Chapter

2

STATE OF THE PRACTICE

This chapter documents the use of Road Weather Information Systems and similar weather information by other states.

In order to provide the best possible evaluation of California RWIS, researchers wanted to determine the national trends in the state of practice of RWIS (Remote Weather Information Systems) operations and contracting. Research staff conducted telephone interviews with state officials that were in a position to be the most knowledgeable about RWIS activities. An interview approach, rather than a survey instrument, was deemed as the best way to collect state input efficiently, and gather anecdotal information from the state officials at the same time. Twelve states were initially targeted for interviews. Nine of the 12 states were successfully contacted: Nevada, Utah, Iowa, Montana, Washington, Oregon, Idaho, Virginia, and Minnesota. The interviews were recorded for reference purposes. The results from these interviews depict the various states of practice for RWIS operations and forecasting, and also provide many lessons learned that may serve to assist California and other states as they implement these systems. Researchers gained additional information for this chapter by conducting a review of literature and relevant websites, by participating in regional and national transportation conferences, and by consulting with national leaders.

Use of RWIS

Many states external to California have had RWIS stations in operation since the late 1980's. A majority of these early stations were funded by federal earmarks and were used primarily to improve safety on hazardous roadways. The earliest systems were DOS terminal-based units that did not offer any intercommunication between individual sites.

Many innovations and improvements have taken place since the first stations were installed. While there have been certain improvements in the computer-based RPU's, servers, and communication media, the innovation that has been most instrumental in the rapid increase in the deployment of RWIS has been the advent of anti-icing technology. In the past, ice control activities were limited to post-event surface applications of salt and gravel countermeasures. Beginning in the early 90's, transportation managers realized that if certain chemicals were applied to a roadway **prior** to a snow/ice event, then the effects were much more substantial. The realization was that snow/ice control was more effective when done in a preventative sense as opposed to a "damage control" capacity.

It is imperative to have a comprehensive plan that can be used as a guide for future goals, data collected, and how systems will relate to other operations that are in place

Other changes that have been responsible for the prevalence of RWIS technology are attributable to the advent of the Internet. Suddenly, there existed a medium that would allow for the rapid dissemination of information in "real-time". Also important is the use of ITS and the associated change to an outlook that emphasizes transportation management and operations instead of just road construction. As changes have taken place, the numbers of RWIS vendors and forecasting services have increased substantially. For more than 10 years there was really only one RWIS vendor, but now that number has increased to four or five major providers. This growth in the number of providers has increased competition, which in turn has advanced the state of the practice. This advancement applies to both the operations of the systems, as well as the procurement and maintenance contracts that are inherent to system implementation. These changes have had a direct effect on the states' RWIS approach, and have provided many lessons learned. These lessons learned pertain to the type and amount of data and forecasts that a state receives, as well as the way they go about initiating contracts. For states on the cutting edge of RWIS usage, the overall lesson learned is that it is imperative to have a comprehensive plan that can be used as a guide for future goals, data collected, and how systems will relate to other operations that are in place (e.g. snowplowing operations).

Currently, RWIS are sited with two primary objectives. Traditionally, the stations have been installed to get real-time weather information for roadway sites that are challenged by severe weather and/or remote travel distances. These stations are effective at giving a glimpse of conditions at these locations, but as a stand-alone system they do little to adequately predict what future conditions will be. Agencies can now use the stations in a weather monitoring capacity as they have done in the past, or they can place them in an arrangement to provide better forecasts. (Flat states have accomplished this with a grid pattern.) Instead of providing a single snapshot of weather occurrences at one location, the stations are tied together to provide input into models that offer a better macroscale and mesoscale view of the weather and how it may affect travel conditions. The current state of practice demonstrates this use of many stations to forecast road conditions in advance. This trend has driven the rapid increase in the number of stations in many states. Minnesota, for example, went from only a few sites in the early 90's, to a total of 93 sites to date. Despite whether the stations are used as a monitoring device, or as a forecasting tool, the overall pattern seems to be that RWIS are being utilized more as an operational tool, rather than simply as a weather station.

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Road Weather Information

RWIS networks are a combination of many components. One of these components is the weather collection tower that can be frequently seen by the side of the roadways. The collection units are comprised of the tower, the sensors, and the RPU (Remote Processing Unit). The RWIS incorporates all installed towers, the communication hardware, the GUI (Graphical User Interface), and the servers that tie everything together. The least tangible component is the information structure itself. The information must be collected, categorized, and archived in such a way as to address the intended purpose of the RWIS. States contacted were split on how they handled this data custodian issue. Some states like Virginia opted to have their information archived by their vendor. Other states, like Oregon, have been emphatic about maintaining custody of their information structure. A state's decision to maintain an information structure, or to contract it out to a vendor depends on the state's RWIS budget as well as the level of technological competency of its information technology division.

There is a correlation between the amount of resources allocated to a state's RWIS program, and their state of practice. The states that have invested significant time and money into their systems are better organized in that they know exactly what they want to accomplish with their program, and where they will be wanting to make developments in the future. These states represent the state of the art for the practice of RWIS applications.

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Data

State RWIS officials were asked what data they collect, how they selected that data and the respective sites, and what sort of data they would find helpful in the future. It was determined that states collect a wide variety of data from their stations. Often times they obtain a standard meteorological (MET) data sensor package that they purchase from a vendor. The standard sensor package typically includes air temperature, surface (freeze point) temperature, sub-surface temperature, wind speed & direction, precipitation, and relative humidity. States, including Washington and Utah, expressed the opinion that solar radiation is an overlooked standard, especially for forecasting purposes. Additional data sensors that states would find useful are visibility sensors, barometers, and more accurate precipitation sensors. Overall, the most important consideration that must be taken into account when deciding what type of data will be collected is the purpose and placement of the station.

Data Selection Criteria

Data collection needs are dependent upon the intended RWIS purpose and site designation. If the purpose is to simply monitor weather at a remote location, then the states typically collect the standard weather data from their station. If a state's RWIS purpose is to adequately predict conditions on their roadways, then the data that they desire becomes more sophisticated. For example, Washington DOT is especially interested in forecasting conditions. Because of their varying topography, they have had more barometric sensors installed on their stations. These barometric sensors provide their maintenance operations a better "feel" for how things are changing at exact locations. Washington has also identified solar radiation data as an important input for their forecasts. An example of how the type of data collected can be dictated by the specific site comes from Oregon. Many of their sites are challenged by fog incidents. As a result, they deem that a visibility sensor is in order. Often times, these site-specific considerations are used solely by decision makers to determine what sort of data will be collected.

The states interviewed were split as to how they had decided what data they would collect at their stations. Many times, the states simply bought what the vendor was selling them, and then went back and tweaked the systems to their specific needs. The problem with this approach is that often a state would end up paying for un-needed sensors, and then pay even more to add sensors that do indeed serve their purpose.

Data selection criteria is driven by each individual site, as well as by the overall purpose of the stations

Other states, especially those that have had RWIS stations since the eighties, have become much more selective as to what data they actually desire or need. This selectiveness typically arose after trying the preceding approach, then realizing that the earlier vendor product did not fully meet their needs. Either the package the state bought had more features than the state needed, or the package did not have the compatibility to work with pre-existing systems. Again, the overall lesson learned was that data selection criteria is driven by each individual site, as well as by the overall purpose of the stations.

Site Selection Criteria

States deploying RWIS often determine specific sites for their stations based upon input from their maintenance personnel. This is beneficial because they are the predominant end users. A drawback of this approach is that sometimes sites that are identified can be in a location that is not necessarily representative of the overall area. This is especially pertinent if the agency's main purpose is for use in forecasting. Again, the site selected ultimately depends upon the overall purpose of the stations. Many times it is the vendor that will come in and revise a station's siting. As the experts, they are able to determine if a site is appropriate for an RWIS station. Factors that may require a station to be re-located are: site is shielded from the wind (erroneous wind readings), or the site is too close to the roadway (road spray), etc.

States that install their RWIS for the first time often have used a 60 km grid arrangement as a goal for their site placement. A 60 km grid plan laid out across the entire state is sometimes recommended by the vendor and adopted by the agencies to obtain a thorough depiction of how weather moves through their state regions. When station siting is done this way, it is usually with a forecasting objective in mind. This approach should be taken in conjunction with input from the NWS (National Weather Service), VAMS (Value Added Meteorological Services), as well as with other partnering agencies. A drawback to this approach is that it requires **many** stations, some of which do not directly monitor the most challenging roadway conditions, which leads to holes in the road weather data. More stations are then required to fill the holes that do not address specific roadways of interest.

The state of Iowa began with a 60 km scheme, but later abandoned it in favor of an arrangement that more effectively addressed the area representation. As such, they utilized inputs from their maintenance foremen to identify locations that were especially challenged (either by weather events, remote locations, traffic volume or number of incidents).

Other state agencies learned by experience when it came to site selection, resulting in the development of an implementation or future expansion plan. These plans often resulted from experiences similar to the ones described for their data selection criteria. Restated, they bought a system that did not meet their needs, and/or had features that they did not use. When states realized that this was inefficient they began to develop plans, which have been instrumental in determining their data needs, site identification (holes), as well as where RWIS operations fit in their overall vision. Idaho, for example, is currently in the midst of developing such a plan. Their integration plan will assist in determining just exactly what they have and what they want to do in the future. This plan calls for an open architecture interoperability for existing and future RWIS activities that will serve to coordinate the RWIS with other maintenance processes such as plowing and traffic management. The plan will ultimately serve to place Idaho in a position of compliance with the ESS/NTCIP standards, which call for a regional architecture to be developed that will serve as a platform for a consistent nation-wide protocol for use in RWIS.

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Hardware

The RWIS hardware is divided into two categories: communications and environmental systems. The environmental systems are comprised of the tower, the RPU (remote processing unit) and the sensors. There are a multitude of sensors, including air temperature sensor, pavement sensors (pucks), anemometers (measure wind speed), and pyranometers (measure solar radiation). There are also visibility sensors, sub-surface temperature sensors, humidity sensors, sub-surface moisture sensors, dew point sensors, and others.

States like Oregon are working to standardize their statewide deployment by developing configuration management, which dictates how systems will be set up.

The communications hardware includes a dial-up server, micro-servers, and modems. The hardware configuration of a station varies from state to state, and often from District to District. States like Oregon are working to standardize their statewide deployment by developing configuration management, which dictates how systems will be set up.

Typically, the environmental systems hardware is close to uniform for all states, with the exception of their individual sensor arrays. The communications hardware configurations vary much more by state. Some agencies rely solely on dial-up systems via phone lines. Alternative and back-up communications media in use include micro-servers and repeater microwave systems.

To save on annual long distance phone costs, states like Washington have installed micro-servers. These devices allow for the central server to communicate with smaller servers (hence micro) that in-turn poll the remote weather stations via a Wide Area Network (WAN). The benefit of these micro-servers is that several stations can be tied into one of these micro-servers and can relay information by a local call versus a long distance call.

A repeater microwave system relays information via microwaves to a local station (typically a prominent point, e.g. hilltop/mountain top), which in-turn broadcasts that information to the service garages via radio waves. These transmitters with their receiver counterparts comprise a Data Transmission Network (DTN).

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The cost of communication hardware can be a deciding factor when installing and implementing RWIS. Often state officials responsible for the stations have to compare costs that are inherent to each type of communication system. Placing the hardware for microwave transmissions may be initially costly, but it could serve to reduce long-term communication costs, especially monthly long distance call up costs. Additionally, states that wish to avoid prolonged down time when a communication problem arises may install back up communication systems as previously mentioned.

An important hardware consideration came out of the Minnesota interview. The Minnesota Department of Transportation RWIS coordinator stated that it is important to be sufficiently organized prior to RWIS installation so that all services (and related hardware) are in place before the vendor comes. The reason for this is strictly due to contract obligation compliance. A state in the process of implementing an RWIS should be organized and have their communications and power in place so that, in case the vendor is negligent in providing their services on time, the state has the opportunity for retribution. In the case of Minnesota, they did not have their power and communications in place when it came time for the vendor to come in and commission the stations. Instead of the vendor being responsible for being delinquent, they used the state's lack of preparedness as an excuse for the delay. The state was therefore unable to impose penalties on the vendor.

Winter Maintenance

The use of RWIS stations as a winter maintenance and operations tool is becoming more prevalent and pro-active. A majority of the states contacted has identified their road maintenance personnel as the primary RWIS "end user". The systems are ultimately intended to be tools that can be used to reinforce the maintenance supervisor's gut instincts, but the level of actual utility is dependent on the overall receptiveness of the maintenance personnel to the systems.

Receptiveness

The level of receptiveness of maintenance personnel varies with each state. Often times it is proportional to the amount of resources that the state has allocated to RWIS integration. All of the state RWIS officials contacted stated that system acceptance and utilization varied from district to district, and from individual to individual. Some personnel use the systems extensively, while others are not at all receptive. Overall, they said that the receptiveness **is** favorable and improving. Maintenance operations' openness to RWIS depends upon a couple of variables. An important consideration that profoundly affects receptiveness is the involvement of maintenance personnel in the data and site selection process. The states that have involved their maintenance supervisors fully in the planning process have seen their maintenance personnel more quickly embrace and use the systems. A second item that directly affects overall perception of RWIS is the availability of periodic training. Montana, for example, conducts a winter maintenance workshop every other year where they discuss many facets of winter operations including the use of RWIS meteorological data and forecasts in the decision making process.

Mechanisms

Agency officials and vendors are aware and sensitive to the fact that maintenance supervisors are extremely busy during the stormy seasons. To address this, many states have opted for systems that will alert users of impending/changing weather conditions. Instead of periodically requiring the users to physically check a website, the system utilizes threshold values (set by the maintenance supervisor) to beep, call, and/or email maintenance personnel and inform them of changing conditions.

Many states have opted for systems that will alert users of impending or changing weather conditions.

These automatic notifications can be especially useful for preventative maintenance activities such as anti-icing.[1] The system will alert when the pavement surface temperature gets near freezing. The supervisor can then check the chemical sensor to see whether there are any chemicals present on the roadway. They can then make a more informed and timely decision to send a crew out to apply chemicals. Typical chemicals in use are magnesium chloride, calcium chloride, and salt brine. Concentrations of these chemicals can be applied to a roadway before a storm occurs to sufficiently lower the freezing point of the roadway surface and thus reduce ice development. As a storm progresses, the chemical countermeasures are diluted or washed off the roadway. The freezing point begins to rise back to normal and at some point it becomes necessary to reapply the chemicals. (4)

Vendors have developed two types of sensors to help in measuring the freezing temperature. A passive sensor is calibrated for the specific freezing temperature for whichever chemical the agency is utilizing for anti-icing. The active sensor utilizes a little cup that collects a sample of whatever liquids are present on the roadway. The sensor analyzes what the chemical composition is and calculates what the resultant freezing temperature will be. This is one example of the automatic calibration of which these sensors are capable.

Utah uses their notification in conjunction with their forecast service to determine their manpower levels. This can be especially beneficial during the holiday season, when manpower levels can be relaxed to allow for unneeded personnel to go home to their families, if weather conditions and forecasts allow.

A mechanism that is currently in development is Maintenance Decision Support systems (MDSS). MDSS is a part of the Surface Transportation Weather Decision Support Requirements (STWDSR) Initiative established by the FHWA's Office of Transportation Operations Road Weather Management Program. The MDSS project seeks to produce a prototype tool for decision support that will aid road maintenance managers. While there are other maintenance decision support tools in existence and under development, the MDSS has an important feature that makes it unique. "The MDSS is based on leading diagnostic and prognostic weather research capabilities (high resolution numerical forecast models and experimental algorithms) and road behavior (surface and sub-surface), which are being developed at nationals research centers" (5).

The tasks of the MDSS development centers has been to collect and refine the needs of the winter road maintenance community and to identify existing

[1] For anti-icing, salt or other chemicals are applied to a roadway in order to lower the freezing point of water. This makes it important to realize what the actual freeze point is, especially after chemical measures have been applied somewhat recently. It is a method of making anti-icing techniques more efficient and cost-effective.

resources and mechanisms that are effective at assisting the maintenance decision process. The FHWA will conduct outreach with various state DOT's to determine operability and to ultimately demonstrate prototype components in field operations tests.

The MDSS project will address storm maintenance decisions in three phases: first, monitor conditions; second, activate staff; and third, perform mid-storm management. The role of RWIS monitoring capabilities will be instrumental in this process. However, in order for the MDSS to be used most effectively it will need to utilize the RWIS data in conjunction with a VAMS (Value Added Meteorological Service). VAMS are meteorologists that use weather condition information (typically NWS data) along with site specific weather inputs from the RWIS to forecast roadway conditions due to weather events. That is, they are forecast providers.

The state of Washington has identified two future phases that they will be implementing in their RWIS operations, one being the use of MDSS as it becomes available. Their current scope for the MDSS deployment is to pair weather/pavement forecasting with AVL (Automatic Vehicle Location) technology to increase their maintenance operations efficiency. They are currently in a good position to incorporate these systems into their operations because of the extent of their forecasting and how they handle their information structure.

Traffic Operations

Some states are utilizing their advanced weather sensing systems to monitor poor traveling conditions and to update the changeable message signs (CMS) in the area. The Idaho Transportation Department (ITD) has conducted a study of just such a system. ITD installed visibility sensor systems along a test section of their Interstate highway. The systems were from three different vendors and were used to measure visibility, wind speed and direction, precipitation type and rate, air temperature, relative humidity, and pavement conditions. Additional systems were installed to monitor traffic and road surface data. ITD also installed CCTV cameras to verify visibility sensor readings. The study determined that it is possible to automatically convey RWIS visibility sensor data to a CMS when there is a decrease in site distance, but that the motorists were apt to slow down during deteriorating conditions with or without a CMS message telling them to do so.

States like Montana and Oregon use a procedure developed by the vendor to strip down the data and relay pertinent information to their traveler websites.

Traveler Information

Some states have begun to relay information to the motorists via the Internet. However, the traveling public is considered more of a secondary "End User", and modified weather information from the stations are passed on to them (typically in a simplified version of the actual data report). The reason for this is that most public citizens do not have a need or desire to know what the sub-surface water content is, or what the long-wave radiation reading is coming off the solar sensor, for example. The amount of RWIS information relayed to motorists varies widely from state to state. States like Montana and Oregon use a procedure developed by the vendor to strip down the data and then relay pertinent information to their traveler websites. Other states like Idaho and Minnesota are in the planning phase of developing a motorist interface. Washington's website, http://www.rWeather.com, made it's premier in the fall of 2000. This website provides viewers with information from over 400 weather stations, pass information, weather warnings, radar images, HAR reports from across the state, and tutorials on how weather can affect roadway conditions (See FIGURE 2-1).

Other

States that are on the cutting edge of RWIS deployment disseminate their data to other interested entities. Washington DOT (WSDOT), for instance, provides their RWIS data to the Northwest Regional Modeling Consortium (NRMC) based at the University of Washington. This entity performs work in air quality management, national forest harvest monitoring and burn rates throughout the northwest, and has a stake in weather patterns. On WSDOT's website there are 450 stations shown, 400 of these are owned by NRMC. Partners in the development of rWeather include: WSDOT, University of Washington, National Weather Service, and the Northwest Regional Modeling Consortium. These entities consolidate their data and place them in a master file for future analysis.

Another innovative demonstration project that may further the deployment of road weather information is a collaboration between the Western Transportation Institute and the Montana Department of Transportation. Under the "Safe-Passage" project and the Greater Yellowstone Regional Traveler and Weather Information System (GYRTWIS) project, WTI is developing a pavement temperature thermal model that uses forecasted wind, air temperatures, humidity, and radiation, as well as the topography of the landscape to predict pavement temperatures. This type of modeling has its greatest utility in areas with complex topography, such as mountain passes and coulees, or in areas of complex thermal dynamics, such as bridges. The chain of computer model has the potential of forecasting road surface conditions where no RWIS sites exist.

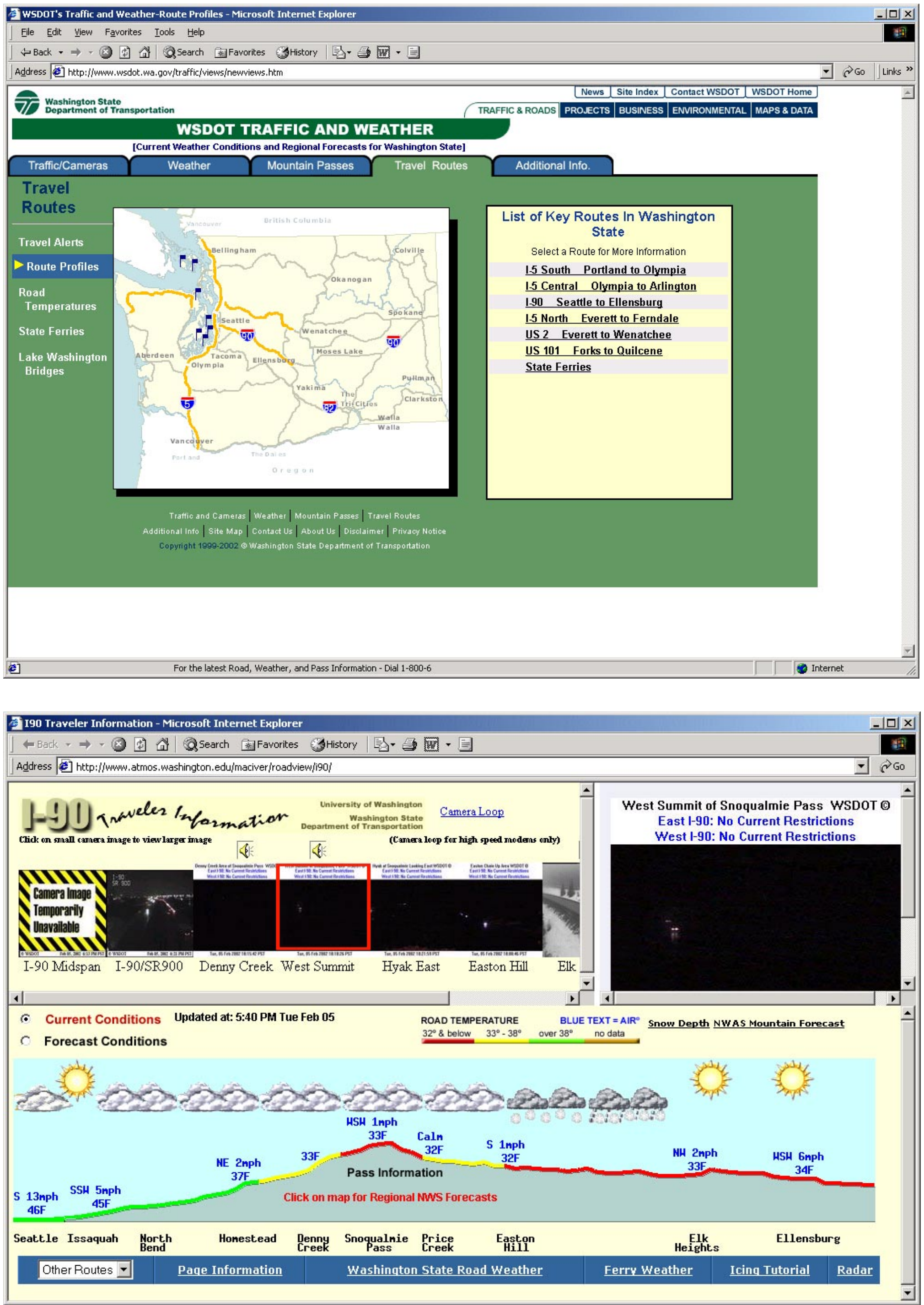

FIGURE 2-1 Washington State DOT rWeather web site.

Procurement and Contract Information

The states that were contacted during this interview process had their RWIS stations in place since at least the early 90's. Their experiences with the procurement and contracting process illustrate a learning process that has ultimately changed the way that they deal with vendors. States have even begun to form coalitions that share agencies' experience with contracting procedures. The Aurora website (www.aurora-program/matrix.cfm) shows all the contracting information for several states including Iowa and Virginia, as well as final prices that were determined by the (Request For Proposal) RFP processes.

In the early days of RWIS technology, there was really only one sole provider. After the advancements noted earlier, other RWIS vendors became competitive and provided an alternative for agencies. This increase in competition allowed states to put their system deployment activities out to bid, giving them much more bargaining power and negotiating advantages than previously available through sole source contracting.

Consulting Services and Mechanisms

Of the nine states contacted, over half had used some type of outside consultant, including meteorologists, transportation research agencies, and thermo-mapping experts.

States with previous RWIS experience, or those that have had research done into the state of practice, have utilized consultants in their planning activities. These consultations were valuable in determining site placement, data collection requirements, as well as types of forecasting services desired. Of the nine states contacted, over half had used some type of outside consultant, including meteorologists, transportation research organizations, and thermal-mapping experts. The states use meteorologists mostly for road forecasting and weather pattern tracking. Thermal mapping is a process that uses vehicle-mounted infrared sensors to develop thermal profiles the selected road system.

Nevada initially had RWIS stations sited primarily by maintenance supervisor inputs. Later they determined that forecasts were their focus, and that many of their sites were inadequately positioned for this purpose. At that time, they developed an RWIS plan that called for thermal mapping to be conducted for station siting. It also required the consultation of a meteorologist to determine optimal station positioning.

Idaho has also focused on the need for adequate weather forecasting. They determined a need for an integration plan and consulted with a transportation research agency to conduct a needs assessment and to develop an open architecture that would ensure that they would be NTCIP/ESS compliant. This process also called for the development of a winter maintenance plan.

Other states have consulted with universities to determine their needs and, in some cases, to perform actual services such as roadway and bridge surface temperature forecasting. States that have involved universities in their RWIS processes include: Utah, Iowa, Washington, Montana, and Oregon. Many universities conduct various research activities and form a partnership with state agencies to gather and analyze data at a relatively low cost. The research conducted by these institutions varies from determining trouble spots (e.g. crashes and weather) to performing actual analysis and developing new models (e.g. pavement temperature forecasting).

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Maintenance Services and Costs

States address maintenance services for the station hardware in one of two ways. States either enter into a service contract with the vendor, or they send their own state personnel to the vendor to receive service training. Of the nine states contacted, more than half have gone to training their own people to perform monthly or annual maintenance. The training costs approximately $5000 and lasts for two days. The primary reason that these states have opted to maintain their own stations is cost. They simply did not feel that they were getting their money's worth with their vendor service contracts. This was either due to poor services received in the past, or to the hardware being quality products that did not break down. (Note: The services discussed here are solely hardware-based, i.e. sensors, RPU's, and communication infrastructure; the maintenance of the system software is fully proprietary and can only be worked on by the vendor).

As for costs, vendor provided maintenance services are typically based upon a standard two-year contract. The monthly costs of these services range from $450/site to $900/site. These costs must be weighed against the training costs of DOT personnel with consideration given to the learning curve. Trouble-shooting a system takes a certain skill and familiarity that only comes from experience. Therefore, it must be assumed by the agency leaders that their personnel will not be fully proficient at first with the service activities.

In the case where services were deemed poor, the main complaint was about the vendor service response times. Usually, the vendor technicians are based in another state and the distance adversely effected the response times. As previously discussed, RWIS is used primarily in the winter season. Vendors that service many states are usually most busy during this time of year. Thus, if a problem does occur in the wintertime for a state geographically distant from the vendor, the response time can be significantly delayed. The most extreme example of this is a state that described a bad RPU at a station that did not receive services until two months later. Obviously, a state that is paying for these service contracts will expect their services to be received in a timely manner, and to have to wait such a long time is unsatisfactory.

States that opt to do their own maintenance typically have had the standard two-year service contract after their initial station deployment. This is when everything is new and in good working order. Therefore, it follows that these components tend to operate in good condition. These states then recognized that the hardware installed was of good quality (true or not), and that paying so much each year for unnecessary service was not economically beneficial.

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States like Utah and Oregon are taking their service contracts one step further. Instead of servicing entirely with the vendor for a whole RWIS system, they are contracting components by individual line item. This approach has not been done before, but makes sense for states that are familiar with RWIS components. In other words, they know what breaks and they desire to contract services for these particular items. This approach, while logical, lends itself to lots of paperwork.

Vendors that lose agencies' service contracts understand their considerations. In fact, they have provided training as a result. Sometimes agencies return to vendors for service contracts because of the states growing weary of doing things themselves. There is a relationship between the effectiveness of state-performed service work and the extent of RWIS planning for the state. Effectiveness depends upon the amount of resources and time that the agencies are willing to be allocating to their systems.

Forecast Services and Costs

Several forecasting vendors currently exist; some are RWIS vendors, and others are companies that specialize solely in condition forecasting. Forecasting depends upon several inputs, including meteorological data from private entities, as well as data from public agencies such as NOAA and NWS. Additional inputs are topography and actual RWIS data. These services can forecast up to 72 hours ahead. Depending upon the level of challenges present at a station (e.g. traffic volumes and weather), agencies can apply forecasts as needed.

For states that contract their forecast services from a vendor that is different than their RWIS station provider, logistical problems can arise. This typically occurs with states that opt for the main vendor to be their information custodian. In this case, the forecast service provider can experience difficulty getting the data for the forecasts from the custodian. This does not occur too frequently however, because states that designate their RWIS vendor to be their information custodian also tend to contract their forecast services from the same vendor.

Since RWIS is used primarily in the wintertime, the forecasting services received are tailored accordingly by the agency. Forecast services are usually provided twice a day in the winter and either eliminated or provided once a day in the summer. States like Utah specify their forecasts by geographical considerations.

Their forecasts are generated from mid October to mid May for their mountainous sites, and from November 1 to May 1 for urban areas.

The types of forecasts contracted range from basic weather patterns to surface (pavement) and sub-surface temperature predictions. The costs of these services are tiered according to the forecast complexity. For example, Utah's current monthly forecast costs range from $90-110 per station. They had pavement temperature forecasts in the past, but discontinued these services because they felt the service was not worth the cost. This is partially because of the daily freeze-thaw cycles, which did not require a forecasting service to predict.

The contracting process involved with forecast services provides a good insight into RWIS contracting overall. Often times, states have initially purchased the full standard package from the vendor. This package includes the station with its host of meteorological sensors, the maintenance services, and the forecast services. States that entered into a sole-source contract for their services paid a set price for the package. After a couple of years of experience, the agency frequently realized that they were paying too much for their systems. Thereafter, they put their renewal contract out to bid with an RFP (request for proposal) process. These states experienced cost reductions up to 50% from this approach.

For example, Iowa initially entered into a sole source contract with their vendor. After their initial contract was up, they put their forecast service up for open bid. Iowa ultimately awarded the contract to their initial provider, who reduced their price for forecasting services by over half.

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Some states are also addressing the issue of forecast accuracy. States relying upon forecasts for their maintenance deployments expect a certain level of accuracy in the services they received. States like Minnesota have stipulated these levels of accuracy in their RFP contracts. The problem with these stipulations is that it is difficult to measure accuracy and then to levy penalties.

Finally, another difficulty that arises with forecasting services occurs in states that did not consider forecasting when initially placing their sites. These states, like Nevada, initially selected their sites based upon input from their maintenance personnel. Thereafter, they determined the ineffectiveness and began planning for forecasting by utilizing thermal mapping and meteorology.

Lessons Learned

- Know (determine ahead of time) what RWIS goals that the agency desires for their state. Develop a plan as to how RWIS will be used and where sites will be located in the future.