

# ITS Institutional Issues: A Maintenance/Operations Perspective

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As advances in technology find their way into the maintenance activities of departments of transportation, traditional methods are being challenged with innovation. The struggle results in finding a balance between applying past methods that have shown results and using new advanced technology to optimize resources. The issues that are prevalent implementing new and innovative technology in maintenance operations are very similar to deploying intelligent transportation systems (ITS). This paper details these challenges and presents resolutions for addressing these concerns. The paper is based on the findings of a project sponsored by the multinational Aurora consortium and exchange of information among members. One significant issue is that technology-based methods of resolving operations and maintenance problems may meet resistance from staff familiar with conventional, proven methods of performing their duties. Another issue is that deployment of new technology involves considerable investment in training to ensure proper results. The inability to effectively use a system as a result of lack of training creates frustration and loss of faith in the system. Furthermore, the cost of equipment is another issue. With funding for projects already spread thinly across various interests, the competition for funds remains fierce. Public agencies are seeking partnerships with the private sector to share costs for implementing and operating traditionally "public" responsibilities. The Aurora-sponsored project found that, particularly with Road Weather Information Systems (RWIS), the proprietary nature of new technologies tends to hold public agencies to using equipment from a single vendor. This is a concern because, ultimately, the benefits of deploying RWIS are most visible when the technology is implemented as a statewide network. The same will be true with ITS deployments. This issue can be resolved with standards and protocols, but they are slow in emerging. Although there are many challenges, recognizing their existence is the first step in resolving these issues.

## INTRODUCTION

The Aurora consortium is leading the charge to maintain a joint program for cooperative research, evaluation, and deployment of advanced technologies for detailed road monitoring and forecasting for improved surface transportation with emphasis on efficient highway maintenance and effective real-time information outreach to travelers. The Consortium provides a forum of exchange for Road Weather Information Systems (RWIS), operations, and maintenance practices among transportation agencies within the United States and worldwide at their quarterly meetings.

By bringing together the leaders in snow and ice control movement, many lessons can be learned from their experiences in

implementing RWIS. As a result of expressed frustration in dealing with institutional issues, a project was suggested (funded by Aurora) to research, compile, and share the concerns related to deploying RWIS.

The increased interest in RWIS is a result of efforts to optimize resources. Like many intelligent transportation initiatives, maintenance engineers have sought new technologies for years to further enhance present snow and ice control techniques. While the positive effects of road weather information systems have allowed maintenance personnel to better predict weather events and then to manage these activities, fundamental issues seem to arise with deploying these technologies. In regards to ITS, similar parallels can be drawn. This paper will discuss some of the issues determined from a study funded by the Aurora consortium and show the parallels to implementing Intelligent Transportation Systems (ITS).

## TECHNOLOGY AS IT APPLIES TO MAINTENANCE ACTIVITIES

Traditional means of snow and ice control consist of reactive approaches to maintenance activities. When a storm occurs, oftentimes maintenance crews wait for accumulation before plowing and applying salt and sand. With over \$2 billion spent on snow and ice control each year within the United States, any reduction or savings from practices that optimize resources would mean alleviating a burden on maintenance budgets. As such, proactive approaches such as anti-icing and RWIS practices are becoming increasingly more popular forcing maintenance practices to be reexamined. These methods allow maintenance personnel to anticipate storms, preapply chemicals to prevent adhesion of precipitation to road surfaces, and then to better schedule staff to handle the effects of the storms, resulting in better optimization of resources.

The deployment of new technologies for use within the surface transportation community raises many issues that need to be addressed. A study conducted by the Aurora consortium reviewed previous research into RWIS issues. The types of issues that were identified could be categorized into funding, staffing, partnership, and standards issues. The primary sources of archived institutional issues were derived from a set of four documents. They included:

1. *Road and Weather Information Systems (RWIS) Feasibility Workshop Summary of Findings (1)*;
2. *Proceedings of the FHWA Surface Transportation Weather Information Workshop (2)*;
3. *Road Weather Information Systems Volume 1: Research Report 1993 (3)*; and
4. *Missouri Weather Collection and Dissemination Study (4)*.

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In the case of the first two publications, the information concerning institutional issues was identified from comments given by the workshop participants. The information on institutional barriers obtained from the Road Weather Information Systems Research Report were the results of actual interviews conducted with snow and ice personnel and from a review of field tests conducted during the winter of 1990. The interviews encompassed personnel from every level of the state agency (3).

In addition to the literature review, Aurora members were interviewed to further support the findings. The results of the literature search and interviews can be found in the report, *Review of the Institutional Issues Relating to Road Weather Information Systems* (5).

## Funding

From the documented research, the issues associated with funding included finding sources and competition for funding (1,2,4). Obtaining funding is the initial step in developing an RWIS program. Although the initial backing for purchase of equipment was important, funding for maintenance and operation of the technology in addition to funding for training of personnel were other considerations. As systems are implemented, funding for upgrading equipment to prevent the technology from becoming obsolete was more apparent. These were challenges for maintenance departments as they competed for funds against such contenders as traditional road repair and rehabilitation projects.

Traditional projects appeared to have more precedence since they provide the most clear-cut results from the road-using citizen perspective. However, obtaining funding may be easier if the benefits of RWIS were shown to be worth the investment. For example, numerous RWIS programs exist across the United States from which to derive proven success stories. These may be used along with published benefit/cost studies to educate higher level positions within transportation organizations about the effectiveness of RWIS. By leveraging the lessons learned and experiences of those with existing systems, the implementation of RWIS may be more cost-effective.

The strong correlation between RWIS and ITS is the use of technology to resolve traditional transportation related concerns. As a result, funding for implementation of ITS projects faces the same funding issues of determining initial funding sources and competing for funding with a multitude of other traditional road preservation and operational projects. Ultimately, whether RWIS or ITS related, the documented research noted that implementation benefits must be quantifiable whenever possible and well-documented in order to justify funding (1,2,4).

## Staffing

Once the initial hurdle of acquiring funds has been overcome and RWIS has been successfully installed, the next issue faced was staff acceptance. Successful implementation involved the willingness of maintenance personnel to use the new system and the practices involved. However, the negative mindset—including feelings of cynicism, lack of knowledge of what RWIS can accomplish for agencies, and lack of appreciation for the benefits of RWIS—of staff using

RWIS was identified as a difficulty faced by agencies implementing RWIS. The mindset issue was further nourished by the perceived ineffective dissemination of weather information and the lack of understanding of who the customer was and what it was they needed. There appeared to be a distinct need for personnel to overcome technical change and their attitudes towards RWIS and technology (1, 2).

As an example, RWIS use is successful within the Swedish National Road Administration where the system has been in place for many years. However, the system has not always been popular with their staff. When the program was first initiated, their staff saw “an enemy in the typewriter.” There were concerns with trying to use new techniques to interpret and read the data (5). Previous methods for determining winter maintenance included applying chemicals whenever staff felt it was necessary. Personal judgment was preferred over relying on data from sensor systems (5). How could this mindset change to the point where RWIS has become institutionalized to the extent that maintenance personnel are now fully at ease with these technologies? The answer has been considerable investment into initial and continual training.

Sufficient training was an area that seemed to be lacking for the Aurora agencies surveyed within the United States. Many personnel were opting to use “tried and true” methods over RWIS practices. This may have been attributed to the inability to effectively use RWIS resulting in frustration and a lack of trust in the system. Again, looking to the successful program in Sweden, less emphasis on education may result in RWIS being perceived as “another extremely expensive thermometer” rather than a tool that may aid in better decision making (5).

Staff acceptance of new technology could also be quite common in ITS implementation. As documented from the RWIS institutional issues, overcoming the reluctance to accept new technical systems by personnel was a huge hurdle (3). As more investments in advanced methods are implemented, bridging the gap between traditional methods and using ITS and RWIS technologies will become easier as staff become more familiar with and can witness benefits firsthand.

## Partnerships and System Ownership

Investment in new technology can be expensive and result in less than ideal expectations. Partnerships were an alternative to bearing the burden of the full cost of a program. From the documented research, partnership issues overlapped other issues such as funding and ownership (1). It was noted that there were concerns over public agencies’ commitments for long-term financial obligations within partnerships. While the public sector was concerned over private sector monopolization of data, the private sector had concerns over giving the information away for free (1,2). Other barriers of concern involved the private sector profit-driven market such as issues over maintaining competition and lack of public interest as a primary concern for private vendors.

Although there was strong interest from the public sector with pursuing private sector partners, there have not been many experiences from which to learn. Public/private partnerships to implement RWIS have been attempted only in Minnesota within the United States and have proved unsuccessful. The lack of success was due to concerns over liability issues and assumption of risk (5). Currently, most RWIS programs exist on a contractor-based premise. In Virginia, for example, RWIS was maintained and operated under a con-

tract with the vendor. The Virginia Department of Transportation (VDOT) owned both the systems and the resulting data. The vendor owned the proprietary program that collects and processes data at the remote processing units and transmits these to the central processing units. Interestingly, maintenance of 150 miles of interstate was privatized within Virginia, and the organization maintaining this roadway had requested RWIS information. VDOT allowed maintenance contractors access to their station data for free, however, these contractors paid a fee to the RWIS vendor for additional access privileges (5).

ITS implementation faces similar partnership issues as documented for RWIS. The difficulties of partnering stem from conflicting bottom-line objectives such as the providing a public service versus the private profit margin. Beyond the contractor agreements, successful partnership models are few and unclear.

## Standards

RWIS was most useful with widespread coverage such as when it is deployed as a statewide network. The most pressing issues documented concerned compatibility of systems from different vendors (1). The problem for most agencies when a network was deployed was that they were held to using equipment from the same vendor. While the RWIS market is currently growing and allowing more options in terms of vendors, this does not resolve the issue of compatibility among systems. Compatible communication infrastructures as well as fully compatible hardware and sensors were essential to successfully sharing information between various jurisdictions and creating a useable statewide network of technology. Products developed by different vendors need to communicate with one another, and the only way this may be achieved is through the standardization of protocols. The proprietary development of products was frustrating to public agencies where purchasing policies encourage tendering of generic products and discourage the purchase of single source products. The Ontario Ministry of Transport encouraged suppliers to develop a compatible product to technologies currently in use by approaching RWIS suppliers and expressing their concern with incompatibility of communications systems (5).

Standards and compatibility issues are also consistent with ITS. For example, traffic operations centers collect various traffic data from field systems. Similar to a network of RWIS stations, the ability for different components to exchange and accept information is critical, but is sometimes difficult due to the incompatibility of systems. While standards (such as center-to-center or roadway-to-center communications) are being developed for RWIS and ITS, they are still in the developmental stages. Despite their eventual emergence, the issue of vendors not being held to incorporating standards into their designs remains significant. Nevertheless, standards provide a common framework that will allow for compatibility in the future.

## HOW DO DEPLOYMENT OF OPERATIONS AND MAINTENANCE TECHNOLOGIES RELATE TO ITS?

The term ITS often conjures up images of technologies that only assist traffic and transportation engineers in resolving congestion or manage traffic flow. However, there are many facets to

ITS among those being the use of technologies for maintenance activities. As already discussed, a host of issues occur with the deployment of "new" technologies that, although documented for RWIS, may be applicable to ITS. While the objectives of traffic/transportation and maintenance engineers may be different, they both have the same underlying goal, making the road a safe environment for drivers. Maintenance personnel may focus on obtaining the best "driveable" surface and providing valuable pavement condition information to users, while traffic and transportation engineers work toward removing incidents from the roadway that may attribute to secondary accidents and better informing travelers of hazards, for example. Whether they are for traffic, transportation, or maintenance engineers, technologies are being sought to assist in better performing their jobs.

## CONCLUSIONS

Generally speaking, integration of new technology involves allocation of funds that may be difficult to procure. In addition to initial costs, funding for yearly operations and maintenance in addition to future upgrades also require consideration. Innovative financing methods as well as partnerships with the private sector are attractive options for funding new technology. However, there are currently few examples of successful public/private partnerships. As more partnerships are forged, more can be learned from what creates or prevents successful partnerships.

Transition to new technology requires personnel to adapt to a changing environment in addition to learning new skills. Educating users is an important step in successful applications of technologies, with emphasis on continued training. Although the technical feasibility of equipment is a concern, for technologies such as RWIS and other proven ITS technologies, the issue of standards and protocols is more apparent. Agencies want technologies that are compatible (that can communicate with each other), easily adaptable and upgradable as improved systems continually emerge.

Institutional issues remain some of the biggest concerns to tackle as the internal environment of each agency is unique. Nevertheless, being aware of the types of issues that may arise when deploying a technology-based (maintenance or ITS) project and learning from the lessons of previous endeavors will provide agencies with the insight to face these challenges head on.

## REFERENCES

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