PANEL 3 -- TECHNICAL RISKS AND CHALLENGES

Moderator: Mr. Kenneth Kobetsky, American Association of State Highway and Transportation Officials (AASHTO)

Rapporteurs: Mr. Michael Neyland, OFCM (STC)
Mr. Gary Nelson, MITRETEK

Panelists: Prof. Leon Osborne, University of North Dakota (UND)
Mr. William Mahoney, National Center for Atmospheric Research (NCAR)
Dr. Paul Jovannis, Pennsylvania State University (PSU)
Mr. Bradley Skarpness, Battelle

Objective: Summarize and discuss the technical risks and challenges facing implementation of decision support capabilities and services.

Synopsis

Moderator's Introductory Remarks

Mr. Kobetsky began by stating that in the weather information technology realm, there are several levels of needs. Meteorologists want large volumes of very accurate and precise information to enable them to forecast exactly what the weather will do. At another level, most users are unaffected by the weather unless they cannot get where they want to go or cannot do what they want to do. At still another level, decision-makers, like the state DOT's, need to know what the weather conditions will be, and when, in order to make decisions about when to send crews out on the roads. These decisions must be correct in order to avoid unnecessary costs or operations impacts. Mr. Kobetsky closed by saying that the precision needs of everyone are well-respected, but the various precision needs must be brought together so that each user knows what the others' precision needs are.

University of North Dakota

Professor Osborne is the Director, Regional Weather Information Center in the Department of Atmospheric Sciences at the University of North Dakota. In his presentation, entitled *Decision Support Systems* (DSS), he discussed DSS design goals (every system must be efficient, effective, appropriate and affordable), and the conceptual interfaces of DSS with environmental information systems and the surface transportation systems. The evolution of the Internet has had a dramatic effect on DSS's over the last 5 years, making access to those systems available to almost anyone.

Professor Osborne identified three risks associated with the introduction of tailored DSS's into the decision-making processes for surface transportation:

- the risk of overstating forecast capability while developing an over-dependence on models for final forecast values; it is important to understand the limits of mesoscale models;
- the risk of seeking a "one-size-fits-all" solution where diversity of the various state requirements and methods make that inappropriate and unfeasible; and
- the risk of attempting to support the needs of the operational environment by using programs designed only to support research.

There are six challenges facing the surface transportation and meteorological communities:

(1) to improve the science of meteorology through robust research and development;
(2) to make better and more efficient use of environmental sensors and data in weather forecasting;
(3) to create a tailored DSS framework that is flexible and customizable, without compromising the core capabilities of the DSS;
(4) to ensure the effective exchange of data and information across the user and provider communities;
(5) to sustain an innovative approach to ITS; and
(6) to increase the awareness of surface transportation weather within both the weather and transportation communities.

Professor Osborne closed with four recommendations:

(1) to facilitate a national road weather and surface condition collection and reporting system;
(2) to establish and expand education and outreach programs;
(3) to maintain parallel efforts in both research and operations; and
(4) to increase the funding for research in this area.

He concluded by saying that surface transportation weather has expanded rapidly in the past half decade by building on recent weather technologies not associated with surface transportation, but that further growth will require a focus and commitment to solving problems of specific interest to surface transportation.

National Center for Atmospheric Research (NCAR)

Mr. Mahoney addressed technical risks and challenges in four general areas.

- *Weather Diagnoses and Forecasts.* Mr. Mahoney pointed out that the weather information requirements of the surface transportation community are highly specialized, and that the weather community has not traditionally been focused on surface transportation needs. The surface transportation community requires very high-resolution weather information of a type that has not traditionally been available before. For example, the required resolution is "*misoscale*" (from 40m to 4km) in the horizontal, and in a very shallow layer in the vertical (surface to about 2m AGL), while the updates must be rapid (scale of minutes to hours) and coupled with long (48 hr) leadtimes. These requirements present some formidable scientific challenges, which require that more emphasis be placed on areas such as the boundary layer (0-2 m), thermodynamics (and the influence of small local effects), probability and statistics, high-resolution numerical modeling, verification, and quality control of non-standard data. Mr. Mahoney pointed out that, for example, if the weather information used by a Decision Support System (DSS) is not sufficiently accurate, then the DSS stakeholders will ignore the DSS-produced guidance. Although there are no off-the-shelf weather capabilities that can fully address the needs of the surface transportation community, there are several emerging technologies that are likely to provide benefits.

- *Weather Data Acquisition*. Access to the surface observation data nationwide is important for not only the quality of the forecasts, but also to provide a means to verify those forecasts. However, there is also a risk associated with using non-traditional data, and data standardization and quality control issues arise that must be addressed.

- *DOT Operations and Data Acquisition*. Mr. Mahoney contends that access to near real-time DOT operations data is important because those data are critical inputs to the DSS's and are necessary to produce reliable products. There are risks associated with managing such operational data, however, particularly when the data become old or invalid.

- *Decision Support Systems* (DSS). The DSS user community is large and diverse; as such there is risk to assume that any specific DSS solution will be broadly applicable across the surface transportation community. Nearly every user has something unique about their operation, and so there is no "one-size fits all" solution. In addition, any proposed DSS should represent an evolutionary change to the way that people do their jobs, rather than a revolutionary change, since users have shown that they often will reject any new tool that is too revolutionary or that makes too many of the decisions for the workers. This mandates a "bottoms-up" rather than a "top-down" approach to developing DSS's.

Mr. Mahoney concluded his remarks by stating that although there are challenges ahead, scientific and engineering solutions are being developed which are likely to produce significant benefits to the surface transportation community. To further improve the chances for long-term success, he recommended the establishment of a long-term, multi-faceted WIST research and development program to properly address user needs and to help exploit the scientific and technical capabilities that exist across the country.

Pennsylvania State University

Dr. Jovannis, Head of the Civil and Environmental Engineering Department, Pennsylvania State University, spoke on the *I-99 Advanced Transportation Technology Test Bed.* The project takes advantage of the fact that Interstate Highway 99 (I-99) is being built adjacent to the Pennsylvania State University (PSU), and is a collaborative effort between PSU and the Pennsylvania State Dept of Transportation (Penn DOT). The project creates an "*in situ*" laboratory for testing advanced transportation technologies and techniques in the areas of bridges, pavements, traffic, and the environment. The lab tackles work that is specific project-related in nature, rather than doing basic highway research. In addition, the lab projects are distinctly separated from the actual highway construction itself. Much of their focus will be on concrete bridges (curved, skewed, new deck materials, and techniques, etc.), as well as hydrologic projects. Specific areas of interest include modeling surface and ground water, and monitoring the effectiveness of stream and wetlands restoration efforts. Additionally, they have created a new faculty position in hydro-informatics, specifically to manage and exploit the huge and diverse regional databases of surface weather and hydrologic data.

Dr. Jovannis then talked about the effort to coordinate their slate of projects with the Intelligent Transportation System (ITS) Regional Rural Architecture, which cannot be finalized until the architecture study is completed later in 2001. This led to a discussion of the requirements for successful collaboration, which Dr. Jovannis said began with a sense of trust and familiarity between the investigator and his colleagues, the funding agency, and the ultimate beneficiary of the work. Other factors were the presence of the college and research center for support, and (importantly) understanding the challenge that cultural differences within the college environment represent. Finally, he concluded by saying that they have been successful in connecting with Penn DOT in the infrastructure management area, where Penn DOT is comfortable with what PSU proposes to do. However, they have been less successful in many of the other areas, where more work needs to be done.

Battelle

Dr. Skarpness, Director of Battelle's CPHRE Atlanta Office, is an expert in advanced rural transportation systems and spoke about *Rural Evaluations: Risks and Challenges*. He provided a summary of several recent advanced traffic information systems project evaluations in which Battelle has participated. The primary challenge, he said, is that there is plenty of weather data out there now and it must be determined whether the new weather information being produced by these projects (a) has more added value than the existing data, and (b) is changing people's behavior.

Dr. Skarpness described two projects in Missouri and Arizona. The first was the *Branson, Missouri, Travel and Recreational Information Program (TRIP)*, a stretch of 3-lane road through a commercial area with a high concentration of movie theaters and entertainment establishments, and subject to extensive traffic congestion. The transportation information system installed had several components, including inputs for traffic detection, variable message signage (VMS), information kiosks, and road weather information. The second was the *Interstate Highway 40 Traveler and Tourist Information System (TTIS)* project, a section of I-40 in Arizona near the

Grand Canyon. This project has a road weather component, including road weather sensors, and the resultant information is available on an Internet site and in information kiosks, as in the Branson project. The evaluation of the I-40 project showed a large number of requests for information, both on the web site and the information kiosks, but it did not appear that a large number of travelers were taking in the information and making decisions that impacted traffic operations very much. The results at Branson were very similar – lots of information, but was it utilized? "Not as much as hoped," said Skarpness. He said a theme became apparent, ". . . that you can have the most accurate information, but if you can't get it to the users and they can't digest it, it will not make an impact on what's going on." However, surveys of travelers in the Arizona area showed good awareness: 45 percent of travelers knew about and used some form of the information that was available, 33 percent knew about but did not use it, and 22 percent did not know anything about it. In Branson, the percentage of travelers who used the information was just slightly higher. A conclusion that could be drawn in Arizona, based on the metric of modified driver behavior, is that the high-technology solution on I-40 had some effect on drivers, but it may be that the low-tech solution demonstrated in Branson, with broad distribution, may have higher utility.

Dr. Skarpness then discussed the evaluation of FORETELL, a three-state (Iowa, Missouri, Wisconsin) project, to provide weather information and pavement predictions to travelers and decision makers, primarily via the Internet. The goals of the evaluation are to determine whether: (1) the additional information available to travelers and highway maintenance groups has added value over information that already exists; (2) it will change behavior; and (3) there is some outcome that the project can measure. The first challenge was to develop a conceptual model against which to evaluate FORETELL. That model postulates that FORETELL: (1) provides improved roadway and weather information, (2) gets the information to users, (3) who use it to make decisions, and (4) those decisions impact safety and efficiency. The evaluation does not assess either FORETELL system performance, or institutional performance. Follow on questions that will need to be answered include whether changes in driver behavior will affect safety and efficiency of the road system, and how many years of data must be analyzed to discern whether there has been any measurable effect on weather related deaths on the highways.

Follow-up Discussion

The first comment addressed the value of weather data collected locally and asserted that data has its greatest value at the local level--where it is collected rather than waiting for it to be gathered into a national database, processed, then redistributed back to the local level. The panel members agreed that the local level is where the first benefit will be realized; partnering at the local level is critical to the process. Since a national collection of all these data sources cannot be mandated, the next best solution is one whereby the data is used locally, then passed through to a national collection location, where data can be quality controlled, aggregated, synthesized and archived.

The next question, directed to Dr. Jovannis, asked why he was having problems connecting with the highway operations folks with regard to installing road weather sensors in the I-99 project. Dr. Jovannis replied that it was a functional problem, stating that his group had gotten ahead of the architecture study and planning for ITS deployment on I-99, and that they needed to stay engaged with the architecture study activity. He wants to ". . . move ahead the state of the art of integrating ground data and atmospheric data," but doesn't believe there is any consensus there. Penn DOT has probably deployed 40-50 RWIS sites around the state, but there is no systematic process for evaluating the data from them.

The final question was for Mr. Mahoney and asked what the strategy was for defining the requirements and capabilities for the first several DSS's, given the diverse user community. Mr. Mahoney replied that the process used as part of the Federal Highway Administration's Surface Transportation Weather Decision Support Requirements (STWDSR) project was a good starting point to try to get a set of high-level requirements documented so the entire community can use it as a reference point to identify how to attack the problem. However, in terms of actually building systems with the logic involved, the requirements must come from the bottom up. He stated that one couldn't capture on a national-scale the details necessary to build a system for very localized application. Those questions (what should it look like, feel like, what decisions are going to be made, how does the local operation work, etc.) can only be answered by close consultation with the local user.

Links to Presentations

Professor Leon Osborne, UND
www.ofcm.gov/WistII/Presentations/Day2/3_Panel3/Osborne.ppt

Mr. William Mahoney, NCAR
www.ofcm.gov/WistII/Presentations/Day2/3_Panel3/3_Mahoney.ppt

Dr. Paul Jovannis, PSU
www.ofcm.gov/WistII/Presentations/Day2/3_Panel3/Jovanis.ppt