# *Utah RWIS Traveler Information Evaluation*

UTRAC #99.4-5

Dr. Peter T. Martin, Ph.D. Associate Professor
Civil and Environmental Engineering

Joseph Perrin, PE, Ph.D., PTOE
Assistant Associate Professor

Blake Hansen, M.S.
Civil Engineering Research Assistant

David Meldrum and Isaac Quintana
Research Assistants

Department of Civil and Environmental Engineering
University of Utah
122 S. Central Campus Dr.
Salt Lake City, UT 84112

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## EXECUTIVE SUMMARY

This research document represents the analysis and recommendations of the University of Utah Traffic Laboratory (UTL) on the following Road Weather Information System (RWIS) topics:

1. public dissemination of RWIS station information
2. the area of influence of available RWIS equipment

For the first objective, a survey was developed by the UTL and the Project's Technical Advisory Committee to determine what people want in terms of the type, amount, and preferred delivery method of weather related road information. The target audience was categorized into four main groups: commuters, truckers, recreational travelers, and long distance travelers.

It was found that variable message signs and radio are the most popular form of RWIS information dissemination. Commercial radio and television reports are popular among all but the trucking industry dispatchers, who prefer Internet methods. Telephone services, paging services, and in-car navigation systems may not be familiar enough for people to prefer them and they, therefore, were not ranked high on the preference lists by any group.

The surveys indicate that road condition information is preferred by all groups over information on alternate routes, travel times, and travel speeds. They also indicate that road conditions which alter driving habits, such as accumulating snow, fog, ice, wind, and road closures, are most important while rain, non-sticking snow, thunder storms, and snow flurries are less important. The preferred delivery time is while en route, making use of radio and variable message signs. The four groups were unanimous in preferring site specific and corridor information rather than information accuracy in any specific radius.

The third objective relates to how an RWIS site's information changes with increasing distance from the sensor location. This information is important in determining whether the in-road device

information can be applied to a broad area, such as a canyon or a corridor, and whether it could reliably be used to drive any automatic information dissemination equipment. It was found that all equipment vendors will only "guarantee" the RWIS information in the immediate vicinity of the sensors. They agree that there are too many microclimate areas in close proximity to reliably apply the information to nearby areas without knowing how the climates normally differ. No published research was found in academic or popular literature on the subject. The survey of other DOTs revealed that many of them disseminate much of the individual RWIS station information over the Internet. They offer no discussion of what area the information covers.

# CHAPTER 1. INTRODUCTION

Road Weather Information Systems (RWIS) recently have become prevalent throughout the United States and the world. RWIS equipment can provide information about weather and road surface conditions such as wind speed, air temperature, pavement temperature, precipitation, de-icing chemical presence, and visibility. RWIS Environmental Sensor Stations (RWIS-ESS) provide detailed road conditions at strategic locations that are often used to make effective maintenance decisions.

RWIS can effectively be used to provide weather-related road conditions to the public. Current road condition information has the potential to improve traveler safety by enabling drivers to make informed decisions. Although several states have already tried some form of RWIS information dissemination, many unanswered questions still exist. Some of the questions that will be addressed in this research project are as follows:

- Who are the potential public users of RWIS information?
- What weather-related road information do the users want?
- How and when do users want to receive RWIS information?

To answer these questions, this project's Technical Advisory Committee provided input in the development of a survey. In addition to RWIS information dissemination issues, this project investigates two other RWIS related research questions:

- What research has been done to show how the reliability of an RWIS station's information varies with increasing distance from the station?
- Where should other RWIS-ESS be located along the Utah highway system?

To determine the locations of future RWIS sites, it is assumed that snow and ice accident data can be used as an indicator of trouble sections. These location recommendations can be readily evaluated with the current and planned RWIS sites throughout the state.

# CHAPTER 2. RWIS HARDWARE AND AREA OF INFLUENCE

It is not clear how reliable RWIS devices are over an area of roadway as they represent only a specific point on the road. They could be applicable over a few feet or a few hundred feet. This information is important in determining whether the in-road device information can be applied to a broad area, such as a canyon or a corridor, and whether it could be reliably used to drive any automatic information services.

In this section, the type of point sensor equipment UDOT currently is using will be reviewed. Second, the results of the information search from published literature and contact with RWIS equipment vendors is provided.

## Equipment Used by UDOT

Both commercial road surface sensors and some equipment created "in-house" are being used. UDOT uses the Surface Systems Inc. (SSI) FP2000 and the Vaisala DRS50 road surface sensors. Weather stations and visibility sensors also are used. There was no information about this equipment's area of influence available from UDOT or from the vendors of the equipment. No studies that test the reliability of the RWIS station information were discovered.

## Information Search

The purpose of this search is to determine what work has been done to study the area of applicability of an in-road sensor. Three general areas were searched: published works and equipment vendors.

*Published Works*

To find research in the published works area, several scientific literary indexes were explored that hold information about individual articles published in professional journals and conference proceedings. Only articles relating to general RWIS topics and experiences were discovered. Among these are: McKeever, 1998; Hibbs, 1998; Better Roads, 1992, 1993, 1997; Martinelli, 1998; and Crosby, 1997. No published works were found that related to the area of RWIS station reliability.

*Equipment Vendors*

Sometimes vendors will sponsor research on their products or will at least have information about research that has been done by universities or DOTs that involve their products. For these reasons, three major vendors of RWIS equipment were contacted. These companies are Surface Systems, Inc., Vaisala, and Nu-Metrics. None of the companies, however, were aware of any studies or even in-house research related to this topic. They did, however, share their opinions on the matter.

Each company agreed that they would never give a "guarantee" on RWIS information outside of the immediate vicinity of the sensors. The primary reason for this is that as the distance from the sensor increases, the probability that the conditions are similar to that in the sensor area decreases. This could be a potential area of liability. For example, if the RWIS station were to be used to feed information to a variable message sign in the area, a driver might read the sign and mentally apply the information to the next several miles. If there were some incident caused by this misinformation, this may become a legal issue.

The representative from the Vaisala company also discussed a service that is worth mentioning because it relates to this topic. The service is called "Thermal Mapping," which involves measuring all appropriate environmental variables at an RWIS site. Then use a "sensing" vehicle gathering point data at

several nearby highway locations. This information is used as a differential between each measured point on the roadway. The representative explained that this was a convenient way to "extrapolate" the information measured at the RWIS site and estimate what the conditions are at each mapped point in the surrounding area. He also explained that this is an efficient way to identify optimum RWIS equipment locations. One of the reasons that a general relationship cannot be derived for the reliability of RWIS information away from the station itself is the existence of microclimate areas. These are areas near each other, which have different climates. An example location might be Little Cottonwood Canyon and the Salt Lake Valley.

## CHAPTER 3. RWIS AND ATIS LITERATURE REVIEW

This research explores the dissemination of RWIS through current Advanced Traveler Information Systems (ATIS) technology. A brief discussion of some of the individual ATIS technologies is presented along with descriptions of several research articles.

South Dakota's local transportation assistance program stated in an article that North and South Dakota have joined to form an information system available via telephone. This system allows users to input their location and then receive information for that site (SD LTAP 1997).

Arizona uses many different methods of dissemination. One of the most unique is their kiosk system. In the past, kiosks generally have not been well accepted by the public. To overcome this lack of enthusiasm, Arizona selected a private company to produce a well-received, well-liked kiosk. With them, Arizona has created a kiosk system that is convenient and reliable. This system joins all the features of a normal kiosk and adds some features of the Internet. Arizona's kiosk system gives up-to-date weather and traffic information as well as visitor and community information. They are available at rest areas and many service stations throughout Arizona. Joining with a private firm also has other advantages. Risk has been reduced; the private firm supplied a certain number of kiosks and the service for them. Since their implementation, the new system has had a positive response from travelers (AZTech 1999).

In many of the major cities a system called SmarTraveler is being used. This system provides up-to-the-minute reports concerning road and traffic conditions for a variety of different cities. This system allows you to pick certain routes to see what the traveling conditions look like. This information historically has been available by Internet. Recently, this information has been made available in some cities by phone and is broadcasted over the radio and television (SmarTraveler 2000). Many DOT

agencies are providing a web site so the public can use it for pre-trip information. Among these are California, Minnesota, Nevada, and Washington.

Atlanta has experimented with interactive television. Interactive television is similar to conventional television, but it allows a traveler to directly query for specific information at any point in time to receive real-time information. This system was tested during a four-month period in 1996, which included the Summer Olympics, in three hundred rooms at the Crown Plaza Hotel. Ninety-eight percent of the guests used the system. Nearly half of all the inquiries included access to real-time traffic information (GCM 1997).

Highway Advisory Radio (HAR) system, commonly "broadcast only" systems, use the conventional AM broadcast band radio in the vehicle. They are short-range transmission systems limited to only a few miles. These systems can provide travelers with information regarding construction activities, special events, road closures or hazards (GCM 1997).

In-car navigation units also may be used. In-car navigation systems use a database in the car to give directions to the driver. These systems are being merged with wireless voice and data communications to provide detailed information to a driver about road conditions, hazards, accidents, and alternate route information and directions (Trimble 2000). The systems are not well known because they are relatively new and have only a limited installation base.

Seattle conducted a study to determine which type of dissemination device was easiest to use (Wetherby, 1998). In this study, Seattle officials investigated three specific devices, a Seiko message watch, a Delco in-car navigation system, and a PC based device. They found that Seiko Information Watches were the most popular (see Figure 3.1).

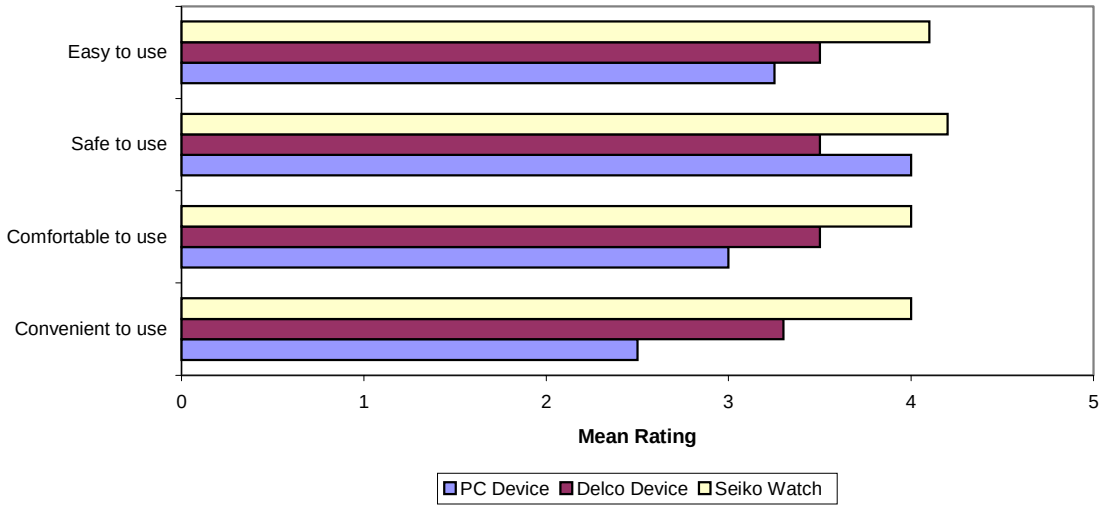


**Figure 3.1 Seattle real-time information device survey results**

The FORETELL project has found that a multi-state system could be valuable for travelers. A study conducted for the Wyoming Department of Transportation recommended a similar multi-state network (Davies, 1998; French, 1993; WY DOT, 1988). The study also concludes that the most important characteristics of information released to the public are:

- Timely and accurate. The reports must contain detailed information for specific locations.
- Accessible from multiple means. This includes radio, TV, conventional and cellular telephone, pager and Internet. The information must be available on demand and in customizable packages.
- Flexible. Users need flexibility in delivery formats and information selection. There is too much information to provide all the data to everyone.
- Upgradeable. The system must be open to upgrades and new technology.

Traveler information is one of the most important responsibilities of Finnra, in Finland (US DOT, 1997). The goals that Finnra tries to reach are as follows:

- Communication from all data sources to the media should be as automatic as possible.
- Data processing and deduction also should be as automatic as possible.
- All parties should have the same information on the service level with no contradictions.
- The information should be easily interpreted by end users.
- Information should be easily available to the road users.

The weather-controlled signs along E 18, between Kotka and Hamina (Finland), are an excellent example of the traveler information principles. Safe driving speeds are determined and displayed automatically based on RWIS sites. There also are several slippery road warning VMS along the length of the corridor (US DOT, 1997).

Road users can obtain information before and during trips about prevailing road and traffic conditions using TV, radio, Internet, in-vehicle information systems, telephone systems, VMS, and kiosks (US DOT, 1997).

In Finland a public poll was conducted to determine which information services the public used most frequently. The results were as follows, in order from most to least used: (US DOT, 1997)

1. local radio
2. speed and temperature displays along the road (VMS)
3. commercial radio
4. newspaper
5. maps of work zones
6. kiosks

More than 44 percent of all Finnish drivers polled obtained information about their journey prior to departure.

The Weather Information for Surface Transportation (WIST) System expands the scope of RWIS, which are focused on snow removal and ice treatment (Weather Team, 1998). The WIST System serves all decisions of all surface transportation decision-makers where weather and its impacts are an issue.

WIST is organized on a federal level, with plans to share the information with local agencies upon completion of the project.

According to the paper, transportation decision-makers cannot change the weather, but they do have three basic options to control outcomes:

- Treat — This is what the RWIS system has been used for, it includes plowing snowfall and treating ice.
- Cope — Close routes, alter plans etc.
- Respond — Issue advisories, repair storm damage, patrol severe weather areas etc.

The authors suggest that the WIST System will have its largest benefits from reducing delay and congestion costs. This is because weather affects traffic level of service through lane capacity or through driver behavior and vehicle response. Because WIST would be part of a large ITS system, adjustments could be made throughout the whole system to increase capacity for any weather situation.

According to the authors, "Information systems cannot improve the immediate perceptions of weather conditions, but they may affect behavioral response to those conditions, or prompt management decisions to deny access to unsafe routes." This report cautions that warning drivers with advisories on VMS only works if the warnings are credible.

The authors state that currently RWIS sites generally are too sparse to be able to give weather-risk assessment of specific travel and routes. Since the number of RWIS sites is increasing, weather-risk assessments could be likely in the future.

This paper comments on how trip length determines the type and amount of information needed. The authors provide three fictional scenarios that illustrate how weather information could be used by different decision-makers.

*Example 1: A Morning Commuter*

This example is idealistic, but some aspects also are practical. In this example a commuter uses the radio, the internet, an information service provider ISP, and variable message signs for information while en-route to work. The radio station news says that heavy overnight rains have flooded low-lying areas, and slick roads already have caused some accidents. The Internet allows the commuter to check the regional Traffic Management Center's (TMC) web site showing traffic flows on major routes and incident warnings. An information service provider (ISP) also provides an email message every day tailored to the commuter's route. The TMC website uses information from RWIS sensor sites and the National Weather Service (NWS) to make recommendations and post warnings. While driving, the radio gives voice messages every 10 minutes, which provides updates on significant road conditions. VMS along the way warn of slick roads. This is reinforced by news of more accidents.

While this scenario maybe idealistic, the ideas are applicable today. Use of the Internet to get specific road conditions is already occurring in states with many RWIS sites. Television and radio stations are connected to the UDOT traffic cameras and give regular updates on conditions. The pieces that currently are missing are: VMS that give accurate road weather information, ISP that give email warnings, and — the largest hurdle for this scenario — the communication between the different entities.

*Example 2: A Long distance vacation traveler*

Navigational systems that have an interface with the car radio receive subcarrier messages on road conditions, and can reroute accordingly. The problem with this technology is that not all vehicles have on boar navigation systems and not all FM stations carry this service.

Cell phone travel information numbers also are available in some areas. These numbers are accessible by cell phone and give current road conditions and advisories. The problem with this is that many people will call while driving and there already are many people concerned with cell phone use while driving. Studies also have been done that show that this is not a safe practice. Another problem is that such numbers are not yet set up everywhere.

*Example 3: A Common Carrier Truck*

The dispatcher for the trucker's company could use new routing software that can give risk evaluations of different routes. The trucker is always in contact with the dispatcher via satellite link to the driver's mobile terminal.

The Advanced Transportation Weather Information System (ATWIS) in North and South Dakota are showing good use of cell phones and the Internet for route-specific weather information (South Dakota Local Transportation Assistance Program 1997).

Items of interest to different transportation decision-makers:

- road surface temperature
- ambient air temperature
- wind speed and direction
- precipitation, type and amount
- visibility

- pavement surface salt concentration
- pavement coverage: snow, ice water
- air pollutant concentrations

Most of these items currently are used with an RWIS system. Much of this information is available through the NWS. The NWS is limited in the scope of weather information it can supply and interpret; this makes an independent vendor necessary. Although most RWIS systems are an end-to-end package, individual components are increasing in availability. This means that you buy the data from the source to the display; therefore there is no way to mix in other information from the NWS or other sources. The authors suggest that this is why a current RWIS user usually has at least three separate information feeds and physically separated displays. Utah is one of the few states that is not constrained in this way.

The authors of this report suggest using some form of statistical decision principles to smooth out individual sensor error although no methods were suggested.

## Informal Survey of Other DOTs RWIS Experience

Thirteen "cold weather" states were contacted with regards to their RWIS equipment. These are: California (2 districts), Iowa, Idaho, Kansas, Maryland, Minnesota, Montana, North Dakota, Ohio, South Dakota, Virginia, and Washington. The informal survey revealed several interesting items, listed below. The full survey results are located in Appendix A.

- All of the surveyed states have RWIS equipment. The number of stations ranges between 14 and 92 operational and planned RWIS sites.
- Most sites consist of surface and sub-surface equipment. A fewer number of sites have additional atmospheric detection capabilities.

- Most all of the states purchase equipment from SSI inc. A few others also purchase from NuMetrics (Qalimetrics). No states had purchased any RWIS equipment from Vaisala.
- Most states generally are satisfied with the performance of their equipment. Many report some motherboard failures and that the analog equipment from SSI requires frequent maintenance. Several states also complain about SSI's service.
- Several states report that their RWIS data is good, but not without error. Most agree that the pavement sensors are the most valuable and that the precipitation sensors are the least accurate.
- Many states are using the SCANWEB software from SSI Inc. Others are beginning to try out the Nu-Metrics and Qualimetrics software.
- During a storm, the pavement sensors are the most valuable, being used largely by the maintenance crews.
- Most states refer people to the NWS for weather forecasts. Others incorporate the RWIS info with their general traffic conditions reports. North Dakota provides the RWIS data to a private weather forecasting company to provide "meso-scale" forecasts for planning.
- Sixty-four percent of the surveyed states provide or will provide RWIS info over the WWW in the near future. Others reply on radio, television, telephone, and press releases. California District 2 has a system with automatic RWIS info displayed onto a VMS. No more details were provided.

# CHAPTER 4. TYPE AND AMOUNT OF RWIS INFORMATION TO GIVE TO THE PUBLIC

## Survey Objectives

One of the main objectives of this research is to determine what weather related information people want and need, and how they want to receive it. The UDOT technical advisory committee recommended that the best way to meet this objective was to ask the public through a series of surveys.

## Survey Design

The assumption was made that the traveling public could be divided into four main user groups. This stratification, suggested by the TAC, provides more detailed information about the needs, commonalities, and differences of each group. The groups are defined as follows:

- **Commuter** – a person who travels to or from work and/or school on a regular basis.
- **Traveler** – one who makes an infrequent long-distance trip. "Long-distance" was defined as traveling 150 miles or more during the trip.
- **Trucker** – one who runs and operates long-haul or other commercial vehicles.
- **Recreational traveler** – one who travels in conjunction with any recreational activity. This group includes sport enthusiasts, spectators, shoppers, and other miscellaneous drivers.

It is assumed that drivers in the commuter group are traveling routes they are familiar with and travel on daily. Because of the regularity of the trips, it was assumed that the commuter would be familiar with conditions and critical points along the route where caution should be taken.

The traveler group was intended to include people traveling in Utah and those traveling from outside the state. Although the population of this group is smaller than the commuter group, drivers

generally are less familiar with the conditions and surroundings. Due to this unfamiliar traveling environment, it was decided that "travelers" might have special needs to which RWIS information could specifically be applied to help them as they are traveling through the state. With additional information, the likelihood of a traveler being "surprised" by the weather and road conditions could be reduced.

In the trucker group, long-haul and commercial vehicle operators must comply with special regulations because of the size, maneuverability, and high profile of many of the vehicles. The size and behavior of the vehicles makes it necessary to provide accurate and reliable information to the vehicle operators and their dispatchers. It also helps them to be more efficient in their operations and increases safety.

Recreational trips generally are more discretionary than commuter trips. The frequency of some recreational trips, such as those traveling to participate in winter sports activities, may increase because of the inclement weather. Conversely, other types of recreational trips will decrease because of people who avoid travel in adverse conditions.

Each of the user groups essentially used the same questionnaire with only minor changes to tailor the questionnaire for each user group. Each of the four blank questionnaires can be found in Appendix B. The survey focused on answering the following, more detailed questions:

- What information is available from RWIS-ESS that the road users potentially could use to make travel easier and safer?
- What information about the road conditions does the public need to make travel easier and safer?
- How much information about the road conditions does the public need to make travel easier and safer?
- In what ways would the public like to receive all available information regarding the road conditions so that it is easy and accessible to retrieve it?

- What level of accuracy does the public demand so they will rely on the information provided to them by RWIS-ESS?

The objective of these questions can be summarized into two parts: What information does the public want and how the information should be presented to be useful to the most users. The surveys provide some insight into the answers of these questions, which can help in the development of a plan to take RWIS information to the traveling public. A more extensive look is taken at these questions and is explained better as the survey is described in more detail.

## Survey Method

The TAC helped in the design of a relevant and statistically significant survey. Each question was set up such that the response is given as an importance or significance on a scale of one to seven, where 1 is unimportant or unnecessary and 7 is very important or necessary. The responses were assumed to follow a normal distribution along the scale. From this assumption, a worse case calculation was performed to determine the minimum sample size required so that the survey would produce a confidence of 95 percent with an error of +/- 0.5 on the 1-7 scale. Therefore, based on the worse case scenario, 270 completed surveys would be required. Since the standard deviation for each portion of each question is calculated from the results, the error varies within the 95 percent confidence (Gonick and Smith 1993).

The surveys were all performed in April in an attempt to solicit answers from drivers with winter driving fresh on their minds, but without being biased by mid-winter conditions. For instance, a driver may be influenced by current severe weather, or may be unconcerned about weather during the summer months.

A professional telephone survey company was hired to survey the commuters. The professional survey company was used to ensure that the sample being collected was completely random. The

company used a system to minimize business and fax phone numbers. The survey company completed the surveys with pen and paper from which the results were then inserted into a spreadsheet to find the average and standard deviation.

The respondents' ages were fairly evenly distributed between the 19-35 and 36-50 age groups. The general working population tends to be distributed between these age groups. The majority of commuters (46 percent) drive less than 15 miles a day. Also, about one-half of the respondents live and work in the Wasatch Front, as does half of the population of Utah. The number of male and females was nearly equal.

The traveler group survey was performed with the help of the Welcome Centers from the state of Utah. A stack of surveys was mailed to the Welcome Centers to be placed on the front desk. Individuals would then take time to fill out the survey and give it back to the Welcome Center to be mailed back to the Utah Traffic Lab. The surveys were analyzed in the same manner as the commuter group. People from the state of Utah were allowed to fill out the survey as were people who live outside of Utah, although the majority of respondents were people who lived in neighboring states. Even though the majority lived close to Utah, there were few who traveled to Utah on a regular basis. The majority of people (38 percent) made either one trip or no trips to Utah in a year. From these characteristic profiles of the traveler group, the respondents seem to be typical and representative of the general population. However, the traveler group tended to be a little older than the other groups. One-half of the respondents were 55 or older. The group as a whole is older than the general population of travelers and the results will carry their bias. Only 127 surveys were completed due to the fact the standard deviation was low enough to be able to have the desired level of significance and error with only 99 completed surveys.

The trucker surveys were not as successful. The survey was faxed to the Utah Motor Traveler's Association (UMTA) list of registered trucking companies. The companies were asked to fill out the

form and fax the form back. Unfortunately, few responded. A reminder was faxed a second time, and again, few responded. It was decided that short of going out and performing the surveys in person, the results of what was received would be satisfactory. The significance level remained at 95 percent, but the allowable error was increased to +/- 1.0. Because it was assumed that the dispatchers primarily would complete the survey, profiles were not requested. Of the completed surveys, the majority of companies are multi-state and medium in size (21-200 trucks).

The recreational group included all winter sports and activities. Since it is impossible to get a reasonable sample from all the possible sports and activities, three activities were focused on. The first activity that was focused on was that of snowmobiling. During one Saturday morning, surveys were performed at a snowmobile parking lot at Monte Cristo, which is about 40 miles north east of Ogden. The survey was distributed to people as they were either unloading or loading their snowmobiles. The majority of people that were asked to fill out the survey did so. Those that did not fill the survey out were primarily those who were in a hurry. Those that answered the surveys were fairly diverse and representative of snowmobilers in general. The next activity that was focused on was that of skiing. Again on one Saturday morning, surveys were collected at two of the local ski resorts (Brighton and Solitude). Both of the resorts are located in Big Cottonwood Canyon and are within 5 miles of each other. Despite having prior permission to survey people in the parking lot, the managers at Solitude requested that the surveyors leave. The vast majority of surveys that were completed by skiers were completed at Brighton Ski resort. Again, the respondents completed the survey as they stood in line to buy lift passes as well as in the parking lot as they were getting ready. The last activity that was focused on was that of spectators. Surveys were completed in front of the Delta Center before a Utah Jazz basketball game. The respondents were stopped as they were going into the Delta Center and were asked to fill the survey out.

There were 137 completed surveys from the recreation group. The distribution of completed surveys for each of the activities is 32 snowmobilers, 58 skiers, and 47 spectators. The ultimate goal was to get a comparative even distribution of activities that can be representative of the whole. Although the three activities are a small sample of the many local recreational activities available, they are among the most popular. The recreational travelers were fairly evenly scattered between the ages of 19 and 45.

## Survey Results by Question

In the analysis of the surveys, it was important to know what items are most important to the respondents. Since each question is rated on a scale of one to seven with seven always being the most important, the results were ranked according to importance. These tables are provided in Appendix C.

The survey's ultimate goal was to determine the most important devices and information to give to the traveling public. With the current rating system, it was uncertain how people felt compared to other people. Some people might feel strongly toward something and only rate it a six, where as someone else who feels less strongly about the same subject might rate it a seven. Due to the subjective nature of the rating system, a method was devised to distribute the responses to find the most important one. Since both six and seven are rated as important, the method took the percentage of people who rated the question a six and added it to 1½ times the percentage of people who rated the question a seven. This method is used to ensure that the percentage of number seven's have more impact than the percentage of number six's, since seven is a higher rating. This method produces numbers that are greater than 100 percent. Results that received an importance number greater than 0.70 are deemed to be important and valid information for the user group.

The results for each user group's question are compared against the other groups' responses to determine the significance of the item to the population as a whole. Each of the responses was averaged

by taking the level of importance from each user group, calculated from above, and averaging them. It was understood that this method does not accurately describe the distribution between user groups seen on Utah roads, but since the distribution changes throughout the day and year, this was the most logical solution.

As was expected, most of the responses were fairly similar, but there also were some surprising differences. As a whole, knowing about weather affected road conditions is important to each user. The first question asked how important weather-affected road conditions were to each user. The results of this question can be seen in Figure 4.1. This question was asked to find out what initiative people take to find information on their own. It was assumed that the higher people ranked the question, the more initiative people take in finding out the information. The importance of weather-affected road conditions follows the logical assumptions. The truckers need the most information due to the size of their vehicles. Also, travelers find the information helpful since they usually are in unfamiliar surroundings. The recreational travelers use the information a little less since many of them are familiar with the area and know what to expect while traveling through the areas. The commuters are less concerned with traveling conditions because many people have to travel regardless of the conditions. The result of this question is seen in Figure 4.1.

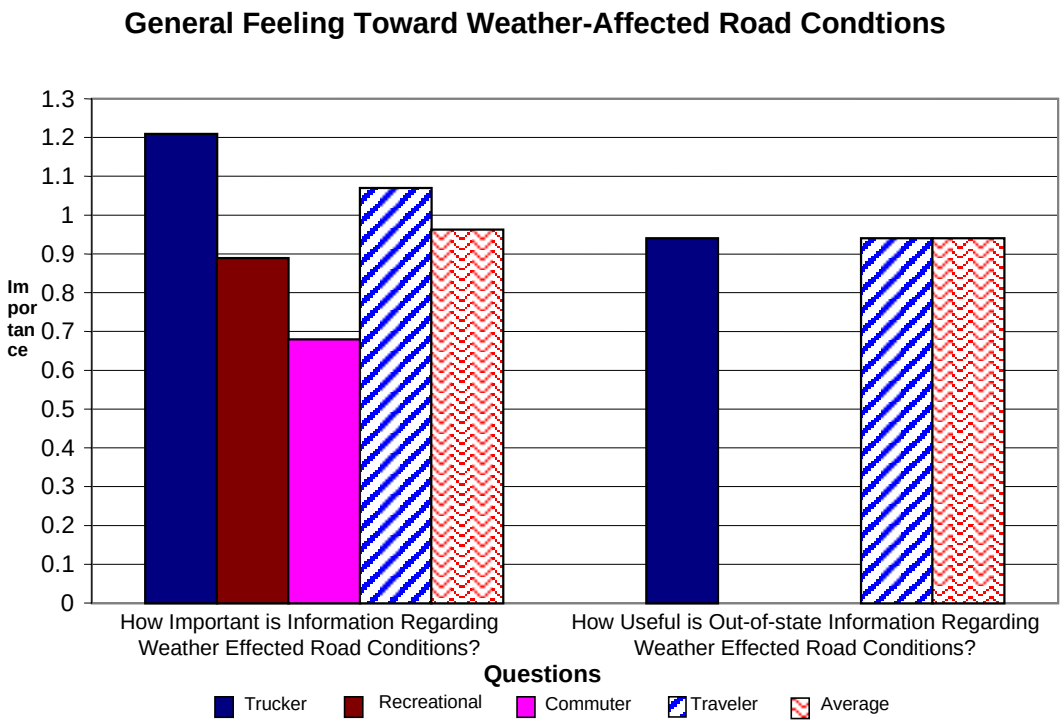


**Figure 4.1 General feeling toward weather-affected road conditions**

Since the questionnaire asked essentially the same question to all user groups, a detailed comparison of each of the questions follows.

***Types of Information Available***

There are many types of information available to disseminate to road users. For example, road users could be informed that the road temperature is 12 degrees Fahrenheit or that the humidity is 22 percent. But what good does that type of raw data do for the majority of road users? To answer this, one of the questions on the questionnaire focused on what type of information is the most helpful. The question gave five types of information that are available and asked how helpful each of them would be.

The five types of information included average travel time, estimated travel time, alternate routes that are available, the road surface conditions, and weather conditions.

The results of this question are shown in the Figure 4.2. The recreational traveler and commuter groups were rather equally distributed in the types of information they would like to have available. The truckers and long-distance travelers find that surface and weather conditions are by far the most important. None of the groups found the average travel times of the estimated travel times helpful. This could be attributed to the fact that few road users are accustomed to receiving that type of information and therefore, it carries less significance for the individual user. Likewise, since the weather conditions, road conditions, and alternate routes currently are given regularly on commercial radio and TV stations, road users find that information the most helpful because it is what they are used to.

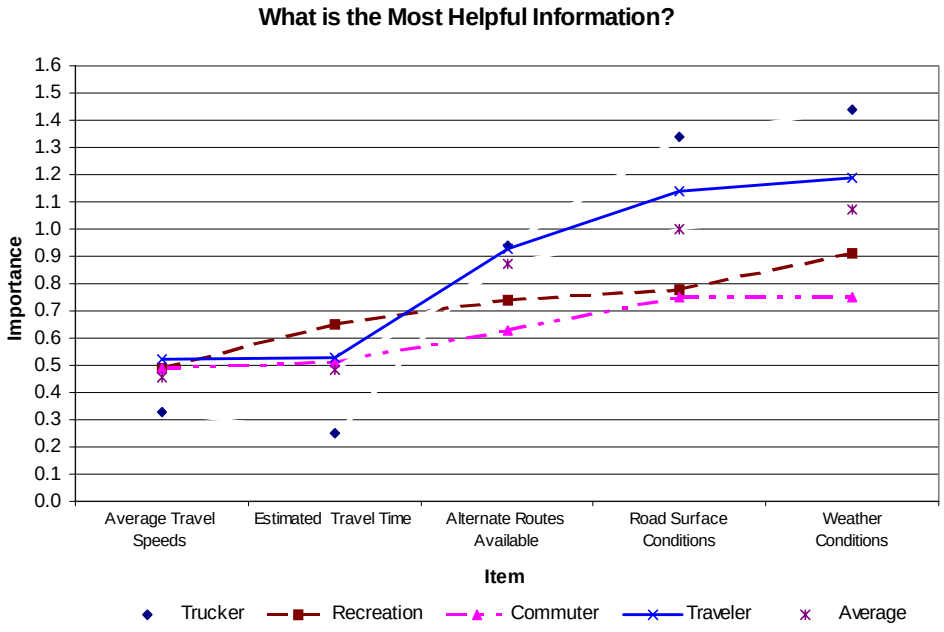


**Figure 4.2 Most helpful type of information**

On almost all accounts, the weather and road conditions are the most important. The results of this question lead directly to the next question, "What specific road and weather conditions are the most important to know about?"

***Road and Weather Conditions***

After determining that road and weather conditions are the most important types of information for road users, the object of attention turns to specific conditions that people want to know about. There is an exorbitant amount of information available. If road users were given all this information, the road users would go into "overload" and start ignoring warnings and information. It is important to learn how much and what information the road users need and want. The following graph shows the results of this question.

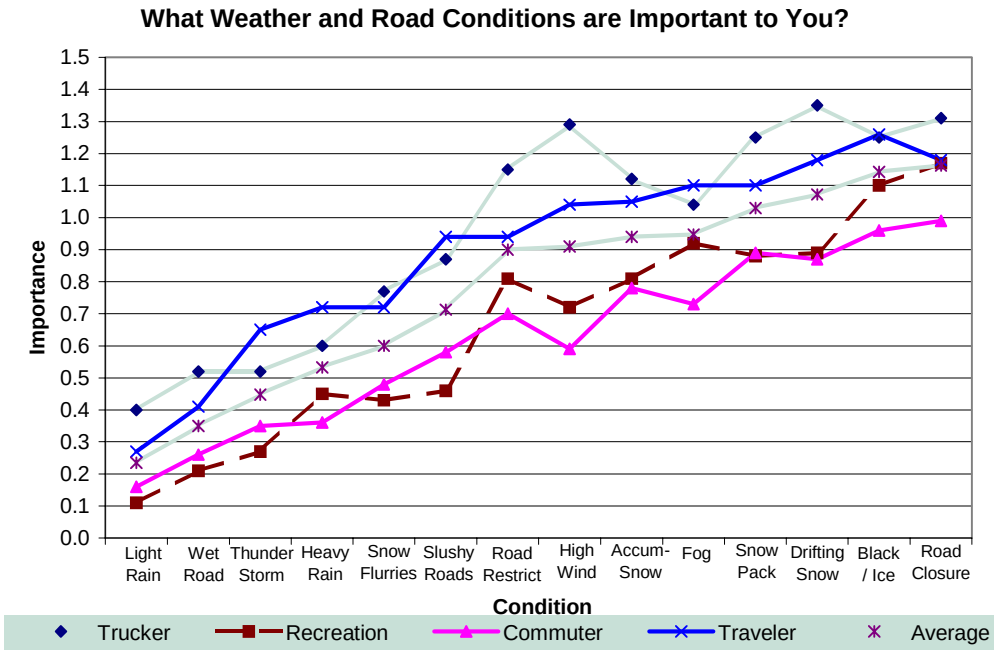


**Figure 4.3 Most important weather and road conditions**

Most drivers are less concerned with rain, wet roads, snow flurries, or slushy roads. There are conditions that are more likely to affect visibility and handling of the vehicle, including road restrictions and closures, high winds, accumulating snow, fog, and ice. There is little value for information regarding conditions that do not significantly alter the driving conditions.

Each of the groups was consistent in its evaluation of the importance of each item compared to the other groups. The trucker and traveler find the information that is given more helpful than the recreational traveler and commuter. One reason for this may be because the traveler and trucker tend to be in strange surroundings, while the recreational traveler and commuter are reasonably familiar with the roads in Utah. Another possibility for differences in the user groups is the time of travel or time on the road. Where truckers are on the road more often, they care more about the conditions. Likewise, since long-distance travelers try to travel many miles in a day, they have a greater need to know what to expect on the road. The distance recreational travelers go varies greatly. The further they go, the more likely they would need information concerning the conditions. Commuters tend to be on the road the shortest amount of time. From the survey, 45 percent of the commuters traveled less than 15 miles in a day, and 26 percent went less than 30 miles in a day. These statistics suggest that the commuter is on the road the least amount of time to complete a trip, and therefore would be the least likely to feel the need for information about weather and road conditions.

### *Sources of Disseminating Information Acknowledgements*

Out of all the different facets of providing the traveling public with RWIS information, the method that each of the groups preferred would be expected to have the most deviation. Since each of the user groups have different motives and resources, the methods that each group prefers varies with their needs.

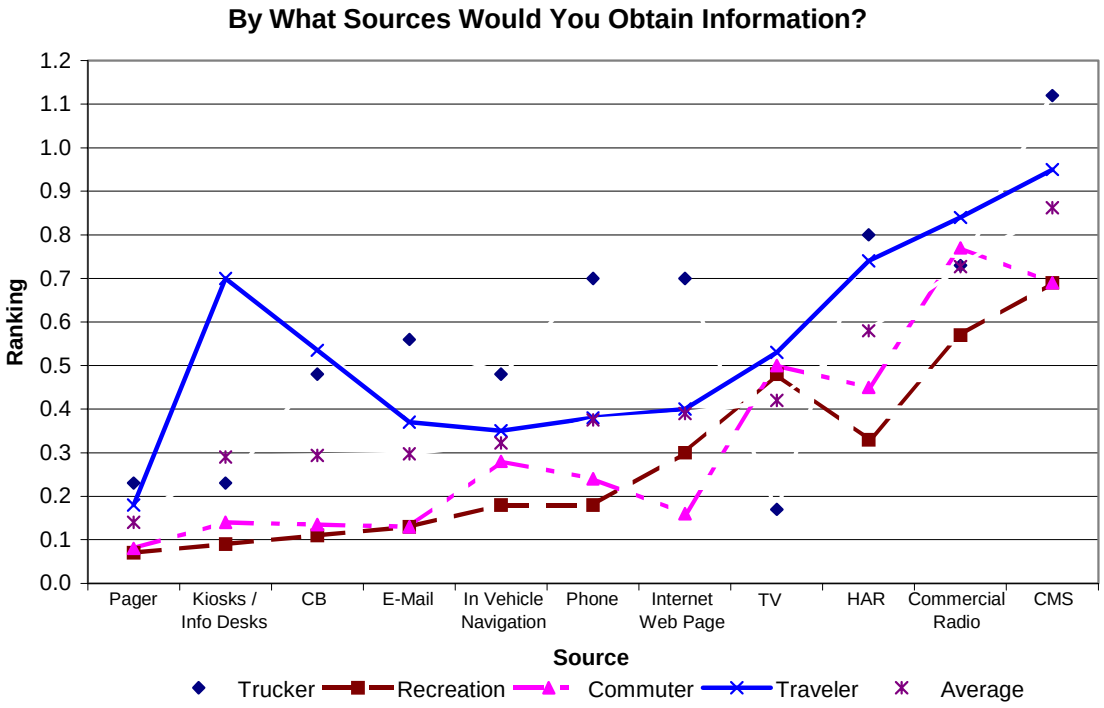


**Figure 4.4 Best sources of dissemination**

There are a few similarities in items shown throughout the user groups — the pager, commercial radio, and variable message signs (VMS). Few people are interested in the possibility of receiving a page on a personal pager. Commercial radio and variable message signs were by far the most popular forms of receiving the information. Once again the commuter and recreational traveler show similar preferences. For both the commuter and recreational traveler, the most helpful methods are the highway advisory radio (HAR), TV, commercial radio, and variable message signs. The long distance travelers are also similar to the commuters except that they find all information more helpful. With the methods that were already mentioned, the long-distance travelers were the only group that found information desks and kiosks helpful, which may be because the surveys were completed at welcome centers across the state. Nevertheless, this method remains important to the long-distance traveler.

The truckers are unique from the other groups of travelers in the methods in which they prefer to receive information. Like the commuters and recreational travelers, the truckers gave low marks to pagers and information desks. The only other low mark that the truckers gave was for TV. This is most likely because few truckers have a TV at their disposal. The truckers gave moderate rankings to in-vehicle navigation, CB (this option was given to truckers only), e-mail, phone, and the Internet. Like the other groups, the truckers gave the highest ranking to commercial radio, highway advisory radio, and the variable message signs.

### *When Information is Sought*

In general, the closer to travel time, the more important it is to look for current and/or projected traveling conditions. The most current and accurate information is what is wanted most by all groups. It is of note that the long-distance travelers like to see what type of conditions to expect a day or two before they actually travel. The other aspect of note is that truckers like to know information an hour or two before travel. This is most likely because many dispatchers completed the survey and they usually need to know reliable information an hour or two before the truckers leave so they have an opportunity to plan routes for the truckers.

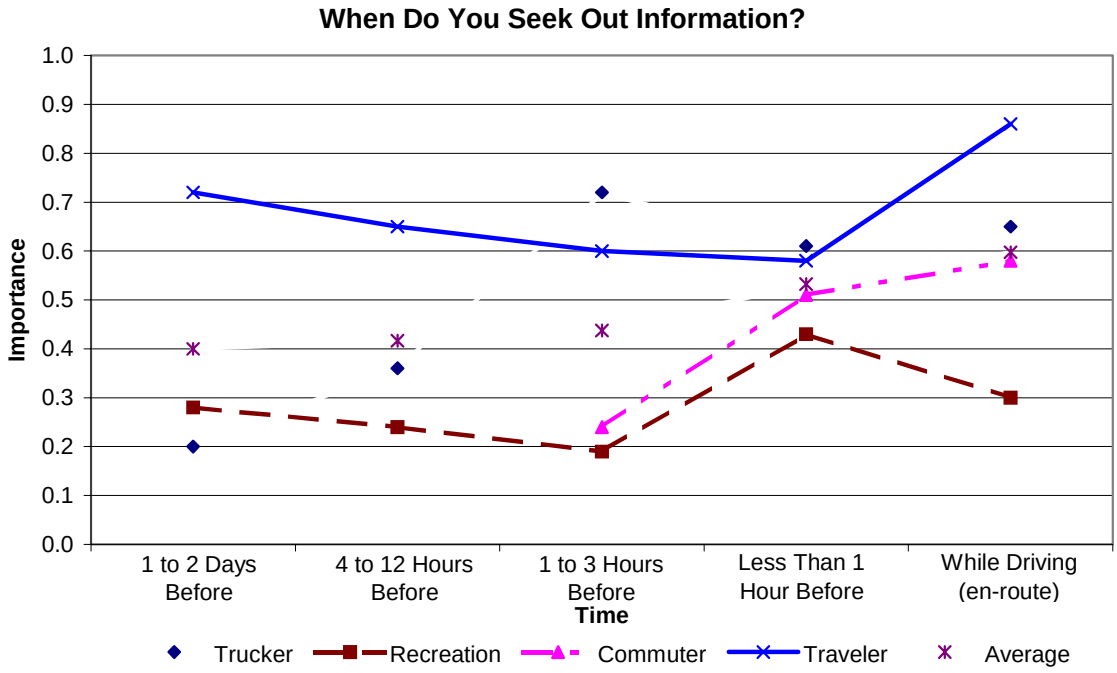


**Figure 4.5 What time road users seek road condition information**

***Information Location Preferences***

If RWIS information is made available to the traveling public, it is desirable to know which locations are the most important. If all the information were being reported all across the state, the information would be helpful for some and obtrusive for others. It is important to the driver to be informed of the "critical" portions of the road so they can be forewarned. The goal of the question was to know how to group the critical portions of road to inform the traveling public. The following phrases inform travelers about the same stretch of road, the only differences are how specific site locations are. For example, the information could read that "I-80 from Salt Lake to the Wyoming border has …," or "I-80 from Salt Lake to Park City has …," or "I-80 at Parley's Summit has …," or "I-80 through Parley's

Canyon has…" Any and all of these phrases could be used at any time for different circumstances, but the purpose of this survey was to find out which phrase to use predominantly.

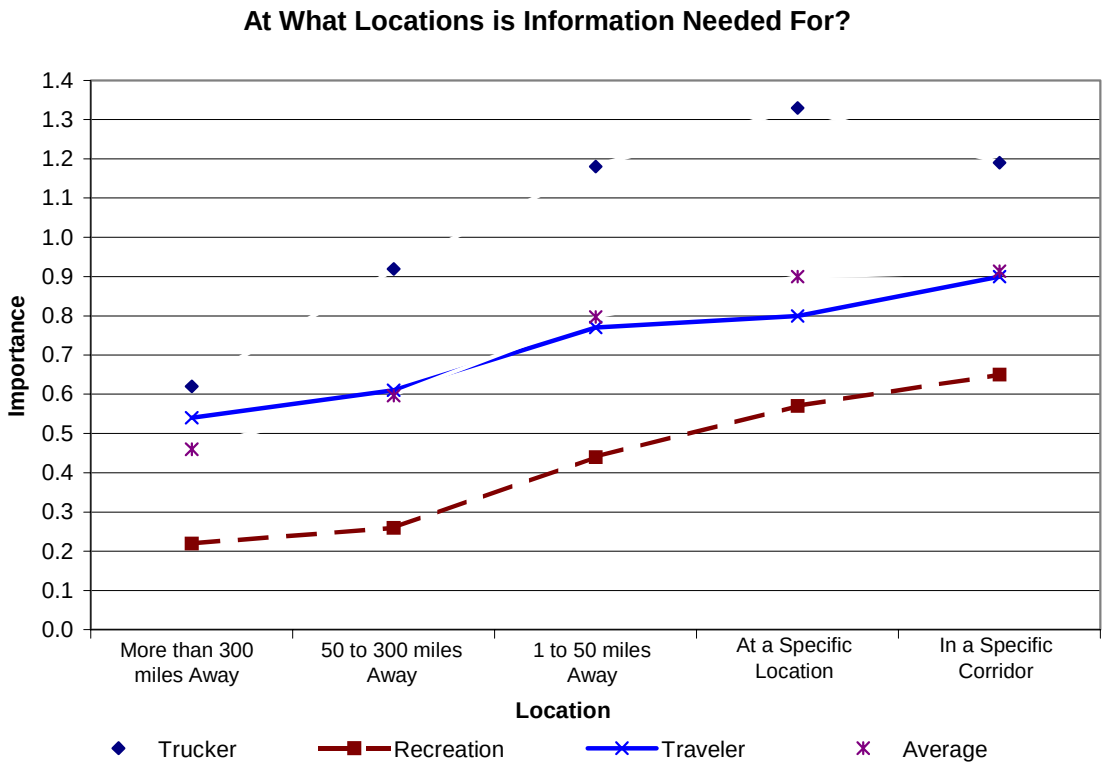


**Figure 4.6 Preferred locations for road condition information**

The results of the survey show that few people are concerned with weather conditions over a large stretch of road. This may be the result of the road users realizing that conditions can vary significantly in short distances. All the user groups provided similar results (the commuter group was not asked concerning location). The most popular responses for location sites were at a specific site and a specific corridor. There was little difference in the rankings that road users gave these two responses.

Truckers tended to like the specific locations better while the recreational and long-distance travelers preferred the specific corridor.

### *Other Important Information for Truckers*

In an attempt to address the special needs of the trucker group, there was an additional question added to their survey, which asked how important it is to be notified of a variety of different items including estimated travel times to current road closures. As has been shown in the previous questions, truckers find most information important and helpful. By using the standard stated before of a ranking of 0.7 as being important, the truckers found that scheduled construction, current lane restrictions, traffic congestion, incidents, and current construction to be important. The most important information requested by the truckers was restrictions relating to FM 49CFR392.14 (FMCSR 392.14) or Utah Regulation UR 600.3. In the trucker survey, the correct code number was mistyped. This number came directly from a trucking specialist on the advisory board, and therefore was not questioned. The correct code is 49CFR392.14. This is a federal regulation that states that commercial vehicles must slow down when conditions dictate such. This error may be evidence that many truckers do not find these regulations to be especially important. Many who filled out the survey may have marked the regulations as important simply because they sounded official. The other possibility is that those filling out the survey realized the mistake and understood what was meant.

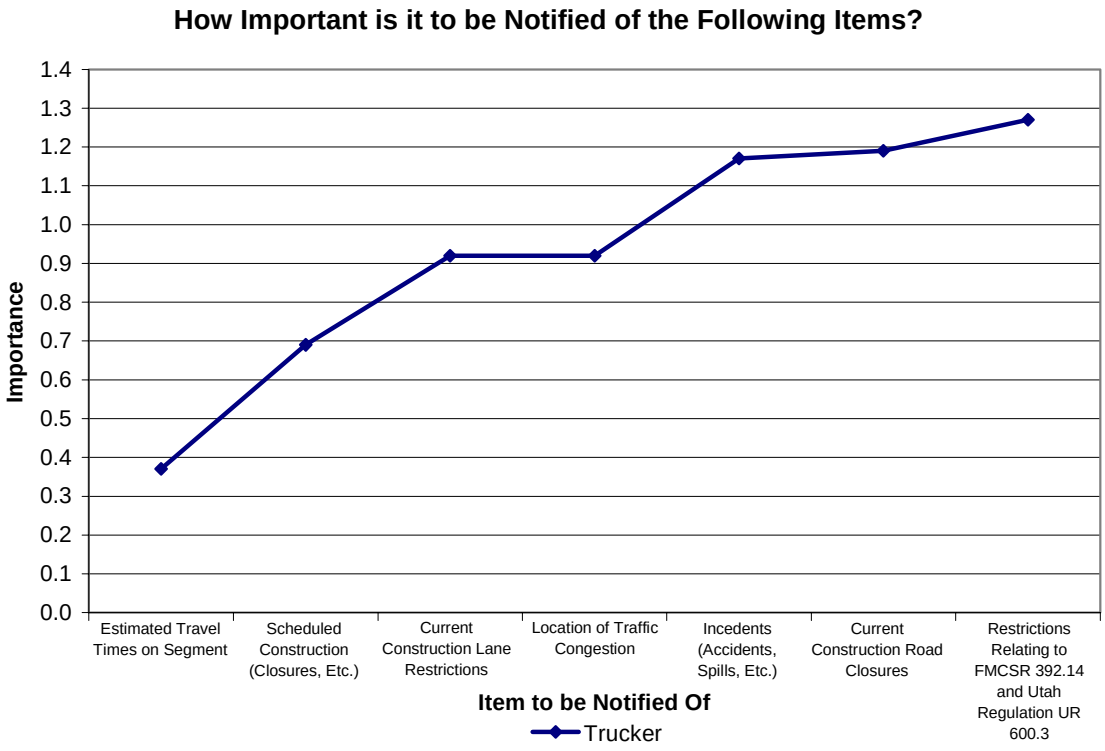


**Figure 4.7 Trucker preference of information notification**

Whether or not those who completed the survey caught and understood the mistake in labeling the regulations and codes becomes inconsequential when the consistency of prior answers are considered. The truckers consistently have rated most information as important. Therefore the importance levels for information regarding construction, incidents, and congestion can be assumed to be correct from these series of questions.

## General Discussion of Survey Results

Prior knowledge of road and weather conditions before traveling can be extremely beneficial to any and all who use the roads. Most people find information regarding weather-affected road conditions

beneficial while traveling long-distances, to recreational sites, or commuting to work. People can use this information to help them plan their route and to help them know with what precautions to take. Truckers and people traveling long distances especially find the information helpful. This can be attributed to the weight and size of the vehicles that truckers drive and the unfamiliar surroundings that long-distance travelers find themselves.

The goal of this research is to determine what information the public wants that is available from an RWIS station. RWIS-ESS are able to measure a variety of physical attributes from the road and surroundings from which the information can be directly disseminated to the public. There are some conditions that require the data from the RWIS-ESS to be analyzed to determine the current road conditions (such as the presence of ice). With the dissemination of RWIS information to the public, it would be easy to include road restriction and closure. The general public believes that information regarding wet roads, rain, thunderstorms, or light snow flurries not to be important. Therefore, these items should be excluded from any RWIS information given to the public. However, they find that information regarding slushy roads, road restrictions and closures, high wind, fog, snow, and ice to be quite important. Thus, these items should be disseminated to the general traveling public.

The methods recommended to disseminate RWIS information are those that the public likes and requests, and/or are easy to implement. There was a high demand from the travelers to have RWIS information available at kiosks and information desks. The top two requested methods were to disseminate information on variable message signs and via commercial radio. Other top options of dissemination include highway advisory radio, television, via the internet, and by phone.

Most of the respondents to the survey tended to want information as fast and easy as possible. The majority of people gave responses that only current road conditions are necessary. There were few people who wanted information a day or two ahead of time, but they were mostly travelers who could get

the information they needed from a weather report. The most popular location for RWIS information to cover is either a specific site or corridor. Road users seem to realize that conditions change rapidly from one point to another. RWIS information should be given as specific as possible. The information should be given for the "critical" locations where the RWIS site is located, unless there is sensible reason to believe that the conditions span the entire corridor at which point information should be given for the corridor. All the information that is disseminated should be primarily focused to within a 50-mile vicinity of the RWIS site.

The truckers pose a special problem. Because of the size and weight of commercial vehicles, they find most information helpful. To assist and be sensitive to the truckers' needs, the primary requirement is to make sure they know how and where to find available RIWS information. Each of the trucking firms should have some form of dispatcher. If the dispatcher has all the options available to them, then they can disseminate information to the individual truckers. Because of this setup, UDOT should leave the option of disseminating RWIS information via CB to the trucking industry.

## CHAPTER 5. RECOMMENDATION FOR DISSEMINATION

The RWIS information that is available can be disseminated in a variety of ways. The preferred display of information is on variable message signs. One reason for this is that little effort is involved to obtain the information. Where UDOT already has invested the money to obtain and install variable message signs, minimal effort would be required to have an operator at the Traffic Operation Center switch a sign that follows Transcore's VMS guidelines.

Most people listen to the commercial radio while they drive. Therefore, providing RWIS information via the commercial radio is an excellent option. UDOT has two options available. The first is to invest in a high-frequency high-power station preferably on the FM dial. This radio station would broadcast information much like the highway advisory radios. The other option, and the one that is recommended, is providing the current radio stations with the RWIS information so they can disseminate this information in their road updates. Some radio stations give traffic updates directly from the Traffic Operations Center (TOC), so it would be easy to disseminate the information. UDOT should give all the radio stations the option of receiving road condition updates from the WRIS sites via the TOC. It is believed that most radio stations will willingly broadcast this information as a service to the listening public.

Highway Advisory Radio is an effective tool for disseminating RWIS information. Highway Advisory Radio should be used in locations where other commercial radios and/or variable message signs are not available. Therefore HAR should be used primarily in remote locations. The HAR could broadcast from the RWIS sites. One complaint that was heard directly while completing surveys for the recreational traveler group was that many times the HAR stations are broadcasting old information. To solve this problem, messages for a variety of conditions could be recorded and stored. If the HAR is

located at the RWIS site, then the RWIS station could flag the HAR recording for the corresponding conditions that it finds. The RWIS station could update which of the HAR recordings to play on a 15-minute interval. Thus the HAR could notify people in remote locations without the use of any additional personnel.

Disseminating RWIS information via the television is an option. Results from the survey suggested that many people, except for truckers, watch TV for information. It is suggested that the RWIS information be made available to television stations as was recommended for radio stations.

There is a high demand from the trucking industry for this information to be available on the Internet. Many other cities and states have their road conditions available on the web. It is recommended that UDOT follow the example of other agencies. UDOT should make a specific site directly related to road conditions with a link to other important and related web sites. Minnesota's DOT has an example of an effective web page design. It has a link that connects to www.smartraveler.com where many of the major cities are detailed with current driving conditions on the freeways. UDOT should make an attempt to include Salt Lake City on the site. Another example of a website can be found from the Washington DOT at www.wsdot.wa.gov/PugetSoundTraffic/. Both of these web sites are interactive with a lot of information.

Disseminating RWIS information via the phone is a costly option and difficult to keep updated with real-time information. Many rely on getting information from calling, so disseminating RWIS information through telephone service should be considered. Creating a dedicated phone number dedicated to RWIS information is something that should be combined with other road information phone services (i.e. congestion, construction, closure, etc.).

In-vehicle navigation systems are not common enough to validate the cost of setting up a system to notify these cars. UDOT should focus its attention of other options of disseminating RWIS

information. Based on the survey, there is not enough interest in receiving e-mails or pages to validate the cost of setting these systems up for the mass public. It would be better to focus on other options that are identified as publicly accepted and preferred forms of information dissemination.

The long-distance travelers requested road condition information at information desks and kiosks. One option available to UDOT that will have a minimal cost would be to follow the example of other states and have a computer located at rest stops and welcome centers. This computer would have access to the UDOT website and all the links they have available as well as the national weather service. Thus, the long-distance traveler's need is recognized and fulfilled with minimal effort and cost by UDOT.

# CHAPTER 6. CONCLUSION

As technology continues to advance, the opportunity to use this technology in a manner that will increase the safety of the traveling public becomes more important. Although RWIS technology is not a new invention, it is becoming reliable enough to where this information can be disseminated to the public without reservation. The advancement of communication technology and the extensiveness of it, makes it possible to disseminate the RWIS information with relative ease. The one caution is not to "overload" the drivers with useless information. The challenge is to make this information available to all who want to access it without burdening those who do not care to know. As a result of this report the following conclusions were made:

- The survey results indicate that drivers prefer road condition information when the conditions alter driving performance (i.e. accumulating snow, ice, high wind for truckers, road closures).
- Conditions by specific location and corridor are preferred over a more general description of area weather.
- Most drivers prefer information en route or one hour prior to traveling
- Communication via radio, TV, and variable message sign are preferred over the more advanced e-mail, Internet, and pager options. The truckers category deviates from the general consensus by preferring internet. This is attributed to the dispatchers being the primary source for the survey.
- No current research exists on the reliable area of influence of RWIS equipment outside the immediate area of the sensors.
- Based on ice and snow accident information, 15 sites were identified as possible future RWIS locations. Four of these locations were within five miles of existing or planned RWIS sites.

- Various recent articles have surfaced since the substantial completion of this report on two RWIS topics. First, the FHWA held its fifth annual Eastern Winter Road Maintenance Symposium and Equipment Expo Sept. 6-7, 2000, at the Roanoke Civic Center in Roanoke, Va. The second article related information about some recent commercial endeavors to disseminate RWIS information to the public. The full text is included in Appendix D.

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## APPENDIX A

### State Survey Concerning RWIS Equipment and Uses.

**1. How many RWIS stations do you have operating across your state?**

**CA (Dist 2)** California District 2 has 7 operational RWIS AND 2 RAWS sites. (RAWS is a low cost atmospheric system)

**CA (Dist 10)** California District 10 has 9 operational RWIS sites.

**IA** Iowa has 50 sites that are currently operational.

**ID** Idaho currently has 15 operational sites and 8 under construction.

**KS** Kansas has 41 sites.

**MD** Maryland has 51 operational sites and 7 sites under construction.

**MN** Minnesota will have 92 when the system installation and integration is completed. (Estimated for June of 2000)

**MT** Montana has 59 sites.

**ND** North Dakota has 14 RWIS sites.

**OH** Ohio has 70 stations in the Columbus, Cleveland, and Toledo areas.

**SD** South Dakota has 36 RWIS sites.

**VA** Virginia has 41 sites.

**WA** Washington currently has 41 existing sites with 3 more planned and 340 weather-only stations.

**2. What main equipment /components are in use for a typical station?**

**CA (Dist 2)** CALTRANS district 2 uses the surface sensors and sub-surface sensors to detect the temperature and chemical make-up. Some locations use a simple precipitation sensor and some use a full precipitation classifier. The visibility sensors for fog are not in use.

**CA (Dist 10)** CALTRANS district 10 uses wind and speed sensors, air, humidity, precipitation, barometric pressure, visibility, and ambient light sensors with RPUs.

**IA** IDOT uses pavement and subsurface sensor, relative humidity, thermometer, wind speeds, precipitation sensors (some basic sensors and several Optical Weather Identifiers (OWI)).

**ID** ITD currently has 15 RWIS sites up and running. Another 8 sites are currently being installed and should be operational in the near future.

**KS** KSDOT uses surface sensors that collect the following data. Subsurface, deck, and approach temperature, humidity, wind direction and speed, ambient temperature, precipitation, chemical factor, and pavement status.

**MD** MDSHA uses the typical SSI installation, weather tower that includes full atmospherics, visibility at 22 locations, SCTI Optic Weather Identifiers on all sites, SSI pavement sensors, and snap shot video at 17 locations.

**MN** MnDOT has a variety of different equipment on their stations. Each one was evaluated individually for equipment needs. They also installed several different brands of equipment (visibility, precipitation sensors, and classifiers) to determine which equipment best suited their needs and was the most cost effective.

**MT** MTDOT's standard unit contains 2 or 3 pavement sensors, met sensors and several have visibility sensors.

**ND** NDDOT's typical RWIS sites all measure atmospheric conditions, pavement conditions, and sub-base temperatures (2 different depths). One site also measures visibility and precipitation rate/accumulation. Solar panels and batteries power all sites. From experience, communication back to server is through telephone lines. We have tried cellular, but it is expensive and unreliable.

**OH** ODOT uses thermal surface and sub-surface sensors that measures moisture type, rate per hour, moisture depth, relative humidity, visibility, dewpoint, freezing point, and wind speed direction and gusts.

**SD** SDDOT uses air temperature, wind speed and direction, humidity, basic precipitation, surface, and sub-surface sensors.

**VA** VDOT has 41 RPU's, 7 CPU's, 133 pavement sensors, 28 sub-surface sensors, 38 full atmospheric stations, 18 Wind speed/Wind direction, and 3 visibility sensors. 39 sites are transmitted by phone line, 2 by radio.

**WA** WSDOT's basic weather instrument array consists of wind speed and direction, relative humidity, air temperature, dewpoint, and basic precipitation sensors. Road sensor array measures subsurface temperature, surface temperature, moisture, chloride concentration and conductivity of pavement moisture, and freezing point of pavement. Some stations have barometric sensors (12 stations) and some WIVIS sensors (2 stations). Sensor arrays from Northwest Weather Consortium stations vary immensely. Best to review observation database supplied by U.W. to confirm individual networks' sensor array.

**3. What company(s), supply your RWIS equipment?**

**CA (Dist 2)** SSI

**CA (Dist 10)** Qualimetrics (Nu-Metrics)

**IA** SSI

**ID** SSI and 3 Nu-Metrics

**KS** SSI

**MD** SSI

**MN** SSI for all new equipment. Older sites have old SSI, Vaisala, and Coastal.

**MT** SSI

**ND** SSI

**OH** SSI

**SD** SSI

**VA** SSI

**WA** Existing SSI and planned Qualimetrics and Nu-Metrics

**4. Are you satisfied with the performance of your RWIS equipment?**

**CA (Dist 2)** CALTRANS district 2 is satisfied so far. They have heard of problems with support from other areas outside of California, and there are integration difficulties with SSI protocol protection.

**CA (Dist 10)** Yes

**IA** IDOT reports that the equipment has been operating relatively well and that repair technicians are a key to equipment reliability.

**ID** ITD is generally satisfied with the performance, however like any electronic equipment there have been breakdowns. When this problem occurs, we have not been completely satisfied with the customer service and promptness of repairs.

**KS** KSDOT is satisfied for the most part. You can always use better reliability, and it would be nice to have components that are interchangeable between manufacturers.

**MD** Yes

**MN** MnDOT said that, "At this point it would be too early to comment, things have not exactly went smoothly but I guess with a project of this size that would be asking a lot."

**MT** Yes

**ND** Yes, but SSI support is not very good.

**OH** Yes

**SD** SDDOT is generally satisfied, but they have experienced repeat motherboard failures requiring them to send them in for repair. Also, during yearly maintenance last summer they had to return 11 precipitation sensors for repair.

**VA** Much of VDOT's equipment is old and has not been maintained. They recently gave a maintenance and upgrade contract to SSI to bring our system up to NTCIP compliance, but there is a long way to go. Many of their pavement sensors have been milled or paved over. This upgrade also includes putting the data on an Internet site so that they can share with whomever they please. Performance satisfaction will be determined after the upgrade.

**WA** WSDOT has mostly of SSI equipment is analog base, not digital. These components require frequent maintenance. Would like to see more solid-state devices. Nu-metric and Qualimetric device show the most promise. Most performance issues reside with network communication issues.

**5. Are you satisfied with the accuracy of your RWIS data?**

**CA (Dist 2)** For the most part, it is not infallible, but a very useful tool, you just need to verify sometimes.

**CA (Dist 10)** Yes

**IA** Yes, although the equipment has never been measured for accuracy levels.

**ID** Since I am at headquarters and the data is primarily used at the district level, I don't have enough information in this area to answer the question properly. However, I have not heard more complaints about any one specific piece of equipment over another.

**KS** Yes

**MD** Yes, but precipitation accumulation could be more accurately tracked.

**MN** Too early to tell

**MT** Not sure, there is no formal analysis that has been done to verify.

**ND** Yes

**OH** Yes

**SD** Yes

**VA** VDOT's equipment is being upgraded to meet NTCIP requirements. Once the old equipment is repaired or replaced, they think that they will be satisfied with the information. The RWIS data is only one tool to monitor conditions. They also use the DTN weather stations, local forecasts, The Weather Channel, video cameras in some parts of the state, and private meteorologists to assist with weather tracking.

**WA** I can't speak for accuracy of current devices. My impression is that the RWIS devices are reasonably accurate. Our people have never expressed this as an issue.

**6. Please name which RWIS equipment has worked the best, and which has had the most problems?**

**CA (Dist 2)** No Comment.

**CA (Dist 10)** Qualimetrics equipment has worked best

**IA** Thermometer has worked the best and precipitation sensors work the worst.

**ID** ScanWeb currently is the best, however as the Nu-metric sites come online we will need to look into some sort of custom software to integrate the data.

**KS** No Comment.

**MD** Pavement sensors have to have the most value, SCTI WIVIS and WI have a lot of communication failures and lens maintenance.

**MN** No Comment.

**MT** Most problems have been with the software used to access the data. Equipment problems are not an issue.

**ND** The equipment worked fairly well, we did have problems with the RPU motherboards at the RWIS sites, but since upgrading 2 years ago, we haven't had any problems. Every once in a while, the server will go down, but don't know if it is SSI's software or our server.

**OH** Equipment works well. Problems are:

1. Unable to 'harvest' sensors for re-use. Resurfacing projects require sensor replacement.

2. Modem dial-up from remote site to central processor. Phone costs can be prohibitive.

3. Phone lines to remote sites can become unstable.

4. Power to remote sites can be cost prohibitive depending on location.

**SD** The best equipment has been the wind speed and direction, air temperature and humidity, and surface sensors. The worst equipment has been modems, motherboards, precipitation sensors and sub-surface temperature probes.

**VA** The atmospheric data along with the visibility data has always worked well. Access to the data in the past has always been a problem when people were not at work. Dialing in with a laptop to the CPU was always a hit or miss venture. The precipitation sensors need cleaning quite often and have been a problem always showing precipitation.

**WA** Bearings in RM young wind sensor need yearly maintenance.

**7. What kind of software processes the data from your RWIS stations?**

**CA (Dist 2)** ScanWeb

**CA (Dist 10)** Qualimetrics - QSoft

**IA** ScanWeb on a LAN

**ID** ScanWeb currently, however as the Nu-metric sites come online we will need to look into some kind of custom software to integrate the data.

**KS** ScanWeb

**MD** ScanWeb

**MN** ScanWeb

**MT** Scan for Windows V 1.5, ScanWeb V 1.0 is used to view the data.

**ND** We use ScanWeb and Scan for Windows.

**OH** 1. SSI proprietary software (scan).

2. ScanWeb

3. ODOT developed web-based software (preferred due to enhanced functionality)

**SD** We contract it with Environmental Technologies Inc., Grand Forks, ND.

**VA** With the CPU's we have been using the SCAN + software. With the move to the Internet, we will be using ScanWeb.

**WA** Upgrading RWIS user software from Scan SCG to Scan for Windows/Scan Web system.

**8. What RWIS data is considered to be most useful before and during inclement weather conditions?**

**CA (Dist 2)** All of it, but mostly maintenance uses it to determine if there will be a need for the snowplows to be operating during off hours (night time), if that is forecasted, the crews get sent home early or told not to come in until later to get the coverage needed for plowing activities. This forecast (Scancast) uses all the information to determine when snow will begin sticking including subsurface probes, surface sensors, temperature, and precipitation sensors. Although the precipitation sensors are useless until the storm has moved in.

**CA (Dist 10)** Wind Speed, and Visibility.

**IA** Pavement temperature, type of precipitation, wind speed and direction.

**ID** Most all the data is useful, however, the pavement temperature, moisture and freeze point information is probably used most.

**KS** Pavement temperature is most critical to the newer Snow/Ice fighting techniques we are trying to implement with the RWIS installation.

**MD** Before the storm the most useful are the pavement temperature, wind speed, wind direction, air temperature, and precipitation. During the storm the factors are pavement temperature and surface status (chemical composition, Ice percentage).

**MN** Precipitation and pavement temperatures.

**MT** Pavement temperature, air temperature, dew point and wind speed.

**ND** Before the storm, pavement temperature, air temperature, relative humidity, and wind are most important. During the storm, pavement conditions, pavement temperature, wind, and air are important.

**OH** Pavement forecasting services (Scancast) and pavement temperature.

**SD** Wind speed and pavement temperature.

**VA** Before the storm, the most useful are the pavement temperature, air temperature and relative humidity. During the storm, the most useful are the pavement temperature, chemical factor, precipitation type, and air temperature.

**WA** Temperature data (air vs. pavement) and moisture information.

**9. How often are your road conditions updated and displayed to the public?**

**CA (Dist 2)** Approximately every 15 minutes, though this information is generated by field personnel through our dispatch office, not with RWIS.

**CA (Dist 10)** The Central Data Platform computer polls at 3-minute intervals.

**IA** The Iowa State Patrol is responsible for updating road condition reports.

**ID** We have not made this information available to the public yet. We have a central server on order and as that goes online we will be able to put the data out to the Internet. Updates will be around 15 to 20 minutes.

**KS** 15-minutes intervals.

**MD** 20-minute updates, but atmospheric information is all that is given to the public.

**MN** 10-minute updates.

**MT** RWIS sites are updated on the web between 15 minutes for some sites with local call, to every three hours for sites that are long distance. Our Road Reporting system updates condition reports twice daily as well as when major conditions change.

**ND** The RWIS data is displayed on the web and updated every hour.

**OH** 5 to 15 minute updates.

**SD** We don't display the information to the public directly. The NWS picks it up once per hour and melds it with their information to update the public. For our internal use we have information updated once per hour over the internet (password protected) but we still have the capability of dialing into each of our four CPUs to retrieve up to the minute information.

**VA** Our RWIS data is updated every 15 minutes however we do not currently share this information with the public. We are planning to when we get the Internet site up and fully operational. We do have a Road Condition map that shows the current travel conditions of all the Interstates and Primary roads. This is updated for any major change as they occur or at 4 hour intervals.

**WA** Varies, remote stations that are long distance are polled less frequently than station within local calling radius of server or directly connected to a network node. Most stations are on a 15-minute polling cycle, but remote ones are 1-3 hour cycles.

**10. Do you rely upon other sources of data to use along with your RWIS data to mitigate road hazards, or issues travel warnings?**

**CA (Dist 2)** We provide links on our web page to some sites such as the weather service to allow people to make informed decisions, but we don't advise based on forecasts to my knowledge. We just give current conditions and inform them of possible delays due to weather conditions if we are seeing difficulties with current traffic.

**CA (Dist 10)** Traffic Monitoring Stations supply traffic volumes and speed.

**IA** DTN, AWOS, vehicle mounted infrared thermometers, NWS, Internet

**ID** Yes, weather and pavement forecasts are useful as are maintenance personnel observations.

**KS** Yes, without question. We urge our personnel to use multiple sources.

**MD** Scan Casts, SSI Forecast products- Precipitation Timing Map, WSI Weather Products - Wx Source.

**MN** We feed our R/WIS data to Meridian weather services (University of North Dakota) and they provide us with site-specific 12-hour forecasts for all 92 R/WIS sites (updated every 6 hours), Current conditions on a statewide map and 36-hour forecasts for 34 areas throughout the state. We also have links to radar and satellite sites on our R/WIS homepage. Along with data from our R/WIS sites we also include AWOS and ASOS sites, info from other states (Iowa, North & South Dakota, and Wisconsin).

**MT** We include the NWS forecast in our Road Condition report

**ND** We rely on our snowplow operators calling in road conditions, which are used to update our road report. The public seems to get the most benefit from our road report on our web page, rather than the RWIS. Our maintenance people rely more on the RWIS data than does the public. Our RWIS data is also used by a private weather forecasting company to give us site specific, meso-scale forecasts which help us plan for up coming storms.

**OH** Some county offices have data transmission network (DTN) satellite based weather stations. They operate independent of in-house computer networks, cable television, etc. We also have computer internet service at all locations.

**SD** Our main source of information is on site observations by our field personnel in conjunction with the Highway patrol if we close highways or issue travel warnings.

**VA** We have conference calls with the National Weather Service during inclement weather, receive reports from a private meteorologist, have access to the DTN weather stations, monitor the Weather Channel, get reports from field offices via a wide area network, view video cameras, and use weather based Internet sites.

**WA** Besides the Consortium data mentioned above, WSDOT uses data from NWS, Northwest Weather Net reports, and Scancast reports. Our state is presently involved with integrating U.W. MM5 forecast output to develop a road surface condition-forecasting model.

**11. Which mode is most often used for issuing your RWIS data to the public?**

**CA (Dist 2)** Not currently done, though we are working on building a TMC and developing a web page that will be linked to our TMC maps that will make the RWIS sites available over the internet. Currently the RWIS data is used exclusively by our maintenance crews and SSI for their ScanCast.

**CA (Dist 10)** A Changeable Message Sign is activated by data set to thresholds to display road conditions to the public.

**IA** Web site: http://www.weatherview.dot.state.ia.us

**ID** We plan to have this data on a web site.

**KS** Our RWIS data is not currently being transmitted to the public. We will have a web-based Road Condition Reporting System going online to the public this month, but that isn't RWIS.

**MD** Website.

**MN** Website and phone info will probably be the most used, along with press releases during poor weather conditions.

**MT** On the internet only.

**ND** Website for RWIS data, website & radio for road report.

**OH** Website. http://webapp3.dot.state.oh.us/otis/rwis/default.asp

**SD** Radio and television.

**VA** We currently do not share RWIS data with the public. We are planning to do that in the very near future. We do provide the public road conditions via either a toll free number or the Internet.

**WA** WSDOT does not formally display raw RWIS data. As for Road condition info WSDOT uses all the systems mentioned in your question to distribute information in some fashion. I couldn't say which is the most frequently used system. WSDOT future plans are to displays road conditions on their statewide traveler information page: http://test.wsdot.wa.gov/rwis/

**12.) Would you like to see improvements (or investments) made in your RWIS system? If so, where?**

**CA (Dist 2)** Maintenance has indicated that the chemical content scale that goes from 0 to 95 should be adjusted. In their experience, anything less than 50 is like having no chemical, and they have readings of 95 where they have had to add chemicals to aid in de-icing.

**CA (Dist 10)** Yes, we would like to expand the system.

**IA** Providing more detailed and accurate road condition information to the public and providing maintenance crews with accurate weather forecasts to support their operations. Several of the Midwest states have been meeting on an annual basis (past five years) to talk and share experiences about RWIS. We usually have 8-10 states in attendance each year and it is a great opportunity to share information and frustrations. This years meeting will be held in Kansas City but I do not know the exact date for the meeting. Peter Caarter from KDOT is coordinating the meeting this year.

**ID** Yes, we have a statewide RWIS plan that includes approximately 45 sites around the state. Once all sites in this plan are installed we will have pretty good statewide coverage. Also installation of cameras in key locations will be useful.

**KS** Component reliability, component interchangeability between manufacturers, increased RPU density in certain areas, and increase data transmission speed to smaller offices.

**MD** Decision Support System - Use historical data to create an operations plan based on weather forecast and conditions.

**MN** It is too early to comment on this, I think that we would eventually like to add more sites but first we must demonstrate the value of the current system.

**MT** Yes, we would like to have the ability to provide better access to current RWIS data and historical data. We get many requests for this information and the existing system is not very reliable or user friendly. We are trying to develop an FTP site that would allow for others to access current or daily data. We would like to have the ability to evaluate other sensors (infrared, etc) that are not SSI compatible. Our current system is dependent on SSI technicians and equipment. We are installing 7 color cameras on mountain passes and we will evaluate those this winter. If they prove useful for both maintenance forces and the traveling public we may install more.

**ND** Yes, we would like to increase the number of RWIS sites. Also we would like to add more sub-base probes at various depths to aid in our research and determination for placing load restrictions. Other improvements would also be, to update our pavement sensors to active sensors rather than passive sensors and to place cameras at some of the sites. We are also planning on installing bridge deck sprayers along with RWIS sites. These sites will probably make use of active sensors.

**OH** Yes. 1. Coverage. 2. Communication costs. 3. In-house installation, maintenance and repair.

**SD** Yes, in the reliability of modems.

**VA** Yes we would like to see some improvements, specifically a system that is non-intrusive into the pavement. Every time we mill or pave a road around one of our RWIS sites, we end up destroying the pavement sensor. We would like to see some other technology such as infrared developed that is

reliable. As far as the existing system, there are no plans to expand the system until we see that the upgraded system fits our needs and is utilized by our maintenance personnel. In the past because of difficulty in accessing the information, the RWIS sites were only used marginally by a few people. By putting this information on the Internet and making it available to everyone, we hope to get this data back into the decision making process. Now, with anti-icing, this data is more important then ever.

**WA** Many of our RWIS system shortfalls are being addressed under a federally funded Traveler Information project currently underway. This project will unify our regional RWIS network into a statewide network, add 12 new RWIS stations into the network, and developed the statewide traveler information website and road surface condition forecasting model mentioned above.

**APPENDIX B**

**Trucker Survey**

**UTAH DEPARTMENT OF TRANSPORTATION**

**Road and Weather Information - Trucking Survey**

This survey will be used to inform Utah Department of Transportation (UDOT) of your firm's opinions and needs concerning weather affected road conditions and other traffic conditions. Please complete the following survey by April 30th and fax to:

Blake Hansen, University of Utah Traffic Lab
Fax: (801) 585-5860 or Mail to:

Attn: Blake Hansen
University of Utah
Utah Traffic Lab
122 South Central Campus Drive
Suite 104
Salt Lake City, UT 84112-0561

**FIRM PROFILE:**

**Which of the following best describes your operations?** (✔ one box)

☐ Multi-state ☐ State of Utah Only ☐ Local Delivery

**Do you consider your firm?** (✔ one box)

☐ Owner/Operator ☐ Small (5-20 trucks) ☐ Medium (21-200 trucks) ☐ Large (over 200)

**Name of your Firm** (Optional):_____ **Home Office City** (Optional):_____

**How important is it to you to be informed of weather affected road conditions during your trip or haul?** (✔ one box using a scale of 1 – 7 with ONE meaning NOT IMPORTANT AT ALL and SEVEN meaning VERY IMPORTANT)

| Not Important at all | | | Moderately Important | | | Very Important | Don't Know |
|---|---|---|---|---|---|---|---|
| ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

**What types of weather related information do you find most helpful?** (✔ one box for each item)

| | Not Important at all | | | Moderately Important | | | Very Important | Don't Know |
|---|---|---|---|---|---|---|---|---|
| Road Surface Conditions (Wet/ Slushy/ Snowy/ etc.) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Estimated Travel Time (between two specific locations) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Average Travel Speeds (on a particular section) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Weather Conditions (snowing, raining, windy, etc.) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Alternate Routes Available | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

**When do you seek out information concerning weather affected road conditions?** (✔ one box for each item)

| | Never | Seldom | Occasionally | Frequently | Always | Don't Know |
|---|---|---|---|---|---|---|
| While Traveling (en-route) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Less than 1 hour before travel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 1-3 hours before travel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4-12 hours before travel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 1-2 days before travel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**How important are the following weather and road conditions to you?** (✔ one box for each item)

| | Not Important at all | | | Moderately Important | | | Very Important | Don't Know |
|---|---|---|---|---|---|---|---|---|
| Light Rain | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Heavy Rain | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Thunderstorms | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Snow Flurries | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Accumulating Snow | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Drifting Snow | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| High Winds | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Fog | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Icy Spots / Black Ice | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Snow Pack | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Slushy Roads | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Wet Roads | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Road Restrictions | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Road Closures | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

**How much would you use the following sources of information about weather affected road conditions, if they were available to you?** (✔ one box for each item)

| | Would Never Use | | | Would Use Moderately | | | Would Use Extensively | | Don't Know |
|---|---|---|---|---|---|---|---|---|---|
| Highway Advisory Radio | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| ("For Road and Weather Conditions Tune to …") | | | | | | | | | |
| Commercial AM/FM Radio | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| TV | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Internet Web Page | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| E-mail | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Phone | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Changeable Message Signs | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Information Desks or Kiosks | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Pager | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| CB | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| In Vehicle Navigation Systems | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |

**How important is it to know of the locations of roadway and weather conditions for each of the following items?** (✔ one box for each item)

| | Not Important at all | | | Moderately Important | | | Very Important | | Don't Know |
|---|---|---|---|---|---|---|---|---|---|
| A Specific Location | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| (i.e. Parley's Summit, Point of the Mountain) | | | | | | | | | |
| In a Specific Corridor | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| (i.e. Ogden Canyon, Provo Canyon, etc.) | | | | | | | | | |
| 1 to 50 mi. from current location | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| 50 to 300 mi. from current location | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| More than 300 miles away | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |

**How often would you use out-of- state weather effected road conditions if it were available to you? (✔ one box)**

| Would Never Use | | | Would Use Sometimes | | | Would Use Frequently | Don't Know |
|---|---|---|---|---|---|---|---|
| ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

**How important is it to you to receive notification of any of the travel restrictions relating to hazardous conditions addressed in FMCSR 392.14 and Utah Regulation UR 600.3? (✔ one box)**

| Not Important at all | | | Moderately Important | | | Very Important | Don't Know |
|---|---|---|---|---|---|---|---|
| ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

**THE NEXT QUESTION RELATES TO NON-WEATHER RELATED TRAVEL/TRAFFIC INFORMATION:**

**How important is the following travel information to your firm/truck drivers? (✔ one box for each item)**

| | Not Important at all | | | Moderately Important | | | Very Important | Don't Know |
|---|---|---|---|---|---|---|---|---|
| Current Construction Road Closures | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Current Construction Lane Restrictions | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Scheduled Construction (closures/ restrictions) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Incidents (accidents, hazardous waste spills, fires, etc.) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Location of traffic congestion (reduced travel speeds) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Estimated travel times on route segments | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

THANK YOU FOR YOUR HELP WITH THIS SURVEY!

PLEASE RETURN (PREFERABLY FAX) TO THE NUMBER LISTED ON PAGE 1.

IF QUESTIONS CALL Blake Hansen, Utah Traffic Lab at (801) 585-5859 or Sam Sherman, UDOT Research at (801) 965-4196

**Commuter Survey**

**UTAH DEPARTMENT OF TRANSPORTATION**

**Road and Weather Information - Commuter Survey**

This survey will be used to inform Utah Department of Transportation (UDOT) of your opinion and needs concerning weather affected road conditions. This information will be used to help UDOT better inform and serve your commuting needs.

**COMMUTER PROFILE**:

What city do you live in? (optional) _____

What city do you work in? (optional) _____

Which age category do you fit in? (✔ one box)

☐ under 18 ☐ 19-25 ☐ 26-40 ☐ 40-55 ☐ 55-65 ☐ over 65

Approximately how many miles do you commute each day? (✔ one box)

☐ 0-15 miles ☐ 16-30 miles ☐ 31-45 miles ☐ 45-60 miles ☐ Over 60 miles

**How important is it to you to be informed of weather affected road conditions while traveling to and from your place of employment?** (✔ one box using a scale of 1 – 7 with ONE meaning NOT IMPORTANT AT ALL and SEVEN meaning VERY IMPORTANT)

| Not Important at all | | | Moderately Important | | | Very Important | Don't Know |
|---|---|---|---|---|---|---|---|
| ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

**How valuable would the following types of information be to you when you are commuting?** (**✔ one box** for each item)

| | Not Important at all | | | Moderately Important | | | Very Important | Don't Know |
|---|---|---|---|---|---|---|---|---|
| Road Surface Conditions (Wet/ Slushy/ Snowy/ etc.) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Estimated Travel Time (between two specific locations) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Average Travel Speeds (on a particular section) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Weather Conditions (snowing, raining, windy, etc.) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

**As a commuter, when do you seek out information concerning weather affected road conditions?** (✔ **one box** for each item)

| | Never | Seldom | Occasionally | Frequently | Always | Don't Know | |
|---|---|---|---|---|---|---|---|
| While Diving (en-route) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | Less |
| than 1 hour before travel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |
| 1-3 hours before travel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |

**How important are the following weather and road conditions to you?** (✔ **one box** for each item)

| | Not Important at all | | | Moderately Important | | | Very Important | Don't Know |
|---|---|---|---|---|---|---|---|---|
| Light Rain | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Heavy Rain | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Thunderstorms | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Snow Flurries | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Accumulating Snow | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Drifting Snow | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| High Winds | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Fog | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Icy Spots / Black Ice | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Snow Pack | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Slushy Roads | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Wet Roads | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Road Restrictions | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Road Closures | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

**How much would you use the following sources of information about weather affected road conditions, if they were available to you?** (✔ **one box** for each item)

| | Would Never Use | | | Would Use Moderately | | | Would Use Extensively | | Don't Know |
|---|---|---|---|---|---|---|---|---|---|
| Highway Advisory Radio | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| ("For Road and Weather Conditions Tune to …") | | | | | | | | | |
| Commercial AM/FM Radio | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| TV | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Internet Web Page | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| E-mail | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Phone | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Changeable Message Signs | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Information Desks or Kiosks | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Pager | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| In Vehicle Navigation Systems | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |

**THAT CONCLUDES OUR SURVEY.**

**THANK-YOU FOR YOUR TIME!**

**Traveler Survey**

**UTAH DEPARTMENT OF TRANSPORTATION**

**Road and Weather Information - Traveler Survey**

This questionnaire will be used to inform the Utah Department of Transportation (UDOT) of your needs and opinion regarding weather affected road conditions. This information will help UDOT better inform and serve you in your traveling needs. **Please take a minute and fill this survey out.**

**Long Distance Traveler Profile:**

What City and State do you live in? (optional) _____

Which age category do you fit in? (✔ one box)

☐ under 18 ☐ 19-25 ☐ 26-40 ☐ 40-55 ☐ 55-65 ☐ over 65

Approximately how many trips do you take in and/or through Utah in a year? (✔ one box)

☐ 0-1 trips ☐ 2-5 trips ☐ 6-10 trips ☐ over 10 trips

**How important is it to you to be informed of weather affected road conditions while traveling in or through Utah?** (✔ one box using a scale of 1 – 7 with ONE meaning NOT IMPORTANT AT ALL and SEVEN meaning VERY IMPORTANT)

| Not Important at all | | | Moderately Important | | | Very Important | Don't Know |
|---|---|---|---|---|---|---|---|
| ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

**How valuable would the following types of information be to you while traveling in or through Utah?** (✔ **one box** for each item)

| | Not Important at all | | | Moderately Important | | | Very Important | Don't Know |
|---|---|---|---|---|---|---|---|---|
| Road Surface Conditions (Wet/ Slushy/ Snowy/ etc.) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Estimated Travel Time (between two specific locations) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Average Travel Speeds (on a particular section) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Weather Conditions (snowing, raining, windy, etc.) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Alternate Routes Available | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

**How important are the following weather and road conditions to you? (✔ one box** for each item)

| | Not Important at all | | | Moderately Important | | | Very Important | Don't Know |
|---|---|---|---|---|---|---|---|---|
| Light Rain | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Heavy Rain | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Thunderstorms | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Snow Flurries | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Accumulating Snow | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Drifting Snow | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| High Winds | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Fog | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Icy Spots / Black Ice | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Snow Pack | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Slushy Roads | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Wet Roads | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Road Restrictions | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Road Closures | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

**As a long distance traveler, when do you seek out information concerning weather affected road weather conditions?** (**✔ one box** for each item)

| | Never | Seldom | Occasionally | Frequently | Always | Don't Know |
|---|---|---|---|---|---|---|
| During your commute (en-route) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Less than 1 hour before travel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 1-3 hours before travel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4-12 hours before travel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 1-2 days before travel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**How important is it to know the location of the roadway and weather conditions for each of the following items?** (✔ **One** Box for each item)

| | Not Important at all | | | Moderately Important | | | Very Important | Don't Know |
|---|---|---|---|---|---|---|---|---|
| A Specific Location | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| (i.e. Parley's Summit, Point of the Mountain) | | | | | | | | |
| In a Specific Corridor | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| (i.e. Ogden Canyon, Provo Canyon, etc.) | | | | | | | | |
| 1 to 50 mi. from current location | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| 50 to 300 mi. from current location | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| More than 300 miles away | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

**How much would you use the following sources of information about weather affected road conditions, if they were available to you?** (✔ **one box** for each item)

| | Would Never Use | | | Would Use Moderately | | | Would Use Extensively | Don't Know |
|---|---|---|---|---|---|---|---|---|
| Highway Advisory Radio | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| ("For Road and Weather Conditions Tune to …") | | | | | | | | |
| Commercial AM/FM Radio | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| TV | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Internet Web Page | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| E-mail | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Phone | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Changeable Message Signs | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Information Desks or Kiosks | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Pager | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| In Vehicle Navigation Systems | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

**How often would you use information regarding out-of-state weather effected road conditions if it were available to you? (✔ one box)**

| Would Never Use | | | Would Use Sometimes | | | Would Use Frequently | Don't Know |
|---|---|---|---|---|---|---|---|
| ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

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**THANK-YOU FOR YOUR TIME!**

**Recreational Traveler Survey**

**UTAH DEPARTMENT OF TRANSPORTATION**

**Road and Weather Information - Recreation Survey**

This questionnaire will be used to inform the Utah Department of Transportation (UDOT) of your needs and opinion regarding weather affected road conditions. This information will help UDOT better inform and serve you in your traveling needs. **Please take a minute and fill this survey out.**

**Recreational and Special Event Profile:**

What city do you live in? _____

Which age category do you fit in (✔ one box)

☐ under 18 ☐ 19-25 ☐ 26-40 ☐ 41-55 ☐ 56-65 ☐ over 65

**How important is it to you to be informed of weather affected road conditions while traveling to or from a recreational site or special event?** (✔ one box using a scale of 1 – 7 with ONE meaning NOT IMPORTANT AT ALL and SEVEN meaning VERY IMPORTANT)

| Not Important at all | | | Moderately Important | | | Very Important | Don't Know |
|---|---|---|---|---|---|---|---|
| ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

**How valuable would the following types of information be to you while traveling to or from a recreational site or special event?** (✔ **one box** for each item)

| | Not Important at all | | | Moderately Important | | | Very Important | Don't Know |
|---|---|---|---|---|---|---|---|---|
| Road Surface Conditions (Wet/ Slushy/ Snowy/ etc.) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Estimated Travel Time (between two specific locations) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Average Travel Speeds (on a particular section) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Weather Conditions (snowing, raining, windy, etc.) | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |
| Alternate Routes Available | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | ☐ |

**How important are the following weather and road conditions to you while traveling to or from a recreational site or special event? (✔ one box** for each item)

| | Not Important at all | | | | | Moderately Important | | Very Important | Don't Know |
|---|---|---|---|---|---|---|---|---|---|
| Light Rain | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Heavy Rain | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Thunderstorms | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Snow Flurries | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Accumulating Snow | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Drifting Snow | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| High Winds | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Fog | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Icy Spots / Black Ice | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Snow Pack | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Slushy Roads | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Wet Roads | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Road Restrictions | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |
| Road Closures | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | ☐ |

**When do you seek out information concerning road weather conditions?** (✔ one box for each item)

| | Never | Seldom | Occasionally | Frequently | Always | Don't Know |
|---|---|---|---|---|---|---|
| During your commute (en-route) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Less than 1 hour before travel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 1-3 hours before travel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 4-12 hours before travel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 1-2 days before travel | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**How often would you use the following sources of information about weather affected road conditions, if they were available to you?** (✔ **one box** for each item)

| | Would Never Use | | | | Would Use Moderately | | | Would Use Extensively | | Don't Know |
|---|---|---|---|---|---|---|---|---|---|---|
| Highway Advisory Radio | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | | ☐ |
| ("For Road and Weather Conditions Tune to …") | | | | | | | | | | |
| Commercial AM/FM Radio | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | | ☐ |
| TV | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | | ☐ |
| Internet Web Page | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | | ☐ |
| E-mail | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | | ☐ |
| Phone | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | | ☐ |
| Changeable Message Signs | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | | ☐ |
| Information Desks or Kiosks | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | | ☐ |
| Pager | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | | ☐ |
| In Vehicle Navigation Systems | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | | ☐ |

**How important is it to know the location of the roadway and weather conditions for each of the following items while traveling to or from a special event or recreational site?** (✔ **One** Box for each item)

| | Not Important at all | | | | Moderately Important | | | Very Important | | Don't Know |
|---|---|---|---|---|---|---|---|---|---|---|
| A Specific Location | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | | ☐ |
| (i.e. Parley's Summit, Point of the Mountain) | | | | | | | | | | |
| In a Specific Corridor | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | | ☐ |
| (i.e. Ogden Canyon, Provo Canyon, etc.) | | | | | | | | | | |
| 1 to 50 mi. from current location | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | | ☐ |
| 50 to 300 mi. from current location | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | | ☐ |
| More than 300 miles away | ☐ 1 | ☐ 2 | ☐ 3 | ☐ 4 | ☐ 5 | ☐ 6 | ☐ 7 | | | ☐ |

**THAT CONCLUDES OUR SURVEY.**

**THANK-YOU FOR YOUR TIME!**

## APPENDIX C

## Trucker Survey Results

Questions

| Survey # | 1 | 2A | 2B | 2C | 2D | 2E | 3A | 3B | 3C | 3D | 3E | 4A | 4B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | 6.577 | 6.760 | 4.208 | 4.500 | 6.917 | 5.833 | 3.500 | 3.565 | 3.739 | 2.864 | 2.273 | 3.846 | 4.962 |
| **SD** | 0.758 | 0.597 | 1.719 | 1.642 | 0.408 | 1.606 | 1.208 | 0.788 | 0.752 | 1.283 | 1.241 | 2.203 | 1.907 |
| **Skew** | -1.478 | -2.443 | 0.040 | -0.064 | -4.899 | -1.422 | -0.516 | -0.234 | -0.218 | -0.168 | 0.577 | 0.138 | -0.390 |
| | | | | | | | | | | | | | |
| **Total Count** | 26 | 25 | 24 | 24 | 24 | 24 | 26 | 23 | 23 | 22 | 22 | 26 | 26 |
| | | | | | | | | | | | | | |
| **1** | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | 0 | 5 | 8 | 6 | 0 |
| **2** | 0 | 0 | 1 | 1 | 0 | 0 | 3 | 2 | 1 | 2 | 5 | 2 | 5 |
| **3** | 0 | 0 | 5 | 5 | 0 | 0 | 7 | | 7 | 8 | 5 | 3 | 1 |
| **4** | 0 | 0 | 6 | 5 | 0 | 5 | 8 | 11 | 12 | 5 | 3 | 7 | 4 |
| **5** | 4 | 2 | 6 | 6 | 1 | 2 | 6 | 2 | 3 | 2 | 1 | 0 | 5 |
| **6** | 3 | 2 | 0 | 2 | 0 | 3 | - | - | - | - | - | 3 | 2 |
| **7** | 19 | 21 | 4 | 4 | 23 | 13 | - | - | - | - | - | 5 | 9 |
| **DK** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | | | | | | | | | | | | | |
| **Percentage** | | | | | | | | | | | | | |
| **1** | 0.00 | 0.00 | 0.08 | 0.04 | 0.00 | 0.04 | 0.08 | 0.00 | 0.00 | 0.23 | 0.36 | 0.23 | 0.00 |
| **2** | 0.00 | 0.00 | 0.04 | 0.04 | 0.00 | 0.00 | 0.12 | 0.09 | 0.04 | 0.09 | 0.23 | 0.08 | 0.19 |
| **3** | 0.00 | 0.00 | 0.21 | 0.21 | 0.00 | 0.00 | 0.27 | 0.35 | 0.30 | 0.36 | 0.23 | 0.12 | 0.04 |
| **4** | 0.00 | 0.00 | 0.25 | 0.21 | 0.00 | 0.21 | 0.31 | 0.48 | 0.52 | 0.23 | 0.14 | 0.27 | 0.15 |
| **5** | 0.15 | 0.08 | 0.25 | 0.25 | 0.04 | 0.08 | 0.23 | 0.09 | 0.13 | 0.09 | 0.05 | 0.00 | 0.19 |
| **6** | 0.12 | 0.08 | 0.00 | 0.08 | 0.00 | 0.13 | - | - | - | - | - | 0.12 | 0.08 |
| **7** | 0.73 | 0.84 | 0.17 | 0.17 | 0.96 | 0.54 | - | - | - | - | - | 0.19 | 0.35 |
| **DK** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.05 | 0.00 | 0.00 |
| | | | | | | | | | | | | | |
| **Error (+/-)** | 0.29 | 0.23 | 0.69 | 0.66 | 0.16 | 0.64 | 0.46 | 0.32 | 0.31 | 0.54 | 0.52 | 0.85 | 0.73 |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.
2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.
3) Errors are given for 95% confidence level.

**Trucker Survey Results Continued (4C-4N).**

Questions

| Survey # | 4C | 4D | 4E | 4F | 4G | 4H | 4I | 4J | 4K | 4L | 4M | 4N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | 4.808 | 5.385 | 6.308 | 6.769 | 6.654 | 6.231 | 6.500 | 6.538 | 5.692 | 4.577 | 6.308 | 6.577 |
| **SD** | 1.855 | 1.768 | 1.225 | 0.587 | 0.629 | 1.142 | 1.030 | 0.948 | 1.594 | 1.922 | 1.123 | 0.987 |
| **Skew** | -0.307 | -0.828 | -1.776 | -2.510 | -1.683 | -1.364 | -2.382 | -2.562 | -0.798 | -0.036 | -1.770 | -2.801 |
| | | | | | | | | | | | | |
| **Total Count** | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 |
| | | | | | | | | | | | | |
| **1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| **2** | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| **3** | 2 | 2 | 2 | 0 | 0 | 1 | 1 | 1 | 5 | 4 | 1 | 1 |
| **4** | 3 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 7 | 2 | 1 |
| **5** | 6 | 4 | 4 | 2 | 2 | 5 | 1 | 2 | 4 | 1 | 1 | 0 |
| **6** | 3 | 5 | 2 | 2 | 5 | 3 | 4 | 4 | 3 | 3 | 6 | 4 |
| **7** | 7 | 10 | 18 | 22 | 19 | 16 | 19 | 19 | 13 | 7 | 16 | 20 |
| **DK** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | |
| **Percentage** | | | | | | | | | | | | |
| **1** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 |
| **2** | 0.19 | 0.12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.12 | 0.00 | 0.00 |
| **3** | 0.08 | 0.08 | 0.08 | 0.00 | 0.00 | 0.04 | 0.04 | 0.04 | 0.19 | 0.15 | 0.04 | 0.04 |
| **4** | 0.12 | 0.08 | 0.00 | 0.00 | 0.00 | 0.04 | 0.04 | 0.00 | 0.04 | 0.27 | 0.08 | 0.04 |
| **5** | 0.23 | 0.15 | 0.15 | 0.08 | 0.08 | 0.19 | 0.04 | 0.08 | 0.15 | 0.04 | 0.04 | 0.00 |
| **6** | 0.12 | 0.19 | 0.08 | 0.08 | 0.19 | 0.12 | 0.15 | 0.15 | 0.12 | 0.12 | 0.23 | 0.15 |
| **7** | 0.27 | 0.38 | 0.69 | 0.85 | 0.73 | 0.62 | 0.73 | 0.73 | 0.50 | 0.27 | 0.62 | 0.77 |
| **DK** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | | | | | |
| **Error (+/-)** | 0.71 | 0.68 | 0.47 | 0.23 | 0.24 | 0.44 | 0.40 | 0.36 | 0.61 | 0.74 | 0.43 | 0.38 |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.

2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.

3) Errors are given for 95% confidence level.

**Trucker Survey Results Continued (5A-5K).**

Questions

| Survey # | 5A | 5B | 5C | 5D | 5E | 5F | 5G | 5H | 5I | 5J | 5K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | 5.840 | 5.583 | 4.667 | 5.240 | 4.880 | 5.640 | 6.320 | 4.000 | 3.958 | 4.500 | 3.957 |
| **SD** | 1.028 | 1.248 | 0.917 | 1.809 | 1.810 | 1.114 | 1.069 | 1.769 | 1.899 | 2.064 | 2.383 |
| **Skew** | -0.405 | -0.426 | -0.725 | -0.756 | -0.585 | -0.187 | -1.377 | 0.051 | -0.060 | -0.421 | 0.078 |
| | | | | | | | | | | | |
| **Total Count** | 25 | 24 | 24 | 25 | 25 | 25 | 25 | 24 | 24 | 24 | 23 |
| | | | | | | | | | | | |
| **1** | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 3 | 3 | 6 |
| **2** | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 4 | 4 | 2 | 1 |
| **3** | 0 | 1 | 0 | 3 | 3 | 0 | 0 | 2 | 2 | 3 | 4 |
| **4** | 3 | 5 | 9 | 3 | 6 | 5 | 3 | 7 | 4 | 2 | 3 |
| **5** | 6 | 4 | 10 | 4 | 3 | 6 | 2 | 5 | 7 | 5 | 1 |
| **6** | 8 | 7 | 4 | 4 | 5 | 7 | 4 | 1 | 1 | 4 | 2 |
| **7** | 8 | 7 | 0 | 9 | 6 | 7 | 16 | 3 | 3 | 5 | 6 |
| **DK** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | | | | | | | | | | | |
| **Percentage** | | | | | | | | | | | |
| **1** | 0.00 | 0.00 | 0.00 | 0.04 | 0.08 | 0.00 | 0.00 | 0.08 | 0.13 | 0.13 | 0.26 |
| **2** | 0.00 | 0.00 | 0.04 | 0.04 | 0.00 | 0.00 | 0.00 | 0.17 | 0.17 | 0.08 | 0.04 |
| **3** | 0.00 | 0.04 | 0.00 | 0.12 | 0.12 | 0.00 | 0.00 | 0.08 | 0.08 | 0.13 | 0.17 |
| **4** | 0.12 | 0.21 | 0.38 | 0.12 | 0.24 | 0.20 | 0.12 | 0.29 | 0.17 | 0.08 | 0.13 |
| **5** | 0.24 | 0.17 | 0.42 | 0.16 | 0.12 | 0.24 | 0.08 | 0.21 | 0.29 | 0.21 | 0.04 |
| **6** | 0.32 | 0.29 | 0.17 | 0.16 | 0.20 | 0.28 | 0.16 | 0.04 | 0.04 | 0.17 | 0.09 |
| **7** | 0.32 | 0.29 | 0.00 | 0.36 | 0.24 | 0.28 | 0.64 | 0.13 | 0.13 | 0.21 | 0.26 |
| **DK** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 |
| | | | | | | | | | | | |
| **Error (+/-)** | 0.40 | 0.50 | 0.37 | 0.71 | 0.71 | 0.44 | 0.42 | 0.71 | 0.76 | 0.83 | 0.97 |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.

2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.

3) Errors are given for 95% confidence level.

**Trucker Survey Results Continued (6A-9F).**

Questions

| Survey # | 6A | 6B | 6C | 6D | 6E | 7 | 8 | 9A | 9B | 9C | 9D | 9E | 9F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | 6.731 | 6.500 | 6.360 | 5.680 | 4.640 | 5.600 | 6.542 | 6.462 | 5.808 | 5.538 | 6.500 | 6.000 | 4.346 |
| **SD** | 0.604 | 0.990 | 1.319 | 1.930 | 2.343 | 1.915 | 0.884 | 0.948 | 1.357 | 1.449 | 0.906 | 1.131 | 1.832 |
| **Skew** | -2.191 | -1.742 | -3.103 | -1.469 | -0.456 | -1.269 | -2.200 | -1.713 | -1.184 | -0.639 | -1.576 | -0.718 | -0.051 |
| | | | | | | | | | | | | | |
| **Total Count** | 26 | 26 | 25 | 25 | 25 | 25 | 24 | 26 | 26 | 26 | 26 | 26 | 26 |
| | | | | | | | | | | | | | |
| **1** | 0 | 0 | 1 | 2 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| **2** | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 |
| **3** | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 4 |
| **4** | 0 | 2 | 0 | 2 | 2 | 5 | 2 | 2 | 5 | 4 | 1 | 4 | 7 |
| **5** | 2 | 3 | 3 | 4 | 4 | 0 | 0 | 2 | 1 | 7 | 4 | 4 | 4 |
| **6** | 3 | 1 | 4 | 2 | 2 | 4 | 5 | 4 | 9 | 3 | 2 | 6 | 2 |
| **7** | 21 | 20 | 17 | 14 | 9 | 13 | 17 | 18 | 10 | 10 | 19 | 12 | 5 |
| **DK** | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | |
| **Percentage** | | | | | | | | | | | | | |
| **1** | 0.00 | 0.00 | 0.04 | 0.08 | 0.16 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 |
| **2** | 0.00 | 0.00 | 0.00 | 0.04 | 0.12 | 0.00 | 0.00 | 0.00 | 0.04 | 0.04 | 0.00 | 0.00 | 0.08 |
| **3** | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.04 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.15 |
| **4** | 0.00 | 0.08 | 0.00 | 0.08 | 0.08 | 0.20 | 0.08 | 0.08 | 0.19 | 0.15 | 0.04 | 0.15 | 0.27 |
| **5** | 0.08 | 0.12 | 0.12 | 0.16 | 0.16 | 0.00 | 0.00 | 0.08 | 0.04 | 0.27 | 0.15 | 0.15 | 0.15 |
| **6** | 0.12 | 0.04 | 0.16 | 0.08 | 0.08 | 0.16 | 0.21 | 0.15 | 0.35 | 0.12 | 0.08 | 0.23 | 0.08 |
| **7** | 0.81 | 0.77 | 0.68 | 0.56 | 0.36 | 0.52 | 0.71 | 0.69 | 0.38 | 0.38 | 0.73 | 0.46 | 0.19 |
| **DK** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | | | | | | |
| **Error (+/-)** | 0.23 | 0.38 | 0.52 | 0.76 | 0.92 | 0.75 | 0.35 | 0.36 | 0.52 | 0.56 | 0.35 | 0.43 | 0.70 |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.

2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.

3) Errors are given for 95% confidence level.

**Trucker Survey Results Continued (Profiles).**

Profile

| Survey # | State | State Code | Size | Size Code |
|---|---|---|---|---|
| **Average** | | | | |
| **SD** | | | | |
| **Skew** | | | | |
| | | | | |
| **Total Count** | 24 | | 26 | |
| | | | | |
| **1** | 3 | Local Only | 0 | Owners |
| **2** | 3 | Utah Only | 10 | Small (5-20) |
| **3** | 18 | Multi State | 9 | Medium (21-200) |
| **4** | | | 7 | Large (Over 200) |
| **5** | | | | |
| **6** | | | | |
| **7** | | | | |
| **DK** | | | | |
| | | | | |
| **Percentage** | | | | |
| **1** | 0.13 | Local Only | 0.00 | Owners |
| **2** | 0.13 | Utah Only | 0.38 | Small (5-20) |
| **3** | 0.75 | Multi State | 0.35 | Medium (21-200) |
| **4** | | | 0.27 | Large (Over 200) |
| **5** | | | | |
| **6** | | | | |
| **7** | | | | |
| **DK** | | | | |
| | | | | |
| **Error (+/-)** | 0.00 | | 0.00 | |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.
2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.
3) Errors are given for 95% confidence level.

**Commuter Survey Results**

Questions

| Survey # | 1 | 2A | 2B | 2C | 2D | 2E | 3A | 3B | 3C | 3D | 3E | 4A | 4B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | 4.941 | 5.252 | 4.509 | 4.632 | 5.159 | - | 3.063 | 2.944 | 2.115 | - | - | 2.570 | 3.837 |
| **SD** | 2.131 | 1.948 | 2.156 | 2.002 | 2.022 | - | 1.518 | 1.474 | 1.335 | - | - | 2.004 | 2.168 |
| **Skew** | -0.651 | -0.890 | -0.374 | -0.499 | -0.836 | - | -0.062 | 0.012 | 0.912 | - | - | 1.082 | 0.086 |
| | | | | | | | | | | | | | |
| **Total Count** | 270 | 270 | 270 | 270 | 270 | - | 270 | 270 | 270 | - | - | 270 | 270 |
| | | | | | | | | | | | | | |
| **1** | 33 | 20 | 39 | 32 | 24 | - | 61 | 66 | 129 | - | - | 130 | 58 |
| **2** | 15 | 17 | 31 | 23 | 20 | - | 51 | 47 | 56 | - | - | 41 | 36 |
| **3** | 24 | 16 | 14 | 15 | 12 | - | 36 | 46 | 32 | - | - | 23 | 36 |
| **4** | 24 | 26 | 30 | 36 | 31 | - | 54 | 56 | 31 | - | - | 24 | 23 |
| **5** | 41 | 43 | 53 | 65 | 34 | - | 68 | 54 | 22 | - | - | 21 | 41 |
| **6** | 31 | 39 | 29 | 32 | 44 | - | - | - | - | - | - | 5 | 31 |
| **7** | 101 | 109 | 73 | 66 | 105 | - | - | - | - | - | - | 26 | 45 |
| **DK** | 1 | 0 | 1 | 1 | 0 | - | 0 | 1 | 0 | - | - | 0 | 0 |
| | | | | | | | | | | | | | |
| **Percentage** | | | | | | | | | | | | | |
| **1** | 0.12 | 0.07 | 0.14 | 0.12 | 0.09 | - | 0.23 | 0.24 | 0.48 | - | - | 0.48 | 0.21 |
| **2** | 0.06 | 0.06 | 0.11 | 0.09 | 0.07 | - | 0.19 | 0.17 | 0.21 | - | - | 0.15 | 0.13 |
| **3** | 0.09 | 0.06 | 0.05 | 0.06 | 0.04 | - | 0.13 | 0.17 | 0.12 | - | - | 0.09 | 0.13 |
| **4** | 0.09 | 0.10 | 0.11 | 0.13 | 0.11 | - | 0.20 | 0.21 | 0.11 | - | - | 0.09 | 0.09 |
| **5** | 0.15 | 0.16 | 0.20 | 0.24 | 0.13 | - | 0.25 | 0.20 | 0.08 | - | - | 0.08 | 0.15 |
| **6** | 0.11 | 0.14 | 0.11 | 0.12 | 0.16 | - | - | - | - | - | - | 0.02 | 0.11 |
| **7** | 0.37 | 0.40 | 0.27 | 0.24 | 0.39 | - | - | - | - | - | - | 0.10 | 0.17 |
| **DK** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | - | - | 0.00 | 0.00 |
| | | | | | | | | | | | | | |
| **Error (+/-)** | 0.25 | 0.23 | 0.26 | 0.24 | 0.24 | - | 0.18 | 0.18 | 0.16 | - | - | 0.24 | 0.26 |

Notes: 1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.

2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.

3) Errors are given for 95% confidence level.

**Commuter Survey Results Continued (4C-4N).**

Questions

| Survey # | 4C | 4D | 4E | 4F | 4G | 4H | 4I | 4J | 4K | 4L | 4M | 4N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | 3.744 | 4.409 | 5.267 | 5.437 | 4.714 | 5.000 | 5.693 | 5.489 | 4.744 | 3.656 | 5.193 | 5.819 |
| **SD** | 2.198 | 2.145 | 1.975 | 2.007 | 2.150 | 2.205 | 1.916 | 1.990 | 2.051 | 1.995 | 1.905 | 1.801 |
| **Skew** | 0.123 | -0.342 | -0.930 | -1.111 | -0.530 | -0.733 | -1.386 | -1.128 | -0.568 | 0.135 | -0.939 | -1.577 |
| | | | | | | | | | | | | |
| **Total Count** | 270 | 269 | 270 | 269 | 269 | 268 | 270 | 270 | 270 | 270 | 270 | 270 |
| | | | | | | | | | | | | |
| **1** | 68 | 46 | 23 | 25 | 38 | 37 | 22 | 23 | 32 | 59 | 25 | 19 |
| **2** | 30 | 20 | 12 | 10 | 21 | 18 | 7 | 10 | 19 | 32 | 7 | 6 |
| **3** | 34 | 22 | 21 | 16 | 18 | 14 | 12 | 18 | 27 | 33 | 19 | 6 |
| **4** | 26 | 32 | 24 | 19 | 26 | 20 | 15 | 19 | 23 | 50 | 24 | 17 |
| **5** | 39 | 53 | 33 | 28 | 49 | 38 | 31 | 27 | 47 | 41 | 54 | 33 |
| **6** | 29 | 31 | 48 | 42 | 34 | 32 | 31 | 37 | 51 | 25 | 47 | 34 |
| **7** | 44 | 65 | 109 | 128 | 83 | 109 | 152 | 136 | 71 | 30 | 94 | 155 |
| **DK** | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | |
| **Percentage** | | | | | | | | | | | | |
| **1** | 0.25 | 0.17 | 0.09 | 0.09 | 0.14 | 0.14 | 0.08 | 0.09 | 0.12 | 0.22 | 0.09 | 0.07 |
| **2** | 0.11 | 0.07 | 0.04 | 0.04 | 0.08 | 0.07 | 0.03 | 0.04 | 0.07 | 0.12 | 0.03 | 0.02 |
| **3** | 0.13 | 0.08 | 0.08 | 0.06 | 0.07 | 0.05 | 0.04 | 0.07 | 0.10 | 0.12 | 0.07 | 0.02 |
| **4** | 0.10 | 0.12 | 0.09 | 0.07 | 0.10 | 0.07 | 0.06 | 0.07 | 0.09 | 0.19 | 0.09 | 0.06 |
| **5** | 0.14 | 0.20 | 0.12 | 0.10 | 0.18 | 0.14 | 0.11 | 0.10 | 0.17 | 0.15 | 0.20 | 0.12 |
| **6** | 0.11 | 0.12 | 0.18 | 0.16 | 0.13 | 0.12 | 0.11 | 0.14 | 0.19 | 0.09 | 0.17 | 0.13 |
| **7** | 0.16 | 0.24 | 0.40 | 0.48 | 0.31 | 0.41 | 0.56 | 0.50 | 0.26 | 0.11 | 0.35 | 0.57 |
| **DK** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | | | | | |
| **Error (+/-)** | 0.26 | 0.26 | 0.24 | 0.24 | 0.26 | 0.26 | 0.23 | 0.24 | 0.24 | 0.24 | 0.23 | 0.21 |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.
2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.
3) Errors are given for 95% confidence level.

**Commuter Survey Results Continued (5A-5K).**

Questions

| Survey # | 5A | 5B | 5C | 5D | 5E | 5F | 5G | 5H | 5I | 5J | 5K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | 4.346 | 5.363 | 4.305 | 2.691 | 2.444 | 3.056 | 5.067 | 2.703 | 2.078 | - | 3.041 |
| **SD** | 2.127 | 1.872 | 2.268 | 1.986 | 1.909 | 2.152 | 2.019 | 1.960 | 1.712 | - | 2.317 |
| **Skew** | -0.253 | -0.966 | -0.260 | 0.905 | 1.124 | 0.626 | -0.848 | 0.828 | 1.514 | - | 0.578 |
| | | | | | | | | | | | |
| **Total Count** | 269 | 270 | 270 | 269 | 270 | 270 | 270 | 270 | 270 | - | 270 |
| | | | | | | | | | | | |
| **1** | 43 | 18 | 57 | 124 | 142 | 103 | 32 | 119 | 168 | - | 128 |
| **2** | 24 | 11 | 19 | 25 | 27 | 38 | 6 | 31 | 27 | - | 21 |
| **3** | 27 | 16 | 22 | 38 | 31 | 27 | 22 | 34 | 21 | - | 12 |
| **4** | 32 | 31 | 28 | 28 | 24 | 25 | 23 | 21 | 18 | - | 21 |
| **5** | 54 | 43 | 43 | 24 | 19 | 29 | 45 | 31 | 19 | - | 30 |
| **6** | 24 | 36 | 30 | 6 | 9 | 16 | 49 | 13 | 5 | - | 21 |
| **7** | 65 | 115 | 70 | 24 | 18 | 32 | 91 | 17 | 11 | - | 36 |
| **DK** | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 4 | 1 | - | 1 |
| | | | | | | | | | | | |
| **Percentage** | | | | | | | | | | | |
| **1** | 0.16 | 0.07 | 0.21 | 0.46 | 0.53 | 0.38 | 0.12 | 0.44 | 0.62 | - | 0.47 |
| **2** | 0.09 | 0.04 | 0.07 | 0.09 | 0.10 | 0.14 | 0.02 | 0.11 | 0.10 | - | 0.08 |
| **3** | 0.10 | 0.06 | 0.08 | 0.14 | 0.11 | 0.10 | 0.08 | 0.13 | 0.08 | - | 0.04 |
| **4** | 0.12 | 0.11 | 0.10 | 0.10 | 0.09 | 0.09 | 0.09 | 0.08 | 0.07 | - | 0.08 |
| **5** | 0.20 | 0.16 | 0.16 | 0.09 | 0.07 | 0.11 | 0.17 | 0.11 | 0.07 | - | 0.11 |
| **6** | 0.09 | 0.13 | 0.11 | 0.02 | 0.03 | 0.06 | 0.18 | 0.05 | 0.02 | - | 0.08 |
| **7** | 0.24 | 0.43 | 0.26 | 0.09 | 0.07 | 0.12 | 0.34 | 0.06 | 0.04 | - | 0.13 |
| **DK** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | - | 0.00 |
| | | | | | | | | | | | |
| **Error (+/-)** | 0.25 | 0.22 | 0.27 | 0.24 | 0.23 | 0.26 | 0.24 | 0.23 | 0.20 | - | 0.28 |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.
2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.
3) Errors are given for 95% confidence level.

**Commuter Survey Results Continued (Profiles).**

Questions

| Survey # | M/F | Gender Code | AGE | Age Code | MILES | Miles Code |
|---|---|---|---|---|---|---|
| **Average** | | | 2.719 | | 2.130 | |
| **SD** | | | 0.846 | | 1.356 | |
| **Skew** | | | 0.313 | | 1.021 | |
| | | | | | | |
| **Total Count** | 266 | | 270 | | 269 | |
| | | | | | | |
| **1** | 128 | Females | 11 | Under 18 | 122 | 0-15 |
| **2** | 138 | Males | 108 | 19-25 | 70 | 16-30 |
| **3** | | | 101 | 26-30 | 25 | 31-45 |
| **4** | | | 46 | 40-45 | 25 | 45-60 |
| **5** | | | 4 | 55-65 | 26 | Over 60 |
| **6** | | | 0 | Over 65 | | |
| **7** | | | | | | |
| **DK** | | | | | | |
| | | | | | | |
| **Percentage** | | | | | | |
| **1** | 0.48 | Females | 0.04 | Under 18 | 0.45 | 0-15 |
| **2** | 0.52 | Males | 0.40 | 19-25 | 0.26 | 16-30 |
| **3** | | | 0.37 | 26-30 | 0.09 | 31-45 |
| **4** | | | 0.17 | 40-45 | 0.09 | 45-60 |
| **5** | | | 0.01 | 55-65 | 0.10 | Over 60 |
| **6** | | | 0.00 | Over 65 | | |
| **7** | | | | | | |
| **DK** | | | | | | |
| | | | | | | |
| **Error (+/-)** | | | 0.10 | | 0.16 | |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.
2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.
3) Errors are given for 95% confidence level.

**Traveler Survey Results**

Questions

| Survey # | 1 | 2A | 2B | 2C | 2D | 2E | 3A | 3B | 3C | 3D | 3E | 4A | 4B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | 6.141 | 6.276 | 4.696 | 4.841 | 6.465 | 5.944 | 3.872 | 3.361 | 3.413 | 3.480 | 3.561 | 3.366 | 5.389 |
| **SD** | 1.407 | 1.252 | 1.902 | 1.777 | 0.889 | 1.364 | 1.131 | 1.218 | 1.171 | 1.208 | 1.260 | 2.054 | 1.634 |
| **Skew** | -1.735 | -2.019 | -0.383 | -0.382 | -1.613 | -1.474 | -0.916 | -0.340 | -0.453 | -0.451 | -0.558 | 0.452 | -0.894 |
| | | | | | | | | | | | | | |
| **Total Count** | 128 | 127 | 125 | 126 | 127 | 126 | 109 | 97 | 104 | 102 | 107 | 123 | 126 |
| | | | | | | | | | | | | | |
| **1** | 3 | 2 | 11 | 7 | 0 | 3 | 6 | 9 | 9 | 8 | 9 | 32 | 5 |
| **2** | 0 | 0 | 7 | 6 | 0 | 0 | 6 | 13 | 11 | 13 | 14 | 20 | 2 |
| **3** | 3 | 2 | 10 | 12 | 0 | 2 | 23 | 29 | 32 | 27 | 22 | 13 | 8 |
| **4** | 14 | 12 | 35 | 33 | 8 | 14 | 35 | 26 | 32 | 30 | 32 | 28 | 22 |
| **5** | 13 | 8 | 12 | 19 | 10 | 21 | 39 | 20 | 20 | 24 | 30 | 4 | 20 |
| **6** | 12 | 20 | 18 | 15 | 24 | 23 | - | - | - | - | - | 11 | 25 |
| **7** | 83 | 83 | 32 | 34 | 85 | 63 | - | - | - | - | - | 15 | 44 |
| **DK** | 1 | 1 | 1 | 0 | 0 | 0 | 2 | 3 | 2 | 1 | 1 | 0 | 0 |
| | | | | | | | | | | | | | |
| **Percentage** | | | | | | | | | | | | | |
| **1** | 0.02 | 0.02 | 0.09 | 0.06 | 0.00 | 0.02 | 0.06 | 0.09 | 0.09 | 0.08 | 0.08 | 0.26 | 0.04 |
| **2** | 0.00 | 0.00 | 0.06 | 0.05 | 0.00 | 0.00 | 0.06 | 0.13 | 0.11 | 0.13 | 0.13 | 0.16 | 0.02 |
| **3** | 0.02 | 0.02 | 0.08 | 0.10 | 0.00 | 0.02 | 0.21 | 0.30 | 0.31 | 0.26 | 0.21 | 0.11 | 0.06 |
| **4** | 0.11 | 0.09 | 0.28 | 0.26 | 0.06 | 0.11 | 0.32 | 0.27 | 0.31 | 0.29 | 0.30 | 0.23 | 0.17 |
| **5** | 0.10 | 0.06 | 0.10 | 0.15 | 0.08 | 0.17 | 0.36 | 0.21 | 0.19 | 0.24 | 0.28 | 0.03 | 0.16 |
| **6** | 0.09 | 0.16 | 0.14 | 0.12 | 0.19 | 0.18 | - | - | - | - | - | 0.09 | 0.20 |
| **7** | 0.65 | 0.65 | 0.26 | 0.27 | 0.67 | 0.50 | - | - | - | - | - | 0.12 | 0.35 |
| **DK** | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.02 | 0.03 | 0.02 | 0.01 | 0.01 | 0.00 | 0.00 |
| | | | | | | | | | | | | | |
| **Error (+/-)** | 0.24 | 0.22 | 0.33 | 0.31 | 0.15 | 0.24 | 0.21 | 0.24 | 0.23 | 0.23 | 0.24 | 0.36 | 0.29 |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.
2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.
3) Errors are given for 95% confidence level.

**Traveler Survey Results Continued (4C-4N).**

Questions

| Survey # | 4C | 4D | 4E | 4F | 4G | 4H | 4I | 4J | 4K | 4L | 4M | 4N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | 5.234 | 5.175 | 6.112 | 6.317 | 6.056 | 6.128 | 6.448 | 6.121 | 5.766 | 4.512 | 5.770 | 6.280 |
| **SD** | 1.726 | 1.927 | 1.460 | 1.354 | 1.557 | 1.470 | 1.323 | 1.517 | 1.603 | 1.847 | 1.665 | 1.462 |
| **Skew** | -0.803 | -0.743 | -1.887 | -2.540 | -1.827 | -2.129 | -2.893 | -2.039 | -1.583 | -0.347 | -1.287 | -2.276 |
| | | | | | | | | | | | | |
| **Total Count** | 124 | 126 | 125 | 126 | 125 | 125 | 125 | 124 | 124 | 125 | 126 | 125 |
| | | | | | | | | | | | | |
| **1** | 7 | 8 | 4 | 4 | 5 | 5 | 4 | 5 | 6 | 12 | 4 | 4 |
| **2** | 2 | 8 | 1 | 1 | 1 | 1 | 0 | 1 | 2 | 7 | 4 | 2 |
| **3** | 9 | 9 | 2 | 1 | 4 | 1 | 3 | 3 | 3 | 16 | 5 | 1 |
| **4** | 21 | 19 | 9 | 5 | 7 | 9 | 3 | 7 | 12 | 23 | 17 | 9 |
| **5** | 25 | 16 | 17 | 10 | 17 | 9 | 6 | 11 | 12 | 28 | 10 | 7 |
| **6** | 18 | 17 | 13 | 18 | 12 | 25 | 12 | 19 | 35 | 15 | 20 | 11 |
| **7** | 42 | 49 | 79 | 87 | 79 | 75 | 97 | 78 | 54 | 24 | 66 | 91 |
| **DK** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | |
| **Percentage** | | | | | | | | | | | | |
| **1** | 0.06 | 0.06 | 0.03 | 0.03 | 0.04 | 0.04 | 0.03 | 0.04 | 0.05 | 0.10 | 0.03 | 0.03 |
| **2** | 0.02 | 0.06 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 | 0.02 | 0.06 | 0.03 | 0.02 |
| **3** | 0.07 | 0.07 | 0.02 | 0.01 | 0.03 | 0.01 | 0.02 | 0.02 | 0.02 | 0.13 | 0.04 | 0.01 |
| **4** | 0.17 | 0.15 | 0.07 | 0.04 | 0.06 | 0.07 | 0.02 | 0.06 | 0.10 | 0.18 | 0.13 | 0.07 |
| **5** | 0.20 | 0.13 | 0.14 | 0.08 | 0.14 | 0.07 | 0.05 | 0.09 | 0.10 | 0.22 | 0.08 | 0.06 |
| **6** | 0.15 | 0.13 | 0.10 | 0.14 | 0.10 | 0.20 | 0.10 | 0.15 | 0.28 | 0.12 | 0.16 | 0.09 |
| **7** | 0.34 | 0.39 | 0.63 | 0.69 | 0.63 | 0.60 | 0.78 | 0.63 | 0.44 | 0.19 | 0.52 | 0.73 |
| **DK** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | | | | | |
| **Error (+/-)** | 0.30 | 0.34 | 0.26 | 0.24 | 0.27 | 0.26 | 0.23 | 0.27 | 0.28 | 0.32 | 0.29 | 0.26 |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.

2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.

3) Errors are given for 95% confidence level.

**Traveler Survey Results Continued (5A-5K).**

Questions

| Survey # | 5A | 5B | 5C | 5D | 5E | 5F | 5G | 5H | 5I | 5J | 5K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | 5.373 | 5.667 | 4.622 | 3.657 | 3.416 | 3.990 | 5.966 | 5.171 | 2.455 | - | 2.887 |
| **SD** | 1.648 | 1.503 | 1.982 | 2.341 | 2.363 | 2.106 | 1.351 | 1.925 | 2.047 | - | 2.457 |
| **Skew** | -1.060 | -1.030 | -0.358 | 0.062 | 0.300 | -0.108 | -1.422 | -0.925 | 1.096 | - | 0.813 |
| | | | | | | | | | | | |
| **Total Count** | 118 | 120 | 111 | 108 | 101 | 104 | 116 | 111 | 101 | - | 97 |
| | | | | | | | | | | | |
| **1** | 6 | 2 | 10 | 37 | 38 | 22 | 2 | 11 | 57 | - | 52 |
| **2** | 2 | 3 | 12 | 9 | 12 | 8 | 1 | 3 | 11 | - | 9 |
| **3** | 6 | 4 | 6 | 6 | 4 | 11 | 1 | 4 | 6 | - | 4 |
| **4** | 19 | 21 | 27 | 8 | 8 | 18 | 15 | 17 | 5 | - | 5 |
| **5** | 16 | 14 | 11 | 11 | 9 | 13 | 16 | 18 | 7 | - | 2 |
| **6** | 33 | 26 | 17 | 24 | 16 | 17 | 22 | 19 | 9 | - | 7 |
| **7** | 36 | 50 | 28 | 13 | 14 | 15 | 59 | 39 | 6 | - | 18 |
| **DK** | 0 | 0 | 1 | 2 | 6 | 3 | 1 | 1 | 5 | - | 11 |
| | | | | | | | | | | | |
| **Percentage** | | | | | | | | | | | |
| **1** | 0.05 | 0.02 | 0.09 | 0.34 | 0.38 | 0.21 | 0.02 | 0.10 | 0.56 | - | 0.54 |
| **2** | 0.02 | 0.03 | 0.11 | 0.08 | 0.12 | 0.08 | 0.01 | 0.03 | 0.11 | - | 0.09 |
| **3** | 0.05 | 0.03 | 0.05 | 0.06 | 0.04 | 0.11 | 0.01 | 0.04 | 0.06 | - | 0.04 |
| **4** | 0.16 | 0.18 | 0.24 | 0.07 | 0.08 | 0.17 | 0.13 | 0.15 | 0.05 | - | 0.05 |
| **5** | 0.14 | 0.12 | 0.10 | 0.10 | 0.09 | 0.13 | 0.14 | 0.16 | 0.07 | - | 0.02 |
| **6** | 0.28 | 0.22 | 0.15 | 0.22 | 0.16 | 0.16 | 0.19 | 0.17 | 0.09 | - | 0.07 |
| **7** | 0.31 | 0.42 | 0.25 | 0.12 | 0.14 | 0.14 | 0.51 | 0.35 | 0.06 | - | 0.19 |
| **DK** | 0.00 | 0.00 | 0.01 | 0.02 | 0.06 | 0.03 | 0.01 | 0.01 | 0.05 | - | 0.11 |
| | | | | | | | | | | | |
| **Error (+/-)** | 0.30 | 0.27 | 0.37 | 0.44 | 0.46 | 0.40 | 0.25 | 0.36 | 0.40 | - | 0.49 |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.
2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.
3) Errors are given for 95% confidence level.

**Traveler Survey Results Continued (6A-Profile).**

Questions

| Survey # | 6A | 6B | 6C | 6D | 6E | 7 | AGE | AGE CODE | TRIPS | # of Trips Code |
|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | 5.593 | 5.784 | 5.513 | 4.939 | 4.619 | 5.805 | | | | |
| **SD** | 1.545 | 1.480 | 1.558 | 1.850 | 2.028 | 1.587 | | | | |
| **Skew** | -0.917 | -1.094 | -0.931 | -0.600 | -0.382 | -1.332 | | | | |
| | | | | | | | | | | |
| **Total Count** | 113 | 111 | 115 | 114 | 113 | 118 | 122 | | 127 | |
| | | | | | | | | | | |
| **1** | 3 | 2 | 2 | 7 | 11 | 4 | 4 | Under 18 | 48 | 0-1 Trips/year |
| **2** | 1 | 1 | 5 | 8 | 13 | 1 | 6 | 19-25 | 55 | 2-5 Trips/year |
| **3** | 4 | 4 | 4 | 9 | 7 | 5 | 22 | 26-40 | 11 | 6-10 Trips/year |
| **4** | 24 | 20 | 20 | 22 | 22 | 17 | 29 | 40-55 | 13 | Over 10 Trips/year |
| **5** | 15 | 11 | 16 | 13 | 13 | 10 | 32 | 55-65 | | |
| **6** | 18 | 20 | 26 | 25 | 18 | 21 | 29 | Over 65 | | |
| **7** | 48 | 53 | 42 | 30 | 29 | 60 | | | | |
| **DK** | 3 | 4 | 1 | 1 | 2 | 3 | | | | |
| | | | | | | | | | | |
| **Percentage** | | | | | | | | | | |
| **1** | 0.03 | 0.02 | 0.02 | 0.06 | 0.10 | 0.03 | 0.03 | Under 18 | 0.38 | 0-1 Trips/year |
| **2** | 0.01 | 0.01 | 0.04 | 0.07 | 0.12 | 0.01 | 0.05 | 19-25 | 0.43 | 2-5 Trips/year |
| **3** | 0.04 | 0.04 | 0.03 | 0.08 | 0.06 | 0.04 | 0.18 | 26-40 | 0.09 | 6-10 Trips/year |
| **4** | 0.21 | 0.18 | 0.17 | 0.19 | 0.19 | 0.14 | 0.24 | 40-55 | 0.10 | Over 10 Trips/year |
| **5** | 0.13 | 0.10 | 0.14 | 0.11 | 0.12 | 0.08 | 0.26 | 55-65 | | |
| **6** | 0.16 | 0.18 | 0.23 | 0.22 | 0.16 | 0.18 | 0.24 | Over 65 | | |
| **7** | 0.42 | 0.48 | 0.37 | 0.26 | 0.26 | 0.51 | | | | |
| **DK** | 0.03 | 0.04 | 0.01 | 0.01 | 0.02 | 0.03 | | | | |
| | | | | | | | | | | |
| **Error (+/-)** | 0.28 | 0.28 | 0.28 | 0.34 | 0.37 | 0.29 | | | | |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.

2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.

3) Errors are given for 95% confidence level.

**Recreational Traveler Survey Results**

Questions

| Survey # | 1 | 2A | 2B | 2C | 2D | 2E | 3A | 3B | 3C | 3D | 3E | 4A | 4B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | 5.759 | 5.628 | 5.175 | 4.861 | 5.839 | 5.460 | 2.723 | 3.115 | 2.570 | 2.361 | 2.383 | 2.635 | 4.504 |
| **SD** | 1.483 | 1.430 | 1.697 | 1.703 | 1.426 | 1.604 | 1.181 | 1.100 | 1.077 | 1.269 | 1.386 | 1.757 | 1.859 |
| **Skew** | -1.265 | -0.759 | -0.819 | -0.569 | -1.072 | -1.032 | 0.183 | -0.160 | 0.122 | 0.577 | 0.619 | 0.928 | -0.222 |
| | | | | | | | | | | | | | |
| **Total Count** | 137 | 137 | 137 | 137 | 137 | 137 | 130 | 131 | 128 | 133 | 133 | 137 | 137 |
| | | | | | | | | | | | | | |
| **1** | 2 | 1 | 6 | 7 | 1 | 2 | 23 | 11 | 26 | 44 | 50 | 51 | 11 |
| **2** | 4 | 0 | 6 | 9 | 1 | 11 | 34 | 26 | 30 | 34 | 27 | 29 | 9 |
| **3** | 8 | 15 | 12 | 10 | 11 | 5 | 39 | 44 | 50 | 28 | 27 | 13 | 22 |
| **4** | 11 | 14 | 17 | 25 | 14 | 11 | 24 | 37 | 17 | 17 | 13 | 25 | 28 |
| **5** | 19 | 27 | 26 | 34 | 18 | 29 | 10 | 13 | 5 | 10 | 16 | 8 | 20 |
| **6** | 35 | 26 | 33 | 23 | 26 | 33 | - | - | - | - | - | 4 | 19 |
| **7** | 58 | 54 | 37 | 29 | 66 | 46 | - | - | - | - | - | 7 | 28 |
| **DK** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Percentage** | | | | | | | | | | | | | |
| **1** | 0.01 | 0.01 | 0.04 | 0.05 | 0.01 | 0.01 | 0.18 | 0.08 | 0.20 | 0.33 | 0.38 | 0.37 | 0.08 |
| **2** | 0.03 | 0.00 | 0.04 | 0.07 | 0.01 | 0.08 | 0.26 | 0.20 | 0.23 | 0.26 | 0.20 | 0.21 | 0.07 |
| **3** | 0.06 | 0.11 | 0.09 | 0.07 | 0.08 | 0.04 | 0.30 | 0.34 | 0.39 | 0.21 | 0.20 | 0.09 | 0.16 |
| **4** | 0.08 | 0.10 | 0.12 | 0.18 | 0.10 | 0.08 | 0.18 | 0.28 | 0.13 | 0.13 | 0.10 | 0.18 | 0.20 |
| **5** | 0.14 | 0.20 | 0.19 | 0.25 | 0.13 | 0.21 | 0.08 | 0.10 | 0.04 | 0.08 | 0.12 | 0.06 | 0.15 |
| **6** | 0.26 | 0.19 | 0.24 | 0.17 | 0.19 | 0.24 | - | - | - | - | - | 0.03 | 0.14 |
| **7** | 0.42 | 0.39 | 0.27 | 0.21 | 0.48 | 0.34 | - | - | - | - | - | 0.05 | 0.20 |
| **DK** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | | | | | | |
| **Error (+/-)** | 0.25 | 0.24 | 0.28 | 0.29 | 0.24 | 0.27 | 0.20 | 0.19 | 0.19 | 0.22 | 0.24 | 0.29 | 0.31 |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.

2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.

3) Errors are given for 95% confidence level.

**Recreational Traveler Survey Results Continued (4C-4N).**

Questions

| Survey # | 4C | 4D | 4E | 4F | 4G | 4H | 4I | 4J | 4K | 4L | 4M | 4N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | 4.000 | 4.456 | 5.750 | 5.860 | 5.500 | 5.926 | 6.304 | 5.875 | 5.044 | 3.801 | 5.662 | 6.331 |
| **SD** | 1.801 | 1.833 | 1.343 | 1.295 | 1.398 | 1.239 | 1.017 | 1.285 | 1.360 | 1.738 | 1.384 | 1.116 |
| **Skew** | 0.008 | -0.170 | -1.208 | -1.294 | -0.767 | -1.281 | -1.852 | -1.252 | -0.690 | -0.042 | -1.023 | -2.179 |
| | | | | | | | | | | | | |
| **Total Count** | 136 | 136 | 136 | 136 | 136 | 136 | 135 | 136 | 136 | 136 | 136 | 136 |
| | | | | | | | | | | | | |
| **1** | 17 | 9 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 19 | 1 | 1 |
| **2** | 10 | 13 | 2 | 3 | 3 | 2 | 0 | 0 | 6 | 14 | 3 | 0 |
| **3** | 25 | 21 | 5 | 3 | 8 | 1 | 0 | 4 | 8 | 23 | 8 | 5 |
| **4** | 33 | 28 | 10 | 13 | 22 | 16 | 8 | 14 | 24 | 32 | 15 | 6 |
| **5** | 23 | 19 | 33 | 22 | 24 | 20 | 16 | 25 | 42 | 23 | 22 | 6 |
| **6** | 11 | 21 | 32 | 39 | 37 | 38 | 32 | 33 | 36 | 17 | 40 | 35 |
| **7** | 17 | 25 | 52 | 55 | 41 | 58 | 78 | 58 | 18 | 8 | 47 | 83 |
| **DK** | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| **Percentage** | | | | | | | | | | | | |
| **1** | 0.13 | 0.07 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.14 | 0.01 | 0.01 |
| **2** | 0.07 | 0.10 | 0.01 | 0.02 | 0.02 | 0.01 | 0.00 | 0.00 | 0.04 | 0.10 | 0.02 | 0.00 |
| **3** | 0.18 | 0.15 | 0.04 | 0.02 | 0.06 | 0.01 | 0.00 | 0.03 | 0.06 | 0.17 | 0.06 | 0.04 |
| **4** | 0.24 | 0.21 | 0.07 | 0.10 | 0.16 | 0.12 | 0.06 | 0.10 | 0.18 | 0.24 | 0.11 | 0.04 |
| **5** | 0.17 | 0.14 | 0.24 | 0.16 | 0.18 | 0.15 | 0.12 | 0.18 | 0.31 | 0.17 | 0.16 | 0.04 |
| **6** | 0.08 | 0.15 | 0.24 | 0.29 | 0.27 | 0.28 | 0.24 | 0.24 | 0.26 | 0.13 | 0.29 | 0.26 |
| **7** | 0.13 | 0.18 | 0.38 | 0.40 | 0.30 | 0.43 | 0.58 | 0.43 | 0.13 | 0.06 | 0.35 | 0.61 |
| **DK** | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| | | | | | | | | | | | | |
| **Error (+/-)** | 0.30 | 0.31 | 0.23 | 0.22 | 0.24 | 0.21 | 0.17 | 0.22 | 0.23 | 0.29 | 0.23 | 0.19 |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.
2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.
3) Errors are given for 95% confidence level.

**Recreational Traveler Survey Results Continued (5A-5K).**

Questions

| Survey # | 5A | 5B | 5C | 5D | 5E | 5F | 5G | 5H | 5I | 5J | 5K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average** | 4.144 | 5.119 | 4.769 | 3.561 | 2.910 | 3.194 | 5.448 | 2.729 | 2.083 | - | 2.685 |
| **SD** | 1.854 | 1.565 | 1.677 | 2.031 | 1.815 | 1.910 | 1.474 | 1.610 | 1.534 | - | 1.941 |
| **Skew** | -0.061 | -0.757 | -0.366 | 0.294 | 0.584 | 0.461 | -0.925 | 0.793 | 1.612 | - | 0.972 |
| | | | | | | | | | | | |
| **Total Count** | 132 | 135 | 134 | 132 | 133 | 134 | 134 | 133 | 132 | - | 130 |
| | | | | | | | | | | | |
| **1** | 16 | 5 | 5 | 28 | 44 | 36 | 2 | 39 | 67 | - | 52 |
| **2** | 9 | 4 | 10 | 21 | 20 | 22 | 5 | 29 | 32 | - | 26 |
| **3** | 20 | 10 | 12 | 20 | 20 | 20 | 8 | 24 | 11 | - | 15 |
| **4** | 36 | 24 | 34 | 22 | 22 | 21 | 14 | 25 | 10 | - | 13 |
| **5** | 17 | 29 | 22 | 8 | 12 | 15 | 32 | 6 | 4 | - | 4 |
| **6** | 14 | 34 | 25 | 19 | 10 | 11 | 33 | 6 | 5 | - | 12 |
| **7** | 20 | 29 | 26 | 14 | 5 | 9 | 40 | 4 | 3 | - | 8 |
| **DK** | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 2 | - | 3 |
| **Percentage** | | | | | | | | | | | |
| **1** | 0.12 | 0.04 | 0.04 | 0.21 | 0.33 | 0.27 | 0.01 | 0.29 | 0.51 | - | 0.40 |
| **2** | 0.07 | 0.03 | 0.07 | 0.16 | 0.15 | 0.16 | 0.04 | 0.22 | 0.24 | - | 0.20 |
| **3** | 0.15 | 0.07 | 0.09 | 0.15 | 0.15 | 0.15 | 0.06 | 0.18 | 0.08 | - | 0.12 |
| **4** | 0.27 | 0.18 | 0.25 | 0.17 | 0.17 | 0.16 | 0.10 | 0.19 | 0.08 | - | 0.10 |
| **5** | 0.13 | 0.21 | 0.16 | 0.06 | 0.09 | 0.11 | 0.24 | 0.05 | 0.03 | - | 0.03 |
| **6** | 0.11 | 0.25 | 0.19 | 0.14 | 0.08 | 0.08 | 0.25 | 0.05 | 0.04 | - | 0.09 |
| **7** | 0.15 | 0.21 | 0.19 | 0.11 | 0.04 | 0.07 | 0.30 | 0.03 | 0.02 | - | 0.06 |
| **DK** | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.02 | - | 0.02 |
| | | | | | | | | | | | |
| **Error (+/-)** | 0.32 | 0.26 | 0.28 | 0.35 | 0.31 | 0.32 | 0.25 | 0.27 | 0.26 | - | 0.33 |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.
2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.
3) Errors are given for 95% confidence level.

**Recreational Traveler Survey Results Continued (6A-Profile).**

Questions

| Survey # | 6A | 6B | 6C | 6D | 6E | AGE | AGE CODE |
|---|---|---|---|---|---|---|---|
| **Average** | 5.052 | 5.293 | 4.733 | 3.837 | 3.143 | 3.204 | |
| **SD** | 1.622 | 1.546 | 1.676 | 1.746 | 2.016 | 1.151 | |
| **Skew** | -0.532 | -0.816 | -0.409 | 0.279 | 0.658 | 0.471 | |
| | | | | | | | |
| **Total Count** | 135 | 133 | 135 | 135 | 133 | 137 | |
| | | | | | | | |
| **1** | 4 | 4 | 6 | 9 | 38 | 6 | Under 18 |
| **2** | 6 | 3 | 10 | 28 | 25 | 33 | 19-25 |
| **3** | 11 | 9 | 12 | 25 | 18 | 45 | 26-40 |
| **4** | 31 | 23 | 30 | 28 | 21 | 41 | 41-55 |
| **5** | 22 | 25 | 30 | 17 | 10 | 4 | 56-65 |
| **6** | 28 | 33 | 22 | 15 | 5 | 8 | Over 65 |
| **7** | 33 | 36 | 25 | 13 | 16 | | |
| **DK** | 0 | 2 | 0 | 1 | 2 | | |
| **Percentage** | | | | | | | |
| **1** | 0.03 | 0.03 | 0.04 | 0.07 | 0.29 | 0.04 | Under 18 |
| **2** | 0.04 | 0.02 | 0.07 | 0.21 | 0.19 | 0.24 | 19-25 |
| **3** | 0.08 | 0.07 | 0.09 | 0.19 | 0.14 | 0.33 | 26-40 |
| **4** | 0.23 | 0.17 | 0.22 | 0.21 | 0.16 | 0.30 | 41-55 |
| **5** | 0.16 | 0.19 | 0.22 | 0.13 | 0.08 | 0.03 | 56-65 |
| **6** | 0.21 | 0.25 | 0.16 | 0.11 | 0.04 | 0.06 | Over 65 |
| **7** | 0.24 | 0.27 | 0.19 | 0.10 | 0.12 | | |
| **DK** | 0.00 | 0.02 | 0.00 | 0.01 | 0.02 | | |
| | | | | | | | |
| **Error (+/-)** | 0.27 | 0.26 | 0.28 | 0.29 | 0.34 | 0.19 | |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.
2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.
3) Errors are given for 95% confidence level.

**Comparative Factored Survey Results**

Questions

| Survey # | 1 | 2A | 2B | 2C | 2D | 2E | 3A | 3B | 3C | 3D | 3E | 4A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Trucker** | 1.21 | 1.34 | 0.25 | 0.33 | 1.44 | 0.94 | 0.65 | 0.61 | 0.72 | 0.36 | 0.20 | 0.40 |
| **Commuter** | 0.68 | 0.75 | 0.51 | 0.49 | 0.75 | - | 0.58 | 0.51 | 0.24 | - | - | 0.16 |
| **Traveler** | 1.07 | 1.14 | 0.53 | 0.52 | 1.19 | 0.93 | 0.86 | 0.58 | 0.60 | 0.65 | 0.72 | 0.27 |
| **Recreation** | 0.89 | 0.78 | 0.65 | 0.49 | 0.91 | 0.74 | 0.30 | 0.43 | 0.19 | 0.24 | 0.28 | 0.11 |

Questions

| Survey # | 4B | 4C | 4D | 4E | 4F | 4G | 4H | 4I | 4J | 4K | 4L | 4M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Trucker** | 0.60 | 0.52 | 0.77 | 1.12 | 1.35 | 1.29 | 1.04 | 1.25 | 1.25 | 0.87 | 0.52 | 1.15 |
| **Commuter** | 0.36 | 0.35 | 0.48 | 0.78 | 0.87 | 0.59 | 0.73 | 0.96 | 0.89 | 0.58 | 0.26 | 0.70 |
| **Traveler** | 0.72 | 0.65 | 0.72 | 1.05 | 1.18 | 1.04 | 1.10 | 1.26 | 1.10 | 0.94 | 0.41 | 0.94 |
| **Recreation** | 0.45 | 0.27 | 0.43 | 0.81 | 0.89 | 0.72 | 0.92 | 1.10 | 0.88 | 0.46 | 0.21 | 0.81 |

Questions

| Survey # | 4N | 5A | 5B | 5C | 5D | 5E | 5F | 5G | 5H | 5I | 5J | 5K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Trucker** | 1.31 | 0.80 | 0.73 | 0.17 | 0.70 | 0.56 | 0.70 | 1.12 | 0.23 | 0.23 | 0.48 | 0.48 |
| **Commuter** | 0.99 | 0.45 | 0.77 | 0.50 | 0.16 | 0.13 | 0.24 | 0.69 | 0.14 | 0.08 | - | 0.28 |
| **Traveler** | 1.18 | 0.74 | 0.84 | 0.53 | 0.40 | 0.37 | 0.38 | 0.95 | 0.70 | 0.18 | - | 0.35 |
| **Recreation** | 1.17 | 0.33 | 0.57 | 0.48 | 0.30 | 0.13 | 0.18 | 0.69 | 0.09 | 0.07 | - | 0.18 |

Questions

| Survey # | 6A | 6B | 6C | 6D | 6E | 7 | 8 | 9A | 9B | 9C | 9D | 9E | 9F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Trucker** | 1.33 | 1.19 | 1.18 | 0.92 | 0.62 | 0.94 | 1.27 | 1.19 | 0.92 | 0.69 | 1.17 | 0.92 | 0.37 |
| **Commuter** | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Traveler** | 0.80 | 0.90 | 0.77 | 0.61 | 0.54 | 0.94 | - | - | - | - | - | - | - |
| **Recreation** | 0.57 | 0.65 | 0.44 | 0.26 | 0.22 | - | - | - | - | - | - | - | - |

Notes:

1) All survey results are based off the Trucker Survey. Meaning that all corresponding questions are labeled the same.

2) The number given in the question column corresponds to the question number on the trucker survey. The letter given corresponds to each possible answer starting from the top going down.

3) The factored results are created by taking the percentage of people who rated the item a 6 and adding that number to 1 ½ times the percentage who rated the item a 7.

## APPENDIX D

### 6) FHWA Plans Winter Symposium and Equipment Exposition

Road Weather Information Systems one of many topics to be discussed.

The Federal Highway Administration (FHWA) will join with the Virginia Department of Transportation, the Virginia Transportation Technology Transfer Center and Virginia Tech University to host the fifth annual Eastern Winter Road Maintenance Symposium and Equipment Expo on Sept. 6-7, 2000, at the Roanoke Civic Center in Roanoke, Va.

“Safety and mobility are top priorities at the Federal Highway Administration, and we recognize that snow and freezing rain can play havoc with the safety and the efficiency of roads,” FHWA Administrator Kenneth R. Wykle said. “The annual symposium provides valuable information and assistance to state and local officials who operate and maintain the regions transportation systems, often under the most adverse weather conditions.”

The symposium will provide a forum for the exchange of information and technologies available to predict and combat the effects of winter on roads, bridges, and other transportation facilities. The symposium also will feature more than 150 exhibitors and the display of 40 new snow-fighting vehicles such as snowplows and anti-icing sprayers. In addition, the symposium will make the latest information available on topics such as snow and ice control, Road Weather Information Systems and forecasting, anti-icing, post-storm clean-up, pavement rehabilitation, and current research, training and educational initiatives. It will give participants the opportunity to compare notes and share experiences with their peers from other states who may have encountered similar circumstances in winters past.

The symposium is free, but those attending must pre-register. For event details and registration forms, visit the website at http://www.easternsnowexpo.org, or call Deborah Vocke at the Eastern Resource Center of the Federal Highway Administration, 410-962-3744.

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**7) AIRTIS Announces E-Commerce Extension Providing Real-Time Traffic and Weather for Individual End-Users**

NORCROSS, Georgia -- July 27, 2000 -- TransCore, an industry leader in transportation technology services, announced that its traveler information division, AIRTIS, has expanded its real-time traffic and weather information service to end-users. Now individuals with alphanumeric wireless devices or an e-mail address can signup for AIRTIS' customized service.

This service allows subscribers to set up a variety of profiles to tailor the information to their personal needs. Profiles can be configured through AIRTIS' web interface and two-way devices. Subscribers can specify up to 10 traffic profiles and 10 weather profiles. Subscribers can receive customized information with respect to the times and days of the week, delivery methods, and the severity for which they wish to receive traffic and weather alerts.

The traffic service provides traffic alerts for specific roadways or corridors as configured by the subscriber's personalized profiles. In addition to specifying when and what traffic information is of interest, profiles can specify what devices are to be used so subscribers can receive alerts on their wireless

device in the morning and on the PC during the day, as an example. Currently AIRTIS provides traffic for 24 traffic cities that include Atlanta, Georgia; Chattanooga, Tennessee; Houston, Texas; Seattle, Washington; Milwaukee, Wisconsin; Chicago, Illinois; and 18 other cities throughout California. AIRTIS is planning to expand to more than 85 major metropolitan areas by aggregating traffic data from public and private sources with its own. As the AIRTIS traffic system expands to additional cities, subscribers will be able to receive high quality local traffic news from a variety of destination cities.

The weather service provides weather information for every county within the United States. Subscribers can receive real-time weather information continuously throughout the day. The service notifies subscribers of all significant weather alerts (e.g., tornado warnings, snow and ice conditions, etc.) for areas specified and provides customized 24-36 hour weather forecasts. When weather advisories or alerts are issued, subscribers receive a notification on their wireless devices that a weather statement has been issued.

AIRTIS' information can be pushed or pulled depending on the subscriber's need, profile and device, and can be sent to a wireless device or an e-mail address. The system has been integrated with the Internet to allow users to customize the service through dynamic web pages and two-way wireless applications.

An individual may signup for the services at AIRTIS' web site at www.airtis.com. Individuals wishing to sign up for the AIRTIS services may do so with their personal credit card. Traffic and weather services are available separately or combined for a low monthly fee. The service cost $5.95 a month for both traffic and weather or $3.95 a month for just traffic and $2.95 a month for just weather. With the use of encrypted data transmission, there is no need to worry about credit card number theft over the Web.