

Alberta's Road Weather Information System (RWIS) Deployment – an Innovative Way to Outsource the RWIS Contract

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Abstract

The department of Alberta Infrastructure and Transportation plans to implement up to 75 new RWIS Environmental Sensing Stations (ESS) through an all-in-one turnkey approach that combines the purchase, installation, maintenance and operational requirements into one contract. The primary advantage with the turnkey approach is to tie the delivery of all aspects of the RWIS network to one single provider and in turn allows the department to build an end-result performance-based contract. Through a Request-for-Proposal (RFP) released in November 2004, the department solicited proposals for this turnkey concept. The decisions on the technologies needed, which manufacturer's equipment to use, who installs and maintains the RWIS stations, and how they fit in with the value-added meteorologists (VAM), were all left to the proponents. The pavement temperature performance verification was one innovative feature that was specifically incorporated into this turnkey concept. Another innovative feature of the RFP was to solicit an alternate financial plan whereby the proponents could assume ownership of a portion of the RWIS network and market the services to other clients for revenue-generating.

At the closing of the RFP in January 2005, five proposals were received. They were evaluated on the basis of technical merits using the criteria presented in the RFP without knowledge of the prices; the final score was a combination of the technical and price scores. The preferred proponent with the highest proposal score was selected from this process and the ensuing negotiations took another month before a contract was successfully awarded. Telvent Canada Ltd. of Calgary along with its partners, Earth Tech Canada Inc. of Ontario and Meridian Environmental Technology Inc. of North Dakota and their supplier, Surface Systems Inc. of St. Louis, is the province's RWIS Service Provider (RSP).

The RSP has begun its work with the launch of the first Local Area Forecasts (LAF) in the last winter month of the 2004/05 season. This paper will include updates on the awarded RWIS contract, the work-in-progress and any important lessons learned.

Background

As part of the Intelligent Transportation Systems' (ITS) suite of technologies, Road Weather Information Systems (RWIS) has been recognized and accepted by many road agencies as a tool to enhance winter maintenance. Based on a "winter severity" formula as agreed-to by all the provinces and territories that formed the RWIS for Canada Working Group (RWSC-WG), a national RWIS network was envisioned to span coast-to-coast with each province/territory installing a minimum number of RWIS Environmental Sensing Stations (ESS) along the National Highway System (NHS). Transport Canada (TC) is committed along with the provinces and territories to this vision by providing funding contributions to the capital costs under the Strategic Highway Infrastructure Program (SHIP) ITS funding initiative, and Environment Canada (EC) is also a partner by contributing in-kind data services.

As its commitment to this vision, Alberta Infrastructure and Transportation commissioned a study¹ in 2002 to map out a new RWIS network that would encompass the NHS in the province (the study was presented as a paper in the 2003 TAC Fall Conference). The RWIS consultant used an innovative methodology that combined the road maintainers' knowledge, meteorological information, environmental and geographical data, traffic and safety data, and multi-jurisdictional station data, into a Geographic Information System (GIS) model of the provincial network. Over one hundred potential RWIS sites were originally identified in the 2003 study which was later narrowed down to 70+ sites (Figure 1 in Appendix). In June 2004, through negotiations with Transport Canada, it was agreed that TC would cost share with the province for the acquisition and installation of 19 new stations along the NHS. Also as part of a separate but related agreement with Environment Canada, it was agreed that EC would provide raw data quality control (QC), a computerized heat balance model (Model of the Environment and Temperature of Roads or METRo) that might be used by the RWIS provider and other meteorological data sets.

After having the planning and financing in place, the next step was the actual implementation phase and it was decided to increase the deployment to 75 stations because of needs on other important non-NHS highway routes. As the department has not contracted any prior RWIS services, it was decided that this represented an opportunity to combine the purchase, install, maintain and operate aspects into an "all-in-one" turnkey contract. Following the general outsourcing philosophy of the Alberta government, the department did not want to expend additional manpower resources to obtain in-house expertise to design, construct and maintain an RWIS network. Although this approach is not unique in the history of RWIS deployment in North America, it is certainly not a conventional approach. Many Canadian provincial and municipal jurisdictions have in the past opted to tender the purchase separately from the installation (sometimes the purchase and installation are combined) and the maintenance work, all of which are also independent of the RWIS forecasting services. Similarly, the RWIS industry is composed of these distinct niche groups – the RWIS equipment vendors, the value-added meteorological (VAM) providers, and the equipment maintenance companies. Savings for the owners may be achieved if the best competitively-valued contract for each specialized area is obtained.

The major drawback to the conventional approach is that Alberta Infrastructure and Transportation must act as a systems integrator/coordinator to ensure all aspects of the system – installation, maintenance (including warranty issues), operations and forecasting, are functioning smoothly and in-sync with each facet and the government must also act as go-between among the various companies. Having different service providers responsible for different parts also makes for a performance-based contract more difficult to develop. Therefore, the key advantage with

¹ Delcan, *Advanced Traveller Information System and Advanced Traffic Management System Blueprint for Highway 2 between Edmonton and Calgary Final Report* (March 2004).

the adopted turnkey approach is to tie the delivery and responsibilities of all aspects of the RWIS network to one single provider which in turn allows the government and highway maintenance contractors (HMC) to expend less resources on up-keeping the system and instead, concentrate on using the RWIS data to deliver proactive winter road maintenance.

Request-For-Proposal (RFP) Development

Lacking the technical expertise in the RWIS and meteorological fields, the department solicited proposals from a number of consultants and selected IBI Group in July 2004 to perform the following tasks in preparation of the RFP:

- a) Research on other jurisdictions' tender or best practices to purchase RWIS equipment and data (the New York State Department of Transportation and the City of St. John's are two potential sources for turnkey approaches);
- b) Perform a business model analysis to validate the department's approach;
- c) Develop the technical and functional requirements that will comply with the equipment specifications as agreed-to by the RWSC-WG (see Table 1);
- d) Consult with Environment Canada on the RWIS equipment specifications and on the data quality control measures;
- e) Define performance measures for the VAM forecasting;
- f) Define a set of performance audit criteria and the verification procedures that include data and forecasting accuracy, reliability, availability, and timeliness on a station-by-station basis;
- g) Define the payment schedule and potential penalties that are linked to the performance measures;
- h) Address the data ownership question, how to promote commercialization of the value-added RWIS data and develop revenue sharing mechanism in the turnkey contract;
- i) Address the financing aspects, and contractual, legal and risk management issues;
- j) Co-ordinate and conduct an RFP information meeting; prepare the agenda and minutes, and prepare responses to the proponents' inquiries during the RFP process;
- k) Review all submitted proposals and provide expert evaluations of each including technical and financial evaluations;
- l) Participate as part of the RSP selection team.

It was decided early on that the marketing of the data and revenue sharing with the province would be a desirable and innovative way for the RWIS contract to help reduce the overall cost of the infrastructure. Therefore, in the development of the RFP, a number of ITS-related business models were researched and considered for the RFP terms:

- a) A ***Contracted Services (or 'Fee for Services') with Asset Management*** model is a publicly-led and paid-for operation with some activities (e.g. data fusion and data dissemination) outsourced to one or more private sector contractors. In this instance, the entire RWIS system is owned by the government and the contractor is typically responsible for product development, marketing, sales, and generally maximizing the revenue generated (and shared) from the products sold. ITS examples include Toronto's *RoadInfo* and Massachusetts Highway's *Smart Traveller* systems.
- b) An ***Exclusive Franchise Operation*** model has the government build the system and distribute the data to a single private sector agency at no cost in exchange for value-added products and services. As with the Non-Exclusive Franchise model, the

government as the owner sets policy on the use, documentation and sourcing of the data. Data is returned to the public agency at no charge, and the private-sector partner is free to market this data to third parties (public and private) on an exclusive basis.

- c) A ***Non-Exclusive Franchise Operation*** model has multiple distribution points so that a number of private sector agencies may receive the data at no cost to ensure the widest possible distribution. The public agency sets policy on the use, documentation and sourcing of the data. The private-sector agencies fuse the data into products they deem marketable. Data is returned to the public agency at no charge, and the private-sector agencies are free to market their products to third parties (public and private). This model was used by the *AZTech* and *Smart Trek* systems (of Phoenix and Seattle, respectively).
- d) ***Public/Private Partnership (P3)*** has a private sector investor contributing initial capital towards some component of the RWIS system (typically field infrastructure or control room operators) in exchange for unrestricted (and potentially exclusive) access to data. The public agency spreads the capital recovery costs over a period of time through a series of monthly payments to the private company rather than one-time capital payments. *SmartRoutes SunGuide* system in Florida is an example of this type of partnership.

A hybrid variation of the Exclusive Franchise Operation (option C) and Public/Private Partnership (option D) were included in some fashion in the RFP. The RFP requested a price breakdown scenario where the RSP may own a number of stations (P3). Because of the province's agreement with TC, the department has to own at least 19 stations that are co-funded with TC, so a 100% privately-financed/owned network is not feasible. In the data distribution model, based on the Data Sharing agreement, the department will require the RSP to distribute "freely" (at cost) to any public agencies. At the same time, the RSP will have exclusive rights from the department to market any data and services obtained through this contract to any private companies for additional revenue. They will have to share a portion of the revenue with the government.

It was recognized early on that in order for the proponents to bid on this project, various industry "players" would need to form consortia from the various disciplines. The decisions on the technologies needed, which manufacturer equipment to use, which company installs and maintains the RWIS stations, and how they fit in with the VAM firm, would be left to the proponents to collaborate and manage. With this in mind, the department began to make calls to several US and Canadian companies that have the potential to be part of this RSP team and consulted with them on the department's favoured approach, their capacity to do the work, the timing and other possible concerns. This was done throughout July to October 2004. Within one month prior to the RFP release, a pre-announcement was made to many ITS-industry members through the ITS Society of Canada (ITSC) – a coordinating body dedicated to advancing ITS work across Canada and who acts as a national front to liaison with the international community. On November 30, 2004, the RFP was officially launched on a public web site (<http://www.purchasingconnection.ca/>). ITSC and ITS America were the main contact channels requested to advertise the RFP. The original closing date was January 12, 2005, but this was later extended at the request of many proponents to January 26, 2005.

Before the RFP closed, an information meeting was held in Edmonton on December 15, 2004. There were 26 participants from across Canada and from the US attending, including one participant via the teleconference. At closing, the RFP were downloaded by 100+ companies or individuals. In spite of the timing challenge that the proponents faced and the newness of this approach, five proposals from five different teams were submitted.

The evaluations took place from the end of January to late February, and it took another month of negotiations with the preferred proponent to have all the details signed off before the final contract execution on April 11, 2005. Five members were on the technical evaluation committee (four from the department and one from IBI Group). The criteria used for scoring are listed in Table 2 of the Appendix as re-produced from the RFP document. None of the evaluation members knew what the prices were prior to the technical evaluation (a maximum score of 40) in order to maintain non-biases. In the price scoring, the lowest price was awarded the maximum 60 score, and all other prices were proportionately scored based on the differences from the lowest price. A final combined score was generated by adding up the technical and price scores. The proponent with the highest scoring proposal was designated as the preferred proponent and the department then proceeded to clarify with this proponent the RFP terms and negotiate for the final RWIS contract.

RWIS Contract

The important highlights of the RWIS Contract:

- a) Seventy-five stations are to be installed along 3,500+ km of Alberta highways by October 2007 with the following milestones:
 - i. Start the Local Area Forecasts (LAF) by April 15, 2005;
 - ii. Phase 1 - Completion of the first 30 sites (minimum) including the delivery of RWIS reports and forecasts by December 15, 2005 or earlier. Of these 30 ESS, the first 19 must be the stations identified as the first 19 stations in Appendix A;
 - iii. Phase 2 - Completion of the next 25 sites (minimum) including the delivery of RWIS reports and forecasts by October 15, 2006 or earlier; and
 - iv. Phase 3 – Completion of the remaining 20 sites (minimum) including the delivery of RWIS reports and forecasts by October 15, 2007.
- b) The RSP will be responsible for the delivery of the required RWIS stations to be paid as the stations become commissioned, and the data and forecast services, to be compensated on a winter month basis (October 15 to April 14 of each season);
- c) Alberta government will own all 75 stations while the RSP will be given the rights to market the value-added data from all 75 stations for additional revenue that may be shared with the province;
- d) The contract duration will be for ten years;
- e) Several performance criteria are built into the contract that will determine if any payment reductions are necessary; the criteria include an evaluation of the delivery of the RWIS data and the accuracy of the forecast based on the cumulated differences between the predicted and the observed pavement temperatures (see Table 3 in Appendix);
- f) Additionally, there are demerit points that may be assigned by the department should the RSP violate any part of the contract consistently;
- g) Random audits of the system performance by an independent consultant will be carried out each year to provide added quality assurance;
- h) Each station will have passive pavement sensors, several atmospheric sensors and a video camera capable of capturing still-frames (see Appendix Table 1);
- i) Minimum station specifications are based on the agreed-to national standards by the RWSC-WG and they generally are modeled after the World Meteorological

- Organization (WMO) standards and the National Transportation Communications for Intelligent Transportation Systems Protocol (NTCIP);
- j) The RSP will deliver two regularly-scheduled RWIS forecasts plus forecast amendments as needed for each commissioned ESS;
 - k) In addition to the RWIS forecasts, the RSP must also provide two regularly-scheduled localized weather forecasts (LAF) at 42 designated local areas around the province (Figure 2 in Appendix);
 - l) The province's highway maintenance contractors (HMC) will be the main recipients of the data and forecasts;
 - m) All RWIS data will be shared with EC and in turn EC will provide QC data back to the RSP in near real-time;
 - n) The two major Alberta cities (Edmonton and Calgary) may access the relevant data and forecasts to their respective areas;
 - o) Other public agencies may request access to the data and forecasts on a cost-recovery basis from the RSP;
 - p) The RSP is encouraged to market any value-added services to private industry (trucking, bus and rail companies, for instance) on a revenue-sharing basis with the department;
 - q) The Alberta Motor Association (AMA) will receive the current road weather conditions and the latest road image which will be displayed as real-time traveller information.

After considering the RSP-financing possibility, it was determined that the government-owned option would be less costly, less complex to manage (compared to a portion owned by the government and a portion owned by the RSP), and the benefit in the RSP financing the capital portion for the first three years would be minor if any.

A very important innovative feature of this contract is the set of four performance parameters that the RSP must meet in providing data and forecasting, and the financial disincentives tied to the performance parameters:

- a) ***RWIS data delivery performance***
The RSP will log the raw data delivery statistics and calculate the overall on-time delivery percentage for all ESS on a monthly basis for 12 months of each year. All no-data, null readings and out-of-range readings are considered exceptions that will reduce the amount of valid data delivered on-time. When summing the total data from all commissioned ESS, if the total percentage delivered falls below 95%, a 1% reduction in the monthly RWIS portion of the payments will be assessed.

- b) *RWIS forecast delivery performance***
The RSP will log the RWIS forecasts delivery statistics and calculate an aggregate on-time monthly percentage for all ESS during the winter months. Each time a forecast is missed or late by more than 60 minutes, exceptions will be incurred. When summing the total number of RWIS forecasts delivered for all commissioned ESS, if the total percentage delivered falls below 95%, a 1% reduction in the monthly RWIS portion of the payments will be assessed.
- c) *RWIS forecast accuracy performance***
The accuracy of the RWIS pavement surface temperature forecast will be used as a surrogate accuracy measure for all other forecasted parameters. The temperature accuracy parameter will be calculated by comparing the forecast values (from the two regularly-scheduled forecasts) to the observed values measured hourly for the first six hours of the forecast period. This comparison only applies when the observed or predicted temperature values fall between -20°C and +10°C. Exceptions will be recorded when the difference between the observed and predicted values differ by 2°C or more when the observed temperatures are between -3°C and +3°C, or differ by 3°C or more when the observed temperatures fall between -20°C and -3°C or between +3°C and +10°C. When summing the overall accuracy from all commissioned ESS, if the total percentage delivered falls below 85%, a 1% reduction in the monthly RWIS portion of the payments will be assessed.
- d) *LAF delivery performance***
The RSP will log the LAF delivery statistics and calculate an aggregate on-time monthly percentage for all local areas during the winter months. Each time a forecast is missed or late by more than 60 minutes, exceptions will be incurred. When summing the total number of LAF delivered for all 42 local areas, if the total percentage delivered falls below 95%, a 3% reduction in the monthly LAF portion of the payments will be assessed.
- e) *Demerit points***
In addition to the above, if the percentage delivered or the accuracy level falls below a set threshold (75% for on-time deliveries and 65% for accuracy level), a demerit point may be assessed. In addition, other contractual non-performance may be subjected to a demerit point assessment and a cumulated total of 10 demerit points over a rolling one-year period may be reasonable grounds for terminating the contract.

The unique aspect of the financial disincentives is that the RSP is required to monitor and report on its own performance for each given month. The RSP will at the conclusion of each month invoice for the work completed, will report the delivery and accuracy performance for that month and reduce the invoice according to the rules described above.

This method of self-monitoring will be audited on a regular basis to ensure accurate reporting of the results and subsequent invoicing.

Follow-up Work

As of April 2005, the RSP has delivered the first LAF and is on its way in planning and carrying out the deployment schedule. By September, another update on the activities can be provided. Some of the near-term tasks to be completed include:

a) Perform random performance audit verifications including the following:

- i. Based on the RFP criteria, recommend an audit verification plan including which stations and for which period of time to perform the verifications for the upcoming winter season;
- ii. Perform the audits for the upcoming and future winter seasons;
- iii. Report to the department the findings from these audits and recommend whether the RSP-provided data and forecasts are performing to the defined criteria;
- iv. Recommend to the department any changes to the audit criteria or procedure that may be required for the entire 75-station network for the duration of the 10-year contract as a result of the lessons learned from the audits during Phase One.

b) Evaluate the RWIS effectiveness/benefits after Phase One Deployment including the following:

- i. The department is currently developing some new high-level maintenance performance measures to gauge winter maintenance impacts on the provincial highways – the RWIS evaluations should take these measures into account;
- ii. Develop and implement an evaluation plan to assess whether the system covers the highways adequately and calculate the overall benefits of the system for day-to-day winter maintenance activities and during any major severe storms (in terms of cost, safety and salt/sand usage);
- iii. Include feedback and input from major stakeholders such as the highway maintenance contractors, regional staff, and Environment Canada; other stakeholders may include Alberta Motor Association, Alberta Motor Transport Association and the Royal Canadian Mounted Police;
- iv. Recommend any operational improvements to the RWIS where applicable and also to the way the maintenance forces are using the RWIS.

Conclusion

With the successful completion of the RFP phase and subsequent signing of contract for the RWIS deployment, the department is very optimistic that the 10-year RWIS contract will provide valuable input to improving winter maintenance operations. The near term results of the Alberta approach to the RWIS contract could establish a framework for future contract outsourcing of other major ITS technology investments in Alberta.

Appendix

Glossary

Term	Definition
AMA	Alberta Motor Association
EC	Environment Canada
ESS	Environmental Sensor Station
HMC	Highway Maintenance Contractor
IT	Information Technology
ITS	Intelligent Transportation System
LAF	Local Area Forecast
METRo	Model of the Environment and Temperature of Roads
NHS	National Highway System
NTCIP	National Transportation Communications for ITS Protocol
QC/QA	Quality control/quality assurance
RFP	Request for Proposal
RSP	RWIS Service Provider
RWIS	Road Weather Information System
SHIP	Strategic Highway Infrastructure Program
TC	Transport Canada
UIP	Unit Install Price
ULP	Unit LAF Service Price
UPP	Unit Procurement Price
URP	Unit RWIS Service Price
VAM	Value-Added Meteorologist
WMO	World Meteorological Organization

Table 1 – RWIS Equipment Minimum Specifications

Class	Equipment	Parameter	Operating Requirement	Accuracy Requirement
Atmospheric Sensors	One Temperature Sensor (Thermistor)	Air Temperature	-40°C to +40°C	± 0.5°C
	One Humidity Sensor (Hygrometer)	Humidity	10% to 100%	± 2%
	One Pressure Sensor (Barometer)	Pressure	600 to 1100 hPa	± 1.0 hPa
	One Occurrence Meter	Precipitation	0.5 to 500 mm/hr	Yes/No (95%)
	One Wind Sensor	Average Wind Speed	1 to 216 km/h	± 1.0 m/s
		Direction	0 to 360 degrees	5 degrees
		Gusts	1 to 288 km/h	± 1.0 m/s
Pavement Sensors	Two Passive Pavement Sensors*	Temperature Measurement	-40°C to +60°C	± 0.2°C
		Moisture Presence	Yes/No	95%
		Chemical Concentration	5 to 35%	± 5%
		Chemical Freeze Point	-15°C to 0°C	± 0.5°C
	Advanced Pavement Sensor (Optional item at the request of the Department)	Freeze Point	-15°C to 0°C	± 0.5°C
Subsurface Sensors	Two Sub-Surface Sensor (40 cm & 1.5 m depths)	Temperature	-40°C to +40°C	± 0.2°C
Other Equipment	One Video Camera	Still-frame capture	512 x 486 pixels maximum	-

Table 2 – RFP Evaluation Criteria

TECHNICAL SCORE		
Criteria	Maximum Points	Includes but is not limited to:
Company Qualifications	4	Corporate experiences of all partners and subcontractors, financial statements, contract security, Workers Compensation Board clearance, and Certificate of Recognition in safety requirement
Project management	8	Project Manager, team structure, key staff, project references, Safety Plan, Environmental Plan, Quality Management, and schedule
Environmental Sensing Station (ESS)	4	Civil works, power supply, sensor technology and supplier, camera, communications, installation methodology, and maintenance
Central system	4	Architecture, functionality (data management, diagnostics, report generation, redundancy and recovery plan, archiving and retrieval) testing, and RWIS training
RWIS data service	4	Standard reports, data reporting, on-line access, EC interface and coordination, and user interfaces
RWIS forecasts	8	Forecasting methodology, reporting and amendment process and delivery, user interfaces,, and 24/7 telephone support
Local Area Forecasts	6	Forecasting methodology, reporting and amendment process and delivery, user interfaces, and 24/7 telephone support
Value Added Revenue Generation	2	Business Model, Business plan for selling data and services, and other innovations
Maximum Technical Score		
Maximum Technical Score	40	The passing grade is 25 or higher – less than 25 will not be considered for price scoring
PRICE SCORE		
Total Present Worth for Price Schedule A (All 75 Stations Owned by the Department) or Price Schedule B (Minimum 19 Stations Owned By the Department)	\$ X	The lowest total present worth cost from each Proposal will be used to calculate the Price Scores
Price Score	60*(formula)	Formula= [1-((Proposal \$ - Lowest \$) / Lowest \$)]
Maximum Price Score	60	Maximum points assigned to lowest price Proposal
TOTAL SCORE		
Total Score	(Technical Score + Price Score)	Technical and Price Scores

Table 3 – Contract Performance Requirements

	Description	Reductions in Payments and Demerits
RWIS Data Reporting Delivery Requirements	Delivery performance	1% of URP per % below 95%
		The RSP may be assessed one demerit point for falling below 75% level for Delivery of Data
RWIS Forecasting Delivery and Accuracy Requirements	Delivery performance	1% of URP per % below 95%
		The RSP may be assessed one demerit point for falling below 75% level for Delivery of Forecasts
	Accuracy performance	1% of URP per % below 85%
		The RSP may be assessed one demerit point for falling below 65% level for Accuracy of Forecasts
LAF Delivery and Accuracy Requirements	Delivery performance	3% of ULP per % below 95%
		The RSP may be assessed one demerit point for falling below 75% level for Delivery of Forecasts
	Accuracy performance	No reductions in payments but may be subject to demerit point assessment

URP is Unit Price for the RWIS Data and Forecast (per station per month)

ULP is Unit Price for the Local Area Forecast (per local area per month)