World-Class Winter Services and Management

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By Jan Ölander, Arne Johansson, Pekka Pakkala and Eva Lodenius

ABSTRACT

The Swedish Road Administration (now known as the Swedish Transport Administration) endeavored to benchmark winter services and management in order to improve the maintenance of winter services and pavements. Eight countries/states that include Norway, Sweden, Finland, Denmark, Scotland, Slovenia, Minnesota Department of Transportation (MnDOT) in USA, and Alberta, Canada were included in the survey. In Sweden, customer satisfaction surveys for winter services indicated lower than desirable results. Therefore, the objective of the international survey would allow comparison and determination of innovative maintenance and management practices from world class countries. This study would benchmark winter services, and outsourcing issues, and management practices in cold climate countries.

This international survey used a comprehensive custom-made questionnaire approach, which was followed-up by country interviews in the participating cold climate countries. The study was carried out by a team from Aalto University in Finland and took place from October 2009 to June 2010. A final workshop was held to allow countries to present their best practices and engage in a brainstorming workshop to solicit challenges, innovative ideas, and possible continuation.

It is important to understand how different countries approach management, quality practices and customer services to provide them, the road users, with satisfactory/reasonable road condition during the winter time. The results from the study could be used by all participating countries to change or re-engineer their own road management practices. The results indicate that winter services are very difficult to compare both nationally and internationally as weather, road type, different maintenance standards, different survey methods and questionnaires, outsourced or in-house maintenance, and different practices are all present. However, the results demonstrate that similar issues were encountered in the participating countries. Benchmarking other countries practices revealed that existing practices can be improved and in spite of differences, it can be fruitful to benchmark road management practices.

INTRODUCTION

The Swedish Road Administration (now known as Swedish Transport Administration as of April 1, 2010) conducted an international survey pertaining to winter services, pavements and rest areas in cold climate regions. The study focused on four areas; customer satisfaction, energy and environment, effectiveness of rendered services (quality), and retaining competence in the agencies with a side focus on Research and Development (R&D). This paper will address road management and winter services. The paper will discuss the various management issues, good practices, results, and challenges when comparing winter services.

A concluding workshop was one of the highlights of this project and took place on March 24-25, 2010, in Stockholm, Sweden. This was a unique effort that included a "*brainstorming workshop*" on the second day. It was a demanding project carried out in a short time span.

Background

Winter services of roads and delivering good quality to the customers are essential components for road administration's management. In order to fulfill the expectations of society and road users, road authorities need to continuously improve their operations and efficiency. In recent years, expenditures for the roads have been declining, despite increasing traffic volumes and significant wear and tear on the road network. Also, increasing congestion, emissions and other external impacts have a negative effect to the quality and condition of the road network.

"The Road to Excellence" was an international benchmarking project and was a bold initiative by the Swedish Road Administration and was completed during the period from October 2009 to June 2010. The research was carried out by a team from Aalto University's School of Science and Technology, at the Department of Civil and Environmental Engineering in Finland. The aim of the study was to examine and benchmark sustainable, innovative and better practices for winter maintenance, pavements and rest areas. This paper will address road management and winter services. The following eight countries participated in the study:

- Sweden
- Finland
- Norway
- Denmark
- Slovenia
- Scotland
- USA (Minnesota Department of Transportation- MnDOT)
- Canada (Alberta Province)

Objectives

The main objective of the project was to benchmark different countries in four different and specific areas that were under development by the Swedish Road Administration. The aim was to compare different international practices, learn from one another, and begin implementing those innovative management practices that were most important to them. Efficient knowledge sharing provides great opportunity and allows the understanding of

management practices used elsewhere. Benchmarking also enables continuous improvement in its own organization. By going outside the organization, hopefully one can bring back new state-of the-art practices which will help the management and organization move forward. The specific objectives for the four task areas are as follows.

Task Area 1

The first task area involves focusing on the road users and customers by determining how to gather road user data from customer feedback and surveys. The intent is to determine what type of customer satisfaction surveys are more effective and represent true customer perception. If the customer needs can be understood, then it is possible to provide quality services to the customers or change practices that meet the customer needs.

Task Area 2

The second task area was to consider alternative energy and environmentally friendly products, processes, and methods. This will assist the road agencies to be better environmental stewards and consider sustainable and environmental practices.

Task Area 3

The third task area is to evaluate how quality, effectiveness and efficiency are assured when outsourced or done by own workforces. This knowledge could assist if there are innovative practices used elsewhere to verify that the services are ordered effectively and efficiently.

Task Area 4

The fourth task area is to determine the main means and methods to retain the core competences in the road administration and how to attract younger professionals to the road sector. In addition, it was intended to understand the R&D practices, challenges and various studies used by other road administrations.

The final objective was to host a workshop and brainstorming session in Stockholm, Sweden, to share the results. It was intended to discover good practices and different approaches used by the countries participating in the study. Benchmarking is very useful means and the workshop enables all to benefit from this comprehensive study.

The objective of this paper is to summarize the best management and winter services practices from the study.

Means and methods

The Swedish Road Administration originated this international study. It was an expression of forward thinking and risk taking to endeavor into such a study with uncertainty about participation and usefulness of results. The study was carried out by the team from Aalto University's School of Science and Technology, Department of Civil and Environmental Engineering.

The scope of the work was targeted to winter services, pavements (summer and winter) and rest areas in cold climate countries. Questionnaires were jointly developed by Swedish Road Administration's and Aalto University's team for the four different task areas as the principal source of data collection. The four task areas in the study are as follows:

- Task 1 - Customer Satisfaction
- Task 2 - Energy and Environmental Efficiency
- Task 3 - Quality, Effectiveness and Efficiency of Rendered Services
- Task 4 - Competence Development and Identifying Better Practice for R&D

Questionnaires were distributed to the participating countries key representation and the data was collected from the answers. Having a key representative from each country to collect the information was one key solution for streamlining the data collection. Due to the detailed and comprehensive questionnaires it was necessary to visit each country for clarification and additional information.

A two day workshop in March 2010 titled *"The Road to Excellence – a new, international challenge between road agencies"* was part of this project. On the first day each country made a presentation on the topic of their choice followed by discussions. The second day of the workshop concentrated on a brainstorming exercise to discuss in smaller groups the challenges and concerns the road agencies are experiencing.

The project was made more challenging and interesting by having a competition to select the country with the best practices in each of the four different task categories. Aalto University's team was assigned the challenge to be "judge and jury". The winners were considered "international champions" in their respective areas, but in the end all were considered winners. The winners "by points" were presented an award during the workshop evening reception and are listed accordingly:

- Task 1: MnDOT (Minnesota DOT, USA)
- Task 2: Swedish Road Administration
- Task 3: Transport Scotland
- Task 4: Swedish Road Administration

This paper will present only the results for manage and winter services.

DISCUSSION

Since customer perception is a growing issue, continuous improvement is emphasized as an important factor for management to become more customer oriented. This is also a key for management and organizational performance metrics, where many countries are responsible for measuring the public entity performance and several are using the Balanced Scorecard (BSC) method. Management should be concerned with the level of customer satisfaction and understand the correlation between the customer's expectations and their experiences. Customer measures are required for those using the BSC approach. However, customer expectations and requirements change with time and the level of satisfaction can also be influenced by other factors, such as the image of the organization[1]. Snow and ice during the winter season occurs at unpredicted periods (such as the winters in 2010 and 2011) and the services should be managed and applied efficiently. Most countries are using state of the art Road Weather Information Systems (RWIS) to prepare for these occurrences. Good functioning RWIS is considered a good management practice.

Most of the countries in this study have outsourced the maintenance and it is important to verify that the services ordered match the actual services received by the customers. Good contracting practices are needed to make sure that the quality standards are written correctly in the tender documents and that the quality control practices are meeting the desired outcomes.

Salt usage and other environmental issues are to be taken into consideration and reflect upon environmental stewardship and good management practices. Excessive salt usage can be detrimental to the water systems and emissions from vehicles need to be minimized. Lesser environmental consequences need to be put into practice and achieving these goals requires management to implement and possibly reward such practices.

Performance measures and organizational efficiency are becoming more common management practices. Also, incorporating Performance Based Service Agreements (PBSA) appears to be common and some countries are using significant portions of performance based criteria or outcomes. Performance type contracts were thought to bring more innovation, less costly and more efficient results.

The pressure of lowering cost, potential downsizing of organizations, an aging administration, and future economic instability are significant issues facing the future managers. Doing more for less seems to be a common productivity goal. It will be challenging to determine to what extent productivity can be realized and what are the respective uncertainties.

These will be discussed in more detail with respective examples and comparisons.

Comparisons and Results in Winter Services

All of the participating countries have conducted and developed systematic scientific customer satisfaction surveys, despite each using different means and methods to accomplish them. Some countries are also developing and testing new qualitative methods in order to capture customer service. In the age of new management, performance measurements and management are becoming more common among the public road management practices. Some are using the Balanced Scorecard (BSC) method, while others are using other measurement forms. Therefore, measuring customer satisfaction is common practice and one of good management.

There are differences in how the participating countries perform and evaluate customer satisfaction measurement. The most common methods used are telephone interviews, postal surveys and face-to-face interviews. Some countries have tried to use the Internet as a survey channel, but experiences have not been so positive.

Table 1 shows the results from the survey related to customer satisfaction attributes and shows the countries anonymously according to letters A through H. This is to secure the sensitivity of the scores to their respective countries. The customer satisfaction results for winter services are amazingly similar and there is not such a significant deviation from scores of different countries. The Nordic countries have an ongoing cooperation in the organization called the Nordic Road Association, where experiences are shared on a regular basis and good practices are usually synergized. Survey sample sizes vary from the different types of surveys and due to country specific requirements or objectives.

Table 1 Comparison of Customer Satisfaction

Country	Frequency of Survey	Method of surveying	Average sample size	Average response rate	Average Pavement Satisfaction	Average Winter Satisfaction
A	Once per year	telephone interviews	800	50 %	63%	66%
B	winter: every year summer: every other year	postal surveys	winter: 24 600 summer: 15 000	40 %	70%	68%
C	Once per year, alternating winter & summer	postal surveys	3 500	75 %	57%	59%
D	Twice per year	face-to-face interviews	2 000	100 %	N/A	55%
E	Once per year	telephone interviews	8 000	100 %	61%	60%
F	Once every 3rd year	Internet and face-to-face	109 50	20 % (Internet) 100%	80% (1 year data only)	60% (only done once)
G	Twice per year	telephone interviews	1 900	44 %	66%	66%
H	Twice per year	telephone interviews	800	100 %	N/A	59%

Winter services include plowing, anti-icing and de-icing techniques to keep the roads highly availability and most importantly, to have reasonably safe driving conditions. Some countries are testing and using de-icing chemicals and environmentally friendly substitutes like sugar, molasses, and other agricultural ingredients, but Sodium Chloride (NaCl) continues to be the main choice for de-icing. A few countries are using Magnesium

Chloride (MgCl), which is more environmentally friendly, but cost can range from 3-7 times more expensive compared to Sodium Chloride.

Table 2 displays the amount of salt used in the different countries and includes the mount of salt used per kilometer. Again it shows the countries anonymously according to letters A through H. The results show significant deviations in the amount of salt used in the countries, but it cannot be a fair comparison due to climatic conditions, different road classifications, salting policy, centerline versus lane miles, and those countries requiring a bare pavement policy.

Table 2. Comparison of Total Amount of Salt Usage (tons)

Country	2004	2005	2006	2007	2008	tons/km (2008)
A	233 434	273 261	182 386	226 783	228 866	12.0
B	87 973	98 357	83 194	82 064	97 743	1.2
C	246 089	291 593	154 195	152 135	196 450	7.2
D	46 784	60 986	48 856	77 820	100 423	29.3
E	115 000	128 000	166 000	157 000	159 000	5.9
F	49 632	76 446	18 183	35 314	59 210	9.9
G	36 134	46 855	35 278	30 484	41 394	10.9
H	210 712	150 686	192 037	194 791	212 200	6.8

Note: The tons/km is not suitable for comparison due to differences in road classifications, road length, salting policy and etc. (calculated using centerline kilometers).

Other environmentally friendly practice for winter services include the use and testing of longer snow blades, low-emission vehicles, brine, pre-wetted salt, and eco-driving practices. These are considered as small steps, but nevertheless important means in order to promote and eventually have good environmental stewardship.

Management Issues

As discussed earlier “customer based measures” is an important part of good management and can steer the public oriented services to be more customer friendly that include public values as opposed to traditional specifications. Winter services need to become outcome based as that is more aligned with the customer’s perceptions.

Most winter services are being outsourced by the participating countries. Most are using performance-based elements to a major proportion, while others are using more technical

and traditional type standards. A good understanding of the different types of procurement options available is important to management and administration. Some models deliver more value for money and some are considered as good management practices. The procurement requirements are quite similar (most using EU requirements), but the actual implementation by countries can vary significantly. Also, many award the tender using different factors and via low bid criteria. Innovative and successful procurements methods do influence the outcomes of the contract.

Quality verification is needed from the public road administrations even though Quality Control (QC) procedures are being used in many contracts. Quality for winter services are typically measured by spot checking, using consultants to measures QC, using sensors, GPS for confirming maintenance operations, having a customer complaint system that is integrated into Maintenance Management Systems (MMS), and from verifying QC plans. It is important to verify the quality and a good practice observed from the study was demonstrated from the Performance Audit Group (PAG) in Scotland. This PAG is an extension of the client, which incorporates many layers, systems, audits, and objective verification of quality. This is a very good example of good management that confirms the value for money and demonstrates an educated client organization is actually monitoring the quality objectively and thoroughly.

There is a perceived loss of control in quality and working operations for those using performance contracts, but they should be able to include options for client interjection when safety and important maintenance activities take place. It is possible and a good management practice to redirect the winter service operations, where and when appropriate. This requires clever measures and writing good contracts to avoid any incomplete contracts that might lower quality or major customer concerns. This can be accomplished for those countries having in-house services and by retaining control of winter operations.

Also, it is imperative to make sure that the private market for winter services is functional and wealthy. Since the maintenance is outsourced by many countries it is very important to determine how to open the market for winter services, so that the effectiveness of true head to head competition could be realized. Each country had its own strategy, application, EU restrictions, and approach to opening the market to winter services. Also, the approach to what type of contracts were first implemented, either attracted or repelled the private market responses to providing winter services and some may have opted out.

Table 3 shows the typical number of contractors bidding on the winter services and generally ranges from 3-6 bidders. Again it shows the countries anonymously according to letters A through H. It was interesting to observe that some countries considered this satisfactory, while others thought it was in jeopardy of having only a few large companies competing for winter services. If the market remains healthy, it is not considered a problem, but if there is company mergers or buyouts there could be a potential for market imperfections and cartels. Therefore it is good management practices to verify and keep the market in healthy conditions or change the procurements practices to invite more competition.

Table 3. Key figures for a Functioning Market

Country	Costs for winter services (2008 in € Million)	Average number of contractors/competitors for each area contract
A	-	-
B	97	3.9
C	189	4
D	9.4	2-3
E	92	2.7 – 2.8
F	12	2-3
G	20	2-6
H	95	2-3

Since the road network length, road classification, winter weather conditions, bare pavement policy, and other variations from country to country, it is not possible to compare costs and expenditures. It was not the objective either to compare cost, but some countries may be able to infer if costs were more or less, but could not deterring what the reasons for differences or why they differ.

As many road administrations are facing an aging and retiring workforce, there will be a valuable asset that is lost. The private sector is also realizing similar consequences. Therefore, it is important to train young professionals, recruit young engineers, and entice others to be interested in civil engineering for both the client and private organizations. The private can easily acquire professionals through hiring strategies that the public sector cannot utilize, so good management practices are needed to retain highly skilled workers.

Since road administrations do not have internal personnel resources to perform Research and Development (R&D), most have to be procured or ordered from universities and consultancy organizations. R&D projects and studies are important tools for development and a pro-active approach to be aware of research activities in other countries. It was initially perceived that innovations would be carried out by the private sector during the competitive contracts, but that did not occur as expected and responsibility now lies with the clients. Table 4 shows the amount of R&D expenditures available as a comparison. Again it shows the countries anonymously according to letters A through H. Most agree that the funding levels need to be increased in order to maintain development and spark new innovations.

Table 4. Comparison of Training and R&D Budgets

Country	Average annual training budget (€)	Average annual R&D budget (€)
A	approx. 1.7 million	approx. 7.9 million
B	no separate training budget	approx. 3.5 million
C	approx 2000 per employee	approx. 6 million
D	approx. 212 000	approx. 718 000 €
E	included in the budget	approx. 11 million
F	no separate training budget	approx. 0.5 million
G	1300 – 2000 per employee	approx. 3.8 million
H	approx. 700 € per employee	approx. 107 000 €

There were other good ideas observed during the study and some of these factors might be considered as good management practices and include the following:

- Using sensible performance-based requirements where applicable
- Using good procurement methods like PBSA (Low bid should be used when using PBSA)
- Better quality verification of winter services is needed (during entire season)
- Actually measuring the service providers performance (through Performance Measures)
- Use other customer satisfaction measures like driving panels and focus groups
- Correlating the customer satisfaction with the technical road data conditions[2]
- Communicating with customers using a common language (not technical details)
- Continue monitoring the maintenance service providers market
- Investing more in R&D
- Having incentives for better services and rewarding better environmental practices
- Long term contracts seem to have better cost containment (Using Lump Sum contracts)

- Training young professional by involvement in client, design, and service provider organizations

CONCLUSIONS

Customer satisfaction and increased focus on road users are important issues in road management. Customer surveys are one way to measure the effectiveness of winter services, but should be augmented with other types of measures. There is also a growing need to learn how to communicate with the public and how feedback can affect the decision-making processes. The other options observed were focus groups, driving panels, evaluation the contractor's performance, and achievement of specified outcomes or performance measures. The surveys however, should be conceivably integrated for a more comprehensive approach.

It is difficult to benchmark practices where there are so many variations in winter service policy, road types, weather deviations, country specific practices, and cultures. Even though many issues could not be rated or directly compared it was possible to motivate countries to utilize different management approaches and practices. As important as the quantifications and classifications, benchmarking practices are more than tabulating results from surveys. Perhaps no-one else travels and knows the "back roads" of the road network as well the road maintenance engineers.

The workshop that concluded the study was compelling evidence that "story telling" experiences and approaches to provide better services is an important, and perhaps a superior means to transmit experiential knowledge on road maintenance. The "brainstorming session" also provided insights that would never have been revealed by any other means and proved valuable to understand the challenges and benefits. The studies and the workshops of "Road to Excellence" served in an important way to transmit that knowledge and final report is available at http://publikationswebbutik.vv.se/upload/5591/2010_075_the_road_to_excellence_.pdf[3]

Probably the most significant conclusion is that international benchmarking can be good method if one wishes to develop or improve practices and a means to learn from alternative practices. There is a benefit from knowledge-sharing and learning from one another's experiences and results. "The Road to Excellence" was considered a success and provided motivation for the road agencies to focus interest on winter services and improving management practices.

SWEDISH RESULTS

As a result of this study Sweden is now in the progress of introducing a new model of customer survey (Minnesota model), the Scottish PAG-model (Performance Audit Group) for auditing contractors and new procurement models with incitements for contractors.

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