | Neutral | 6 ( 37.5%) |
| | | Agree | 5 ( 31.3%) |
| | | Strongly Agree | 4 ( 25.0%) |
| Q19 | Agree/Disagree Information Timely to Use in Decisions | Strongly Disagree | 1 ( 6.3%) |
| | | Disagree | 1 ( 6.3%) |
| | | Neutral | 5 ( 31.3%) |
| | | Agree | 7 ( 43.8%) |
| | | Strongly Agree | 2 ( 12.5%) |
| Q20 | Agree/Disagree Information Useful in Performing Work | Strongly Disagree | 2 ( 12.5%) |
| | | Disagree | 1 ( 6.3%) |
| | | Neutral | 4 ( 25.0%) |
| | | Agree | 6 ( 37.5%) |
| | | Strongly Agree | 3 ( 18.8%) |
| Q21 | Agree/Disagree Information Useful in Performing Action | Strongly Disagree | 3 ( 18.8%) |
| | | Disagree | 1 ( 6.3%) |
| | | Neutral | 3 ( 18.8%) |
| | | Agree | 7 ( 43.8%) |
| | | Strongly Agree | 2 ( 12.5%) |
| Q22 | Agree/Disagree Information Disseminated Efficiently | Strongly Disagree | 5 ( 33.3%) |
| | | Disagree | 2 ( 13.3%) |
| | | Neutral | 1 ( 6.7%) |
| | | Agree | 5 ( 33.3%) |
| | | Strongly Agree | 2 ( 13.3%) |
| | | Refused | 1 |
| Q23 | Agree/Disagree More Confident with FORETELL | Strongly Disagree | 2 ( 12.5%) |
| | | Disagree | 3 ( 18.8%) |
| | | Neutral | 4 ( 25.0%) |
| | | Agree | 4 ( 25.0%) |
| | | Strongly Agree | 3 ( 18.8%) |

1. Percentages are calculated based on the non-missing responses.

**Table C.1 Frequency and Percentage Distribution for Questions from the Highway Patrol Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=16) |
|---|---|---|---|
| Q24 | Agree/Disagree Information Increased Safety | Strongly Disagree | 3 ( 18.8%) |
| | | Disagree | 2 ( 12.5%) |
| | | Neutral | 7 ( 43.8%) |
| | | Agree | 4 ( 25.0%) |
| Q25 | Agree/Disagree Information Increased Efficiency | Strongly Disagree | 3 ( 18.8%) |
| | | Disagree | 2 ( 12.5%) |
| | | Neutral | 4 ( 25.0%) |
| | | Agree | 5 ( 31.3%) |
| | | Strongly Agree | 2 ( 12.5%) |
| Q26 | Agree/Disagree Will Continue to Use FORETELL | Strongly Disagree | 3 ( 18.8%) |
| | | Neutral | 4 ( 25.0%) |
| | | Agree | 5 ( 31.3%) |
| | | Strongly Agree | 4 ( 25.0%) |

1. Percentages are calculated based on the non-missing responses.

# APPENDIX D:
# SCHOOL ADMINISTRATORS —

# DATA COLLECTION INSTRUMENTS
# AND
# SUMMARY TABLE

# ACTIVITY/WEATHER LOG

U.S. Department of Transportation
Federal Highway Administration

# FORETELL Activity/Weather Log for School Administrators

***Please mail or fax to Amy Thomas at Battelle Memorial Institute, 505 King Ave., Columbus, OH 43201, (614)424-4250 (fax).***

**ID Number 01301**

**Event Date** ☐ / ☐ / ☐

Administrator's Name: _____ School District: _____

## Event* Conditions (Please ■ all that apply)

- ☐ Fog
- ☐ Freezing rain
- ☐ Snow
  - ☐ Accumulation ☐ Drifting
- ☐ Black ice
- ☐ Sleet
- ☐ Rain
- ☐ Hail
- ☐ Frost
- ☐ Extreme temperature

## Information Used During Event

| Did you use: (■ all that apply) | Type (■ all that apply) | | Source (■ all that apply) | |
|---|---|---|---|---|
| ☐ Accumulation | ☐ Forecast | ☐ Actual ¶ | ☐ FORETELL | ☐ Other |
| ☐ Road Decision Support | ☐ Forecast | ☐ Actual ¶ | ☐ FORETELL | ☐ Other |
| ☐ Precipitation | ☐ Forecast | ☐ Actual ¶ | ☐ FORETELL | ☐ Other |
| ☐ Atmospheric Temperature | ☐ Forecast | ☐ Actual ¶ | ☐ FORETELL | ☐ Other |
| ☐ Road Snow Depth | ☐ Forecast | ☐ Actual ¶ | ☐ FORETELL | ☐ Other |
| ☐ Road Conditions | ☐ Forecast | ☐ Actual ¶ | ☐ FORETELL | ☐ Other |
| ☐ Radar | ☐ Forecast | ☐ Actual ¶ | ☐ FORETELL | ☐ Other |
| ☐ Visibility | ☐ Forecast | ☐ Actual ¶ | ☐ FORETELL | ☐ Other |
| ☐ Other _____ | ☐ Forecast | ☐ Actual ¶ | ☐ FORETELL | ☐ Other |

## Decisions Made

**(Please ■ all that apply)**

| | How far in advance was decision made? (e.g., night before, 4 hrs, 2 hrs) |
|---|---|
| ☐ Delayed start of school | |
| ☐ Cancelled school for the day | |
| ☐ Released school early | |
| ☐ Cancelled AM Kindergarten | |
| ☐ Cancelled PM Kindergarten | |
| ☐ Rerouted bus(es) | |
| ☐ Other _____ | |
| ☐ None _____ | |

## Event Outcomes

**(Please ■ all that apply)**

| | How Many? |
|---|---|
| ☐ Bus(es) delayed | |
| ☐ Bus accident(s) | |
| ☐ Student(s) injured | |
| ☐ Other _____ | |
| ☐ None | |

* A weather event can include fog, precipitation, extreme atmospheric temperatures, etc. ¶A nowcast provides actual information.

Comments: _____

# QUESTIONNAIRE

# FORETELL™ *School Administration Field Operational Test*

## Final Questionnaire

**This survey is designed to evaluate your use of the FORETELL system during the 2001-2002 winter season. Instructions are provided as needed for each question. Please complete the following questionnaire and return it to Battelle (505 King Avenue, Columbus, OH 43201) in the enclosed postage-paid return envelope by April 30, 2002. If you have any questions, please contact Shawna Collins at (614) 424-7486. Thank you for your participation in the evaluation of the FORETELL system.**

1. Did you use the FORETELL system this past winter?

❑ Yes ❑ No

If you did not use the FORETELL system, please indicate why.

_____

_____

_____

_____

2. Have you attended a FORETELL training class?

❑ Yes ❑ No

3. What information do you use in making weather-related management decisions?

*If YES, please go to box A.* →

| Do you use: | YES | NO | A. Do you use actual readings, forecast information, or both? (Please check the appropriate box[es]) Actual Readings | Forecast Information |
|---|---|---|---|---|
| a. Accumulation | ❑ | ❑ | ❑ | ❑ |
| b. Precipitation | ❑ | ❑ | ❑ | ❑ |
| c. Atmospheric temperature | ❑ | ❑ | ❑ | ❑ |
| d. Radar | ❑ | ❑ | ❑ | ❑ |
| e. Road conditions | ❑ | ❑ | ❑ | ❑ |
| f. Visibility | ❑ | ❑ | ❑ | ❑ |
| g. Other measure (*Please specify below)* | ❑ | ❑ | ❑ | ❑ |

SPECIFY: _____

4A. Please check the box corresponding to the source you rely on most heavily for obtaining each type of information. If you do not use a given type of information to make decisions, please check "Do not use."

**SOURCES OF INFORMATION**

| | Do Not use | Automated weather station (e.g. RWIS, AWOS) | CNN | FORETELL | Intellicast | Local Weather | National Weather Service | Weather Channel | *Other |
|---|---|---|---|---|---|---|---|---|---|
| a. Accumulation? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| b. Precipitation? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| c. Atmospheric temperature? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| d. Radar? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| e. Road conditions? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| f. Visibility? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| g. Other measure? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |

*Please specify:*_____ **Please specify for other:* _____

4B. For the types of information that you do **not** rely on FORETELL to provide, please describe the reason(s) why:

a. Accumulation:_____

b. Precipitation: _____

c. Atmospheric temperature: _____

d. Radar: _____

e. Road conditions: _____

f. Visibility: _____

g. Other, please specify: _____

**IF YOU DID NOT USE FORETELL THIS PAST WINTER, YOU MAY STOP HERE. Thank you for taking the time to complete the survey.**

5. Please indicate how strongly you disagree or agree with the following statements. Circle 'N/A' if you have not used FORETELL.

The information from the FORETELL system was:

| | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|
| a. Understandable | 1 | 2 | 3 | 4 | 5 |
| b. Usable | 1 | 2 | 3 | 4 | 5 |
| c. Accurate | 1 | 2 | 3 | 4 | 5 |
| d. Easily Obtainable | 1 | 2 | 3 | 4 | 5 |
| e. Useful | 1 | 2 | 3 | 4 | 5 |

6. **How often do you obtain information from the FORETELL System?**
(Please check all that apply.)

| | YES | NO | How Often? TWICE A DAY | 4 TIMES A DAY | EVERY OTHER HOUR | EVERY HOUR |
|---|---|---|---|---|---|---|
| a. Daily? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| b. Weekly? | ❑ | ❑ | NOT APPLICABLE | | | |
| c. In advance of a weather event*? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| d. During a weather event*? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| e. After a weather event*? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |

**A weather event can include fog, precipitation, extreme atmospheric temperatures, etc.*

7. For each of the following school management decisions, please indicate whether information from FORETELL helped you to make more effective decisions. Please circle one number for each school management decision or Not Applicable (NA) if you were not faced with a given decision.

| | | NOT HELPFUL → | | | | HELPFUL |
|---|---|---|---|---|---|---|
| a. Delay the start of schools | NA | 1 | 2 | 3 | 4 | 5 |
| b. Close schools early | NA | 1 | 2 | 3 | 4 | 5 |
| c. Close schools for the day | NA | 1 | 2 | 3 | 4 | 5 |
| d. Change bus routing or scheduling | NA | 1 | 2 | 3 | 4 | 5 |
| e. Other *Please specify* | | 1 | 2 | 3 | 4 | 5 |

**For questions 8 through 14, think about your experience before FORETELL was implemented compared to your present experience. Please indicate how strongly you disagree or agree with the following statements by circling the appropriate number.**

| | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|
| 8. You are more confident in making weather-related management decisions when you use information from the FORETELL system. | 1 | 2 | 3 | 4 | 5 |
| 9. The FORETELL system provides timely information for making weather-related management decisions. | 1 | 2 | 3 | 4 | 5 |
| 10. You are able to improve vehicle routing and avoid travel delay when you use information from the FORETELL system. | 1 | 2 | 3 | 4 | 5 |
| 11. Information obtained on the FORETELL web site improves the overall efficiency of your operations. | 1 | 2 | 3 | 4 | 5 |
| 12. Having information from the FORETELL system improves safety/reduces accidents. | 1 | 2 | 3 | 4 | 5 |
| 13. The FORETELL system provides valuable information that is not available from other sources | 1 | 2 | 3 | 4 | 5 |
| 14. You would be willing to pay for the benefit of having information from the FORETELL system, assuming it is reasonably priced. | 1 | 2 | 3 | 4 | 5 |

15. Would you like to use information from the FORETELL system in the future?

❑ Yes ❑ No

16. Do you have suggestions for ways to improve the FORETELL system?

17. Do you have any other comments?

# SUMMARY TABLE

## Table D.1 Frequency and Percentage Distribution for Questions from the School Administrator's Survey

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=5) |
|---|---|---|---|
| Q1a | Use Foretell System This Past Winter | Yes | 2 ( 40.0%) |
| | | No | 3 ( 60.0%) |
| Q2 | Attended a FORETELL Training Class | Yes | 5 (100.0%) |
| Q3Aa | Use Accumulation Information for Decisions | Yes | 4 (100.0%) |
| | | Refused | 1 |
| Q3Ab | Use Actual Readings for Accumulation | Yes | 3 ( 75.0%) |
| | | No | 1 ( 25.0%) |
| | | Refused | 1 |
| Q3Ac | Use Forecast Information for Accumulation | Yes | 4 (100.0%) |
| | | Refused | 1 |
| Q3Ba | Use Precipitation Information for Decisions | Yes | 4 (100.0%) |
| | | Refused | 1 |
| Q3Bb | Use Actual Readings for Precipitation | Yes | 3 ( 75.0%) |
| | | No | 1 ( 25.0%) |
| | | Refused | 1 |
| Q3Bc | Use Forecast Information for Precipitation | Yes | 4 (100.0%) |
| | | Refused | 1 |
| Q3Ca | Use Atmospheric Temperature Information for Decisions | Yes | 4 (100.0%) |
| | | Refused | 1 |
| Q3Cb | Use Actual Readings for Atmospheric Temperature | Yes | 3 ( 75.0%) |
| | | No | 1 ( 25.0%) |
| | | Refused | 1 |
| Q3Cc | Use Forecast Information for Atmospheric Temperature | Yes | 3 ( 75.0%) |
| | | No | 1 ( 25.0%) |
| | | Refused | 1 |
| Q3Da | Use Radar Information for Decisions | Yes | 4 (100.0%) |
| | | Refused | 1 |
| Q3Db | Use Actual Readings for Radar | Yes | 4 (100.0%) |
| | | Refused | 1 |
| Q3Dc | Use Forecast Information for Radar | Yes | 2 ( 50.0%) |
| | | No | 2 ( 50.0%) |
| | | Refused | 1 |
| Q3Ea | Use Road Condition Information for Decisions | Yes | 3 (100.0%) |
| | | Refused | 2 |
| Q3Eb | Use Actual Readings for Road Condition | Yes | 3 (100.0%) |
| | | Refused | 2 |
| Q3Ec | Use Forecast Information for Road Condition | Yes | 2 ( 66.7%) |
| | | No | 1 ( 33.3%) |
| | | Refused | 2 |
| Q3Fa | Use Visibility Information for Decisions | Yes | 3 (100.0%) |
| | | Refused | 2 |
| Q3Fb | Use Actual Readings for Visibility | Yes | 3 (100.0%) |
| | | Refused | 2 |

1. Percentages are calculated based on the non-missing responses.

**Table D.1 Frequency and Percentage Distribution for Questions from the School Administrator's Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=5) |
|---|---|---|---|
| Q3Fc | Use Forecast Information for Visibility | Yes | 2 ( 66.7%) |
| | | No | 1 ( 33.3%) |
| | | Refused | 2 |
| Q3Ga | Use Other Information for Decisions | No | 1 (100.0%) |
| | | Refused | 4 |
| Q3Gb | Use Actual Readings for Other | Refused | 4 |
| | | No. of Appropriate Skip | 1 |
| Q3Gc | Use Forecast Information for Other | Refused | 4 |
| | | No. of Appropriate Skip | 1 |
| Q4Aaa | Do Not Use Accumulation Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Aab | Use Automated Weather Staton Most for Accumulation Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Aac | Use CNN Most for Accumulation Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Aad | Use FORETELL Most for Accumulation Information | Yes | 1 ( 50.0%) |
| | | No | 1 ( 50.0%) |
| | | Refused | 3 |
| Q4Aae | Use Intellicast Most for Accumulation Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Aaf | Use Local Weather Most for Accumulation Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Aag | Use National Weather Service Most for Accumulation Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Aah | Use Weather Channel Most for Accumulation Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Aai | Use Other Most for Precipitation Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Aba | Do Not Use Precipitation Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Abb | Use Automated Weather Station Most for Precipitation Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Abc | Use CNN Most for Precipitation Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Abd | Use FORETELL Most for Precipitation Information | Yes | 1 ( 50.0%) |
| | | No | 1 ( 50.0%) |
| | | Refused | 3 |
| Q4Abe | Use Intellicast Most for Precipitation Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Abf | Use Local Weather Most for Precipitation Information | Yes | 1 ( 50.0%) |
| | | No | 1 ( 50.0%) |
| | | Refused | 3 |
| Q4Abg | Use National Weather Service Most for Precipitation Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Abh | Use Weather Channel Most for Precipitation Information | No | 2 (100.0%) |
| | | Refused | 3 |

1. Percentages are calculated based on the non-missing responses.

**Table D.1 Frequency and Percentage Distribution for Questions from the School Administrator's Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=5) |
|---|---|---|---|
| Q4Abi | Use Other Most for Precipitation Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Aca | Do Not Use Atmospheric Temperature Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Acb | Use Automated Weather Station Most for Atmospheric Temperature Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Acc | Use CNN Most for Atmospheric Temperature Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Acd | Use FORETELL Most for Atmospheric Temperature Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Ace | Use Intellicast Most for Atmospheric Temperature Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Acf | Use Local Weather Most for Atmospheric Temperature Information | Yes | 2 (100.0%) |
| | | Refused | 3 |
| Q4Acg | Use National Weather Service Most for Atmospheric Temperature Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Ach | Use Weather Channel Most for Atmospheric Temperature Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q4Aci | Use Other Most for Atmospheric Temperature Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q4Ada | Do Not Use Radar Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Adb | Use Automated Weather Station Most for Radar Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Adc | Use CNN Most for Radar Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Add | Use FORETELL Most for Radar Information | Yes | 2 (100.0%) |
| | | Refused | 3 |
| Q4Ade | Use Intellicast Most for Radar Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Adf | Use Local Weather Most for Radar Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Adg | Use National Weather Service Most for Radar Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Adh | Use Weather Channel Most for Radar Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Adi | Use Other Most for Radar Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Aea | Do Not Use Road Condition Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q4Aeb | Use Automated Weather Station Most for Road Condition Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q4Aec | Use CNN Most for Road Condition Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q4Aed | Use FORETELL Most for Road Condition Information | Yes | 1 (100.0%) |
| | | Refused | 4 |

1. Percentages are calculated based on the non-missing responses.

**Table D.1 Frequency and Percentage Distribution for Questions from the School Administrator's Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=5) |
|---|---|---|---|
| Q4Aee | Use Intellicast Most for Road Condition Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q4Aef | Use Local Weather Most for Road Condition Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q4Aeg | Use National Weather Service Most for Road Condition Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q4Aeh | Use Weather Channel Most for Road Condition Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q4Aei | Use Other Most for Road Condition Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q4Afa | Do Not Use Visibility Information | Yes | 1 ( 50.0%) |
| | | No | 1 ( 50.0%) |
| | | Refused | 3 |
| Q4Afb | Use Automated Weather Station Most for Visibility Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Afc | Use CNN Most for Visibility Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Afd | Use FORETELL Most for Visibility Information | Yes | 1 ( 50.0%) |
| | | No | 1 ( 50.0%) |
| | | Refused | 3 |
| Q4Afe | Use Intellicast Most for Visibility Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Aff | Use Local Weather Most for Visibility Information | Yes | 1 ( 50.0%) |
| | | No | 1 ( 50.0%) |
| | | Refused | 3 |
| Q4Afg | Use National Weather Service Most for Visibility Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Afh | Use Weather Channel Most for Visibility Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Afi | Use Other Most for Visibility Information | No | 2 (100.0%) |
| | | Refused | 3 |
| Q4Aga | Do Not Use Other Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q4Agb | Use Automated Weather Station Most for Other Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q4Agc | Use CNN Most for Other Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q4Agd | Use FORETELL Most for Other Information | Yes | 1 (100.0%) |
| | | Refused | 4 |
| Q4Age | Use Intellicast Most for Other Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q4Agf | Use Local Weather Most for Other Information | Refused | 5 |
| Q4Agg | Use National Weather Service Most for Other Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q4Agh | Use Weather Channel Most for Other Information | No | 1 (100.0%) |
| | | Refused | 4 |

1. Percentages are calculated based on the non-missing responses.

**Table D.1 Frequency and Percentage Distribution for Questions from the School Administrator's Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=5) |
|---|---|---|---|
| Q4Agi | Use Other Most for Other Information | No | 1 (100.0%) |
| | | Refused | 4 |
| Q5A | Agree/Disagree FORETELL Information Understandable | Strongly Agree | 1 (100.0%) |
| | | Refused | 1 |
| | | No. of Appropriate Skip | 3 |
| Q5B | Agree/Disagree FORETELL Information Usable | Strongly Agree | 2 (100.0%) |
| | | No. of Appropriate Skip | 3 |
| Q5C | Agree/Disagree FORETELL Information Accurate | Agree | 1 ( 50.0%) |
| | | Strongly Agree | 1 ( 50.0%) |
| | | No. of Appropriate Skip | 3 |
| Q5D | Agree/Disagree FORETELL Information Easily Obtainable | Agree | 1 ( 50.0%) |
| | | Strongly Agree | 1 ( 50.0%) |
| | | No. of Appropriate Skip | 3 |
| Q5E | Agree/Disagree FORETELL Information Useful | Strongly Agree | 2 (100.0%) |
| | | No. of Appropriate Skip | 3 |
| Q6Aa | Obtain Information from FORETELL - Daily | No | 1 (100.0%) |
| | | Refused | 1 |
| | | No. of Appropriate Skip | 3 |
| Q6Ab | How Often Daily | No. of Appropriate Skip | 5 |
| Q6B | Obtain Information From FORETELL - Weekly | Yes | 2 (100.0%) |
| | | Refused | 3 |
| Q6Ca | Obtain Information From FORETELL - Before Event | Yes | 2 (100.0%) |
| | | No. of Appropriate Skip | 3 |
| Q6Cb | How Often Before Event | 4 Times a Day | 1 ( 50.0%) |
| | | Every Hour | 1 ( 50.0%) |
| | | No. of Appropriate Skip | 3 |
| Q6Da | Obtain Information From FORETELL - During Event | Yes | 2 (100.0%) |
| | | No. of Appropriate Skip | 3 |
| Q6Db | How Often During Event | Every Other Hour | 1 ( 50.0%) |
| | | Every Hour | 1 ( 50.0%) |
| | | No. of Appropriate Skip | 3 |
| Q6Ea | Obtain Information From FORETELL - After Event | Yes | 1 ( 50.0%) |
| | | No | 1 ( 50.0%) |
| | | No. of Appropriate Skip | 3 |
| Q6Eb | How Often After Event | Refused | 1 |
| | | No. of Appropriate Skip | 4 |
| Q7A | FORETELL Information Helpful for Delay the Start of Schools Decisions | Neutral | 1 ( 50.0%) |
| | | Somewhat Helpful | 1 ( 50.0%) |
| | | No. of Appropriate Skip | 3 |
| Q7B | FORETELL Information Helpful for Close Schools Early Decisions | Somewhat Helpful | 1 ( 50.0%) |
| | | Helpful | 1 ( 50.0%) |
| | | No. of Appropriate Skip | 3 |
| Q7C | FORETELL Information Helpful for Close Schools for Day Decisions | Somewhat Helpful | 1 ( 50.0%) |
| | | Helpful | 1 ( 50.0%) |
| | | No. of Appropriate Skip | 3 |

1. Percentages are calculated based on the non-missing responses.

**Table D.1 Frequency and Percentage Distribution for Questions from the School Administrator's Survey (continued)**

| SAS Variable Name | Label | Response Category | Number (%) [1] (N=5) |
|---|---|---|---|
| Q7D | FORETELL Information Helpful for Change Bus Routing/Scheduling Decisions | Somewhat Helpful | 1 ( 50.0%) |
| | | Helpful | 1 ( 50.0%) |
| | | No. of Appropriate Skip | 3 |
| Q7E | FORETELL Information Helpful for Other Decisions | Refused | 2 |
| | | No. of Appropriate Skip | 3 |
| Q8 | Agree/Disagree More Confident with Decisions Using FORETELL Information | Agree | 1 ( 50.0%) |
| | | Strongly Agree | 1 ( 50.0%) |
| | | No. of Appropriate Skip | 3 |
| Q9 | Agree/Disagree FORETELL Provides Timely Information for Decisions | Agree | 1 ( 50.0%) |
| | | Strongly Agree | 1 ( 50.0%) |
| | | No. of Appropriate Skip | 3 |
| Q10 | Agree/Disagree Improves Vehicle Routing and Travel Delay with FORETELL Information | Neutral | 1 ( 50.0%) |
| | | Strongly Agree | 1 ( 50.0%) |
| | | No. of Appropriate Skip | 3 |
| Q11 | Agree/Disagree FORETELL Information Improves Overall Efficiency of Operations | Agree | 2 (100.0%) |
| | | No. of Appropriate Skip | 3 |
| Q12 | Agree/Disagree FORETELL System Improves Safety/Reduces Accidents | Agree | 2 (100.0%) |
| | | No. of Appropriate Skip | 3 |
| Q13 | Agree/Disagree FORETELL Provides Exclusive Information | Neutral | 1 ( 50.0%) |
| | | Strongly Agree | 1 ( 50.0%) |
| | | No. of Appropriate Skip | 3 |
| Q14 | Agree/Disagree Will Pay for FORETELL if Reasonably Priced | Neutral | 1 ( 50.0%) |
| | | Agree | 1 ( 50.0%) |
| | | No. of Appropriate Skip | 3 |
| Q15 | Use FORETELL Information in the Future | Yes | 2 (100.0%) |
| | | No. of Appropriate Skip | 3 |

1. Percentages are calculated based on the non-missing responses.

# APPENDIX E:
# TRANSIT OPERATORS —

# DATA COLLECTION INSTRUMENT

# INTERVIEW GUIDE

## TRANSIT/PARATRANSIT INTERVIEW GUIDE

**Name** _____ **Organization** _____

**Title** _____ **Location** _____

**Location** _____ **Date** _____

Scheduled time of interview _____ am/pm

I'm a member of the Battelle Memorial Institute's team that is under contract to the Federal Highway Administration to evaluate the FORETELL weather information system usage by transit and paratransit agencies. We understand that you have used this system and we would like to have your assistance in providing us information that we can use to try to quantify the benefits of FORETELL. The results of our evaluation will be used to improve the FORETELL system and the information it provides to help you make weather-related decisions.

1. Data from FORETELL indicate you have been using the FORETELL system.
(*Skip to* ✪

**OR**

1. Data from FORETELL indicate your agency has **NOT** been using the system. Why not?

_____

_____

_____

*Thank the interviewee for answering the question and **END** the interview.*

✪ Are you willing to help us in this evaluation? This interview may take as much as 20 minutes. Also, be assured that company and individual information will be kept confidential. The following information will be used for the purpose of this survey only. Is this a good time to talk or would you prefer to talk at a different time?

Now is OK ☐ Would prefer a different time. Date/Time: _____

If you would like to interrupt the interview at any time, please let me know.

2. How many miles of transit service do you provide from this location?

| | | | |
|---|---|---|---|
| Commuter routes | _____ | Urban routes | _____ |
| Daily routes | _____ | Rural routes | _____ |
| Nighttime routes | _____ | Weekend routes | _____ |
| Suburban routes | _____ | Paratransit routes | _____ |

3. How many full time employees do you supervise (FTEs)? ☐

4. What is your work email address? _____

Thank you. Now I'd like to ask the evaluation questions. There are five central objectives for evaluation. They are user acceptance of the concept and the technology, decision effectiveness, improvements in traffic or operational efficiency, safety, and environmental conservation. I will be asking questions related to each of these areas. You may or may not be able to determine how FORETELL has affected you in all of these areas, but we will do our best. I'll begin with User Acceptance.

5. We'd like to find out what information you use in making weather-related management decisions.

*If YES, complete box* →

| Do you use: | YES | NO | Do you use actual readings, forecast information, or both? (Please check the appropriate box[es]) Actual | Forecast |
|---|---|---|---|---|
| a. Wind speed or direction? | ❑ | ❑ | ❑ | ❑ |
| b. Precipitation? | ❑ | ❑ | ❑ | ❑ |
| c. Atmospheric temperature? | ❑ | ❑ | ❑ | ❑ |
| d. Pavement temperature? | ❑ | ❑ | ❑ | ❑ |
| e. Pavement conditions? | ❑ | ❑ | ❑ | ❑ |
| f. Dewpoint? | ❑ | ❑ | ❑ | ❑ |
| g. Some other indicator? | ❑ | ❑ | ❑ | ❑ |
| *Please Specify* _____: | | | | |

6. On a scale of 1 to 5, please indicate how strongly you disagree or agree with the following statements, where 1 means Strongly Disagree and 5 means Strongly Agree.

The information from the FORETELL system was:

| | | | Strongly Disagree | | | | Strongly Agree |
|---|---|---|---|---|---|---|---|
| a. | Understandable | N/A | 1 | 2 | 3 | 4 | 5 |
| b. | Usable | N/A | 1 | 2 | 3 | 4 | 5 |
| c. | Accurate | N/A | 1 | 2 | 3 | 4 | 5 |
| d. | Easily Obtainable | N/A | 1 | 2 | 3 | 4 | 5 |

7. Before introduced to the FORETELL web site, what information sources did you use for road surface and weather information? I'm going to read a list of different information sources. Please indicate whether the sources were available, how often you used them, and when you used them (e.g., before a trip or en-route).

| Source of Information | Not Avail | Frequency of Use | | | | Type of Use | |
|---|---|---|---|---|---|---|---|
| | | Often | Some times | Rarely | Never | Pre-trip | En-route |
| AM/FM Radio | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| CB Radio | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| TV | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Cell Phone | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Satellite Delivery | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| DOT Call-in | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Highway Patrol Call-in | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Internet | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Private Forecasting Service | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Word of Mouth | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Other(s) Specify: _____ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

8. How often do you obtain information from the FORETELL System? (Allow multiple answers.)

*If YES, please go to box A.* →

| | YES | NO | A. How Often? TWICE A DAY | 4 TIMES A DAY | EVERY OTHER HOUR | EVERY HOUR |
|---|---|---|---|---|---|---|
| a. Daily? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| b. Weekly? | ❑ | ❑ | **NOT APPLICABLE** | | | |
| c. In advance of a weather event*? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| d. During a weather event*? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| e. After a weather event*? | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |

**A weather event can include high winds, precipitation, extreme atmospheric temperatures, frost, etc.*

9. Which feature(s) of FORETELL do you like most? (Allow multiple answers.)

- ❑ Animation
- ❑ Long-term forecast
- ❑ Scroll labeling
- ❑ Information Options
- ❑ Zoom capability
- ❑ Map display
- ❑ Current Conditions
- ❑ Other (SPECIFY) _____

10. Which feature(s) of FORETELL do you like least? (Allow multiple answers.)

- ❑ Animation
- ❑ Long-term forecast
- ❑ Scroll labeling
- ❑ Information Options
- ❑ Zoom capability
- ❑ Map display
- ❑ Current Conditions
- ❑ Other (SPECIFY) _____

11. What types of decisions do you make using FORETELL information? (Allow multiple answers.)

| Type of Decision | How often? |
|---|---|
| ❑ Route changes | _____ |
| ❑ Schedule changes | _____ |
| ❑ Chain up fleet | _____ |
| ❑ None | |
| ❑ Other (Specify) | |

12. For each of the following weather-related management decisions, please indicate whether information from FORETELL helped you to make more effective decisions. *Please circle one number for each management decision or Not Applicable (NA) if they were not faced with a given decision.*

| | | NOT HELPFUL → | | | | HELPFUL |
|---|---|---|---|---|---|---|
| a. Route changes ..... | NA | 1 | 2 | 3 | 4 | 5 |
| b. Schedule changes ..... | NA | 1 | 2 | 3 | 4 | 5 |
| c. Chain up the fleet ..... | NA | 1 | 2 | 3 | 4 | 5 |
| d. Other *Please specify*..... | | 1 | 2 | 3 | 4 | 5 |

13. What decisions do you make differently using the FORETELL information?

_____

_____

_____

**For the next four questions, on a scale of 1 to 5, please indicate how strongly you disagree or agree with the following statements, where 1 means Strongly Disagree and 5 means Strongly Agree.**

| | Strongly Disagree → | | | | Strongly Agree |
|---|---|---|---|---|---|
| 14. The FORETELL system provides valuable information that is not available from other sources. | 1 | 2 | 3 | 4 | 5 |
| 15. You received the information from the FORETELL system in time to incorporate it into weather-related management decisions. | 1 | 2 | 3 | 4 | 5 |
| 16. The information provided by the FORETELL system is sufficient for making weather-related management decisions. | 1 | 2 | 3 | 4 | 5 |
| 17. Your agency would be willing to pay for the benefit of having information from the FORETELL system, assuming it is reasonably priced. | 1 | 2 | 3 | 4 | 5 |
| 18. You are more confident in making weather-related management decisions when you use information from the FORETELL system. | 1 | 2 | 3 | 4 | 5 |

| | Strongly Disagree → Strongly Agree | | | | |
|---|---|---|---|---|---|
| 19. You are able to improve vehicle routing and avoid travel delay when you use information from the FORETELL system. | 1 | 2 | 3 | 4 | 5 |
| 20. Having information from the FORETELL system improves safety and/or reduces accidents. | 1 | 2 | 3 | 4 | 5 |

**21. Would you like to use information from the FORETELL system in the future?**

❑ Yes ❑ No

22. Do you have suggestions for ways to improve the FORETELL system?

_____

_____

_____

23. Please provide us with any other comments you have relative to FORETELL.

_____

_____

_____

_____

_____

_____

Thank you for taking the time to participate in this interview. Your information will be held in confidence and only included in data summaries. If you can think of anything else, or if you have any questions concerning the evaluation, please call me at 636/230-5672, or if you have access to e-mail, you can reach me at:

**boselly@weathersolutions.com**

# APPENDIX F:
# TRAFFIC MANAGERS —

# DATA COLLECTION INSTRUMENT
# AND
# SUMMARY

# INTERVIEW GUIDE

# TRAFFIC MANAGERS INTERVIEW GUIDE

**Introduction for discussion:**

- We are assisting Battelle Memorial Institute to conduct an FHWA-sponsored independent evaluation of a new road surface/weather information system called FORETELL.
- We are conducting telephone interviews to evaluate who has used the FORETELL web site, how well the system works (accuracy), for what purpose the information is being used (e.g., routing or timing alterations), and whether or not it provides improvements in operations, mobility, and safety. The results of our evaluation will be used to improve the FORETELL system and the information it provides to help you make weather-related decisions.
- You were contacted previously as a potential user and identified as one who is interested in using (or trying) the FORETELL web site and assisting us in this evaluation process.
- Have you had an opportunity to familiarize and use the FORETELL system (if not, thank you for your time; this questionnaire was developed for evaluation of those who have experience in some minimal amount of FORETELL products). Are you willing to help us in this evaluation?

Be assured that company and individual information will be kept confidential. The following information will be used for the purpose of this survey only.

- This will take 15-25 minutes. Is this a good time to talk or would you prefer to talk at a different time? Would it be more appropriate to speak to a dispatcher, driver, or other person in your company?
- I appreciate your time. If you would like to interrupt the interview at any time, please let me know.

Name: _____ Title: _____

Organization: _____ Operating Area: _____

Office Location: _____ Number of Employees: _____

Date/Time: _____

**The first set of questions pertain to information available prior to your use of the FORETELL web site.**

1. Before introduced to the FORETELL web site, what information sources did you use to obtain road surface and weather information? I'm going to read a list of different information sources. Please indicate whether the sources are available, how often you used them, and when you used them (e.g., before a trip or en-route).

| Source of Information | Not Avail | Frequency of Use | | | | Type of Use | |
|---|---|---|---|---|---|---|---|
| | | Often | Sometimes | Rarely | Never | Operate | Disseminate |
| AM/FM Radio | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| CB Radio | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| TV | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Cell Phone | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| DOT Call-in | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Highway Patrol Call-in | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Internet | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Private Forecasting Service | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Word of Mouth | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Other(s) Specify: _____ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

***Note: If no previous sources were used to access road surface and weather information, skip to question 8 of this questionnaire.***

**Please indicate how strongly you disagree or agree with the following statements based on a scale of 1 to 5, 1 being strongly disagree and 5 being strongly agree.**

| | Strongly Disagree → Strongly Agree | | | | |
|---|---|---|---|---|---|
| 2. The information sources used were easy to access and readily available. | 1 | 2 | 3 | 4 | 5 |
| 3. The content (information) from the above sources was easy to understand. | 1 | 2 | 3 | 4 | 5 |
| 4. Of the information sources your organization accessed, the information was accurate and up to date. | 1 | 2 | 3 | 4 | 5 |
| 5. The road surface and weather information obtained was useful for performance of your work. | 1 | 2 | 3 | 4 | 5 |

How?_____

_____

| | | | | | |
|---|---|---|---|---|---|
| 6. Information pertained to your coverage area with the necessary detail. | 1 | 2 | 3 | 4 | 5 |
| 7. Obtained information assisted you in carrying out specific actions. | 1 | 2 | 3 | 4 | 5 |

What actions?_____

_____

How?_____

_____

8. What information do you use in making weather-related management decisions?

*If YES, please go to box A.* →

Do you use actual readings, forecast information, or both? (Please check the appropriate box[es])

Do you use:

| | YES | NO | Actual Readings | Forecast Information |
|---|---|---|---|---|
| a. Wind speed or direction? ..... | ❑ | ❑ | ❑ | ❑ |
| b. Precipitation? ..... | ❑ | ❑ | ❑ | ❑ |
| c. Atmospheric temperature? ..... | ❑ | ❑ | ❑ | ❑ |
| d. Pavement temperature? ..... | ❑ | ❑ | ❑ | ❑ |
| e. Pavement conditions? ..... | ❑ | ❑ | ❑ | ❑ |
| f. Dewpoint? ..... | ❑ | ❑ | ❑ | ❑ |
| g. Some other indicator? *Please specify*... | ❑ | ❑ | ❑ | ❑ |

SPECIFY: _____

**The remaining questions pertain to information obtained through your use of FORETELL.**

9. a) Have you or your organization received any training or training material regarding the FORETELL system?

❒ Yes ❒ No

b) Was it useful? ❒ Yes ❒ No

10. Do you obtain the following information from FORETELL?

| | YES | NO |
|---|---|---|
| a. Wind speed or direction ..... | ❑ | ❑ |
| b. Precipitation ..... | ❑ | ❑ |
| c. Atmosphere temperature ..... | ❑ | ❑ |
| d. Pavement temperature..... | ❑ | ❑ |
| e. Pavement conditions ..... | ❑ | ❑ |
| f. Dewpoint..... | ❑ | ❑ |

If you don't use the information, why not?

_____

_____

11. How often do you obtain information from the FORETELL System…
(please check all that apply)

| | YES | NO | TWICE A DAY | 4 TIMES A DAY | EVERY OTHER HOUR | HOURLY |
|---|---|---|---|---|---|---|
| a. Daily? ..... | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| b. Weekly?..... | ❑ | ❑ | **NOT APPLICABLE** | | | |
| c. In advance of a weather event*? .. | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| d. During a weather event*?..... | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |
| e. After a weather event*? ..... | ❑ | ❑ | ❑ | ❑ | ❑ | ❑ |

**A weather event can include high winds, precipitation, extreme atmospheric temperatures, frost, etc.*

**Again, please rate the following statements based on a scale of 1 to 5, 1 being strongly disagree and 5 being strongly agree. [Interviewer: If an answer is Disagree or Strongly Disagree, ask the respondent to please explain.]**

| | | Strongly Disagree → | | | | Strongly Agree |
|---|---|---|---|---|---|---|
| 12. | Information received from the FORETELL system is understandable. | 1 | 2 | 3 | 4 | 5 |
| 13. | Information received from the FORETELL system is usable. | 1 | 2 | 3 | 4 | 5 |
| 14. | Information received from the FORETELL system is easily obtainable. | 1 | 2 | 3 | 4 | 5 |
| 15. | The FORETELL web site was easy to navigate. | 1 | 2 | 3 | 4 | 5 |

Comment: _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 16. | Information received from the FORETELL system is accurate. | 1 | 2 | 3 | 4 | 5 |

Explain: _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 17. | Information received from the FORETELL system is useful. | 1 | 2 | 3 | 4 | 5 |

Comment: _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 18. | Information provided by the FORETELL web site was up to date. | 1 | 2 | 3 | 4 | 5 |
| 19. | You received the information from the FORETELL System in time to incorporate it into weather-related management decisions. | 1 | 2 | 3 | 4 | 5 |
| 20. | The road surface and weather information obtained on the FORETELL web site was useful for the performance of your work. | 1 | 2 | 3 | 4 | 5 |

How? _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 21. | Obtained information assisted you in carrying out specific actions. | 1 | 2 | 3 | 4 | 5 |

How? _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 22. | Road surface and weather information is compiled and disseminated more efficiently. | 1 | 2 | 3 | 4 | 5 |

Explain: _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 23. | Notifications of road closures or restrictions are issued more efficiently with FORETELL information. | 1 | 2 | 3 | 4 | 5 |

Comment: _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 24. | You are more confident in making weather-related management decisions when you use information from the FORETELL System. | 1 | 2 | 3 | 4 | 5 |

Explain: _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 25. | Having information from the FORETELL System increases safety and/or reduces accidents. | 1 | 2 | 3 | 4 | 5 |

How? _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 26. | Information obtained on the FORETELL web site improved the overall efficiency of your operations. | 1 | 2 | 3 | 4 | 5 |

Explain: _____

_____

| | | | | | | |
|---|---|---|---|---|---|---|
| 27. | Your organization will likely continue to access information on the FORETELL web site and rely on it more over time than you do on other alternative sources. | 1 | 2 | 3 | 4 | 5 |

Do you have other comments (e.g., ways to improve FORETELL)?: _____

_____

_____

_____

Thank you for taking the time to participate in this interview. If you have any questions concerning the evaluation, please call me at 208-345-4630. Do you think it would it be beneficial to speak to operations personnel?

Name: _____ Title: _____ Phone: _____

# INTERVIEW SUMMARY

# TRAFFIC MANAGERS INTERVIEW GUIDE

## Introduction for discussion:

- We are assisting Battelle Memorial Institute to conduct an FHWA-sponsored independent evaluation of a new road surface/weather information system called FORETELL.
- We are conducting telephone interviews to evaluate who has used the FORETELL web site, how well the system works (accuracy), for what purpose the information is being used (e.g., routing or timing alterations), and whether or not it provides improvements in operations, mobility, and safety. The results of our evaluation will be used to improve the FORETELL system and the information it provides to help you make weather-related decisions.
- You were contacted previously as a potential user and identified as one who is interested in using (or trying) the FORETELL web site and assisting us in this evaluation process.
- Have you had an opportunity to familiarize and use the FORETELL system (if not, thank you for your time; this questionnaire was developed for evaluation of those who have experience in some minimal amount of FORETELL products). Are you willing to help us in this evaluation?

Be assured that company and individual information will be kept confidential. The following information will be used for the purpose of this survey only.

- This will take 15-25 minutes. Is this a good time to talk or would you prefer to talk at a different time? Would it be more appropriate to speak to a dispatcher, driver, or other person in your company?
- I appreciate your time. If you would like to interrupt the interview at any time, please let me know.

Title: **Traffic Manager**

Operating Area: **Wisconsin**

Number of Employees: **6**

**The first set of questions pertain to information available prior to your use of the FORETELL web site.**

1. Before introduced to the FORETELL web site, what information sources did you use to obtain road surface and weather information? I'm going to read a list of different information sources. Please indicate whether the sources are available, how often you used them, and when you used them (e.g., before a trip or en-route).

| Source of Information | Not Avail | Frequency of Use | | | | Type of Use | |
|---|---|---|---|---|---|---|---|
| | | Often | Sometimes | Rarely | Never | Operate | Disseminate |
| AM/FM Radio | ☐ | ☐ | ☑ | ☐ | ☐ | ☑ | ☐ |
| CB Radio | ☑ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| TV | ☐ | ☑ | ☐ | ☐ | ☐ | ☑ | ☑ |
| Cell Phone | ☐ | ☐ | ☐ | ☐ | ☑ | ☐ | ☐ |
| DOT Call-in **(us)** | ☐ | ☑ | ☐ | ☐ | ☐ | ☑ | ☐ |
| Highway Patrol Call-in | ☐ | ☑ | ☐ | ☐ | ☐ | ☑ | ☐ |
| Internet | ☐ | ☐ | ☑ | ☐ | ☐ | ☑ | ☑ |
| Private Forecasting Service/ DTN | ☐ | ☑ | ☐ | ☐ | ☐ | ☑ | ☐ |
| Word of Mouth | ☐ | ☑ | ☐ | ☐ | ☐ | ☑ | ☐ |
| Other(s) Specify: **SSI .** | ☐ | ☑ | ☐ | ☐ | ☐ | ☑ | ☐ |

***Note: If no previous sources were used to access road surface and weather information, skip to question 8 of this questionnaire.***

**Please indicate how strongly you disagree or agree with the following statements based on a scale of 1 to 5, 1 being strongly disagree and 5 being strongly agree.**

| | Strongly Disagree → | | | Strongly Agree |
|---|---|---|---|---|
| 2. The information sources used were easy to access and readily available. | 1 | 2 | 3 | ④ | 5 |
| 3. The content (information) from the above sources was easy to understand. | 1 | 2 | ③ | 4 | 5 |
| 4. Of the information sources your organization accessed, the information was accurate and up to date. | 1 | 2 | 3 | ④ | 5 |
| 5. The road surface and weather information obtained was useful for performance of your work. | 1 | ② | 3 | 4 | 5 |

How? **Usually not that much road surface information provided. This road information was not detailed or area specific enough**

| | | | | | |
|---|---|---|---|---|---|
| 6. Information pertained to your coverage area with the necessary detail. | 1 | ② | 3 | 4 | 5 |
| 7. Obtained information assisted you in carrying out specific actions. | 1 | ② | 3 | 4 | 5 |

What actions? **Use information for DMS indications, ramp metering, signal timing adjustments, and etc.**

How? **Need better route specific information for taking these actions.**

8. What information do you use in making weather-related management decisions?

*If YES, please go to box A.* →

Do you use actual readings, forecast information, or both? (Please check the appropriate box[es])

Do you use:

| | YES | NO | Actual Readings | Forecast Information |
|---|---|---|---|---|
| a. Wind speed or direction? | ☐ | ☑ | ☐ | ☐ |
| b. Precipitation? | ☑ | ☐ | ☑ | ☐ |
| c. Atmospheric temperature? | ☑ | ☐ | ☑ | ☐ |
| d. Pavement temperature? | ☑ | ☐ | ☑ | ☐ |
| e. Pavement conditions? | ☑ | ☐ | ☑ | ☐ |
| f. Dewpoint? | ☐ | ☑ | ☐ | ☐ |
| g. Some other indicator? *Please specify*... | ☐ | ☑ | ☐ | ☐ |

SPECIFY: _____

**The remaining questions pertain to information obtained through your use of FORETELL.**

9. a) Have you or your organization received any training or training material regarding the FORETELL system?

☑ Yes ☐ No

b) Was it useful? ☑ Yes ☐ No

10. Do you obtain the following information from FORETELL?

| | YES | NO |
|---|---|---|
| a. Wind speed or direction | ☑ | ☐ |
| b. Precipitation | ☑ | ☐ |
| c. Atmosphere temperature | ☑ | ☐ |
| d. Pavement temperature | ☑ | ☐ |
| e. Pavement conditions | ☑ | ☐ |
| f. Dewpoint | ☐ | ☑ |

If you don't use the information, why not? **We don't have a use for dewpoint specifically.**

11. How often do you obtain information from the FORETELL System…
(please check all that apply)

| | YES | NO | TWICE A DAY | 4 TIMES A DAY | EVERY OTHER HOUR | HOURLY |
|---|---|---|---|---|---|---|
| a. Daily? | ☑ | ☐ | ☐ | ☑ | ☐ | ☐ |
| b. Weekly? | ☐ | ☑ | **NOT APPLICABLE** | | | |
| c. In advance of a weather event*? | ☑ | ☐ | ☑ | ☐ | ☐ | ☐ |
| d. During a weather event*? | ☑ | ☐ | ☑ | ☐ | ☐ | ☐ |
| e. After a weather event*? | ☐ | ☑ | ☐ | ☐ | ☐ | ☐ |

** A weather event can include high winds, precipitation, extreme atmospheric temperatures, frost, etc.*

**Again, please rate the following statements based on a scale of 1 to 5, 1 being strongly disagree and 5 being strongly agree. [Interviewer: If an answer is Disagree or Strongly Disagree, ask the respondent to please explain.]**

| | | Strongly Disagree → Strongly Agree | | | | |
|---|---|---|---|---|---|---|
| 12. | Information received from the FORETELL system is understandable. | 1 | 2 | 3 | ④ | 5 |
| 13. | Information received from the FORETELL system is usable. | 1 | 2 | 3 | ④ | 5 |
| 14. | Information received from the FORETELL system is easily obtainable. | 1 | 2 | ③ | 4 | 5 |
| 15. | The FORETELL web site was easy to navigate. | 1 | 2 | 3 | ④ | 5 |

Comment: **Dependent on internet access. FORETELL is not necessarily integrated into our systems. We would have to pull away from our common tools to look at the separate FORETELL graphic map.**

| | | | | | | |
|---|---|---|---|---|---|---|
| 16. | Information received from the FORETELL system is accurate. | 1 | 2 | 3 | ④ | 5 |

Explain: **Not able to check the accuracy.**

| | | | | | | |
|---|---|---|---|---|---|---|
| 17. | Information received from the FORETELL system is useful. | 1 | 2 | ③ | 4 | 5 |

Comment: **Dependent on internet access. FORETELL is not necessarily integrated into our systems. We would have to pull away from our common tools to look at the separate FORETELL graphic map.**

| | | | | | | |
|---|---|---|---|---|---|---|
| 18. | Information provided by the FORETELL web site was up to date. | 1 | 2 | 3 | ④ | 5 |
| 19. | You received the information from the FORETELL System in time to incorporate it into weather-related management decisions. | 1 | 2 | ③ | 4 | 5 |
| 20. | The road surface and weather information obtained on the FORETELL web site was useful for the performance of your work. | 1 | 2 | 3 | ④ | 5 |

How? **1) Adapting traffic control timing; 2) Closures; 3) Warning signs; and 4) Integrating w/ other entities.**

| | | | | | | |
|---|---|---|---|---|---|---|
| 21. | Obtained information assisted you in carrying out specific actions. | 1 | 2 | 3 | ④ | 5 |

How? **1) Adapting traffic control timing; 2) Closures; 3) Warning signs; and 4) Integrating w/ other entities.**

| | | | | | | |
|---|---|---|---|---|---|---|
| 22. | Road surface and weather information is compiled and disseminated more efficiently. | 1 | 2 | 3 | ④ | 5 |

Explain: **We didn't use it in this detail but sure could if we needed to.**

| | | | | | | |
|---|---|---|---|---|---|---|
| 23. | Notifications of road closures or restrictions are issued more efficiently with FORETELL information. | 1 | 2 | ③ | 4 | 5 |

Comment: **Didn't feel like we had an opportunity to integrate into our daily operations to verify improved efficiency.**

| | | | | | | |
|---|---|---|---|---|---|---|
| 24. | You are more confident in making weather-related management decisions when you use information from the FORETELL System. | 1 | 2 | 3 | ④ | 5 |

Explain: **We could be more confident from quick access to a good weather and road condition source.**

| | | | | | | |
|---|---|---|---|---|---|---|
| 25. | Having information from the FORETELL System increases safety and/or reduces accidents. | 1 | 2 | 3 | ④ | 5 |

How? **It very well could; we did not use the system for this purpose nor checked it for this purpose.**

---

| | | | | | | |
|---|---|---|---|---|---|---|
| 26. | Information obtained on the FORETELL web site improved the overall efficiency of your operations. | 1 | 2 | 3 | ④ | 5 |

Explain: **I see that it has great potential to improve the overall efficiency if used as a primary source of road and weather information.**

| | | | | | | |
|---|---|---|---|---|---|---|
| 27. | Your organization will likely continue to access information on the FORETELL web site and rely on it more over time than you do on other alternative sources. | 1 | ② | 3 | 4 | 5 |

Do you have other comments (e.g., ways to improve FORETELL)? **I would rather pursue a system that can be integrated into our current operating systems and tools rather than add yet another, more complicated layer to our personnel and operations. Have one more weather related repository superimposed as another source on top of the existing system we deal with.**

Thank you for taking the time to participate in this interview. If you have any questions concerning the evaluation, please call me at xxx-xxx-xxxx. Do you think it would it be beneficial to speak to operations personnel?

Name: **None** Title: _____ Phone: _____

**Note: Please send the results!**

# APPENDIX G:

# FORETELL USER MANUAL AND TRAINING GUIDE

# USER MANUAL

# FORETELL

## User Manual

**October, 2001**

## Welcome to FORETELL

*FORETELL* is a multi-state initiative integrating Intelligent Transportation Systems (ITS) with advanced weather systems prediction to create operational highway maintenance management and traveler information systems throughout North America. As the first project of its kind, and one of the first major rural ITS initiatives in the United States, *FORETELL* is playing a major role in the development of rural ITS architecture. Overall goals include reducing winter-condition related road deaths by at least 15%, and creating a viable road and weather information network across the continent, both within 5 years. Operators will use FORETELL to access information on a wide range of weather and pavement condition information for any road or region in their state.

This document will provide an overview of the various functions within FORETELL and explain how to use them.

### *How does FORETELL work?*

FORETELL realizes that effective winter maintenance needs accurate future information to make plans on how to tackle an oncoming storm as well as detailed current information to track the storm's location and intensity over the past few hours. FORETELL works by combining three sources of weather information to provide the most accurate current data and forecasts available.

The first source of information is the **30 hour forecast** created four times per day and show you the conditions expected in the future. These forecasts are updated starting at 4:00 AM, 10:00 AM, 4:00 PM and 10:00 PM (all times in Eastern Standard Time – EST). The second source of information provided by FORETELL is called a **nowcast**. A nowcast is a display that shows the actual weather conditions over the entire region as recorded at the top of the hour. The nowcast is available every hour at 30 minutes past the hour (i.e. 1:30, 2:30, 3:30, etc.). The third source is live **Radar** information,

In FORETELL, when a nowcast becomes available, it **replaces** the forecast for that hour. This allows you to see the actual conditions for each past hour and the forecasts for hours still to come. In addition to this, as FORETELL creates one new hour worth of forecast at each of the four startup times, FORETELL replaces the old forecast weather information for the new ones, therefore updating the information available to users as soon as possible. The graphic below shows how this influences the information available.

The FORETELL Schedule graphic illustrates the time range that the nowcast and each of the forecasts operate. The FORETELL Forecast Times shows an example of the files available for viewing at 10am, 12pm and 2pm. Users should recognize that over time, new weather data files are available (e.g 10am files) and replace the existing forecast files (e.g. 43am), thus providing the most up to date information to users.

## ***Getting Started with FORETELL***

FORETELL is an internet-based system. That means that you will use an internet browser such as Internet Explorer or Netscape to access it and keep it running while you use FORETELL. You are able to view other web pages while logged into FORETELL.

1. Log onto the Internet using whatever Internet service provider you have chosen, and open either Netscape or Internet Explorer.

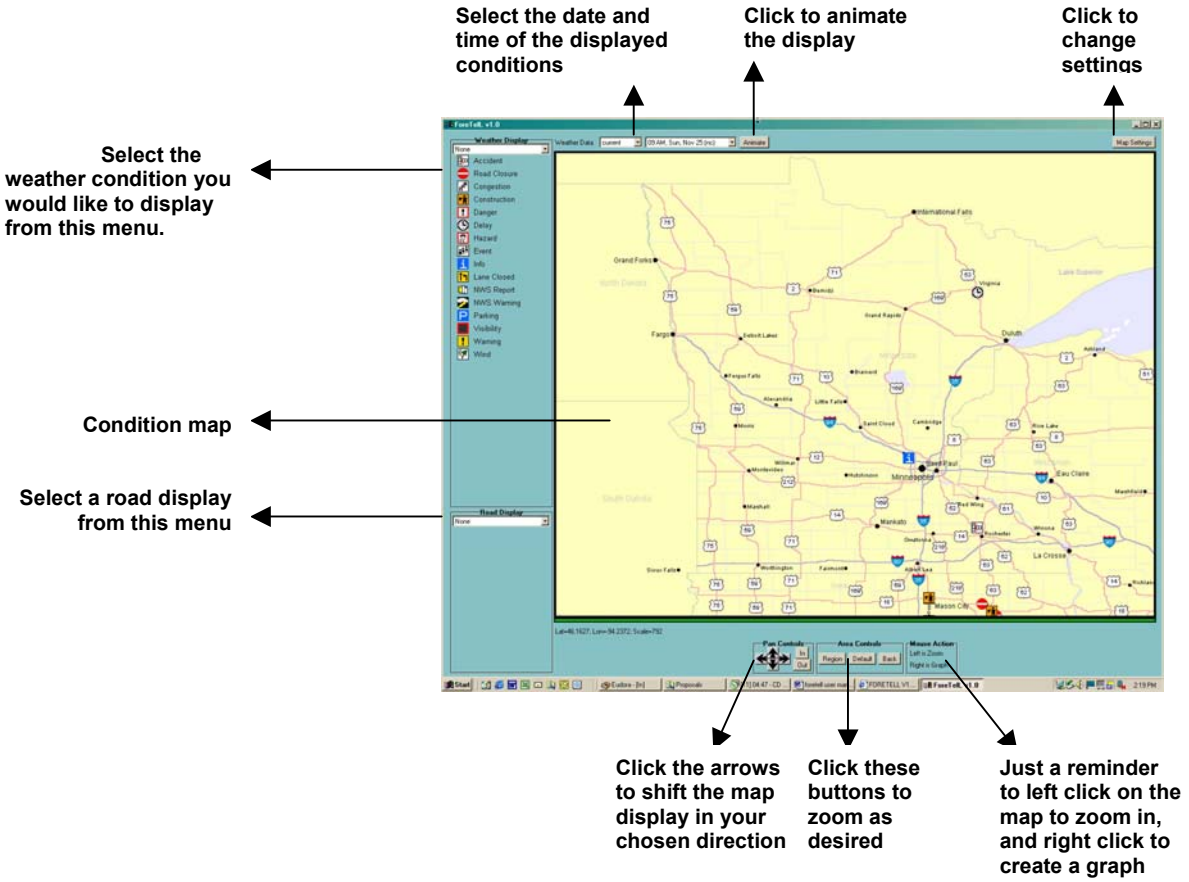
2. Access the FORETELL web site at www.foretell.com.

3. Save this location to either your Favorites (if using Microsoft Internet Explorer) or to your Bookmarks (if using Netscape).

4. Select the **LAUNCH** button to start the program.

5. Enter your userid and password provided to you by your network administrator. These are case sensitive, so make sure you don't accidentally use capital letters. Then left click on the **LOGIN** button.

6. You will now enter a page that shows a map and several menus. This is FORETELL.



***About the Conditions Map***

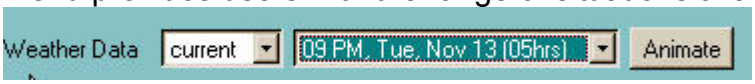
At the default zoom level, FORETELL displays all of area where FORETELL information is available and the interstates running through each region. From the map, you have the ability to zoom in and out, move your display in all directions and select the time frame and type of information you want to see.

***Zoom and Pan***

There are two ways to zoom. You may also **click and hold** the left mouse button while dragging the mouse over a region on the map to zoom in. When you release the mouse button, the new zoomed map will appear. You can keep doing this until you get to the zoom level you prefer. You can also use the **Zoom Controls** buttons to zoom in and out to a regional map or a default map set up for your user ID.

***Time Frame Viewing options***

FORETELL enables you to view various levels of road and weather conditions both in terms of detail and time ranges. The pull-down menus shown below control the time period and the type of information that you can display on the map. The Weather Data menu provides users with the range of situations available.



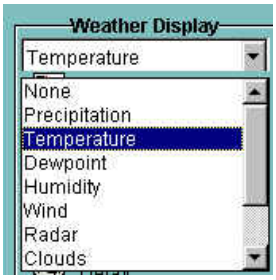

The **CURRENT** option provides you with the ability to see the weather conditions for at least a 24-hour period into the future as well as a historical view of the past few hours in hourly increments. Weather data under this option is shown at a six-mile spacing, meaning that FORETELL determines the conditions at points no more than six miles apart. The time periods available under this option are displayed in the time menu.

The **REGIONAL** option provides information at a lower resolution but over a greater area. The data is displayed at an 18-mile resolution but shows an area at least twice the size of the CURRENT option. This information is also available in hourly time increments as shown in the time menu.

The **RADAR** option provides access to near-live radar information at a 2.5 mile spacing using 10 minute intervals for the past two hours. This information only contains radar information and must be used in conjunction with the radar weather type discussed later in this manual. The time menu displays the options a user can choose from.

The FORETELL system requires that a user update their display periodically to ensure that they have the latest information. To check for updates, reselect any of the options from the Weather Data menu. In some situations, such as training or demonstrations, past forecasts may be available for viewing.

***Viewing weather conditions***



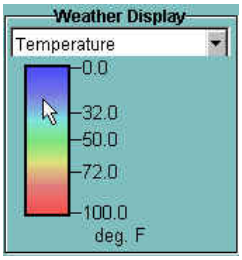

As shown here, clicking on the pull-down menu under **Weather Displays** lists the types of forecasts available.

FORETELL displays color-coded forecasts for the following weather conditions:

- **Precipitation:** rate of precipitation in melted inches per hour
- **Temperature:** air temperature in degrees Fahrenheit
- **Dewpoint:** predicted Fahrenheit temperature at which dew will form
- **Humidity:** relative percent moisture in the atmosphere
- **Wind:** arrows indicate wind speed and direction
- **Radar:** forecasted radar in dbZ, or intensity of echoes
- **Clouds:** cloud thickness
- **Pressure:** atmospheric pressure in millibars
- **Precipitation Accumulation:** 30 hour melted accumulation of all precipitation in inches.
- **Frozen Accumulation:** 30 hour melted accumulation of frozen precipitation in inches
- **Measured Accumulation:** 30 hour accumulation of frozen precipitation in inches, measured as seen on the ground.

Selecting one of these conditions brings up a legend for the color codes used, as well as displays the current forecast for that condition on the map. The section **Time Frame Viewing Options** contains information on how to view specific time periods.

The graphics below show what an operator who had zoomed in on Wisconsin and then selected Temperature might see:





Note that by dragging the mouse over the map, individual temperatures (or any other weather selected) may be displayed.

## ***Viewing road conditions***

FORETELL can display roadway information from the Road Display pull-down menu for any of the conditions listed below:

- **Road condition:** When completed, this feature will show color coded road indices based on driveability (i.e. Driving conditions good, Driving conditions fair, Driving conditions poor). This display is based on forecasted conditions and uses the assumption that no maintenance activities (plowing, sanding or salting) have been performed.
- **Air temperature @ road:** air temperature above road surface, five feet above ground
- **Pavement temperature:** temperature of the road driving surface
- **Dewpoint @ road:** dewpoint above the roadway surface

To view roadway information, first use the zoom and pan controls as explained above to view the roadways you are interested in. Next, select the type of information you are interested in from the **Road Display** pull-down menu. You will see a legend explaining the color-coding used for that type of information. Roadways shown on the map are now color-coded to reflect the current forecasted conditions.


The graphics above show the road conditions for the Milwaukee area.

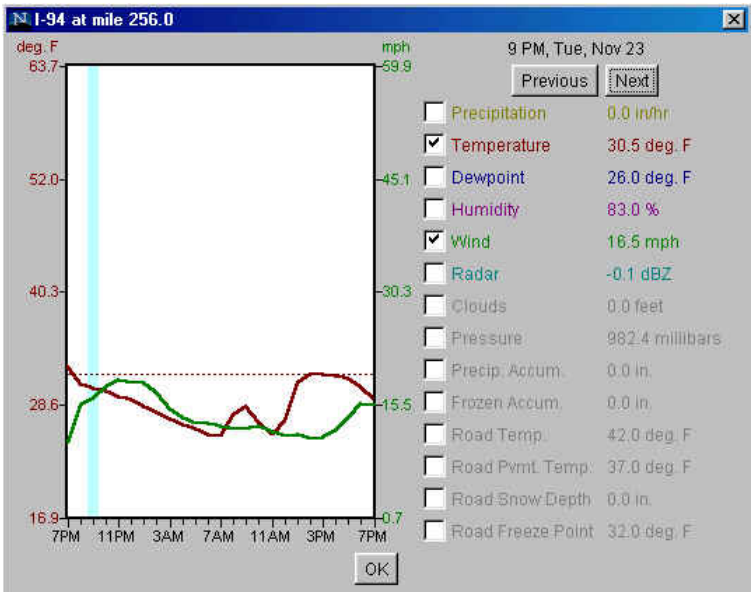
***Animating forecasts***

Clicking the **Animate** button after selecting a road or weather display will trigger an animation of the forecasted conditions, with one frame corresponding to each of the 30 hours covered by the current forecast. Along the top of the map, you will see a bar that shows the hour of time for the weather data being displayed.

You may freeze the animation by clicking the **Stop** button at any time.

## ***Creating graphs***

A key feature of FORETELL is the ability to create graphs of the forecasted conditions over a 30 hour period for any point along any roadway. To begin creating graphs, click on any point on the map using the ***right*** mouse button. A window will open that shows the name of the road and milepoint you selected, as well as all the current road and weather conditions for that point. If you have selected a point on the map that is not on a roadway, only weather conditions will be graphed--no road conditions or road temperatures will be available.




A graph like the one shown above will not appear until you select one or more conditions that you would like graphed. Above, temperature and wind have been checked. Note that the lines on the graph, the scale, and the condition name are all color-coded for clarity.

Clicking **Previous** and **Next** moves the transparent blue bar along the vertical axis and changes the display of the forecasted conditions to correspond with the hour highlighted by the bar. Also, text is displayed in the gray area to the right of the box to report the exact value at the time selected. Click **OK** to close the window. The graph is not saved.

HELPFUL HINTS:

1. Dew may form as Temperature and Dewpoint get closer, with frost occurring when temperatures below 32 degrees if the surface is also below freezing
2. Horizontal accumulation graph means zero additional expected for that period. The steeper the graph, the more intense the precipitation accumulation expected.
3. Plotting Frozen and Measured Accumulations display water equivalent of frozen precipitation expected and the expected depth. Closer values are together, means that precipitation is increasingly wet and dilution of solution may occur.

## Maximizing your Benefit from FORETELL

1. Data is being updated continuously. Be sure to check conditions regularly and update data file list. This should be done prior to manpower and operational decisions to see approaching storm and how storm is changing over time.

2. Remember that the information are the forecasted or actual conditions at the top of the hour, so precipitation and accumulation displayed at 0AM means between 9AM and 10AM precipitation will begin. Other data are expected readings at 10AM.

3. Remember you can access the site from anywhere you have internet access.

4. Understand the currency of the data. Nowcasts (nc) are the actual observed data from sensors around the area. Forecasts (example 25hrs) means that this particular set of data is forecasted 25 hours from the start of the forecast. There will be some variability in forecasts further out in the future.

Medium Term

1. From the ***Current*** or ***Regional*** Weather Data options, use the **Animate** button to view ***Precipitation*** location, rate and type expected over next 24-30 hour period.

2. Select last time frame to and display ***Precip Accum.***, ***Frozen Accum.*** and ***Measured Accum.*** to determine precipitation type(s), water equivalent amount and total measured frozen amount of precipitation expected over forecast period.

3. Right-click on the map and select the accumulation display(s), air temperature and road temperature to see how conditions will change over time.
   a. Flat accumulation graph equals no accumulation, sharp graph means heavy accumulation;
   b. Potential for frost / dew when air and dewpoint temperatures get close;

4. This information provides a basis for making operational decisions such as:
   c. The length of the storm affecting whether to split shifts and overtime issues;
   d. The type and water content of precipitation expected determining the type and quantity of chemicals applied;
   e. The Frozen / Unfrozen precipitation switches affecting timing of anti-icing or brine applications;
   f. Temperature changes affecting point when chemical application occurs.

Short Term

1. From the ***Radar*** Weather Data option, use the **Animate** button to view past two hours of live NextRAD data at 10 minute intervals.

a. Provide real-time indication of locations of precipitation and cell intensity;
b. Snow appears at lower readings and tends to be evenly spread over area;
c. Allows user to see current detailed storm track.

2. From the ***Current*** or ***Regional*** Weather Data options, use the **Animate** button to view if precipitation differs in location or timing between the latest nowcast (nc) and the forecast for the next hour.

**Weather and Road Data**.

1. The consistency in the flow from Nowcast to Forecast identifies how close the storm is actually moving compared to the forecast. A shift in time or location should be used to gage how close the forecast is and where the storm will track.

2. All precipitation amounts are melted totals other than Measured Accumulation. Use the melted amounts to determine how much water is in the precipitation. Use the measured accumulation to determine how "heavy" the precipitation is. As a general rule 1 inch of water = 10 inches of normal snow.

3. Use this ratio to determine if anti-icing options will be useful, the amount of chemical application to avoid dilution of solution and what type of blading operation will work.

# TRAINING GUIDE

# FORETELL™

# Training Guide

October, 2001

**Any questions can be emailed to**
**FORETELL@CRC-CORP.COM**

# FORETELL™

# Getting Started with FORETELL

7. Open up a web browser, either Netscape or Internet Explorer.
8. Access the FORETELL web site at www.foretell.com
9. Click on the **LAUNCH** button on the screen to start the JAVA version of FORETELL.
10. The JAVA version will require you to enter your UserID and password provided to. When you first log in, the user name and password will be your last name in lower case letters. Once you've entered in the information, then left click on the **LOGIN** button.
11. You will now see another window open to a page that shows a map and several menus. This is FORETELL.

## Initial Screen

The initial screen contains several main features. Let's get ourselves familiar with the features of FORETELL.

1. In the center is the map that provides the main information display.
2. The top left contains the weather condition options that can be displayed.
3. The bottom left contains the road condition options that can be displayed.
4. The top center contains the time selection information for data available.
5. The bottom center contains the pan / tilt and zoom functions.
6. The top right button allows users to select the some map characteristics.

## Zooming and Panning

FORETELL allows you to zoom to any area that is of most interest to a user. Let's begin using the zoom and pan functions.

1. Move your mouse to the north west corner of your state on the map.
2. Click and hold the left mouse button and drag the mouse over to the south east corner of the state and then release the mouse button. Notice the green line that fills the status bar at the bottom of the map. This reveals the status of the map update.
3. The new map will appear with your state completely filling the map.
4. Let's assume that you made a mistake and zoomed to the wrong area. Use the **BACK** button in the Area Control region to go back to our previous view.

5. Hit the **In** button several (3-4) times, each time waiting for the map to be displayed. This zooms the map in with each time you hit the button. Note that you can keep doing this until you get to the zoom level you prefer or reach the minimum zoom map size.
6. Now, let's use the **Out** button in the Pan Control region to zoom the map out a preset amount. We now see a slightly larger area than the previous screen.
7. Again, perhaps you made a mistake and want to see everything that is going on in the Midwest. Use the **Region** button to zoom the map out to the entire area quickly.

**Panning**

1. Position your mouse arrow over any city and click the left mouse button without holding the mouse or dragging it.
2. We can also move the screen using the mouse. Click the left mouse button at the edge of the screen in the direction that will move the map over Iowa, each time waiting for the map to redraw.
3. Click the arrows in the Pan Controls to display somewhere else on the map.

## Selecting Data to View

1. Each user can control what information they see. The first important step is learning how to get to the data you will want to see. The Weather Data menu is comprised of two components, the Data Type pull down menu and the Time Period pull down menu. Use the Zoom features to show the map you want to see.
2. Select the Data Type pull down menu to reveal other options that may be present other than **CURRENT**. Select the **RADAR** option.

> FORETELL now collects live radar information. We provide that to you in two different ways. The first is that each nowcast contains a weather option called Radar and displays the conditions at the top of each hour. We provide an image of the radar for that time here. This allows you to see the actual radar and the forecasted radar display into the future. Note that the actual radar WILL BE more random in location and color. The second location is by providing live radar

images through the RADAR option in the Weather Data. Information is available in 10 minute intervals for the past two hours. Note that you must have RADAR chosen as the Weather Display Type also for this to be viewable.

3. Now select the Time Period pull down menu to reveal the options available and use the scroll bar to review all the times available.
4. Choose one time period listed that you may want to see by clicking the left mouse button on the text of the given time period. This should be highlighted in blue.
5. You can now scan through each time period by using the up and down arrows of your keyboard. This is a simple way to scan through time periods at your own pace.
6. You are not limited to scanning through the times in order and can jump from one set to another, remembering to wait for the map to completely redraw.

***Updating the data***

Users are interested in knowing the difference when they were looking at a forecast and a nowcast. Remember that a forecast is everything that is expected to happen in the future at the top of each hour, while a nowcast is a snapshot of what happened at the top of an hour. The important difference gives you the ability to see the trends over the past several hours and where the forecast shows the storm tracking.

Usually there will be a very smooth transition between the two, indicating that the forecast is right on. If there is a difference either in location tracking or in time, you can make a judgment of how far off the forecast is. Remember that we update our forecasts 4 times per day, so if the storm begins moving differently near the end of our first forecast, the second forecast will take that into account and correct the difference.

Nowcasts are displayed in the Time Display by the text **(nc)** after the time. In addition, when animating the screen, the Time Bar shows the **(nc)** after the hour.

Forecasts are displayed in the Time Display with the numbers of hours out the information is for. For example, the information for tomorrow at 4:00pm which was forecasted at 10:00am today is 30 hours out **(30hrs)** while today's 4:00pm forecast would only be forecasted 24 hours out **(24hrs)** at 4:00pm tomorrow. The farther out a forecast is, the more there is a potential for slight deviation in time and location of a storm track before it reaches your location.

Four times a day, FORETELL generates a new forecast for the next 30 hours. These forecasts are started at 4:30am, 10:30am, 4:30pm and 10:30pm Eastern Standard Time

(EST) with the last of the 30 hour forecast period completed by 8:30am, 2:30pm, 8:30pm and 2:30am EST. Additionally, FORETELL gives an update of current conditions at 30 minutes past the hour, every hour. You may have accessed FORETELL earlier in the day and still have it running on your computer when it comes time to make an operational decision, or you just want to get an update of the weather conditions. While you may have been logged in to FORETELL, to update the information you see, you will need to do the following.

1. Reselect the option you wish to view from the weather Data Type menu.
2. That's it. This will send a request to the FORETELL website to update the Time Period list with the newest available time information.

## Viewing weather conditions

1. Select one of the **Weather Data** options for the type of data to view.
2. Select the Weather Display pull down menu to reveal the type of weather information that is available for viewing.
3. FORETELL displays color-coded forecasts for the following weather conditions:
    - **Precipitation:** rate of precipitation (in melted inches/hour).
    - **Precip & Temperature:** a combined display that overlays the precipitation on top of the air temperature.
    - **Temperature:** air temperature (in degrees Fahrenheit or degrees Celsius).
    - **Dewpoint:** predicted temperature at which dew will form (in degrees Fahrenheit or degrees Celsius).
    - **Humidity:** relative percent moisture in the atmosphere.
    - **Wind:** arrows indicate wind speed and direction (in miles per hour or kilometers per hour).
    - **Radar:** forecasted radar in dbZ, or intensity of echoes.
    - **Clouds:** cloud thickness (in feet or meters).
    - **Pressure:** atmospheric pressure (in millibars or Pascals).
    - **Precipitation Accumulation:** 30-hour accumulation of precipitation (in melted inches or centimeters).
    - **Frozen Accumulation:** 30-hour melted accumulation of frozen precipitation (in inches or centimeters).
    - **Measured Accumulation:** 30-hour accumulation of frozen precipitation as measured out in the field.
4. Select **Temperature** from the Weather Display pull down menu list by clicking the left mouse button on the word and notice the status bar slowly fill with green.
5. The map display should now show a colorful display.
6. Look within the Weather Display to see the color coded legend for the temperatures.

7. Move your mouse over the map slowly from an area with one color to an area with another color. Notice the label with the mouse now appear and providing details regarding the actual value at the location you are pointing at.
8. Let's now select **Precipitation** from the Weather Display menu.
9. Notice that this reveals a new and different looking legend.
10. Move your mouse over various areas on the map.
11. Now try selecting **Winds.**
12. The display and legend changes yet again.
13. Try scanning through the remaining options to see how the various weather conditions are displayed.
14. When finished, use your mouse to select the **None** option in the Weather Display pull down menu.

## Viewing road conditions:

1. You should choose one of the **Weather Data** option for the data to view.
2. Select the Road Display pull down menu to reveal the type of weather information that is available for viewing.
    - **Road condition:** This feature will show color-coded road indices based on drivability (i.e. Driving conditions good, Driving conditions fair, Driving conditions poor). This display is based on forecasted conditions and uses the assumption that no maintenance activities have been performed.

- **Air temp at Road:** Air temperature five feet above road surface.
- **Dewpoint at Road:** Dewpoint temperature five feet above road surface.
- **Pavement temperature:** Temperature of the road driving surface.
    - **Road dewpoint:** The dewpoint above the road surface. This information combined with the road pavement temperature can be used to evaluate the potential for frost and dew formation on the road surface.
    - **Road snow depth:** The predicted depth of snow accumulating on the road surface, assuming that no immediate treatment or maintenance activity is undertaken by the Department of Transportation

3. Select **Road Pavement Temperature** from the Road Display pull down menu list by clicking the left mouse button on the word and notice the status bar slowly fill with green.
4. The map display should now show a colorful display on different roadways.
5. Look within the Road Display to see the color coded legend for the temperatures.
6. Move your mouse over the map slowly from an area with one color to a road with another color. Notice the label with the mouse now appear and providing details regarding the actual value at the location you are pointing at.
7. Let's now select **Road Condition** from the Road Display menu.
8. Notice that this reveals a new and different looking legend.
9. Move your mouse over various areas on the map.
10. Try scanning through the remaining options to see how the various weather conditions are displayed.
11. When finished, select the **None** option from the Road Display menu.

## Animating forecasts

1. Using our knowledge from the previous sections, use the available zoom and pan functions to select a map that covers the State of Iowa and Chicago.
2. Select any of the **Weather Data** options for the type of data to view.
3. Select **Precipitation** from the Weather Display pull down menu list by clicking the left mouse button on the word and notice the status bar slowly fill with green.
4. Now use the **Animate** button, by clicking on the button. The green status bar should begin to fill across the bottom of the map and once complete, the map should begin to animate.
5. Each frame shown will correspond to one of the 30 hours available from the current forecast.
6. Along the top of the map, you will see a bar that shows the hour of time for the weather data being displayed. This allows a user to see the time for which the current map is referring to.
7. You may stop the animation by clicking the **Stop** button at any time.
8. Select **Winds** from the Weather Display menu.
9. Restart the animation by clicking the **Animate** button.
10. Stop the animation by clicking the **Stop** button.

## Creating graphs

A key feature of FORETELL is the ability to create graphs of the forecasted conditions over a 30 hour period for any point along any roadway.

1. With **Dewpoint** selected from the Weather Display menu, use the mouse to click the right mouse button in a location away from roads.
2. A window will open that shows the latitude and longitude of the point you selected, as well as all of the weather data for that point along the right side of the window, but that there is no information for the road-related condition information.
3. Notice that all the data is color coded to make for easier reading of the graph.
4. Clicking the **Previous** and **Next** buttons moves the transparent bar from left to right.
5. As you click these buttons, stop to look at the numbers along the right side of the display. The numbers display the conditions provided by FORETELL.
6. Now let's add **Temperature** to the data we are viewing. To do this, use the mouse to click the left mouse button in the small checkbox to the left of the word **Temperature.**
7. The graph will change to indicate the scales of the data you have chosen, as well as graph both weather condition data points.
8. Click **OK** to close the window. The graph is not saved.
9. Use the mouse to click the right mouse button on a road.
10. The window will open that shows the road name and milepost that you selected, as well as all of the weather data for that point along the right side of the window.

11. Notice that the road-related condition information now shows up.
12. Use the mouse to uncheck the **Dewpoint** from the list and check the options **Air temp at Road, Dewpoint at Road** and **Road Pavement Temperature.**
13. Clicking the **Previous** and **Next** buttons moves the transparent blue bar from left to right and you will notice the numbers once again changing as you click these buttons.
14. The graph will change to indicate the scales of the data you have chosen, as well as graph both weather condition data points.

## Keys to Using FORETELL Effectively

**General Items**

1. Monitor long term forecast periodically. We update our data 4 times per day which allows you to see storms in advance and plan your actions.

2. Remember you can access the site from anywhere you have internet access.

3. Understand the currency of the data. Nowcasts (nc) are the actual observed data from sensors around the area. Forecasts (example 25hrs) means that this particular set of data is forecasted 25 hours from the start of the forecast. There will be some variability in forecasts further out in the future.

**Weather and Road Data**

4. Animating weather data allows you to see the changes over time.

5. The consistency in the flow from Nowcast to Forecast identifies how close the storm is actually moving compared to the forecast. A shift in time or location should be used to gage how close the forecast is and where the storm will track.

6. All precipitation amounts are melted totals other than Measured Accumulation. Use the melted amounts to determine how much water is in the precipitation. Use the measured accumulation to determine how "heavy" the precipitation is. As a general rule 1 inch of water = 10 inches of snow.

7. Use this ratio to determine if anti-icing options will be useful, the amount of chemical application to avoid dilution of solution and what type of blading operation will work.

8. Use forecast to get prepared for the size and scope of storm, use RADAR to assist in determining the local effects during the storm.

9. The data identifies the start and end times for the storm, as well as the intensity each hour. Temperatures, winds and other variables display the value or total by that time. Remember that if precipitation shows up at your location at 10:00am that

some time between 9:00am and 10:00am is when the storm should arrive and the accumulation is the total arrived at 10:00am.

10. Graphing data allows you to see many variables at a single shot. Plotting Temperature, Dewpoint and Pavement Temperature shows if dew or frost may form and if the road is cold enough to sustain frost.

11. Graphing Precipitation Accumulation, Frozen Accumulation and Measured Accumulation allows you to see the rate of precipitation by the angle of the line. The stepper the line, the heavier the precipitation. Flat line means no accumulation.