EVALUATION OF THE OPERATION AND DEMONSTRATION TEST

OF SHORT-RANGE WEATHER FORECASTING DECISION SUPPORT

WITHIN AN

ADVANCED RURAL TRAVELER INFORMATION SYSTEM

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I. Introduction

The Advanced Rural Traveler Information System (ARTIS) began development June 30, 1995. While a number of activities were underway to operationally test and evaluate metro or urban traveler information systems in the 75 target markets, ARTIS setout to provide a national standard for statewide or multi-state systems that addressed the long distance travelers needs.

During the past four years, efforts were initiated to develop and demonstrate the utility of an en-route traveler information system. The goal was to provide operational decision support information to vehicle operators in a manner that will enhance efficiency and safety. One key feature in this decision support information was to improve access to real-time and forecast weather conditions.

ARTIS is the only system to date that has been developed, tested, and produced an operational rural system for travel across vast open spaces, where road conditions and weather information are essential to economic and personal safety. ARTIS capitalized on the existing wireless telecommunication infrastructure while designing a system that can easily expand and adapt to the rapidly changing telecommunications industry. ARTIS has merged technologies from meteorology, computer science, wireless telecommunication, road weather monitoring and forecasting, and transportation together into a single decision support system that can respond, adapt, and disseminate information on short notice, with a recurring cycle. ARTIS has the ability to quickly adjust to changes in information standards, formats, and protocols as this industry matures.

The work under this Federal Highway Activity (FHWA) funded activity has entered the commercialization and deployment phase of the application research. This report includes the development efforts undertaken and the results of these efforts. Both internal and external evaluations were conducted based on the original and later modified goals and objectives of this operational test.

II. Evaluation of the Advanced Rural Traveler Information System

While there was no independently sponsored evaluation of ARTIS during development, deployment, and operational testing, the ARTIS steering committee required both external and internal evaluations of key measures during the three-year operational test. These evaluations were designed to measure the user acceptance and use of the traveler information system for decision-making. Later modified objectives included the use of the weather-related data for transportation maintenance operations.

2-1   Rural Transportation Problem

Weather and transportation in vast rural areas can be deadly. Over 17 percent of all fatal crashes occur during severe weather. Of these, 60 percent happen in rural areas (most on non-interstate highways). While ARTIS recognized this problem and began research in 1995, the Federal Highway Administration formed a weather team in 1997 to coordinate efforts across the nation addressing a weather system for travelers as well as operators.

While a number of stand-alone systems for dynamic route guidance have been developed and marketed, and other more intelligent systems have been designed to provide roadway information in an urban setting, no attention has been given to the rural setting. The information needs of the rural traveler, both commercial and general, vary according to the following situations: unfamiliar locations, advisory notices, en-route service location, and road conditions.

While weather observations provide valuable current conditions for the travel corridor and must be used to adjust forecasts when necessary, the value of weather information to travelers is greatest when it provides forecasted conditions for a later segment of the travel path.

2-2   Using ITS to provide solutions

Following the Intelligent Transportation System (ITS) architecture designed for the future of ITS across America, ARTIS focuses on ITS market packages designed to bring the architecture to life. The first focus was the traveler, the primary user of the ARTIS technology, with a goal of creating a more efficient and safer transportation system.

"ITS can't change the weather, but it can change the way we think about the weather. Forecasting at higher resolutions and predicting road surface conditions means that we can better understand how weather will affect the roadway. On top of this, improved decision support system and expanded information dissemination to the full range of surface transportation users and operators means that we can ultimately saves lives, money, and time." (Paul Pisano, FHWA Weather Team)

2.2.1. Goals

The goal of this project is to provide an evaluation and demonstration of how current technologies in mesoscale meteorological analysis and forecasting can be effectively used to produce precise spatial and temporal weather information that can be integrated into an ATIS for safer and more efficient operations. Upon achieving these goals, it is the desire of the project to establish a long-term self-sustaining program to continue to provide advanced transportation weather information to the traveling public and the transportation infrastructure in which it exists.

2.2.2. Objectives

To accomplish this goal, it was imperative that a close partnership among the federal, state, and private sectors be maintained. Within the federal sector, it was important to draw upon the expertise of the Federal Highway Administration for guidance and vision for the development of transportation systems within the nation. The regional focus and application of this project required state collaboration. To effectively integrate weather information into the highway systems, the Department of Transportation in each state made major commitments of support to the goals of this project and committed resources to the execution of the research plan.

Since this project was designed to become a self-sustaining operational component of an intelligent transportation system, the activities performed were expected to yield economic benefit to transportation. This was expected to facilitate privatization efforts of ARTIS, which would sustain the operational components of the system. Therefore, it was important to develop partnerships with private sector firms interested in pursuing long-term economic gains from this program. The three specific objectives of ARTIS were and continue to be:

➢ Ongoing development/integration of site specific nowcasting/forecasting weather information into a decision support software environment to support analysis and interpretation of traveler information needs,

➢ Develop/implement effective information distribution procedures to the traveler, and

➢ Estimate the marketability and user acceptance of the provided weather information leading to the transition in commercialization.

After the start of the research for ARTIS, the steering committee expanded the number of objectives to four to include:

➢ Demonstrate the feasibility of providing weather forecasting specifically for winter maintenance operations.

III. System Development

3-1   1995-1996

3.1.1   Program Administration

The administrative structure of this project is given in Figure 1. The North Dakota Department of Transportation (NDDOT) under the supervision of the Federal Highway Administration (FHWA) administered the project. The South Dakota Department of Transportation (SDDOT) and the University of North Dakota (UND), together with the NDDOT, served as the steering group for the project with coordination from the FHWA. The departments of transportation work with UND to ensure the efficient conveyance of weather information to the traveling public. The departments of transportation also became major users of the weather information as part of the road maintenance mission as the goals were modified. Administrative points-of-contact for the respective steering committee group members included FHWA Region 8 office (until reorganization), ND FHWA, SD FHWA, NDDOT, SDDOT, and the UND, Regional Weather Information Center.

Administration of the Advanced Rural Traveler Information System

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                    │ Federal Highway  │
                    │ Administration   │
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    │ University of   │             │ South            │
    │ North Dakota    │             │ Department of    │
    │ RWIC            │             │ Transportation   │
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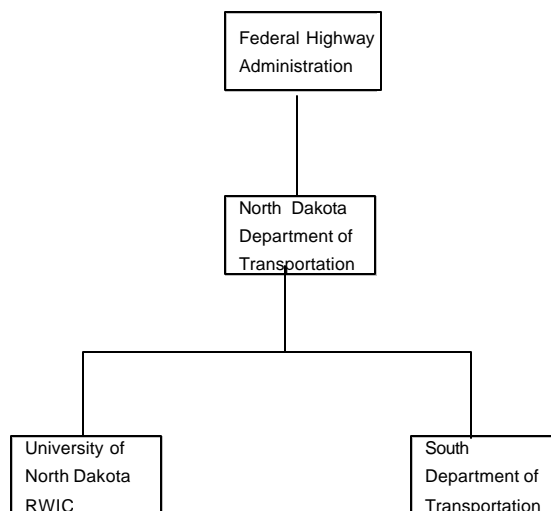
FIG 1. PROGRAM ADMINISTRATION

3.1.2   Mesoscale Models/Analysis

While weather observations provide valuable current conditions for the travel corridor and must be used to adjust forecasts when necessary, the value of weather information to travelers is greatest when it gives forecast conditions for a later segment of the travel path. Although technology did not exist to provide detailed site-specific weather forecasts for specific travel corridors, recent advancements in short-range weather forecast modeling did provide opportunities to support high spatial and temporal resolution short-range weather forecasts.

Utilizing numerical weather prediction models that had been under testing and evaluation for the previous two years at the NOAA Forecast Systems Laboratory in Boulder, Colorado, RWIC meteorologists began work to utilize advanced technologies to produce short-range weather forecast products for discrete segments of the travel corridor. These forecasts were updated regularly to produce nowcast products, which reflect the changes to the model projections as based on hourly weather analyses.

Most of National Weather Service and commercial weather forecast information is derived from numerical weather prediction models used by NOAA's National Center for Environmental Prediction (NCEP). These models produce forecasts in intervals of 12-hours out to 120-hours (5-days). The use of these operational numerical weather prediction models has played an important role in the improvement of routine weather forecasting activities over the past three decades.

While extensive work has been conducted on improving these operational models by increasing their spatial resolution, the ability to resolve small-scale weather features had not progressed sufficiently to provide routine operational benefit to users, such as enroute ground transportation, who require fine-detailed information.

The response in increased mesoscale meteorological modeling had resulted in a cadre of sophisticated numerical models which, when tuned for specific regional features such as soil composition and terrain, could be used to resolve weather features of horizontal size of tens of kilometers. Unfortunately, the operational use of such models was not presently possible due to limitations in proper data networks necessary for model initialization and high computational requirements, which exceed the operational capabilities of regional NWS forecast centers. However, the system proved with proper initialization of these models and ever-decreasing prices of high-performance workstations, short-term forecasts could be issued operationally by the end of the decade in relationship to precipitation, temperature, humidity, winds, and visibility for much smaller areas than are currently being used by the National Weather Service. This information was then tailored to application-specific decision support tools such as those necessary to support local and interstate transportation systems.

As part of research activities during this operational test, researchers at the University of North Dakota's, Department of Atmospheric Sciences, began working with a meso-ß scale numerical weather prediction model to provide improved high-resolution guidance on precipitation, temperature, and wind forecasts. Using a model known as MM5 developed by the National Center for Atmospheric Research and Pennsylvania State University, efforts were made to adapt model features to perform in the Northern Great Plains.

Work focused on experimental studies of the effectiveness of IAPS in providing analysis of meso-ß scale features of temperature, moisture, winds, and visibility. Additionally, the modeling features of LAPS will be used to investigate the feasibility of automated short-range weather forecasts for road segments, using short-range, high spatial resolution models to provide 0 to 6 hour lead time notices of precipitation and visibility.

At the start of the test, LAPS was executed on NOAA/FSL workstations in Boulder with the capability of producing a twelve-hour forecast after three hours of execution. This long execution time made the operational use of the model in nowcasting unacceptable. However, executing the model on a more powerful computer, such as the UND Cray Y-MP, reduced the execution times to a length acceptable for operational application. LAPS was ported to the UND Cray Y-MP supercomputer. The Cray Y-MP was used to execute the analysis and modeling functions of LAPS and provide visualization of analysis and model output to RWIC. These guidance products were developed for use in a Decision Support System (DSS) from which weather forecasts were generated for dissemination to information distribution points within a traffic test environment. This model was executed every three hours to produce short-range forecast guidance products.

3.1.3. Data Integration

The weather information used in this project was drawn from federal, state, and private data sources (Fig. 2). Federal data included the use of hourly surface weather observations reported by the National Weather Service, the Federal Aviation Administration, and the use of twelve-hourly upper-air observations made from rawinsonde sites across North America. In addition, data from WSR-88D Doppler weather radar data from the NWS was also included.
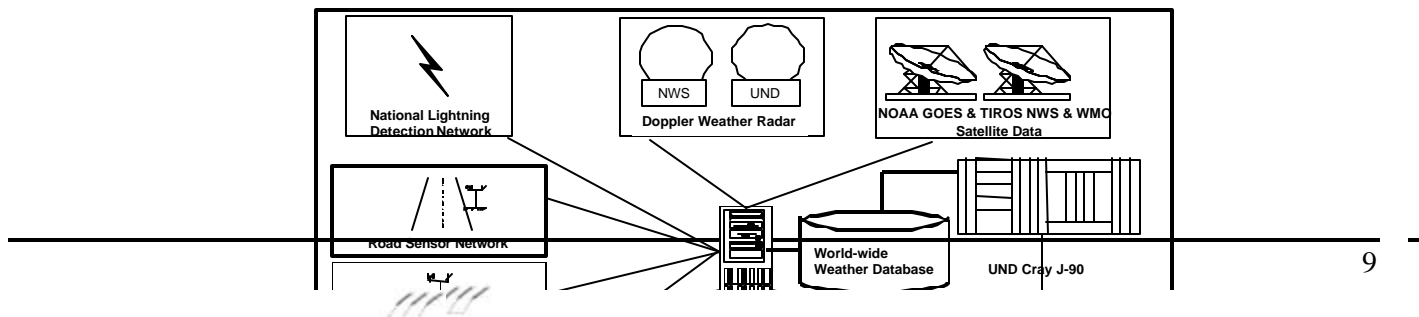
FIG 2. DATA ACQUISITION SYSTEM

Include with this federal data, weather observations from the North Dakota Agricultural Weather Network (NDAWN). NDAWN consists of 45 surface weather monitoring sites across North Dakota, eastern Montana, and northwestern Minnesota (Fig. 3). This information was collected hourly by the University of North Dakota, Center for Aerospace Science's, Regional Weather Information Center (RWIC).

RWIC also served as the focal point for all weather data collection and was the primary weather analysis and forecasting center from which road weather information was issued. In addition to the NDAWN surface weather information, RWIC also utilized Doppler weather radar data from the UND Department of Atmospheric Sciences' 5-cm research Doppler weather radar located on the UND campus. Weather satellite data to support nowcasting and forecasting operations was provided by NOAA GOES 8 and AVHRR imagery from the NOAA TIROS series of polar orbiting weather satellites. The GOES imagery was received every fifteen minutes to provide important 15-minute updates of visible and infrared cloud imagery for winter and summer storm development assessment. In addition, satellite imagery (particularly in the visible spectrum) was useful during daylight hours in depicting fog conditions. Daily passes of the polar orbiting satellite provided detailed snow coverage information useful in temperature forecasting and provided vegetation information used in short-range weather modeling activities.

Data available from private sector lightning detection networks was valuable in the nowcasting and short-range weather forecasting process, thus obtained via the Internet. This resulted in near real-time analysis and display of polarized ground strike information, and provided important information regarding the development and severity of thunderstorm activity which often exceeds that available from radar observation.

Other weather data included roadway weather and road surface condition observations from existing sites across South Dakota and North Dakota. These existing observational systems were provided by the NDDOT and SDDOT in cooperation with Surface Systems, Incorporated (SSI). Additional SCAN systems were installed at various locations within North Dakota and South Dakota, which enhanced the surface weather observation network, used in the demonstration project. This road weather information included air temperature, relative humidity, precipitation, and road surface temperature. The acquisition of this data was coordinated with the respective DOTs in both states. Data provided by the surface sensor is given in table 1.

Surface Temperature
2.   Surface Conditions (state of the roadway surface)
Dry
Wet
Amount of deicing chemical
Snow/Ice Alert
Dew
Frost
3.   Sub-Surface Temperature
4.   Depth of Moisture
Percentage of Ice in Solution

TABLE 1. SURFACE SENSOR DATA

The NDDOT and SDDOT road attribute data was required for the DSS, to provide road segment coordinates, skid numbers, surface types, bridge and culvert locations, and construction status. The latter information was acquired on a routine basis as it recognized this was not static information, but excepted to change often during the year. This combination of weather information with road attribute information was a requirement for increasing the pertinence of weather forecast information. The combining of this information through a common user interface was required to provide coalescence of critical information (Fig. 4).
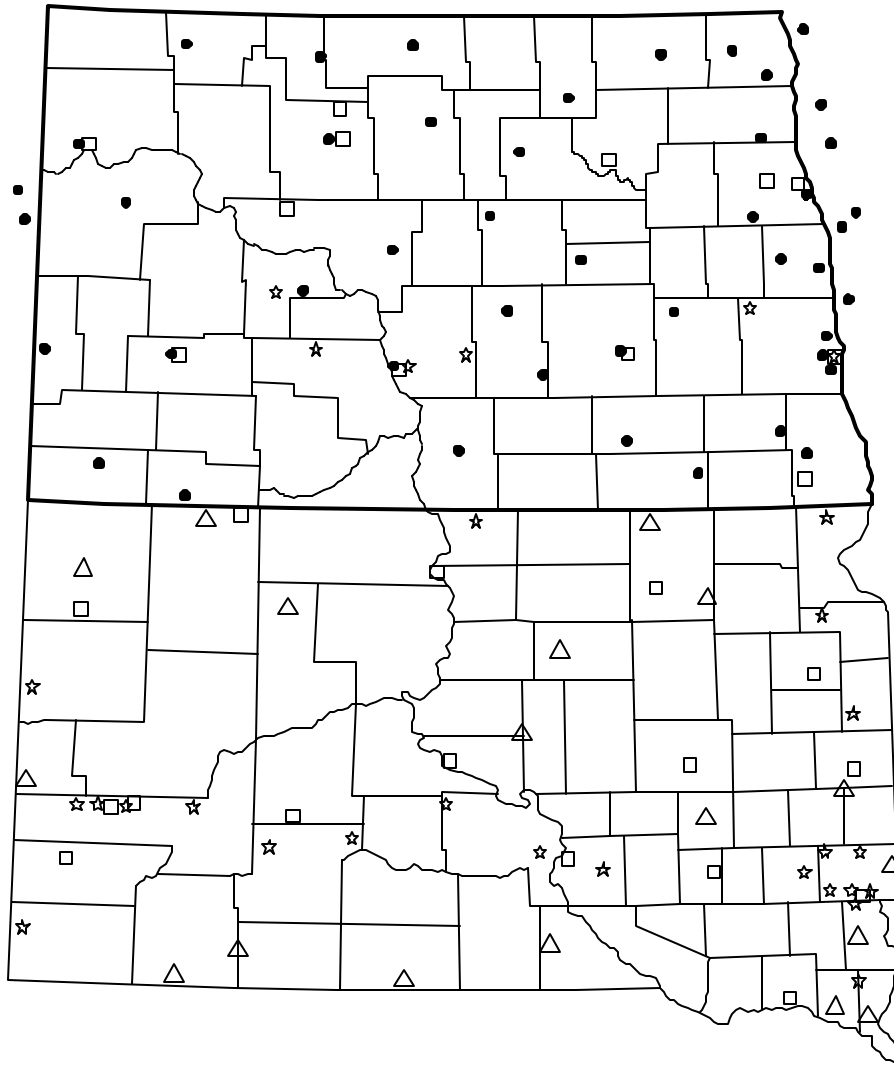
FIG 3. VARIOUS DATA SENSORS ACROSS TEST REGION

3.1.4   DECISION SUPPORT SYSTEM (DSS)

The high volume of observed weather data and computer-generated forecast guidance products had to be integrated with current and expected road conditions in order to develop pertinent weather forecast information. The formation of a DSS, a tool for making decisions based upon computer aided evaluation of complex information applied to specific problems, was needed to provide information designed to enhance traffic flow during changing weather conditions. Once forecast information was generated it had to be managed in ways such that immediate verification and validation was possible to permit forecast adjustments during rapidly changing weather conditions.

While much of the technology required to complete this project existed within the operational and research environment, it had to be brought together in a synergistic manner to provide the necessary support mechanisms to achieve the goals of the project. This included development of a DSS that provided efficient and timely forecast information to enhance the safety of the enroute traveler. This DSS combined the technology of weather analysis/forecasting with the computer representations of spatial and attribute information. It also required the development of an infrastructure for collecting, processing, and disseminating information in a framework, which permits concept validation.

The synthesis of weather analysis and forecast information with current weather observations and road conditions posed a significant task in data management and visualization. Integration of weather information with road attributes (data fusion) yielded the capability to simultaneously discern the weather and its potential impact on traffic flow. The decision support system for this project made it possible to identify specific travel corridor segments and immediately assess current and forecast weather conditions as generated from numerical and subjective weather analysis and prediction processes. Continued review and refinement of the current Decision Support System included enhancements to the forecaster interface enabling staff meteorologists to generate high volumes of travel segments forecasts for possible expansion both within current states and surrounding states.

This large amount of data fusion required a DSS designed to manage data for timely dissemination of short term site-specific nowcasts/forecast. The DSS's evaluation of complex information made it possible to identify a specific travel corridor and immediately assess present and forecast weather conditions.
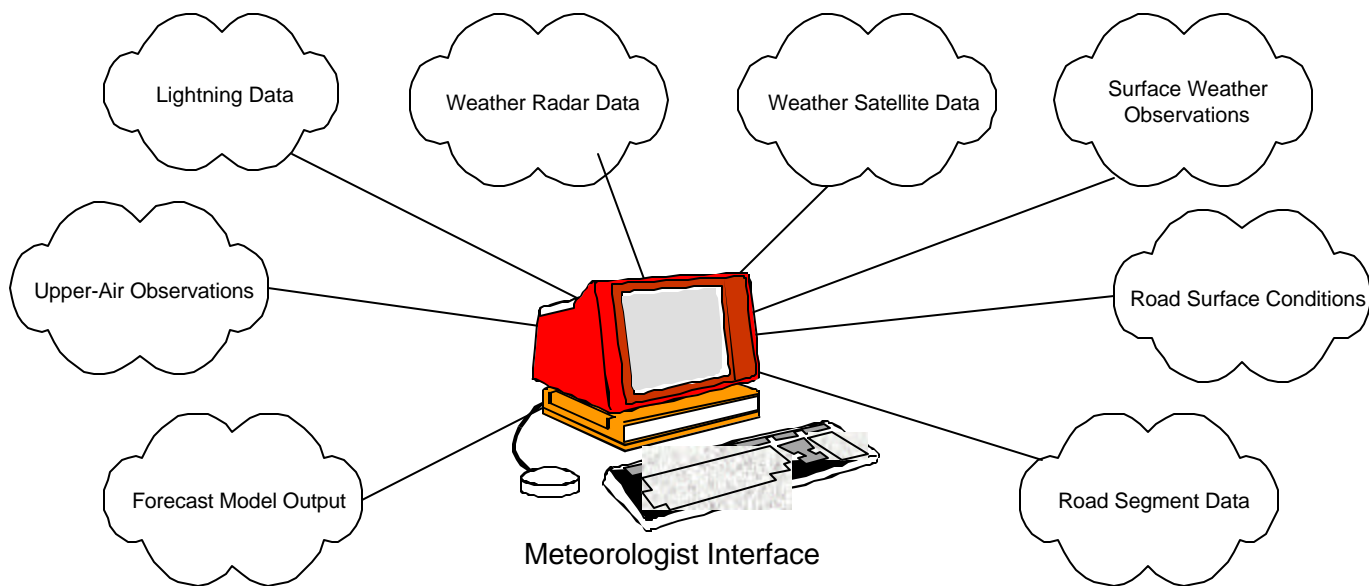

FIG 4. METEOROLOGICAL DECISION SUPPORT SYSTEM

3.1.5 Telecommunications

Since the work of this project was directed primarily towards assessing the feasibility of generating useful weather information for safe and efficient travel while en-route, it was important that a means be available to distribute this information to vehicles.

Considerations were given to Highway Advisory Radio, side-band AM or FM systems, or a specialized in-vehicle display. Seeking a large test bed from which to gather data on usefulness, accuracy, timeliness, and acceptance, the decision was made to create a special dial-in number or switch number for cellular phones. This solution provided a growing base of users and required no additional expense from the user to access the system. UND developed a forecast distribution procedure based upon coded weather information, which allowed interface to a computer telephony system using interactive voice response (IVR). To facilitate cellular communication, relationships were developed with cellular service providers across North and South Dakota. These include both side 'A' and side 'B' cellular communications bands. These companies which have been, and wish to continue as commercial partners for the continuation of the project, include:

- CommNet Cellular, Inc. The B-side carrier for the central and west parts of both North and South Dakota including the southeastern part of South Dakota. (acquired by Verizon Wireless)
- Glacier Lake Cellular 2000, Inc. The B-side carrier for the northeastern part of South Dakota only. (Acquired by Rural Cellular Corp.)
- Airtouch Cellular, Inc. The B-side carrier for the eastern third of North Dakota, and
- Cellular One, Inc. The sole A-side carrier for both states.
- Wireless North. A new PCS wireless carrier in North Dakota.
- Unicel. A new PCS wireless carries in North and South Dakota.
- Quick Call Cellular. A new cellular carrier in South Dakota.

Considerable cost in programming was required initially to activate a special switch (#7233) or (#SAFE) at each cell location across the region. The cellular companies absorbed this programming expense and a majority of them offer not only the service free to their customers, but the airtime as well. This switch allows the user to dial (#7233) or (#SAFE), which uses landlines to dial the CT system located at RWIC to begin the menu process. On average, one minute and 20 seconds later (1:20) the user has the road condition/weather information they need to make a decision.

3-2   1996-1997

The general geographic area in this study during the first year was planned at 875 miles along the Interstate systems in North and South Dakota. However, prior to start of the first operational year this was expanded to approximately 2,200 miles of interstate and state highway travel corridors across North and South Dakota.

3.2.1. Improvements

Initial and proof of concept testing of the DSS, information dissemination, Mesoscale Modeling, and Data acquisition systems was the main focus during the first year of operation. While in-vehicle weather advisories were produced and made available to the public beginning 1 November 1996, maintenance specific forecasts for transportation operators began October 1, 1996.

3-3   1997-1998

3.3.1. Improvements

As of 1 November 1997, the road miles covered by ARTIS increased to 3,200 miles (Fig 5) across North and South Dakota. These additions included the remainder of US Highway 2, US 52 from Minot ND to Jamestown, US 281 from US 2 to the South Dakota State line. In South Dakota, additions included US Highway 281 from the North Dakota State line to US 14, US 12 from US 83 to the Minnesota State line, US 81 from Watertown SD to Interstate 90, SD State Highway 37 from US 14 to State Highway 50, and State Highway 50 from State Highway 37 to Interstate 29. This expansion increased the road miles from 2,200 to 3,200.

MM5 has been used successfully in the operational environment of ATWIS at grid spacing of 30-km and 10-km in predicting the development of short-term, small-scale weather systems. Research and refinement of the MM5 model continued throughout with an improvement in the grid resolutions to 4-km, 12-km, and 36-km near fall 1998.
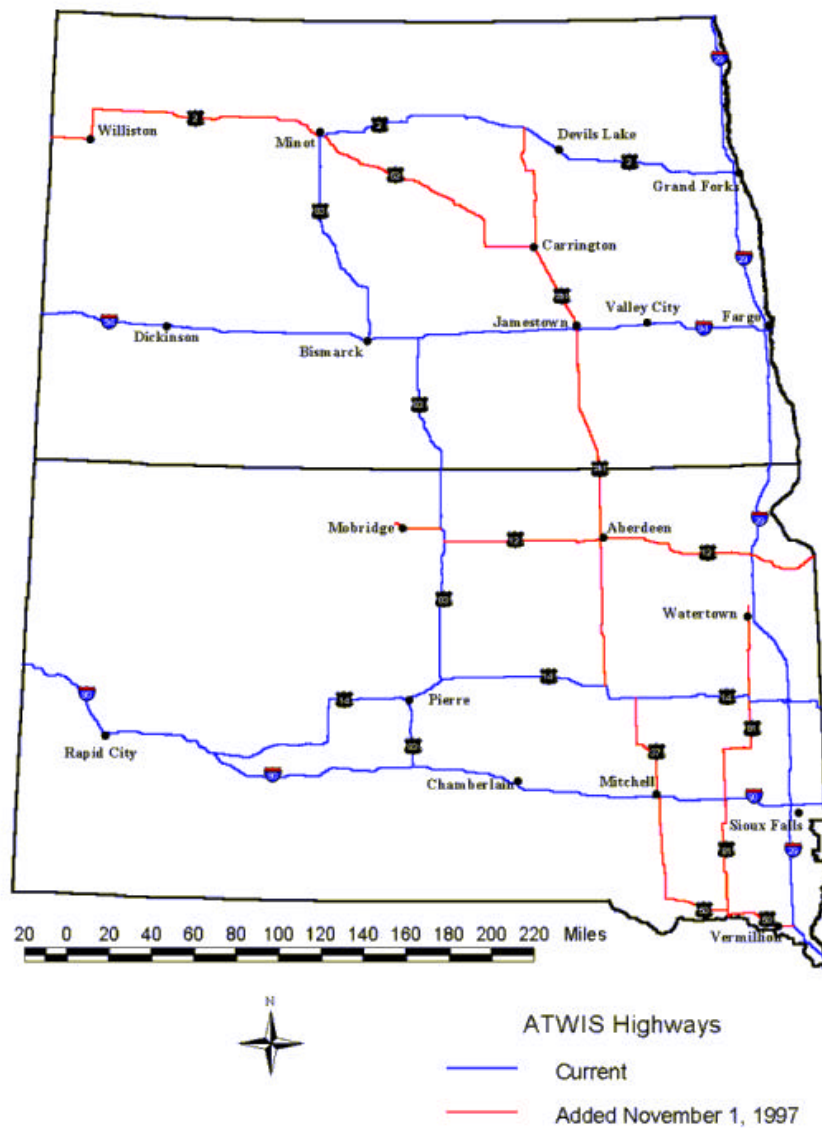
Fig. 5. Current travel corridors for #SAFE. The ~3,200 miles of roadway in the 1997 expansion demonstration project.

3-4. 1998-1999

3.4.1. Improvements

On November 1, 1998, #SAFE was once again expanded to cover a total of 4800 miles across North and South Dakota. These additions included the remaining miles of road within the state of North Dakota consisting of US highways 52, 81, 83, 281 and all of US Hwy 85. South Dakota additions included US 85 from Interstate 90 to North Dakota, the remainder of US Hwy 83, US 16B, 79, 18, and 385 south of Interstate 90 to Nebraska, US

18 from US 79 to State 37, the remainder of US Hwy 12, and all of US 212. This expansion increased the road miles from 3,200 to 4,800 across the two states.

The system began using the University of North Dakota's Cray J90 supercomputer during the 1998 winter driving season. Cray J90 computer required approximately 1.5 hours (wall-time) to complete a nine-hour model forecast. A weather forecast and analysis system has been developed that incorporates sophisticated high-resolution weather forecast models capable of resolving local weather variations and providing greater site-specific detail over finer time scales.

Model forecast products for discrete segments of the travel corridor are generated and updated regularly to produce nowcast products (forecasts from current time to six hours into the future) which reflect the changes to the model projections as based on hourly weather analyses. In addition to the MM5 mesoscale model during this time, RWIC begin utilizing the ARPS mesoscale model for comparison analysis in late fall 1998.

During this time, additional improvements were made to the forecaster interface to include greater flexibility in the descriptive nature of weather hazards a traveler may face. Focus on improvements to the integration of satellite imagery, radar, road condition monitoring, and sensor acquisition was also required. These improvements reduced human resource requirements of the ARTIS program for improved commercialization opportunities. While the DDS provided unlimited site-specific forecast recommendations within the mesoscale domain region, the current forecaster interface inherently contained a limit to the number of processes an individual forecaster can operationalize in a timely manner. Under a non-exclusive agreement with a commercial partner, Meridian Environmental Technology, Inc., RWIC will begin testing, review and refinement of a new forecaster interface enabling increased forecast generation efficiency. This process improvement while greatly reducing the cost of production increases the commercial viability of ATWIS as a self-sustaining system.
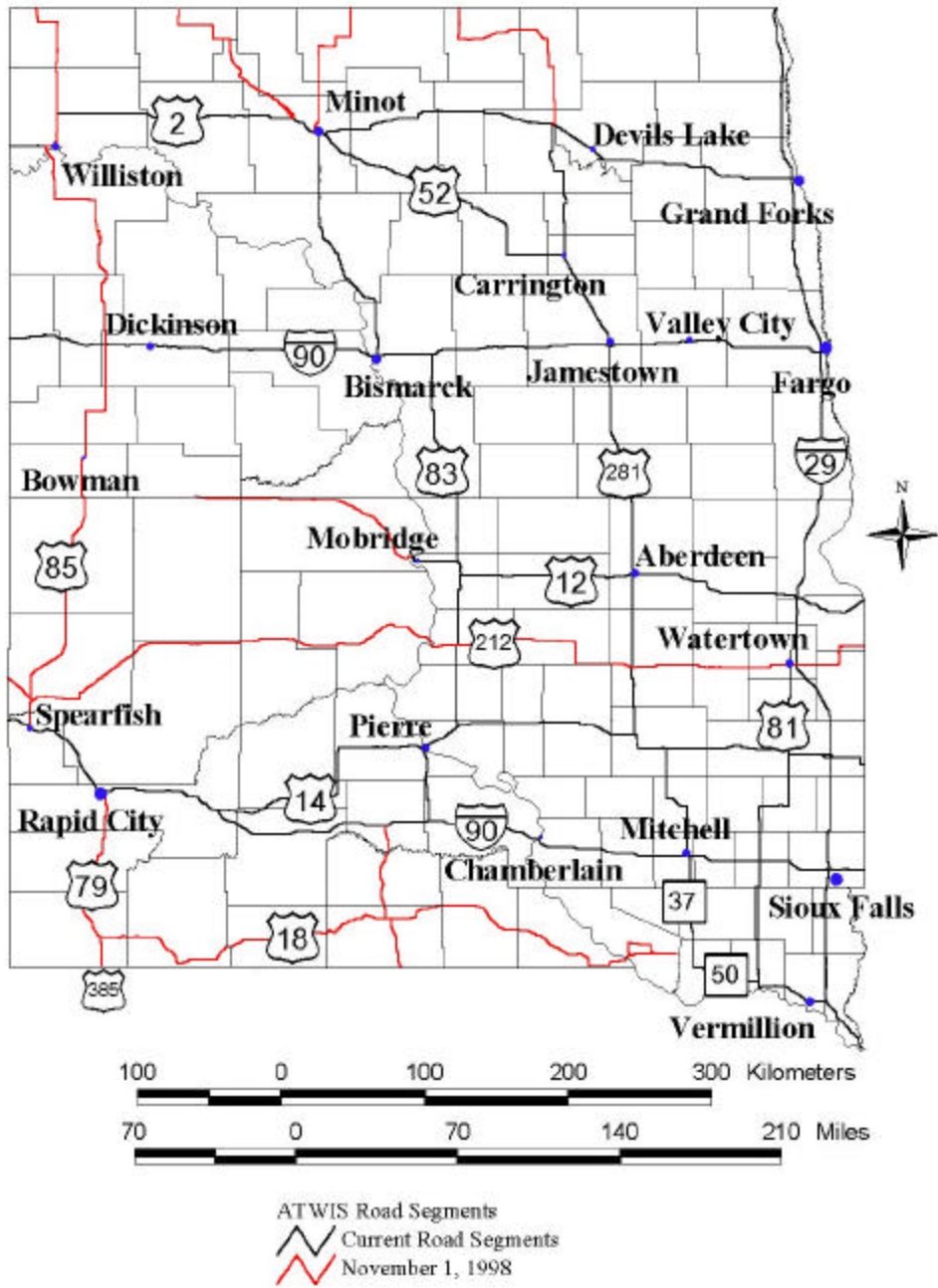
FIG. 6. CURRENT TRAVEL CORRIDORS FOR #SAFE. THE ~4,800 MILES OF ROADWAY IN THE 1998 EXPANSION

DEMONSTRATION PROJECT.

IV. Operational Out-Sourcing/Commercialization

As directed by Congress, a commercialization plan was under development for ARTIS. This plan was scheduled for completion by 1 September 1998. Two private companies expressed interest in the commercialization activity. The transition to a commercial, self-sustaining program began October 1, 1999. Full commercialization is slated to be in place by the end of FY 2001.

4-1   1999-2000

4.1.1.   Improvements

#SAFE technology commercialization will grow out of the expansion of markets and diversification of products. Expansion of markets must include a greater areal coverage over a larger population base. While the first steps to commercialization activities have begun successfully, work will continue on a detailed market analysis and strategic partnering evaluations will continue for each new product or opportunity. The transition to this market-based system requires public education of the available use of the information. Each market analysis will be developed over time and incorporate focus group opinions and recommendations to enhance public acceptance of each product.

Meridian Environmental Technology Inc. began technology transfer of the underlying technology for #SAFE. Shortly after Meridian developed additional products and services from the basic technology in February 1999, they were able to expand the #SAFE service in its first commercial application. This expansion on February 14, 1999 into an adjacent state broadened #SAFE use to a total coverage area of 7200 road miles. On August 14, 2000, the system entered the deployment and integration phase expanding to statewide operation covering more than 27,000 road miles across three states. The operational test and statistic analysis of customer use during the development and testing ended on August 14, 2000.

V. Evaluation Goals

The goal of this project is to provide an evaluation and demonstration of how current technologies in mesoscale meteorological analysis and forecasting can be effectively used to produce precise spatial and temporal weather information that can be integrated into an ATIS for safer and more efficient operations. After the start of the research for ARTIS, the steering committee expanded the number of objectives to four.

5.1.   Evaluation Results to Date

During the initial operational testing, a customer comment line was provided to increase feedback from the traveling public. Since that time, a number of comments, questions, and suggestions have been left for the program manager. These comments were recorded word for word and reported regularly to the steering committee. A list of these customer responses is attached as Attachment 1.

5.1. Evaluation Goal 1	Methodology
Ongoing development/integration of site-specific nowcasting/forecasting weather information into a decision support software environment to support analysis and interpretation of traveler information needs.	Systematic statistical verification of the forecasts generated.

The validity of the analysis and forecasting were monitored through systematic statistical verification of the analyses and forecasts generated. Numerical calculations were made to validate and score the forecast accuracy utilizing the observed conditions reported by the sensor stations. Every forecast segment of roadway served as a validation point. The lack of sufficient site-specific information on cloud, visibility, and precipitation limited the verification efforts to temperature, wind speed and wind direction.

Overall validation scores for each segment were stratified to provide performance information based upon time of year and geographical location. A composite performance for all segments was used to normalize the individual segments to identify specific trouble spots. Performance skill was measured by computing accumulated absolute error for the verified forecast parameters.

5-2. Evaluation Goal 2	Methodology
Develop/implement effective information distribution procedures to the traveler.	Memorandum of Understanding with telecommunication companies, track FCC licensing of new markets.

Memorandum of Understandings (MOUs) where signed with four cellular providers across North and South Dakota during the summer and fall of 1996. At this time, this represented the only cellular providers in the two states.

As the program progressed, it was necessary to track not only new licenses issued by the FCC for PCS or digital systems, but to track the industry as market areas changed hands. This changed the footprint coverage of each company's reach as they sold or bought new market areas. To date, North and South Dakota contain eight wireless companies, four cellular and four digital providers. Of the original four, only two still exist, while the coverage of wireless access across both states have improved greatly.

5-3. Evaluation Goal 3	Methodology
Estimate the marketability and user acceptance of the provided weather information leading to the transition in commercialization.	Independent evaluator will perform annual customer market surveys across the two-state region.

CUSTOMER SURVEY

With limited advertising the first year, this system handled over 55,000 accesses to the weather forecast database from cellular telephones. Information for specific road segments was accessed following a menu-driven procedure using touch-tone commands.

Two surveys of cellular telephone owners--a telephone survey and a mail survey--conducted during the spring of 1997 and again during the winter of 1997-1998 produced quite similar findings. The UND Bureau of Governmental Affairs conducted these surveys, as part of an independent evaluation. There were no major inconsistencies in the findings from the surveys. The margin of error for the surveys is approximately +/- 2.5 percent. Copies of the final reports of each survey can be found in attachment 3 and 4.

While the Bureau of Governmental Affairs had agreed to perform the annual survey associated with the external evaluation of ARTIS, the bureau failed to accomplish the survey during the winter of 1998-1999. As a result, the steering committee researched additional research facilities outside UND to perform future surveys. In February 2000, the ARTIS steering committee requested Western Transportation Institute (WTI), Montana State University to perform a traveler survey only during the June to August 2000 timeframe. The survey results are still under review and analysis at this time by WTI, however attachment 2 contains a copy of the initial report. The complete report is still being written and should be available December 1, 2000.

| 5-4. Evaluation Goal 4	Methodology
Demonstrate the feasibility of providing weather forecasting specifically for winter maintenance operations.	Independent evaluator will perform annual customer market surveys across the two-state region.

The UND Bureau of Governmental Affairs as part of their independent evaluation responsibilities also conducted surveys during the spring of 1997 and the winter of 1997-1998 of maintenance operators across both states. Once again, the bureau failed to accomplish these surveys in 1999. As stated above, WTI has agreed to assume the bureau's responsibilities, however the first maintenance operators' survey will not take place until the winter driving season 2000-2001.

Transportation Department maintenance crew supervisors were almost all daily consumers of weather information following the change of objectives in the project. Almost all used the daily weather forecasts, most used the forecasts in their planning activities, and they rated the forecasts as accurate. A majority (58.3 percent) had altered their assignment of personnel as a result of the daily forecasts. Attachment 3 includes the survey results as accomplished by the Bureau of Governmental Affairs.

VI. INTERNAL STATISTIC REVIEW

FINAL OPS TEST USER STATS
### Total Transactions Nov 1, 1996 to Aug 14, 2000
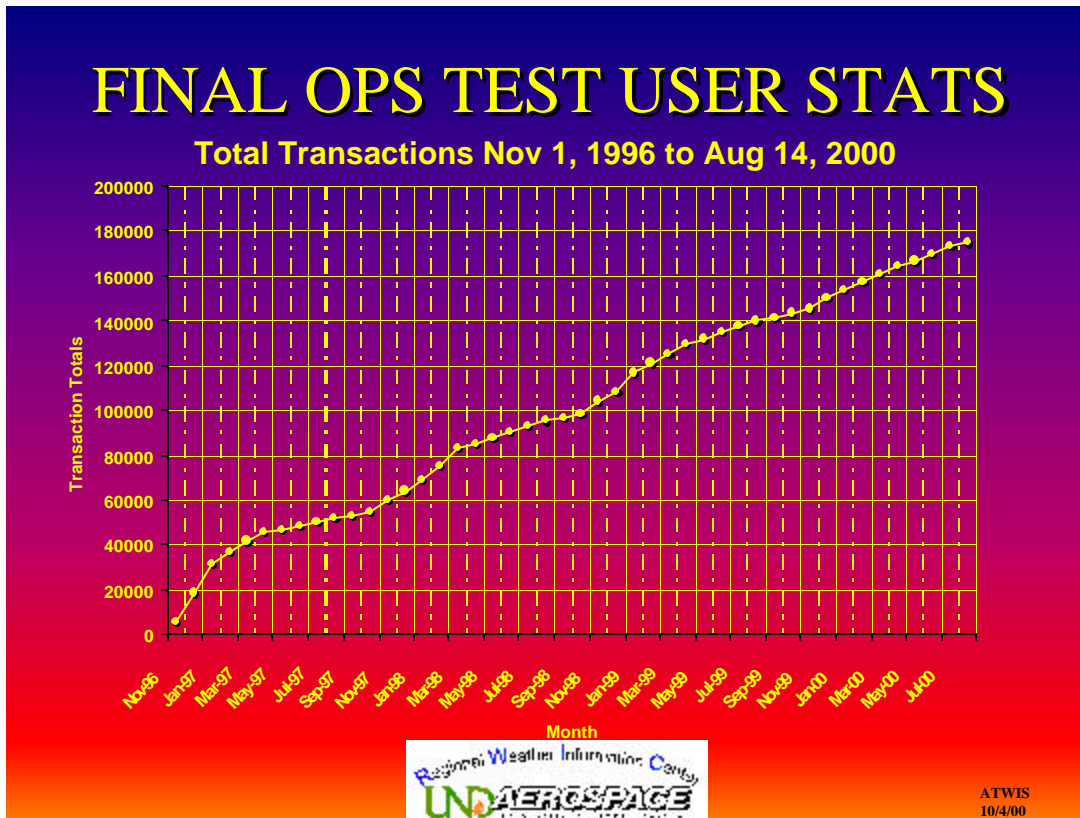
The final statistic analysis of the use of #SAFE clearly indicates a desire for information during travel across an entire state or even multi-state region. The chart above records the total transactions processed during the operational test phase. An immediate jump occurred the minute the system came on-line, followed by rapid increases every November each time the system experienced an expansion of road miles.

While the chart below confirms #SAFE popularity was primarily during the winter months, notice must be taken of the increased daily usage during the summer as the system progressed. September was recorded as the low use month until 1999, when an extremely mild beginning to the winter recorded October as the low use month. The important factors in these statistics indicate traveler information is still very important during the summer as well as the winter.
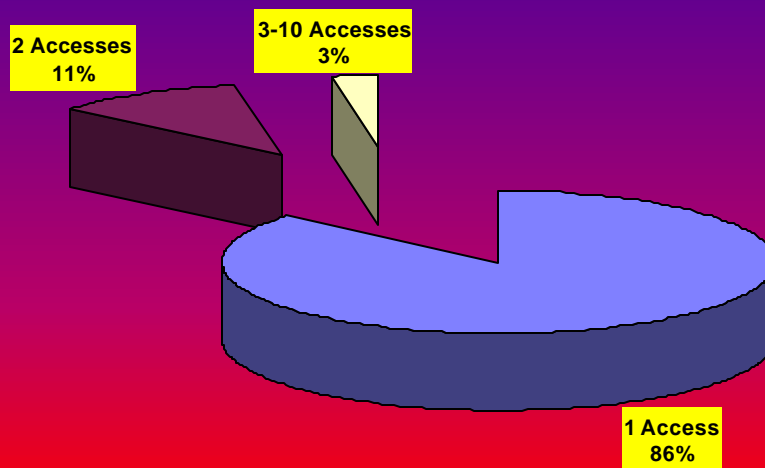
FINAL OPS TEST USER STATS

**Total Transactions Nov 96-Aug 14, 2000**
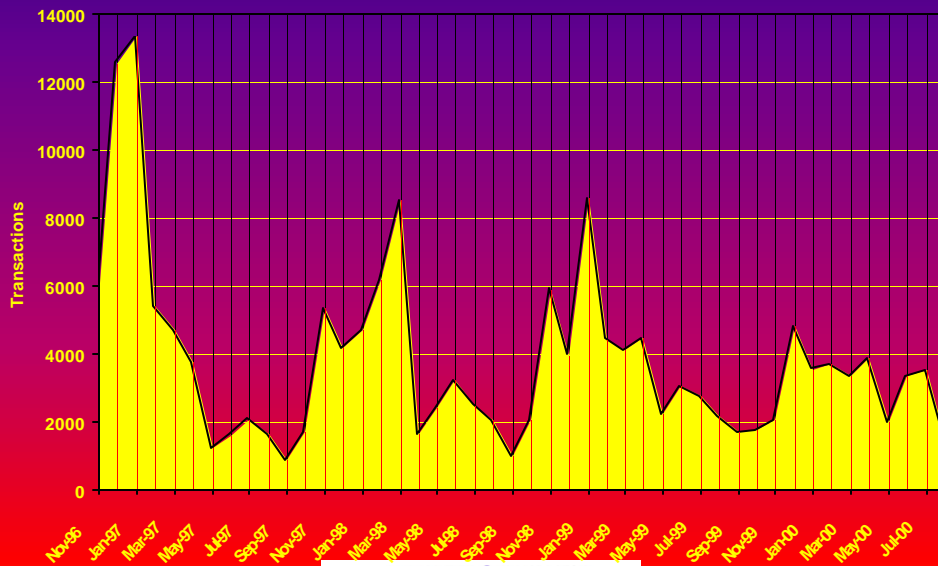
ATWIS
10/4/00

FINAL OPS TEST USER STATS

Percentage of Multiple Requests per Call

2 Accesses
11%

3-10 Accesses
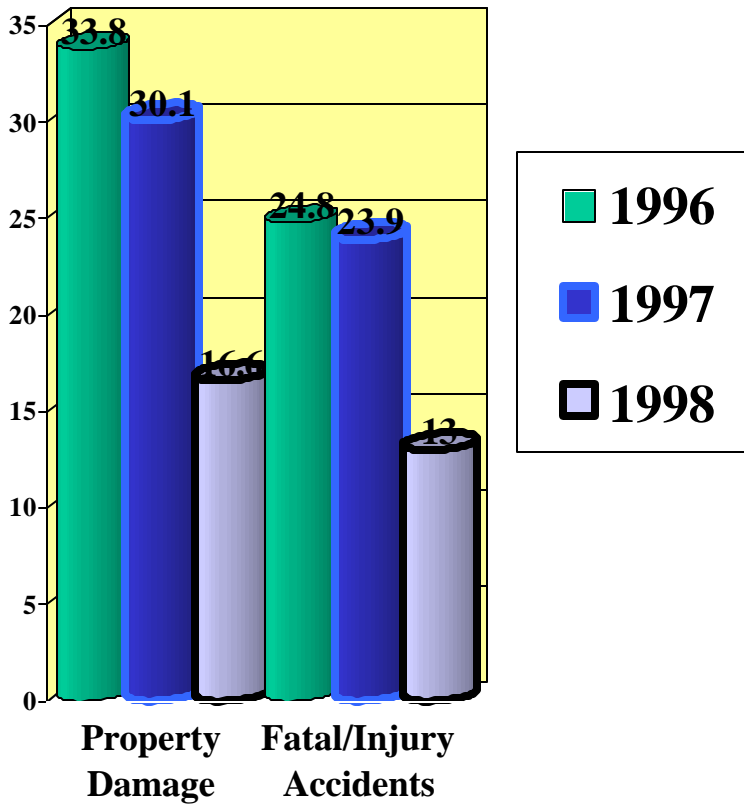3%

1 Access
86%

ATWIS
10/4/00

The majority of callers requested information for the travel corridor directly ahead of their current location. However, 14% of all callers also requested information for corridors several miles ahead as well. Of this 14%, 11% requested two reports, while 3% of the callers requested multiple reports, in some case across the state for their entire travel route.
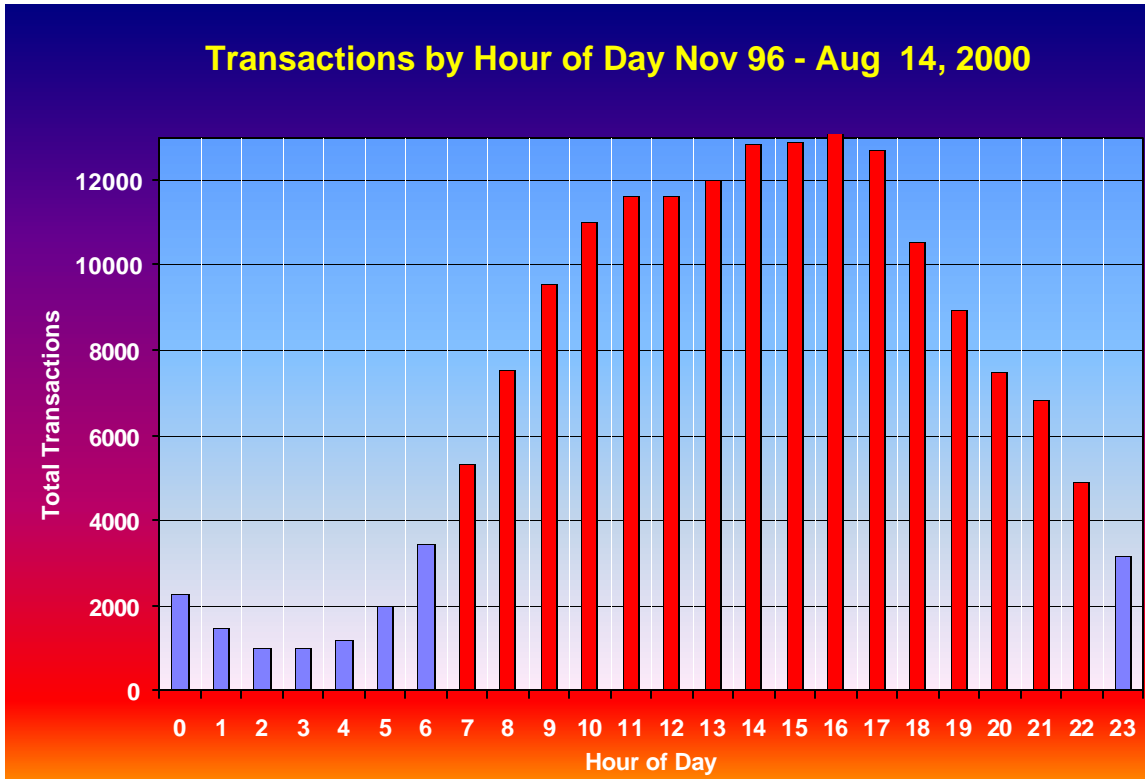
As demonstrated by the above chart and the Total Transactions chart, there has never been a day during the year or an hour during the day someone is not accessing #SAFE traveler information.

And finally, the Program Manager of #SAFE recently began reviewing fatality, accident, and property damage reports across both states in an effort to determine if travel has become safer in the two-state. While very preliminary review to date, the following illustrate statewide fatality, accident, and property damage reports. While a number of external factors effect these results and continued research is required to determine the possible effects #SAFE has had on the items, initial results are very promising as depicted in the graphs below.

South Dakota Weather Related Accidents

Legend:
- 1996
- 1997
- 1998

Property Damage:
- 1996: 33.8
- 1997: 30.1
- 1998: 16.6

Fatal/Injury Accidents:
- 1996: 24.8
- 1997: 23.9
- 1998: 13

North Dakota Weather Related Accidents

Property Damage:
- 1996: 15.8
- 1997: 13.4
- 1998: 10.4

Fatal/Injury Accidents:
- 1996: 11.7
- 1997: 11.4
- 1998: 9.3
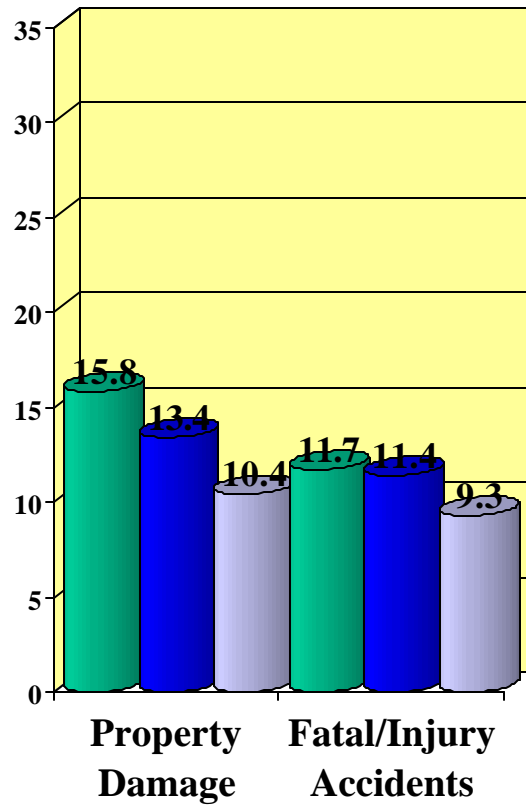
VII. ATTACHMENT 1 - CUSTOMER COMMENTS

7:30 PM Sunday Nov. 2 1997
Hi Max Faith? Calling and I'm on I 29 at about the 188 mile maker I been traveling south for about 20 miles and your service is very value and helpful but in fact north bound I was able to utilize it effectively but south bound now later this evening I go through all the instruction and enter all the parameters and the message comes back for a new search to enter 1 and bah, bah, bah it doesn't get me any new information so I thought you should know about that fact thanks.

8:40 PM Sunday November 2 1997
Yes today is Sunday November 2 it's 8:30 in the evening I'm calling to check on weather reports using the cellular system and I'm checking on hwy. 2 eastbound mile marker 350 and I keep getting the same it's a cutoff message saying degrees and then that's all I can get out of it, I don't know if that's a problem with the system that will be identified later my name is Gary Sumarcheck? I do not need a call back my home phone is XXX-XXXX Thanks

10:25 AM Thursday November 6 1997
Hi this is Diane at Farstad Oil in Fargo I understand that the number to get the road report is # 7233 I just need to know what they mean and how to go about putting in your highway number. It doesn't seem to work, could you call me at XXX-XXX-XXXX. Thank you

11:36 AM Saturday November 8 1997
Grabbled it's an information number, ah, grabbled

11:32 AM Friday November 21 1997
Hi this is Bill? of central? Iowa. I think it's a good idea, hope its a lot more wide spread. Good work. Thank you very much

6:24 PM Thursday January 1, 1998
My name is Arron Crostad? I'm a sales manager for Cellular One in the Fargo area. I'm traveling down I-94 Eastbound on Thursday New Year's Day at 6:25 PM. Your message says 10 miles visibility and I have about 5 feet of visibility, maybe I'm over exaggerating, I can barely see the next car in front of me. It's really foggy. I just thought you guys might want that information being that it's not very accurate. Other than that I hope everyone has a great day, just wanted you guys to be aware of that. Thanks

2:02 PM Monday January 5, 1998
Blank

1:32 PM Thursday January 5, 1998
My questions is when it says enter the Interstate or Highway number and the Pound Sign, I enter the road number and pound sign, and then I don't know what to push after that because I push send after the pound sign, I push send then I put the ear piece back up it repeats the same question. Repeats Interstate number or pound sign and I keep doing that it won't go through. My question is what do I push after the road number and pound sign, what do I push after that? Ran Malory? XXX-XXX-XXXX.

2:20 PM Wednesday January 20, 1998

Yes, I'm trying to get a report on the road here, I'm 10 miles west of Ft. Pierre, and they want my hwy. # and I give the Hwy. # 14/34, I get a recording, they want the mile sign, I give the mile sign 222 that was the mile sign and I still get a recording, so I'm not getting through. My cell number is XXX-XXXX uh-sorry XXX-XXXX is my cell number. (Area Code?) (605?)

Margaret Sioux Falls called my line direct and asked about a landline number and cellular number to use the system. Her boss travels a lot and loves the system, he had heard the number had changed and want the new one. No change. Explained 900 number service coming. XXX-XXX-XXXX.

10:51AM Wed 1/27/98
"Yes, I'm just calling in. I appreciate the SAFE number to be able to call on my Cell 1 phone. But I guess I have a problem. I don't always know my mile markers very well, and I was wondering if there was some other system you could come up with. Bye."

9:51PM Saturday 2/7/98
Yes, could give me or call me at XXX-XXX-???? Monday after 6:00 Thanks

Tried 0089No Answer, 0098 Not a number, 0090 Not them, 4090 No answer, 4098 Left Message, 4490 Not a number,

4:55PM Sunday 2/15/98
Nothing

4:59PM Sunday 2/15/98
Hi yes it's 4:57PM on Sunday 2/15/98. I called the #7233 number to get the weather for this area, I am traveling south on 41 approximately 10 south of Velva. Anyway I called and when I punched in Hwy 41 it was invalid, they said it wasn't correct, I was just wondering why they would say that or if something was happening that shouldn't be. My home phone number is XXX-XXX-XXXX that's XXX-XXX-XXXX Thank you.

Called her back at home on 2/17/98 at 8:20AM. Explained the routing of the system, why it stated what it did, thanked her for using the system. She stated it was foggy that night she just wants to know what was head of her. Explained the limitations of current system and the plans for testing and research on the new interface.

11:20AM Monday 2/16/98
Nothing

11:23 am Tuesday 2/24/98
Is there any thing in ID? Glen Baxter XXX-XXX-XXXX looking for an ARTIS System in ID Thank you.

Called him back on 2/24/98 at 12:30pm Explained ATWIS was a FHWA test program presently in North and South Dakota only. Expansion possible.

7:49am Thursday 2/26/98
Uh, yes I'm calling to say I am presently in Rugby, I called your #7233 number on a cell phone. It requests a Hwy #, I put in Hwy 3 and it keeps telling me it's invalid so uh it's obviously of no use to me so uh just wanted to let you know Hwy 3 doesn't work Bye

8:23 am Thursday 2/26/98
Nothing

10:41 am Friday 2/27/98
I was hoping I Wouldn't get an answering machine, I was wondering why my cell phone won't work on this number when asked to enter a hwy number I enter Hwy 12, SD 1 2 and the # sign apparently it ain't working on the cell phone I'll get back to you.

4:56 PM Saturday 2/28/98
uh yes this uh I am on 281 going north in SD and we can't get a weather report and I don't know and I have the right # number of the mile marker. I'd like to know what kind of good it does me out here.

4:09 PM Thursday 3/5/98
Nothing

4:35 PM Monday 3/30/98
Nothing

5:21 PM Monday 3/30/98
Hi my name is Phil and I have a question about your service it has to do with ND Highways and my number is XXX-XXX-XXXX Ext. 29 That's Phil as is Philip Thanks and has a good one.

Stated he uses the system all the time and loves the information, was wondering if any state highways in ND were included. Explained the routes, the system, the future, he was never positive on the continuation of the system.

2:09 PM 2/22/99
Hi, I'm just ah taking seriously what you've said on your message for the Weather system. Just calling to say thanks, I've used it, I like it. Keep up the good work
Bye.

4:54AM Tuesday 3/14/00
This thing is great….You need to call the North Carolina Legislature and get one in NC. Call them and tell them what you got. Really this thing is cool. Neat. Richard Simmons XXX-XXX-XXXX Bye.

9:42am Wednesday 3/17/99
Nothing

7:27 PM Saturday 5/29/99
"Your mile markers are hard to find in South Dakota. Thanks. Goodbye."

11:23AM Monday 5/31/99
"My name is Richard Burton. My phone number is xxx.xxx.xxxx, and I'm just calling to say thank you. I enjoy it very much. I use the line in all my travels. I hope it continues to grow and prosper. I don't have any questions right now. I'll follow-up as need be. Thank you."

Just called to touch base with him, asked him for suggestions or ideas in the future to help system grow.

5:32pm Wednesday 6/9/99
Good Job!

9:32am Thursday 6/10/99
Thank You, so much for this service you do a great job!

9:13am Friday 6/11/99
Hi, My name is mike I live in SE MN and uh I think this a good idea, I would like to see it expanded I can be reach at xxx.xxx.xxxx

Response: Talked with him about the system. He travels between Twin cities and Rochester would like to see it expanded to 52 between them. Will call AT&T Wireless.

7:09pm Sunday 6/13/99
Great System

We are from Colorado headed south and then west. I wanted to tell you we are a bunch of guys from colo and we think your system is good keep it up Good Bye.

12:12AM Tuesday 6/22/99
"You don't need to get back to me, but I think it's just a great, great thing. I pretty much make my living on the road, and to be able to get weather information like this is terrific. I haven't used the system here much yet because I just haven't had to yet. But if it comes time that I need it, I hope that it is always here. My name is Dan Anderson. I'm from Evansville (MN), and my cell number is xxx.xxx.xxxx."

Can't get him on the cell number.
 11:12PM Monday, 6/28/99
 "Yes. This is Rodney Sheffield, and my number is xxx.xxx.xxxx. Thank you."

Wrong Number can't find. There is a Sheffield at this number in Minot, But wrong number.

10:23am Thursday 7/8/99
Well I need something quicker than 2 business days, I'm traveling east on 90 here I'm at mile marker 395 it is about 10:20am (Drop out) road sign blowing (Drop out) over into the middle of the highway Thank you.

5:40am Wednesday 7/14/99
Yea, I just was wondering is there anyway you could add the lake recreational forecast to this system so that when a person is headed out of Bismarck going North you could have the latest forecast for the lake as well. My name Larry Hothbrook my number is xxx.xxx.xxxx just would be sort of a neat feature.

Called left message about transportation site, research to see what is involved with Lake Forecasts, and steering committee will read his questions. Please call me left my name and number.

10:23am Thursday 7/15/99
Phone Captured xxx.xxx.xxxx
Don't have any questions, Just wanted to leave a comment that that is a nice service you provide just wanted to thank you for your #SAFE service God Bless you Bye Bye

6:44pm Tuesday 7/20/99

Hi My name is Mike Falaten I live in Warren MN My Number is xxx.xxx.xxxx. I'd like to thank you for the good service, it's wonderful. I'm a motorcoach driver and it's really nice knowing what the weather conditions are and the road conditions too. Thank You

Called him back, left message Inviting him to ask questions or leave comments or suggestions for the improvement of the service in the future.

11:33am Sunday 7/25/99

I truly appreciate the road information as I travel in the Winter my name is Ron Harold xxx.xxx.xxxx Thank you for your service.

2:30p.m Friday 7/30/99

Nothing

3:46pm Sunday 8/1/99

Mark Bronsmit 373-9942 I was just wondering where do babies come from?

6:43pm Monday 8/2/99

It's 5:48 and I was just wondering if it would be possible to get information on Hwy 200 going west to east Thank You.

9:32am Saturday 8/7/99

Great system but I think you should also give camping information. How far or where the next camping site is - great system thank you.

xxx.xxx.xxxx

5:29pm Tuesday 8/10/99

Yea, you know that south bound 35 there at 69 it's ah not as warm as you said ah I think you need another individual to keep you posted, give me a call thanks hay.

xxx.xxx.xxxx

11:56pm Sunday 8/15/99

Ah good system keep up the good work you may try, my only possible recommendation is for somebody who doesn't know the exact highway, maybe you give a list of highway to chose by state so that good thanks for the information have a good day.

10:21am Monday 8/16/99

oh, I think it's a great Idea having this on your cellular and just wanted to complement you on this nice new advanced system.

1:34pm Saturday 8/21/99

I have never experienced this service before - I find it very helpful. I wish we had it on all of our interstates. We Travel a great deal in our motorhome and appreciate it very much. My cell # is xxx.xxx.xxxx

6:01pm Saturday 8/21/99

Yea my comment is that I have already called this thing once and you ask about the mile marker, you ask the question 3 times and hang up before I can even get to the next mile marker. I think it's bullshit - I'm not giving you my name or number or address cause I don't want your supid ass calling me.

4:29pm Friday 8/27/99
Yes, No…..

5:33pm Friday 8/27/99
Yea, this is great thank you for the information, Thanks.

5:33pm Monday 8/30/99
This Barbara, we live in Portland Or. We are traveling, we brought our daughter to Sioux Falls to go to college and we were so thankful for this weather service, because we were caught in, we got into a really bad thunder storm on the night of the 29th and we were able to project how we could travel or whether we should go on so thank you very much, we appreciate and are so grateful for it so thank you.

9:58am Monday 8/30/99
Hello, I'm traveling through your state, I'm moving my family from southern Ontario to Alberta and I'm very impressed with the service you have here on the highway. I'm traveling here on the I94 just west of Fargo, so anyway thank you very much, I wanted to tell you it is a great service.

12:05pm Friday 9/3/99 - xxx.xxx.xxxx
Hey, I think you should have highway 61 listed on your deal there cause a lot of times we travel highway 61 and would like to hear the road conditions. Thank you.

9:13pm Saturday 9/4/99
Yea, my comment is that the Blunt road is open since this morning Saturday. Thank you.

2:32pm Saturday 9/12/99
Hi, I'm very interested in your system. I'm currently driving on the Highway and have always seen the signs, but never used it, I think it's awesome, it is very specific when you talk about the mile marker. I'm glad it gives you some time for your next mile marker, because who really remembers your last mile marker or exit and it didn't disconnect just because I didn't know it at the time. My name is Kathy Schawn from Fargo traveling toward Minot. xxx.xxx.xxxx

5:09pm Saturday 9/12/99
No reason to call just wanted to say I really appreciate having this system in place. Thank you.

5:09pm Tuesday 9/14/99
From xxx.xxx.xxxx Nothing

9:48pm Wednesday 9/15/99
Yes, I think that your uh this system is good keep it up. This Justin Butler xxx.xxx.xxxx

8:12 pm Friday 9/24/99

Uh, Brock Devine xxx.xxx.xxxx, and I think this system is really awesome, I just wanted to say I really appreciate it. We have a long road trip ahead of us and I think it is just nice to know the truth in specific words, especially the road conditions and weather - Thank You

2:39 pm Sunday 9/26/99
Uh I'm west bound and a resident of ND and I just think this is a tremendous system for me to anticipate the weather conditions and road conditions, so I thank you very much for the system.

12:51am Tuesday 9/28/99
Hey, my name is Mike Seabrook and this #SAFE system you have is very nice. This is the first time I've used it and you are doing a good job. Thank You.

10:31am Saturday 10/2/99
Hi, we're just traveling through, we're from out of state and I just wanted to comment that we truly like this #SAFE system. I think it's an Excellent Idea it's very accessible, it's pinpoints the area we are in and I really like it. Thank you.

11:54 am Wednesday 11/3/99
Hi, My Name is Allen Willit., I come from Broad Brook, CT. I'm driving with my own company and this is the first time I've come across your wonderful state. I think this weather channel should be in all states. I think it's a great idea keep up the good work Thank you. Oh my number in the truck is xxx.xxx.xxxx. Again, thank you for your courtesy - I hope your police are just as friendly. Ha! Ha!.

11:53 am Wednesday 11/17/99
Just a comment, I think it is a great idea, never heard of this before especially if someone is going to be traveling very much. I'm from NE. Oh My name is Ann Stivers Thank you very much Bye.

7:18pm Sunday 11/21/99
Nothing

12:26 am Monday 11/22/99
Hi, My name is Jason Hanson, my Daytime phone number is xxx.xxx.xxxx - I was just calling to tell you I think your system is really great for people who are traveling. Thanks for having it.

4:19pm Friday 11/26/99
Nothing.

10:40pm Thursday 12/2/99
Hi, my name is George Pratt, I'm a traveler from Canada. Just visiting the U.S. I think this system is great. I'm on my cell phone it is fabulous knowing what the weather conditions are, However I have to take the phone away from my head in order to press the #s and the first option of the message is repeat fairly quickly. So I don't hear the first item on the message as I'm pushing the buttons and so again thank you for the service. xxx.xxx.xxxx

5:03pm Tuesday 12/14/99
My Name is Sandra Carlsgard I travel in my occupation. My work # is xxx.xxxx that's SD so the area code is 605. I just wanted to say thanks a lot for having this available to us, it's a real comfort and its appreciated. Thank you and Merry Christmas.

2:23am Thursday   12/16/99

I just wanted to thank you for having such a good system. It's really important especially in places where the weather can be as harsh as it is in SD and I just thank you for being there. Bye.

9:25am Saturday 12/18/99

Yeah, thanks, on your report, Hwy 200 isn't covered, I tried it a couple of times and it says it is an invalid entry. My Name is Clay Johnson, my daytime # is xxx.xxx.xxxx that's my cell phone thank you.

12:36pm Saturday 12/18/99

Hi Good Morning I'm?? xxx.xxx.xxxx. This is the first time I have ever used this system and I REALLY REALLY appreciate it and I just wanted to say I am going to use it more in the future Thanks Good Bye

6:54pm Saturday 12/18/99

Nothing.

2:59pm Wednesday 12/22/99 - xxx.xxx.xxxx

No need to leave a message. I'll give you my phone number anyway. xxx.xxx.xxxx and I think this is a Really good system and the powers to be should expand it further than they already have done, it's good, it works, it's nice to have. Thanks Good Bye.

Hi, my Jason Buttermierer, I'm from Sioux County IA. My Cell number xxx.xxx.xxxx. I really appreciate this service, I feel it does a very good job of telling me what the weather is going to do. When I am travel that I can count on knowing what the weather is going to do. Especially during the wintertime right now it can be cold and snowy and roads can often be quite icy and slick. Again Thank you for your services.

2:44pm Thursday 1/6/00

Cary Austin – xxx.xxx.xxxx Comments/questions either or. Comments – I think what would be better also if you had a listing of the major towns, St. Cloud, Alex, Salk Center, etc, etc. That's about it. Thank you very much.

4:06 pm Thursday 1/6/00

My name is Bill Tibedeau at xxx.xxx.xxxx. No need for a replay unless you want to. Just coming into ND around the 4 mile marker and I see a sign that says for weather information dial #7233 so I do that. And then I go to through the menu and it asks me for the last known mile marker, think about this, I didn't know that it was going to ask me that question, did I? So I wait until I can see a mile marker. But before I get to the mile marker it gives up on me because I haven't punched in the mile marker. Now I would suggest either allowing a little more time which would be a minute, because generally you get a mile marker a minute, or place that at an appropriate distance from a mile marker so that when someone has seen the sign, recognized it, decided to call it, and gone through the menu, well uh there's a mile marker. Thank you.

3:46 am Monday 1/10/00

Jim Thorst xxx.xxx.xxxx. Just a quick call to let you know how much I appreciate the service and being a free service it's even doubly better. Thank you very much.

8:21 am Tuesday 1/11/00

Robert Snow. xxx.xxx.xxxx at Hardware Hank. I have been traveling MN and ND and appreciate your assistance. Very helpful Information. Thank you.

6:36pm Tuesday 1/11/00
605-280-5828
Just a comment – This #SAFE system is a great idea Thanks Goodbye.

12:08pm Friday 2/18/00 xxx.xxx.xxxx
Yes My name is Rick Hinus and I'm a Canadian Truck Driver registered on with Landstar Inway coming up from Portal, I've been to Fargo and I have seen your signs and I didn't know if we paid for the phone call being #7233 or if it was sponsored by the state, anyway your information is very very good and it is very well appreciated, my cell phone is xxx.xxx.xxxx. Thank you

5:22pm Friday 2/18/00
Yea Hi My name is Allen Zent I just wanted to leave a comment, I think your service great I use it went every I need to and if I could make any type of request would be that you add road conditions, I mean you seem to address every other factor related to weather expect what are the condition of the road. That's what people are really interested in when they are driving they cars, I mean are they snow packed and slippery, are they dry. That's the one comment I would leave I guess. Thank you.

11:18am Sunday 2/20/00
Hello, This is Tim. We love your weather information. Thank you.

12:14am Wednesday 2/16/00
Nothing

8:57pm Thursday 2/24/00
Allen Vergum xxx.xxx.xxxx. This system is great, but unless you have a handheld phone, you can't punch your numbers in fast enough as the guy speaks way to fast. Thank you very much.

6:15pm Friday 2/25/00
Nothing

6:42pm Thursday 3/9/00
941-928-391   Nothing

9:40pm Friday 3/17/00
It is hard to hear what you are saying. Thank you.

7:53pm Saturday 3/18/00
Hi I just wanted to I think it's cool you got that weather thing going on. It would be cooler if you had it for tomorrow, for the next day. See you Later.

11:59pm Monday 3/20/00
Nothing

10:20am Thursday 2/23/00
Nothing

12:34pm Sunday 3/26/00
This is the best service ever guys, Thanks.

10:12am Friday 4/7/00
Nothing

10:02am Monday 4/10/00
Hi, My name is David Herberger my phone number, you can reach at xxx.xxx.xxxx and I just used your #SAFE system and I just have a couple of questions. When you guys are doing your forecasts would be possible to include like if you are traveling the next day, the following days weather. I travel a lot and get to the hotel late after the local weather and it would be nice to be able to call this number to check the weather for the next day. Thank you.

8:18am Friday 4/14/00
xxx.xxx.xxxx Hi, My name is Steve Holt. Just wanted to let you know I appreciate your service. I'm a professional driver. We need more of these around the country. Thank you.

10:42pm Saturday 4/22/00
This Tom Lucavena? xxx.xxx.xxxx Regarding, Could the #SAFE system put the MSP area on their list. Thank you very much.

10:27am Thursday 4/27/00
Hi there, my name is Karen and I'm just calling to say it's a wonderful service and very easy to use and I can be reached at xxx.xxx.xxxx ext. 1326. Thank you.

10:37am Monday 5/1/00
Nothing.

12:35pm Wednesday 5/3/00
Carol Hepsel, I live in Phillip SD. You don't need my address, I just wanted to say it's a great service.

2:29pm Monday 5/8/00
Hi, Ed Madagan xxx.xxx.xxxx
Response not necessary good system. Thank you. Enjoy working with it. Thank you very much.

3:55pm Wednesday 5/17/00
Hello, I just bought a phone and my phone that I have right now is not activated as for as any system and I wanted to see if it would work to get on to your system ---------Because -----what so ever---------

5:57pm Wednesday 5/17/00

I just wanted to take this opportunity to say thank you. I'm new in SD and a travel this afternoon and unexpectedly ran into this Thunderstorm and Hail storm and it was nice to find out these were scattered and would not be long term so it is very nice to have this in SD so Thank You.

6:25pm Friday 5/26/00
Hello my name is Randy Shram calling from Bismarck ND My # is xxx.xxx.xxxx at home, although I won't be there until Tuesday or Wednesday in the evening. Quick comment, I love the system, I use it a lot during the winter months. Summer Months I wish you could put in road delays. I'm traveling south on US 85 now to Spearfish SD. Someone in Bowman ND told me there are long delays south of Bowman. I was just curios now it is raining really hard wonder if the road is torn up and is gravel, or asphalt and just resurfacing, if it's gravel it is going to be messing, slippery and they also said there was a pilot car. Just curious to the length of the construction – 1 mile, 5miles, 10 miles – one lane or two lanes. That would sure help. Once again I just love the system. Now I have been told to back track 30 miles to Redding and go into Newell SD. Had I know this I could have gone south of Dickinson ND. Just wish you could put road construction on it. Again I just the love the system. Thank You very much.

12:36am Saturday 6/10/00
This is Lisa Helgson xxx.xxx.xxxx just wanted to call and thank you for the service, we now have a sign up on Hwy 200 going east into Mayville. Thank You for the service – I don't have to call back.

12:15pm Saturday 6/10/00
This is Phil from Utah. My number is xxx.xxx.xxxx. Just wanted to say how much I like this system. We need it in more states. Thanks

10:33am Tuesday 6/13/00
No message

1:26pm Friday 6/16/00
Denny Whitefield xxx.xxx.xxxx Need more space between entering info and hearing the message.

4:23pm Friday 6/16/00
Hi, my name is Bill Dodge xxx.xxx.xxxx, I'm just wondering if there is any cost the system using or if it is a free system using the #SAFE travel weather info. Just tried it, it's a fine system. Just wanted to know if it cost anything or is it free. Thanks Bye.

10:29pm Thursday 6/22/00
605-881-7816
Mike Wood xxx.xxx.xxxx. I think this system is really great. Keep up the good work. Bye.

11:20am Monday 7/3/00
Just think your system is great, just wish more states would give that option . However, right now when you say 10 miles visibility, it's foggy ½ mile to ¼ mile visibility. That's at mile 250 on 94 west bound. Been foggy a long time. Thanks Bye

9:43am Sunday 7/9/00

I'll tell you in a minute….

#SAFE Evaluation

Interim Report

Prepared by

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October 25, 2000

Introduction

The purpose of the #SAFE survey was to investigate system users' perceptions of the effectiveness of the cellular based #SAFE road conditions and weather forecasting system being used in North and South Dakota. The results of this survey will be used to improve the quality of services rendered as well as provide insight into the development of a long-term user fee supported program to eventually provide this information.

The survey was distributed to 3500 randomly chosen individuals living in North and South Dakota. It was sent to each individual via US mail on July 24, 2000. Participants were asked to respond to the survey by August 10, 2000. A total of 1128 surveys were completed and returned and included in the analysis. The results provided in the interim report reflect users opinions regarding the various features offered by the #SAFE system.

Survey Design

The specific objectives of the survey were to assess system availability, system accuracy and system effectiveness. The various sections of the survey solicited the following types of information:

1. basic travel characteristics,
2. travel information needs,
3. amount and/or likelihood to use #SAFE,
4. #SAFE use,
5. qualitative assessment of #SAFE system,
6. willingness to pay and
7. demographic information.

The survey questions used in this study are shown in Appendix A.

Two types of questions were used throughout the survey: multiple choice questions and likert scale questions. Multiple choice questions contained between 4 and 10 responses. Likert scale questions allow survey respondents to select one of three values they felt best represented their behavior or opinion regarding a particular topic. The ordinal nature of the scale allows conclusions to be drawn on a <u>relative basis only</u>; differences between response values <u>cannot be quantified</u>. This is because each respondent's assessment of the intervals between the three responses will vary. In general, results from specific questions are qualitative and are intended to make general improvements and modifications to the #SAFE system. Specific details must be gathered from additional investigations.

Survey Administration

Survey administration was designed to target cellular telephone owners in North and South Dakota. A simple random sample of 3500 cellular users within North and South Dakota was purchased from USWest Dex (now Qwest) Data Products Group. The list of individuals was geographically diverse across the two state region. From the 3500 surveys sent, 1128 were returned, resulting in a response rate of 32.2%. To increase the response rate, an incentive of $100 free Conoco gasoline was offered to five of those who responded. Once the surveys were mailed, no attempt was made to encourage those that did not respond to the survey to do so. The response rate was sufficient to conduct a valid statistical analysis.

The survey was distributed using first class US mail. Included in the mail-out package was a cover letter, a survey, a small card to enter the $100 free gasoline drawing, and a postage paid return envelope.

Statistics

The responses to the #SAFE survey were analyzed using various summary statistics, including percentages, frequencies and chi-square values. Results are to be used to determine user assessment of the system, traveler information needs and willingness to pay for use of the system. Differences in responses were investigated between respondents in selected demographic categories.

Respondents had the option of not responding to any question on the survey. Percentages are based on total responses obtained for each question, as opposed to the total number of survey respondents, thereby eliminating the need for an "unknown" or " no response" category for each question. Also, if more than one option was selected for questions requiring only a single response, all responses to that particular question were omitted from the statistical analysis. This was done to avoid biasing the results by choosing which option among several selected by the respondent was to be included. Failure to comply with written directions also resulted in omission of that particular response from the data analysis.

Survey Results

Responses to the #SAFE survey were gathered and analyzed using various summary statistics including percentages and means.

Demographic Composition

Demographic questions were asked to ensure that responses to the survey were properly represented when the data was analyzed. Questions were asked relating to:

1. residence,
2. gender,
3. age,
4. type of vehicle normally drive,
5. primary purpose of travel,
6. average number of miles/trip,
7. number of cellular telephones,
8. current cellular carrier, and
9. income.

Other questions that were also used as demographic comparisons were how often respondents used the #SAFE system, frequency of travel on U.S. or Interstate highways in North or South Dakota, and how respondents typically determine road conditions and weather forecast information.

Residence

The survey was sent to 1802 North Dakota residents (51.5%) and 1698 South Dakota residents (48.5%). Responses resulted in 53.4% North Dakotans and 46.6% South Dakotans as shown in Figure 1.
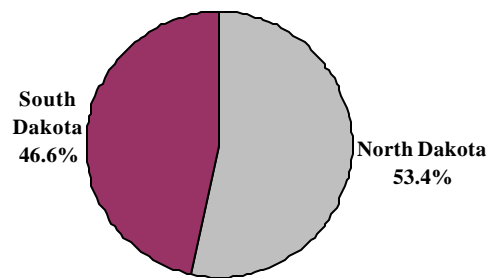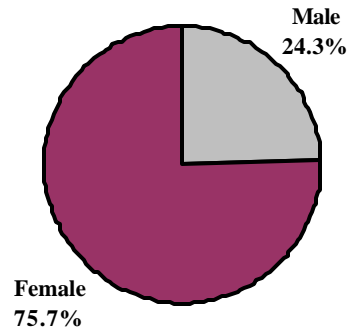

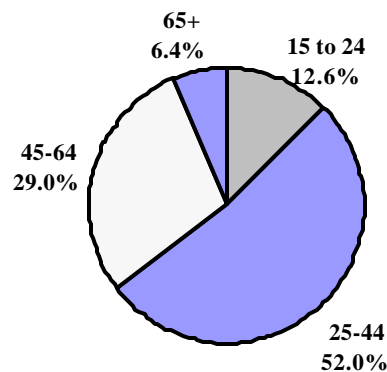*Figure 1: Residence classification of survey respondents*

Gender

When the survey was sent out, it was assumed that the gender of the respondents would be representative of cellular users in North and South Dakota. The list purchased from Qwest Dex contained approximately X% male to X% female. This bias is currently being investigated since it is unknown what the true percentage of each gender currently use cellular telephones. Responses to the survey indicate similar percentages, 24.3% males to 75.6% females, as shown in Figure 2.

Figure 2: Gender classification of survey respondents

Age

The percentages of ages of those who responded to the #SAFE survey are 12.6% from ages 15 to 24, 52.0% from ages 25-44, 29.0% from ages 45 to 64 and 6.4% 65 years of age or greater. Figure 3 shows each of these classifications graphically.

Figure 3: Age classification of survey respondents

Vehicle Type

The vehicle classifications from which survey participants had to choose from were automobile, commercial (i.e., truck, bus), motorcycle, RV or ride as a passenger only. The majority of the individuals responding to this survey typically used an automobile as their primary vehicle on U.S. or Interstate highways in North and South Dakota. The actual classification can be seen in Figure 4.
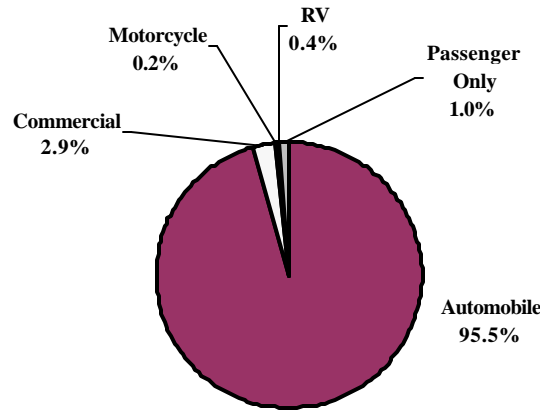

Figure 4: Vehicle type normally driven by survey respondents

Trip Purpose

To identify potential differences in responses for varying trip purposes, respondents were asked to choose a category which best describes the purpose of the majority of vehicle travel on U.S. or Interstate highways in North and South Dakota. The seven categories from which respondents had to choose were work, school, shopping, medical, recreation, visit family or friends and other. The results from this question are shown in Figure 5.
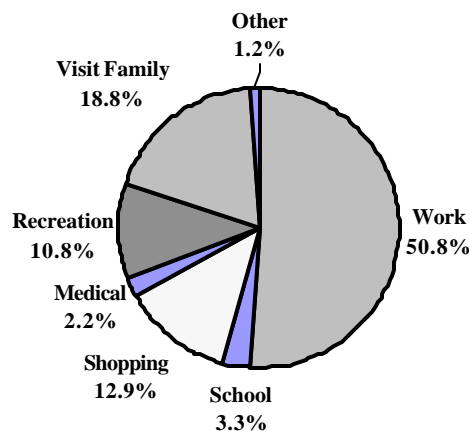

Figure 5: Primary purpose of vehicle travel by survey respondents

Trip Length

Due to the rural nature of the states of North and South Dakota, trip length may vary. Data from the survey indicates a fairly even distribution of responses to each of the four trip length categories. The results from this question are shown in Figure 6.
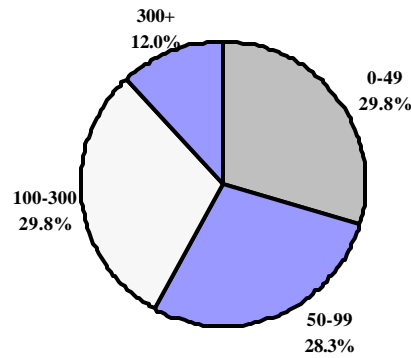

Figure 6: Trip length (in miles) classification of survey respondents

Cellular Telephone Information

Knowing the quantity of cellular telephones as well as its primary carrier is important since many of the questions on the survey are related to cellular usage. Questions that query system availability, accessibility, etc. may have associations with the type and number of cellular telephones. Figures 7 and 8 show the distribution of number of cellular currently using and their cellular carrier or carriers. Since the question regarding the cellular carrier allowed respondents to check more than one response, the total of the percentages adds to %. The majority of the respondents (57.3%) used Cellular One as their primary cellular carrier. The second largest category was Airtouch/Verizon at 30.2%.
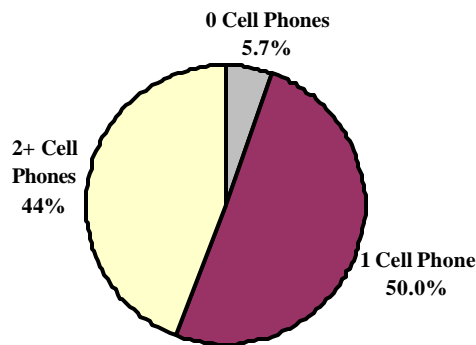
Figure 7: Number of cellular telephones owned by survey respondents

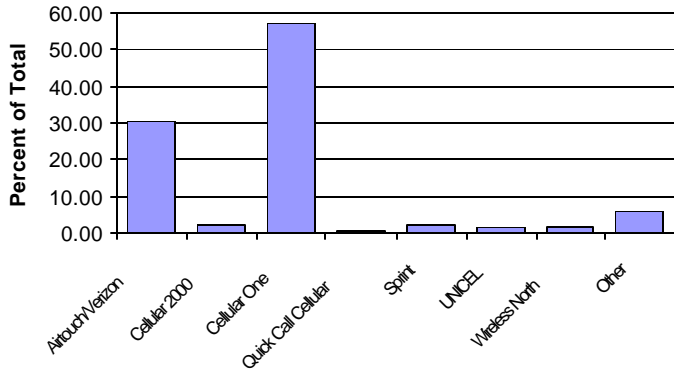*Figure 8: Classification of cellular telephone carriers of survey respondents*

Income

   The last demographic question was related to income. Survey participants were asked to select from four categories that best described their approximate annual income for their household. Results are shown in Figure 9.
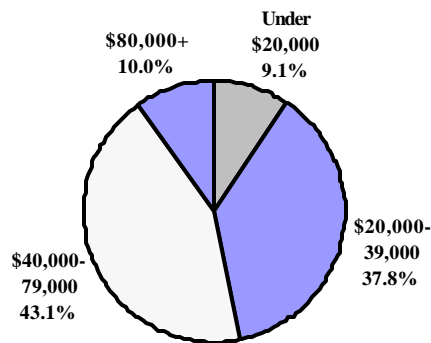

Figure 9: Average annual household income classification of survey respondents

System Availability

The #SAFE system was evaluated with regard to ease of access and clarity of road condition and weather forecast information. Specifically, questions eight, ten and twelve were designed to provide insight into this system attribute. To further investigate possible differences in responses from these questions, three preliminary questions were asked, i.e., questions five, six and seven.

Questions 5, 6, &7

Questions five, six and seven were asked to gather further information about travelers' use of the #SAFE system. Part of question five was used as a qualifier, while questions six and seven asked more pointed questions regarding when they use the service.

Question 5: Frequency of #SAFE use

This question had a twofold purpose. First it was used to determine the amount #SAFE was used and second as a qualifier whether to answer questions six through fourteen. The question and response choices were stated as follows:

> **5. HOW OFTEN do you NORMALLY us the #SAFE number to determine road conditions or to hear a weather forecast report?**
>
> ❑ Never use #SAFE
> _____ times per day
> _____ times per week
> _____ times per month
> _____ times per year

Results from this question indicated that 85.6% of those who answered the question never use #SAFE, and 15.1% of those who returned the survey did not answer the question at all, making it the most skipped question on the survey. This may indicate that those who participated in the survey misunderstood the question.

Of those who indicated their frequency of use of the #SAFE system, the mean use was 29.6 times per year. This mean is heavily influenced by two respondents who indicated that they use the system once per day and one respondent who indicated using the system twice per day. Without including them in the analysis, the mean would be 13.6 times per year. The median of this data is 5 times per year indicating that half of those who responded to this part of the question use the system 5 times per year or less and the other half use it 5 times per year or more. Figure 10 shows how often those who use the #SAFE system as percentages of the following categories: 1 to 6, 7 to 12, 13 to 24 and more than 24 times per year.
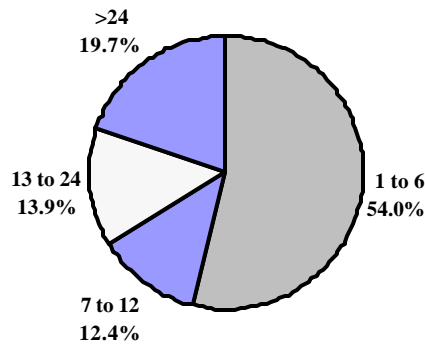
Figure 10: Times per year of #SAFE use by #SAFE users

Once respondents answered question five, they were asked a qualifying question regarding the amount they have used #SAFE in the past 12 months. The qualifier was as follows:

> *****If you haven't used the #SAFE system during the past 12 months please skip to <u>Question 15</u> on the back.*****

To accurately assess the accuracy, timeliness and ease of use of the #SAFE system, survey respondents were to have used the system at least once in the past 12 months.

Questions 6 & 7: When utilize #SAFE

Question six was asked identify whether #SAFE users typically dial into #SAFE before or after they leave on a trip. Question seven was asked to identify during which season the #SAFE system is typically used. Question six and seven were presented as follows:

> **6. Do you TYPICALLY use #SAFE to access road conditions of hear a weather forecast report…**
>
> - ❑ Before you start a trip?
> - ❑ While on the road?
> - ❑ Both
> - ❑ Neither
>
> **7. During which SEASON(S) do you MOSTLY use the #SAFE system?** *(Check all that apply)*
>
> - ❑ Spring
> - ❑ Summer
> - ❑ Fall
> - ❑ Winter

Responses to question six show that most users utilize #SAFE while on the road. Nearly as many respondents indicated that they use the system both before they begin their trip and while on the road. The minority indicated that they use #SAFE neither before nor during a trip. One hundred thirty six individuals responded to this question. Figure 11 shows the categorical response with its associated frequency.
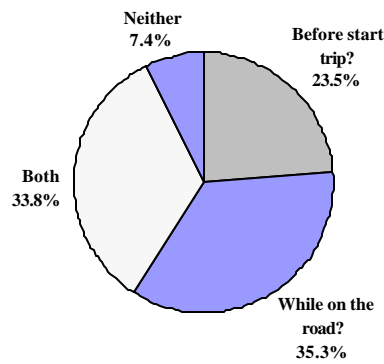
Figure 11: Classification of when respondents utilize #SAFE

Responses to question seven indicate that most #SAFE users utilize the system during the winter. 98.5% of the 132 that answered question seven indicated that winter was at least one of the seasons in which they use #SAFE. 70.5% indicated that they use the system only during the winter, 6.8% use it only during fall and winter, 3.0% use it during all seasons and the remaining 19.7% contained various combinations of seasons (most of which include winter). Figure 12 shows the categorical classification of use by seasons.
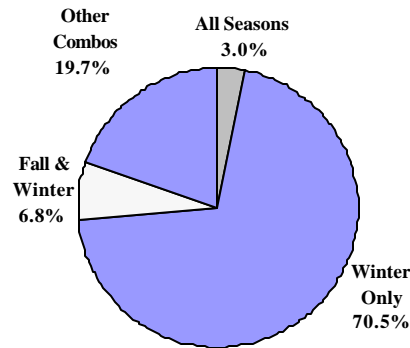
Figure 12: Categorical classification of #SAFE use by season

#SAFE Availability

This question was designed to collect qualitative data regarding #SAFE system availability. This is an important question since system use is often related to its availability. Responses to this question included both a likert scale and a "don't recall" option.

To analyze the likert responses, numerical values were assigned to each of the three responses. The "VERY" response was assigned 3, the "SOMEWHAT" response was assigned 2 and the "NOT VERY" response was assigned a 1. Mean values are based on these numerical allocations. This is true of all of the likert based responses used in this survey.

Question 8 was presented as follows:

8. When trying to access the #SAFE system, HOW AVAILABLE is it?

- ❑ Very Available
- ❑ Somewhat Available
- ❑ Not Very Available
- ❑ Don't Recall

Out of the 134 responses to this question, 14 (10.4%) indicated that they couldn't recall how available the #SAFE system. The mean, determined from 120 remaining likert responses, was 2.47.

Appendix A

VIII.A.1.1 HOW OFTEN do you travel on U.S. or Interstate highways in North or South Dakota? (Fill in only one blank)

_____ times per day
_____ times per week | **Mean= 470 times per year** |
_____ times per month
_____ times per year

VIII.A.1.2 When traveling in North or South Dakota, WHAT RESOURCES do you NORMALLY use to determine road conditions or to hear a weather forecast report? (Check all that apply)

❏ Television   **78.4%**
❏ Radio   **89.2%**
❏ Telephone   **21.0%**
❏ Highway Advisory
❏ #SAFE   **7.6%**
❏ Internet
                            24.0%

❏ Observations of Existing Conditions   **52.2%**
❏ Notices at Truck Stops, Convenience Stores, Rest Areas   **6.21%**
❏ Communication with Other Drivers   **19.2%**
❏ Other (please specify) *See Table A1*   **1.2%**

VIII.A.1.3 How IMPORTANT is the following traveler information for determining a change in your travel plans?
(Check only one box for each item)

	VIII.A.1.3.1. Hot Very Important	VIII.A.1.3.1.1.2 Somewhat Important	VIII.A.1.3.1. Very Important	*VIII.A. Mean*
Road conditions	1	2	3	**2.72**
Weather conditions	1	2	3	**2.73**
Occurrence of hazard/accident	1	2	3	**1.89**
Location of hazard/accident	1	2	3	**1.93**
Travel delays	1	2	3	**1.92**
Average travel speed	1	2	3	**1.85**
Availability of alternate routes	1	2	3	**1.99**
Other (please specify) **See Table A2**	1	2	3	**3**

VIII.A.1.4 HOW LIKELY are you to use the #SAFE system to determine road conditions or hear a weather forecast report, during the following conditions? (Check one box per item)

	VIII.A.1.4. Not Very Likely	VIII.A.1.4.1.1. Somewhat Likely	VIII.A.1.4.1.1. Very Likely	*VIII.A.1. Mean*
Clear	1	2	3	**1.09**
Cloudy	1	2	3	**1.22**
Rainy	1	2	3	**1.47**
Snowy	1	2	3	**2.31**
Windy	1	2	3	**1.59**
Blizzard	1	2	3	**2.63**
Daytime	1	2	3	**1.54**

Nighttime		1	2	3	**1.91**
ther *(please specify)* **See Table A3**		1	2	3	**3**

5 *HOW OFTEN do you NORMALLY use the #SAFE number to determine road conditions or to hear a weather forecast report?* (Fill in only one blank)

❑ Never use #SAFE
_____ times per day
_____ times per week
_____ times per month
_____ times per year

> **Mean= 29.6 times per year of those who indicated using #SAFE.**

> ***If you haven't used the #SAFE system during the past 12 months please skip to <u>Question 15</u> on the back.***

VIII.A.1.5 Do you TYPICALLY use #SAFE to access road conditions or hear a weather forecast report…

❑ Before you start a trip? **23.5%**
❑ While on the road? **35.3%**
❑ Both **33.8%**
❑ Neither **7.4%**

8 *When trying to access the #SAFE system, HOW AVAILABLE is it?*

❑ 3.Very Available
❑ 2.Somewhat Available
❑ 1.Not Very Available
❑ Don't Recall **10.0%**

> **Mean= 2.47**

10 *HOW EASY are #SAFE road condition reports and weather forecasts to understand?*

❑ 3.Very Easy
❑ 2.Somewhat Easy
❑ 1.Not Very Easy
❑ Don't Recall **5.2%**

> **Mean= 2.66**

7 *During which SEASON(S) do you MOSTLY use the #SAFE system?* (Check all that apply)

❑ Spring **13.6%**
❑ Summer **12.9%**
❑ Fall **14.4%**
❑ Winter **98.5%**

9 *HOW TIMELY are #SAFE road condition reports and weather forecasts?*

❑ 3.Very Timely
❑ 2.Somewhat Timely
❑ 1.Not Very Timely
❑ Don't Recall **11.0%**

> **Mean= 2.31**

11 *HOW ACCURATE are #SAFE road condition reports and weather forecasts?*

❑ 3.Very Accurate
❑ 2.Somewhat Accurate
❑ 1.Not Very Accurate
❑ Don't Recall **5.3%**

> **Mean= 2.31**

VIII.A.1.6 When using the #SAFE menus, HOW EASY are the following menu questions/options to follow?

	VIII.A.1.6. Not Very Easy	VIII.A.1.6.1. Somewhat Easy	VIII.A.1.6.1. Very Easy	VIII.A.1.6. Don't Recall	*VIII.A.1. ean*
Question regarding what highway you are on?	1	2	3	**9.0%**	**2.52**
Question regarding what State you are traveling in?	1	2	3	**6.7%**	**2.69**
Question regarding your direction of travel?	1	2	3	**9.8%**	**2.54**
Question regarding what mile marker/exit you are near	1	2	3	**14.2%**	**2.35**

13 *HOW LIKELY are #SAFE road condition reports and weather forecasts to affect your travel plans?*

❑ 3.Very Likely
❑ 2.Somewhat Likely
❑ 1.Not Very Likely

> **Mean= 2.36**

14 *Overall, HOW USEFUL are #SAFE road condition reports and weather forecasts?*

❑ 3.Very Useful
❑ 2.Somewhat Useful
❑ 1.Not Very Useful

> **Mean= 2.69**

VIII.A.1.7 *For most, #SAFE is currently provided free of charge. If, in the future, there was a cost associated with the #SAFE system, HOW MUCH PER CALL would you be willing to pay to use #SAFE?* **(Check only one box)**

❑ No charge	**56.3%**		❑ more than 75¢	**0.7%**
❑ 10 to 25¢	**33.8%**			
❑ 26 to 50¢	**8.5%**			
❑ 51 to 75¢	**0.7%**			

VIII.A.1.8 *How have you been made aware of the #SAFE system?* (Check all that apply)

❑ Radio	**7.1%**		❑ Highway Signs	**21.6%**
❑ Cellular Retailer	**8.0%**		❑ Brochure/Flyer	**3.2%**
❑ Acquaintance	**5.3%**		❑ This Survey	**76.6%**
❑ Internet	**1.3%**		❑ Other *Television*	**0.3%**
❑ Newspaper	**2.5%**			

VIII.A.1.9 *The following information is needed to ensure that your responses are properly represented in this survey. It will be used for the purposes of this survey ONLY.* **(Check only one box per question)**

Percent

VIII.A.1.9.1 a) What is your current state of residence?	❑ *North Dakota*	*53.4*
	❑ *South Dakota*	**46.6**
VIII.A.1.9.2 b) What is your gender?	❑ *Male*	**24.3**
	❑ *Female*	**75.7**
VIII.A.1.9.3 c) What is your age?	❑ *15 – 24 Years*	**12.6**
	❑ *25 – 44*	**52.0**
	❑ *45 – 64*	**29.0**
	❑ *65 +*	**6.4**
VIII.A.1.9.4 d) What type of vehicle do you NORMALLY drive on U.S. or Interstate highways in North or South Dakota?	❑ *Automobile*	**95.5**
	❑ *Commercial (Truck, Bus)*	**2.9**
	❑ *Motorcycle*	**0.2**
	❑ *RV*	*0.4*
	❑ *Ride as Passenger Only*	**1.0**
VIII.A.1.9.5 e) What is the PRIMARY PURPOSE for the majority of your vehicle travel on U.S. or Interstate highways in North or South Dakota?	❑ *Work*	*50.8*
	❑ *School*	*3.3*
	❑ *Shopping*	**12.9**
	❑ *Medical*	**2.2**
	❑ *Recreation*	**10.8**
	❑ *Visit Family or Friends*	**18.8**
	❑ *Other* Unspecified	**1.2**
VIII.A.1.9.6 f) What is the AVERAGE number of miles traveled for the trip purpose checked above?	❑ *0 – 49*	**29.8**
	❑ *50 – 99*	**28.3**
	❑ *100 – 300*	**29.8**
	❑ *300 +*	**12.0**
VIII.A.1.9.7 g) How many cellular	❑ *0*	**5.7**

telephones do you have in your household?	❑	*1*	50.0
	❑	*2 or more*	44.3

VIII.A.1.9.8 h) **Please identify the cellular carrier(s) you use for the cellular telephone(s) in your household.** *(Check all that apply)*	❑	*Airtouch/Verizon*	30.2
	❑	*Cellular 2000*	2.1
	❑	*Cellular One*	57.3
	❑	*Quick Call Cellular*	0.3
	❑	*Sprint*	2.1
	❑	*UNICEL*	1.1
	❑	*Wireless North*	1.6
	❑	*Other* See Table A4	5.9

VIII.A.1.9.9 *i)* **What is your approximate annual household income?**	❑	*Under $20,000*	9.1
	❑	*20,000 – 39,000*	37.8
	❑	*40,000 – 79,000*	43.1
	❑	*80,000 +*	10.0

Table A1

Others	Count
Newspaper	3
Sheriff's Office	2
CB Radio	2
DTN	3
National Weather Service	1
AAA	1
ND DOT	1
Fog	4

Table A2

Others	Count
Amount of Traffic	3
Construction	12

Table A3

Others	Count
Ice	7
Tornado	8

Table A4

Others	Count
AT&T	5
Bell South	1
Commnet	23
GTE Wireless	1
Horizon	1
Ionex	2
MCI Worldcom	2
MTS	1
Nextel	1
Trackphone	1
Unspecified	26

Voice Stream	1
Western Wireless	1

IX. ATTACHMENT 3 – BUREAU OF GOVERNMENTAL AFFAIRS SURVEY RESULTS

Interim Report
Advanced Transportation Weather Information System
ATWIS
April 1998

Dr. Nicholas A. Gannatasio
Director

TABLE OF CONTENTS

FINAL REPORT

Evaluation of Use of the
Advanced Transportation Weather Information System

       The Bureau of Governmental Affairs at the University of North Dakota agreed to conduct six (6) evaluations of client users of ATWIS between March 1, 1997 and April 1, 1998. The evaluation of clients was to come from random samples of cellular telephone owners in North Dakota and South Dakota. In addition, maintenance crew supervisors with the Department of Transportation in North Dakota an d South Dakota were to be telephone interviewed. This final report represents the results of the evaluations performed in the spring of 1998.

Summary of Findings

Evaluations of Users
Advanced Transportation Weather Information System

1.   Less than half the population surveyed was aware of the existence of #SAFE.
        Ten percent (10.5%) of all persons surveyed reported using the #SAFE
        number. But when controlled from awareness the users numbers increased to
        eighteen (18.5%) percent of the population.

2.   Highways signs were the most frequent way people reported becoming aware
        of #SAFE, followed by radio radio/TV advertising. No other means of
        information reached 10 percent of the population. Residents of North Dakota
        were much more likely to acknowledge the highway signs as a source of
        awareness.

3.   Transportation Department maintenance crew supervisors were almost all
        daily consumers of weather information. Almost all claimed they used the
        daily weather forecasts, most used the forecasts in their planning activities,
        and they found the forecasts accurate. A majority (75%) said they had altered
        their assignment of personnel as a result of the daily forecast.

The evaluations of client users of the Advanced Transportation Weather Information System were as follows:

1.   A mail survey of cellular telephone owners, conducted March 1 – April 15, 1998. 2862 questionnaires were mailed out originally with 837 completed questionnaires being returned.
2.   A telephone survey of 600 cellular telephone owners, conducted November 16 – 18, 1998.
3.   Telephone interviews with 20 Transportation Department maintenance supervisors in North and South Dakota, conducted April 1-15, 1998.

The number of telephone interviews was selected in order to produce a margin of error rate in the +/- 4 percent range. In the same vein the large number of mail questionnaires were mailed in order to yield a return rate equal or better than that of the telephone survey. This produced a margin or error rate in the range of +/- 2.5 percent. The response rate of 837 from 2862 mailed questionnaires, or 29.95 percent, is relatively good and assures a response number sufficient to provide sample reliable. When the two surveys are compared demographically, they look remarkably similar. The only exception was the higher percentage of rural respondents in the mail survey and a higher percent of city respondents in the phone survey, this maybe due to the difficulty of reaching rural residents during telephone interview times. The comparability of the two surveys is further evidence of the two samples' reliability.

Table 1

	Mail Survey **March 1 – April 15** **N=837**	**Telephone Survey**
State		
North Dakota	54.9% (451)	58.4% (348)
South Dakota	45.1 (371)	41.6 (248)
Residence		
Farm/Rural	38.2% (311)	17.8% (106)
City	61.8 (504)	82.2 (489)
Age		
18-29	16.2% (132)	17.5% (104)
30-45	43.5 (355)	44.1 (262)
46-60	25.9 (212)	25.4 (151)
Over 60	14.4 (118)	13.0 (77)

Awareness of #SAFE

The most basic finding from the two surveys is that a majority of residents of North Dakota and South Dakota are not aware of the #SAFE program and that an even smaller number of citizens have ever utilized the number. When asked if cellular telephone owners were aware of #SAFE, 56.8 percent of mail survey respondents said yes and 46 percent of telephone respondents said yes. Both sets of respondents were asked if they had ever used the #SAFE number. In the mail survey 10.5 percent of the sample responded positively (18.5 percent of those aware of the number's existence) and in the telephone survey 1.7 percent of the total sample said they had used the number or 3.6 percent of those of the system's existence .

Table 2

Knowledge and Use of #SAFE

	Mail Survey	Telephone Survey
Aware of #SAFE	56.8% (475)	46.0% (276)
Used #SAFE	10.5 (88)	1.7 (10)
Use by Aware Respondents	185 (88/475)	3.6 (10/276)

The mail survey found residents of South Dakota slightly more likely to be aware of the #SAFE number, 53% to 47% for North Dakota residents. City dwellers were found to be more aware of the system in the mail and telephone survey. Both surveys found persons ages 30-45 to be more likely to be aware of the system. The mail survey found females more likely to be aware (65%) and the telephone survey found no difference.

Use of #SAFE fairly well matched awareness. The mail survey found greater use in North Dakota. Residents ages 30-45 and city residents were more like to use the #SAFE system. The mail survey found greater use among females (71% to 29%) while the telephone survey found no significant difference between males and females.

Sources of Awareness for #SAFE

The results suggest that highway signs have the most effective means of informing drivers of the #SAFE system, followed by media publicity.

Table 3

Source of Awareness for #SAFE

	Mail Survey
Highway Signs	55.0% (237)
Radio/TV Advertising	27.8 (120)
Newspaper Advertising	6.3 (27)
Retailer Selling Phones	6.3 (27)
Other/Refused Answer	4.6 (20)

There were no important differences in the demographics of how people became aware of #SAFE.

Table 4

Awareness of #SAFE Through Highway Signs

	Mail Survey
North Dakota	26.6% (120)
South Dakota	30.2 (112)

Conditions for Use of #SAFE

A series of questions sought to establish the conditions for which people would promote the use #SAFE. The system was designed for bad weather advice and it was expected citizens would access the system during periods of bad weather.

Table 5

Conditions for Use of #SAFE

	Mail Survey		Telephone Survey	
Purpose of Travel				
Business	23.6%	(25)	27.8%	(167)
Personal	36.8	(39)	15.2	(91)
Both	31.1	(33)	7.7	(46)
No Response	8.5	(9)	49.3	(295)
Miles Traveled				
Under 10	1.0%	(1)	10.6%	(32)
11-30	3.8	(4)	29.4	(89)
31-100	21.0	(22)	32.0	(97)
Over 100	56.2	(59)	27.1	(82)
No Response	18.0	(19)	.9	(3)
Time Used				
One	24.2%	(22)		
2-3	45.1	(41)		
4-7	18.7	(17)		
8 or More	7.7	(7)		
No Response	4.3	(4)		

It appears quite clear from the data that persons accessing the system were traveling considerable distances and that they were multiple users of the system.

Level of Satisfaction with #SAFE

A major objective of the surveys was to ascertain the level of satisfaction with the #SAFE system. The surveys sought to determine if people had difficulty accessing the system, found the weather information provided was accurate, and weather they altered their driving as a result. Table 6 presents the findings from the final mail survey.

Table 6

Satisfaction with #SAFE

	Mail Survey	
Difficulty Accessing #SAFE		
Yes	6.4%	(7)
No	80.7	(88)
Don't Know	12.9	(14)
Accuracy of Weather Information		
Very Accurate	36.1%	(39)
Somewhat Accurate	43.5	(47)
Not Very Accurate	1.0	(1)
No Response	19.4	(21)
Changes Driving Plans		
No Change	42.7%	(44)
Not Travel	16.5	(17)
Slowed Down	11.7	(12)
Different Route	2.9	(3)
Go Later in Day	11.7	(12)
No Response	14.5	(15)
Benefit from SAFE in Future		
Yes	94.3%	(510)
No	5.7	(31)

The majority of respondents did not have difficulty accessing the #SAFE system and found the information to be accurate.

Table 7

Traveling in the Upper Midwest

Mail Survey

How Many Times Traveled on
State/Interstate Highways

Daily	37.9%	(316)
2-3 Times a Week	24.9	(207)
Once a Week	11.0	(92)
Few Times a Month	17.7	(147)
Once a Month	7.6	(63)
Never	.8	(7)
No Response	.1	(1)

Main Reason for Winter Travel

Visit Family/Friends	22.5%	(187)
Get To/From Work	29.7	(247)
Shop	10.6	(88)
Travel Out of State	2.2	(18)
Business	10.6	(88)
Other	24.4	(203)

Last Winter, Ever Delay or Cancel
Travel Because of Weather

Yes	62.2%	(516)
No	37.7	(310)
No Response	.5	(4)

If Delayed or Canceled, How Decide
Not to Travel

Weather Report on Radio/TV	46.9%	(277)
Saw Bad Weather Outside	19.3	(114)
Called Ahead to Destination	4.4	(26)
Started Out and Found Poor Conditions	4.9	(29)
Called #SAFE	.5	(3)
Other	11.5	(68)
No Response	12.5	(74)

Maintenance Crew Supervisors

The final component of the evaluation was an interview with Transportation Department maintenance crew supervisors in North Dakota and South Dakota.

MAINTENANCE CREW SUPERVISORS

April 1-15

Daily Use	30%	(6)
Weekly Use	5	(1)
During Bad Weather	65	(13)

Table 9

**Use of Daily Weather Forecasts in Planning
Highway Maintenance Activity**

Daily Weather Forecasts Helpful in Planning

Yes	95%	(19)
No	5	(1)

Altered Planning or Assignments as a Result
Of Daily Weather Forecasts

Yes	75%	(15)
No	25	(5)