Road Weather Management Program (RWMP) Performance Measurement

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ABSTRACT

Since the late 1990's, the U.S. Department of Transportation (USDOT), Federal Highway Administration (FHWA) has managed a program dedicated to improving the safety, mobility and productivity of the nation's surface transportation modes by integrating meteorology into transportation operations and maintenance. Guided by goals in national legislation, FHWA's Road Weather Management Program (RWMP) seeks to improve the level of service on roads and reduce vehicle crashes through a combination of road weather research, scientific innovations to invigorate the private sector weather enterprise, and multifaceted education and outreach programs to engage public transportation agencies. The RWMP conducted a study with stakeholders from the transportation and meteorological communities to define eleven performance measures that will enable the USDOT to determine the extent to which these goals are being met. This paper discusses these performance measures and presents results that illustrate the social, scientific and organizational benefits that can be attributed to the RWMP.

KEYWORDS

PERFORMANCE MEASURES / ROAD WEATHER / ASSESSMENT / OUTREACH / TRANSPORTATION AGENCIES

1. BACKGROUND

In 2005, the U.S. Congress passed the Safe, Accountable, Flexible, Efficient, Transportation Equity Act – A Legacy for Users (SAFETEA-LU) to fund the U.S. Department of

Transportation (USDOT). Title V, Section 5308 of this act established a Road Weather Research and Development Program. The Road Weather Management Program (RWMP) is housed within the Office of Operations of the Federal Highway Administration (FHWA) at the USDOT. The RWMP's activities and services are guided by a set of goals that are specified in Section 5308 of the current SAFETEA-LU legislation. Three significant goals are defined in the legislation to guide RWMP research and development:

1. Maximize use of available road weather information and technologies;
2. Expand road weather research and development efforts to enhance roadway safety, capacity, and efficiency while minimizing environmental impacts; and
3. Promote technology transfer of effective road weather scientific and technological advances.

Section 5308 specifically cited the National Research Council report *Where the Weather Meets the Road* [1] as a source for programmatic recommendations to help guide the work of the RWMP in meeting the SAFETEA-LU goals. The RWMP responds to as many of these programmatic recommendations as possible within the limits of the available resources. To measure and interpret the social, scientific, and organizational benefits that accrue from these RWMP projects, activities and services, a challenge is to identify and implement reasonable performance measures that track the attainment or progress towards the SAFETEA-LU goals.

The RWMP contracted with a consultant team to identify potential output and outcome measures and select a reasonable and practical subset of those measures to quantify program performance. Eleven measures across the three goal areas were selected for implementation. Data have been collected that reflect accomplishments through the implementation of a variety of RWMP activities undertaken in 2005-2009 to raise awareness, adoption and use of road weather information and technologies. These include, for example, *Clarus,* Environmental Sensor Station Siting Guidelines, Maintenance Decision Support Systems, Traffic Management Center Weather Integration, Vehicle Infrastructure Integration, and a number of other activities. These programs are intended to support the provision of high quality advisory information to travelers, information and management systems for enhanced traffic operations and control, and automated decision support systems to improve the overall performance of the highway system during inclement weather.

The accomplishment and delivery of each of these program elements are intended to contribute directly to the attainment of the SAFETEA-LU goals. By measuring the progress towards the goal via the set of performance measures, and by attributing the impacts of the program elements to the attainment of these goals, the effectiveness of the RWMP can be assessed.

Challenges include obtaining appropriate data to quantify each performance measure and attributing observed changes in target measures over time specifically to the RWMP, net of other external factors that influence those measures. In addition, many of the RWMP's projects are at a very early stage of deployment, and therefore identifiable benefits would be limited at this point. For example, the applications based on the *Clarus* system are only now starting to be demonstrated in selected states. This paper presents results based on available secondary data, and data collected through stakeholder interviews. These data are

interpreted in terms of the effect of the RWMP's activities over the past several years on progress toward meeting the SAFETEA-LU goals.

Finally, it is important to emphasize that these measures are focused on the performance of the federal program; they are *not* measures of individual state DOT performance in these goal areas.

2. MEASUREMENT APPROACH

The identification of a manageable set of performance measures began with a literature review that included over 150 documents pertaining to measures being used throughout the federal government and private sectors, including the National Oceanic and Atmospheric Administration (NOAA) and the Federal Aviation Administration. Initially about 120 output and outcome measures were identified, reduced to about 65 measures in a workshop, and then circulated to over 250 public and private sector stakeholders for comments and recommendations. Out of this process, eleven measures were selected based on their relevance to the RWMP, endorsement by stakeholders, data availability, and ease of implementation. These 11 measures are shown in Table 1 under each of the 3 goal areas.

Table 1 - RWMP Performance Measures

Goal 1: Maximize use of available road weather information and technologies.
1.1 Number or percentage of transportation agencies that use road weather information and decision support systems (based on current or forecast information) for making advisory, control and treatment decisions.
1.2 Number or percentage of travelers who use road weather information for making travel decisions (both pre-trip and en-route).
1.3 Number of environmental sensor stations (ESS) deployed and used by transportation agencies to support decision-making (normalized by total area or length of road network).
Goal 2: Expand road weather research and development efforts to enhance roadway safety, capacity and efficiency while minimizing environmental impacts.
2.1 Number of agencies participating in and benefiting from road weather R&D projects.
2.2 Percentage of time roadway meets safety and capacity level of service (LOS) standards (i.e. V/C ratio, etc.) during and after weather events (normalized by the frequency/intensity of winter events).
2.3 Reduction in agency costs (i.e. labor, equipment, and materials) due to adoption of maintenance and operations decision-support systems for road weather management.
2.4 Reduction in user costs (i.e. delay, crashes, vehicle operating costs, emissions, salt damage) due to improved road weather advisory, control and treatment strategies.
Goal 3: Promote technology transfer of effective road weather scientific and technological advances.
3.1 Number of agencies/individuals visited or contacted through technology transfer, training and outreach efforts.
3.2 Rate of adoption of RWM technologies (e.g., decision-support systems) by agencies that participated in workshop or training activities.
3.3 Number of RWM technology development, testing and deployment activities initiated through public or private sector based on identified operational needs.
3.4 Number of road weather technologies developed through public-private and/or public-public partnerships reaching operational deployment.

Most of the eleven measures shown in Table 1 are multi-dimensional, and in order to effectively operationalize these measures using available data, selected indicators have been identified that seek to support these various dimensions. For example, measure 1.1 has associated with it four separate indicators. In a few instances, a data source can directly support the measure, such as with measures 2.1 and 2.3.

3. ANALYSIS AND INTERPRETATION

This section presents the data for measures and indicators, and interprets that information in terms of RWMP performance toward achievement of each of the three goals.

3.1. GOAL 1: MAXIMIZE USE OF AVAILABLE ROAD WEATHER INFORMATION AND TECHNOLOGIES

The RWMP has been promoting the use of weather information in operations through a variety of activities including providing tools and promoting best practices for weather information integration, weather-responsive traffic management, *Clarus*, the Maintenance Decision Support System (MDSS), and ESS Siting guidelines. These activities provide guidance, services, and tools to transportation operators to improve their advisory, control and treatment operations. Measure 1 under Goal 1 focuses on how many agencies are using road weather information for advisory, control and treatment decisions. The first indicator supporting Measure 1 for this goal focuses on states providing weather advisory information to travelers. The data came from periodic surveys conducted in 2004 and 2007 to measure ITS deployments [2]. Figure 1 shows the number of states reporting that they provide weather information as part of four different technologies including Dynamic Message Signs (DMS), Highway Advisory Radio (HAR), 511 phone system, and traveler information website. Across these four technologies, the number of states offering traveler information of all kinds increased somewhat (average 16% between 2004 and 2007), but the provision of weather information (indicated by the colored portion of the bars) increased 42% on average. The provision of weather information on DMS increased the most, about 84% over this three year period. The nature of weather information provided was not clearly identified in the data and probably varies across the technologies.

The second indicator supporting Measure 1 is the number of agencies adopting MDSS technologies and methods (treatment). As reported by the RWMP, the year 2004 was the first year in which the MDSS technology was considered sufficiently mature for states to adopt it operationally. By 2008, 30 state agencies were reporting some use of the MDSS, either in terms of partial geographic coverage or only parts of the software system usage. Of those, five (5) agencies reported full operational use as part of their regular winter maintenance operations and decision support.

The third indicator looks at the number of states using weather information, specifically atmospheric data and pavement data, to support their traffic operations. These data are also derived from the ITS Deployment Statistics [3]. In 2004 states were already reporting quite widespread use of weather data, so by 2007 only relatively small increases were possible in overall reported usage. In 2004, 44 states reported using atmospheric weather data and 41 states reported using pavement data. By 2007, 47 states were reporting use of atmospheric data and 46 states for pavement data. What remains unknown from these statistics is the

quality of the data, or how widespread the use had become over this period within the states using weather information.

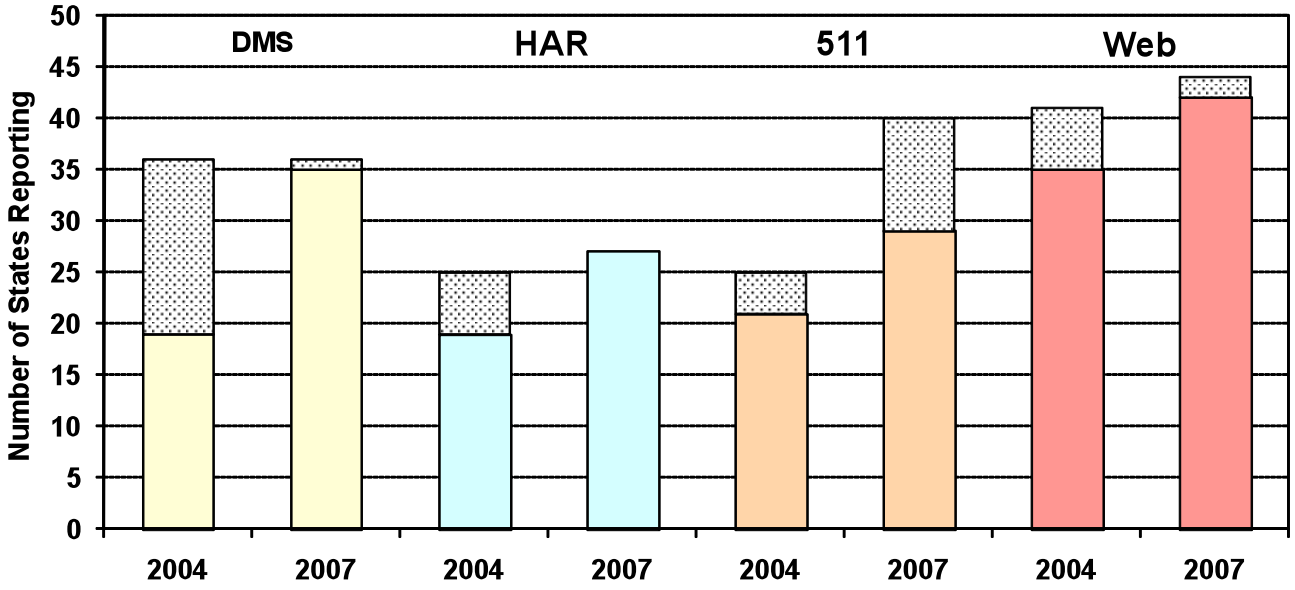

Figure 1 – Number of States Disseminating Weather Information to Travelers, by Year and Technology

The fourth and last indicator used to operationalize Measure 1 examines the number of states with agencies that subscribe to weather products and services. Again the primary source of data was the ITS Deployment Statistics [4]. Figure 2 shows the number of states that subscribed between 2004 and 2007 increased by an average of 26%.

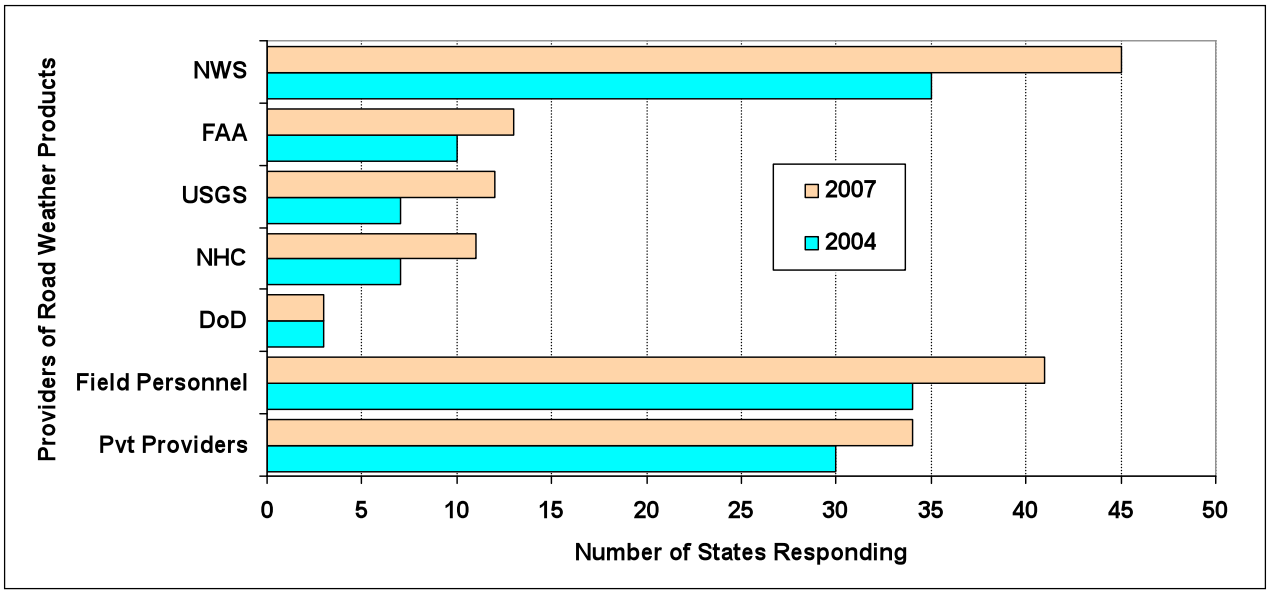

Figure 2 – States that Subscribe to Road Weather Products and Services by Providers: 2004 and 2007

Measure 2 for Goal 1 looks at how many travelers are using road weather information for making their travel decisions. One indicator was selected for this measure, namely, the number of travelers' calls to states' 511 travel information phone systems in 2008 and the number of those calls that were directed to weather information on those 511 systems. In 2008, 33 states had 41 operating 511 systems, and 25 of those systems offered some form of weather or road weather information. Those systems that offered weather information reported a wide range of calls requesting weather information, from a low of 1% to a high of 100% (several state 511 systems are solely dedicated to weather reporting, so all callers receive weather information). The 38 systems reporting call volume between starting their 511 systems and June 2008, recorded over 109 million calls, with an estimated 13 million calls that sought weather or road weather information, about 12% of all calls on an average across the systems. A few states (6 among those reporting) have not yet included weather information on their 511 sites. A roughly equal number of states are providing general weather (24) and road weather (25) information. Importantly, only a few (4) are now starting to offer route-specific road weather condition information. An assumption regarding this indicator is that travelers calling in for this type of weather information are also likely users of that information for making their travel decisions, which is what the measure is about.

Measure 3 examines the deployment of Environmental Sensor Stations (ESS) and their use by agencies to support their decision making. The first indicator assesses the number of agencies that are contributing their ESS data to *Clarus,* a road weather data repository and quality checking system. Between 2006 and 2008, the number of agencies contributing their ESS data to *Clarus* increased from 3 to 33. These 33 agencies had a total of 1,700 ESS supporting *Clarus*, and as of the end of 2008, 10 agencies are pending connection to *Clarus* and another 8 are considering connection. This rapid increase in connectivity early in the *Clarus* program reflects recognition of the value to these agencies of having easy access to quality-controlled data from a variety of sources in their states and regions. Agency representatives who were interviewed were asked whether they have a copy of the ESS siting guidelines and, if so, have they used them. Of 20 who responded, 18 (90%) said they had read the guidelines and 10 (50%) of them had used the guidelines either to support ESS installations or to review their current ESS usage plans.

The second indicator for Measure 3 addresses the number of agencies providing ESS data via the web for both agency and public use. Between 2004 and 2007 the number of agencies providing ESS data for agency use increased from 25 to 31 (24%), and for public use from 19 to 28 (47%) [5].

3.1.1. GOAL 1: SUMMARY OF FINDINGS

The three measures included under Goal 1 focus on changes over time in the number of users (including agency and end-users) of road weather information and the deployment of two key technologies (MDSS and ESS) used to support decision making. The data collected under the seven indicators all demonstrate significant increases in access to and use of road weather information over the past three years. There clearly remains room for further improvement in the use of available road weather information and technologies, and the activities and services of the RWMP are contributing toward the successful achievement of Goal 1.

3.2. GOAL 2: EXPAND ROAD WEATHER RESEARCH AND DEVELOPMENT EFFORTS TO ENHANCE ROADWAY SAFETY, CAPACITY AND EFFICIENCY WHILE MINIMIZING ENVIRONMENTAL IMPACTS

The RWMP advocates for best practices to improve safety and productivity, and has served as a catalyst for increasing the level of awareness of advisory, control and treatment strategies during weather events and promoting these techniques to the states. There are four measures included under Goal 2, supported by three indicators. Measure 1 addresses the number of agencies engaged in road weather R&D projects, and data for this measure were obtained from agency interviews in which respondents were asked about their agency's involvement in selected RWMP R&D projects and the extent of benefits they derived from that involvement. Out of 22 respondents to these interviews, 82% reported involvement with at least one of the RWMP's R&D projects, and 64% said their agencies were involved in both *Clarus* and MDSS. Of the involved agencies, over half (56%) said they were deriving "substantial" benefits from these projects, and an additional 39% said they experienced "moderate" benefits. A number of the agencies commented that they thought it was still too early in the RWMP program to expect significant benefits, but they appreciated the benefits derived to date and saw additional potential for the future.

Measure 2 addresses safety and capacity in terms of maintenance of Level of Service (LOS) standards during and after weather events. Data on LOS are difficult to obtain as there is no consistent reporting on this topic. In the agency interviews, respondents were asked if they had quantified the benefits and costs associated with maintaining winter LOS, and 3 out of 12 respondents (25%) said their agency had done that. Additional support and guidance will likely be needed to encourage agencies to quantify benefits in terms of return to LOS and to contribute uniform data that can allow the RWMP to better assess their performance.

Measure 3 looks at reductions in agency costs for labor, equipment and material due to adoption of decision support systems. For the past several years the RWMP has been supporting the development and deployment of MDSS technology for use in state's winter maintenance operations. The RWMP is in the process of expanding the use of decision support technologies year round under the Maintenance and Operations Decision Support System (MODSS) to support better scheduling of road maintenance to avoid adverse weather. Few studies have been conducted that can document cost reductions, but results are now emerging that suggest MDSS can lead to significant cost savings and benefits. Agency interviews indicated that 8 out of 12 respondents (67%) report efforts to quantify such cost reductions with mostly positive outcomes. The Indiana DOT reports normalized savings of almost 10 million dollars in salt used during the 2008-2009 winter season and almost 1 million dollars in overtime compensation due to the MDSS [6]. Significant savings in labor have been experienced by the Denver City/County DOT in Colorado over the past two winter seasons [7]. Evaluations of MDSS deployments in several states have also reported savings in labor and materials [8].

Measure 4 focuses on reductions in user costs associated with, for example, delays or crashes, due to improved road weather strategies. Two indicators support this measure. The first addresses reductions in crashes due to RWMP-identified best practices adopted by public agencies. Each year 22 percent of injury and fatal crashes can be attributed to adverse weather and its effect on visibility and road surfaces (snow, rain, etc.) [9]. The RWMP encourages the use of best practice advisory, treatment and control technologies to reduce

crashes and incidents due to adverse weather. The data in Table 2 show estimated reductions in crashes in 2007 experienced by select states that have deployed these best practice systems [10]. It appears clear from the data presented in Table 2 that the RWMP, by encouraging the use of these systems and strategies, can have a significant beneficial impact on crash reduction and, hence, enhanced roadway safety.

Table 2 – Estimated Crash Reduction Due to RWMP Best Practices

Best Practices	Percentage Reduction in Crashes*	Level of Use by States (2007)*
Fog Warning System	70-100%	~12
Road Weather Information System	3-17%	33
Variable Speed Limits	8-25%	5
Anti-icing Strategies	7-83%	nd
Wet Pavement Detection	39%	nd
Automated Anti-icing on Bridges	25-100%	20
Conditions on DMS	2.80%	29
Conditions on HAR	nd	18
Conditions on 511	nd	23
Water Level Monitoring	nd	15

* nd = No Data

The second indicator that supports Measure 4 addresses the RWMP's ability to reduce roadway capacity losses and delays by encouraging the adoption of best practices by public agencies. Data compiled by the RWMP indicate that average speeds on roadways are reduced between 3% and 40% by weather that ranges from light rain to heavy snow. As is the case with crash reduction, RWMP best practices implemented by state DOTs have served to reduce speed, capacity and delay impacts associated with adverse weather. Table 3 shows the RWMP impacts.

Table 3 - Impacts on Speed, Capacity and Delays due to RWMP Best Practices

Strategies	Capacity and Delay, Impacts (examples from selected states)*	Level of Use by States (2007)
Low Visibility Warning Systems	More uniform traffic flow Reduced speed variability by 22% Speeds increased 11%	~12
Weather-related signage on DMS	Nd	29
Weather information on 511	Nd	23
Highway Advisory Radio	1/3 of CVOs reported considering changing routes based on information	18
Variable Speed Limits/Speed Management	Reduced average speed by 13%	5
Weather-related signal timing	Reduced vehicle delay 8% Reduced vehicle stops over 5%	4
Weather and/or Road Condition Information on Websites	94% travelers - better prepared to travel 56% travelers - helped avoid delays	37

* nd = No Data

3.2.1. GOAL 2: SUMMARY OF FINDINGS

The four measures under Goal 2 seek to quantify the extent to which agencies are engaging in activities that will enhance the safety, capacity, and economic advantages of addressing the impacts of adverse weather conditions on roads and travelers, and do that while also minimizing impacts to the environment. Although many of the best practices and new technologies being promoted by the RWMP have only recently become available, state transportation agencies are eagerly adopting them. Best practices have existed prior to the RWM program, and the RWMP has sought to promote and catalyze increased adoption and use of these techniques. Clear results are difficult to quantify in this early stage of deployment but the evidence to date suggests significant use and benefits. As more states and agencies proactively adopt these advisory, treatment and control strategies, significant additional progress is virtually assured. The Goal 2 measures are the most important ones that need to be quantified, and actions by state agencies are the basis for assessing RWMP performance.

3.3. GOAL 3: PROMOTE TECHNOLOGY TRANSFER OF EFFECTIVE ROAD WEATHER SCIENTIFIC AND TECHNOLOGICAL ADVANCES

The RWMP has involved the transportation and meteorological communities using a combination of training, outreach, peer exchanges, conferences and collaborative research with universities, private entities, and state and local agencies to foster an engaged and active stakeholder group supporting road weather research and development. There are four measures under Goal 3, two of which are supported by three indicators each. Goal 3 addresses the RWMP's marketing, outreach and efforts to engage state agencies in the RWMP's programs and technologies. Measure 1 focuses on agencies and individuals visited or contacted, and the first two supporting indicators address participation in the *Clarus* initiative and MDSS stakeholder meetings. Figure 3 shows the number of state DOTs participating in these meetings.

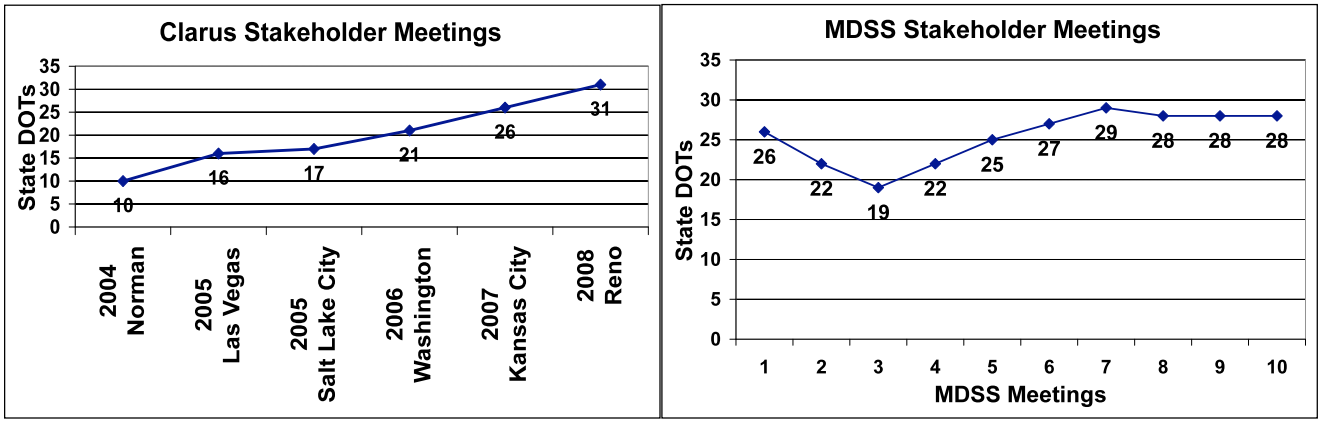

Figure 3 – State DOT Participation in *Clarus* and MDSS Stakeholder Meetings: 2000 - 2008

Involvement in the *Clarus* initiative has increased significantly between 2004 and 2008. Since the year 2000, 41 state DOTs have participated in one or more MDSS stakeholder meetings, and the level of participation in any one year has remained relatively stable over this period. The third indicator covers participation in RWMP-sponsored or promoted training. Four courses have been presented on "Principles and Tools for Road Weather Management" that have drawn a total of 113 participants to four on-site locations. Two additional blended courses on this topic drew 38 participants in 2008. An Institute of Transportation Engineers

(ITE) course in 2008 had 40 participants. Also, the RWMP has sponsored the "MDSS Road Show" that has been conducted 28 times between 2006 and 2009 across the country. Through the *Clarus* and MDSS meetings and sponsored training activities, the RWMP has reached a wide audience of key stakeholders.

Further support for progress on Measure 1 is provided by the agency interviews, in which 14 out of 20 (70%) said they have visited the FHWA RWMP web site and downloaded either research reports, guidance documents, or other tools and information. In addition, 13 of 20 respondents (65%) said they have participated in the FHWA NTOC webcasts, which is a forum that the RWMP uses to communicate with its national constituency.

Measure 2 covers the extent to which agencies that have participated in workshops or training have adopted RWMP technologies. Data are not directly available to tie participation to adoption, so three indicators are presented that offer insight into this measure. The first looks at the number of agencies that are contributing their ESS data to *Clarus*. In 2006 there were three agencies that contributed ESS data to *Clarus*, and by 2008, 33 agencies had contributed data from 1,700 ESS. As has been noted already, the *Clarus* program is just now getting off the ground, and more agencies are expected to contribute significantly more data to *Clarus* in the future. The second indicator of RWMP technology adoption is the extent of public and private sector use of quality-checked *Clarus* data. This indicator will become more useful as the *Clarus* system evolves, but in the early phases of this initiative, at least five private sector entities are active users of *Clarus* data. States are starting to acquire *Clarus* System data, and applications are being developed as part of Phase III of the *Clarus* initiative regional demonstrations that are expected to be deployed in about 8 states by 2010. The third indicator for Measure 2 is the number of states adopting MDSS technologies and methods. This indicator also supports Goal 1, Measure 1, and the data were reported under the Goal 1 discussion.

Measure 3 addresses the number of RWMP development, testing and deployment activities of both the public and private sectors. Between 2001 and 2008 approximately 90 projects have been initiated through Federal, State and University sponsorship.

Measure 4 addresses the number of road weather technologies developed through partnerships that have reached operational deployment. Table 4 lists eight such technologies that are in various stages of operations across the country.

Table 4 – Operational Road Weather Technologies by Partnership Type

Technologies	Partnership Type
Condition Acquisition and Reporting System (CARS)	public-private
Meridian-MnDOT Weather Response Index	public-private
MDSS (Pooled Fund / Meridian)	public-private
WeatherShare (WTI-CalTrans)	public-public
#SAFE (UND - NDDOT/SDDOT)	public-public
Avalanche advisories (WTI - MtDOT)	public-public
Roadway Environment Blowing Snow Modeling (UND-PFS MDSS)	public-public
Federal Prototype MDSS (NCAR-FHWA)	public-public

Each of the technologies shown in Table 4 is being widely used by states and agencies, and each has been initiated or supported by the RWMP.

3.3.1. GOAL 3: SUMMARY OF FINDINGS

The four measures under Goal 3 seek to quantify the extent to which the RWMP has been able to engage a wide range of stakeholders and potential users of road weather technologies, communicate the benefits, promote usage, and successfully transfer operational tools and systems to states and agencies across the country. Departments of transportation have traditionally interpreted their jobs in terms of construction, operation and management of transportation infrastructure. The underlying tenet of Intelligent Transportation Systems (ITS) is to encourage a focus on enhancing the safety, efficiency, and productivity of existing systems. In this context, the RWMP seeks to expand the vision of transportation system operators to more proactively integrate road weather into their daily activities consistent with the ITS philosophy. Although indicated as the third goal of the RWM program, this goal reflects the first step in the process of raising awareness of the benefits of adopting RWM technologies and systems. Effective outreach and technology transfer enables agencies to address the significant effects of weather and road conditions affected by weather on the safety and satisfaction of the traveling public. The RWMP has taken steps in this direction to provide training and direction, and achieved measurable progress in terms of agency awareness, involvement, and adoption of such systems as *Clarus* and MDSS. Much more progress along these lines can be expected in the future as these systems mature.

4. CONCLUSIONS AND PROSPECTS

Performance measures offer a valuable tool in support of efforts to understand programmatic impact, benefit, and potential for improvement. Stakeholders at the state and local level are eager to benefit from the activities, programs and services being offered by the FHWA Road Weather Management Program. At the same time, the RWMP is eager to see documented evidence that they are achieving the goals set out for the program and satisfying the needs of their constituency. Reflecting early guidance from stakeholders, the eleven metrics examined in this paper are primarily directed to measuring the outcome benefits that the program is providing. But even the most carefully crafted output and outcome metrics can only approximate the concepts they seek to measure. The measures used to support the performance of the RWMP reflect a combination of quantifiable *outputs* (e.g., number of agencies that have acquired an MDSS, or the number of training programs conducted) and qualitative *outcomes* (e.g., the extent to which agencies are using MDSS more effectively throughout their jurisdiction, or the proactive incorporation of road weather information by transportation operators in decision making). In addition, other programs and factors can influence the measured outcomes, presenting a challenge to attribute observed data to the causal effects of the RWMP.

Recognizing these challenges, it is prudent to have multiple measures and indicators supported by a variety of relevant data sources and to look at all available evidence in assessing the RWMP's performance to date. The RWMP will supplement and modify current data collection to incorporate the best available indicators for these measures. This paper has summarized the findings under each of the three SAFETEA-LU goals. Recognizing that

the RWMP has been conducting its activities and services for only a limited time, it is a program that can point to a number of tangible and significant results and benefits under each of the three goals and across the entire program. This paper reports on those performance results where data are available to support them.

In addition, the responses of the state agencies and stakeholders that are served by the RWMP offer another valuable indicator of program performance. State agency stakeholders who were interviewed were asked to provide suggestions on how the RWMP could better support them. While a few respondents said they wanted more financial support from the RWMP, others sought more of what the program is already providing; namely, more opportunities to participate in programs such as *Clarus* and MDSS, more long-distance learning opportunities and technology transfer given that states have severely constrained travel budgets, more direct engagement with the states in addition to channeling support through the private sector, and continued emphasis on ways to enhance and expand information flow and integrate weather into their operations. Overall, these stakeholders seemed pleased with the RWMP's performance, with one respondent saying, "Keep doing what you're doing."

This is only the first step for the application of performance metrics in the RWM program. Applying these measures consistently over time will give a more complete picture of performance, particularly as the data improve and are collected more systematically with the purpose of supporting the metrics. Based on an enhanced understanding of its past performance, the RWMP will be in a position to more effectively move the quality and benefits of the program forward. Even with this first application of the measures, clear progress toward attaining the SAFETEA-LU goals has been demonstrated, and the future forecast for improving performance of the RWMP appears bright.

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